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Sport Sciences for Health

Volume 13 · Supplement 1 · September 2017

SISMES – IX National Congress

Research and Training Applied to Movement and Sport Sciences
Brescia, September 29 – October 1 2017

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Sport Sciences for Health

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Sport Sciences for Health is an international, interdisciplinary journal devoted to researchers and practitioners involved in sport and physical activity for health. Areas of interest include sport, physical activities, sports medicine, healthy lifestyles, motor behavior, physical education and adapted physical activity with different methodological approaches such as physiological, clinical, biomechanical, performance, psychological, educational, social and learning perspectives. The journal also deals with the mechanisms through which exercise can prevent or treat chronic degenerative disease contributing to prevention and personalized treatment of specific diseases and health maintenance with a translational perspective. The journal publishes original research, case studies and reviews.

Sport Sciences for Health is the official journal of the Società Italiana delle Scienze Motorie e Sportive (SISMeS), an Italian scientific society that aims to promote, support and disseminate knowledge and innovations in the sciences of sport and physical activity for health and quality of life.

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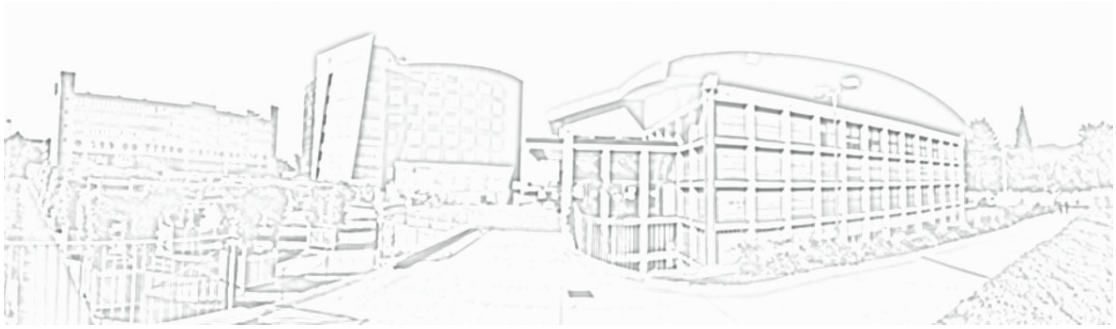

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ABSTRACTS

SISMES IX NATIONAL CONGRESS

Brescia, September 29–October 1 2017

MARCELLO FAINA LECTURE

Physiological and performance aspects of elite female soccer

Fábio Yuzo Nakamura

Department of Medicine and Aging Sciences, "G. d'Annunzio" University of Chieti-Pescara (I)

Professional female soccer players cover similar total distances compared to their male peers during a match. Besides this, they display position-dependent specific physical demands and engage in similar proportions of high-speed activity as men (Datson et al. in press), thus evidencing the high degree of specialization and elevated demands imposed by competition on their organisms. On the other hand, due to sexual dimorphism, several of the fitness indicators are inferior in female players (e.g., Yo–Yo Intermittent Recovery Test, level 1 [Bangsbo et al. 2008]). Hence, for achieving high performance, training of physical capacities can be crucial to these athletes. In addition, the competitive level and age should be taken into account to provide adequate stimuli to the players. For instance, during international matches, playing against teams of similar or lower ranking elicit more high-intensity runs than playing against stronger opponents (Hewitt et al. 2014), while some playing positions (e.g., central defenders and midfielders) need to improve more the ability to sustain high-intensity activity across age categories than others (unpublished data). In spite of the aforementioned studies about match characteristics, less work has been done regarding appropriate training methods to develop sport-specific physical capacities in females. A recent controlled study has suggested that plyometric training combined with creatine supplementation can increase jump and repeated-sprint performance in female soccer players (Ramirez-Campillo et al. 2016). Nevertheless, more studies on different training interventions are warranted, with special reference not only to physical performance in field and laboratory tests, but also to match-specific performance.

INVITED LECTURE 1

From "Gymnastics" to "Motor Sciences". Pedagogical meaning of a transition

Giuseppe Bertagna

Department of Human and Social Sciences, University of Bergamo, Italy

The historical seasons of the "Gymnastics", of the "Physical education" and of the "Motor and Sports Sciences" in Italy pay a debt of forgetfulness: in their constitution, they never measured themselves with a clear and justified anthropological foundation. Nowadays, the problem is made even worse and in some way concealed, by the growing interest for the "Eliminative" or "Incompatibilistic" Neurosciences.

Therefore a brief summary of the seasons of "Gymnastics", of "Physical education" and of "Motor and Sports Sciences", from the nineteenth century to the present day, can work as an exemplification of these epistemological deficiencies and misunderstandings. This is proved by 'imperialistic strategies' in the practice of human physical activity put forth, from time to time, by nationalists, militarists, medical-hygiene-biologists, aesthetes, bureaucrats, promoters of competitive sports and eco-environmentalists. As a matter of fact, and especially in recent decades, important decisions regarding physical activity and support to sport practice among children and young/old people, have been driven by choices made by ministers, bureaucrats and unionists.

We need to make evermore explicit the implicit role played by pedagogical anthropology, in the past and at present, in defining the structure of the object, the methods and, even more important, of the purposes of the "Gymnastics", of the "Physical education" and of the "Motor and Sports Sciences" in the wide frame of the holistic education of the individuals. So, the attention to the problem of pedagogical anthropology becomes a "figured bass" that we have to explore and cultivate to unveil the purposes, the content and the teaching methods specifically.

INVITED LECTURE 2

Electrical nerve stimulation as a strategy to improve physical function

Roger M. Enoka

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When an electric current is passed between a pair of electrodes attached to the skin over a muscle, the current field can elicit action potentials in intramuscular axons (not muscle fibers). At low currents (mA) and long stimulus pulses (1 ms), action potentials can be selectively evoked in axons arising from sensory receptors. Increases in current amplitude, however, progressively engage motor axons and evoke muscle contractions. The purpose of the presentation is to describe the therapeutic benefits that can be achieved by exploiting these stimulation characteristics.

Neuromuscular electrical stimulation (NMES) involves the application of a current that elicits action potentials in both motor and sensory axons. We recently completed two intervention studies in which we compared the gains in motor function achieved with narrow-pulse (0.2 ms) and wide-pulse (1 ms) NMES. One study enrolled individuals who were moderately disabled by multiple sclerosis (MS) (Almuklass et al. 2017), whereas the other study recruited healthy old adults (Mani et al. 2016). Wide-pulse NMES can elicit widespread responses throughout the nervous system (Mang et al. 2011), which we thought might facilitate greater adaptations than would be produced by narrow-pulse stimulation (Collins 2007). The results were similar for the two studies, so the presentation will describe the findings for the MS study only.

Individuals with MS (52.6 ± 7.4 years) were randomly assigned to either a narrow-pulse (n = 13) or a wide-pulse (n = 14) group for a 6-week treatment (3×/week) with NMES applied to the dorsiflexor and plantar flexor muscles of both legs. Outcomes were assessed before and after the intervention and 4 weeks later. There was no influence of stimulus-pulse duration on the outcomes ($P > 0.05$), thus the data were collapsed across groups. The NMES intervention improved ($P < 0.05$) the primary outcomes: maximal gait speed (25-ft walk), walking endurance (6-min walk), dorsiflexor strength in the affected limb, plantar flexor strength in the less affected limb, and self-reported fatigue (Modified Fatigue Impact Scale) and walking disability (MS Walking Scale-12). In addition, the 6-week intervention improved force steadiness of the plantar flexors during submaximal (20% MVC force) isometric contractions (Farina and Negro 2015; Galganski et al. 1993), but did not change daily levels of physical activity. The double-blind, randomized clinical trial demonstrated that a 6-week NMES intervention can evoke clinically significant improvements in gait speed and walking endurance of persons who were moderately disabled by MS. Similar findings were obtained in the 6-week intervention with old healthy adults.

In an ongoing study, we are using transcutaneous electrical nerve stimulation (TENS) to elicit action potentials in sensory axons. TENS is typically used in pain management, which it does by generating action potentials in small-diameter sensory fibers that depress activity in fibers transmitting pain information. When the TENS current is increased to involve a broader range of sensory fibers but not motor fibers (augmented TENS), a 3-week treatment (1 h/day) can improve tactile sensitivity of persons with MS (Cuypers et al. 2010) but the functional consequences are unknown. The purpose of our ongoing study is to assess the influence of acute exposure to augmented TENS on the walking performance and manual dexterity of individuals with MS.

To date, we have tested 11 persons with MS (55 ± 5 years) and have begun testing an age- and sex-matched control group. Each person participates in two sessions during which standardized tasks are performed either with or without the concurrent application of augmented TENS. The tests comprise 25-ft walk, 6-min walk, chair-rise test, pegboard test of dexterity, and two disability questionnaires. The TENS pads are placed over rectus femoris and tibialis anterior during the walking tests and over the median nerve and thenar eminence during the pegboard test. The application of augmented TENS has significantly improved the distance walked in 6 min, the number of repetitions completed in 30 s during the chair-rise test, time to complete the grooved pegboard test, and the self-reported assessment of walking disability. The acute application of TENS did not influence maximal gait speed (time to walk 25 ft). In healthy control subjects, augmented TENS does not seem to alter performance on these tests. The results suggest that the application of augmented TENS can improve motor function by providing supplementary sensory feedback in individuals in whom sensory function has been compromised.

These findings indicate that the artificial generation of action potentials in motor and sensory axons with electrical nerve stimulation can produce clinically significant improvements in the motor performance of individuals (persons with multiple sclerosis and old adults) who have diminished nervous system function.

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7. Supported by an award (R03HD079508) from the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health.

INVITED LECTURE 3

Body and tool: is the peripersonal space representation sport-dependent?

Marco Bove

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The peripersonal space (PPS) is the space directly surrounding the body within we can act and interact. This area is characterized by a high degree of multisensory integration between information originating from different sources, and this property differs from farther regions of space. The aim of the present study was to test whether PPS is modulated by the long-term motor experience with a specific tool in a sportsmen population. To this end, we evaluated, by means of a multisensory integration paradigm, the extension of the PPS in tennis players and novices to the sport of tennis while holding a tennis racket. Going deeply, in the case of the athletes, we tested the effect of their personal racket, i.e., the one they regularly use during their

sport activities compared to a common one. The main result was that the tool daily used during sport activity is stably embodied in the peripersonal space of tennis players. Conversely, when tennis players hold a racket different from that daily used we found a similar PPS to that observed in novices.

Further, the potential damage caused by an environmental threat increases with proximity to the body, so more effective and stronger defensive responses are performed when threatening stimuli occur nearby the body, in a region termed defensive peripersonal space (DPPS). The hand blink reflex (HBR) is a subcortical defensive response, known to dramatically increase when the stimulated hand is statically positioned inside the DPPS of the face. This work refers to the research field attempting to explain why and how the DPPS modulates its boundaries by continuously updating the threat value attributed to potentially dangerous stimuli getting inside. It is known that a fine cortical tuning of HBR was observed when a thin wooden screen was placed between the participants' face and their hand. Thus, the screen reduces the extension of the DPPS so that the hand is never inside the DPPS of the face. We hypothesized that this "screen effect" can automatically manifest as consequence of experience in those subjects who use hands as a shield to protect the face from an external threatening stimulus, as it occurs when boxers assume the guard position. By studying a group of boxers we observed a suppression of the HBR enhancement in the static position when the stimulated hand was close to the face. Also, the higher years of practice in boxing the higher suppression occurred. These observations suggest that, as a result of sensorimotor experience, brain can shape the DPPS by evaluating the harm probability through the assessment of the ability to set an accurate defensive postural adjustment able to cope with possible dangerous stimuli.

SESSIONS

ABBREVIATION	**SESSION**
APA	Adapted physical activity
BM	Biomechanics
CRF	Cardio-respiratory Function
GS	Genetic expression and Sport
NM	Neuromuscular function
NMF/MC	Neuromuscular function/motor control
NS	Nutrition and sport
PAFH	Physical activity fitness and health
PED	Pedagogy
PSY	Psychology
TEC	Technology applied to materials for sport
TFE	Training and functional evaluation

ORAL SESSIONS

ADAPTED PHYSICAL ACTIVITY

1 APA

The use of a mobile application to support physical activity and lifestyle changes in persons living with HIV. Baseline preliminary results of the SMARTAPP study

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Aim: During recent years, the use of mobile technologies has been implemented for health monitoring interventions, including exercise. We hypothesized that the use of a mobile application will favour engagement to exercise by providing motivational inputs, and therefore adherence, and, as a consequence, an improvement of physical fitness.
Methods: A multicentre, open-label, pilot-study enrolling HIV-infected subjects, of age $\geq$18 years, with/without cART, sedentary or already practicing mild/moderate physical activity with a primary endpoint defined as the proportion of participants with an improvement from baseline of 15% of $\dot{V}O_{2max}$ through 16 weeks of training. Subjects were randomized 1:1 to experimental group (EG), where participants will be trained with an exercise program for 16 weeks with the use of a smartphone application and to control group (CG), where participants will be trained with an exercise program for 16 weeks without smartphone application. At baseline medical assessment anthropometry, blood examinations and peak oxygen consumption ($\dot{V}O_{2peak}$) were measured.
Results: Thirty-seven participants were screened and 33 (89%) were enrolled in the study, 16 EG in the and 17 in the CG. At baseline, Spearman correlation revealed negative significant relationship between $\dot{V}O_{2max}$ and waist ($P = 0.0014$; $R = -0.7$), and hip ($P = 0.003$; $R = -0.7$) circumference, BMI ($P = 0.002$; $R = -0.5$), fat mass ($P = 0.0005$; $R = -0.6$), insulin ($P = 0.03$; $R = -0.4$), Hb1Ac ($P = 0.0003$; $R = -0.6$), HOMA-Ir ($P = 0.03$; $R = -0.4$), ALT ($P = 0.0007$; $R = -0.6$), AST ($P = 0.0004$; $R = -0.6$), and Vitamin D ($P = 0.04$; $R = 0.4$) were observed. Moreover, a negative trend relationship for Nadir-CD4$^+$ ($P = 0.056$; $R = -0.4$), and VACS ($P = 0.059$; $R = -0.4$), was found. Currently, participants are still training 3 times a week for a total volume of 150-min of physical activity a week.
Conclusions: Preliminary data shows that patients' physical fitness is impaired due to their health condition. At the end of the training program, we expected that the use of mobile application in EG group will favour adherence and therefore an improvement of $\dot{V}O_{2peak}$.

2 APA

Effect of fat mass on fitness and balance ability in obese adult subjects

G.P. Emerenziani[1], D. Ferrari[2], S. Iazzoni[2], S. Migliaccio[2], A. Lenzi[3], C. Baldari[2], L. Guidetti[2]

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Aim: Obese subjects present compromised body composition, functional capacity, and low levels of fitness that may results in postural instability in young obese subjects (Meng et al. 2016). Recently, fat percentage showed more clear deterioration effect on postural control than BMI. To better understand, also in adults, the effects of percentage of fat mass on fitness and balance ability, it is important to examine fitness features at different levels of fat mass percentage.
Methods: Twenty-four obese adult were divided into 2 groups according to the percentage of fat mass: the obesity group (OB, $n = 11$, %FM > 25 in men and > 35 in women, and the high obesity group (HO, $n = 13$, %FM > 35 in men and > 45 in women). Participants performed (1) a continuous graded incremental test on a treadmill, (2) a chair stand test (CST), (3) a 30 s-CST test, and (4) six minute walking test (6MWT). Balance ability was assessed by the time while steadily standing on one leg (OLSB). OLSB was also assessd during a dual task condition, consisting of counting backwards aloud (OLSBc). Both OLSB and OLSBc were performed with open and closed eyes.
Results: OB had significant better performance in 30 s-CST test (number of repetition, 27.5 ± 3.0 vs 23.1 ± 5.5) and 6MWT (distance: 669.5 ± 52.1 vs 572.3 ± 42.2 m). No differences were found for peak oxygen uptake, CST, OLSB, and OLSBc.
Conclusions: 6MWT and muscle power performance decreased as body fat percentage increased. No influence of percentage of fat mass were observed for peak oxygen uptake and OLSB. The addition of a cognitive task did not further worsen balance performance in both groups.
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3 APA

Effects of home-based aerobic training on muscle performance in obese adult subjects

D. Ferrari[1], G.P. Emerenziani[2], L. Falcioni[1], G. Belli[1], S. Migliaccio[1], A. Lenzi[3], L. Guidetti[1], C. Baldari[1]

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Aim: Weight loss program may lead to a decrease in lean body mass affecting negatively muscle function in obese subjects (Weiss, 2017). Aim of the study was to examine the effects of unsupervised aerobic training (UAT) based upon individual ventilatory threshold (IVT) on muscle performance in obese subjects.
Methods: Eighty obese female adults (age = 45.6 ± 12.3 years, BMI = 37.9 ± 5.0) received a training prescription (UAT) based upon IVT plus a low-calorie diet. Before and after the 2-months UAT, subjects performed: chair stand test (CST), and 30-s CST to analyze muscle power; hand-grip test to assess muscle strength; six-minute walking test (6MWT) and incremental sub-maximal test to analyze cardiorespiratory function. According to the compliance with exercise program, subjects were divided into two groups: high compliance (HC, exercise performed 3-5 $d \cdot week^{-1}$), and low compliance (LC, exercise performed <3 $day \cdot week^{-1}$).
Results: Drop-out rate was 55% after two months. 14 subjects had HC while 22 subjects had LC to exercise prescription. ANOVA results showed significant time main effect and time × group interaction for body composition and physical fitness variables. In detail, Weight and FFM significantly ($p < 0.05$) decreased more in HC compared to LC (6.0% and 0.9%, respectively). Watt during 30 s-CST increased in HC (11%) while decreased in LC (−6%). Distance and speed of 6MWT significantly increased in HC (6.2%) where LC did not change (0.7%)
Conclusions: These results demonstrated that UAT based upon the IVT is an effective method to reach positive improvements in body composition and muscular performance.
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4 APA

Efficacy of elastic band resistance training in rheumatic diseases: a pilot study

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Aim: Many international studies investigate effects of adapted training for people with rheumatic diseases. The aim of this research was to measure the effects of a training program including range of motion exercises, balance exercises, flexibility exercises and strength exercises with elastic band on maximum hands' strength and balance in subjects with rheumatic diseases.
Methods: Six women (age 61 ± 12 years, weight 71 ± 16.5 kg, height 160 ± 8 cm) with different rheumatic diseases performed a program including range of motion exercises, balance exercises, flexibility exercises and strength exercises with elastic band. Maximal strength values were recorded by hand dynamometer. Balance was measured by baropodometric platform.
Results: The maximum strength of right hand (Anova $p < 0.05$; Post Hoc $p < 0.05$, +8.9%) and left hand (Anova $p < 0.01$; Post Hoc $p < 0.05$, +16.2%) increased. The baropodometric platform recorded a reduction of the parameter C.o.P. distance (Anova $p < 0.01$; Post

Hoc $p < 0.01$, −8.4%) and of the parameter average speed (Anova $p < 0.01$; Post Hoc $p < 0.01$, −46.2%) between T0 and T1.

Conclusions: A program including range of motion exercises, balance exercises, flexibility exercises and strength exercises with elastic band improves strength and balance in subjects with rheumatic diseases.

Reference

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5 APA

Adapted Physical Activity for People with Multiple Sclerosis: effects of a training program and follow-up

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Aim: Our research wants to check effectiveness of a program of Adapted Physical Activity (APA) for people with multiple sclerosis (MS).

Methods. Eighteen patients with MS (EDSS = 5.11 ± 1.26) have agreed to undergo an APA program for 10 lessons of 60 min and daily exercises at home. Measures adopted were MFSI scale, Time Up and Go test, Two and Six-Minute walking test, Timed 25-Foot Walk, Timed five meters, 10 and 20 m tests. Measures were taken at the beginning (M1), at the end of the training (M2) and two months after the conclusion (M3). Pearson correlation and One-Way ANOVA for repeated measures or for ranks was adopted.

Results. All tests showed a significant difference between M1 and M2 ($p < 0.05 \pm 0.001$ for all data). Differences between M2e M3 was statistically significant ($p < 0.05 \pm 0.01$) in 10 and 20 m tests, 25-Foot Walk and 2-min Walking Tests. No test showed a statistically significant difference between M1 and M3. Results suggests that subjects improved their fitness in training period but they worsened during the idle period and are back at the initial levels. Correlation study between all test showed medium or high values among all the measures ($r = 0.49 \pm 0.99$; $p < 0.05 \pm 0.001$).

Conclusions. For subjects with MS is important adopt an active lifestyle and maintain high level of motor skills to slow disease degeneration processes. Our research seems confirm (Fracca 2015) that these people can significantly improve physical fitness with APA but it must be practiced steadily. Considering the medium or high correlations among tests, protocol should be reduced and integrated with other instruments to evaluate different motor skills.

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6 APA

The effects of Nordic Walking on asymmetry in muscle's strength of the lower limbs and on oxidative stress in Parkinson's disease

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Aim. To analyse the effects of Nordic Walking (NW) on asymmetry in muscle's strength of lower limbs and on oxidative stress mechanisms in Parkinson's disease.

Methods. Twenty-nine patients with PD (1-3 Stage Hoehn & Yahr in ON medication) underwent a multidisciplinary intensive rehabilitative program for 4 weeks. They were randomnly divided in two groups: Control group (Ctrl) composed by 12 patients and experimental group (Exp) composed by 17 patients that practiced additional NW 60 min, twice a week. As instrumental outcomes we used PeaK Torque right and left leg and markers of oxidative stress (AU/CR markers, 8OHdG, 2dG, 8OH/2dG, HCY, 3NT). As clinical outcome we used UPDRS III, PDQ-39, BBS, FES, FOG-Q, TUG, 6MWT. Measures were taken at the beginning (T0) and at end of training (T1). Chisquare, Test-T and two-way ANOVA for repeated measures were used.

Results. In Exp there was a trend towards the symmetry of lower limbs strength. Moreover Exp showed a reduction in HCY compared with Ctrl where it increased. The 8oHdG/2dG ratio seems to have a higher trend in Exp with 2dG increased.

Significant improvement was found for all subject in: UPDRS III ($P < 0.001$), BBS ($P = 0.002$), 6MWT ($P < 0.001$), TUG ($P < 0.05$), PDQ-39 ($P = 0.006$), FoGQ ($P = 0.001$). PDQ-39 and FoGQ improve ($P < 0.05$) in Exp but not in Ctrl. FES do not shows variation.

Conclusions. This pilot study confirms that NV is a valid rehabilitation strategy and contributes to correct the asymmetry in muscle's strength and improves REDOX status, increasing markers of DNA repair and decreasing markers of oxidative stress.

7 APA

Validation of a kinematic protocol for the biomechanics of handbike cycling

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Aim Develop and validate a new kinematic analysis protocol, based on two IR camera, to evaluate several aspects of handbike cycling biomechanics.

Methods 6 male and 9 female healthy subjects (age 29.4 ± 5.4 years old). Optical passive markers placed on the subject (Hand, Wrist, Elbow, Acromion, Tragus) and on the handbike (Bottom Bracket, Frame Front and Frame Rear). Subjects choose their favorite position and setup on a specific handbike ergometer; performed a 3 min warm up, followed by a cycling pedaling at free chosen speed (at least 3 min—T0), until they reached 8/10 Borg Scale Score. Data were collected at the beginning (average of first 20 cycle at no fatigue—NF_{ex}) and at the end of the exercise (average of last 20 cycle at fatigue—F_{ex}). After that markers are removed and subjects take a rest of 30 min, walking around outside the laboratory. Then markers were repositioned and test was repeated likewise (at least 3 min—T1).

Results

T0-NF_{ex} vs T1-NF_{ex}: no statistically significant differences (SSD) in any of the 13 measured parameters (except one "Speed Variability");
T0-F_{ex} vs T1-F_{ex}: No SSD in any of the 13 measured parameters;
T0-NF_{ex} vs T0-F_{ex}: SSD in 7 out of 13 measured parameters;
T1-NF_{ex} vs T1-F_{ex}: SSD in 9 out of 13 measured parameters;

Conclusions The kinematic evaluation protocol is appropriate to study and analyze fundamental parameters of handbike cycling biomechanics and to asses intra and extra differences between different subjects or athletes. Data and statistical analysis shows that marker placement has been simple and repeatable (no SSD in the same testing conditions), theoretically suitable for every handbike. Future studies may investigate in expert paraplegic and tetraplegic subjects the repeatability of the same evaluation protocol on their handbike.

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8 APA

A motivational, educational, exercise-based intervention to improve physical fitness of individuals with type 2 diabetes: results from a 1-year follow-up

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Aim: In 2013, a multidisciplinary intervention based on motivational support, nutritional education and adapted exercise granted by the National Center for Control and Prevention of Diseases of the Ministry of Health was implemented in the city of Naples to improve physical fitness and related health parameters in subjects with type 2 diabetes. After a year from the end of the intervention, participants who independently continued the exercise pathway were evaluated to verify the durability of the lifestyle change.

Methods: Participants who completed the intervention were contacted after 12 months. Changes in BMI, waist circumference, and HbA1c were registered among respondents. Habitual PA was measured through the International Physical Activity Questionnaire and physical fitness was evaluated through the Senior Fitness Tests.

Results: On a total of 69 participants, 52 (75.3%) agreed to participate and 46 (66.6%) were still physically active. All the parameters showed an improvement respect to those registered at the end of the intervention in the same individuals, and respect to those measured in subjects who were inactive at follow up. Only the changes detected in HbA1c and habitual PA were not significant.

Conclusions: The results testify the durability of the effects of a multidisciplinary exercise-based intervention to improve health conditions of individuals with type 2 diabetes.

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9 APA

Proprioceptive effects of mechanical stimulation on the plantar arch: modification of the functional relationships between the foot and posture

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Aim: Previous studies suggest that the podalic stimulation can restructure the functional relationships between the lower limbs and trunk (Gordon et al. 1995). Furthermore, the selective stimulation of the plantar mechanoreceptors induce a displacement of body's CoP always opposite to the vibration simulated pressure increase (Kavounoudias et al. 1998) but the direction of illusory body tilts were always orthogonally directed and ipsilateral to the vibrated plantar site (Roll et al. 2002).

The aim of this study was to verify if the insertion of an Internal Heel Wedge (IHW) and External Heel Wedge (EHW) applied according to the Bricot's method can produce modifications of stabilometric and podobarometric variables, functional changes during the gait cycle and any temporal summation of the proprioceptive stimulation.

Methods: Twenty-three healthy subjects with the right dominating lower limb (age 31 ± 5 years) were recruited. First trials with IHW was performed, three months later second trials with EHW. The IHW and EHW was made from a cork half moon thickness of 1.5 mm, length 6 cm and a height of 3 cm.

The sequence of tests foresaw: trials baseline without IHW or EHW, trials with IHW or EHW, trials after an adaptation period of 15 min on treadmills with IHW or EHW.

Results: Data showed statistically significant variations (Parametrical statistic analysis ANOVA, Post-hoc, Baseline vs After 15 min, $p < 0.05$) in the Cadence steps, Duration of the cycle of the left step and Single Right Support phase for the IHW; Duration Single Right support and Single Left Support phase for the EHW.

Conclusions: Data showed that the proprioceptive stimulation of the plantar arch, thickness of 1,5 mm, is enough to induce changes in the gait cycle and which changing the position of the proprioceptive stimulation it inverts the functional response of the feet.

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10 APA
DXA-measured body composition changes across a competitive season in wheelchair athletes

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Aim: The impact of regular training in wheelchair sports (WS) on body composition (BC) of athletes with physical impairments has been poorly investigated yet (1). This work explored the role of the amount of training on BC changes in wheelchair athletes (WA) across a competitive season by means of Dual-Energy X-Ray Absorptiometry (DXA).
Methods: Twenty-one WA (15 wheelchair basketball and 6 wheelchair rugby players) underwent DXA at pre- and post-season. WA were divided into two groups: a low-training group (LWA, n = 10) training twice a week for 2 h and a high-training group (HWA, n = 11) training four times a week for 2 h. Bone mineral density (BMD), lean mass, and fat mass percentage (%FM) were measured at the total body (TB) level and regionally. Data were analyzed using a 2 × 2 analysis of covariance (factor 1: group; factor 2: time) with repeated measures on the second factor and the severity of impairment as covariate.
Results: At pre-season within-group comparison revealed no significant difference between the groups for all variables. The results revealed a significant main effect of time for BMD in the trunk (P = 0.017) and a significant group by time interaction effect for the %FM at the TB level (P = 0.001), in the trunk (P = 0.001) and in the right upper limb (P = 0.015) regions. At post-season in the HWA group there was a significant decrease of %FM at the TB level (P = 0.008) and in the trunk region (P = 0.015), by respectively 1.2 and 1.5%. No significant main effect for the severity of impairment was found.
Conclusions: Higher amount of regular training across a competitive season favorably impact on BC in WA independently of the severity of impairment.
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11 APA
Inclusive adapted physical education in the regular school

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Aim The inclusion was became core of quality of life, peacekeeping and society for all. (UNESCO 2015). The education and physical education were important for inclusive process from the school versus the society.
Methods Preliminary survey was descriptive (Thomas et al. 2011). It was investigated teacher attitudes, opinions by Teacher Integration Attitude Questionnaire (TIAQ) (Sideridis and Chandler 1997) about : "Teachers felt to have the knowledge to cope with the instructional needs of children with disabilities. PE Teacher participation at Special Pedagogy academic course"
Results:

	PE Teacher/subjects have attended the academic course in Special Pedagogy /Inclusive teaching Group Yes	PE Teacher/subjects have not attended the academic course in Special Pedagogy /Inclusive teaching Group No
Physical Disabilities/ Orthopedic impairments (OH)	2=Agree (48.13%)	2=Agree (42.04%)
Multiple disabilities (MH)	3=Disagree (39.25%)	3=Desagree (32.48%)
Intellective disabilities (ID)*	**2=Agree (37.85%)**	**2=Agree (29.94%)**
Behavior disorders (BD)**	**2=Agree (44.86%)**	**2=Agree (35.03%)**
Learning Disorders (LD)***	**2=Agree (54.21%)**	**2=Agree (42.68%)**

*p-value = 0.14 **p-value = 0.07 ***p-value=0.04 (significant difference)

Conclusions The comparison in order the PE Teacher participation at Special Pedagogy/Inclusive teaching academic course was showed significant differences between the group PE Teacher/subjects have not attended the academic course in Special Pedagogy/Inclusive teaching in order of inclusion of students with disabilities Intellective ID; Behavior BD; Learning LD) (*p value = 0.14 **p value = 0.07 ***p value = 0.04, significant difference)

12 APA
Effect of long-term passive stretching on vascular function

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Aim: Involved muscles reduces arterial blood flow during the elongation while increases arterial blood flow the relaxation phase During a single session of passive stretching (PS) [1, 2]. These repetitive changes in peripheral blood flow may act as vascular training. However, it is unknown whether long-term PS administration could be a sufficient stimulus to improve vascular function [3].
Methods: Thirty-six participants (age: 23 ± 2 years; stature: 1.68 ± 0.12 m; body mass: 62 ± 15 kg) were randomly assigned to PS protocol (N = 18; duration: six weeks, frequency: 5 session/w), or to control group (CTRL, N = 18). Before (T_0) and after (T_1) PS, the vascular functionality of the arteries directly involved in (femoral and popliteal arteries), and distal to PS administration (brachial artery) was assessed by duplex eco-doppler. Single limb passive movement (SLPM) tested the femoral artery, whereas the flow mediated dilation (FMD was utilized in the popliteal and brachial arteries. SPLM peak blood flow (BF_p) and the maximal arterial vasodilation (FMD $_{\%}$) were calculated as indexes of endothelial function. The pulse wave velocity (PWV) was determined by tonometry as indirect marker of central (carotid-femoral artery PWV, PWV_{CF}), and peripheral (carotid-radial artery PWV, PWV_{CR}) arterial stiffness. Systolic (SBP) and diastolic (DBP) blood pressure was also measured.

Results: In PS, BF_p and popliteal FMD $_{\%}$ increased at T_1 by 30 and 25% respectively ($p < 0.001$), whereas brachial FMD % slightly increased by 8% ($p = 0.06$). Concomitantly, PWF_{CF} decreased by 19% ($p = 0.002$), whereas PWF_{CR} remained unchanged ($p = 0.07$). No changes in SBP and DBP occurred. Ctrl did not show any significant alteration.
Conclusions: Long-term PS intervention improved endothelial functions and reduced the arterial stiffness particularly in the feeding arteries directly involved in the protocol. Under a practical perspective, PS could be used as an effective means to improve vascular functionality in subjects presenting a limited mobility.
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13 APA
Roman Press, an approach that ameliorates motor disabilities and improves range of motion of joints. Comparison with proprioceptive neuromuscular facilitation and Oswestry Disability Index

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Aim: The Roman Press is a straightforward self-controlled slow movement of the body, based on the concept of impedance, as referred to stiffness of joints, and kinematic lateralization (KL) or body-side preferences The intention is to mimic a natural pelvic swing movement, frequently compromised in subjects suffering motor disabilities. The study indicates a possible solution for excessive joint stiffness especially of the lumbar-pelvic-hip complex, giving rise to postural maladaptation and pain. Currently, proprioceptive neuromuscular facilitation (PNF) is the most popular stretching approach to decrease excessive stiffness and improve range of motion (ROM) of joints. Yet theoretically when a muscle is held extended for several seconds, its spindles lose their sensitivity as a result of slackness on the spindles themselves. This is detrimental to the body's proprioception. Thus, the recalibration of spindles is possible only by performing wide amplitude movements, not by stretching. This study presents evidence-based practice of the innovative protocol which effectively releases excessive joint stiffness without stretching.
Methods: a clinical randomised study, 54 subjects, both genders, mean age 35 (range 21–68 years), suffering hip extensor stiffness, divided into two groups. One group responded to the Oswestry Disability Index (ODI) prior to attempting the Roman Press and again five/seven days afterwards; the second group performed PNF for comparison; joint ROM was calculated for both groups with Kinovea.
Conclusion: the *effect size* of the new approach is four times greater than that of the control group in improving ROM. Moreover, the new approach is effective in ameliorating motor disabilities, even after just a 3 min procedure. Strikingly, after performance of the new approach all subjects also reported a pleasant sensation of lightness in walking.

14 APA
Effect of neuromuscular electrical stimulation on human skeletal muscle of healthy elderly

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Aim: The aim was to determine whether neuromuscular electrical stimulation (NMES) affects skeletal muscle tissue and regeneration on elderly healthy subjects.
Methods: Myogenic precursor cells (MPCs) from the *Vastus lateralis* skeletal muscle of healthy elderly subjects was obtained and analysed before and after 8 weeks of NMES. It was analysed: proliferation, differentiation, cytoplasmic free $[Ca^{2+}]$ managment, the expression of myogenic regulatory factors (*PAX3, PAX7, MYF5, MYOD, MYOG*) and microRNAs (miR-1, miR: -133a/b, miR-206. Both MPCs and skeletal muscle fibers were tested for NMES-dependent oxidative level.
Results The NMES effect on skeletal muscle regeneration was assessed on healthy elderly for the first time. The oxidative status of both MPCs and muscle fibers has been modified by NMES. NMES favored the regeneration by increasing the $[Ca^{2+}]_{cyt}$ along with *MYOD*, *MYOG* and miRNAs up-regulation, reducing $O_2\cdot^-$ production.
Conclusion: NMES improved the skeletal muscle function acting both on fibers themselves and on regenerative capacity of skeletal muscle in elderly subjects.
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15 APA
Effects of passive mobilization in vascular function of mobility limited oldest-old

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Aim: During the lifespan, vascular function (VF) declines. Indeed, the 15% of oldest-old individuals are in chronically mobility restriction, and

literature indicates that this condition exacerbates VF decline. Although studies have suggested that passive mobilization of the limbs (PM) may improve local VF, the effect of PM on nitric oxide (NO)-mediated VF has not been Aim was to determine whether PM is effective to counteract VF worsening in mobility limited oldest-old. We hypothesized that mobility-limited patients who underwent a month of PM would have gained significant improvement in NO-mediated VF.
Methods: Twenty mobility-limited individuals (86 ± 7 years) were randomly assigned to PM or control (CT) group. PM groups underwent a program of 30 min of passive knee (flexo-extension) mobilization (4-week, twice a day/5 days a week) in addition to their standard therapies. Pre and post treatment, NO-mediated VF was measured by means of single passive limb movement (sPLM) test.
Results: Concerning sPLM test, PM group improved significantly $sPLM_{peak}$ (+33%), ΔPLM (+55%), as well as Area Under the Curve (AUC, +200%). CT group did not exhibit any change in VF.
Conclusion: Results suggest that the reduction in VF exhibited in chronically mobility-limited oldest-old individuals can be reversed by a PM program. PM seems to be an effective strategy to counteract the deleterious effects of disuse.

16 APA
Heart dimensions and aerobic fitness in Paralympic Athletes with paraplegia

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Aim: The possibility that individuals with a spinal cord injury (SCI) could undergo to the typical long term adaptations to exercise, called "the athlete's heart", is debated in Literature. Venous return, the main stimulus for heart hypertrophy, is reduced, thus SCI subjects, including those with paraplegia, show a smaller and less efficient heart. To verify the hypothesis that sport can reverse this physiopathological heart remodeling, we analyzed retrospectively data from a large cohort of Paralympic Athletes with paraplegia (P-PA) competing in sports with different characteristics and energy expenditure.
Methods: In a group of 101 male P-PA (age 35 ± 8.3 years old, mass 72 ± 12.8 kg, body surface area 1.9 ± 0.17 m^2), 28 competing in skill sports (SS), 16 in power sports (PS), 35 in mixed metabolism sports (MS) and 22 in endurance sports (ES), evaluated during the health and fitness visits carried out before 9 Paralympic Games (from 2000 to 2016), ventricular septum, posterior free wall, telediastolic and telesystolic diameters were measured at rest through standard echocardiography, performed with Philips Sonos ie33 (Philips Medical System, Bothell, WA) instruments, to assess normalized to BSA left ventricular mass (LVM). Maximal oxygen uptake (VO_2peak) was determined through cardiopulmonary exercise testing (CPET), performed by arm-crank ergometer, using a breath-by-breath metabolimeter (Quark b2; COSMED, Rome, Italy).
Results: Normalized LVM was significantly higher in P-PA competing in ES (102 ± 20.8 g m^{-2}) than in P-PA competing in SS (78 ± 13.4 g m^{-2}), paralleled by higher values of VO_2peak in the former (43 ± 16,3 ml min^{-1} kg^{-1}) than in the latter (25 ± 6.0 ml min^{-1} kg^{-1}). On the contrary, while the VO_2peak in P-PA competing in PS and in MS was significantly higher than that in SS (and equal to 32 ± 6.5 and 31 ± 6.0 ml min^{-1} kg^{-1}, respectively), normalized LVM mass resulted significantly lower than that in ES and similar to that of SS (86 ± 14.5 and 86 ± 15.4 g m^{-2}, respectively). A significative positive linear correlation ($R^2 = \sqrt{0.315}$) was found between the two variables (VO_2peak = 6.445 + 0.290 indexed LVM).
Conclusion: High intensity and energy expenditure sports (e.g., handbike, cross-country skiing, rowing, paracanoeing, long distance wheelchair racing) induce high values of aerobic fitness determined also by central cardiac adaptations to exercise.

17 APA
Effects of lifelong football training on the muscle protein expression profiles related to healthy longevity

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Aim: Football is an intermittent team sport characterized by multiple high-intensity anaerobic actions interspersed with periods of low-intensity recovery. Football training improves cardio-respiratory fitness and the oxidative component of muscle fibers in healthy untrained individuals (1, 2). Emerging studies are focused on the effects of long-term football training on the expression of healthy longevity-related muscle molecular markers (3, 4). Here, we explored the proteomic changes in muscle tissues of Veteran Soccer Players (VSP) compared to healthy age-matched untrained subjects (control group, CG) in order to cast light on the molecular mechanisms underlying the healthy longevity effects of lifelong football training.
Methods: Muscle biopsies were obtained from the *Vastus lateralis* of 12 male volunteers (65–75 years), 6 belonging to VSP and 6 to CG. Protein expression profiles from VSP *vs* CG were analyzed by label-free approach using liquid chromatography-tandem mass spectrometry (LC–MS/MS). Protein Discoverer platform was used for quantitation analysis. Proteomic data were further analyzed by bioinformatic tools to classify identified proteins according to gene ontology (GO) terms and to unravel relevant molecular networks.
Results: Quantitative analysis revealed 170 differentially expressed proteins in VSP *vs* CG with fold changes ≥1.50 or ≤−1.50 (75 overexpressed and 95 underexpressed proteins).

Classification based on GO terms showed that the top significantly enriched biological processes involved "Amino acid metabolism" and "Proteasome-dependent protein degradation". We also identified protein interaction networks related to "Fatty acid metabolism" and "Oxidative phosphorylation".

Conclusions: In elderly lifelong football training modulates the expression levels of muscle proteins involved in crucial pathways related to healthy longevity.

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18 APA

Factors influencing falls prediction in aged people: a path analysis model

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Aim: to date few studies address the complex mechanism of falls in seniors according to a biopsychosocial approach which simultaneously consider different functional domains (Cesari et al. 2002). The herein study aimed to examine the contribution of physical, cognitive and psychological domains of functioning in predicting falls at one year in a sample of Italian community-dwelling older adults. Both direct and indirect effects were investigated.

Methods: participants were 192 older adults (age 73 ± 6 years; 62% women) living in Piedmont Region, who underwent a baseline assessment of physical, cognitive and psychological functioning, and of multidimensional frailty. Number of falls was collected during 1-year follow-up. Statistical analyses were performed using SAS software, version 9.4 (SAS Institute, Inc., Cary, NC).

Results: the path model fitted the data well ($\chi^2 = 11.06$, $p = 0.52$; RMSEA < 0.001; GFI $= 0.96$; CFI $= 1.00$). Falls were directly affected only by frailty with higher frailty contributing to falls. Greater physical fitness, lower depression and lower anxiety were directly associated with less severe frailty condition, and indirectly via frailty with falls. Furthermore, physical activity and cognitive functioning positively affected physical fitness. Physical activity negatively influenced depression. Others significant indirect effects were found, including: (1) depression on falls via anxiety and frailty, (2) cognitive functioning on falls via physical fitness and frailty, and (3) physical activity on falls via physical fitness and frailty as well as via depression and frailty.

Conclusions: these findings suggest firstly that a multidimensional approach is the most suitable to capture intrinsic and extrinsic factors leading to fall, and secondly that fall prevention programs should be designed taking also into account potentially reversible factors that indirectly affected falls.

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19 APA

A comparison of ADAMO mobility index with physical performance measures for identifying frailty: results of an IMI SPRINTT Living Lab in older adults

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Aim: ADAMO is a carewatch produced by Caretek S.r.l. able to identify emergency situations and to monitor mobility in aged population. This study aimed to compare the association between frailty and: (1) the mobility index (MI) provided by ADAMO, (2) a walking ability measure, (3) a physical health indicator, in older adults.

Methods: data were from 31 participants (71 ± 6 years, 55% women) living in Piedmont and Lazio. ADAMO was continuously worn for a week. The MI is a measure of the time spent performing physical activity, subdividing it in: Very Low (VLM), Low (LM), Medium (MM), High (HM), and Very High (VHM) Mobility. Walking ability, physical health and multidimensional frailty were measured using the 400-meter Walk Test (WT), the Short Physical Performance Balance (SPPB) and the Tilburg Frailty Indicator (Mulasso et al., 2016), respectively. Analysis of variance, clustering and linear regressions were run.

Results: frail and robust participants were different for VLM (frail = 58%, robust = 44%, $p < 0.001$), LM_MM (frail = 26%, robust = 33%, $p = 0.021$), and HM_VHM (frail = 16%, robust = 23%, $p = 0.036$). A cluster analysis allowed to divide participants in two groups statistically different for VLM, LM_MM and HM_VHM. Controlling for age and gender, the MI clustered resulted strictly associated with frailty ($R^2 = 13.3\%$, $p = 0.031$). No association of the WT and the SPPB with frailty was found ($p > 0.05$).

Conclusions: the MI seems to be a suitable tracking in time system to capture frailty, probably because it reflects the mobility level over a period and it is more influenced by social/psychological functioning of individuals than traditional physical performance measures.

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20 APA
Healthy aging in obese: walking with or without poles? Preliminary results

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Aim: As endurance exercise, walking in all its forms, is a simple and safe activity wildly recommended for healthy aging[1] and overweight or obese population[2]. Aim of this study was to compare different training programs (i.e. Nordic Walking (NW) and conventional Walking (W)) in terms of body composition, cardiorespiratory fitness and strength in obese older adults.
Methods: The study was performed in the framework of Healthy Aging Center in Verona. 18 subjects, divided into two groups, NW ($n = 9$, 66 ± 7years, 157 ± 6 cm, BMI 32.2 ± 4.2) and W ($n = 9$, 66 ± 9years, 162 ± 9 cm, BMI 33.4 ± 5.9), took part in 3 months of training with or without poles. The exercise sessions were conducted three times a week for 60-90 min/session, under expert supervision. Pre and post training body composition (DEXA), cardiorespiratory fitness (Peak of VO_2 and power output), functional capacity (6MWT) and maximal voluntary contraction of brachial biceps (MVC_{BB}) and femoral quadriceps (MVC_{FQ}) were determined.
Results: After 3 months, both NW and W interventions, without an interaction effect, produced significant differences over time ($p < .001$) in terms of weight loss (-6.09% and -2.77%) and reduction of total body fat (-12.83% and -5.29%). No differences were found in lean mass ($p > 0.05$). Both groups without interaction effect, increased metabolic values (VO_{2peak}: +11.5 and +8.1%; PO_{peak}: +7.9 and +5.5%) and 6MWT (+6.4 and +5.1%). Both groups improved in MVC_{BB} (13.7 and 19.8%) and MVC_{FQ} (28 and 8.4%) without interaction effects.
Conclusions: After 3 months both interventions led to a significant increase in functional capacities. Although not significant, the greater magnitudes of the improvements in the NW group suggest that NW exercise could generate more health benefits than walking. However, the effectiveness of the training programs in obese population should be investigate in long-term studies.
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21 APA
Exercise-induced peripheral vascular adaptations in patients with Alzheimer's disease

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Aim: Recently, Alzheimer's Disease (AD) has been shown to be characterized by vascular dysfunction not only at cerebral level but at peripheral level as well. Interestingly, exercise has been shown to positively affect vascular function (VF) in healthy older adults. However, to our knowledge no study investigated the exercise effect on VF in patients with AD. Therefore, the aim of this study was to investigate the exercise-induced adaptations in peripheral VF in patients with AD. We hypothesized that patients with AD who performed 6 months of exercise (ET) would have gained significant improvements in VF.
Methods: Fifty patients with AD (79 ± 6 years) were randomly assigned to ET ($n = 25$) or control group (CT, $n = 25$) treated with standard therapy. ET group performed 72 treatment sessions, 3 times a week, including moderate intensity aerobic and strength training. Before and after 6 months of treatment, peripheral vascular function was measured by means of Flow-mediated Dilation (FMD) and Passive Limb Movement (PLM).
Results: Subjects assigned to ET completed the 95% of the 72 treatments sessions. Concerning FMD, ET group improved significantly FMD % (+25%, $p < 0.05$), as well as FMD/Shear (+32%, $p < 0.05$), while CT group did not exhibit any amelioration. Concerning PLM, ET group exhibited significant ameliorations in: PLM_{peak} (+20%, $p < 0.05$), ΔPLM (+60%, $p < 0.05$), as well as Area Under the Curve (AUC, +65%, $p < 0.05$). CT group showed a further reduction in all the parameters: PLM_{peak} (-15%, $p < 0.05$), ΔPLM (-25%, $p < 0.05$), AUC (-25%, $p < 0.05$).
Conclusion: Data from the current study suggests that the progressive reduction in vascular function usually exhibited in patients with AD can be reversed by an ET program. Consequently, exercise seems to be an effective non-pharmacological strategy that can be used to counteract deleterious effects of this neurodegenerative disease.
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22 APA
Training effects on central and peripheral components of force, in old healthy subjects: the role of central command

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Aim: The aim of this pilot study, was to investigate the role of central command (CC), during strength training in old healthy men. For this purpose, maximal voluntary contraction (MVC), percentage of neuromuscular activation (%VMA) and rest twitch (RT) were determined before and after 4 weeks of quadriceps electro-stimulation (ES), or voluntary isometric training (VT).
Methods: For this purpose, 4 old (65–70 years) and 4 young subjects (20–25 years) were recruited for this study. ES was performed by a commercially available electrical stimulator (Globus Italy SRL, model Genesy 1200 Pro). ES included 15 min of isometric-evoked contractions (6 s contraction/11 s of recovery) in 1 leg, 3 times a week for a total of 12 training sessions. VT was performed after a washout period of 5 weeks, matching the force-output recorded during the EC.
Results: MVC was reduced (-15%) after ES in old subjects, while young subjects showed an increase (+28%). Both, %VMA and RT were increased after ES in old subjects, +17 and +78%, respectively. Contrarily, changes in %VMA and RT were negligible in young

individuals.Both, young and old subjects exhibited after VT significant increases in MVC +10 and 42% respectively. Changes in, %VMA and RT were negligible in old subjects. Contrarily, changes in %VMA and RT were increased in young individuals by +9 and +38%, respectively.

Conclusions: The results of the current study, suggest that the CC has a primary role to determine improvement of MVC, in old subjects. Moreover, the lack of improvements in %VMA and RT after VT in old subjects suggest that MVC amelioration was primarily due to central components of force.

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23 APA
Hypopressive training, adaptations and impact on Quality of Life

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Aim: Hypopressive exercises, born in the eighties as a treatment for uro-gynecological dysfunction, reduce intra-abdominal pressure and improve the muscular tone of the abdominal and pelvic fascia. In this study we evaluated the functional effects and the quality of life of hypopressive method in healthy elderly subjects.

Methods: 50 subjects (60–78 yy) was randomly subdivided into three groups: hypopressive training (HTG n = 16); maintenance aerobic training (MTG n = 18) and control group (CTR n = 16). Before and after 2 months of 3 times a week training we evaluated anthropometric variables (weight, BMI, WHR, maximum breathing thoracic circumference MBTC); flexibility (back-scratch and sit-and-reach); respiratory function (FVC, FEV1, MVV); metabolic function (V'O2max); quality of life (questionnaires SF-12, ICIQ-IU). Two-way ANOVA for repeated measurements was applied for statistical analysis.

Results: Significant differences were found in MBTC (+65.9, +20.0 and +26.2% in HTG, MTG and CTR respectively); In FVC (+7.23% in HTG versus −3.16% and −5.28%); In FV1 (+6.50% in HTG versus −3.26 and −4.92%); In MVV (+7.62% in HTG versus −3.03 and −4.71%). In back-scratch HTG improved by 57% ($p < 0.018$), not in other groups. No significant difference was found in the three groups for $\dot{V}O_2$max and anthropometric variables except a poor increase in WHR (HTG +1.88%, MTG +0.11%, CTR +3.60%). The SF-12 questionnaire did not report any significant differences while the ICIQ-IU (more specific) has shown the greatest benefit in terms of urinary incontinence after the training in HTG.

Conclusions: HTG on healthy elderly subjects improves the ventilatory function, particularly the MVV, inducing a modest gain in quality of life. No variations in other functional and structural parameters (anthropometry, flexibility, metabolism), justified by the poor metabolic and muscular impact of its exercises, suggests that its use may be more useful if combined with aerobic, anaerobic and muscular exercises.

24 APA
Adapted Physical Activity in Genoa Socio-Sanitary Districts: empowerment and active ageing

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Aim: Ageing boom and chronic diseases produced a real emergency in the world, one of W.h.o.'s general purpose is to contrast physical inactivity. In Genoa, the Socio-Sanitary Districts approach a new collaborative leadership and empowerment for a new health pro-active deal with social and private stakeholders to create a virtuous process of care and prevention support for elderly with frailty and disabilities.

Methods: The study investigates the whole process of APA (enrolment criteria, monitoring actions, empowerment actions, professional rules and responsibilities, communication policies and social engagement and fair activities in solidarity) and step by step the construction of quality actions ISO 9001 for prevention. Since 2012, the Project has involved about 2000 elders, and about 800 of them are currently attending to Apa activities.

Results: Data analysis are in progress. Preliminary physical and psychosocial performances outcomes indicate a good customer satisfaction and the right goals for physical abilities and functionalities and for psychological dimensions.

Conclusion: The study confirms scientific literature and indicates new opportunities to promote health and wellness for elders through APA activities.

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BIOMECHANICS

1 BM
Improving the articular mobility of the bumble-humeral crawler in agonists swimmers through osteopathic manipulative treatment

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Aim: The objective of this study is to demonstrate both the relation between the efficiency of the glenohumeral girdle's joint mobility, the fascial system of the upper thorax district and the axilla pyramid and the central tendon and how the osteopathic manipulative treatment (OMT) could improve the fascia rebalancing for swimmers, in order to increase their performance and also probably to reduce some problematic issues linked to the practice of competitive swimming. Our study wants to demonstrate that the OMT generates an optimal joint mechanics by developing an accurate technical gesture, providing a balanced results-to-effort ratio. A better functional condition will lead to a good muscle coordination and consequently to a reduction of energy consumption and then to better performances.
Method: The sample used in this study consists of competitive swimmers, 4 male and 3 female aged 13–17 years, who compete in both regional and national circuits. The athletes first underwent some joint mobility tests, that measured the mobility range of the glenohumeral joint, and afterwards they underwent a test in the water, covering a 200 mt distance crawl, in order to count the strokes needed to cover such a distance.
The athletes underwent 4 treatments, one per week; after 15 days tests were repeated in order to verify whether the treatment efficiency had changed over time.
Results and Conclusion: The results obtained show a significant improvement in the movement range of the humeral bones ($P \ll 0.0001$), which allows us to hypothesize that the use of OMT could guarantee and maintain a fascial equilibrium in this district by improving performance.
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2 BM
Wearable inertial sensors devices in front crawl swimming: detection of the stroke phases through 3D hand trajectory

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Aim: The arm-stroke technique is a key factor for the swimmer performance. Stroke cycle in front crawl is described by four phases (entry; pull; push; recovery), commonly expressed as a percentage of the stroke duration. This study introduces, for the first time, an approach for automatic temporal phase detection in front-crawl swimming using inertial measurement units (IMUs) based on the tridimensional position of the hand (Dadashi 2013). The validity of the proposed method is compared with a video-based system considered as gold standard.
Methods: Kinematic of 8 swimmers was evaluated during 25 m swimming trial performed at self-selected velocity. The four phases duration were automatic identified by the time between the following events: Tentry occured when the antero-posterior position of the hand is maximum; Tpull occurred when the derivative of medio-lateral position of the hand is for the first time lower than a threshold fixed at −50 cm/s; Tpush occurred when the dorsal–ventral position of the hand reach the minimum value; Trecovery occurred when the angle between the forearm and thorax anterior–posterior axes starts to decrease. A high-frequency sagittal video was used as the gold standard.
Results: A strong mean correlation ($R = 0.83$) for the stroke phase duration was observed between two methods. The Bland–Altman plot indicated a good agreement and an acceptable mean error between the stroke phases detection with video-based and the IMU methods (the bias and the limits of agreements of the phases duration expressed in percentage of the stroke cycle were always lower than 1.8 and 9.2%, respectively).
Conclusion: The present findings confirmed the practical use of IMU technology for the detection of the stroke phase based on hand trajectory.
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3 BM
Changes in athletes posture due to DOMS are reduced by direct vibratory therapy

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Aim: Delayed onset muscle soreness (DOMS) affect walking and running gait biomechanics. Furthermore, it is not known if impairments in mechanical changes could generate a compensatory postural adaptation with the risk of more severe musculoskeletal injury for the athletes (1). Previous investigations of therapeutic modalities used to reduced perception of soreness point out on efficacy of vibration therapy (VT). We designed this study to investigate the effect of DOMS on athletes posture and to provide some insight into understanding of the role of pain sensation in biomechanical modifications.
Methods: Forty professional futsal players (no goal-keepers) agreed to take part in this study. Participants visited the data collection venue on five different occasions: baseline, eccentric exercises (EE) session day, 24 and 48 h after EE. A device (Vibra3.0, ADswiss Medtech, Swiss) was used to apply 120 Hz vibration on the left and right quadriceps, biceps femoris and adductor muscles for 15 min in the VT group, while no vibration was applied in the non-VT group. The measurements included: isokinetic evaluation, stabilometric test (3) and perceived soreness evaluation. After 24 and 48 h, the serum

levels of creatine-kinase (CK), and lactate dehydrogenase were measured (2).

Results: The results showed changes in plantar force distribution ($p < 0.05$), and in biomechanical parameters 48 h after EE in non-VT group. Moreover a reduced contractile force ($p < 0.01$) and significantly increased CK levels and soreness perception were found in the non-VT group, compared to the VT group ($p < 0.01$).

Conclusion: DOMS significantly changes the athletes posture. Pain thresholds increased significantly after VT. When pain decreases, the postural change do not come up. It is concluded that soreness perception is the principal reason of postural changes.

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4 BM
Acute effects of weighted wests sprint training on mechanical power production

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Aim: To improve the acceleration phase in sprint running mechanical power production should be maximized. The aim of this study was to establish which load would maximize mechanical power without inducing changes in running technique and in lower limbs injury risk during weighted west sprints (WWS).

Methods: Ten male sprint athletes (stature: 1.78 ± 0.05 m; body mass (BM): 70 ± 6.1 kg; personal best: 11.02 ± 0.2 s) performed 3 trials at their maximum speed over a 10 m distance unloaded (UL) and with loads equal to +15%BM and +25%BM. The experiments were video recorded (Elixim, Casio, 100 Hz). Maximal horizontal speed (vh0) and power (Ph0), leg (k_{leg}) and vertical stiffess (k_{vert}) were calculated according to Samozino et al. (2015) and Morin et al. (2005). Hip, knee and ankle angles at touch-down and take-off were measured over the entire running distance.

Results: vh0 linearly decreased with the external load ($vh0 = -0.48$ load + 10.53, $R^2 = 0.99$) while Ph0 achieved its maximum (1638 ± 183 W) at + 15%BM. k_{vert} increased with the external load while k_{leg} showed no significant changes (main effect: $P < 0.01$ and P = NS for k_{vert} and k_{leg}, respectively). The differences in k_{vert} were mainly due to differences between UL ($63.02 \pm 15.9 kN \cdot m^{-1}$) and the loaded conditions (67.25 ± 13.68 and 67.62 ± 16.86 $kN \cdot m^{-1}$ for +15%BM and +25%BM, respectively). All angular parameters showed no significant changes as a function of load at touch-down and take-off.

Conclusion: These data suggests that the +15%BM condition represents the optimal overload to maximize the acute effects of training in WWS without altering running technique (e.g. joint angles). A significant increase in k_{vert}, however, was observed at this load, and this suggests a (slightly) larger risk factor for lower limb injury when training with WWS.

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5 BM
Mechanical power in sprint running: results from two computational methods

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Aim: Mechanical power is the major determinant of sprint performance. Recently, a simple method based on the sprinter's velocity time course was developed to obtain sprint power output on a field setting (1). The aim of this study was to compare this recent method with the 'classical approach' proposed by Cavagna and Kaneko (1977) (2).

Methods: 21 athletes (age 23 ± 2 years, mass 67 ± 11 kg) performed two maximal 20 m sprint in a gym. The experiments were recorded by a motion capture system (35 Vicon MX cameras, Oxford Metrics, UK; 100 Hz) with the aim to calculate the 3D trajectory of the body centre of mass. From the time course of BCoM total energy the external power (Pext) was computed as the sum of the increments and added to internal power (Pint) to obtain total mechanical power (Ptot) according to Cavagna and Kaneko (1977). According to Samozino et al. (2016) the BCoM horizontal velocity was fitted with a mono-exponential function and differentiated to obtain BCoM forward acceleration and force; mean horizontal power (Phoriz) was computed by multiplying horizontal force and velocity.

Results: Mean 20 m speed was 5.80 ± 0.42 m/s. Average power values were: Pext 15.3 ± 2.4 W/kg, Pint 10.6 ± 1.9 W/kg and Ptot 25.9 ± 4.1 W/kg, whereas average Phoriz was 8.1 ± 1.8 W/kg (significantly lower than Pext and Ptot). When power was calculated only on the increments of the horizontal velocity ($Pf = 13.3 \pm 2.5$ W/kg), Pf was still significantly larger than Phoriz.

Conclusion: Phoriz was implemented as a simple method, however this simplification does not take into account the power for accelerating the limbs, which is almost 70% of Pext. Moreover it neglects the power fluctuations (calculated in 6.5 ± 1.5 W/kg) that occur at each step for redirecting the BCoM and disregards BCoM vertical excursion.

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6 BM

Cross-country skiing technical factors analyzed through principal component analysis of full body movements

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Aim: Biomechanical investigation of different cross-country skiing techniques was the goal of several scientific studies in the last two decades. The rationale of these investigations was the assessment the kinematic features that drive best performances, in order to provide technical reference models and properly address training efforts. In the present study, we applied Principal Component Analysis (PCA) to the DP technique by factorizing its kinematic features into components of the whole movement
Methods: Eight high-level (HL) and eight regional level (RL) male cross-country skiers performed a 5-min submaximal DP trial while roller skiing on a treadmill at 14 km h^{-1} and 2° incline. Whole-body kinematics was recorded with a 3D motion capture system. PCA was applied to markers coordinates to extract a set of principal movements (PM_k), which represent linear motion of markers and were ranked by their variance. Energy cost of locomotion (EC) was calculated from ergospirometric measurements.
Results: The first component (PM_1), accounting for 70% of the variance described mainly shoulder motion, PM_2 and PM_3 described mainly trunk and elbow flexion–extension, respectively. $96.7 \pm 0.60\%$ of total skiing pattern variance can be described with the first three PM_k. Further components, representing residual movements such as slow postural modification, slow changes in trunk inclination or foot position or high frequency vibrations, was greater for RGL compared to HLG and positively correlated with EC.
Conclusion: The method adopted here extracted and isolated components of the movements that, would not have been revealed with other data analysis techniques. It revealed that residual movements were associated with worse skiing economy and lower athletes' skill.
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7 BM

Mechanical work of shuttle running at different speeds and over different distances

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Aim: The aim of this study was to measure total mechanical work (W^+_{tot}) work during shuttle running (SR) and to compare these data with data collected during constant speed running (CR).
Methods: Twenty-two athletes were requested to perform SR (with a 180° change of direction) at three velocities (S: slow; M: moderate; H: high) over four distances (5, 10, 15 and 20 m) and to run, at constant speed, over the 20 m distance. The experiments were recorded by a motion capture system (Vicon MX, Oxford Metrics, UK; 100 Hz) with the aim to calculate the 3D trajectory of the body centre of mass, based on which mechanical work was calculated.
Results: In CR W^+_{tot} ($J{\cdot}kg^{-1}{\cdot}m^{-1}$) was found to increase linearly as a function of velocity ($W^+_{tot} = 1.385 + 0.174.v_{mean}$, $R^2 = 0.352$, $P < 0.001$). In SR, the relationship between W^+_{tot} and velocity is not linear and data are best fitted by 2nd order polynomial functions (range R^2: 0.7–0.9). On the average, W^+_{tot} ($J{\cdot}kg^{-1}{\cdot}m^{-1}$) was found to be about 1.5 times larger at H vs. S (over all distances) and about 14% lower at 20 vs. 5 m (at all velocities). At high shuttle speeds W^+_{tot} ($J{\cdot}kg^{-1}$; i.e. not normalized by the distance covered) was found to increase linearly as a function of velocity ($W^+_{tot} = -116.23 + 49.59.v_{mean}$, $R^2 = 0.915$, $P < 0.001$); this equation can thus be utilized to estimate $W^+_{tot}$of SR over different distances, albeit at maximal speed only.
Conclusion: Whereas the mechanics of CR are well known (1), little is known about the mechanics of unsteady locomotion, especially when the speed oscillations are significant. Data reported in this study are in agreement with those reported in the literature (2) over the 5 m distance; they further extend present knowledge to larger SR distances.
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8 BM

Whole body kinematic description while cross country skiing on the snow: experimental setting and tracking methodology for a good analysis

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Aim: The challenge was to verify if a whole body kinematic analysis during a cross country skiing race is possible and able to describe the behavior of skiers, in non-fatigued and fatigued conditions.
Methods: The first 10 male and female finishers of the 44th Marcialonga were filmed (100fps, HD resolution) 7 km after the start and 4 km before the arrival of the 58 km long race. The filming zones, 20 m long, had similar slope and three parallel tracks sculpted in the snow. Each track was calibrated by 5 equally spaced cones placed alongside the track. The horizontal line was identified with a liquid level system. The coordinates of the principal body segments were digitized through the semi-automatic tracking modality of *Tracker* software. A specific calibration was applied for each skier considering the track he/she used. The angular displacement of main body joints, poling and cycle durations of two consecutive skiing cycles were considered.
Results: Joint angles pattern and angular range of hip, knee, shoulder and elbow joint, and bi-dimensional displacement of centre of mass (COM) were all comparable with literature data acquired from laboratory set-ups. Typical fatigue effects were also appreciable by comparing the two filming zones: increased cycle frequency, duty

factor, vertical displacement of COM and reduction of COM forward displacement at the beginning of the poling phase (all $p < 0.05$) were found, with some specific between-sex differences.
Conclusion: Scrupulous calibration, filming procedures and data tracking can provide precise and reliable kinematic information while cross-country skiing in ecological conditions.
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9 BM
Morphofunctional adaptations of muscle–tendon interface to aerobic training

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Aim: The muscle–tendon interface, also called myotendinous junction (MTJ), is a key anatomical area for the locomotor system, through which the contractile strength generated by muscle fibres can be transmitted to the tendon tissue. At morphological level, the plasticity of MTJ has been demonstrated in different physiological conditions, such as aerobic training or muscle atrophy (1,2). The aim of this work is to investigate the possible presence of protein complex adaptation, at MTJ level, in relationship to the morphological changes that appear in this interface following aerobic training.
Methods: The MTJs of *EDL* muscles of control and trained rats have been investigated. The running speed of exercise sessions (1 h a day for 5 weeks) was 25 m/min. Optical and transmission electron microscopies have been used to evaluate MTJ changes. Confocal microscopy and immunofluorescence quantification have been performed to evaluate the MTJ protein complex.
Results: Ultrastructural observations confirmed the plasticity of MTJ following aerobic training. The increased contact area between muscle and tendon in trained rats was associated with the appearance of electron-dense zones in the muscle tissue, suggesting the presence of a denser MTJ protein complex in this group. Confocal images and immunofluorescence quantification on the muscle fibre cytoskeleton confirmed these observations.
Conclusion: Aerobic training induces MTJ morphofunctional adaptations. In fact, the morphological modifications are related to a modulation of the muscle fibre cytoskeleton. During training, muscle injuries occur more frequently at the MTJ level than in the muscular belly, therefore these data on MTJ plasticity may suggest new interesting prospects.
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10 BM
The hurdle clearance technique in young athletes

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Aim: The hurdle technique consists in three main phases: take-off, clearance and landing. The aim of our study was to investigate in young athletes how the main kinematic parameters, used in hurdle's biomechanical, analysis (1), can influence their performance.
Methods: Ten males young athletes (age 9 ± 2 years, height $1.39. \pm 0.05$ cm, weight 29 ± 3.5 kg) were recruited for this study. They performed three trials each over five hurdles, with about 1 min recovery between trials. Distance between the hurdles and height of each hurdle were 70 cm and 50 cm, respectively. Kinematic analysis was performed at the third hurdle by a 2D kinematic system Kinovea and two video cameras GO-PRO, operating at a frequency of 120 Hz and placed at an angle of 90° and 45° with respect to the hurdle.
Results: The youngers showed a smaller take-off distance and a greater landing distance (ratio 47%:53%) compared to elite athletes. At take-off, the deviation angle was 89° and the horizontal velocity of the centre of mass (CM), decreased by 33% from braking (3.78 m/s) to propulsion phases (2.51 m/s). The flight time was 0.43 s and the trajectory of the CM was 89 cm. In landing, they showed a long contact time (210 ms) and a negative vertical velocity of the CM (−2.34 m/sec), with an increase of the horizontal velocity of the CM (22%).
Conclusion: The young athletes showed an inadequate hurdle clearance. In particular, they cleared the hurdle with a very long trajectory and a loss of horizontal velocity, thus increasing the flight time. Moreover, the long landing contact time and the very negative vertical velocity of the CM highlight their poor ability to transform the flight phase into running.
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11 BM
Design of a 3D Educational Animation Model for Learning the Squat Motor Pattern

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Aim: Kinesiologists observe actions for both learning and evaluating motor skills. The quality of the visual representation limits the precision of the motor skills acquisition (1). With respect to the Bernstein's principle of the equal simplicity, the human movement is not repeatable, and any video store an instantaneous and individual motor strategy (2). Focusing on the sport kinesiology, a standardized virtual model of the motor skills is required. Such a paper reports on

the use of a 3D dynamic model to design an educational animation protocol to learn the essential motor skills of the squat.
Methods: A 78 link-model humanoid manikin was designed in a 3D virtual reality room (3). The manikin was fitted out with a soft-body polymesh texture to emulate the anatomical deformations of the skin wrapping the joints during movements.
Results: Repeatable squat tasks were performed by manikin. Proper hip-hinge, kneeling and deepping motor patterns were showed highlighting the alignment of the vertical trajectory of the center of body-mass with respect of the middle point of the feet stance.
Conclusion: The 3D virtual reality room allows for enhancing an educational animation protocol with very high quality biomechanics reproductions of motor skills useful trainers, physicians and kinesiologists, which have to be educated and trained to the sport gestures.
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12 BM
Indoor cycling activity induced modification in muscular viscoelastic characteristics in healthy adults

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Aim. The aim of this study was to examine the acute effects of indoor cycling exercise, on muscular viscoelastic characteristics (tone, stiffness and elasticity) in healthy adults.
Methods: Eight healthy subject, 4 women and 4 men, mean age 45 ± 6 years, mean body mass 64.9 ± 11.4 kg, mean height 172.3 ± 7.4 cm, body mass index 21.8 ± 2.7, with two years experience in spinning training, were recruited underwent indoor cycle training (55 min two time at week for 9 weeks) and were tested in a motor control laboratory. Pre and post training, a non-invasive measurement device, called MyotonPro was used to measure viscoelastic characteristics on dominant rectus and biceps femoris in relaxed and contracted state. Mixed model analysis with only fixed factors was performed.
Results: In relaxed state, the tone data of rectus (16.6 ± 1.7 vs 19.8 ± 3.2) and biceps femoris data (16.0 ± 1.6 vs 18.5 ± 2.8) increased significantly ($p < 0.05$) pre-post, by 19 and 16% respectively. In contracted state this difference was less relevant: 0.5% (17.3 ± 1.6 vs 18.3 ± 2.4) and 0.4% (17.2 ± 1.7 vs 17.9 ± 2.4). The stiffness data had the same trend but with higher increments for both relaxed state and contracted state. In relaxed state: 41% rectus (304 ± 29 vs 432 ± 113) and 35% biceps femoris (289 ± 32 vs 392 ± 102); in contracted state, respectively: 14% (315 ± 30 vs 359 ± 67) and 12% (307 ± 36 vs 346 ± 65). Elasticity data showed, in the relaxed state, an increase in both the rectus and the biceps femoris, 27% ($1.55 \pm 0{,}32$ vs 1.12 ± 0.13) and 26% (1.44 ± 0.28 vs 1.07 ± 0.13). In contracted state, it was, respectively, 0,9% (1.55 ± 0.18 vs 1.39 ± 0.29) and 0.8% (1.50 ± 0.19 vs 1.38 ± 0.29).
Conclusions: Tone, stiffness and elasticity increase post training, independently by time, in both rectus and biceps femoris, in relaxed and contracted state. Interestingly this variation are stronger in pre-post measures in relaxed than in contracted state. This results could be used to monitoring athletes muscular viscoelastics characteristics during recovery.

13 BM
Effect of postural changes on block start performance in sprint running

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Aim: A few studies focused on the effect of posture during sprint start (1, 2) despite identification of optimal posture to perform this task would be of great relevance to both coaches and athletes. The aim of this study was to assess the effects of two different block settings on kinetic and kinematic parameters in sprint start.
Methods: Thirty-six skilled sprinters performed a total of 6 maximal-effort 10-m sprints using two different starting conditions: (1) the athlete's usual personal block setting condition (UC), and (2) a test condition (TC) where start block positions were set according to a calculation on the athlete's leg length (1). A set of dynamometric sprint blocks was used to measure the magnitude of forces generated by athletes.
Results: Mean length distances in starting blocks were significantly different in the two conditions: starting line/front block distance, 52.9 ± 4.6 cm and 49.8 ± 2.4 cm ($p = 0.0001$) and inter-block distance, 27.4 ± 2.42 cm and 37.3 ± 1.9 cm ($p < 0.001$) in UC and TC, respectively. A significant increase was found in TC for total impulse ($p < 0.001$), rear leg in the maximum resultant force and impulse ($p = 0.003$, $p = 0.026$, respectively); time at 5 m decreased ($p = 0.005$) and horizontal velocity increased in TC ($p = 0.007$)
Conclusion: Results indicate that a block setting based on the individual's leg length (TC) improves sprint start performance by enabling larger rear block forces and impulse. This may be in association with greater inter-block distance in the TC starting condition.
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14 BM
Endurance speed depends on biomechanical factors?

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Aim: "Physiological factors" influence endurance speed: $v_{end} = FVO_{2max}/C$ where FVO_{2max} is related to the "anaerobic threshold" and C is the energy cost of running (1): faster athletes are thus characterized by larger values of FVO_{2max} and lower values of C.

The aim of this study was to investigate whether v_{end} is also influenced by biomechanical parameters.
Methods: Forty-one male recreational long distance runners (age: 42.7 ± 10.2 years; body mass: 72.2 ± 9.2 kg; stature: 1.76 ± 0.07 m; 10.4 ± 9.0 years of practice) participated to the study. Data were collected during a half marathon organized by the University of Verona in the event RunforScience (R4S). C ($J \cdot m^{-1} \cdot kg^{-1}$) was measured the day before the race, on a treadmill, at the speed (v_T) the runners were expected to maintain during the race (v_{end}). The runners were video-recorded (Exilim, Casio, 100 Hz) when they reached the 7th km, to measure v_{end}, step frequency (SF) and length (SL); leg (k_{leg}) and vertical (k_{vert}) stiffness were calculated as proposed by Morin et al. (2005) (2).
Results: No differences in speed were observed between v_T and v_{end} (3.46 ± 0.46 vs 3.48 ± 0.42 $m \cdot s^{-1}$). No relationship was observed between v_{end} and SF (2.82 ± 0.19 Hz), k_{leg} (9.28 ± 2.50 $kN \cdot m^{-1}$) or k_{vert} (25.55 ± 4.73 $kN \cdot m^{-1}$) but SL was larger in the fastest runners ($v_{end} = 0.71 + 2.23SL$; $r = 0.839$; $p < 0.001$). The runners with larger SL were those with the lower values of energy cost ($C = 5.18 - 0.86SL$; $r = 0.434$; $p < 0.01$).
Conclusion: These data indicate that, during a half marathon, SF is kept as close as possible to the resonant step frequency (2.6-2.8 Hz) (3) and that faster athletes are those that can increase their SL the most. This data also suggest that SL is a strong determinant of v_{end} and thus that this parameter should be the focus of training interventions in endurance runners.
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15 BM
The variation of the balance strategy during the lifespan: a pilot study

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Aim: The control of standing is a complicated task, and many factors contributes to an adequate postural control. The postural control system is influenced by peripheral sensory systems and from their correct functions. The aim of this pilot study was to investigate on the change of balance in young age, middle age and elderly age.
Method: Nine hundred and twelve subjects, between 7 and 90 years, were analyzed in this study. The subjects no had to be professional sportsmen and had to be healthy subjects. Participants were asked to hold the standardized Romberg test position on the baropodometric platform and the ellipse area parameters of the statokinesigram were considered for evaluation. The analysis was measured through the FreeMed posturography system (by Sensor Medica). The sample was divided in: Under 25 group, 25/65 group and Over 65 group. STATISTICA software was adopted to perform an unpaired t test. The P value lower than 0.05 was considered to be statistically relevant.
Results: The analysis showed that the ellipse surface area improves with age, up to 45 years or so, with opposite trend later on (Table 1 and Fig. 1). 25/65 group have middle values significantly lower values than the other two groups.
Conclusion: Analyzing findings, we showed a worsening balance in elderly; and these results are in line with the data published in literature. In addition, we showed a lower balance in young age also, probably because the children lack important motor abilities (strength, power, coordination) that are necessary components of balance capacities. Further studies are needed in this field but this pilot is a beginning towards standardization of the parameters of the posturographic analysis.
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16 BM
Pedal type influences mechanical power output in cycling

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Aim: In many sports where locomotory tools are utilized (e.g. in cycling) the use of innovative technologies has profound effects on performance. The design of modern pedals is aimed at increasing force transmission during the down-stroke and at improving cycling economy and efficiency (1). The aim of this study was to evaluate power production in cycling while pedalling with three types of pedals: Speedplay (SP), Look-Keo (LK) and a normal pedal (common toe clip pedal model: NP).
Methods: Thirteen male well-trained cyclists (age: 26 ± 6.8 years; annual training volume: 16307 ± 7040 km) performed force–velocity tests (5 s all-out sprint with different gears: 2, 4, 6, 8) (2) with these pedals. All sprint conditions (pedals and gears) were randomized with 3 min of recovery between trials. The average values of power (P_{mean}) and cadence were recorded by means of the SRM powermeter (5version; 2 Hz). From these data the individual power-cadence relationships were obtained and the maximal power value (P_{max}) was calculated.
Results: Pedalling cadence decreased with increasing gear (100-200 rpm) whereas average force decreased with it (100–450 N) with no major differences among pedals. P_{mean} was largest at gear 6-8 (about 800 W) compared to gear 2–4 (500–700 W); no significant differences in P_{mean} were found between LK and SP but P_{mean} was lower in NP compared with the other two pedals ($p < 0.01$). No differences in P_{max} were observed between LK and SP (1077.7 ± 201 W and 1094 ± 210 W, respectively), but P_{max} was lower in NP (1013.6 ± 107 W) compared with the other two conditions ($p < 0.001$).
Conclusion: These data indicate that there is a significant advantage, in terms of power production, when using LK and SP pedals compared to a common toe clip pedal model in all-out sprint trials.
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CARDIO RESPIRATORY FUNCTION

1 CRF

Can incremental exercise tests accurately predict steady-state aerobic exercise intensity? Exploring a possible methodological flaw in the current guidelines for exercise prescription

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Aim: The 1:1 relationship between oxygen uptake reserve (%VO_2R) and heart rate reserve (%HRR) percentages derives from studies that used incremental exercise protocols, but it is currently applied in the prescription of steady-state aerobic exercise[1], which may not be appropriate[3].
In this study, the 1:1 relationship was applied to assess the accuracy of target HR prediction, using both steady-state exercise (SSE) and graded exercise test (GXT) data.
Methods: Once filtered from outliers and missing values, cycle ergometer data from GXTs (to maximum) and SSEs (60% of maximum VO_2) of 440 sedentary subjects (17–66 years) of the HERITAGE study[2] were analyzed. SSE %HRRs (SSE_{60} %HRR) and %VO_2Rs (SSE_{60} %VO_2R) were calculated using measured maximal HRs and VO_2s and resting HRs, and estimated resting VO_2s (3.5 mL kg^{-1} min^{-1}). The same calculations were made on GXTs data, and individual linear regressions between %HRRs (dependent variable) and %VO_2Rs (independent variable) were performed. Subjects' %HRRs corresponding to their SSE intensities (GXT_{60} %HRR) were then predicted (SSE_{60} %VO_2R × *slope* + *intercept*). Paired sample t-tests, ICCs and Bland–Altman plots were used to compare SSE_{60} %HRRs to SSE_{60} %VO_2Rs and GXT_{60} %HRRs ($\alpha = 0.05$).
Results: SSE_{60} %HRR were significantly different from both SSE_{60} %VO_2R (difference = 6.13%; $t = 16.57$, $p < 0.01$; ICC = 0.46) and GXT_{60} %HRR (difference = −1.18%; $t = -3.21$, $p < 0.01$; ICC = 0.79). Bland–Altman plots showed broad error ranges for both SSE_{60} %HRR vs. SSE_{60} %VO_2R (LoA at 95% CI −9.08, +21.33) and SSE_{60} %HRR vs. GXT_{60} %HRR (LoA at 95% CI −16.27, +13.91).
Conclusions: Predicting the target HR of SSEs using VO_2s data derived from prior GXTs may reduce prescription inaccuracy, at 60% of maximal VO_2, compared to the straight application of the 1:1 relationship. Nonetheless, both the prediction biases were high. Additional studies addressing the HRR-%VO_2R relationship during SSE are therefore warranted to improve the accuracy of aerobic exercise intensity prescription.

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2 CRF

Respiratory frequency and tidal volume dynamics in response to sinusoidal variations in workload

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Aim: Sinusoidal variations in workload have been used to investigate the control of ventilation during moderate exercise.[1,2] This paradigm has consistently shown a strong link between minute ventilation ($\dot{V}_E$) and $\dot{V}CO_2$, suggesting that V_E is mainly regulated by humoral stimuli. However, it is unclear whether this relationship is mediated by respiratory frequency (f_R), tidal volume (V_T) or both. This is remarkable in the light of different inputs acting on f_R and V_T.[3] Therefore, we aimed to further our understanding of the responses of f_R and V_T during moderate sinusoidal exercise.
Methods: Twelve well-trained male cyclists, performed a preliminary ramp incremental test and two sinusoidal exercise trials in separate days. The sinusoidal trials had the same fluctuations in power output (nadir at 40 W; zenith at 90% of the first ventilator threshold), but differed in the sinusoidal period, i.e. 2 min (SP2) and 8 min (SP8). A frequency analysis was used to obtain amplitude (A) and phase lag (φ) of relevant variables.
Results: $\dot{V}_E$, V_T, $\dot{V}CO_2$ and $\dot{V}O_2$, showed a higher A and a shorter φ during SP8 compared to SP2, while no sinusoidal variations were observed for f_R. The φ of $\dot{V}_E$, V_T and $\dot{V}CO_2$ (-34.8 ± 7.32, -33.0 ± 11.58, -32.4 ± 5.90 degree and -105.9 ± 11.55, -103.8 ± 17.75, -103.3 ± 7.57 degree for SP8 and SP2 respectively) and the correlation analysis ($\dot{V}_T$ vs. $\dot{V}CO_2$, $r = 0.88$, $p < 0.001$; $\dot{V}_E$ vs. $\dot{V}CO_2$, $r = 0.95$, $p < 0.001$) show a strong link between these variables in both sinusoidal periods.
Conclusion: The strong link between $\dot{V}_E$ and $\dot{V}CO_2$ during moderate exercise is mediated by V_T, but not f_R. This corroborates the hypothesis that V_T, unlike f_R, is mainly regulated by humoral stimuli.

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3 CRF

Acute effect of Carnosine- β-alanine supplementation on blood lactate concentration and perceived exertion during long duration exercise

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Aim: The use of dietary supplements is currently widespread in sport as a strategy to increase exercise performance. Carnosine and β-alanine have been shown to be effective for short-duration, high-intensity exercise, possibly through a buffer action. The present randomized, placebo-controlled study examined whether the

ergogenic effect of carnosine supplementation are effective also present for aerobic exercise of longer duration.

Methods: Ten healthy participants (age 22.2 ± 1.9 years, weight 72.5 ± 7.9 kg, height 172 ± 8 cm, BMI 24.47 ± 1.91 kg/m^2, fat mass 12.62 ± 3.51%) performed 4 cycling tests (maximum incremental constant load test, incremental ramp test, exhaustive test at 50% and 90% of maximum oxygen uptake, VO_{2max}) 4 h after ingestion of Carn-BA (2.5 g of L-Carnosine and 2.5 g of β-Alanine) or placebo (PLA), in random order. During and after any tests, cardiorespiratory and metabolic variables, blood lactate concentration ([La-]), general, muscular and respiratory rating of perceived exertion (RPE), perceived workload (NASA task load index) and muscle pain with visual analogic scale (VAS, 24 and 48 h after the end of the fatiguing protocol) were assessed.

Results: No differences in maximum workloads, time to exhaustion and cardiorespiratory variables, during different tests, were observed between experimental conditions. [La-] concentration was significantly lower ($P < 0.05$) post Carn-BA assumption during and after 50%VO_{2max} to exhaustion, while no differences between conditions were retrieved in other protocols. Moreover, after 50%VO_{2max} exhaustive test, lower ($P < 0.05$) NASA-tlx scores (in mental demand, temporal and effort subscales) and lower ($P < 0.05$) RPE values were observed with Carn-BA.

Conclusions: The results seem to suggest an effect of Carn-BA supplementation on the blood lactate kinetics during low-intensity effort. An acute supplementation of Carn-BA should be, therefore, taken into account by athletes who perform long-term low-intensity activities.

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4 CRF
Sexes differences in athletes left ventricle with a cell mass indexed

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Aim: Differences between sexes in the left ventricle parameters are well established, however, both sport activity and body composition analysis seem to eliminate them. The aim of this study is a sexes comparison of athletes' hearts with an indexation of body cell mass in elite soccer players.

Methods: 18 females were matched with 18 elite male soccer players of the same age (female = 26.2 ± 2.4, male 26.9 ± 2.5; p = NS). An accurate body composition analysis and an echocardiography were performed in the morning on athletes group who were in a rest condition, having not exercised in the previous 12 h and having fasted for breakfast.

Results: Body composition show higher values in females for hip circumference/height (female: 0.55 ± 0.03, male: 0.52 ± 0.02; $p < 0.01$) and fat mass index (female: 3.7 ± 0.7 kg/m^2, male: 2.4 ± 0.4 kg/m^2; $p < 0.001$), while there is no difference in extra cellular mass index (female: 7.1 ± 1.2 kg/m^2, male: 7.6 ± 0.4 kg/m^2; p = NS). There are no differences in systo-diastolic parameters between sexes. Absolute values of the left ventricular dimension shows higher values in male, when these parameters are indexed with body composition they present their own development with the left ventricular mass being higher in males also with the indexed body cell mass (female: 126.62 ± 16.08 g/m^2, male: 142.87 ± 13.48 g/m^2; $p < 0.001$). There are no sexes differences with this indexation for the inter ventricular septum.

Conclusions: Sport activity seems to slightly reduce the differences in body composition and in left ventricular parameters. The different hormonal statuses play an important role in the adaption also with the same physical effort.

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5 CRF
Effect of learning process on cardiac autonomic activity

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Aim: Analysis of Heart Rate Variability (HRV), as a reflection of autonomic activity, has shown that vagal indices decrease more during executive than non-executive tasks. The influence of cognitive functions on autonomic HR modulation has not however clearly defined. Our aim was to evaluate the effect of learning process on HRV.

Methods: Thirty males (age: 23 ± 2 years) were administered a motor task (MT) and a visual task. The MT consisted of performing 64 abduction movements with the left thumb as fast as possible. The visual task was an orientation discrimination task (ODT), i.e. the subject had to decide whether the presented stimulus was tilted clockwise or counter-clockwise relative to the previous stimulus. HR was continuously recorded (Polar S-810) before (ctrl) and during the tasks. HRV was analyzed in time (SDNN, rMSSD) and frequency domains (LF/HF ratio) and by Poincaré plot (SD_1, SD_2).

Results: HR was 75 ± 12 b/min in ctrl and did not change during both MT and ODT. SDNN decreased from ctrl (83 ± 31 ms) by about 25% in both tasks, whereas rMSSD remained unchanged (overall mean 63 ± 53 ms). SD_1 was similar in ctrl and during the two tasks (45 ± 37 ms), while SD_2 decreased from ctrl (108 ± 35 ms) by 33% both in MT and ODT. LF/HF ratio was 5.2 ± 4.2 in ctrl and dropped to 1.7 ± 1.0 in MT and 2.1 ± 3.0 in ODT ($p > 0.05$ between tasks).

Conclusions: Both MT and ODT were coupled with stable HR and similar changes in HRV. Only indices of slow HR fluctuations were significantly lower than in control, indicating a selective effect of learning on cardiac modulation. The reduced LF/HF ratio would suggest that learning process induces a shift in the autonomic interaction toward vagal dominance.

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6 CRF
"BEet On Alps": ergogenic effects of dietary nitrate supplementation at high altitude

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Aim: Dietary nitrate supplementation reduces oxygen consumption ($V'O_2$) during moderate-intensity exercise and improves endurance performance, both in normoxia and acute normobaric hypoxia (1,2). No data have been provided during prolonged sojourn at high altitude, a condition that affects exercise tolerance and may change nitric oxide bioavailability (3). This study aimed to investigate the effects of dietary nitrate supplementation on oxygen cost of exercise and exercise tolerance during a prolonged sojourn at high altitude.
Methods: Fourteen subjects (28 ± 6 years) participated in a double-blind randomized crossover study at Casati hut (3269 m a.s.l). After 5 days of acclimatization, each subject they was supplemented for 3 days with beetroot juice (2 × 70 mL/day, 8.4 mmol nitrate/day [BR]) or placebo (PLA) separated with a 4 days washout period. At the end of each supplementation period, subjects performed two cycle-ergometer tests: i) 8 min moderate-intensity (MOD) constant work rate exercise and ii) high-intensity (HIGH) constant work rate exercise up to exhaustion.
Results: Plasma [nitrate] and [nitrite] were significantly higher in BR than in PLA ($p < 0.01$). In MOD, oxygen cost of exercise was significantly reduced in BR vs. PLA (11.8 ± 1.4 vs. 12.7 ± 1.8 mL*min^{-1}*w^{-1}, $p < 0.01$) and a linear correlation was found between the reduction in oxygen cost and sea level aerobic fitness level ($r^2 = 0.58$). In HIGH, $V'O_2$ was significantly lower in BR than in PLA after 6 min of exercise (2.588 ± 0.424 vs. 2.686 ± 0.438 L*min^{-1}, $p < 0.01$) and time to exhaustion was 9% longer in BR vs PLA (785 ± 180 vs. 715 ± 235 s).
Conclusion: Dietary nitrate supplementation reduced oxygen cost during moderate-intensity exercise and improved high-intensity exercise tolerance during prolonged exposure to hypobaric hypoxia. These effects were not evident in two highly fit subjects suggesting that at high altitude the ergogenic benefits of beetroot juice supplementation may be dependent on the training status of the subjects.

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7 CRF
Physiological effects of high-altitude trekking on gonadal and thyroid hormonal responses in young lowlander women

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Aim: In this study, gonadal and thyroid hormones were determined in seven regularly menstruating, lowlander native women living at sea level participating in 14 days of trekking at moderate and high altitude.
Methods: Blood samples (for hormone determinations) were collected from each subject at high altitude (5050 m a.s.l.), and at sea level before and after the expedition.
Results: Testosterone level was lowered by high altitude and was restored after the end of the expedition, while progesterone decreased significantly in all participants at the end of the expedition, though most of the participants were in the luteal phase.
Conclusion: Our findings showed high sensitivity and rapid changes of the determined parameters in response to the high-altitude hypoxic environment, particularly Testosterone.

8 CRF
The slow component of HR kinetics occurs at a lower work rate and is more pronounced than the slow component of $\dot{V}O_2$ kinetics

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Aim: Aerobic activities prescription is often based on a linear relationship among pulmonary oxygen consumption ($\dot{V}O_2$) and heart rate (HR) vs. power output. The aim of the present study was to test the hypothesis that during constant work rate (CWR) exercises at different intensities the slow component of HR kinetics occurs at lower work rate and is more pronounced that the slow component of $\dot{V}O_2$ kinetics.
Methods: Seventeen male (age = 27 ± 4 year, height = 181 ± 5 cm, weight = 77 ± 10 kg) subjects performed on a cycle ergometer an incremental exercise to voluntary exhaustion (to determine peak O_2 uptake [$\dot{V}O_2$ peak] and the gas exchange threshold [GET]) and several CWR exercises: (1) moderate CWR exercises (MOD), below GET; (2) heavy CWR exercise (HEAVY), at 25% of the difference between GET and $\dot{V}O_2$ peak (□); (3) severe CWR exercise (SEVERE), at 75% of Δ; 4) "HR controlled" exercise in

which work rate was continuously adjusted to maintain a constant HR value. Breath-by-breath $\dot{V}O_2$, heart rate and cardiac output (CO) were recorded during all tests and blood lactate concentration ($[La]_b$) was measured at rest and during recovery.
Results: In MOD, no slow component of $\dot{V}O_2$ kinetics was observed, whereas for HR kinetics a slow component with an actual amplitude (A*s'*) corresponding to 24.8 ± 11.0% of the total response (A*tot*) was observed. During HEAVY and SEVERE, A'*s*/A*tot* were more pronounced for HR kinetics (31.6 ± 11.2% and 26.9 ± 8.0%, respectively) than for $\dot{V}O_2$ kinetics (23.3 ± 9.0% and 18.7 ± 8.8%, respectively). During the HR-controlled exercise both work rate and $\dot{V}O_2$ had to decrease in order to maintain a constant HR.
Conclusion: The HR slow component occurred at a lower work rate and was more pronounced than the VO_2 slow component. This may have profound implications on exercise prescription based on HR values.
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NEUROMUSCULAR FUNCTION/MOTOR CONTROL

1 NMF/MC
The influence of central and peripheral fatigue induced by prolonged running on the rate of force development scaling factor

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Aim: In a series of fast force pulses performed across a range of submaximal amplitudes, for each pulse there is a linear relationship between the peak force and the peak rate of force development (RFD). The slope of this relationship is termed RFD scaling factor (RFD-SF; Bellumori et al. 2011). RFD-SF quantifies the extent to which RFD scales with the amplitude of the contraction. This study investigated the effect of central and peripheral fatigue induced by endurance running on the RFD-SF of knee extensors.
Methods: Twenty-six male amateur runners (aged 20–55 years) were evaluated before and immediately after a half-marathon race. Knee extensors forces were obtained using the RFD-SF protocol and during maximal voluntary isometric contractions (MVC). Electrically doublet stimuli were delivered during MVC and at rest to calculate the level of voluntary activation.
Results: Participants showed decreased voluntary activation (−9%, $p < 0.01$), resting doublet twitch (−10%, $p < 0.01$), maximal force (−18%, $p < 0.01$), and maximal RFD −20%, $p < 0.01$). Nevertheless, the slope and intercept of RFD-SF regression were unaffected by the race. The RFD of pulses up to 50% of MVC were largely unaffected by the race (all p values >0.4).
Conclusions: The half-marathon induced a considerable amount of central and peripheral fatigue and a decrease of maximal RFD. Nevertheless, the RFD-SF was unaffected by fatigue. Thus, for a wide range of submaximal intensities (up to 50% of MVC) the rapid force capacity was not affected by fatigue. Consequently, investigating the RFD in maximal and submaximal contractions do not provided interchangeable results. Since submaximal contractions are more specific for runners, we underline the relevance of measuring RFD in submaximal rapid contractions.
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2 NMF/MC
Does the behavior of quadriceps motor units differ during open and closed kinetic chain exercises? Preliminary results

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Aim: To examine whether muscle activation and motor unit behavior of the quadriceps femoris muscles are different in open versus closed kinetic chain (OKC vs CKC) tasks.
Methods: Five healthy young men (aged from 24 to 34years.) performed isometric knee extensions at 10, 30, 50, 70% of the maximum voluntary contraction force (MVC), in OKC and CKC exercises. High-density surface electromyographic signals were recorded with grids of 13 × 5 electrodes from the vastus medialis (VM), vastus lateralis (VL) and rectus femoris (RF) muscles. The average rectified value (ARV) was calculated as the ARV from all channels of the electrode grids for each muscle. Motor unit discharge rates were automatically identified by a decomposition algorithm (Negro et al. 2016).
Results: The ARV was higher in OKC than in CKC for the RF at 30, 50 and 70% MVC, for the VL at 50 and 70% MVC, and for the VM at 70% MVC. The CKC elicited a higher VM/VL activation ratio than OKC at 30, 50, and 70% MVC. The average motor unit discharge rates were higher in OKC than in CKC for the VM at 50 and 70% and for the VL at 50% MVC.
Conclusions: This study shows that the higher activation of the vasti muscles during OKC, as previously observed, is attributed to

higher discharge rates of the recruited motor units. Further analysis should investigate if the higher activation of VM relative to the VL in CKC versus OKC is related to differences in motor unit behavior.

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3 NMF/MC

Stretching-induced crossover effect: partitioning the mechanisms by an EMG, MMG and force combined approach

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Aim: After an acute bout of passive stretching (PS), the performance of the stretched muscle (SM) is depressed [1]. Often this occurs also in the contralateral muscle (CM), which is not involved in the PS manoeuvre [2]. This phenomenon is called crossover effect. Mechanisms underpinning PS-induced crossover effect are still unclear. The use of an electromyographic (EMG), mechanomyographic (MMG), and force (F) combined approach may help to shed more light on this phenomenon [3].

Methods: Twenty-one participants (age: 22 ± 3 years; stature: 1.75 ± 0.08 m; body mass: 73 ± 9 kg, mean ± SD) underwent a single-leg PS-bout (5 elogantions of 45 s) of the knee extensor muscles (KE). Before and after, the maximum voluntary contraction (MVC), the percentage of muscle activation, detected by the interpolated twitch technique (VA $_{\%}$), and the range of motion (ROM) of the KE of both legs were measured. During contraction, EMG, MMG and F were recorded from the vastus lateralis, medialis and rectus femoris muscle of SM and CM. The total electromechanical delay ($Delay_{TOT}$) and its components (Δt EMG-MMG, electrochemical component; Δt MMG-F, mechanical component) were calculated off-line for each muscle.

Results: After PS, MVC and VA % decreased in both legs (−15 and −10% SM, −8 and −7% CM; P from 0.01 to <0.001). The ROM increased (+14% SM, +6% CM; $P = 0.02$ and 0.04). Independently from the muscle, $Delay_{TOT}$ (+20% SM, +12% CM; $P = 0.007$ and 0.01) and Δt EMG-MMG lengthened in both legs (+24% SM, +12% CM; $P = 0.002$ and 0.009), whereas Δt MMG-F lengthened only in SM (+28%, $P < 0.001$).

Conclusions: The present findings suggest that PS-induced crossover effect seems to be due to alterations in the chain of electrochemical events linked to the excitation–contraction coupling (longer Δt EMG-MMG) likely provoked by a decrease in the central motor command (reduced MVC and $VA_{\%}$).

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4 NMF/MC

Effects of marathon fatigue on the discharge rates of individual motor units in older adults

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Aim: Age-related changes in motor unit properties are essential to understand muscle behavior after exercise in older adults. In this study, we compared the changes in motor unit discharge rates during steady isometric contractions before and after a half-marathon in elderly individuals.

Methods: During the event Run4Science, we recorded high-density surface electromyography (HD-sEMG, 128 channels) on the tibialis anterior muscle (TA) in eight old subjects. Subjects executed a 40 s static dorsiflexion at 25% MVC. The test was performed in two consecutive days, the first under non-fatigue conditions before half-marathon (BM) and the second immediately after half-marathon (AM). Using a novel decomposition technique for HD-sEMG recordings (Negro et al. 2016), we compared the changes in the discharge properties of the TA motor units before and after the half marathon. We calculated the global average discharge rate value (GADR) of all MUs in the two conditions. Only MU pulse trains with a silhouette measure > 0.9 were used in the study.

Results: We extracted the individual contribution of 486 unmatched MUs (∼ 30 per contraction). The GADR were 13.43 ± 1.46 (pps) and 14.89 ± 1.67(pps) for the BM and AM conditions respectively. Paired T-test analysis showed a significant difference between conditions ($P < 0.05$).

Conclusion: The results showed that the discharge rates of the identified MUs increase after the half-marathon. Future work will focus on the tracking of the same MU in the two conditions (Martinez-Valdes 2017) in order to increase the sensitivity of the estimation.

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5 NMF/MC

Motor output relative error during static linear maximal torque ramp: influence of the age

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Aim: To evaluate if the torque output relative error during linearly varying static contractions can be influenced by possible changes in

motor unit properties and activation/deactivation strategies (MUAS and MUDS) due to the ageing process.

Methods: Eleven young (Y, 23.90 ± 3.72 years) and eleven old (O, 69.63 ± 4.34 years) subjects were recruited for the study. After the measurement of first dorsal interosseous (FDI) maximal voluntary contraction (MVC) during static abduction, the subject performed one triangular isometric contraction (0-100-0%). The rate of the up-going (UGR) and down-going ramp (DGR) was 13.3% MVC/s. The requested output tension (% MVC target) was provided on a pc screen together with the force from the subject for the necessary visual feedback. The global relative errors (E %) were calculated, for the whole triangle and for the up going and down-going phases separately, according to the formula E % = absolute value of (exerted—requested target force)/requested target force*100. The filtered force signal (bandwidth: 0–20 Hz) was also analyzed using the Spike Shape Analysis (SSA) technique. Statistical significance of the calculated parameters between Y and O was set at $p < 0.05$.

Results: As reported in the table the calculated E % were always greater in old subjects. The SSA reported lower number of longer spikes, with similar absolute amplitude, in O with respect to Y subjects. When the spike amplitude is scaled to the individual MVC the spikes of O subjects are greater than in Y.

	Time interval of contraction	Young	Old	Young vs Old Statistical Significance
E %	1.25 - 13.75 s (UGR + DGR) % Relative Error [%]	9.52 ± 1.85	16.81 ± 4.95	**
	1.25 - 7.5 s (UGR) % Relative Error [%]	9.98 ± 2.77	16.15 ± 7.06	*
	7.5 - 13.75 s (DGR) % Relative Error [%]	9.06 ± 1.69	17.47 ± 7.93	**
S S A	**1.25 - 13.75 s** (UGR + DGR)			
	Number of spikes [#]	20.27 ± 3.49	13.09 ± 3.38	**
	Relative average spike amplitude [%MVC]	6.81 ± 1.78	11.88 ± 4.36	**
	1.25 - 7.5 s (UGR)			
	Number of spikes [#]	10.27 ± 2.37	7.17 ± 1.83	*
	Relative average spike amplitude [%MVC]	7.94 ± 3.26	12.60 ± 5.25	*
	7.5 - 13.75 s (DGR)			
	Number of spikes [#]	10.00 ± 2.40	5.90 ± 2.16	**
	Relative average spike amplitude [%MVC]	6.10 ± 1.6	12.06 ± 6.71	*

* p<0.05 **p<0.001

Conclusion MUAS and MUDA adopted by Y and O subjects determine a more precise motor output in Y than in O. The key factors may be: a. the larger number of error correction (reflected in the spike number) and b. the larger motor unit size due to the muscle fibers reinnervation process with age (reflecting the larger relative spike amplitude in O compared to Y).

6 NMF/MC

Electromechanical delay components after acute effect of direct inhibitory pressure: new insights from an EMG, MMG and force combined approach

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Aim: Direct inhibitory pressure (DIP) is commonly used to enhance joint range of motion and decrease the perceived level of soreness [1]. A force (F) reduction is often reported after DIP [2]. Factors underpinning F reduction are still under debate, and the intervention of the autogenic inhibitory reflex seems is the most accredited mechanism. The partitioning of the total electromechanical delay ($Delay_{TOT}$) into an electrochemical and mechanical component may help in clarifying possible mechanisms involved in the DIP-induced F reduction [3].

Methods: $Delay_{TOT}$ partitioning was assessed by electromyographic (EMG), mechanomyographic (MMG), and F combined approach during maximum voluntary contraction (MVC) of the plantar flexor (PF) and dorsiflexor muscles (DF) in twenty-four participants (age: 23 ± 2 years; stature: 1.67 ± 0.12 m; body mass: 65 ± 15 kg, mean ± SD). Measurements were performed before and after DIP, which consisted in a constant pressure applied with the thumb at the PF myotendinous junction. Three conditions were tested: DIP lasting 10 s (DIP_{10}); 30 s (DIP_{30}); and without DIP (control, Ctrl). During contraction, EMG, MMG and F were recorded from the medial, lateral gastrocnemius, soleus and tibialis anterior muscles. $Delay_{TOT}$ and its components (Δt EMG-MMG, electrochemical component; Δt MMG-F, mechanical component) were calculated off-line.

Results: MVC of PF decreased significantly by 8 and 10%, in DIP_{10} and DIP_{30}, respectively, compared to Ctrl ($P = 0.002$). MVC of DF increased significantly by 10 and 7% in DIP_{10} and DIP_{30}, respectively, compared to Ctrl ($P = 0.001$). $Delay_{TOT}$ and its components increased significantly in PF in DIP_{10} and DIP_{30}, and decreased in DF only in DIP_{30} ($P = 0.002$).

Conclusions: The present findings suggest that the AIR intervention could explain the changes in F in agonist and antagonist muscles after DIP. The lengthening of Δt MMG-F seems to indicate a concomitant alteration in the myotendinous junction's mechanical properties, altering F transmission to the muscle insertion point.

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7 NMF/MC

Reliable identification of motor unit discharge timings during ballistic contractions of the tibialis anterior muscle

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Aim: The identification of motor unit discharge patters during explosive contractions poses important challenges due to the high degree of time overlapping of motor unit action potentials (MUAPS). In this study, we propose a combination of high-density electromyographic (HDEMG) recordings and an improved optimization algorithm for the reliable extraction of individual discharge patters during ballistic contractions.

Methods: HDEMG signals (128 electrodes) were recorded from the tibialis anterior muscle during ballistic isometric dorsiflexions. Three healthy volunteers (age: 22 ± 3) participated in the experiment. The recorded signals were filtered at 20–500 Hz and convolutive blind source separation (Negro et al. 2016) was applied to estimate individual motor unit pulse trains during the ballistic task. To improve the convergence of the algorithm, three contractions per each subject were concatenated and processed concurrently. Due to the significant superimposition of MUAPS, the decomposed sources exhibited considerable variability in the amplitude of the individual pulses. Consequently, previous reliability indexes based on the silhouette measure showed to be suboptimal. An optimization algorithm based

on the identification of individual motor unit sources with the constraint of minimal inter-spike interval variability was applied to improve the separability of the sources. Regression analysis was performed on the estimated discharge patterns.
Results: The total number of decomposed motor units was 29 in three ballistic contractions. The discharge characteristics of the individual motor units showed initial high instantaneous discharge rates of 92 (64–136) pps and a progressive decline to 17 (16–29) pps within a few seconds. The discharge profiles were well approximated using the rational equation (t1*x + t2)/(x + t3).
Conclusions: The results indicate that the discharge characteristics of several motor units can be reliable estimated non-invasively during ballistic isometric contractions in the tibialis anterior muscle.
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8 NMF/MC
The time course of muscle morphological and architectural adaptations to moderate-load concentric and eccentric training in young and older men

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Aim: Moderate eccentric (ECC) loading has been advocated as an efficient way to achieve increases in muscle mass. We previously reported that concentric (CON) vs. eccentric (ECC) resistance training leads to similar hypertrophy but with distinct structural changes. We investigated the extent and the time course of the muscle morphological remodeling to moderate ECC vs. CON loading in young and older men.
Methods: 24 healthy volunteers (12 young, 19–30 years, and 12 elderly, 65–73 years) were recruited. Young and elderly subjects were randomly assigned to either an ECC ($n = 6$) or CON ($n = 6$) RT group, training 3 times/week for 8 weeks (12–15 reps × 4 sets) at the 60% of either the ECC or CON 1RM. Changes in vastus lateralis (VL) architecture (fascicle length—Lf, and pennation angle—PA) were assessed by ultrasound. Quadriceps mid-thigh (50% of VL length) cross sectional area (CSA) was measured by extended field of view (EFOV) ultrasound. Data were acquired at 0, 2, 4, 6 and 8 weeks of the training regime.
Results: In both age groups, architectural adaptations presented contraction-specific responses (i.e. Lf significantly increased after ECC, while PA showed greater increase after CON RT). However, younger ECC group showed a faster and greater increase in Lf compared to the ECC elderly group since 2 weeks from the start of the protocol (Δ %increase $= 2.84 \pm 0.92$, $P < 0.001$), which was maintained at 4,6 and 8weeks (Δ %increase $= 2.26 \pm 0.1$, $P < 0.05$; 2.3 ± 0.25, $P < 0.05$; 2.73 ± 0.18, $P < 0.01$; respectively). CSA showed similar increase and time course pattern to same loading type across ages (ECC or CON young vs. old): however, in elderly subjects, ECC presented a greater CSA increase at 4 and 6 weeks compared to CON (Δ %increase $= 2.7 \pm 0.5$, $P < 0.05$; 2.6 ± 0.8, $P < 0.05$; respectively).
Conclusions: Thus, even in the elderly, architectural adaptations to moderate-load exercise are contraction-specific. However, structural changes were achieved earlier and in a greater amplitude by moderate ECC loading in young compared to older men. In older men, the more rapid increase in muscle CSA in response to ECC indicates that moderate ECC loading could be a more time-efficient hypertrophic stimulus than moderate CON RT.

9 NMF/MC
The development of new motor skills makes anticipatory postural adjustments more parsimonious

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Aim: Executing voluntary movements destabilizes posture; to prevent so, humans use an internal (forward) model to perform anticipatory postural adjustments (Iodice 2015a). The purpose of the study was investigating the development of anticipatory postural adjustment strategies during the acquisition of novel motor skills.
Methods: Twelve healthy subjects were trained for 4 months and exposed to external perturbations to their posture induced by a mechanical platform device. Electrical activity of specific neck and leg muscles (EMG) was recorded bilaterally. The EMG device (FREEEMG 1000, BTS Bioengineering, NY, USA), startle-like acoustic stimulation (SAS) and platform movement signals were synchronized and recorded by a dedicated device. Data were analyzed off line, EMG signals for each muscle and each subject were integrated with time windows of testing phases (Epochs) and normalized to peak magnitude across all conditions (Iodice 2015b)
Results: Pattern of muscles activity showed a significantly change after training, in onset of muscle activity ($p < 0.05$) and energetic cost of the task ($p < 0.05$). After long term training muscle activity was further delayed and the muscles become active only after perturbation and not at SAS; EMGs integrated data showed a decrease of muscular activity in all observed epochs: before SAS (300 ms, $p < 0.001$), after SAS (300 ms, $P < 0.01$), before perturbation (300 ms, $p < 0.01$) and after perturbation (300 ms, $p < 0.05$). A significantly reduction of muscle activity was documented in 2 s after perturbation ($p < 0.05$).
Discussion: Our data show that long-term training produces a reduction of muscular activation and a more efficient posture control strategy, plausibly associated to a better capability to predict the perturbation onset (and thus to re-adapt just-in-time rather than far earlier(Mazzocchi 2014). This result is consistent with neuronal data showing similar "parsimony principles" in area M1.
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10 NMF/MC
The time-course of the neuromuscular and functional characteristics of plantar- and dorsi-flexors muscles after a direct inhibitory pressure maneuver

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Aim: Myotendinous junction (MTJ) manipulation can affect the neuromuscular and activation characteristics of muscle contraction [1,2]. Among MTJ manipulations, direct inhibitory pressure (DIP) is a maneuver used in rehabilitation [3]. However, the possible DIP-induced changes on the neuromuscular characteristics during maximum voluntary contraction (MVC) and the negative effects duration are still controversial.
Methods: Electromyographic (EMG) amplitude (root mean square, RMS) of the main plantar flexor (PF) and dorsiflexor muscles (DF) were assessed during MVC in twenty-four participants (age: 23 ± 2 years; stature: 1.67 ± 0.12 m; body mass: 65 ± 15 kg) PRE, immediately POST, after 5 (POST5) and 10 (POST10) min after DIP application. DIP consisted in a constant pressure applied over the *gastrocnemius medialis* MTJ with the thumb. Two conditions were tested: DIP lasting 30 s and control (no contact/pressure, CTRL).
Results: PF MVC decreased significantly by 10% in POST, 8% in POST5 and recovered in POST10 compared to CTRL (time factor: $p > 0.05$). Similarly, PF EMG RMS decreased significantly by 34.8% in POST, 35% in POST5 and recovered in POST10 compared to CTRL (time factor: $p > 0.05$). DF MVC increased significantly by 6% in POST, 7% in POST5 and returned to PRE-values in POST10 compared to CTRL (time factor: $p > 0.05$). PF EMG RMS increased by 7% in POST, 8% in POST5 and returned to PRE-values in POST10 compared to CTRL (time factor: $p > 0.05$).
Conclusions: The present findings suggest that DIP induced decreases in MVC and neuromuscular activation of PF up to 5 min after the maneuver. Concurrently, increases in DF MVC mirrored by increments in EMG RMS were seen with a similar time-course. DIP may induce a reflex-mediated inhibition of the targeted muscle [1, 2]. However, DIP-induced changes in mechanical components of muscle contraction cannot be excluded.

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11 NMF/MC
The Self Image. Comparison of young and parent

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Aim: In adolescence physical self-description is considered to play a crucial role (Scarpa and Nart 2012). Recent studies showed postural observation is very important in this age to prevent skeletal muscle disorders (Biancalana and Nart 2012).
Regular physical activity is fundamental to improve health and wellness at any ages. The aim of study was to take over how teenagers feel their posture in comparison to the parent's one.
Methods: 92 students were recruited (44 F, 48 M) aged between 11 and 13 years. Boys filled out the questionnaire for description of his own posture (Q-DPP) while parents the questionnaire for description of their child's posture (Q-DPF). Both evaluated posture, flexibility, physical structure, symmetry, coordination, physical activity carried, worthy and life style.
Results: Correlation between parents and children (Q-DPP/Q-DPF) noted that the greatest part of values in this study are always statistically significant: only 23% of values has a higher possibility that these one are due chance ($p > 0.05$). This means that parents and children express generally very similar scores and the correlation between subscales is, for 77% of the times, positive and significant.
Conclusions: Results showed that parents and children have the same perception regard the variables been examined. It is very important to educate students at movement to better deal with body's changes in teens.

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12 NMF/MC
Eye movements for performance. Saccades and microsaccades in elite table tennis players

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Aim: Investigation of the combined occurrence and characteristics of saccades and microsaccades during free-viewing sport task, with the intention to explore gaze behaviour that would optimize information gathering for action outcome prediction.
Methods: Gaze behaviour of expert and novice table tennis players was recorder during a task in which subjects were instructed to predict the ball future direction after the opponent's throw. Response accuracy, reaction time, fixations, microsaccades and saccades were recorded to estimate the relationship between gazing strategy and success in the task. Analysis of the sequence of saccades/fixations and microsaccade dynamics (during fixations) allowed to study allocation of overt or covert attention in successful predictions.
Results: Compared to novices, experts showed more correct responses (70 vs. 64%) with shorter reaction time (411.88 ± 94.62 vs. 468.56 ± 123.22 ms). Experts fixated more times and for longer periods, with more saccades and microsaccades, on hand-racket during forehand and on trunk during backhand drive technique. Furthermore, experts showed a narrower frequency distribution of microsaccade orientations when fixating on hand-racket and trunk areas, meaning that the attention was focused on those small locations.
Conclusions: Microsaccades and saccades can be related to the salience of interest areas during performance. Athletes who play ball games are repeatedly exposed to motion stimuli during their training, improving their perception of moving objects. The link between visuomotor performance and covert attention shifts could have a potential impact upon sports, as for example assessments of visual performance that can help to predict people who have elite potential. On these premises, one can suggest that vision training offers a mean to improve performance.
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13 NMF/MC
Metabolic and neuromuscular fatigue in obese subject

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Aim: Neuromuscular fatigue is defined as any exercise-induced reduction in the ability of a muscle to generate force[1] due to central (i.e. reduced motor output capacity from the brain and spinal cord) and/or peripheral (i.e. reduced ability for the muscle to contract due to changes in the peripheral nerve axons, neuromuscular junction or within the muscle itself)[2] factors. We investigated the etiology of fatigue in obese patients comparing maximal incremental exercise on cycle ergometer (CE) and on single knee extension (KE) ergometer.
Methods: 6 obese patients (age 16–47 years, BMI 32–46 kg/m^2) participated in this study. V'O_2, Cardiac Output (CO), heart rate (HR) were measured during the incremental exercise. MVC was performed before and immediately after the incremental test. Vastus Lateralis (VL), Vastus Medialis (VM) end Rectus Femoralis (RF) EMG were measured during both, incremental exercise and MVC.
Results: HR, CO and V'O_2 were significantly higher in CE than KE (HR: 157 *vs* 120 bpm, CO: 20.2 vs 14 l/min, V'O_2 2.4 vs 1.2 l/min, $p < 0.05$). The MVC and the EMG Root Mean Square decreased significantly after CE by 34.2 and 11.9%, instead in KE decreased by 16.9 and 11.9%, respectively.
Conclusions: In KE, MVC reduction was greater than RMS, which suggest peripheral fatigue. While in CE, MVC and RMS decreased similarly, which suggest central fatigue.
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NUTRITION AND SPORT

1 NS
Short-term effect of ketogenic diet on oxidative state in divers

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Aim: overweight divers face a challenging activity such as immersions, starting from a higher levels of circulating cytokines and oxidative stress. Recently, several Ketogenic Diet (KD) therapeutic uses have been validated on weight loss, and reduction of cardiovascular risk factors (Paoli et al. 2013) and its effectiveness (role) in reducing the incidence of seizures in epileptic patients is well known since the early 20th century (Bough et al. 2007). This pilot study aimed to investigate if KD may protect divers from oxidative stress and inflammation during immersion.
Method: blood and urine samples from six overweight divers were obtained a) before (CTRL) and after a dive breathing Enriched Air Nitrox and performing light underwater exercise (NTRX), b) after a dive (same conditions) performed after 7 days of KD (K-NTRX). We measured urinary 8-isoprostane and 8-OH-2-deoxyguanosine evaluating lipids peroxidation and DNA oxidative damages. Plasmatic IL-1β, IL-6 and TNF-α levels were measured to investigate the inflammatory status.
Results: KD was successful for weight loss (3.20 ± 1.31Kgs) and seemed to dampen lipids peroxidation and inflammatory biomarkers production in response to EAN-diving. Indeed, Levels of

8-isoprostane, IL-1β, IL-6 at K-NTRX dive were similar to those measured at the baseline.

Conclusion: short-term KD seems to be effective in weight loss and protective towards lipids peroxidation, and inflammatory status triggered by diving.

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2 NS
Eating disorders in the sport environment

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Aim: Eating disorders are not caused by sport environment, although the coaches can increase the risk of developing or exacerbating an existing disorder. The aim of the present study was to investigate the point of view of the coaches on eating disorders, focusing the attention on the problem knowledge of the health and performance consequences and the criteria of identification and management.

Method: Sixty-nine rhythmic gymnastics coaches completed a 23 items questionnaire, based on the NCAA survey used in the study of Trattner Sherman (2005). All the coaches had 15.2 ± 9.6 years of experience in coaching. The comparison of the impact of disordered eating behaviors on health and performance was performed using paired *T* Test. Chi-Squared analysis was used to compare the different outputs obtained in the questions.

Results: An average of 1.3 ± 1.7 athletes with disordered eating behaviors was declared for each coach and the 25% of the coaches declared to have no good knowledge about the problem. Overall the participants declared that the disordered eating behaviors may negatively influence both health and performance. The 88.4% of the coaches indicated that a current eating disorder influences the decision to recruit an athlete. The 91.0% of the coaches never referred to a mental health professional.

Conclusion: Coaches understood the problem seriousness, nevertheless the majority of the coaches did not refer to a therapist. It was recommended, instead, a treatment staff in management, including coaches, psychologist and nutritionist (Cook 2016).

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3 NS
Acute influence of magnesium on anaerobic test in elite runners

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Aim: The functions fulfilled by Magnesium are very different from each other, in particular there is evidence, widely recognized, about its role in energy process and muscle contraction. These data drives to the idea to test whether a high dosage of Magnesium can affect the performance at threshold speed in middle-distance racers.

Method: 31 top-class athletes have been involved and volunteers have been carried out 2 incremental exercise tests (Conconi test) after 3-day break in order not to affect training conditions.

Nutrition and environment conditions have been identical, furthermore cardiac frequency up to the hearth rate break point have been registered through telemetry technology.

Before performing the second test 22 athletes have taken 330 mg two day previously, 495 mg the day before and 165 mg in one administration 2 h before the test, other 9 have been given placebo.

Results: in the subjects involved in terms of maximum speed the average variation recorded is about ±0.5 km/h; one subject only has no increase of speed and any decrease for all. Any variations registered for the target group.

Conclusion: we registered a significant effect of a high dose of Mg, specific studies are needed in order to provide a precise explanation for it.

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4 NS
Ketogenic Diet does not affect the improvements in physical performance after three weeks multidisciplinary intervention program in severe obese people

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Aim: Previous paper (1) has already documented the short-term improvement in physical performance resulting from a 3-week mul-

tidisciplinary program in obese people. Additionally, ketogenic diet seems to be an effective tool to fight obesity (2), but its possible interaction with physical training is still unclear. Our purpose was to compare the effects of Very Low Caloric Ketogenic Diet (VLCKD, 800–900 kcal/day, 40–50% protein, 30–40% carbohydrates) or Hypocaloric Balanced Diet (HBD, 1200–1500 kcal/day, 15–20% protein, 50-55% carbohydrates) in combination with an intensive exercise program, in severe obese patients.

Methods: The study involved 89 severe obese patients (BMI > 40), who took part in a multidisciplinary inpatient rehabilitation program, including nutritional, exercise and psychologic interventions. All subjects performed a combination of aerobic and resistance exercise at low-moderate intensity (2000-2500 METs/week) and were assigned in VLCKD [n = 35, 22 M, 48.6 ± 14.4 years, 49.2 ± 10.9 kg/m^2] or HBD [n = 54, 29 M, 50.0 ± 13.3 years, 46.2 ± 8.9 kg/m^2] group. Aerobic capacity was assessed by Cardio-Pulmonary Exercise Test (CPET) and Six Minute Walking Test (6MWT), while strength of upper and lower extremities was measured by Chair Stand Test (CST) and Arm Curl Test (ACT).

Results: After the intervention, both groups showed, without interaction effect ($p > 0.05$), a significant ($p < 0.000$) weight loss [−5.43 and −4.93% in VLCKD and HBD respectively] and increased metabolic values [$VO2_{peak}$: +10.5 and +8.4%, Peak Power Output: +8.0 and +10.5%, $VO2_{VT1}$: +12.4 and +9.8%, P_{VT1}: +12.0 and +10.8%], distances in 6MWT [+14.9 and +9.4%] and number of repetitions in CST [+21.2 and +27.2%] and in ACT [+19.5 and +21.4%].

Conclusions: A short-term VLCKD may induce a substantial weight loss without reducing the improvements in physical performance and it is a nutritional intervention that is as effective as HBD when associated to exercise in severe obese patients.

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5 NS

Effects of one year of intermittent fasting on strength, body composition and metabolism in athletes

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Aim: Recently, a modified intermittent fasting protocol (i.e. time-restricted feeding [TRF]: 8 h feeding and 16 h fasting per day) was demonstrated to be able to maintain muscle mass and strength, decrease fat mass and improve some inflammation and cardiovascular risk factors in healthy resistance-trained males after 2 months (Moro et al. 2016). The present study sought to investigate the long-term effects of TRF on these parameters.

Methods: Twenty-six subjects enrolled in our previous study continued the assigned nutritional and training protocol. In the TRF protocol, subjects consumed their energy needs in 3 meals during an 8-h period of time each day. Subjects in the normal diet (ND) group also had three meals, which were consumed at 8 a.m., 1 p.m., and 8 p.m. Hormones, inflammatory cytokines and blood biochemistry were measured. Body composition, muscle area of thigh and arm, maximal strength, resting energy expenditure (REE), and respiratory ratio (RR) were also tested.

Results: After one year analysis showed a significant decrease ($p < 0.005$) of fat mass, fat-free mass ($p < 0.05$) and muscle area of arm and thigh ($p < 0.05$) in TRF compared to ND. Testosterone and IGF-1 decreased significantly in TRF, with no changes in ND ($p < 0.05$). Adiponectin increased significantly ($p < 0.005$) in TRF. Inflammatory markers significantly decreased in TRF group. REE and RR significant decreased in the TRF group. Finally, subjects in TRF spontaneously decreased their daily energy intake (−306 kcal/die) whilst ND maintained their daily energy intake. No significant changes were detected for the other variables.

Conclusions: Our results suggest that long-term TRF during a resistance training program maintains maximal strength, improves some health-related biomarkers, and decreases fat mass; however, fat-free mass and muscle area also decrease. The decrease of muscle mass could be explained by the spontaneous reduction of daily energy intake after long-term TRF.

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GENETIC EXPRESSION AND SPORT

1 GS

Effects of different training on myogenic differentiation in LHCN-M2 human myoblast cells: a pilot study

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Aim: We investigated the effects of long-term, different aerobic/anaerobic training on myogenic differentiation using the human LHCN-M2 myoblast cell line [(1)]

Method: Healthy young (19-28 y) males, long-term (at least 3y), differently trained (≥180 min/week): swimmers (SW, n.6), body-builders (BB, n.6), soccer (SO, n.6) and volleyball players (VB, n.6) or active, Untrained (UN, n.6) subjects were recruited; an human sera pool (HC) was also used as control. Enrolled subjects gave their informed consent; blood samples were collected, 8 h after the last training bout. LHCN-M2, human myoblast cells, were cultured in growth (GM, 15%FBS) or in differentiation medium, DM, supplemented with 0.5% serum from differently trained subjects, HC or UN for 4d. Myogenic differentiation was assessed by Fusion Index (FI) and Myogenin and MyHC-β mRNAs expression levels in differentiated cells. P62, Bcl-2 and Parp-1 autophagy and apoptotic markers expression levels were also determined in differentiated cells.

Results: Significant increases in myotube formation were found in cells treated with differently trained human sera *vs* HC, the highest FI value in SW-treated cells. Myogenin mRNA expression levels were

significantly increased in BB, SO and VB-treated cells vs HC, the lowest expression in SW-treated cells. On the contrary, SW-treated cells showed the highest MyHC-β messenger expression compared to HC and DM. p62 expression was significantly reduced ($p < 0.05$) in cells treated with SW, BB and SO vs DM-treated cells; similarly, the antiapoptotic-Bcl-2 expression resulted significantly reduced ($p < 0.05$) in LHCN-M2 cells treated with human trained sera *vs* DM. Parp-1 expression resulted unmodified in treated cells.

Conclusion: Our results suggested that LHCN-M2 cells represent an useful tool to study the myogenic differentiation in a homologous human system; further experiments to deepen this process are in progress.

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2 GS
Fiber type-specific hypertrophic response to resistance training in older adults

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Aim: Aging induces a physiological decline in human skeletal muscle functions and morphology. Resistance exercise training (RET) has been identified as an effective strategy to overcome loss in muscle mass and improve strength. In the present study we sought to determine the effect of RET on skeletal muscle fiber type hypertrophic response in older adults.

Method: 19 subjects (71.1 ± 4.3 years; 27.6 ± 3.2 BMI) were studied before and after 12 weeks of RET. Immunohistochemical analysis were used to quantify myosin heavy chain (MyHC) isoform expression, cross-sectional area (CSA), satellite cells, capillaries and myonuclear content.

Results: RET induced a decrease in MyHC type I fiber frequency and a concomitant increase in MyHC type II fiber frequency. Mean CSA significantly increased only in MyHC type II fibers. Myonuclear content was also increased following training, specifically in MyHC type I fibers, with no change in MyHC type II fibers. Satellite cell content slightly increased in both fiber types. Capillary density significantly increased with RET. In addition, the distance between satellite cells and the nearest capillary increased in type I fibers, decreased in type II fibers, with a significant interaction between the fiber types.

Conclusion: These data provide intriguing evidence for a fiber-type specific response to RET. Hypertrophy of MyHC type II fibers seems to occur without detectable myonuclear addition. Moreover, fiber capillarization did not affect satellite cell activity after prolonged RET in older adults.

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3 GS
Multi-gene cardiac sudden-death panel analysis in a cohort of athletes is indicative of risk prediction

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Aim: Sudden cardiac death (SCD) is a rare but fatal event that may occur in athletes, and has been associated to several cardiovascular disorders [1, 2]. To determine the frequency of inherited cardiac mutations in athletes potentially at risk for SCD, we developed a next-generation sequencing (NGS)-based analysis using a gene panel of 138 SCD-related genes.

Method: Thirty-seven athletes, recruited from CONI (Rome) and from the Cardiology Unit of the Hospital Monaldi (Naples), were enrolled in this study. All patients had an overt disease or a diagnostic suspicion of an inherited heart condition, including primary myocardial and/or cardiac rhythm alterations. DNA samples were first evaluated for quantity and quality. Our designed panel explored 3009 target regions for a total of 1,302 Mbp. Targeted enrichment was carried out using the HaloPlex system (Agilent Technologies) according to the manufacturer's instructions. Three sequencing runs were optimized with the NextSeq and MiSeq systems (Illumina). We used Agilent's SureCall software v.3.5.1.46 for data analysis.

Results: Two runs were performed on the NextSeq system (Mid Output, 150x2) to analyze 35 samples. We obtained about 40 Gb/run (70% of QScore >30, 80% of Clusters Passing Filters). About 55 million reads were obtained per run. The remaining 2 samples were sequenced on the MiSeq system and yielded 7 million reads (90.6% of QScore >30, 83% of Clusters Passing Filters). Causative or possibly-causative variants, identified via bioinformatics analysis of the reads obtained, were confirmed by Sanger sequencing. We found some causative or possibly-causative variants in several genes, which are not usually analyzed in genetic cardiopathies screening.

Conclusion: It has been rather difficult in "at risk" athletes to establish SCD incidence: our data assess the efficacy of enlarged genetic screening for the early identification of DNA variants in genes that may predispose athletes to SCD.

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PHYSICAL ACTIVITY FITNESS AND HEALTH

1 PAFH
Parental influence on children's cardiorespiratory fitness level and health-related risk factors

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Aim: Parents are likely to play a crucial role in influencing children's physical activity behaviors[1]. However, parental influence on children's physical fitness (PF) and risk factors has been only marginally investigated[2]. Therefore, the purpose of this study was to assess the association between family and children's cardiorespiratory (CRF) and estimated health risk indicators.
Methods: Forty-five families (parents: $n = 73$, 46.2 ± 4.7 years, 1.69 ± 0.09 m, 69.6 ± 14.6 kg; children: $n = 53$, 12.5 ± 3.6 years, 1.55 ± 0.1 m, 49.1 ± 16.9 kg) participated in this study. Each participant underwent anthropometric measurements (height, weight, waist circumference), in order to calculate waist-to-height ratio (WHtR), and completed the 6-min walk test (6MWT), a valid and reliable functional test to assess CRF[3]. A MANOVA and linear regression analyses were performed to assess differences between groups and associations between variables, respectively. Significance level was set at $p < 0.05$.
Results: WHtR did not differ between parents, while it showed a decreasing trend from primary to secondary school. Fathers showed a significantly higher CRF compared to the mothers ($p < 0.0001$), while primary school pupils had a significantly lower CRF compared to middle ($p = 0.0100$) and secondary ($p = 0.0012$) school children, respectively. A significant and positive association was found between children's and parents' WHtR ($p = 0.038$, $R^2 = 0.135$). Particularly, a predominant role of the mother in influencing children's WHtR appeared during primary ($\beta = 0.821$, $P = 0.001$, $R^2 = 0.642$) and secondary ($\beta = 0.591$, $p = 0.033$, $R^2 = 0.290$) school, respectively. There were no significant associations between parents' and children's CRF at any age-group.
Conclusions: This study seems to be the first to objectively evaluate anthropometric and cardiovascular parameters, both of children and parents. These results suggest that parents affect children's WHtR but not CRF. Mothers seem especially influential on their children's WHtR, during primary and secondary school.

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2 PAFH
Effects of physical exercise in cystic fibrosis

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Aim: The clinical expression of cystic fibrosis (CF) is widely heterogeneous also in patients bearing the same genotype and in affected sib-pairs. Physical exercise may contribute to modulate such variability. We studied 59 adult patients with CF that performed supervised physical exercise in the last three years and a control group of 59 patients that did not performed any physical activity to assess clinical, anthropometric and biochemical effects of the exercise. The aim of this study is to investigate the effects of physical exercise in patients with CF.
Methods: The study population consisted of patients with CF in follow-up since diagnosis at the regional CF care center of Campania. Anthropometric measurements such as height, weight, BMI, waist circumference and upper arm circumference were recorded; biochemical parameters were determined using assays performed with an automated biochemistry analyzer.
Results: Physical exercise did not modify the clinical parameters of the disease (i.e., sweat chloride levels, pancreatic status and enzyme supplementation requirements, the occurrence of liver disease or diabetes) while it had a significant effect on: a) FEV1 annual decline (reduced in the exercise group); b) anthropometric parameters (i.e., we found a significantly lower number of cases with altered BMI, waist and arm circumference among the patients that performed physical exercise); c) biochemical parameters (i.e., significant increase of HDL cholesterol and reduction of either VLDL cholesterol and triglycerides; reduced number of patients with impaired glucose metabolism in the exercise group); d) serum levels of vitamin D (the levels resulted significantly higher in patients that performed physical exercise).
Conclusion: Physical exercise in patients affected by CF may have a relevant impact on biochemical and anthropometric parameters. However, we suggest to careful monitor the patients in order to avoid dehydration and other possible complications.

3 PAFH
Can physical exercise improve the quality of life in binge eating disorder?

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Aim: Binge Eating Disorder (BED) is characterized by recurrent episodes of eating large amount of food in a brief period. Bouts of binge are commonly associated with a lack of control on stop eating or on what or how much one is eating. BED patients could develop depression, bipolar disorder, anxiety disorder and obsessive–compulsive disorder (Vancampfort et al. 2014).
Aim of this study was to estimate the effectiveness of a structured physical activity program on the Body Mass Index (BMI) and psychological factors in BED patients.
Methods: Twenty BED women were recruited for this study. The participants were randomly assigned to two groups: Intervention Group (IG, n = 10) and Control Group (CG, n = 9). All participants underwent the following measurements: height and weight, to calculate BMI (kg/m^2), and self-reported questionnaires (BES, BITE) for the assessment of the psychological characteristics. In addition, the IG carried out a physical activity program for 6 months. The exercise session consisted of aerobic, balance and strength activity performed in four weekly sessions of 90 min. At baseline and after 6 months BMI, BES and BITE were assessed in both groups.
Results: Both groups improved their BMI and psychological condition but the IG achieved significant results probably for the effects of structured physical activity program.
Conclusions: The combination of traditional BED treatment and physical activity seem to improve the quality of life and to reduce binge episodes in BED patients.
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4 PAFH
Effects of a 3-months high-impact training program on bone formation markers and health-related quality of life in postmenopausal women with low bone mass

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Aim: low bone mass is an established risk factor for fragility fractures, physical disability, chronic pain and impaired quality of life (QoL). Accumulating evidence suggest that structured exercise programs may increase the bone mass and improve the QoL in different populations. Aim of our research was to explore if a high-impact exercise program could affect markers of bone formation and the QoL in osteopenic postmenopausal women.
Methods: thirty-three postmenopausal women, consecutively referring to our Bone Mineral Metabolism Outpatient Clinic, were recruited. Patients with a T-score at lumbar spine or femural neck between -1 and -2.5 SD were included in the study. Anthropometric and fitness parameters, bone formation markers, circulating osteoprogenitor cells (OPCs) and QoL were evaluated at the time of enrolment, after 1 month run-in and after 3 months of high-impact exercise. For QoL assessment, the Italian version of the Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO) was employed.
Results: after 3 months training, we observed a significant increase in marker of bone formation P1NP (pro-collagen type 1 N-terminal peptide) (from 57.91 ± 8.49 mcg/L to 64.87 ± 12.67 mcg/L; $p < 0.001$) and in number of OPCs (OCN +/CD34 + from 1393.92 ± 687.76 cells/mL to 2311.82 ± 1356.20 cells/mL; $p < 0.001$–OCN +/PA + from 4512.60 ± 1658.76 cells/mL to 5062.00 ± 1975.72 cells/mL; $p = 0.02$). Physical fitness was improved, as attested by the significant increase of strength on the pulldown lat machine and leg press, as well as mean values of VO2max. Finally, QoL was significantly improved with regard to pain, physical function, mental function and total score.
Conclusions: high-impact exercise training may induce bone formation in post-menopausal women, mainly acting on recruitment and commitment of OPCs. Furthermore, high-impact exercise seems to improve physical fitness and QoL in these subjects.
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5 PAFH
PHYSICAL ACTIVITIES AND SEDENTARY LIFESTYLES: A CROSS-SECTIONAL STUDY AMONG ITALIAN PRIMARY SCHOOL CHILDREN

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Aim: Overweight and obesity represent currently a public health problem that affects populations of all ages including children [1]. In childhood, such conditions have direct implications for the health of the child, as they are risk factors for the onset of serious adult illness. Obesity has been considered to result from lifestyle changes, especially in food consumption and sedentary inclinations. In Italy since 2007, the Ministry of Health/CCM promoted and financed, a surveillance system focusing on the weight of primary school children "*OKkio alla Salute*" [2]. Our aim is to describe food habits, physical activities and sedentary lifestyles of primary school children to guide health promotion and prevention strategies. We present the preliminary results of the ongoing study.
Methods: We conducted a cross-sectional study on children ages 8-9 of Lombardy region's primary school in the scholastic year

2015/2016. We used Survey data collected of "OKkio alla Salute". To compare differences between male and female we used unpaired Student's t-test for the continuous variables and Chi-Square test for the categorical variables, or their analogous non-parametric test. For all the analyses, we considered as a significant level $p < 0.05$.

Results: Children are 2244 (53% male) whit a median age of 8.83 years. Overweight or obese children are 24%, 38% of children get less than two days of physical activity in a week.

Conclusion: Our results suggest the need to implement health promotion programs in relation to appropriate dietary styles and to carry out adequate physical activity in primary school and in the community.

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6 PAFH

A comprehensive interpretation about the timeline of healthy adaptation related to physical activity

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Aim: The "exercise is medicine" line, in the bio-psycho-social paradigm, needs to be enhanced thanks to a better comprehension and definition of the adaptation peculiarities, related to both the context, the individuality and the timing.

Methods: To this aim we consider physical activity as a primary factor or as a co-factor in the stress system and we explain the topic basing on three macro-areas: wanted conditioning, de-conditioning and inactive conditioning.

Results: Regarding the first area, after few days there are hormonal rapid responses; after few weeks start the cerebral haematic changes, then the morpho-mechanical and myo-tendinous changes, among with the cardiac AAP (Acute Augmentation Phase) and after three months the cardiac CMP (Chronic Mainteinance Phase) (Weiner et al. 2015). Regarding the second one, after 1 week of de-training arise cerebral haematic alterations; after 1 month of de-training arise morpho-mechanical and myo-tendinous alterations; overall, de-stimulation follows the principle of "use it or lose it". Regarding the third one, we know several common causes such as sedentary behaviour, physical inactivity, ageing and WMSDs (Work-related MusculoSkeletal Disorders).

Conclusions: We should be aware about biological rhythms and perceived motor skills, avoiding furthermore long-term de-training with scheduled mainteinance activities.

We should improve our knowledge about "training-induced skeletal muscle memory" (Lindholm et al., 2016), trainability, phasic phenomenons and latent effects.

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7 PAFH

Non-invasive brain stimulation and virtual reality boost motor performance in athletes

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Aim: The aim of this study was to demonstrate that excellent sporting performance derives from several factors, such as high levels of physical fitness, coordination, visual detection, anticipation and, last but not least, the will to win. The last years have been characterized by a growing interest in further exploiting the features that can contribute to success in a given sport [1]. In this regard, intense technological development of virtual reality (VR) devices and non-invasive brain stimulation techniques have been developed to address this issue. VR tools are typically based on the so-called phenomenon of motor learning, resulting from intensive, repetitive, and task-oriented motor activities that require patient's effort and attention, generated by augmented feedback towards the central nervous system. On the other hand, transcranial direct current stimulation (tDCS), which is a non-invasive technique that modulates brain excitability may boost motor performance and reduce athletes' ability to perceive fatigue.

Method: We combined tDCS over M1 with the computer assisted rehabilitation environment (CAREN) system aiming at exploring the tDCS- and CAREN-after effects on functional brain networks and motor performances of 10 athletes.

Results: Our results reinforce the idea that non-invasive brain stimulation boosts motor performance improving athletes' endurance and abilities as assessed by the outcome measures taken from the CAREN system. In addition, we demonstrates an extensive remodelling of the functional brain networks mainly involving the sensorimotor areas in the athletes who received real-tDCS compared to the sham group.

Conclusion: Taken together our results suggest that non-invasive brain stimulation and the CAREN system may improve motor performance, thus being likely candidates as novel tools for intensive training.

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8 PAFH

Mental fatigue does not influence rowing performance in young athletes

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Aim: Despite the growing evidence supporting the detrimental effect of mental fatigue on endurance performance (Van Cutsem et al., 2017), no study has investigated the effect of mental fatigue in young athletes yet. The aims of this study were to investigate the effect of

cognitive demanding task on rowing performance in prepubertal children and to compare the effect of a standard cognitive task (Colour Word Task) with a maths-logic test simulating a school exam.
Methods: Single blind cross-over randomised counterbalanced design. Subjects: eighteen young rower athletes (11–15 years). Each athlete visited the laboratory for 4 trials. Each of the three experimental visits included a cognitive activity followed by a 1500-m time-trial performed on the rower-ergometer. Cognitive activities were Stroop Task (Colour Word Task) and a maths-logic test, while a leisure activity was used as a control condition. Power, heart rate and perception of effort were measured during time-trial. Alpha was set to <0.05 a priori for differences.
Results: The difference in the time trials' performance was not significant between conditions ($p = 0.521$). There was no effect of condition on power output ($p = 0.212$). Perception of effort was not affected by any of the manipulations ($p = 0.834$). Average HR did not differ significantly between conditions ($p = 0.332$). Average speed was obtained from each split times of every 150 m and used to assess pacing profiles of the trials; it did not show differences between conditions ($p = 0.308$). From NASA-TLX, the Stroop Task and maths-logic test were rated as more mentally ($p < 0.001$), temporally ($p = 0.013$) demanding and effortful ($p < 0.001$) compared to control.
Conclusions: There were no effects of mental fatigue on rowing performance in young athletes.
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9 PAFH
Performance vs biological ground

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Aim: Oxidative processes are everyday in the human body, because we use oxygen to produce energy but at the same time we produce free radicals, that are unstable molecule at the basis of oxidative stress. This is a pathological situation that can generate premature aging, cellular damages, predisposition to diseases and traumas. Strong physical activity is a main cause of oxidative stress in our body. Aim of this study is to demonstrate the efficacy of antioxidant nutrition in reducing oxidative stress and thus in developing osteo-articular traumas and/or inflammation in a group of athletes.
Methods: Semi-professional volleyball players 23 ± 3.9 years old were subjected to the d-rom's test to see their level of oxidative stress and their antioxidant defenses: the most stressed athlete use an antioxidant diet for 12 weeks. They also do a hand-force chinesiological test with dynamomter and a questionnaire on health perception to note any improvements about health perception before and after the antioxidant diet.
Results: Five of ten athletes presented oxidative stress out of border line levels and they did an antioxidant diet for three months. After three months, three of this five athletes showed an important improvement between 7 and 27% of the oxidative stress meanwhile the other two athletes showed a little worsening of this between 5 and 9%. The other subject who at the beginning were in the border line levels, after twelve weeks showed an high worsening of the oxidative stress between 17 and 27%.
Conclusions: The results provide that an antioxidant diet is a very good exogenous integration to fight oxidative stress, but it doesn't stimulate antioxidant endogenous systems. The subjects who did the antioxidant diet showed significant improvement in sport performance and little improvements about sleep and daily rest quality. A lower oxidative stress isn't directly related with a highest physical strenght.
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10 PAFH
Functional movement screen: a statistical survey about relation between active straight leg raise and low back pain

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Aim: Low back pain is a current problem, wich is very common and due to many factors like working position, posture, muscle imbalances, hyper mobility of the spine. It can manifest itself as localized pain between the 12th rib and the lumbar area but the pain can radiate even at the leg level; it affects equally men and women. It is often present a condition of hip stiffness that reduce natural articular ROM forcing the subject creating spine compensatory movement pattern; repeated bending and flexion movements of the lumbar spine increased the risk of protrusion and herniation of the intervertebral disks. It's important to evaluate basic motor patterns in every subject and verify the presence of assimetries or pain during the movement.
Methods: we recently studied the relation between an insufficient score during FMS Active Leg Straight Raise test, wich shows relative mobility of the hip, with the low back pain. The statistical sample was composed by 1223 people of wich 630 men and women 593 between the ages of 9 and 75 years.
Results: 10.2% of the sample, corresponding to 125 people feel low back pain during FMS, in particular during Trunk Stability Push Up(70.4%) and Deep Squat(21.6%) test. More specifically, 43.2% of these 125 people manifested also an incompetence during the Active Leg Straight Raise test.
Conclusions: There is correlation between hip stiffness and low back pain, confirmed by 0.69 linear correlation coefficient value. In these subject it is important create a workout wich is focused on the recovery of mobility and core activation.
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11 PAFH

Does living in urban/rural setting in different geographical regions affect children's motor performance?

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Aim: Living setting (urban/rural) is an important factor affecting the development of motor skills. To date, children's motor competence across regions has been rarely compared (Bardid, 2015). Aim of this study was to assess whether rural or urban setting in different geographical regions could influence children's motor coordination.
Methods: 802 children from Lazio, as region of Central Italy (198 urban, 189 rural) and Veneto, region of North Italy (193 urban, 222 rural), aged 8–11 years (3–4 and 5 grade of primary school) were recruited for this study. The *KTK* Test Battery was used to assess children's gross motor coordination (Kiphard and Schilling, 2007). Children's motor quotient was analysed using an analysis of variance (ANOVA) with Group (Urban Group *vs* Rural Group) and Region (Centre *vs* North of Italy) as factors.
Results: The main effect of setting (Rural: 94.8 ± 13.0 *vs* Urban 91.4 ± 15.7; $F_{1,284} = 13.1$ with $p < 0.0001$) and region (Lazio: 86.7 ± 12.6 *vs* Veneto: 99.0 ± 13.5; $F_{2,284} = 204.5$ with $p < 0.0001$) were reported. The interaction between setting and region revealed that children of rural area scored significantly better than those of urban area (Rural area 92.9 ± 11.7 *vs* Urban area 80.8 ± 10.4, $p < 0.005$) in Lazio, whereas children of urban area scored better than those of rural area (Urban North 102.2 ± 12.5 *vs* Rural North 96.3 ± 13.8, $p < 0.005$) in Veneto. No differences were found (Rural Centre 92.9 ± 11.7; Rural North 96.3 ± 13.8) between rural area of Lazio and Veneto.
Conclusions: Our results indicate that living in rural or urban setting may influence children's motor performance. The higher children's motor coordination measured in North urban setting could be determined by environmental characteristics, such as, sports facilities and opportunities for physical activities.
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12 PAFH

12 weeks of recreational soccer with different doses, in middle-age sedentary men: effects on matches training load

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Aim: Recreational soccer (RS) is effective to improve aerobic fitness and cardiovascular health in sedentary people if performed 2 or 3 times per week (Krutsrup et al. 2009). Usually RS is played no more than once or twice a week, so we aim to analyze a dose–response effect by checking if the internal (ITL) and external training load (ETL) of matches increased playing RS with a low frequency.
Methods: 21 men performed 1 h per-week (1/W) and 16 men 2 h per-week (2/W) of RS for 12 weeks; after 8 min of warm-up (FIFA 11+, 1st part), 2 halves of 25-min with 2 min of recovery were performed. Subjects wore heart rate monitor and GPS-devices during each session and RPE with CR-100 Borg scale were collected at the end. Session-RPE (S-RPE) and Edwards Training Load (ED-TL) was used as ITL indices. Total distance (TD), Total distance per minute (TD/min) and distance covered at different speeds (LID, MID, HID) were used as ETL indices.
Results: TD and TD/min increased in both groups, respectively 7 and 5% in 1/W and 6 and 4% in 2/W ($p < 0.05$). Also the MID and HID increased in both groups, respectively 20% and 52% in 1/W and 33 and 44% in 2/W ($p < 0.01$). The LID increased only in 1/W (4% $p < 0.05$). Both ED-TL and s-RPE did not change in both groups.
Conclusions: The increments in ETL that we found demonstrate that RS played only 1 or 2 times/week could improve performance in sedentary people. No difference found in ITL showed that subjects did less fatigue to produce more ETL, and this may be a clue in support of aerobic fitness improvement.
Reference
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13 PAFH

Mental fatigue impairs time-trial performance in Under 23 cyclists

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Aim: Despite the growing evidence supporting the negative effect of mental fatigue on recreational endurance athletes, elite cyclists seemed not to be affected in time-trial performance (Van Cutsem et al. 2017). The role of genetic and training on the capability to tollerate mental fatigue was unclear. No study has investigated the effect of mental exertion on Under 23 cyclists, a category in the middle between recreational cyclists and professional cyclists. The aim of this study was to investigate the effect of a cognitive demanding task on cycling time-trial performance in Under 23 cyclists.
Methods: Single blind cross-over randomised counterbalanced design. Subjects: 10 Under 23 cyclists (18–22 years; $VO_2max > 60$ mL $\times$ kg^{-1} $\times$ min^{-1}). Each athlete visited the laboratory for 3 trials. Each of the two experimental visits included a cognitive activity followed by a 30-min time-trial performed on the cycle ergometer. Cognitive activity was a modified incongruent version of the Stroop colour-word task, while a leisure activity was used as a control condition. Power, cadence, heart rate and perception of effort were measured during time-trial, blood lactate after time-trial. Alpha was set to <0.05 a priori for differences.
Results: The difference in the time trials' power output was significant between conditions ($p = 0.037$). Perception of effort was not affected by the manipulation ($p = 0.465$). Average HR ($p = 0.465$),

cadence ($p = 0.445$) and blood lactate post-exercise ($p = 0.654$) did not differ significantly between conditions. From NASA-TLX, the Stroop Task was rated as more mentally ($p < 0.001$), temporally ($p < 0.001$) demanding and effortful ($p < 0.001$) compared to control.

Conclusions: There was an effect of mental fatigue on time-trial performance in Under 23 cyclists.

Reference:

1. Van Cutsem J, Marcora S, De Pauw K, Bailey S, Meeusen R, Roelands B (2017) The effects of mental fatigue on physical performance: a systematic review. Sports Med

14 PAFH

Activity levels in binge eating disorder: analysis of rest-activity circadian rhythm

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Aim: Altered Rest-Activity circadian Rhythms (RARs) are associated with a compromised health status. RARs abnormalities have been observed in several pathological conditions, such as cardiovascular, neurological, and cancer diseases (Paudel ML, 2010). Binge Eating Disorder (BED), and its associate obesity and motor inactivity, could induce RARs disruption and have negative consequences on health-related quality of life. The purpose of this study was to determine RARs by actigraphy in patients with BED compared to a body mass index-matched control group (Ctrl).

Methods: Sixteen participants (8 obese women with and 8 obese women without BED diagnosis) were recruited to undergo a 5-day monitoring period with an actigraph (MotionWatch 8®, CamNtech, Cambridge, UK) to evaluate RARs.

Results: The population mean cosinor applied to BED and Ctrl revealed the presence of a significant circadian rhythm in both groups ($p < 0.001$). The MESOR (170.0 *vs* 301.6 a.c., in BED and Ctrl, respectively; $p < 0.01$) and amplitude (157.66 *vs* 238.19 a.c., in BED and Ctrl, respectively $p < 0.05$) resulted significantly different between the two groups. Acrophase was not different between BED and Ctrl. The dysfunctional RARs found in BED cannot be attributed to obesity *per se* because the participants of the two groups were all obese with similar BMIs (31.3 ± 1.0 *vs* 31.6 ± 0.7 kg/m^2 in BED and Ctrl, respectively).

Conclusions: These data provided the first actigraphy-based evidence of RARs disruption in patients with BED. The circadian timing approach can represent a novel potential tool in the treatment of patients with eating disorders. We suggest that in BED treatment protocols, the rest-activity circadian parameters should be assessed and managed to enhance interventions capable to normalize the spontaneous activity level and improve the quality of life.

Reference

Paudel ML et al. Rest-activity circadian rhythms and mortality rates in older men: MrOS Sleep study. Chronobiol Int. 2010; 27:363–377.

PEDAGOGY

1 PED

School and extra-school mobility. The influence of a walk-to-school action on children independent mobility

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Aim: The objective of this research is to study the influence of a walk-to-school action on children independent mobility and active lifestyles.

Methods: the 3 years longitudinal research-intervention is based on a quali-quantitative method, involves the pupils attending the three public primary schools in Cassino (IT) and their parents. A CNR's validated questionnaire on children's autonomy has been administered to students 8-11 y/o and their parents: 699/745/530 returned by children and 574/597/421 by parents in 2015/2016/2017 (in 2017 only two schools). The parents' questionnaire was integrated by sections on sport participation and the use of ICT-devices/internet. Focus groups ($n = 09$) have been administered to teachers, parents and pupils. The walk-to-school intervention (Pedibus) involved two schools with an experimental group of children ($n = 12$) participating more frequently in the last part of the year.

Results: According to the results of the parents' questionnaire, the 75.3% go to school by car, the 9.1% by school-bus, the 15.3% in active way. Only the 4.4% is allowed to go to school independently. The motivations not to give the permission to go alone: distance (55.3%), traffic dangers (17.8%) and strangers' dangers (15.6%). In the extra-school hours, the 28.1% can use the bicycle near home and the 13.1% can go to friends' homes alone. The 77.3% play sport and the 33.9% have their own smartphone with internet access. Teachers' focus groups emphasized the key role of the normative restrictions and the parents' control in the decrease of children's autonomy.

Conclusions: It's evident that children are more independent out of the school-related trips. We presume a minor increase of the independent mobility in the experimental group.

Reference:

1. Mackett R. (2013). Letting children be free to walk. *UK Department of Transport Journal*, 107, 2013: 1–12.

2 PED

The relationship between motor timing, reaction time and academic achievements in primary school children

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Aim: Recent studies have reported a correlation between motor skills and school performance, which is different according to the type of motor ability or academic subject examined (Fernandes et al. 2016; Bellafiore et al. 2016). The aim of this study was to analyze the relationship between motor timing, reaction time and achievements in mathematics and Italian in sedentary and active children.
Methods: Seventy-eight children (8.55 ± 1.43 years old, 28.93 ± 5.74 kg weight, 126.54 ± 4.74 cm height and 19.30 ± 2.62 kg/m^2 BMI) were randomly recruited by a primary school of Palermo, 68% of them practiced a sport outside the academic hours. The motor timing was measured with the finger and foot tapping test, while the reaction time with the ruler drop test. The outcomes in mathematics and Italian were collected at the end of the first four months of academic year. For parametric parameters the differences were examined with T-test; while for non-parametric parameters Mann–Whitney test was used and they considered significant with $p < 0.05$. The correlations between motor skills and school performance were analyzed by Pearson's test and r was considered significant with $p < 0.05$.
Results: Active children showed higher academic results in mathematics and Italian than sedentary ones. The outcomes of motor timing and reaction time were better in active than sedentary children. We did not find any correlation between the reaction time and the performance in Italian and mathematics. Conversely, there was a significant and negative correlation between the finger and foot timing and the achievements of both subjects.
Conclusions: These results suggest the training of motor rhythm might be an exciting and enjoyable strategy to ease the learning of mathematics and Italian in the primary schools.
Reference
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2. Bellafiore M et al. (2016) Effects of a ludic-motor program on motor development and early literacy skills in preschool children. IJAE 121:58.

3 PED
Children physical activity and independent mobility: a conceptual model

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Aim: to embrace in a single, open, model the typologies of physical activity (PA) performed by children considered from the point of view of their independent mobility (IM) and autonomy.
Methods: associated with the preliminary evidences of an ongoing longitudinal research in Cassino (IT), a transdisciplinary review has been carried out on physical activity, environmental psychology, pedagogy, town planning, mobility, public health, and urban sociology fields.
Results: a conceptual model based on the PA and IM criteria has been drawn: the first group of PA behaviours is associated with children's autonomy to roam in the public space thus improving their independent mobility; the second assembles activities performed escorted by adults for mobility or leisure purposes; the third is related with sport, leisure or educational activities, in and out school time, organized and taught by adults.
The first two groups challenge the adults' lifestyles and urban mobility culture. According to the model, large part of PA in children should be considered an epiphenomenon of their autonomy outlined as independent mobility and roaming opportunities in the public space.
Conclusions: to support the decision-making process, a socio-ecological and interdisciplinary approach encompassing all the realms of children's PA should be adopted to improve active lifestyles in children. The overall aims of PA regard the entire life-experience of the children. Consequently, the emphasis of the policies, programs and actions to promote PA should be on the cultural, educational, legislative determinants of PA.
References
1. Mackett, R. (2013). Letting children be free to walk. *UK Department of Transport Journal*, 107 on line, 2013, 1–12.

4 PED
The SBAM program for the promotion of motor activities and physical education at the primary school in Apulia region. Monitoring children's motor abilities and generalist and specialist teacher training

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Aim: SBAM is a three-year regional program aimed at children of the third year of primary school and is composed of three sub-programs: physical education, education to the proper eating habits and active transport, through safe home-school paths. The aim of the present study is to present the three-year monitoring results and the modalities of the training process of general teachers and specialists.
Methods: The sample is 15.231 children the first year (8 years); 14.147, the second year (9 years), 13.362, the third (10 years). Every year the children have performed four engine tests: *standing long jump*; *shuttle run 10x4*; *medicine ball throw kg 1*; *6 min walk test*. The sample was subdivided according to gender and BMI differences (normal-weight, over-weight, obese). Specialist teachers have carried out the physical education classes with the teachers generalists (30 h/year). Teacher training was conducted with theoretical lessons and research-action laboratories; teaching of styles and the assessment of skills and motor abilities have been deepened.
Results: Apart from the descriptive statistics ($M \pm DS$), Student's T-Test was carried out, in order to highlight the significant differences within the groups ($p < 0.05$). The annual data were organized into deciles. The results showed significant differences in the three groups (Nw-Ow-Ob) to 8, 9, 10 years and in all motor tests.
Conclusions: Primary school is the main context for learning motor competences and developing life skills (Castelli et al. 2014). The results show the evolution of motor abilities but the BMI increase corresponds to lower motor performance of children (Rauner et al. 2013).
SBAM program has allowed to experience a joint training of specialist and generalist teachers to complement different and complementary areas.
Reference:
1. Castelli, D.M., et al. (2014). *Preventive medicine*, 66, 95–100.
2. Rauner, A., et al. (2013). *BMC Pediatrics*, 13–19.

5 PED

Feasibility of implementing 10-minutes of classroom activity breaks in primary and junior high school: the project "*un km al giorno*"

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Aim: The purpose of this study was to investigate the feasibility of the program "*un km al giorno*" based on outdoor bouts of physical activity in primary and junior high school settings.
Methodsl: Three hundred and twenty students of the primary (F = 46%; range 6–10 years) and 217 students of junior high schools (F = 39%; range 11–15 years) with the respective teachers (N = 62) participated in the activity for eight months (from October 2016 to May 2017). The intervention program was based on a previous strategy named "The daily mile" consisting in walking/running outside the school buildings along a path purposely marked in the schoolyard. The classroom teacher conducted the activity that did not require a specific training. At the end of the activity, teachers filled questionnaires about the impact of such activity on student behaviour, organizational and general aspects.
Results: The 88% and the 80% of the teachers of the primary and the junior high schools reported that the program did not negatively affect their teaching activity. Furthermore, the majority of the teachers did not highlight any difficulty to resume the teaching after the activity (71%). Teachers reported that the activity improved the relationship among the students both in the primary (50%) and junior high school (85%) and between teachers and students (52 and 69% respectively). Generally, teachers were satisfied of the program (60% in the primary and 90% in the junior high school) and would like to repeat the program next year (60 and 75% respectively).
Conclusions: Teachers referred satisfaction for participating in the activity "*un km al giorno*". The present feasibility study revealed that the activity was successfully implemented in the school day routine both in the primary and in the junior high school.

6 PED

Children' social behavior, physical activity and motor skills: tools validation and correlation study

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Aim: Main objectives of the research are: (1) verify objectivity and reliability of questionnaires on social behaviours compiled by children and teachers. (2) study any correlations between the results of these questionnaires and children's motor skills.
Methods: "Student Survey" (SS) and "Teacher Survey" (TS) developed by Tauck Family Foundation and Child Trends (2014) to assess social behaviours were translated into Italian and administered at two hundred and one children and twenty teachers respectively. Children, furthermore, compiled a physical activity questionnaire and performed six motor skills tests (Leger, Standing long jump, Handgrip, Speed 10x5, 9 Hole Pole Test, Sit and Reach). Objectivity and reliability of the SS and TS were assessed. Pearson' correlation between social behaviours and motor skills was evaluated.
Results: SS shows low objectivity ($r = 0.33/0.47$; $p < 0.001$ for four factors and total). TS has medium objectivity ($r = 0.63/0.74$; $p < 0.001$ for all factors and total) and good reliability ($r = 0.75/0.82$; $p < 0.001$ for all factors and total). Correlation between the two factors common for both tools is low ($r = 0.28/0.36$; $p < 0.001$ for two factors and total). Correlation between social behaviour and physical parameters was calculated with teachers' values separately for males and females.
Males and females show very different results; only speed test was positively related for both ($r = 0.20/0.30$; $p < 0.05/0.001$ for factors and total). Males have negative correlation with age, BMI, hand coordination and Strength ($r = 0.0.15/0.23$; $p < 0.05$) and a positive correlation with Endurance ($r = 0.27$; $p < 0.01$ for one factor). Females have two other positive correlation with Sit and Reach and Hand coordination ($r = 0.21/0.43$; $p < 0.05 \div 0.01$).
Conclusion: Only the questionnaire compiled by the teachers has an acceptable objectivity and reliability. The great differences found in males and females in the correlations between their social behaviours and motor skills oblige to study this factors with gender attention.
References
Tauck Family Foundation and Child Trends, 2014; Measuring Elementary School Students' Social and Emotional Skills. Child Trend

7 PED

Quantitative and Qualitative tools for a physical education program that increases inclusion of children with disabilities

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Aim: A small group of primary school students with disabilities was involved in motor tests, self-perception of effectiveness in school tasks and daily motor balance surveys. Tests were conducted at the beginning and at the end of a motor training period (6 months) to study the effect of physical activity on all features.
Methods: The research studied the psychological effects on 114 certified (L.104/92) students (82 M + 32 F) of supervised physical activity (*Perceived Self-efficacy*_ASP, *Physical Activity Enjoyment*_PACES-It and *Previous Day Physical Activity*_PDPAR). The

students (7-11 years old range) global fitness was also evaluated by: anthropometric measures (body mass index), skill (4 × 10 m shuttle run test_SRT) and health-related abilities using tests as the standing broad jump_SBJ and six-minute walking test_6MWT.

Results: Except for 6MWT, data showed that there were no significant changes at the end of structured activities in most of the investigated psychophysical features (ΔPSBJ[M + F] > 90 = −0.2%; ΔPSRT[M + F] > 90 = −0.1%). 6MWT (ΔP6MWT[M + F] > 90 =+19.2%) had significant increases in walking distance. The same happens in psychological surveys.

Conclusions: The impossibility to verify changes in the psychophysical indexes we measured doesn't mean that the activities carried out through the administered program did not lead to any effects or that the measuring procedures were incorrect. Indeed, the literature (1) suggest that, when disabilities are tested, it is necessary to adopt complex adaptation and interpretation strategies: we need an adaptation report to certify and to track the measurement, for better focusing the results of the motor tests (also in 6MWT) and a qualitative and narrative interview for psychological tests (2). On these basis, the design of future investigations we planned for the next school year, will encompass participant observation tools through observation grids with inclusion descriptors in order to highlight the inclusive effect of the physical activity (3). The new tools will be defined on the bases of the *Grounded Theory* (i.e. *NVivo*) and phenomenological analysis.

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8 PED

Teaching using novels help 4 y old children to develop motor skills

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Aim: Motor skill competence is a primary underlying mechanism to promote engagement in physical activity (Stodden, 2008) and to execute new tasks. Learning a motor task requires capacity to stay focuses, pay attention and activation of working memory, expecially if it is difficult (Diamond, 2016). Story telling helps to develop executive functions and to be able to play attention.

Methods: We recently studied the effects of telling a novel to 4–5 year old children, teaching them a difficult task with cognitive engagement. Children of 2 kindergarten of northern Italy were engaged in the study.

Methods One class of 4–5 year old children was given instructions usually provided to 7–10 year old children to execute a motor task (Sigmundsson et al. 2016, walking, running in slope); in another class the task was dramatized with a fantastic situation

Results: Both groups understood the task but children scaffolded with the story executed the task more accurately and faster than children that received only standardized instructions.

Conclusions: For 4–5 year old children inserting a motor task in a fantasy novel improves understanding and remembering of the task resulting in more accurate and rapid execution of the task.

Reference

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9 PED

Gross Motor Coordination, Bmi and Phisical Activity: Trend and Correlation In Children

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Aims: Modern lifestyle can generates an early movement deficit in children that can produce a deficiency in motor skills even exaggerated in overweight children (1). Our study aim at verifying the evolution of physical activity, BMI and gross motor coordination in children (8-11 y.o.).

Methods: Study involved 991 children (Females = 452; Males = 539; Number for age: Eight = 284; Nine = 325; Ten = 315; Eleven = 67) from Veneto and Lazio regions. Normalized measure of Gross Motor Coordination (MC) was detected with KTK test (1). PAQ-C questionnaire was adopted to measure physical activity (PA).

Results: Physical activity was lower in females (F = 2.66; M = 2.86; $p < 0.01$) who, at 11y, also showed a significant drop (8 year = 2.71; 9 year = 2.76; 10 year = 2.82; 11 year = 2.34; $p < 0.05$ 9 year and 10 vs 11 year). Males maintains their PA's level and, at 11 year, was higher than that of Females (Males 11 year = 2.95; $p < 0.01$ Males vs Female). MC was better in males (M = 95.3; F = 90.9; $p < 0.001$) and, for both, decreased with age (8 year = 98.7; 9 year = 93.1; 10 year = 89.7; 11 year = 90.8; $p < 0.001$ 8 year vs 9–10–11 year; $p < 0.019$ vs 10 year). BMI increased significantl year from 8 year. (8 year = 17.9; 9 year = 19.0; 10 year = 19.3; 11 year = 19.8; $p < 0.001$ 9–10–11 year vs 8 year). Negative correlation was found between MC and age (Females r = −0.21; Males r = −0.27; $p < 0.001$ for both) as well as between MC and BMI (Females r = −0.25; Males r = −0.26; $p < 0.001$ for both). No correlations were measured between MC and PA.

Conclusions: The age dependent reduction of normalized values of MC seems to be partiall year related to increase in BMI but low grade of correlation suggests that other important factors play a role in the progressive impairment of motor skills which apparently affect children in the so called "golden age" for motor learning.

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10 PED

"Un km al giorno": the effect of brief walking active breaks on motivation to physical activity in secondary school

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Aim: The introduction of brief walking active breaks during the school day is a relatively innovative method for increasing physical activity in educational setting (e.g., Wilson et al. 2017). The aim of this study was to explore the effect of brief walking active breaks on motivation to physical activity in students of an Italian middle-school.
Methods: Two hundred and ninety students (F = 39.3%; age M = 13 ± 1 years) of a secondary school neighbourhood Turin were enrolled in the study. One hundred and thirty-eight students (age M = 12 ± 1 years) participated in the intervention group named "un km al giorno", while a convenience sample of 138 students (age M = 13 ± 1 years) maintained the school routine. The intervention consisted in walking or running in the schoolyard along a path for 10-min break on a daily basis for four months. Data about motivation to physical activity were obtained using the Participation Motivation Questionnaire (PMQ; Gill et al. 1983).
Results: Controlling for age, significant interactions between the intervention and control group were observed in the PMQ. Specifically, after the program "un km al giorno" a significant decrease in "Social Status" components of the PMQ [$F(1,273) = 4.851$; $p = 0.028$] and an increase in "Team" and "Energy Release" components [$F(1,273) = 6.015$; $p = 0.020$ and $F(1,273) = 4.328$; $p = 0.038$, respectively] were observed in the intervention group.
Conclusions: Results showed that a brief walking in educational context can change the shape of motivation to physical activity. Moreover, the program "un km al giorno" might be useful to reach the recommended 60 min per day physical activity and consequently decrease sedentary lifestyle in children.

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11 PED

Physical Activity in old age: educational and psycological aspect

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Aim: Several studies showed that an adequate and continuous psychomotor activity seems to be associated with a lower risk of dementia and improves the expectations and quality of life, prevents disability, may better control pain and copes better with stressful situations, keeps the brain more efficient and plastic (1–3). WHO (4) states that physical activity may achieve well-being, helps to reduce anxiety and stress, improves mood, stimulates social interaction, promoting an elderly improved efficiency, greater independence. According to researches this paper above all examines the psychomotility in old age in different ways.
Methods: We interviewed many elderly people, engaged in physical activity, grouped by sex, age (<75 years >75 years), residence (metropolitan and rural areas), educational level. Tools: (a) MMSE; (b) Multiareas questionnaire, including "physical activity"; (c) Zung Self-Rating Anxiety Scale; d) Geriatric Depression Scale.
Results: Physical activity resulted greater in men, in less than 75 years old, in living in the metropolitan area, in people with a higher educational level. The interviewed elderly prefer to practice sport in a group, in gyms and swimming pool. The levels of anxiety and mood improved after some months of sport, especially realized in groups. The examined elderly said that exercise had improved their quality of life and their relationships, they had better physical and mental health, felt more loosely moving.
Conclusions: The psychomotility allowed to the interviewed elderly people to have a better quality of life, a more clear mind and a more confidence in their abilities, in according to WHO (4) said about "interventions aimed at encouraging people to increase their physical activity levels".

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12 PED

Technologies in physical education in primary school. Preliminary study for the assessment of motor development with the MOBAK 5

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Aim: New technologies in PE provide children with the opportunity (a) to improve motor learning and self-efficacy, (b) model and stucture new prospective of the educational process (Clapham et al.,2015). The purpose of this study is to evalute and compare (a) the development of motor coordination of primary school's children in relation to BMI, (b) effects of strategies that utilize interactive video game technology (T0 vs T1), (c) enjoyment and physical self-efficacy between EG and CG.
Methods: The study has been conducted in a primary school of Puglia, Italy. The sample includes 65 children, separated into two groups in relation to sex and BMI: EG (M: 22, age,10.09 ± 0.30; F:

19, age 10.10 ± 0.31) and CG (M: 12, age, 10 ± 0.42; F: 12, age 10 ± 0.0). The experimental program consists of 10 lessons, using specialised interactive video game technology to point out unusual motor responses. For the CG has been used teaching styles of production. The following tests have been proposed before and after the intervention: MOBAK 5 (Hermann and Seelig 2016), PSP_C (physical self-efficacy) and PACES (enjoyment).

Results: Besides the descriptive statistics (M ± DS), T-test was used in order to highlights significative differences between T0-T1, indipendently from sex differences. The significance value was set at $p < 0.05$. Data analysis revealed significative differences between EG for boys and girls about (a) *Control Object* and *Self-Movement* ($p < 0.05$); (b) and physical self efficacy scale ($p < 0.05$).

Conclusions: The use of modern technologies and different teaching styles in PE promote motor learning and self-efficacy in children. The trail of new and different instruments are needed to enhance educational environments and develop intrinsic motivation to motor activities.

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13 PED
Living S.M.A.R.T.: a project for the enhancement of healthy dimensions in adolescence

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Aim: Nowadays, children and youths live in a world full of new technologies, and often adopt unhealthy lifestyles, to the detriment of bodily features. The aim of the "Living SMART" project is to explore in a sample of adolescents the five dimensions (Sport, Movimento, Alimentazione, Relazioni, Tecnologie) which are fundamental in the construction of their future health and quality of life, in order to implement adequate measures of control for unhealthy behaviors.

Methods: The study includes four steps. In the preliminary step (screening phase) a questionnaire will be used to identify subjects with "risky behaviors". In the second step (evaluation phase) these the identified subjects will undergo an evaluation of anthropometric, functional and cognitive features. In the third step (experimental phase) a functional recovery program regarding lacking skills and an educational intervention will be proposed to the adolescents and their families. In the last step (follow up phase) an evaluation of the parameters considered will be repeated at the end of the intervention.

Results: During the first phase of study, 275 subjects were interviewed through a questionnaire that showed their behaviors referring to 5 dimensions. For each of these dimensions a different risk profile has emerged. A Kendal Correlation Test shows the association between "Sports" and "Nutrition", "Nutrition and Movement", "Movement and Relation" and "Nutrition and Technologies".

A comparison between the 5 five dimensions shows that the population has higher score in "Sport" than the other dimension, meanwhile they has lower score in "Movement" and "Technologies".

Conclusions: A good attitude to sport practice has been showed by the sample, but this is not reflected by a general active lifestyle. The extension of the screening to a wider sample will be useful to address these findings. The correlation between the 5 dimension show that wellness can be considered as a multidimensional System, that include Sports and Nutrition as well as Relations and Technologies.

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14 PED
The validity of the Italian version of the Simple Physical Activity Questionnaire to measure physical activity in healthy young adults

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Aim: Measurement of habitual physical activity (PA) is a challenging task because PA is a complex behaviour (Arem et al. 2015). PA questionnaires are easy to use, but their accuracy in comparison to objective measures has been questioned. The Simple Physical Activity Questionnaire (SIMPAQ), a recently developed questionnaire, uses an interview format to estimate time in bed, structured exercise participation, and incidental or non-structured PA (Rosenbaum and Ward 2016). The purpose of the present study was to examine the validity of the Italian version of the SIMPAQ among healthy young adults.

Methods: After providing informed consent, university students who wished to take part in the study provided information about anthropometry and demographic background. Accelerometer data was collected for seven days among 106 participants (57 women). Telephone interviews were conducted to complete the SIMPAQ and the IPAQ at the end of the week wearing the accelerometer.

Results: Significant positive correlations were found between the accelerometer-based daily moderate-to-vigorous PA and the SIMPAQ measures of incidental and structured PA summed up ($r = 0.21$; $p < 0.05$), and between SIMPAQ walking time and objective lifestyle intensity time ($r = 0.41$; $p < 0.001$). Although participants needed more time to complete the SIMPAQ ($p < 0.001$), most of them preferred completing the SIMPAQ in comparison to the IPAQ (53.7%).

Conclusions: The findings suggest that the Italian version of the SIMPAQ is an appropriate instrument to assess PA daily levels among university students. The SIMPAQ can be completed in a relatively short time, which could be an advantage in large studies and clinical settings where time for assessment is limited.

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15 PED "Più Sport @ Scuola": a RE-AIM evaluation for Veneto Region project to promote physical activities and sports in schools

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Aims: This research examines aims, cultural background, and significant results of the PS@S project funded by the Veneto Region from 2004 to 2014 to promote physical activities and sports in schools.
Methods: The project was based on Project Coordinators (PCs) that collaborated with teachers in sport-related activities and promoted connections with local sport clubs/associations. To evaluate PS@S project we adopted RE-AIM (reach, efficacy, adoption, implementation, maintenance) framework (www.re-aim.org). Data were collected on more than 500 schools involving approximately 370,000 students. Motor skills among 200 students (10 y.o.) involved in PS@S were compared with those of students from other areas of North Italy and Europe.
Results: PS@S project was maintained for eleven years and reached about 75% of Veneto students. It was adopted and implemented on the basis of specific guidelines to respect common aims and permit local adaptations. Heads teachers and PCs have a largely positive judgment of PS@S efficacy (mode = 6 on seven grades). Primary and upper secondary schools generally preferred improve quality of their physical activities while lower secondary schools improved also quantity of activities. Different percentage in increase for quality and quantity of physical activity improvement were found among schools: Primary = 3.5%, Upper secondary = 1.5%, Lower secondary = 27.0% ($p < .001$). The comparison between children participating at PS@S' project with those of other provinces and European countries showed lower motor skills among Veneto children ($p < 0.01$).
Conclusion: Data suggests that PS@S project can be considered as a good practice for physical activities and sports promotion in schools and that it could be used also in different contexts, however an improvement of motor skills seems to need more physical activity.
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16 PED
Promoting physical activity among university students: a systematic review of controlled trials

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Aim: University years are characterized by a decline in physical activity (PA) levels,[1] but they can offer an opportunity to promote a lifelong active lifestyle.[2] The present review aims at summarizing controlled trials of interventions promoting PA among university students, discussing the quality of the evidence, effective strategies, methodologies, and deficiencies in the interventions employed to provide directions for future research and for practical implementations.
Methods: We searched for articles in five online databases (PubMed, PsychINFO, Cochrane Library, Education Source, SPORTDiscus) up to November 2016. Inclusion criteria: randomized or non-randomized controlled trial design, describing an intervention to promote PA in university students, PA was one of the outcomes reported as a quantitative measure, results published in English. Data was synthetized considering study characteristics, strategies used, and outcomes.
Results: 2585 articles were identified; 28 articles met inclusion criteria. 16 studies reported an increase in PA levels. The high risk of bias of many studies (n = 17) and lack of information about intervention components, hinder the possibility to draw strong conclusion about the most effective strategies.
Conclusion: The review revealed some limitations in the existing literature and the need for further high quality studies, which should investigate also the long-term effects of the interventions, integrate qualitative and quantitative research methods, plan interventions around participants' needs, and provide a more detailed report of the strategies used. Engage participants in practical physical activity sessions, and using a personalized approach, are worth a further investigations in future studies.
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17 PED
Technological teenagers: the impact of technologies on healthy lifestyles

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Aim: The current social context appears lacking of authentic human relations because people have interaction mediate by new technologies, in particular teenagers. Virtual environment can be considered dangerous for youth's wellness without an adequate parental control.
The project is intending to detect and improve the levels of awareness of teenagers and their parental control. The aim is realize some good practices as important points of reference for formal and informal educational contexts.
Methods: The study includes four steps. In the preliminary step (screening phase) a questionnaire will be used to identify subjects with risk behaviors. In the second step (evaluation phase) these subjects will undergo an evaluation of anthropometric, functional and cognitive features. In the third step (experimental phase) a functional recovery program regarding lacking skills and an educational intervention will be proposed to the adolescents and their families. In the last step (follow up phase) an evaluation of the parameters considered will be repeated at the end of the intervention.

Results: 275 adolescents (M 130; F 145 mean age 12 years ± 1.1) have been interviewed during the first phase of the study. A comparison of the results shows a lower score in Technologies than the other dimension. A Factorial analysis shows two main factors that can explain 54% of variance: Parental Control Factor (Nutrition and Technologies) and Factor Autonomy (Relationship and Movement). The comparison Males and Females score highlight greater parental control over girls than boys, particularly in the dimension that concerns technologies.
Conclusions: The results shows that that teenagers have lower level of awareness in use of technologies than in relationship and Sport. This dimension can be considered the higher health risk evaluated by this survey. Another important finding is coming out from the comparison of boys and girls in those dimension. Boys have lower parental control than girls in particular during the use of technologies, so they have an higher risk to be involved in dangerous situation. Technologies are very important in our society, but could not be considered as substitute of real Human Interaction.

18 PED
On rules and roles: A reflection on the referees' figure

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Aim: In most sport systems, referees are of crucial importance for a match/game and the system in general. Referees need to dispose of a variety of competencies in order to fulfill their tasks and to make instant decisions in complex situations. These decisions are quite often subject to public criticism, harsh discussions and sometimes even physical assaults occur. The key-role of referees seems to be conflicting with the low overall acceptance and reputation of this functional figure. Consequently, most sport federations have difficulties in recruiting young people to volunteer for a career as referee and in counteracting dropout (Breuer and Giel in press; Hancock Dawson and Auger 2015). The present qualitative study aims to explore the individual perspective of referees on their role in the sport system.
Method: Seven invasion team games referees were interviewed, in order to obtain insights into their personal career, their preparation/education, the motivation and volition to become a referee and the required physical, mental and emotional skills. Moreover, referees' positive and negative experiences in practice were investigated.
Results: The contents of the interviews will be discussed, with a specific focus on the pedagogical implications and the consequences for educational and sport settings (Achtergarde, 2012).
Conclusions: Sport pedagogy should consider the opportunity to researching in depth a neglected figure of sport: the referee.
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19 PED
The Physical Education Based on Evidence and teaching and coaching science

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Aim: The education paradigm in the 3rd millennium was changed. Orientation was shifted from content to processes. The teaching was developed in a profession based on decision making. (OECD 2005; Eurydice 2013; UNESCO 2013). The teacher training was developed a complex profession based on: a. knowledge, skills and competences (Spencer and Spencer, 1993); b. socio-constructivist education model (Dewey 1929; Piaget 1952; Bruner 1973; *Vygotskij* 1934); ecological approach teaching and coaching model (Bronfenbrenner 1979; Davis and Broadhead 2007); education based on evidence and research data for teaching decision making (Cochrane 1972; Chambless 1998; Hjørland et Birger 2011).
Methods: The survey was based on the PE teacher attitudes on research data and decision making processes in teaching and coaching by questionnaire (Teacher Attitude Physical Education Based on Evidence Questionnaire-TAPEBEQ (UNESCO 2013; ESRC-TLRP 2000; 2011; OECD, 2002; LBE USA, 2005 modified). The hypothesis was teaching and coaching decision making differences between in-service and pre-service PE Teachers. Research sample was randomized 457 subjects (n = 457).
Results: Preliminary results was on the question "Research is a right/duty of the teaching profession?". The summary data was: Group A (in service teachers) 51 non-answered; most common answer "right" for 88 subjects (48.35%); Group B (pre-service teachers) 5 non-answered; Most common answer: "right" to 183 subjects (92.89%). Comparison of two rates was very significant difference (p value = 0.00).
Conclusion: The globally research data was showed a positive attitude at to think the research was right of PE teacher. The PE pre-service teacher pre-service (group B) expressed more stronger attitude versus the PE in-service teacher in-service (Group A). The data confirmed the trend of teacher training oriented versus decision making based on scientific/research data in order to prepare at European knowledge society and economy(EU Lisbon Treated 2009; UN SDGs 2030).

20 PED
The role of academic education in increasing the awareness of physical education significance in health promotion: insights from TFA and PAS courses

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Aim: WHO documents identify physical activity as one of most relevant determinants of health. Considering the importance of school in the life style education we studied the effects of academic physical education teacher courses (TFA and PAS) in generating knowledges towards the role of physical activity in health promotion.
Method: A total number of 331 final project works (PW) have been analysed from TFA = 136 and PAS = 195 participants in Veneto and Trentino. In order to properly identify the topic of PW we used the keywords (on average 5) freely chosen by students which were divided in 9 thematic areas by separate independent evaluation of experts.
Results: 9 semantic areas were selected and ranked for TFA and PAS separately: Citizen values (Cv), Emotions (Em), Evaluation (Ev), Health (H), Inclusion (In), Natural settings (Ns), Physical activity (Pa), Sports (Sp), Technology(Te).
Cv:1.23/1.29; In:0.98/1.01; Pa:0.75/0.84 (TFA/PAS respectively), got the higher choices while H turned to be better placed among PAS than TFA (0.82 vs 0.66). Ns advanced H only in TFA (0.70 vs 0.66) while S were always less selected by the future teachers (TFA:0.52, PAS:0.71). Em, Ev and Te were the last three areas. Application of Kendall's tau-b correlation coefficients among choices indicated significant ($p < 0.01$, two-tailed) relations between H and other areas in PAS and TFA. H in TFA had a positive report with Ns (0.233) and negative with In (−0.238), Em (−0.239) and Cv (−0.245). In PAS group H has only negative relations with In (−0.214) and Sp (−0.187).
Conclusion: The relevance of health concepts appears to be better established in PAS students. On the contrary TFA students establish relationship between health and Ns, indicating operative proposals for health promotion at the end of TFA. This kind of analysis could also be useful to evaluate academic education and new concepts to be implemented by future teachers.

21 PED
Sport civil liability: recent issue

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Aim: This paper provides a study about the civil liability law in the sport activities in the italian legal system, according to the latest issue of the doctrine and the recent judicial statements.
Methods: The legal notion of civil liability can be divided into the two following categories: extra-contractual civil liability and civil contractual liability.
It is very important to note that when we talk about the sport liability, we mean to refer to the civil liability as regulated into the italian civil code; in particular, the doctrine disscuss how basic law principles of the italian civil law, as the "neminem laedere", are applied in the sport context, in order to the sport related injuries, happend during the sport activities that the atlets play following the teacher's instructions.

In the light of the italian legal system, the fundamental legal rule governing the liability of sports participants for sports-related injuries is the article 2043 c.c. concerning to the neminem laedere, but there are specific rule as the article 2047 c.c. and the article 2048 c.c. in order to the teacher and the trainer liability.

Can we apply other rules and principles to regulate civil liability in the sport, for example the contractual liability rule?
Results: The italian legal literature and judicial practice provides some contribution to the debate on the legal liability in the sport activities, in particular about the duty of the care, of the teacher and the principle of the self-determination.
Conclusions: However it is possible to apply the contractual liability and we can identifie also other responsible in the sport field.
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22 PED
What is the evidence for the impact of the Sport Sciences University Courses on the labour market in Italy?

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Aim: The law 127/1997 established the sport science university courses in Italy as a replacement of the Higher Institute of Physical Education (ISEF). This reform was linked with the need to align the system to the rest of the European countries and with the necessity to provide an educational path that matched the requirements of the labour market. This work assesses what is currently known about the actual impacts of the sport sciences university courses on the labour market.
Methods: The study is based on a secondary analysis of different sources: ISTAT: Labour Force Survey (2005-2016); EUROSTAT: Employment in sport (2011–2016); ALMALAUREA: employment conditions of the graduates (2011–2016); ISFOL: Employment survey (2011–2016). A further refinement was possible with primary data from the following European Projects: ESSA-Sport and S2A-Sport.
Results: The Italian sport labour market (ISLM) is one of the most dynamic in Europe. The employment significantly rose between 2011 and 2015 (AAGR 2.9%). Additionally, the rate of individuals working in the sector with a tertiary education shows a positive trend during the last 5 years. On the other hand, sport accounted only for the 0.5% of the total employment, whereas in most EU Member States accounts for approximately 1%. Finally, the share of tertiary graduates in total employment (28%) is lower than the EU-28 average (35%).
Conclusions: Despite its dynamism, the ISLM still has margins for growth. It is crucial to have a better understanding of the real needs of the labour market and to coordinate qualification and training for VET and Higher Education through the development of a common methodology for Occupational and Training Standards.
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23 PED
Physical education in kindergarten and primary school. Results of an empirical study

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Aim: To collect data about the organization, meaning and value of physical education in kindergarten and primary school, and about how this has been translated into teaching practices. For the teachers who participated in the study, the critical reflection on their experience has created an opportunity for enrichment with a greater understanding of the educational value of this teaching field.
Methods: Empirical survey, carried out using a questionnaire, which consisted of 29 questions, of which 18 were closed response (general data, design, curriculum, and evaluation) and 11 were open response (concepts of competence, body, connection to DM objectives N 254/2012, and training). The questionnaire was given to a random sample of kindergarten and primary school teachers in Lombardy, mainly in the province of Bergamo: there were 307 total teachers, of which 165 were from kindergartens and 142 from primary schools.
Results: The collected data showed a variety of understandings regarding the concept of physical education (in the most popular terminology variants: physical education, psychomotor education, motor sciences) and the objectives assigned to it in the different school levels examined. It also highlighted a number a critical issues related to the concepts of competence, body and evaluation, that are correlated to approaches, meaning, didactics, and evaluation practices related to different conceptual and cultural frameworks.
Conclusions: The survey had a twofold outcome: an informational result, that is, a collection of data on specific issues related to the discipline of physical education (a quantitative aspect); and an educational result, from the teachers' perceptions and reflections (a qualitative aspect), and the opportunity to better understand the added value (historical/cultural/anthropological/scientific) of motor, physical, and sports education in kindergarten and primary school.

24 PED
An educational pilot project for active and healthy ageing

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Aim: Life expectancy in the world population has increased over the last few years and in the European Region the aging rate is the highest in the world. This requires interventions that can ensure successful aging preventing non-communicable diseases. The World Health Organization recommends the association of an appropriate physical activity and healthy, balanced diet. Promoting healthy lifestyles and adopting healthy habits can lead to a successful aging by improving anthropometric parameters, quality of food choices and perceived quality of life.
Methods: The "Get in motion the third age" project consists in a three months lasting training course aimed at promoting the regular practice of physical activity and correct dietary choices in the elderly through an educational intervention based on physical activity and food education. During the project anthropometric measurements (body weight, waist circumference, height and BMI) were performed and adherence to the Mediterranean diet were assessed in addition to referred health status.
Results: Data show that a program including structured physical activity (twice a week) supervised by qualified personnel, together with meetings on healthy eating, can play a key role in elderly health status ameliorating, improving weight (−1.46 kg), waist circumference (−4.4 cm) as well as dolour and anxiety score.
Conclusion: The results suggest that an educational intervention based on food education and structured exercise can help prevent aging decline, the risk of depression and contributes to successful aging, through the containment of pain, the maintenance of the usual activities and the autonomy in personal care. A secondary aim is that the elderly can also transfer to the family, in particular to children, the right lifestyle and can play an important community role in preventing childhood obesity.
Reference
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25 PED
Long-term motor and sports educational strategies and active lifestyle: prevention of occupational stress for psychophysical well-being

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Aim: The present study aimed to determine the effects of demographic and occupational characteristics, anthropometric indices, lifestyle adopted, and leisure-time physical activity levels on stress sources and coping strategies, and perception of the state of physical and mental health of the State Police officers from the Apulia.
Methods: The sample included 101 police officers (age 46.08 ± 5.66 years; body mass 81.60 ± 14.04 kg; and body height 173.47 ± 6.14 cm) volunteered to this study. The Occupational Stress Indicator and the Short Form-12 were used, in addition to a survey of socio-demographic, occupational and anthropometric data. Statistical analyses were performed using descriptive analysis followed by multiple linear regression analysis with the stepwise method. The level of significance was set at $p < 0.05$.
Results: Follow an active lifestyle, practicing motor or sports activity at any level, could allow the State Police officers to cope with stress adequately. In addition, the beneficial effects of active lifestyle on some sources of stress and perception of the physical health status are mediated by the abdominal circumference.
Conclusions: These findings suggest that the Public Security Department should adopt an institutional policy that allows police officers to practice regular physical activity in order to maintain and improve their physical fitness, health, job performance, and quality of life.

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PSYCHOLOGY

1 PSY
Profile of Mood States and psychological responses to High Intensity Interval Exercise. A crossover study on the effect of chronotype

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Aim: The aim of this study was to investigate the influence of chronotype on mood state and RPE before and in response to acute high intensity interval exercise (HIIE) performed at different times of the day.
Methods: Based on the morningness-eveningness questionnaire, 12 M-types (age 21 ± 2 years; height 179 ± 5 cm; body mass 74 ± 12 kg) and 11 E-types (age 21±2 years; height 181 ± 11 cm; body mass 76±11 kg) were enrolled in a randomized crossover study. All subjects underwent measurements of Profile of Mood States (POSM), before (PRE), after 12 (POST12) and 24 h (POST24) the completion of both morning (08.00 am) and evening (08.00 pm) HIIE. Additionally, Global Mood Disturbance (GMD), and Energy Index (EI) were calculated. Rating of perceived exertion (RPE), was obtained PRE and 30 min POST HIIE.
Results: Two-way ANOVA with Tuckey's multiple comparisons test of POMS parameters during morning HIIE showed significant differences in fatigue at PRE ($P = 0.024$) and POST24 ($P = 0.045$), vigour at PRE ($P = 0.023$) and POST24 ($P = 0.011$), and EI PRE ($P = 0.006$) and POST24 ($P = 0.012$) between M-type and E-types. Significant differences were found after the evening HIIE in fatigue ($P = 0.019$), vigour ($P = 0.019$), and EI ($P = 0.003$) only in POST12. For what concerns Borg perceived exertion, comparing morning versus evening values in PRE condition, an higher RPE was observed in relation to evening HIIE for M-types ($P = 0.0107$) while E-types showed higher values in the morning ($P = 0.008$). Finally, intragroup differences showed that E-types had a higher RPE respect to M-types before ($P = 0.002$) and after 30 min ($P = 0.042$) the morning session of HIIE. No significant changes during evening HIIE were found.
Conclusions: Chronotype seems to significantly influence fatigue values, perceived exertions and vigour in relation to HIIE performed at different times of the day. Specifically, E-types will meet more of a burden when undertaking a physical task early in the day.

2 PSY
Visual-spatial skills and physical activity: a cross-sectional study on undergraduate students of sport science

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Aim: Visual-spatial skills are very important for health and autonomy. They allow to move around the space more easily and to relate to surrounding objects more effectively (De Beni et al. 2014). The aim of this study was to investigate the relationships between visual-spatial skills and levels of physical and sport activity in a group of Motor Science students.
Methods: One hundred forty-five students ($M = 24 \pm 1$; range: 22–29 years), who were attending the Master Degree in Motor Science at the University of Turin, participated in this study. The participants completed a socio-demographic questionnaire, the Spatial Orientation Questionnaire (sQOS), the Spatial Anxiety Questionnaire (QAS), the Attitude Questionnaire towards Orientation Tasks (QACO) (De Beni et al., 2014) and the Global Physical Activity Questionnaire (GPAQ).
Results: Significant differences were observed between: (1) female and male students in GPAQ [$t(140) = 2.188$; $p = 0.03$], in sQOS [$t(139) = 3.178$; $p = 0.002$] and in QACO [$t(141) = 1.964$; $p = 0.05$]; (2) students of the first and the second year in QACO [$t(141) = 1.928$; $p = 0.05$] and GPAQ [$t(140) = 2.561$; $p = 0.011$]; (3) students who practiced sport categorized as open and closed skills in GPAQ [$t(139) = 2.020$; $p = 0.05$].
Conclusions: In accordance with the literature (e.g., Habacha et al., 2014) our study underlines the influence of sport practice on visual space skills and the difference between males and females. Future studies should investigate these findings considering the different university contexts, more age ranges and possible cause-effect relationships.

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3 PSY
Psychological readiness and self-confidence to return to sport after injury: Initial validation of the Italian versions of two questionnaires

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Aim: To examine the internal consistency and the concurrent validity of the Italian versions of the Injury-Psychological Readiness Return to

Sport scale (I-PRRS; Glazer, 2009) and the Sport Confidence Inventory (SCI; Vealey & Knight, 2002).
Methods: Male ($n = 29$) and female ($n = 7$) formerly injured athletes, aged from 18 to 39 years, completed the questionnaires the week before returning to competition. The I-PRRS and SCI were translated from English into Italian. The I-PRRS includes 10 items assessing the psychological readiness of injured athletes to return to sport. The SCI comprises 15 items measuring the three types of sport-confidence (i.e., SC-Physical Skills and Training, SC-Cognitive Efficiency, and SC-Resilience). The Brunel Mood Scale (BRUMS; Lane et al. 2007) was also administered.
Results: Findings showed a Chronbach's alpha of 0.932 for the I-PRRS and 0.924 for the SCI. Concurrent validity was evaluated through Pearson's correlation coefficient. We found from moderate to moderately high negative correlations between I-PRRS and some scales of the BRUMS (i.e., tension, depression, anger, confusion) ranging from -0.500 to -0.780, positive correlation with vigor ($r = 0.550$) and no correlation with fatigue. A similar trend of correlation was found between the subscales of the SCI and the BRUMS.
Conclusions: Our preliminary findings showed a high reliability on both I-PRRS and SCI instruments. Concurrent validity of both measures with the BRUMS was moderate or moderately high.
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4 PSY
Are changes of coaches, during the championships, useful for achieving better team results?

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Aim: The aim of the study was to investigate the effects of changing coaches during the same championship and the effects of this on team ranking.
Methods: According to UEFA Ranking, we analyzed the effect of coach's changes on the team in the four main European National Championships (Spanish, English, German and Italian) during the last five seasons (2012/13–2016/17). Statistical analysis consisted in descriptive collection of data, and comparative analyzes among countries, seasons and ranking positions.
Results: Italy showed the highest number of coaches' changes in the last 5 years (63 changes) followed by Spain with 55 and England and German with 46 changes. The majority of the changes occurred in the teams placed in the second part of the national rankings, with a significant linear increment according to the position in the ranking. Germany showed the highest percentage of favorable changes (63.04%) and only 13.04% unfavorable changes. England showed the 47.83% of favorable changes and 23.91% unfavorable. Italy and Spain have an intermediate situation with 53.97 and 58.18% favorable changes respectively (23.81 and 23.64% unfavorable). The majority of the teams who took advantage of the coach's changes, were classified in their championships in the 5th-6th, 9th-10th, and 13th-14th position. The top teams (1^{st}–3rd position) showed unfavorable changes.
Conclusion: Changing the coaches during the championship is not a good solution to improve the team ranking (Bell 2013). Frequent changes of coaches take place in teams that are in the relegation zone. This study highlights the lack of effectiveness of this strategy for teams at the top rankings. In Germany there is a lower turnover rate and this strategy seems to be more effective for teams.
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5 PSY
Emotion and emotion regulation in sport: Confirmatory factor analysis of three measures

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Aim: To examine the factor structure of the Italian versions of the Sport Emotion Questionnaire (SEQ; Jones et al. 2005), the Emotion Regulation Questionnaire (ERQ; Balzarotti et al. 2010), and the Emotion Regulation of Others and Self (EROS; Niven et al. 2011).
Methods: Male ($n = 197$) and female athletes ($n = 59$), ranging in age from 16 to 40 years, drawn from different sports, completed the questionnaires before a regular training session. The SEQ and EROS questionnaires were translated from English into Italian using the backward translation technique. The ERQ was already validated in the Italian language, but not applied to sport. The SEQ includes 22 items assessing the intensity and perceived impact dimensions of anger, anxiety, dejection, excitement, and happiness. The ERQ comprises 10 items measuring cognitive reappraisal and expressive suppression of emotions, and the EROS consists of other 10 items gauging intrinsic affect improving and worsening. Participants were asked to complete the questionnaires thinking on how they usually feel or behave before or during competition.
Results: Confirmatory factor analysis (CFA) models were estimated using the maximum likelihood parameter estimates (MLM) with standard errors and a mean-adjusted Chi-square test statistic that are robust to non-normality. CFA yielded fit indexes for all measures ranging from acceptable to very good.
Conclusions: Findings provide initial validity evidence for sport-specific emotion and emotion regulation measures.
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6 PSY
Ericksonian Hypnosis as Mental Training for Marathon Runners

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Aim: Imagery, goal-setting, self-talk and physical relaxation techniques are considered the four mental techniques predominantly used in sport psychology interventions. Hypnosis can be used as a technique to enhance their effectiveness by increasing the intensity and vividness of mental imagery (Liggett 2000) and increasing self-efficacy levels (Barker 2013); (c) contributing to the emergence of "peak performance" and "flow states" through the recollection of thoughts, emotions and movements that characterized the athlete's best performance. The present study aims at testing the effectiveness of Ericksonian hypnosis as a technique of mental training to enhance the performance of marathon runners and to reduce their pain and fatigue.
Methods: 20 individuals (18 men and 2 women), aged 30–54 ($m = 44.25$; s.d. $= 5.89$), were randomly assigned to two groups that do not differ in terms of years of practice ($t = 0{,}26$; $p = 0.79$), training intensity ($t = 0$; $p = 1$) and expected finishing times ($t = 1.41$; $p = 0.17$). While the control group kept training as their usual, the experimental group participated to a total of three hypnotic sessions during the three weeks preceding the competition.
Results: The data showed a significant improvement of performance times ($t = 2.81$; $p < 0.05$) and fatigue ($t = 3.04$; $p = 0.01$) in participants in the experimental group compared to those in the control group.Concerning pain, no significant differences were observed between groups.
All tests are 2 tailed since we do not hypothesize a direction in the variation. We used t-tests since they proved reliable also with small samples
Conclusion: This study provides support for the use of hypnosis as a mental training strategy for marathon runners.
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7 PSY
Effects of attentional control and associative strategies on running performance

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Aim: We conducted a counterbalanced repeated measure trial to investigate the effects of four attentional strategies resulting from the interaction between attentional control (low and high) and associative strategies (internal and external) on running performance. We tested the hypothesis that different attentional strategies (low control and external focus, low control and internal focus, high control and external focus, and high control and internal focus) would be equally effective with respect to endurance time performance on a running task, given that all strategies were associative.
Method: Twenty-six male runners ($M_{age} = 28.46$ years, $SD = 5.91$ years) were involved. During the first visit to the laboratory, participants performed an incremental test to determine their second ventilatory threshold velocity (VT2). During the subsequent visits, participants were randomly assigned to one of the four experimental conditions in a random order and occurring on different days. They performed time-to-exhaustion (TTE) tests at individual constant load (VT2 + 5%) during running. A manipulation check questionnaire was administered to verify adherence to the experimental conditions. A RM-ANOVA was computed to compare participants' TTE data.
Results: 2 × 2 (control × attentional focus) RM-ANOVA on overall scores showed non-significant differences across the four experimental conditions in regard to the duration of the TTE tests (control, $F_{1,\ 25} = 0.548$, $p > 0.466$, $\eta_{p2} = 0.021$; attentional focus, $F_{1,\ 25} = 0.118$, $p > 0.734$, $\eta_p^2 = 0.005$; interaction, $F_{1,\ 25} = 0.011$, $p > 0.917$, $\eta_p^2 = 0.000$).
Conclusions: Our results showed that runners were able to reach similar performance levels (i.e., non-significant running time differences) irrespective of whether they used a low or high attentional control combined with an internal or external associative strategy. As expected, the four attentional strategies led to the same results in terms of running duration performance.

TECHNOLOGY APPLIED TO MATERIALS FOR SPORTS

1 TEC
Are wearable multisensors suitable for energy expenditure estimation in badminton? a pilot study

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Aim: Badminton is a team game characterized by bouts of high intensity efforts interspersed by short recovery periods. A direct assessment of the energy demand through the measure of oxygen uptake is not suitable on-court because of the encumbrance of portable metabolic devices. Wearable multisensors (WMS) have been developed to estimate indirectly the energy demand. Thanks to their portability, they could be used to evaluate, simultaneously and without any encumbrance, the energy demand and the intensity of the activity of team game athletes. Despite these portable devices are widely used in different team sports, their use during badminton is still not validated. This study aimed at evaluating the performance of a wearable multisensors during simulations of badminton activities.
Methods: Six professional badminton players (age: 16.9 ± 2.1 years.; body mass: 62.8 ± 9.2 kg.; stature:1.71 ± 0.09 m; mean ± SD) participated to the study. The athletes were asked to play against an opponent at three different simulation intensities (LOW, MODERATE and HIGH) for 5 min each. The energy expenditure (EE) was measured by indirect calorimetry (IC), by using a portable metabolic device, and estimated by a WMS equipped with a heart rate sensor and a triaxial accelerometer.
Results: Estimated EE well correlated with the measure of IC ($R^2 = 0.72$, $p < 0.05$), however WMS overestimated significantly EE obtained by IC in all conditions. Average difference between WMS and IC measure was about 6 kcal/min and tended to be proportional with the game intensity.
Conclusions: Wearable multisensors could be useful tools in monitoring, the level of activity during on-court and on-field activities with minimal encumbrance. However, an individual calibration is recommended in order to improve estimation accuracy.

2 TEC
Correlation between energy expenditure assessed by indirect calorimetry and wearable multisensors: from young adults to elderly people

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Aim: Total energy expenditure (TEE) correlates strongly with the incidence of morbidity and mortality in some chronic diseases, such as hypertension and diabetes. An accurate evaluation of TEE during free-living conditions may provide useful information on the level of physical activity and quality of life. Wearable multisensors (WMS), have been recently developed for TEE estimation to overcome the drawbacks of gold standard methods (costs, time-demand and invasiveness), but their accuracy is still questionable. Therefore, this study aimed at evaluating WMS accuracy in TEE estimation compared to the data obtained by indirect calorimetry method (IC) from young adults to elderly people.
Methods: Thirty-eight participants (age: 42.3 ± 23.8 years; body mass: 69.4 ± 15.9 kg; stature: 1.71 ± 0.1 m; mean ± SD) were divided by age in three groups: (a) <30 years (n = 18; young, YNG), (b) 30–60 years (n = 13, adult, AD), and (c) > 60 years (n = 7; institutionalized elderly, ELD). TEE was measured by IC and estimated by WMS during cycling with only the upper- or lower-limbs and during walking. Each task was performed at three different exercise intensities.
Results: WMS significantly underestimated TEE in all groups and conditions. The error increased with physical activity intensity. The best correlation coefficient occurred in YNG while the worst was found in ELD ($R^2 = 0.69$, $R^2 = 0.61$ and $R^2 = 0.15$, for YNG, AD and ELD, respectively; $p < 0.05$).
Conclusion: WMS underestimated TEE compared to IC during all physical activities, with the lower correlation coefficient in elderly people. Care should be taken when using WMS for TEE estimation during free-living conditions. An individual calibration of WMS seems to be mandatory to obtain accurate estimations of TEE, especially in elderly people.

3 TEC
Time-motion analysis during official match in élite young soccer players (from U15 to U19): Preliminary data

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Aim: Time-motion analysis in young soccer players is used to determine external loads during matches of different categories (Harley et al. 2010). The aim of this study was to compare the external load during official matches in young élite soccer players from U15 to U19.
Methods: Sixty-two élite young soccer players were monitored by GPS (10 Hz; accelerometer: 100 Hz, 16G Tri-Axis) during 24 official matches for a total of 29, 37, 28, 135 individual observations for U15, U16, U17, U19, respectively. Only the participants that played more than 90% of the total match-time were included. The considered parameters were total distance (TD) and total distance at very high intensity running (VHIR, $> 20 < 24$ km·h^{-1}). Due to different match exposure over categories, each data was presented both as total volume (m) or meters covered in one minute (m·min^{-1}).
Results: No differences were found among categories in TD, while U19 covered a greater distance than U15/U16 ($P < 0.05$) in VHIR (7142 and 9345 m and and 389 m for TD and VHIR from U15 to U19, respectively). When data were normalized per m·min^{-1}, no differences among categories were found for both TD and VHIR (106 and 103 m·min^{-1} and 3.4 4.3 m·min^{-1} for TD and VHIR from U15 to U19, respectively).
Conclusions: Despite a different match exposure, only VIHR was greater in U19 than U15/U16. Interestingly, normalizing data by m·min^{-1}, despite a trend for higher VIHR in U17/U19 *vs* U15/U16, no differences among categories for both TD and VHIR were found,

probably due to a different technical and tactical strategy. Future studies are needed to better understand these observations.

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4 TEC
Estimating oxygen uptake in cycling using neural network analysis of easy-to-obtain inputs

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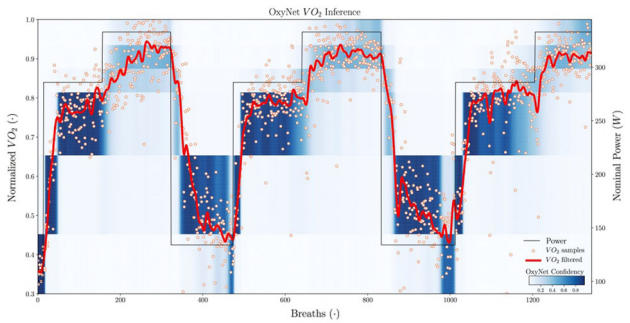
Aim: Machine-learning technologies like Multi Layer Perceptron (MLP) can help to estimate physiological variables that typically require exotic hardware [1]. For instance, direct measurement of oxygen uptake (VO_2) is practically unattainable during outdoor cycling exercise. Using an Artificial Intelligence approach, the aim of our project was to predict VO_2 dynamics during cycling from heart rate, power output and minute ventilation.
Methods: An MLP was used as the classifier composed of 5 fully connected layers built to predict the probability for VO_2 to fall into different intensity levels (or classes). Five common classes (zones) used in the design of training programs were defined [2], with one additional class added for appropriate analysis (0–45%VO_{2max}), totalling 6 classes. The dataset was formed from data collected on amateur cyclists asked to follow pseudorandom cycling on an ergometer in the laboratory. The dataset was split into a training set (that typically used in training), a validation set (that used to tune hyper-parameters) and a test set (used to assess accuracy, see Figure).
Results: The performance of the MLP on the test set reached 78% for the single run. The main uncertainties of the predictor were in the upper level of VO_2 consumption (between classes 5 and 6), where the experimental signal showed the highest noise. Moreover, these two classes did not show a balanced representation in the training set, as such exercise intensities that elicit high VO_2 are less sustainable, and more variable, above critical power [3].
Conclusion: Despite modest levels of accuracy, this AI methodology holds potential to be refined and used for future cycling performance assessment from other easy to obtain variables, such as blood glucose or blood lactate concentrations.



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TRAINING AND FUNCTIONAL EVALUATION

1 TFE
The effect of a whole body compression garment on autonomic recovery in competitive swimmers

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Aim: In international swimming events, the swimmers compete several times, often with short resting periods. Therefore, effective recovery is essential to warrant optimal performance (Toubekis 2008). The aim of this study was to evaluate the effects of using a whole body compression garment on hemodynamic and autonomic nervous system parameters related to the recovery pattern.
Methods: 10 male competitive swimmers were completed a maximal 400-m freestyle swim, respectively with and without wearing the garment. Heart rate variability (HRV), baroreflex sensitivity (BRS) and hemodynamic parameters were assessed by means of non invasive continuous blood pressure monitoring for 90 min after the effort. The garment was worn to ensure the maximum compression at the level of the limbs.
Results: Baroreflex sensitivity decreased similarly in both conditions with respect to the baseline, while the BRS alpha index showed a significant reduction after 20–30 min only in the condition of using the garment. HRV restored to baseline values with and without bodysuit after 40–50 min and 60–70 min, respectively. Significantly higher values related to the cardiac output were observed in the condition of wearing the garment. In the control condition, heart rate (HR) was restored back to baseline value 20 min later with respect to the garment condition, confirming that the garment allows a faster recovery.
Conclusions: In summary, there were higher changes in autonomic regulation after exercise when the swimmers wore the compression garment than in the control condition. Therefore, compression garments may have beneficial effects on the pattern of autonomic function recovery in competitive swimmers.

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2 TFE
Prolonged use of smartphones negatively affects physical and technical performance in young footballers

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Aim: Prolonged periods of cognitive activity induce mental fatigue, a psychobiological state which influences the performances in team sports. Purpose of this study was to assess the effects of prolonged use of smartphones on physical and technical performances in young footballers.
Methods: Sixteen male young footballers (age 15.0 ± 1.1 years) volonteers were randomly assigned to Group 1 (G1, n = 8) or Group 2 (G2, n = 8) that performed the Yo–Yo IRT Lev.1 and LSPT test, respectively. The soccer-specific physical performance was assessed with G1 and the soccer-specific technical performance with G2. Both groups underwent to mental fatigue through the use of the smartphone (Brain It On App) for 30 min, and the control condition after at least 48 h. A paired t-test was used for statistical analysis ($p < 0.05$).
Results: The G1 performed shorter running distances in the state of mental fatigue than control condition (1610 ± 135 vs. 1780 ± 249 m, $p < 0.05$). Mental fatigue also significantly increased the performance time in the G2 compared to the control condition (51.0 ± 6.0 vs. 43.0 ± 2.2 s, $p < 0.05$).
Conclusions: Our findings suggest that prolonged use of smartphones, causing mental fatigue, could reduce the physical and technical performances of young footballers. Therefore, it would be necessary to educate in the conscious use of technologies.
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3 TFE
Effects of a proprioceptive training in young adult: functional evaluation of the cervical spine with S9 SENSOR

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Aim: The cervical spine is the dynamic protection structure of the spinal cord and plays a decisive role in the movements and orientation of the head in the three spatial dimensions (Norkin and Joyce White 2016). The aim of the study was to evaluate the effectiveness of a postural training of the head through the multifunction sensor "S9 Sensor" and the related Sprintware software.
Methods: A total of 24 subjects (7F,17 M; mean age = 25.5 years) were involved in the study, undergoing for a 4-week period a postural gymnastics protocol (Nart and Scarpa 2008). The evaluation was conducted using the *Rotation Test*, *Flexion–Extension Test* and *Lateral Flexion Test*, performed at T0, T1 and T2 time intervals, i.e. upon the follow-up one month after. For the statistical analysis, we used the ANOVA one-way test for repeated measurements (p value = 0.05) and Tukey's post hoc test (p value = 0.05). The Index of Symmetry (IS) in the rotation test was applied to evaluate the motion range to the right and to the left and to observe the sample distribution.
Results: Tukey's post hoc procedure highlighted significance in the *Rotation Test* between T0 and T1 and between T0 and T2 (p value <0.05) as well as in the *Flexion–Extension Test* between T0 and T1 (p value <0.05).
The symmetry index, assessed in the *Rotation Test* only, showed a more significant rotation inference (IS < 0) to the left at T0, T1, and T2 time intervals.
Conclusions: The proposed specific training was found to be effective in the postural organization of the head.
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4 TFE
Relationship between shoulder muscles and grip strength in female tennis players: a pilot study

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Aim: Shoulder pain and lesions are very common among overhead athletes: 9 out of 10 tennis players report radiographic signs of structural lesions probably brought about by overhead arm movements (Lädermann et al. 2016). Therefore, the aim of this study was to analyze shoulder internal and external rotators muscle strength ratios and differences concerning the hand grip strength.
Methods: This study enrolled 10 Italian nationally ranked female tennis players (19 ± 9 years old, 164 ± 7 cm, 54 ± 7 kg 11 ± 9 years of competitive experience, 3 ± 1 training sessions per week) who play the two-hand backhand. The shoulder muscles isometric strength was assessed by utilizing a dynamometer (MicroFet, Hoggan Scientific, Salt Lake City, UT, USA), while the hand grip strength by means of a CAMRY-EH101 hand dynamometer (Henqi, Guangdong, China).
Results: The players, in the dominant arm, have stronger internal rotators than externals ($p < 0.001$, ES = 2.38, +51%), and these said internal rotators are stronger in the dominant arm compared to the non-dominant ($p < 0.01$, ES = 0.44, +8%). If the non-dominant arm is taken into account, internal rotators are stronger than externals ($p < 0.01$, ES = 2.99, +45%). The hand grip strength was higher in the dominant hand compare to the non-dominant one ($p < 0.01$, ES = 0.70, +13%), while both of them were positively correlated with shoulder's muscles isometric strength.

Conclusions: This study highlighted large differences between shoulder muscles strength. Hence, specific training protocols to compensate for these imbalances, because they must not be greater than 15–20% (Witvrouw et al. 2003; Wang et al. 2006).

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5 TFE
Benefits of 8 weeks of High Intensity Training in healthy women: the Trion project

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Aim High-intensity training (HIT) has recently been shown to be a suitable alternative time-saving strategy to improve athletic performance, cardiovascular fitness and muscle metabolism[1]. Nevertheless, women have rarely participated in studies investigating the efficacy of HIT[2]. Therefore, the aim of this study was to evaluate in moderately active women the effectiveness of an HIT intervention performed on a new device called *Trion*.

Methods Before and after 8 weeks of HIT (3 time/week, 7reps × 30 s all-out interspersed with 2 min of active rest), in 35 healthy women volunteers (22.5 ± 3.7 yy; BMI: 21.2 ± 2.6), we measured maximal oxygen uptake ($V'O_{2max}$), ventilatory threshold (VT), anaerobic performance, muscle structure, body composition, hematochemical ($CHOL_{tot}$) and blood pressure profile at rest. The HIT workout was performed running on non-motorized curve treadmill and cycling on an competition bike mounted on an electromagnetic roller.

Results Absolute and relative $V'O_{2max}$ significantly increased by 10% ($p < 0.05$); maximal power and power@VT increased by 7.2 and 6.3% ($p < 0.05$), respectively; peak anaerobic performance significantly increased by 10% ($p < 0.05$). Large significant differences ($p < 0.05$) were identified for vastus lateralis thickness and pennation angle, +4.9 and +10.1%, respectively. Fat mass and $CHOL_{tot}$ decreased by 3.9 and 5.7% ($p < 0.05$), respectively.

Conclusions Our results confirm the feasibility and effectiveness of HIT to improve exercise performance and health related parameters: HIT performed on *Trion* device was absolutely safe and well tolerated by the subjects. As confirmed in previous studies, our findings shows that exercise intensity, rather than duration, is the key factor in determining functional benefits.

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6 TFE
Relationship between change of directions and anthropometric factors in collegiate soccer players

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Aim: Very little research has attempted to correlate anthropometric variables and change of direction speed performance. In particular Sheppard and Young (2006), supposed that an athletes anthropometry could potentially be related to performance during change of direction Therefore, the aim of this study was to assess possible relationship between anthropometric parameters and performance during change of direction tests.

Methods: Twenty-two collegiate soccer players (22 ± 5 years old) were enrolled in the study. Anthropometric parameters (stature, body mass, BMI, sitting high and lower limb, femur, tibia, fibula and foot length) and performance during change of direction tests (5–0–5, 10 × 5 shuttle run, modified T-test, slalom test, Illinois agility test, 20 Yards Shuttle Run, 3-cone drill, Box Test) were assessed.

Results: Pearson's correlation coefficient test was applied to found relationship between stature (1.78 ± 0.05 m), body mass (73 ± 9 kg), BMI (23 ± 2 kg/m^2), sitting high (91 ± 3 cm), and lower limb (94 ± 3 cm), femur (45 ± 2 cm), tibia (40 ± 2 cm), fibula (40 ± 1 cm) and foot (26 ± 1 cm) length, and 5–0–5 (2.56 ± 0.15 s), 10x5 shuttle run (16.91 ± 0.86 s), modified T-test (6.57 ± 072 s), slalom test (6.42 ± 1.02 s), Illinois agility test (16.13 ± 1.18 s), 20 Yards Shuttle Run (5.10 ± 0.36 s), 3-cone drill (8.66 ± 0.78 s), Box Test (17.18 ± 1.97 s). No significant relationship was found between anthropometric parameters and performance during change of direction tests.

Conclusion: In conclusion, results suggest that agility performance does not appear to be linked with anthropometric parameters. Essentially, speed and agility are distinct physical qualities and anthropometry does not appear to enhance change of direction speed. For this reason, further investigations are needed to assess what are the physical performance measures that are related to change of direction ability.

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7 TFE

Comparison of dynamic postural-balance ability between elite and semi-professional female volleyball athletes

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Aim: Star Excursion Balance Test (SEBT) is a series of single-limb squats using the non-stance limb to reach and touch lightly the furthest point along 1 of 8 designated lines on the ground with the most distal part of the foot. We used the short-form of SEBT to assess dynamic-postural balance. It is composed by: anterior (A), posteromedial (PM), and posterolateral (PL) distances and a composite score (COMP) can be calculated. The aim of the study was to compare SEBT performance between elite and semi-professional female volleyball players, during the pre-season period, to better identify those athletes who exhibit an elevated lower limb injury risk.
Methods: Fifty-one female volleyball players were recruited and grouped in two groups: elite athletes (EG; $n = 27$) and semi-professional players (SG; $n = 24$). In addition, the athletes were categorized into 1 of 4 groups based on playing position: hitters ($n = 20$), middle blockers ($n = 11$), setters ($n = 12$), and liberos ($n = 8$). All the subjects performed the short-form of SEBT.
Results: We observed significant differences between EG and SG in A ($p < 0.05$), PL ($p < 0.05$), PM ($p < 0.001$) directions and COMP ($p < 0.01$) with elite volleyball players showing higher normalized distances. SEBT performance did not vary among playing positions.
Conclusions: Elite female volleyball athletes have greater dynamic postural-balance and anthropometric measures than semi-professional players. Greater level of competition required higher physical and performance attributes.

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8 TFE

A new method for monitoring training load in soccer: the "R.O.M.E.I. model" report on ongoing monitored exercise in individuals

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Aim: For a proper training organization it is vital to monitor individual training load (TL). However, both physiological parameters and distance indicators highlighted some limits in quantifying correctly TL in team sport. For these reasons, the use of subjective self-reported measures and metabolic power indicators becomes popular in soccer. Despite this wide interest, a conclusive response in individual relationship between TL indicators is yet to be reported.
The aims of this study were to investigate the relationship between TL indicators and to propose a new method for monitoring individual TL response and actual physical fitness in soccer players.
Methods: 22 semi-professional (Primavera U-19) and 19 professional (Serie A) soccer players were involved in the study (mean ± SD: age 17.5 ± 0.5, 25.8 ± 4.1y; bm 69.7 ± 6.6, 76.8 ± 4.3 kg; h 175 ± 5.4, 184 ± 4.6 cm respectively). The analysis of 905 training sessions was use for set up the individual relationship between internal TL (s-RPE) and external TL (energy expenditure). The relative standard error of regression line was use to indicate three areas: well-conditioned, average-conditioned, and poor-conditioned (named ROMEI Model).
Results: The average sessions TL for the observed period were: 86.2 ± 17.7 and 58.2 ± 21.8 min; 279 ± 160.9 and 228 ± 100.7 UA of s-RPE; 35.3 ± 12.7 and 25.3 ± 8.9 kJ of energy expenditure for the semi-professional team and for the professional team respectively, all data shows a significant difference ($P < 0.001$). The collective correlation between s-RPE and energy expenditure is $r = 0.81$. With an individual analysis semiprofessional and professional soccer players shows a values of $r = 0.89 \pm 0.6$ and $r = 0.88 \pm 0.8$ respectively.
Conclusions: It was described the average internal and external TL of one semi-professional team of U-19 and one first team of Italian Serie A. Moreover, it seems that an individual analysis allow to better understand the TL administered to youth and professional soccer players than a collective analysis. Finally, with the ROMEI model it seems that it is possible monitoring individual fitness of soccer players.

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9 TFE

Effects of female soccer match on sprint and jump performances

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Aim Considering that (1) the popularity and professionalism of female soccer has increased markedly with 29 million participants recorded in 2011 (Fahmy 2011), and (2) 48% of all official registered soccer players is represented by girls (US Youth Soccer Key statistics 2014), the aim of the present study was to investigate on the effects of female soccer match on sprint and jump performances.
Methods Before (pre) and after (post) female soccer match, 10 m sprint (sprint) and countermovement jump (CMJ) performances of 10 female Italian Soccer Players (Age: 23 ± 5 year; High: 167 ± 5 cm, Weight: 56.9 ± 4.9 kg; BMI 20.6 ± 2.1 kg/m^2) were analysed. A

paired Student t-test in each performance (CMJ and Sprint) was applied to asses statistical differences ($p < 0.05$) between condition (pre and post).

Results No significant differences emerged between pre and post match in CMJ performance (pre = 26.4 ± 2.6 cm; post = 26.5 ± 4.2 cm). Sprint time showed a decresased performance (pre = 2.01 ± 0.05 s; post = 2.17 ± 0.11 s; difference = −8%) with significant differences ($p = <0.01$) between pre and post match.

Conclusions The results of this study showed that sprint performance decreased after female soccer match. According to these findings, female soccer players may not be able to perform at maximal level intense anaerobic activities during the whole match. Considering that successful performance of rapid movements such as sprints is essential in many sports and that the likelihood of scoring increase during the final 15 min of match (Reilly et al. 2000), soccer coaches could use this information in the process of planning sprint training.

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10 TFE

The Relationship between Lower-body Strength, Power, Speed and Change of Direction Skill among a Group of Late Adolescent Female Athletes. Consideration for Youth Sport Specialization

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Aim: Lower body muscular strength has been shown to positively affect performance in adolescent athletes. However, the onset of puberty substantially increases the physiological differences between boys and girls, dictating different response to training. The purpose of this investigation is to develop a better understanding of the relationship between lower body muscular strength, power, linear speed and change of direction speed in late adolescent female athletes.

Methods: Data from 19 female athletes, (age = 18 ± 0.7; height = 162.4 ± 4.7; weight = 63.6 ± 9.2) was utilized to determine if significant relationships existed between lower body muscular strength (SJ) and power (CMJ), linear speed (30 M) and change of direction speed (MOD-T). Results were entered into SPSS v.24 for analysis; a Pearson Product Correlation was chosen to establish relationship among variables.

Results: Strong correlations were found between lower body muscular strength and power (SJ and CMJ, r = 0.000 p = 0.917), linear speed (SJ and 30 M, r = 001 p = −0.709) and sport-specific, change of direction speed (SJ and MODT r = 0.034 p = −0.623) among late adolescent female athletes. These findings were confirmed when relative lower body power (PWRATIOCMJ) rather than absolute power was used to analyze the results collected (PWRATIOCMJ and SJ, r = 0.000 p = 0.908; PWRATIOCMJ and MODT r = 0.014 p = −0.569; PWRATIOCMJ and 30 M r = 0.007 p = −629)

Conclusions: The outcome of this investigation shows that lower body muscular strength and power in late adolescent female athletes are strongly correlated with linear speed and sport-specific change of direction speed. Despite the lack of evidence available in the literature, these findings suggest how strength training is paramount in youth sport specialization, especially among female athletes.

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11 TFE

Prevention and Perfomance in Soccer: differences between kicking and supporting lmb in soccer school children

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Aim: Physical features assessment is considered a necessary process to set appropriate training schedules for young players and to prevent injuries (Nikolaidis, 2010). Hamstring damages are one of the most common injuries in football. For this reason, coaching staff are always applying to find new ways to warn this kind of muscle injury. Considering this, the aim of this study consist in identify and set a preventive screening protocol comparing kicking versus supporting limb parameters in a group of children playing football.

Methods: 20 children (8 ± 2 years, 31 ± 9 kg, 132 ± 10 cm), belonging to a local soccer school were recruited for this study. All their parents approved the attendance at this study by signing an informed consent. Children were tested using Gwalk (BTS S.p.A., Italy) to analyse the gait cycle while baropodometry and stabilometry were investigated using P-Walk balance board (BTS S.p.A., Italy). In addition the Spinal Mouse® (Idiag, Volketswil, Switzerland) and a digital goniometer (GetMyRom for Iphone 5 s, USA) were used to evaluate respectively the spine morphology and the hip joint mobility.

Results: Results show a significant difference in the evaluation of hip joint mobility between kicking and supporting limb ($p < 0.05$, 5%), while other trials did not show any significant difference.

Conclusion: Data shows that playing soccer can enhance joint mobility differences between the kincking and supporting limbs since childhood. Considering that mobility and strenght discrepancy between the limbs increase the risk of muscolar injuries (Knapik et al. 1991) it is reccomended to propose training programs aible to minimize joint mobility differences between legs.

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12 TFE

A comparison between agonist rugby players and fitness people with functional movement screen

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Aim: We studied how Functional Movement Screen (FMS) screened about rugby player injuries. We compared the vault obtained from a rugby team to ones obtained from clients of a gym.
Methods: We looked in many articles about "injuries" and "injuries recovery time" searching for a relationship. We used FMS to screen 420 clients of a gym (the "Futura" in Udine, 25.9 ± 5.9 years old and 179 ± 7 cm height and 76 ± 11.5 kg weight) and we compared the results to 38 rugby union players (in A and C1 league in Udine, 23 ± 5.2 years old and 182 ± 7 cm height and 87.4 ± 15 kg weight). The BMI of rugby players was bigger than fitness subject (26.4 ± 3.4 and 23.6 ± 3.1 respectively).
Results: Functional movement screen (FMS) or its component tests seems to have the ability to predict the occurrence of severe injuries (≥40 days) if the score is less than 6, moderate injuries (≥21/28 days) if the score is less than 13 and light injuries (≥5 days) if the score is less than 14. The Trunk Stability Push Up resulted specific about rugby players. The top performer is 21 years old and has BMI between 24 and 25, with a FMS score of approximately 15.
Conclusion: These players have to compete in the game without a perfect physical form (due to old injuries, or recovery), therefore they are forced to compensate during the game (or during training). Fitness people trained to improve their FMS score on their train-day indirectly instead of the rugby players used training based on skills and velocity. This factor created in the rugby players tests a lower average score than fitness subjects.
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13 TFE

The effects of 8 weeks of proprioception training on a young basketball team

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Aim: Analyze the effects of proprioception training on young basketball players. The purpose was focus on increase of the ROM of the ankle, improve the stability and the balance, analyze the injury risk and try to reduce it.
Methods: Two different group of young male basketball players were selected: the first composed by 19 players (age 16–18), playing in the national championship, involved in the proprioception training; the second (the control group) composed by 12 players (age 16–17) competing in the regional championship. They were examined with flexibility test of the junction of the ankle, stability test on a electronic proprioception device, Lower Quarter Y Balance Test.
They took part in 8 weeks of proprioception training whose intensity and complexity was increased step by step.
Results: The injury analysis showed the benefits of the proprioception training on the injury rate (5.26% in the principal and 25% on the control group). The flexibility of the first group increased of 4.21° (Avg), only 0.21° (Avg) in the second. Also the stability test increased a lot more in the first group than in the second. The Y-Test discovered 3 players with an high injury rate, and one of those after the workouts decreased a lot his injury risk.
Conclusions: All the aspects took in analysis have improved. The time of the study wasn't so long, we can assume that introducing a proprioceptive training throughout the season would lead to even more valuable results especially in young age.
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14 TFE

Static and dynamic postural balance assessment in a group of sailors: effect of 7 weeks of proprioception and balance exercises

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Aim: The contribute of static and dynamic postural balance on sailing performance deserves attention as reported by Riva and colleagues referring to the 49ers Olympic class (Riva et al. 2005). The aim of the present study was to investigate in a group of sailors the effect of 7 weeks of proprioception and balance exercises on static and dynamic postural balance.
Methods: Ten sailors of the Metis Vela Unipd team (age 23.5 ± 2.6 years; height 174.1 ± 6.8 cm; weight 66.81 ± 10.88 kg) performed bipodalic and monopodalic tests on a stabilometric platform and bipodalic tests on an instrumented oscillating platform, before and after 7 weeks of proprioception and balance exercises. Six healthy subjects (age 22.5 ± 0.5 years; height 175.3 ± 5.8 cm; weight 75.4 ± 11.9 kg) were enrolled as control group and were instructed not to practice any kind of sport training for 7 weeks.
Results: Parameters referred to the centre of pressure (COP) motion in the static tests underlined a more marked improvement among sailors in the monopodalic test with eyes closed. Dynamic tests on the oscillating platform showed an overall improvement among sailors, in particular considering the anterior/posterior oscillations.
Conclusions: Complex static and dynamic postural tests seem to be more sensitive in evaluating postural balance improvement after 7 weeks of proprioception and balance exercises among healthy sailors.

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15 TFE
Shoulder muscles and hand grip strength ratio in male tennis players

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Aim: Tennis, as a result of its asymmetric nature, represents an excellent model to study muscle strength ratios in response to chronic competitive practice (1). Therefore, the aim of this study was to analyze differences concerning shoulder internal and external rotators muscle strength as well as the hand grip strength.
Methods: This study recruited 27 Italian nationally ranked male tennis players (16 ± 2 years old, 173 ± 11 cm, 62 ± 13 kg 7 ± 2 years of competitive experience, 3 ± 2 training sessions per week) who play the two-hand backhand. The internal and external rotators isometric strength was evaluated by means of a dynamometer (MicroFet, Hoggan Scientific, Salt Lake City, UT, USA), while the hand grip strength with an electronic hand dynamometer (Camry EH101, Henqi, Guangdong, China).
Results: The participants showed significantly higher muscle strength in the internal rotators of the dominant arm compared to the non-dominant one ($p < 0.0001$, ES = 0.61, +19%) and to ipsilateral external rotators ($p < 0.0001$, ES = 1.50, +50%). Dominant external rotators are stronger than their contralaterals ($p < 0.01$, ES = 0.46, +10%). In addition, in the non-dominant side, internal rotators are stronger than external rotators ($p < 0.0001$, ES = 1.26, +39%). The hand grip strength was higher in the dominant hand compare to the non-dominant one ($p < 0.0001$, ES = 0.67, +17%), while both of them were positively correlated with shoulder's muscles isometric strength.
Conclusions: The large differences which emerged between ipsilateral internal and external rotators and the same muscles between dominant and non-dominant arm require specific training protocols to compensate for these asymmetries, since it has been demonstrated that they must not exceed 15–20% (2–3).
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16 TFE
Effect of two speed endurance training regimes on 5-meters multiple shuttle test (5-m MST) in soccer players

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Aim: To compare the effect of two different anaerobic training regimes on 5 m-MST performance.
Methods: Thirteen male soccer players (age 18.3 ± 0.9 years, height 1.8 ± 0.05 m, weight 67.5 ± 5.25 kg) were divided to either a speed endurance production (SEP; n = 7) or speed endurance maintenance (SEM; n = 6) training group. SEP training consisted of 8 reps of 20-s all out running bouts followed by 2 min of passive recovery, whereas SEM training consisted of 8 reps of 20-s all out running bouts followed by 40-s of passive recovery. Both groups trained twice a week for 4 consecutive weeks. The 5-m MST was performed twice, PRE and POST the training intervention period and included 6 all-out shuttle runs, lasting 30 s with 35 s of recovery period.
Results: At baseline, SEM group showed a large decrement in the last two sprints of the 5-m MST (5th: 121.7 ± 3.7 m; 6th: 125.0 ± 5.0 m) compared to the first bout (136.6 ± 8.9 m; $p < 0.001$) while, in the POST condition, no decrements or variations among the 6 sprints were observed. On the contrary, SEP group improved the covered distance of the first sprint compared to PRE test (+8.6 ± 9.8 m; $p < 0.05$) but decreased the performance during the last two sprints (5th: −3.9 ± 4.2 m; 6th: −4.6 ± 3.9 m; $p < 0.05$). In addition, fatigue index decreased for SEM group but increased for SEP in the POST test ($p < 0.05$).
Conclusions: These two training strategies improved different determinants of soccer-related physical performance. SEP improved the power of first sprints, whereas SEM increased muscles' ability to maximize fatigue tolerance and maintain speed development during repeated all-out bouts.
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17 TFE
Validation of a single 3-min submaximal test to predict Critical Power

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Aim: Critical power (CP) demarcates heavy/sustainable from severe/unsustainable exercise intensity and is used for evaluation/monitoring of exercise capacity and for training design and exercise prescription.

The standard measuring technique requires either a physically demanding and time-consuming protocol (3–5 constant-load trials to exhaustion) or a maximal all out test, neither of which are applicable in all contexts and populations. A recent pilot study from our group demonstrated that CP is accurately and precisely predicted based on blood lactate (LA) accumulation at the third minute of a single submaximal non-exhausting cycle ergometer exercise. To validate the above simple, submaximal and time-efficient approach for CP estimation in a larger, heterogeneous population.

Methods: Forty men [42 ± 18 years (range 22–78), BMI 25 ± 2 (19–30), VO_{2max} 49 ± 11 ml^{-1} kg^{-1} min^{-1} (25–68)] performed 3–5 constant-power trials to fatigue on a cycle ergometer. CP was calculated based on the individual watt–time to fatigue relationship and successively validated ($_{val}$CP) through 2–3 30-min constant power output trials. During each trial, LA accumulation (LA_{3min}) was calculated as the difference between 3-min and resting values. A multiple linear regression was computed to estimate $_{val}$CP from subjects' age, test power output and LA_{3min}. The estimated CP ($_{est}$CP) was compared to $_{val}$CP by *t* test, correlation, and Bland–Altman analysis.

Results: The group mean value of $_{val}$CP was 211 ± 44 W, not significantly different from ($p = 0.96$) and highly correlated with ($r^2 = 0.84$) $_{est}$CP (211 ± 41 W). The average difference (bias) between $_{val}$CP and $_{est}$CP was 0.06 W (not different from zero) with an imprecision of 18 watts.

Conclusions: The simple, submaximal, time- and cost-efficient 3-min submaximal test proposed in our study accurately and precisely predicts CP in a large and heterogeneous healthy male population. This newly developed method offers a practical and valid alternative to traditional, time consuming and physically demanding CP determination.

18 TFE
Relationship between quadriceps and gastrocnemii muscle architecture and peak power exerted during all-out Wingate test

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Aim: Muscle architecture enhances muscle function. Particularly, longer fascicle can exert high-speed contractions while wider pennation angle (PA) and muscle thickness (MT) are correlated to greater force. Since it was shown that sprint performance in running (Kumagai et al., 2000) and in swimming (Nasirzade et al., 2014) was influenced by muscle architecture, the current investigation aimed to evaluate the relationship between MT, PA and fascicle length (FL) in quadriceps and gastrocnemii and sprint performance in cycling.

Methods: Fifteen recreational cyclists volunteered for this study. Sprint performance in cycling was identified as an all-out Wingate (45 s) test and peak power (W/kg) was calculated. Ultrasound was used to measure FL, MT and PA in *rectus femoris*, *vastus lateralis*, *vastus medialis*, *vastus intermedius*, *gastrocnemius lateralis* and *gastrocnemius medialis.* Pearson's coefficient was used to calculate correlations.

Results: MT and PA were correlated ($p < 0.05$) with peak power in *rectus femoris* ($r = 0.762$ and $r = 0.691$, respectively), *vastus lateralis* ($r = 0.642$ and $r = 0.627$), *vastus medialis* ($r = 0.786$ and $r = 0.590$), *vastus intermedius* ($r = 0.602$ and $r = 0.621$), *gastrocnemius lateralis* ($r = 0.705$ and $r = 0.589$) and *gastrocnemius medialis* ($r = 0.520$ and $r = 0.658$). No significant correlation was reported in FL.

Conclusions: The capacity to increase the force production enhancing both MT and PA seems to be predominant in a power all-out cycling task.

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19 TFE
Physiological determinants of ski-mountaineering vertical race performance

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Aim: Despite their increasing popularity, there are no studies analyzing performance of ski-mountaineering vertical races. For the first time this study examined a vertical competition, exploring the association between laboratory measures and uphill performance by means of multiple regression analysis.

Methods: Nine high level ski-mountaineers (age 20.6 ± 3.0 years, VO_{2max} 69.3 ± 7.4 mL/min/kg) performed an anthropometric assessment and a laboratory ski-mountaineering graded exercise test (GXT) to evaluate $VO_{2max,}$ gross efficiency (GE), ventilatory thresholds (VTs) as well as the power output associated with these indices. Race characteristics in terms of vertical gain, length and mean gradient, were respectively as follow: 460 m, 3 km, 15.3% for junior men and senior women; 600 m, 3.5 km, 17.1% for senior men.

Results: Average race time was 23:35 ± 01:25 mm:ss. Mean power output exerted during the race was 3.40 ± 0.34 W/kg, equal to 79.0 ± 3.5% of maximal and 95.3 ± 5.2% of VT2 reached in the GXT. The most performance-correlated variable was VO_2 at VT2 (mL/min/kg) ($r = 0.91$, $p < 0.001$), which accounted for the 80% of performance variation (adjusted $R^2 = 0.80$, $p = 0.001$). The regression model was significantly improved by GE (adjusted $R^2 = 0.90$, $p = 0.031$).

Conclusions: The study showed that the mean power output sustained during a vertical race is close to the power associated with VT2 and it is highly correlated to athletes' physiological characteristics. Particularly, two variables, VO_2 at VT2 and GE, measurable with a specific GXT, accounted for the 90% of performance variation. Accordingly training programs should focus on the maximal development of VT2 as well as on increasing GE by technical improvement.

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20 TFE
Assessment of individual anaerobic threshold in flat-water kayakers

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Aim: Currently, the assessment of individual anaerobic threshold (IAT) of elite flat-water kayakers is performed in-laboratory utilizing specific kayak ergometers (1). Field tests to evaluate IAT in kayakers have not been developed yet. Aim of this study was to propose a new on-water incremental kayaking test for the assessment of IAT in these athletes modifying a test commonly used for evaluate swimmers (2, 3).
Methods: Nine elite (21 ± 3 years) kayakers participated in the study. Each subject performed: (1) an incremental cardiopulmonary test up to voluntary exhaustion on a stationary kayak ergometer (KP Compact, Kayakpro, USA) to determine peak oxygen uptake ($V'O_{2peak}$); (2) a 1000 m distance trial to record best performance time and mean peak speed; (3) an on-water incremental kayaking test (WIK-test), consisting of seven 4 min bouts at progressively increasing speeds (determined as percentage of 1000 m best time and speed), interspersed with a 1 min recovery. Chest band and a global positioning system device continuously monitored heart rate and speed, respectively. Blood lactate samples were collected during each recovery phase and at discrete intervals at the end of the WIK-test.
Results: $V'O_{2peak}$ was 3.677 ± 0.919 L min^{-1}, ranging from 41.9 to 60.6 ml min^{-1} kg^{-1}. Peak heart rate was 187 ± 13 b min^{-1}, corresponding to 94% of predicted maximal HR. The best performance time on 1000 m distance was 251 ± 20 s, corresponding to a mean peak speed of 4.00 ± 0.31 m s^{-1}. In the WIK-test, IAT corresponded to a blood lactate value of 3.16 ± 1.00 mM, a heart rate of 169 ± 10 b min^{-1} and speed of 3.45 ± 0.32 m s^{-1}.
Conclusions: On-water incremental kayaking test appears a feasible procedure to determine the individual lactate threshold on kayakers. Further studies are needed to establish accuracy and reliability of WIK-test and its correlation with other on-water tests aimed to determine lactate anaerobic threshold as Maximal Lactate Steady-State test.

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21 TFE
Measurement of a true VO_{2max} during ramp incremental tests: Is there evidence for the necessity of a constant load validation trial?

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Aim: The accuracy of a ramp incremental (RI) test to exhaustion to determine maximal oxygen uptake ($\dot{V}O_{2max}$) was recently questioned and the utilization of a validation trial proposed as a gold standard. By comparing the $\dot{V}O_2$ at the end of a RI test ($_{RI}VO_{2max}$) to that obtained during a validation trial ($_{Val}VO_{2max}$), confirm the necessity of a validation trial for accurate $\dot{V}O_{2max}$ determination.
Methods: 61 healthy men [31 older (68 ± 5 year) and 30 young (25 ± 4 year)] performed a cycling RI test to exhaustion and, after a 5-min recovery, a constant-load trial to fatigue at either 85% (16) or 105% (45) of the peak power output from the RI test. A subsample of 8 young and 14 older adults repeated the testing protocol after a 12-weeks aerobic training intervention. VO_2 was measured breath-by breath (Quark b2, Cosmed).
Results: $_{RI}\dot{V}O_{2max}$ was not different from and highly correlated with $_{Val}\dot{V}O_{2max}$ (39.8 ± 11.5 vs. 40.1 ± 11.2 mL kg^{-1} min^{-1}, paired t-test $p = 0.22$, $r^2 = 0.99$). The Bland–Altman analysis revealed a very small bias (0.25 mL·kg^{-1}·min^{-1}, not different from 0) and imprecision ± 1.56 mL kg^{-1} min^{-1} between measures. A two-way ANOVA revealed no significant effect of either the age group (young vs older, $p = 0.40$) or the validation trial intensity (85 vs 105%, $p = 0.26$) and no interaction of the two factors ($p = 0.31$) on the bias between $_{RI}\dot{V}O_{2max}$ and $_{Val}\dot{V}O_{2max}$. Finally, in the subsample that underwent training, the correspondence between $_{RI}\dot{V}O_{2max}$ and $_{Val}\dot{V}O_{2max}$ was unaffected by either training status (indicative of cardiovascular fitness and experience with exercise testing, $p = 0.23$) or age group (young vs older, $p = 0.88$), with no significant interaction of the two factors ($p = 0.23$).
Conclusions: This study indicated that validation trials do not add any confirmation for the determination of $\dot{V}O_{2max}$. Therefore, the recommendation that a validation trial should be performed to ensure accurate $\dot{V}O_{2max}$ measures is not supported by the experimental data.

22 TFE
Mechanical work of shuttle running at different speeds and over different distances

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Aim: The aim of this study was to measure total mechanical work $\left(W_{tot}^{+}\right)$ work during shuttle running (SR) and to compare these data with data collected during constant speed running (CR).

Methods: Twenty-two athletes were requested to perform SR (with a 180° change of direction) at three velocities (S: slow; M: moderate; H: high) over four distances (5, 10, 15 and 20 m) and to run, at constant speed, over the 20 m distance. The experiments were recorded by a motion capture system (Vicon MX, Oxford Metrics, UK; 100 Hz) with the aim to calculate the 3D trajectory of the body centre of mass, based on which mechanical work was calculated.
Results: In CR W^+_{tot} (J kg^{-1} m^{-1}) was found to increase linearly as a function of velocity ($W^+_{tot} = 1.385 + 0.174\ v_{mean}$, $R^2 = 0.352$, $P < 0.001$). In SR, the relationship between W^+_{tot} and velocity is not linear and data are best fitted by 2nd order polynomial functions (range R^2: 0.7–0.9). On the average, W^+_{tot} (J kg^{-1} m^{-1}) was found to be about 1.5 times larger at H vs. S (over all distances) and about 14% lower at 20 vs. 5 m (at all velocities). At high shuttle speeds W^+_{tot} (J kg^{-1}; i.e. not normalized by the distance covered) was found to increase linearly as a function of velocity ($W^+_{tot} = -116.23 + 49.59\ v_{mean}$, $R^2 = 0.915$, $P < 0.001$); this equation can thus be utilized to estimate W^+_{tot} of SR over different distances, albeit at maximal speed only.
Conclusions: Whereas the mechanics of CR are well known (e.g. Cavagna and Kaneko 1977), little is known about the mechanics of unsteady locomotion, especially when the speed oscillations are significant. Data reported in this study are in agreement with those reported in the literature (Zamparo et al. 2016) over the 5 m distance; they further extend present knowledge to larger SR distances.
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23 TFE
Specific adaptations in performance and muscle-architecture after weighted vs unweighted jump-squat training in recreational soccer-players

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Aim: The aim of the present study was to compare the effects of weighted (WJST) vs unweighted jump-squat training (JST) on quadriceps muscle architecture, lower-limbs fat-free mass (FFM) and muscle strength, performance in change of direction, sprint and jump in recreational soccer-players.
Methods: Forty-eight healthy soccer-players participated in off-season randomized controlled-trial. Before and after an 8-weeks training, *vastus lateralis* muscle architecture (pennation angle, fascicle length, muscle thickness), lower-limbs FFM, squat-1RM, quadriceps and hamstrings isokinetic peak-torque and agility T-test, 10 and 30 m sprint and squat-jump (SJ) were measured.
Results: Although the similar increases in MT, fascicle length increased more in WJST (ES = 1.18, CI 95% 0.82–1.54) than in JST (ES = 0.54, 0.40–0.68) and pennation angle only in JST (ES = 1.03, 0.78–1.29). Agility T-test (ES = 2.95, 2.72–3.18), 10 m (ES = 0.52, 0.22–0.82) and 30 m-sprint (ES = 0.52, 0.23–0.81) improved only in WJST, while SJ improved in JST (ES = 0.89, 0.43–1.35) more than in WJST (ES = 0.30, 0.03–0.58). Similar increases in squat-1RM and isokinetics occurred in both groups.
Conclusions: The greater inertia accumulated within the landing-phase in WJST vs JST has increased the eccentric workload, leading to specific eccentric-like adaptations in muscle architecture. The selective improvements in agility T-test in WJST may be related with the increased braking ability generated by the enhanced-eccentric workload.
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24 TFE
Sanchin Kata, core stability and physical condition in karate athletes: longitudinal study

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Aim: In karate, and more specifically in Goju Ryu, there is a Kata (Sanchin) which is practiced using diaphragmatic breathing and whose technical movements are performed using an isometric contraction (M. Pervez 2014). This method concentrates muscular work in the core region (T. Okada 2011). The literature revealed a lack of studies on the matter and even less on Goju Ryu. We investigated whether the use of Sanchin Kata as a muscle-joint workout method can positively influence the management of static and dynamic body balance, the resting metabolic rate (RMR), eye-hand reaction time and the explosive strength of lower limbs in a group of national-level karate athletes.
Methods: Twenty athletes were selected. The athletes were divided into an Experimental Group (EG), and a Control Group (CG) (age 17 ± 2). The EG added Sanchin Kata in our routinely workout. All the athletes were subjected to the following tests: (1) Cosmed's Fit-Mate PRO (metabolimeter) to measure RMR; (2) P-Walk (Pedana baropodometric) with open and closed eyes to measure body balance in an upright position; (3) Opto Jump (vertical) to measure reaction time; (4) the Libra platform in an upright and seated position to measure body unbalance in a dynamic situation; (5) Opto Gait to measure vertical jump.
Results: Data showed statistically significant variation (non-parametrical statistic analysis Dunn Post-Hoc T0 vs T2, $p < 0.01$) in the EG for the P-Walk test. For the Pedana Libra in the EG, significant

values were found for dynamic body balance ($P < 0.01$) both in an upright and in the sitting position.
Conclusion: This study has shown how Sanchin Kata conditioning has a positive effects on the mono and bipopdalic balance. Furthermore, this positive effects can produced changes on postural stability both in open and closed eyes.
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25 TFE
Effects of a 15-minutes downhill steep running on physiological factors and neuromuscular functions

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Aim: in mountain running the downhill sections play an important role in determining the final performance. During downhills with a gradient lower than −0.15 muscles perform only negative work (i.e. eccentric contraction) (2) which is associated with neuromuscular fatigue (1). Thus, the aim of this study was to evaluate the effects of a 15-minutes downhill running bout at -0.25 on some physiological parameters [oxygen consumption ($V'O_2$), energy cost of running (Cr), heart rate (HR)] and neuromuscular fatigue affecting the knee extensors (KE). This study is part of a project in which a specific training protocol is proposed to the mountain running athletes.
Methods: we measured the $V'O_2$, $V'CO_2$ and the HR with a metabolic unit, and we analyzed the data at minute 5, 10 and 15 during a 15-min downhill running (DR) at -0.25 and 62.2 ± 5.3% $V'O_2$max. Then, we calculated the Cr. Neuromuscular function was performed before and 10 min after the end of the downhill running and was assessed by motor nerve stimulation during a maximal voluntary contraction (MVC) of KE. Voluntary activation (V.A.), potentiated resting doublet (100 Hz) and singlet were measured (1).
Results: the $V'O_2$ during DR increased by +10.9 ± 9.5% ($p < 0.001$) after 15 min whereas the Cr did not change ($p = 0.881$). Furthermore, after DR, MVC force, potentiated resting doublet and singlet were reduced by −22.9 ± 9.1% ($p < 0.001$), −32.8 ± 11.9% ($p < 0.001$) and −47.8 ± 14.5% ($p < 0.001$), respectively. No changes in voluntary activation levels were found (−1.4 ± 3.1%, $p = 0.167$).
Conclusion: this study shows that O_2 slow component is present during DR in well-trained mountain runners. Moreover, we demonstrated that fatigue developed during this exercise is primarily due to peripheral alterations. Consequently, the training plan proposed to mountain runners should consider also this aspect.
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26 TFE
Reliability and sensitivity of postexercise heart rate measures after repeated-sprints exercise

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Aim: Repeated sprint (RS) training is an effective method to improve short-term post-exercise heart rate (HR) recovery (HRR) and HR variability (HRV). However, the reliability (the degree of change in a particular measure when repeated on different occasions), and sensitivity, [the smallest worthwhile change (SWC) for the considered measure], after a RS exercise has not been tested. Therefore, the aim of this study was to established the short-term reliability and sensitivity of post-exercise HRR and HRV measures after RS exercise.
Methods: Fourteen subjects performed on four occasions, once per week and at a similar time of the day, five 30-m sprints interspersed by 25-s of active recovery. Post-exercise HR during 10 min of seated rest was measured by means of an HR monitor (Polar S810). HRR during the first 60-s of recovery was computed. HRV indices were calculated in time and frequency domains in the last 5-min of recovery. Absolute and relative reliability was assessed by the typical error of measurement expressed as a coefficient of variation (CV) and intraclass correlation coefficients (ICCs), respectively. Sensitivity was assessed comparing the SWC with typical error of measurement.
Results: There was no significant session effect for any of the measures, including RS performance ($P > 0.05$). CV ranged from 3.6 to 13.5% and from 6.3 to 109.2% for HRR and HRV indices, respectively. ICCs were from 0.78 to 0.96 and from 0.76 to 0.92, respectively. The SWC was lower than the typical error of measurement.
Conclusions: Though acceptable levels of both absolute and relative reliability SWC was lower than the typical error of measurement. This suggests that the signal to noise ratio of the post-exercise HR indices was biased towards the latter. Thus, caution must be taken when attempting to assess meaningful changes or differences in the post-exercise HR indices after RS training.

27 TFE
Effect of asymmetric training on postural control in elite fencers

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Aim: Fencing is a high-intensity sport involving dynamic movements such as the lunge exposing the musculoskeletal system to high impact

forces (Sinclair, 2010). The postural and anthropometrical characteristics of fencers show a typical asymmetry of the limbs as a result of the practice of an asymmetrical sport activity. Fencing produces typical functional asymmetries that emphasize the very high level of specific function, strength and control required in this sport (Roi, 2008). The aim of this study was to evaluate the effect of asymmetric training on postural stance in elite fencers.

Methods: Twenty-seven elite fencers, divided by weapon (foil, sabre and epee), were enrolled. Postural and stabilometric parameters were assessed for three times (52′ each one), using the Zebris FDM-S Plate. Area of Centre of Pressure (CoP) ellipse (AREA), CoP total distance (LENGTH) and Variance of Speed (SPEED-VAR) were considered.

Results: Analysis of Variance (ANOVA) was performed in order to evaluate significant differences among athletes of the three weapons on the dependent variables (LENGTH, AREA, SPEED-VAR). The subjects of the three groups showed homogeneous results. The values of CoP's Area fluctuated from borderline to high grade, while the values of LENGTH varied from mild to borderline grade.

Conclusion: The asymmetric training of fencing did not show alterations in upright stance stability. Elite fencers performed compensative training, strengthening the contralateral muscles and improving the visual and vestibular system feedbacks, which adjusts the posture (Schiffer, 2015).

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28 TFE

Early morphological and functional adaptations in response to 6-week plyometric training

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Aim: Muscle power is a major determinant of sport performance requiring explosive force such as throwing and jumping. Plyometric training (PT) has been shown to increase muscle power and athletic performance in soccer players [1]. In this study we assessed the structural and functional adaptations to 6-week PT on an inclined trampoline device (Tramp Trainer, TT).

Methods: 8 males (age 25.4 ± 4.6 years; mass 69.7 ± 13.5 kg; height 173.6 ± 4.7 cm) were recruited after ethical approval. Participants trained 3 times/wk with 4-5 sets of 30 TT jumps. Data was acquired at 0, 2, 4 and 6 weeks of PT. *Vastus lateralis* (VL) fascicle length (Lf), pennation angle (PA) and muscle cross-sectional area (CSA) were assessed by ultrasound. Isometric maximum voluntary contraction (MVC) torque and peak power (PP) were assessed by Cybex dynamometry and by the Nottingham Power Rig, with recordings of VL EMG activity. Data (mean ± SD) were analysed for statistical significance using repeated one-way Anova with Bonferroni's post hoc test.

Results: PP increased by 13, 22 and 27% ($p < 0.05$) after 2, 4 and 6 weeks of PT, F increased by 22% after 4 weeks ($p < 0.05$) with no further increase. Lf increased by 3.7 and 4.3% ($p < 0.01$) after 4 and 6 weeks; PA increased by 5.8% ($p < 0.01$) after 6 weeks. VL-CSA increased by 4.6% after 6 weeks (n.s.). VL EMG, increased by 7.8% at 6 weeks (n.s.).

Conclusions: Early structural and functional adaptations may be achieved just after 4 weeks PT. Notably, the remarkable increase in muscle PP (27%) was only partly accounted for by the increase in muscle F (13%) suggesting a contribution of neural factors (motor unit recruitment and rate coding) as well as of muscular factors, such as an increase in fascicle length (4.3%) and possibly an increased fast myosin heavy-chain isoforms MHC expression [2].

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29 TFE

Assessment of body composition and functional movement patterns in athletes playing different sports

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Aim: The purpose of the present study was to evaluate the associations between body composition and functional movement patterns in athletes of different sports.

Methods: A cross-sectional study was conducted on 85 voluntary athletes (age 25.9 ± 5 years), representatives of 5 professional Italian teams: 30 volleyball players, 25 soccer players and 30 rugby players. Whole-body impedance measurements and Bioelectric Impedance Vectorial Analysis (BIVA) were performed in order to assess body composition in the athletes. Functional Movement Screen (FMS) was used to assess the presence of dysfunctional and asymmetrical movements. For a more detailed analysis, FMS was separated into three parts: FMSmove, FMSflex and FMSstability.

Results: Total FMS score was significantly negatively correlated with percentage of fat mass (%F) and body mass index (BMI). A one-way analysis of variance showed significant differences in body composition and functional movement patterns measures in the three groups. A Tukey post hoc analysis revealed that rugby players have higher %F and body cellular mass (BCM) values than the other groups; moreover, they showed lower scores in FMSflex. The highest scores in FMSflex were obtained by the volleyball players.

Conclusions: The main finding of this study was the significant association between higher %F and BMI with poorer functional movement in athletes. Furthermore, with respect to the sport played, rugby players showed significant differences in body composition and movement patterns compared to soccer and volleyball players. In

general, reaching an optimal body composition is essential to improving the quality of movement, in order to achieve high performance. However, a large body mass in rugby players could be advantageous in some phases of the match.

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30 TFE
A new performance index in volleyball

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Aim: In volleyball jumping ability is very important to hit the ball as high as possible during block jump or spike jump. To measure this jumping ability many different studies in volleyball have used standard jumping tests as squat jump (SJ), counter movement jump (CMJ) or sport-specific jumping as block jump (BJ) and spike jump (SpikeJ), measuring jumping capacity as centimeters or meters. The aim of this study is to validate a new performance index in volleyball during sport-specific jumping : the flight time, expressed in milliseconds.
Methods: Nine female amateur volleyball players were evaluated for jumping capacity in 2 different moment: during training and during an official championship game. During training the athletes performed after a standardized warm-up 3 sets for every standard jumping tests: SJ, CMJ and counter movement jump with arm swing (CMJarm) and the best jump was considered for analysis.
Moreover during training the athletes performed 3 sets for every of sport-specific jumping: BJ, SpikeJ and jump serve (JS). During the official championship the entire game was recorded with a high-frequency video camera at 240 fps (Canon Powershot SX40HS) and every sport-specific jumping, BJ, SpikeJ and JS were subsequent analyzed with a free software (Kinovea).
Results: The ICC of the analysis of the flight time between two independent evaluators is very good 0.996 for single measures and 0.998 for average measures. The standard jumping test (SJ, CMJ and CMJarm) correlate with BJ ($r = 0.888$; $p = 0.01$, $r = 0.801$; $p = 0.09$, $r = 0.807$; $p = 0.09$), JS ($r = 1.00$; $p < 0.05$, $r = 1.00$; $p < 0.05$, $r = 1.00$; $p < 0.05$) in training, and SpikeJmax ($r = 0.732$; $p = 0.160$, $r = 0.756$; $p = 0.139$, $r = 0.878$; $p = 0.05$) and SPikeJaverage ($r = 0.769$; $p < 0.128$, $r = 0.788$; $p = 0.114$, $r = 0.893$; $p < 0.05$) during the game, respectively.
Conclusions: The results of this study demonstrate that the proposed measure: the flight time, offers a reliable and valid method of assessing jumping ability in volleyball players.

31 TFE
Effectiveness of a physical education program on children's physical fitness

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Aim: This study was conducted to evaluate the effectiveness of the implementation of 20 professionally led physical education (PE) lessons on primary school children's physical fitness.
Methods: Two hundred and ninety-two classes, for a total of 25 schools in the Lombardy region, including children aged 6–11 years, were recruited. Participants were assigned to quasi-experimental (EG) or quasi-control (CG) groups. The intervention period lasted 6 months for both groups. Experimental interventions were designed by a specialist PE teacher who conducted one of the 2 weekly 60-min lessons with a psycho-pedagogical approach; the other was conducted by the generalist teacher. The CG school curriculum was administered by the generalist teacher. All children (EG: $N = 4371$; CG: $N = 796$) completed a health-related fitness test battery (weight and height to calculate BMI z-score, standing broad jump_SBJ, 6-min walking test_6MWT, and 4×10 m shuttle run test_SRT) at baseline and follow-up.
Results: After 6 months EG slightly decreased BMI z-score ($\Delta = -0.01$, $p =$ ns), while CG somewhat increased BMI z-score ($\Delta = 0.04$, $p <$ ns). Mean values indicate that all parameters were significantly modified in both groups (6MWT, $\Delta = 5.03\%$, $p < 0.0001$; SBJ, $\Delta = 6.71\%$, $p < 0.0001$; SRT, $\Delta = -6.07\%$, $p < 0.0001$) with respect to baseline data, EG achieving significantly greater improvement in the 6MWT ($p < 0.5$) when compared to CG counterparts.
Conclusions: The present study is the first one at including such a large sample of <8-year children, as compared to previous Italian studies[1,2,3]. PE lessons played a determinant role in improving children's motor skills and fitness. Moreover, specialist PE teachers were more successful than generalist teachers in achieving greater improvement in cardiorespiratory fitness.

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32 TFE

The effect of topical thiocolchicoside in preventing and reducing the increase of muscle tone, stiffness and soreness: a real-life study on top-level road cyclists during stage competition

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Aim: In professional road cyclists, the majority of overuse injuries affect the lower limbs and are mostly represented by contractures or muscle shortening, characterized by an increase of tone and stiffness and a variation of elasticity. Treatment and prevention of these specific conditions may include physical, supplementary and pharmacologic support. The aim of this real life study was to determine (1) the alterations of tone, stiffness, elasticity and soreness of rectus (RF) and biceps (BF) femoris in top class cyclists engaged in three multi-stage races and (2) whether any variable in the management of the athletes may affect the prevention and/or reduction of such alterations
Methods: twenty-three professional cyclists competing in three international, cycling stage races were assessed. Athletes could receive, upon the approval of the medical staff, physical, dietary and/or pharmacological management which could include treatments with topical over-the-counter myorelaxants to prevent and/or reduce muscle contractures. MyotonPro was used to daily measure tone, stiffness and elasticity in RF and BF in relaxed and contracted state after every stage. In parallel, BF and RF soreness was also assessed with a Likert scale.
Results: All athletes received the same general massage management; none of them received dietary supplements; some of the athletes were treated with a topical myorelaxant thiocolchicoside (TCC 0.25%) foam three times daily. TCC was identified as the only variable able to affect these muscle parameters in the cyclists. Tone, stiffness (regardless of the state) and soreness significantly increased over time either in BF or RF in all athletes. In the group of athletes that used TCC ($n = 11$; TCC+) the increase in tone, stiffness and soreness was significantly lower than in the group not receiving TCC ($n = 12$; No-TCC). Elasticity varied coherently with tone and stiffness.
Conclusion: a very intense and protracted sport activity increases muscular tone, stiffness and soreness over time. Topical TCC foam significantly attenuates these alterations and might represent an efficient strategy both to prevent and manage contractures and their consequences in professional cyclists as well in athletes from other disciplines involving similar work loads.

33 TFE

Effect of compressive sleeves on the strength capacity in élite sports climbers

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Aim: Since some years, the use of compression garments is widespread in many sports. Some research have observed positive influences on athletic performance and muscle recovery: increased peripheral blood flow, decreased muscle vibration, reduced proprioceptive feedback, reduced delayed onset muscle soreness. These effects, until now, have been observed mainly on the lower limbs. The present study aims to evaluate the acute and chronic effects of the compressive sleeves on the strength capacity in élite sports climbers.
Methods: Fourteen healthy participants (age 29.2 ± 4.8 years, weight 69.8 ± 5.7 kg, height 176 ± 5 cm, fat mass $9.3 \pm 1.1\%$, best red-point level 8a–8b+) performed, on a specific ergometer, a maximum voluntary contraction (MVC) of the fingers flexors muscles and an intermittent exhaustive test at 40% MVC (10 s on + 3 s off) in both upper limbs, with and without compressive sleeves. The same protocol was repeated after 4 weeks of training, during which each climber wore a sleeve on only one forearm. Force signal variables (peak of force peak, F_{peak}; mean force F_{mean}; time to exhaustion; time to reach the target, T_{target}; standard deviation from the target, DS; coefficient of variation, CV), lactate concentration [La^-], rate of perceived exertion (RPE) were measured and calculated during and after all tests.
Results: No differences were found in MVC between two experimental condition, in both acute and chronic tests. During 40% MVC exercise, with sleeve was observed similar time to exhaustion to that of the control condition. However, T_{target}, DS and CV were significantly lower ($P < 0.05$). [La^-] concentration, moreover, has shown a trend towards a lower values.
Conclusions: The use of the compression sleeves shows to have no adverse influence on the maximum strength capacity. Moreover, during intermittent exhaustive exercise it seems to improve control and precision of muscle contraction.

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34 TFE
Predictive equations for upper body muscular endurance estimation

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Aim: Physical assessment is an essential part of fitness or sport training. However, testing may be expensive or time consuming. A method to reduce the time of physical assessment could be the use of predictive algorithms for indirect assessment. The aim of this study will be to determine a relationship between strength, power and muscular endurance in order to identify predictors for an easier and faster assessment.
Methods: 33 male strength-trained participants (22.8 ± 4.6 years, 172.5 ± 6.7 cm, 68.0 ± 10.6 kg) had to perform a single pull-up (SPU) and a single push-up (SPH) and a set of pull-ups (EPU) and push-ups (EPH) to exhaustion. Force (F), Power (P), Velocity (V) and relative power (R-P), extracted from an accelerometer (500 Hz), were retained for investigation.
Results: There is a significative effect of training experience in regard to the V of the SPU ($p < 0.001$). The regression model was able to explain 61% of the variance with the EPU as dependent variable and the V of the SPU as independent variable and 68% of the variance with the EPH as dependent variable and EPU as independent variable.
Conclusions: The results indicate the possibility to estimate both the number of EPH and EPU from a SPU. The equations may be helpful to reduce the time of assessment for upper body physical evaluation.
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35 TFE
Pacing profile of 10-km open-water swimming in the Olympic Games and World Championships

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Aim: Different aspects of pacing in endurance events have been investigated, however there are no studies on pacing strategies during open-water swimming (Baldassarre et al.,2017).
The aim was to analyse the pacing profile of 10-km open-water swimmers (OWS) in the Olympic Games (OG) and World Championship (WC). We hypothesized that OWS would adopt an even-pacing, like marathon runners (Hanley, 2016).
Methods: In total, 325 (178-male and 147-female) performances were analysed from 2012 to 2016. Split times were obtained for each 2.5-km (1.68-km in OG of London) and the mean speed ($m\ s^{-1}$) was calculated. Swimmers in each race were divided into four groups based on finishing time. Group 1 (G1;85-male and 87-female) whose finishing times were within 1% of the winner's time (WT), G2 (44-male and 42-female) between 1 and 2% slower than WT; G3 (29-male and 24-female) between 2% and 10% slower than WT; G4 (20-male and 13-female) over 10% of WT. The split differences were compared using Friedman's ANOVA, and the differences between groups were compared using Kruskal–Wallis test ($p < 0.05$).
Results: In the OG, G1 showed a significant increase in speed during the second part of the race compared with the other groups in both males and females ($p < 0.001$). In the WC, G1 showed a significant increase in speed during the last segment of the race compared with the other groups in both males and females ($p < 0.05$).
Conclusions: Contrary to our hypothesis, the fastest OWS adopted a negative pacing in all competitions, increasing the speed in the last part of the race. The other groups adopted a positive or an even pacing according to the different race situations. OWS that used a conservative approach remaining in G1 until the finish of the race, increase the possibility to win a medal.
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36 TFE
Influence of swim bike and run in Olympic distance triathlon performance from 2008 to 2016

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Aim: Olympic distance (OD) Triathlon is a multidiscipline consisting of 1500 m swim (S), 40 km draft legal bike (B) and 10 km run (R). Many studies have investigated the consequences of S, B, R on overall performance in elite triathletes (1, 2, 3). However, since 2009, the International Triathlon Union created a new race formula: the World Triathlon Series (WTS) where only athletes in the top 100 world ranking can compete. Therefore, the purpose of this study is to analyse the influence of the three disciplines on all WTS OD races performed each year on 2 Olympic cycles, and if the contribution has changed over the years.
Methods: Data have been retrieved from the ITU website taking into consideration only the WTS OD from 2009 to 2016 for both sexes. A total number of 52 races were analysed. The contribution of each discipline was expressed as percentage of overall time. Multiple linear regressions were used to identify the contribution of each discipline to the total performance. The trends of the disciplines contributions in the years, expressed as standardized beta-weight (β), to the overall performance were computed using polynomial regression models.

Results: No differences were found between women and men in the contribution percentage of each segment. The overall multiple regression showed the contribution of each discipline (Women β: S 0.191, B 0.789, R 0.380; Men β: S 0.208, B 0.779, R 0.428).
Conclusions: Taking into consideration only the WTS races, our results show that the contribution of the three disciplines has an undulatory pattern over the years and that the contribution of S and R has increased in 2016.

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37 TFE
Are changes of coaches, during the championships, useful for achieving better team results?

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Aim: The aim of the study was to investigate the effects of changing coaches during the same championship and the effects of this on team ranking.
Methods: According to UEFA Ranking, we analyzed the effect of coach's changes on the team in the four main European National Championships (Spanish, English, German and Italian) during the last five seasons (2012/13–2016/17). Statistical analysis consisted in descriptive collection of data, and comparative analyzes among countries, seasons and ranking positions.
Results: Italy showed the highest number of coaches' changes in the last 5 years (63 changes) followed by Spain with 55 and England and German with 46 changes. The majority of the changes occurred in the teams placed in the second part of the national rankings, with a significant linear increment according to the position in the ranking. Germany showed the highest percentage of favorable changes (63.04%) and only 13.04% unfavorable changes. England showed the 47.83% of favorable changes and 23.91% unfavorable. Italy and Spain have an intermediate situation with 53.97 and 58.18% favorable changes respectively (23.81 and 23.64% unfavorable). The majority of the teams who took advantage of the coach's changes, were classified in their championships in the 5th–6th, 9th–10th, and 13th–14th position. The top teams (1st–3rd position) showed unfavorable changes.
Conclusion: Changing the coaches during the championship is not a good solution to improve the team ranking (Bell, 2013). Frequent changes of coaches take place in teams that are in the relegation zone. This study highlights the lack of effectiveness of this strategy for teams at the top rankings. In Germany there is a lower turnover rate and this strategy seems to be more effective for teams.

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38 TFE Sound stimulation and physical efficiency in microgravity conditions: a longitudinal study

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Aim: Although applied sport research has dealt with multiple studies on therapeutic effects and post-exercise recovery in a micro-gravitational environment, experiments carry out in water training methodologies aiming at improving performance are lacking. The aim of this study was to evaluate the effects of Interval Training in microgravity through different musical rhythm variations (BPM).
Methods: Seventeen water exercise practitioners were recruited and divided as follows: 9 subjects (GW), age 55 ± 8 years, weight 63 ± 11 kg, height 163 ± 6 cm, and 8 subjects (GWO), age 56 ± 12 years, weight of 59 ± 8 kg, height 165 ± 4 cm. The study lasted 2 months, two sessions/week (45 min each), for a total of 16 sessions. The water training protocol has provided specific music tracks (Aqua Beat Buster® GYM) with changes of rhythm (range 90–170 bpm). The data were measured as follows: T0 for basal physical evaluations; T1, after four weeks of athletic conditioning; T2 after 2 months of training. The tests performed were: resting metabolic rate (RMR) by using Fitmate™ (COSMED, Rome, Italy); trunk flexibility by means of sit and reach test; podo-postural balance with the proprioceptive platform Libra (Easy Tech, Florence, Italy); lower limbs strength by means of the sit-to-stand (30 s.) test.
Results: GW showed a significant increase in both baseline metabolism (Friedman Anova, $p < 0.001$, Dunn post hoc, $p < 0.01$, +6%) and podo-postural balance (Anova, Friedman, $p < 0.0001$; Dunn post hoc, $p < 0.001$, −69%). Significant results were found also taking into consideration the flexibility (Friedman Anova, $p < 0.0001$, Dunn post hoc, $p < 0.001$, −12%) and the lower limbs strength (Friedman Anova, $p < 0.0001$; Dunn post hoc, $p < 0.001$, +24%).
Conclusions: Muscle strength conditioning in microgravity improves RMR, podo-postural balance, flexibility and strength of the lower limbs.

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39 TFE

Fatigue does not decrease acute sprinting performance after a wheelchair tennis match: comparison between hard and clay courts

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Aim: In conventional tennis, sliding is very frequent on clay courts as a result of lower friction forces (Starbuck et al., 2016), but this is not possible in wheelchair tennis, where players have to use the same movement patterns on both surfaces (Ponzano et al., 2017). Therefore, the purpose of this study was to investigate potential modifications in coordinative and conditional abilities after a wheelchair tennis match by means of the analysis of non-linear speed on both hard courts and clay courts.
Methods: Twelve wheelchair tennis players played 12 matches, of which 6 on clay courts and 6 on hard courts. Before and after the matches, the participants performed the Twist and Sprint Wheelchair Test (Gollin et al., 2015) and data collected before and after each event were compared.
Results: The *t test* showed significant variations ($p < 0.05$, ES = 0.20, −2%) concerning the test performed on the hard court (H) between data collected before (H0 = 9.61 s) and after (H1 = 9.43 s) the match. Significant differences regarding the test on the clay court (C) before (C0 = 10.03 s) and after (C1 = 10.04 s) the match did not come to the light.
Conclusions: The effects of fatigue after a wheelchair tennis match that lasts less than 90 min do not bring about decrements of performance, regardless of the playing surface. Sprinting performance improves significantly after having played on hard courts, because of the continuous stimulation of specific coordination and the unimportant friction force caused by this surface.

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40 TFE

Multiple sclerosis: post-exercise recovery of heart rate and autonomic function

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Aim: Parasympathetic reactivation and sympathetic withdrawal affect the post-exercise heart rate recovery pattern (PHRR). Patients with multiple sclerosis (MS) might develop autonomic dysfunctions lengthening the recovery following exercise and favoring the onset of fatigue. This study aimed at evaluating PHRR in MS patients and its relationship with EDSS and subjective fatigue.
Methods: Eleven MS patients [50.8 ± 6.1 years (m ± DS); EDSS: 5.7 ± 1.1] and 8 age-matched controls (56.1 ± 6.0 years, CTRL) participated to the study. Patients were asked to sustain two different exercise intensities (5 and 10 watts, 4 min each) with the upper-limb, followed by 2 min of recovery. PHRR were evaluated from heart rate by: (1) HR reduction 30 (HRR_{30}) and 60 (HRR_{60}) s after the end of exercise; (2) the time constant (tau) of the mono-exponential HR decay; (3) the slope of the semi-logarithmic decay (T_{30}) of HR in the first 30 s recovery and (4) the Root Mean Square of Successive Differences (RMSSD) between consecutive heart beats (index of parasympathetic tone) calculated every 30 s after exercise. Subjective fatigue during recovery was calculated by the Rate of Perceived Exertion (RPE).
Results: Compared to CTRL, HRR_{30} was lower in MS patients, whereas T_{30} tended to be higher ($p < 0.05$ and $p = 0.08$, respectively). HRR_{60}, tau, and RMSSD every 30 s did not differ between groups while RPE was significantly higher in MS patients. No correlation was found between RMSSD, HR recovery parameters and EDSS or RPE.
Conclusions: The post-exercise reactivation driven by the cardiovagal control is altered in MS subjects but this seems not to be associated to fatigue development as no differences were found in the parameters of the 30 s of recovery. The time-course of RMSSD seems to be not suitable in discriminating differences in parasympathetic reactivation suggesting the use of other heart rate variability indexes to focus on this dynamic.

41 TFE

Time motion and notational analysis of competitive paddle

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Aim: Paddle is mainly played outdoors on an artificial turf court surrounded by a glass enclosure (Muñoz Marin et al., 2001), and its regulation and points are similar to those of tennis, so it can be classified as an intermittent sport (Gianfelici et al., 2016). The aim of this study was the description of the performance model of paddle match play. Additionally, intra and inter-observer agreements were assessed.
Methods: Six Italian Serie B national league matches were examined. Data were collected by means of a video camera (GoPro, Hero 4 Silver, GoPro Inc., San Mateo, CA, USA) and analyzed by using the software Longomatch Open Source version 1.3.2. 59 performance indicators, of which 11 pertaining to time-motion analysis (TMA) and 48 to notational analysis (NA), were taken into consideration. ICC has been utilized to evaluate intra and inter-observer agreement.
Results: The average match duration was 53.7 ± 14 min and the effective playing time 31.3% of the total, with a work/rest ratio corresponding to 1:3.4 ± 0.8. The average rally duration was 6.7 ± 1 s, with an average of 4.7 ± 0.7 shots performed per rally.

Many significant differences pertaining to shots characteristics (SC), errors (E), serve (S), points won (PW) and winning and losing players were observed. ICC for the intra and inter-observer agreement were 0.99 and 0.95 to 0.97 respectively.

Conclusions: This study provides important data regarding the match analysis of paddle. With reference to international literature, it is possible to notice many similarities with tennis, despite the shorter match duration and the greater effective playing time in paddle.

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POSTER SESSIONS

1 APA
Effects of thin plantar inserts on the horizontal heterophoria: modification of the functional relationships between the foot and posture

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Aim: The muscles of the feet seems to work with a functional synergy with the ocular muscle: the invertors muscles of the feet are synergic with the convergence muscles and the evertors of the feet work together with the divergence muscles (Roll et al. 1988). Vertical heterophoria could reflect a mild global sensorimotor conflict between sensory, such as somesthetic, and motor inputs affecting the performance of balance control and maybe lead to pain (Matheron et al. 2011). Medial arch support is more effective than lateral arch support and acts upon divergence, whereas lateral arch support produces its effects upon convergence only. (Foisy et al. 2015)

The aim of this study was to verify the modifications of horizontal heterophoria with maintaining an External Heel Wedge (EHW) applied according to the Bricot's method.

Methods: seventeen healthy subjects with the right dominating eye were recruited (age 31 $\pm$ 5 years). The EHW was made from a cork half moon thickness of 1.5 mm, length 6 cm and a height of 3 cm. The Maddox rod test to evaluate the horizontal heterophoria was performed. For both eyes we evaluated the distance of correction and calculated the difference between eyes.

The sequence of tests foresaw: trials baseline without EHW, trials with EHW, trials after an adaptation period of 15 min on treadmills with EHW.

Results: Data showed statistically significant variations (Parametrical statistic analysis ANOVA, post-hoc, baseline vs after 15 min, $p < 0.05$) in the discrepancy of exophoria between two eyes and Left eye correction.

Conclusions: This study has shown how a mechanical stimulation applied on the plantar arch can affect the optical axis. The results highlight that the application of this kind of stimulation decreases significantly the discrepancy of correction of the exophorias between two eyes. This variation occurred on the non-dominating eye while the dominating eye did not suffer significant changes.

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2 APA
Effect of Tai Chi training on strength and balance in a group of elderly people

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Aim: Among the fundamentals of Tai Chi there are "the work on stability", "the work of the legs" and the achievement of a psychological balance. The strength training of the lower limbs and the balance underscore the importance of these conditional and coordinative skills in Tai Chi. In elderly people, one of the main reasons for approaching physical activity is to improve strength, balance and inner wellbeing. The aim of this study was to assess the effects on strength, balance and the degree of acceptance after 6 months of a Tai Chi program compared with an Adapted Physical Activity (APA) program.

Methods: Fifteen older subjects were recruited for this study and divided into two groups: the Tai Chi group (6 subjects; 69.3 $\pm$ 3.3 years) and the APA group (9 subjects; 73.2 $\pm$ 5 years). The protocol was composed of two 1 h-sessions per week, for 6 months, under the supervision of certified Tai Chi and APA trainers. The probability level taken to indicate significance was $p < 0.05$. Values are mean $\pm$ SD.

Results: After 6 months of activity, the Tai Chi group and APA group showed significant improvements in both strength and balance. Furthermore, the enhancements in balance and the degree of acceptance were significantly greater in the Tai Chi group compared to the APA group ($p < 0.05$), whereas not significant differences in strength were showed between the Tai Chi group and APA group.

Conclusions: The results of the present study show that Tai Chi is a more feasible intervention to improve balance, and for the degree of acceptance of physical activity compared to APA.

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3 APA
Postural exam

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Aim: Postural examination is an indispensable tool for assessing how the subject's posture is taken into consideration moves away from normality on the three planes: sagittal, frontal, transverse. It consists of three units: physical analyzer, podoscope, postural analyzer. It is performed for a patient who is undressed, first with podalic support to the podoscope, then to the postural analyzer in the front and posterior, lateral left and right front.
Methods: The physical analyzer consists of a bilaminated platform and an aluminum support on vertically running two web cams and a CD-R containing a specific management software for PC. The digital image capture system allows, both on video that after printing them, evaluate and compare the bodily traits such as feet, legs and trunk. The podoscope is an instrument for foot analysis. It has a floor plan in crystal with angled underneath mirror for a real view of the plant and with double side lighting with high impact lamps. Highlights the points of most and minor loads.
The postural analyzer: Anodized aluminum frame and swivel platform in bilaminated material

Scratchpad has two side aisles complete with millimeter gauge sliders with wires for the postural alignment, a lead wire is placed in the center. The equipment is complete with adjustable top mirror.
Results: A person in a standing position with a side view is crossed by an imaginary vertical vertical line that runs along the body from the height of the ear to the shoulder, to the side, to the malleol. Back view is crossed at the center of the back, along the median of the spine, the interglutea fold and end between the feet at equal distance from both. Finally, frontal view is crossed at the center of the forehead, mouth, nose, sternum, and navel ending in the middle.
Conclusions: The use of the postural examination allows us to compare the initial and final evaluation done after performing a postural adjustment treatment.
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4 APA
Fatigue decrease following a combined training protocol in women with mild to moderate multiple sclerosis: a pilot study

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Aim: Fatigue is a frequent symptom in multiple sclerosis (MS) and contributes to increasing inactivity. Previous studies have shown a positive effect of physical activity on fatigue in MS patients. However, information about the effects of combined training on psychophysiological parameters in MS women are lacking. We aimed to explore the efficacy of tailored and combined training on fatigue, quality of life (QoL), muscle strength and functional c APAcity in MS women with mild to moderate disability.
Methods: Seven women with mild to moderate MS (mean age 43.1 ± 8.3) completed a 12-weeks protocol of supervised combined training. They performed two times a week a workout structured by 3 resistance exercises for body portions (lower, high portion and torso) with 8–10 repetitions each for 3 sets and 20 min of endurance training. Before and at the end of 12-weeks, patients filled questionnaires investigating fatigue, QoL and depression and performed physical tests: 1-Repetition Max test (1RM) for Leg Extension, Chest Press, Rowing and Maximal Voluntary Isometric Contraction (MVIC) for Leg Extension. Wilcoxon signed-rank test was used to determine statistically significant mean difference ($p < 0.05$).
Results: Physical and psychosocial fatigue decreased significantly (−7.9; −2; $p = .02$), while cognitive fatigue did not. Total fatigue decreased significantly (−12.5; $p = .01$). QoL enhanced significantly in "physical function" and "sexual satisfaction" (+3.7; $p = .001$; +1.1; $p = .04$) as well as general physical condition (+10.7; $p = .03$) and overall QoL (+1.7; $p = .02$). Depression decreased from 19 ± 9.4 to 9.7 ± 6.8 ($p = .002$). Regarding physical parameters, MVIC increased in all subjects (right +70.6; $p = .009$; left +50; $p = .01$; both +151.1; $p = .01$; NM), similarly 1RM significantly increased in Leg Extension and Chest Press (+11.6; $p = .01$; +7.5; $p = .003$; Kg) but not in Rowing.
Conclusions: We recorded improvements on fatigue and maximal strength. Furthermore, it seems that a 12-weeks combined training program enhances psychological condition and QoL in women with MS.

5 APA
Oxidative metabolism and pushing strategy during wheelchair propulsion test: effects of lesion level

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Aim: Spinal cord injuries (SCI) lead to impairments in lower and/or upper limbs movements as well as in several other physiological aspects. Furthermore, the efficiency of wheelchair propulsion has been shown to be very low.
Methods: A functional evaluation was carried out on 16 patients with spinal cord injury: 9 paraplegics (P, D4–D12) and 7 tetraplegics (T, C4–C8). Two 4-min exercises were performed on a computer-controlled ergometer (with no resistance set on rollers) in patient's everyday wheelchair at the self-selected speed (SSS) and at the maximal sustainable speed during an "all-out" effort (MS). Ten able-bodied control subjects (CTRL) performed 3 exercises: one a T mean speed, one at P mean speed and one at their own maximal sustainable speed. Pulmonary O_2 uptake ($V'O_2$), energy cost of wheelchair propulsion (C), heart rate (HR), push frequency and push efficiency were determined. Furthermore, a two-dimensional sagittal plane video analysis has been performed.
Results: Mean values of $V'O_2$, HR, velocity and push frequency during 4′MS were inversely and linearly correlated with the lesion level. $V'O_{2peak}$ and HR_{peak} were higher in P (1.50 ± 0.49 l/min,

161.3 ± 12.7 b/min) and CTRL (1.75 ± 0.49 l/min, 167 ± 13.5 b/min) vs. T (0.7 ± 0.3 l/min, 117.5 ± 25.4 b/min). Interestingly, compared at same velocity, no differences were found for any variable between SCI and CTRL. The video analysis showed differences in propulsion strategy at MS between T and both P and CTRL, while no differences were observed between SCI and CTRL, analyzed at same velocity.

Conclusions: Push efficiency and O_2 cost of pushing were found to be similar in both patient's groups and CTRL, though a higher level of lesion in SCI was found to be associated with a lower performance. The self-selected propulsion strategy, seems to be the more efficient in all the subjects observed in this study.

6 APA

A systematic review of the effects of sailing on people with disabilities

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Aim: Sailing sports can be practiced for educational, recreational and therapeutic purposes. Previous studies showed that people with some physical and/or mental disabilities who are sailing improved their quality of life, self-esteem, and perceived health. This systematic review aims to provide a comprehensive overview of the effects of the sport of sailing for people with physical and mental disabilities.

Methods: We conducted a systematic review of 10 electronic databases: PubMed, Cochrane Library, National electronic Library for Health (NeLH), Physiotherapy Evidence Database (PEDro), Science Direct, Scopus, Web of Science, EPPI-Centre database of health promotion research_ Bibliomap and National Institute for Health Research (NIHR). We searched all studies published in English from January 1997 to December 2016, using the following keywords: sailing, rehabilitation, disability, impairment, invalidity and handicap.

Results: 166 scientific articles were initially identified. 160 items were excluded for different samples, results, objectives and topics. 6 studies contained inclusion requirements. One study involved adolescents and children with neurological disabilities in virtual sailing activities followed by experiences in water. Three studies involved adult subjects with spinal cord injuries, only one of these studies included experiences on virtual sail. Two studies involved adult subjects with severe mental disorders. In the latter, there have been no improvements in the discipline of sailing. All studies showed an improvement in the quality of life, overall functioning, clinical status, independence and self-confidence of the people involved.

Conclusions: Our review shows the beneficial effects of sailing sport in people with disabilities or pathologies involving spinal cord injuries, severe mental disorders and neurological disabilities. However, it has not been possible to see whether such benefits can also occur in people with different disabilities and different ages.

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7 APA

The effect of a postural exercises protocol in young female volleyball players with knee valgus

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Aim: The scientific literature shows a relationship between femoral-tibial angle and risk of injury. Knee valgus is a condition in which the longitudinal axes of the femur and the tibia form an angle greater than five degrees of valgus. Athletes with knee valgus participating in sports with high incidence of jumps suffer knee injury greater than athletes with normal knee. The aim of this study was to evaluate the effects of a postural exercises protocol in a sample of young female volleyball players with knee valgus.

Methods: A number of 19 female volleyball players (10.5 ± 0.5 years; 138.4 ± 5 cm; 36,7 ± 2.2 kg) were involved for the study. Participants were divided into the following groups: the (EGV) Experimental Group Valgus (N = 8; 10.6 ± 0.5 years; 137.8 ± 3 cm; 37.5 ± 2.1 kg) was composed by athletes with knee valgus who have performed the postural exercises protocol. The (CGV) Control Group Valgus (N = 3; 10.7 ± 0.03 years; 133.4 ± 2.4 cm; 35.9 ± 1.8 kg) included subjects with knee valgus that haven't performed the protocol. The (CGN) Control Group Normal (N = 8; 10.6 ± 0.5 yrs; 140.9 ± 5.9 cm; 36.03 ± 2.3 kg) consisted of volleyball players with neutral knee. Each group followed the traditional volleyball training program. Moreover, the EGV was subjected to a 3-month intervention with a postural protocol of 30–45 min/session, twice/week which included: (1) proprioceptive exercises; (2) strengthening exercises of the lower limb muscles, especially knee's abductor muscles and foot's supinator muscles; (3) stretching exercises of the medial and lateral muscles of the proximal lower body. In order to assess the jump height ability, each group was evaluated by the Sargent Test before (PRE) and after (POST) the experimental protocol. Data were compared through paired t test. Significance was set at p level of 0.05.

Results: All participants of the EGV improved their jump height ability (+19%). In the other two groups, not all subjects improved at the post-test compared to the pre-test (CGV = 5%, CGN = 7%). Statistical analysis showed a significant pre-post interaction in respectively CGN ($p < 0.001$) and EGV ($p < 0.00001$). Moreover, the CGV did not show any pre-post difference ($p > 0.05$).

Conclusions: Our results indicate that this postural protocol in athletes with knee valgus increases significantly the jump height. As expected, all post test showed better performances, but what is interesting is the raising up of values in EGV that resulted predominant when compared with CGN and CGV. Furthermore, the postural intervention program could be suggested to athletes with knee valgus to reduce the risk of injury and to improve the adherence of training programs.

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8 APA
Effects of scoliosis brace on standing and walking balance: a study design

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Aim: There are a few studies, with conflicting results, evaluating the effects of scoliosis orthoses on standing and walking balance. DeGauzy showed that orthosis improves subjects' stability; furthermore Chow claimed that use of orthosis lead to a reduction of patients' stability performance. This study design aim to verify the acute and long term effects of scoliosis brace on standing and walking balance, both with and without brace.
Methods: 20 AIS subjects with a brace prescription and similar curve's type, Risser sign and Cobb angle will be enrolled in the study. Before the beginning of the brace treatment and after 1, 6 and 12 months, subjects will perform a stabilometric and baropodometric assessment both with (WB—after at least 1 h wearing) and without brace (NB—after at least 1 h without orthosis). Data will be collected using a baropodometric platform (Sensor Medica, Rome, Italy). Center of pressure (COP) sway length, ellipse area, COP sway speed, load asymmetry index, load dynamic asymmetry index, walking speed, step length, step cadence, step width will be recorded.
Results: Brace could impact on standing and walking balance, we suppose that the effect could be visible after 1 month and even more after 6 months from the start of the orthosis treatment both WB and NB, comparing with the evaluation performed before the start of the treatment. We suppose that after 12 months the effects will be stabilized.
Conclusions: This study could help to clarify the relationship between brace use and standing and walking balance.

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9 APA
Kinematic analysis and reference database help wheel chair prescription in SCI people

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Aim: Develop a new kinematic analysis (KA) protocol, based on two IR camera, and create a reference database to analyze wheelchair patient position and support clinicians in Spinal Cord Injury (SCI) people wheelchair prescription.
Methods: 78 paraplegic subjects (56 males, 22 female) were involved in the study and divided into 4 groups, based on lesion level: Cervical (C), Thoracic (Th), Lumbar (L) and Sacral (S). Data were acquired by a two IR camera system in two different situations: resting condition (RC) and while simulating start-up propulsion (SUP). 18 markers were applied on bony markings to obtain data about posture. Functional Evaluation Wheelchair (FEW) scale and Quebec Satisfaction with Assistive Technology (QUEBEC) score were used to assess correlations among kinematics parameters and satisfaction with the assistive device. Person with a score major to 90% of their QUEST and FEW mean value category were included into reference kinematic group.
Results: We found some correlations between FEW-QUEST Scores and some kinematics parameters ($P < 0.05$):—Forward Head Angle SUP: Negative correlation (for all subjects and Th Group)—Forward Shoulder Angle SUP: Positive correlation (Th Group) - Elbow Angle SUP: Positive correlation (L Group) We need more acquisition to improve our database.
Conclusion: The study furnishes a preliminary reference database about paraplegic subjects posture on wheelchair. These data can help the prescribers in the evaluation process of wheelchair prescription and the use of a system with only two cameras can be considered a cost-effective and feasible approach.

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10 APA

Improved mobility and clinical outcomes in peripheral arterial disease: a 5-year follow-up study in patients enrolled in a structured home-based exercise program

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Aim: The long-terms effects of rehabilitation in peripheral arterial disease (PAD) are poorly reported.
In a retrospective observational cohort study we studied the clinical outcomes at 5 years of PAD patients enrolled in a structured home-based exercise program.
Methods: The program carried out at Department of Rehabilitation Medicine–Ferrara University Hospital was prescribed during few visits and executed at home at symptom-free walking speed[1]. PAD patients enrolled between 2006 and 2012 were analyzed. Ankle-brachial index (ABI), pain threshold speed (PTS) and maximal speed (S_{max}) by an incremental treadmill test[2] were determined at baseline and at the discharge, when patient's adherence was scored. The number and date of surgical PAD-related procedures, all-cause hospitalizations and mortality for a 5-year period until September 2014 were collected from the database of Regione Emilia-Romagna.
Results: 702 PAD patients (519 males; 71 ± 9 years; 5.9 ± 1.8 age-adjusted Charlson Comorbidity Index) were followed for 373 ± 186 days (7 ± 3 control visits) with adherence score of 3.1/4. The lowest ABI (from 0.62 ± 0.18 to 0.68 ± 0.19), PTS (from 2.8 ± 1.1 to 3.6 ± 1.2 kmh^{-1}) and consequently S_{max} (from 3.4 ± 1.1 to 3.9 ± 1.1 kmh^{-1}) significantly increased ($p < 0.001$) as previously observed[3].
At follow up 103 (15%) patients underwent peripheral revascularization with 20 (3%) amputations, 503 (72%) were hospitalized and 153 (22%) deceased. The Kaplan–Meier analyses showed that an increase of $S_{max} > 0{,}5$ kmh^{-1} ($n = 337$ vs $n = 365 < 0.5$ kmh^{-1}) was associated with a lower rate of surgical interventions (15 vs 21%; $p = 0.013$; HR: 1,66 [1,13-2,45]); of all-cause hospitalizations (69 vs 75%; $p = 0{,}033$; HR: 1.22 [1.02–1.46]) and with lower mortality rate (24 vs 31%; $p = 0.028$; HR: 1.45 [1.05-2.00]).
Conclusions: In PAD a moderate increase of the maximal walking speed (13% of the baseline) following a low-cost, pain-free exercise program was associated with better clinical outcomes at five-year follow-up.
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11 APA

Exercise therapy in peripheral arterial disease: prevalence and impact of osteoarticular diseases on functional outcomes in a cohort of patients enrolled in a rehabilitative program

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Aim: Osteorticular diseases (OD) are responsible of confounding symptoms and functional limitations, however their interference with the rehabilitation of peripheral arterial disease (PAD) is poorly described. In a retrospective cohort study we studied the prevalence of OD in PAD patients and their possible impact on rehabilitative outcomes.
Methods: The structured exercise program carried out at Department of Rehabilitation Medicine–Ferrara University Hospital, consist of few visits at hospital and of 20-min symptoms–free home walking sessions at controlled speed[1].
The presence and localization of OD affecting lower extremities derived from consultation of medical documents of PAD patients enrolled between 2002 and 2016. Pain threshold speed (PTS) and maximal speed (Smax) determined by an incremental treadmill test[2] at baseline and at discharge, and patient's adherence score[1] were considered.
Results: 1383 patients (1020 males; 71 ± 10 years; 6.0 ± 2.0 age-adjusted Charlson Comorbidity Index; 0.66 ± 0.18 Ankle-brachial Index) were analyzed. Nine-hundred-fifty-seven patients were free of OD (PAD_{ODfree}, 69%) while 426 were affected by OD (PAD_{OD}, 31%), predominantly located at spine (76% of total OD), hips (20%), knee (24%) and ankle/foot (23%). In a logistic regression model ($p < 0.001$) OD presence was associated with female sex, body weight, previous sedentary or driving professions. 1123 patients completed the program with <10% of PAD_{OD} requiring physiatrist consultations.
PAD_{OD} ($n = 344$) and PAD_{ODfree} ($n = 779$) did not differ for program duration (378 ± 260 vs 390 ± 287 days), number of visits (7 ± 3 vs 7 ± 3) and adherence (3,1/4 ± 0.8 vs 3.1/4 ± 0.9); PTS equally significantly increased in both groups (PAD_{OD} 0.8 ± 0.9 km/h; PAD_{ODfree} 0.8 ± 0.9 km/h) as well Smax (PAD_{OD} 0.4 ± 0.8 km/h; PAD_{ODfree} 0.4 ± 0.8 km/h) without differences when comparing OD localizations.
Conclusions: In a cohort of PAD patients one out of three was affected by OD. A low-impact exercise program in collaboration with the physiatrists was associated to satisfactory functional outcomes even in the presence of osteoarticular comorbidites.
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12 APA
The autonomy of the institutionalised elderly: a multitasking problem

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Aim: walking ability is fundamental and indispensable for the autonomy in the multi task daily activities for the elderly living in residential facilities. Physical activity (PA) could help to maintain a sufficient level of physical functioning. The study intends to investigate the changes over time of the single-task (ST) and dual-task (DT) abilities, autonomy, and their relationship, after the participation in a PA training in a group of older adults who are showing cognitive deterioration.
Methods: the participants are 13 non-normative elders with MMSE <20 (8F), mean age of 80.85 ± 5.49 years. The variables were investigated at quarterly (t0, t1, t2) with the following tools: 10 meters walking (10MWT) in ST and DT with transport of a glass (10MWTG) and a box (10MWTB), Barthel Index (BI). Non-parametric statistics and correlation analysis were used for data analysis. The significance level was set to $p < .05$.
Results: there are statically significant differences for 10MWT, 10MWTG and 10MWTB and BI ($p < .05$) between measurement times. There are statistically significant correlations at t2 between the walking ability in ST and DT and the autonomy ($p < .05$); and between the walking ability in ST and DT and the autonomy ($p < .05$). There are not significant correlations between them at t0 and t1 ($p > .05$).
Conclusion: the study emphasises the importance of PA in the maintenance of physical functioning focused to activating the autonomies still present in older people. It reiterated the need to pursue the research on PA trainings that are more related to the real needs of the individual (Agmon et al., 2014).
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13 APA
Effects of judo on functional fitness and fear of falling in older individuals

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Aim: To investigate the effects of a 4-month judo training (1-h training session, twice a week) on functional fitness and fear of falling in older individuals (age: 60–76 years).
Methods: The experimental group (JG) (females = 9, males = 10; 68.9 ± 3.7 years) and the control group (CG) (females = 5, males = 9; 70.4 ± 4.8 years) were administered the Sit&Reach (SR), Back Scratch (BS), 30-s Chair Stand (CS), 30-s Arm Curl (AC) and Handgrip Strength (HS) functional test and to Visual Analogue Scale of Fear of Falling (VAS FoF). A 2 (group) × 2 (gender) × 2 (intervention) ANOVA for repeated measures was applied to ascertain differences ($p < 0.05$).
Results: A main effect emerged for gender ($p < 0.001$) and intervention ($p < 0.001$), whilst a significant interaction intervention x group ($p < 0.001$) was revealed. Regarding intervention effect, significant differences emerged for BS ($p = 0.008$: pre: −4 ± 8.5 cm; post: −2.1 ± 8.2 cm) and AC ($p < 0.001$: pre: 15.1 ± 2.4 repetitions; post: 17.6 ± 3.9 repetitions). For the intervention x group interaction, significant differences was confirmed for SR ($p = 0.001$: pre: −5.4 ± 7.9 cm; post: −2.1 ± 7.4 cm), BS ($p < 0.001$: pre: −3.3 ± 8.5 cm; post: 0.2 ± 8.1 cm), CS ($p = 0.001$: pre: 15.3 ± 3.2 repetitions; post: 17.6 ± 3.1 repetitions) and AC ($p < 0.001$: pre: 15.2 ± 2.5 repetitions; post: 19.9 ± 3.2 repetitions) in the JG. For VAS FoF, a main effect emerged for gender ($p = 0.006$: female: 1.88 ± 1.56 pt; male: 1.18 ± 0.44 pt) and group ($p = 0.007$: JG: 1.19 ± 0.49 pt; CG: 1.87 ± 1.54 pt). Furthermore, a gender x group interaction ($p = 0.016$) was found. Post-hoc analysis maintained differences ($p < 0.001$) between females subgroups, between female and male CG and between female CG and male JG.
Conclusions: Findings indicate that judo practice could be beneficial for functional fitness of older individuals and act positively against the fear of falling, which are relevant aspects of successful aging (Spirduso et al., 2005).
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14 APA
Use of a new gymnastics tool in physical activity in elderly

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Aim: To analyze possible differences on physical skills in elderly people considering different training methods focused on the use of a new gymnastic tool: a non elastic band with multiple handles.
Methods: 233 subjects (72.8 ± 5.8 years), 27 men, divided into two groups. An experimental group EG (115 subjects) using, in physical activities, only a non elastic band and a control group CG (118 subjects) using a conventional tool (wooden wand). The both groups regularly practice physical activities twice a week (50′ per session) for 8 months. The tests evaluate the flexibility of the chain back muscle, balance, the abdominal, legs and handgrip strength. The two working groups, in baseline, are homogeneous between them to anthropometric parameters and the initial performance of motor skills analyzed.
Results: Descriptive statistical procedures are presented as mean and the percentage changes (Δ %) were calculated for each study group ((Media Post–Media pre)/Media Pre) × 100. The significance level were performed of $p < 0.05$. The two groups achieved statistically

significant improvements in the tests. Flexibility, abdominal and limbs strength have improved with the same intensity. Flexibility: EG Δ14% ($p < 0.03$) CG Δ16% ($p < 0.04$), abdominal strength: EG Δ14% ($p < 0.001$) CG Δ11% ($p = 0.01$), lower limb strength in both groups Δ12% ($p < 0.01$).Interesting results are in the handgrip test EG Δ2% ($p < 0.001$) CG Δ-2% ($p = 0.07$) and in balance test: EG Δ26% ($p < 0.001$) CG Δ18% ($p = 0.2$).

Conclusions: Both exercise protocols have made significant improvements but the not elastic band use, due to its conformation, it has detected a useful tool for the balance and the hand grip strength compared to conventional tool's use.

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15 APA

Physical activity in fourth age: effects on strength and flexibility

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Aim: To analyze and to highlight possible differences in motor skills in elderly over 80 years in three years of physical activities focused on strength and flexibility exercises.

Methods: 25 subjects (83.8 ± 2.4 years), divided into two groups. An experimental GS group (13 subjects) who practiced gymnastic lessons for 3 years twice a week (50 sessions) for 7 months a year, and a control group GC (12 subjects) who did not practice any type of physical activities.

The tests evaluate the flexibility of the chain back muscle, the abdominal and legs strength. The groups, in baseline, are homogeneous between them to anthropometric parameters and the initial performance of motor skills analyzed.

Results: Descriptive statistical procedures are presented as mean and the percentage changes (Δ %) were calculated for each study group in each year ((Media Post − Media pre)/Media Pre) × 100. The significance level were performed of $p < 0.05$.

The physiological decline in motor c APAcity in elderly can be observed from the CG results: in 3 years the flexibility is fallen of −3% ($p < 0.05$), lower limb strength Δ-7% ($p < 0.05$) and in abdominal strength Δ-8% ($p = 0.09$). Instead, in EG over the three years, the flexibility improved of 16% ($p < 0.05$), in lower limb strength Δ20% Δ, and in abdominal strength Δ8% ($p < 0.05$).

Conclusions: In fourth age, the strength and flexibility exercises can lead to significant improvements countering the physiological decline in motor skills.

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16 APA

Training effects on central and peripheral components of force: thecross-transfer effect

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Aim: Although it has been showed that unilateral limb-training can produce effects on contralateral limb, it was unclear whether central command has a role during strength training in old healthy men. To investigate this, 4 old (65–70 years) and 4 young participants (20–25 years) were recruited. Maximal voluntary contraction (MVC), percentage of neuromuscular activation (%VMA) and rest twitch (RT) were determined before and after 4 weeks of quadriceps electrostimulation (ES) in one leg (training leg).

Methods: In non-training leg, ES was not performed. In training leg, ES includes 15 min of isometric-evoked contractions (6 s contraction/11 s of recovery) 3 times a week (total of 12 training sessions) was performed by Globus Italy SR (Genesy 1200Pro).

Results: After ES, MVC was reduced (-18%) in old subjects while young subjects showed an increase (+10%). %VMA was increased in both old (+6%) and young (+4%) participants. RT was increased by +98% in old participants while the change was negligible in young subjects.

Conclusion: The data of this pilot study suggests that without central command (after ET) there was a significant increase in peripheral components of force in old subjects but without an increase in MVC. This positive gain of RT was probably due to spinal neural-activation, implicating a cross-transfer effect without the activation of central command.

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17 APA

Does the level of upper and lower limb physical activity influence the muscle volume loss and the activity energy expenditure in aging?

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Aim: Sarcopenia is a physiological process characterized by a progressive loss of muscle mass that is more pronounced in the

locomotor muscles. The age-related decrease in the level of physical activity seems to play a crucial role in this phenomenon. Moreover, it is still not clear whether and to what extent the use of upper limbs (UL) and lower limbs (LL) affects the loss of muscle mass with aging and how this contributes to the activity component (AEE) of the total energy expenditure. Therefore, this study aimed at describing the changes in UL and LL volume and activity index, and the potential correlations with individuals' AEE.

Methods: Fifty-three individuals (age: 20–93 years; body mass: 69.5 ± 16.1 kg; stature: 1.71 ± 0.11 m; mean ± SD) participated to the study. UL and LL volumes were estimated by anthropometry. Limbs activity index and AEE were derived by wearable multisensors, equipped with ECG sensors and a tri-axial accelerometer. The devices were placed on the chest (for AEE estimation) and on the dominant wrist and ankle (for UL and LL activity index).

Results: Contrary to UL, both AEE and estimated LL volume decreased significantly with participants' age. LL activity index slightly affected either LL volume and AEE ($R^2 = 0.14$ with $p = 0.04$ and $R^2 = 0.14$ with $p = 0.02$, respectively). No relationship emerged between UL volume or AEE and UL activity index.

Conclusion: Contrary to UL, a reduction of LL volume was accompanied by a decrease in their use. Moreover, AEE seemed to be more influenced by LL compared to UL activity index. UL and LL activities were different in nature, with the latters characterized by high energy-demanding tasks because of their anti-gravitational role. Therefore, a decrease in LL activity index and consequently in more expensive activities, contributed to AEE changes more than UL use.

18 APA
Combined exercise training and recreational football small sided games in the management of subjects with type 2 diabetes: a pilot study

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Aim: To evaluate whether a combined exercise training and football small sided games (SSGs)[1] program improved health-related clinical and biochemical parameters correlated to cardiovascular diseases (CVD) risk in subjects with type 2 diabetes (DM2).

Methods: 10 sedentary subjects (40–63 years old) with DM2 (for at least 5 years), on oral hypoglycemic therapy, without restriction for recreational sports were enrolled in the study at the Diabetes Unit, University of Naples "Federico II" after providing informed consent. They participated in a combined exercise program constituted by indoor sessions (twice weekly for 6 weeks), resistance (2 × 15rep; 50–60% 1-RM)/aerobic training (30 min at 65% FC max) followed by 24 weeks of recreational 5-a-side football SSGs in a pitch measuring 25 × 40 m. Games consisted of three 12-min bouts, interspersed by 2 min of recovery, once a week. Heart rate (HR) was recorded with a telemetric system during all training sessions. Body composition, serum glucose and lipid profile, VO_2 max, 1-RM, were determined at T0 (baseline), T1 (6 weeks), T2 (12 weeks) and T3 (24 weeks) in all participants.

Results: An improvement in body composition and VO_2 max was observed after indoor training at T1, with a significant increase in HDL-cholesterol ($p < 0.05$) and reduction in homocysteine ($p < 0.01$) serum levels versus T0. Similarly, upper limb strength was significantly higher at T1 than at T0 ($p < 0.05$). During the football SSGs sessions, all subjects reached and maintained a HR >81% of HRmax for more than 26 min.

Conclusions Our preliminary results indicates that 6 weeks of exercise training are sufficient to improve clinical-biochemical markers correlated to CVD risk in DM2 patients. Football SSGs promote metabolic fitness. We are evaluating the effects of 12 and 24 weeks football SSG training on the same metabolic markers.

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1 NM
Study of the postural muscles control in subjects with different retinal functionality

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Aim: The self-motion perception produced by optic flow fields is part of the sensorimotor integration process finalized to the postural control. Depending on the stimulated portion of the retina, the cortico-cortical signals are differently processed. The aim was to investigate if retinal impairments modify the activity of postural muscles.

Methods: We evaluated the electromyographic (EMG) activity of the tibialis anterior and soleus in 34 volunteers. Thirteen people at early stage of retinopathy were included in the "retinopathy group" (average age 62), eight people with a laser treatment on the peripheral retina were included in the "laser group" (average age 62) and thirteen healthy subjects formed the "control group" (average age 59). The EMG activity was recorded while the subjects viewed radial optic flow stimuli presented in the foveal, peripheral and full visual field. A repeated measures ANOVA was performed on the normalized EMG of each muscle, with side (right–left) as within-factor and group and stimuli as between-factors.

Results: The EMG analysis of the tibialis showed a significant effect for group ($p = 0.012$) and an interaction effect side by group ($p = 0.06$). The EMG analysis of the soleus showed a significant effect for group ($p < 0.001$) and an interaction effect side by group ($p < 0.001$). Further, the retinopathy group showed the highest values of muscles activation, while the laser group presented the lowest. The retinopathy and the laser groups activated predominantly muscles of the same side, left and right respectively. The control group activated left tibialis and right soleus.

Conclusion: Results showed that the retinal functionality influences the activity of postural leg muscles. We hypothesize that in presence of retinal damage the postural control system may induce a co-contraction of leg muscles in order to maintain stability. Results seem to

indicate that an impairment of the peripheral retina reduces the muscles activity.

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2 NM
Quercitin supplementation reduces eccentric exercise-induced neuromuscular impairment

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Aim: To test the hypothesis that a chronic Quercetin (Q) supplementation may prevent from the strength loss and the impairment of other neuromuscular indices associated to the eccentric exercise-induced muscle damage (EEIMD) in human skeletal muscle.
Methods: 12 young men (26.1 ± 3.1 year) ingested either quercetin (1000 mg/day) or placebo (PLA) supplements for 14 days using a randomized, double-blind, crossover study design. Participants completed a comprehensive neuromuscular (NM) evaluation before, during and after an eccentric protocol able to induce a severe muscular damage (10 sets of 10 maximal lengthening contractions at 45°/s). The NM evaluation comprised maximal voluntary isometric contraction (MVIC) and force–velocity relationship assessments with a simultaneous electromyographic signals (EMG) recording from the elbow flexors muscles. Soreness, resting arm angle, arm circumference, plasma creatine kinase (CK) and lactate-dehydrogenase (LDH) were also assessed.
Results: Q supplementation significantly increased the isometric strength recorded during the MVIC with respect to baseline condition (+4.7%). Moreover, torque and muscle fibers conduction velocity (MFCV) decay recorded during the eccentric exercise were significant lower compared to PLA condition. Immediately after the EEIMD, the isometric strength, the force–velocity relationship and MFCV were significantly lower when participants assumed PLA with respect to Q.
Conclusions: 14-days of Q supplementation seems able to attenuate the severity of the strength loss after the EEIMD resulting in lower muscular damage and possibly to enhance the neuromuscular function.

3 NM
The role of physical activity in motor skills development. A survey in middle school

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Aim: The long jump test represents an evaluation index for muscular fitness (Castro-Piñero et al., 2010) as well as being a predictor of good coordination and motor skills (Ashby and Heegaard, 2002). The aim of the study is to verify the effectiveness of physical activity on motor skill quality through the standing long jump test.
Methods: The study involved 125 pupils (55 M; 70 F) aged 11–14 years (mean age = 12.52), average weight = 53.41, average height = 1.59. Each subject underwent a standing long jump test. Information on the amount of physical activity practiced by the students was obtained through a questionnaire filled in by themselves and by their parents (Roveda et al., 2008). The sample was divided into 5 groups according to the amount of hours and type of sport practiced.
Results: The correlations of the best jump with height (r = .4302) and the best jump with weekly sports hours (r = .4720) proved statistically significant. This is more evident in the multisport group (r = .5026 for the height and r = .5031 for the weekly sports hours). There appeared to be no significance in the correlation between the length of the best jump and the indexes of physical activity practiced (r = .2355) and not practiced (r = -.603).
Discussion: The results confirmed the effectiveness of the test considered for the motor skill assessment.

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4 NM
Comparison of asymmetry between Tennis and sport team

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Aim: Extensive practice of sports should be useful for development during childhood of a harmonic development of both part of body. There are some sports, like tennis (1), that involve especially upper limb, even if in different manners, which could facilitate asymmetry.

The purpose of this research is evaluate if there are differences or similarity among these sports in asymmetry.
Methods: 124 children 8-12 years-old, that performed tennis (N=16), swim (N=13), basket (N=41), and volley (N=57), had been involved in this study. Asymmetry has been evaluated with Back Scratch test (BS); it was used difference (BS DIFF) between two arms of body. BMI it was calculated by height and weight. Proportion male/female was similar into groups. One-way ANOVA and Pearson Correlation was used
Results: There isn't any correlation between anthropometric parameters (height, weight, and BMI) and BS DIFF. Furthermore, a low correlation between best arm and BMI (r: -0,246, p: 0,00589), and weight (r: -0,212, p: 0,0184) and between worst arm and BMI (r: -0,257, p: 0,00393), and weight (r: -0,213, p: 0,0174) it was founded.
Conclusion: In contrast with other studies in literature, this study suggest the absence of asymmetry correlated with kind of sports practice. Finally, exist a negative correlation between asymmetry and BMI
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1 TFE
Effects of self-myofascial release using foam roller on jump performance in basketball players

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Aim: Foam rolling is a popular form of self-myofascial release (SMR), which is the type of myofascial release performed by the individuals on themselves rather than by a healthcare practitioner. In the last decade, SMR has become a very popular modality to supplement traditional methods of releasing fascial restriction and restoring its tissue health. The aim of this study was to examine the effects of SMR using a foam roller on vertical jump performances in 60 young (15 ± 2 years) female basketball players.
Methods: The experimental protocol consisted in: pre jump test session (PRE), foam roll routine or simulated or moderate walking, followed by a post jump test session (POST): 3 counter-movements (CMJ) and 3 stiffness jumps (STIFF). Each group of lower limbs muscles was rolled over their entire surface area, and was applied at 5 strokes per 30 s. All subjects were assigned randomly to: a Foam Roll Group (FRG; $n = 21$), a Placebo Group (PG; $n = 21$) or a Control Group (CG; $n = 18$).
Results: Data showed that in POST session: CMJ height values decreased in FRG and PG ($p < 0.05$ vs PRE), but not in CG. Also STIFF height values decreased both in FRG and PG ($p < 0.05$ vs PRE), but not in CG, while power values decreased only in PG ($p < 0.05$ vs PRE). Foam rolling application seemed to have an acute effect on vertical jump performance reducing significantly jump height on FRG. Results in PG, could be explained by the sitting position.
Conclusions: Foam rolling application seemed to have an acute effect on vertical jump performance reducing significantly jump height on FRG but authors have also noticed an influence on PG, possibly caused by the sitting positions used during the exercises. Therefore, SMR seems to inhibit several muscles implicated on vertical jump producing similar effects of static stretching on muscle performance.
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2 TFE
Metabolic and kinematic parameters during walking with poles in Parkinson's disease

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Aim: In healthy subjects (control group, CR) walking with poles (WP) increases energy expenditure in comparison conventional walking (W).In Parkinson's disease (PD) patients walking is slower than in healthy subjects: this may increase energy consumption, stride-to-stride variability, and a specific difficulty to regulate stride length. The aim of this study was to verify if the use of poles could induce changes in the kinematic of gaitand oxygen consumption in PD patients, at three different speeds.
Methods: Twenty mild-to-moderate PD patients and twenty healthy CR subjects were enrolled. Subjects underwent 5-min W and WP tests on a treadmill, at three speeds: 2.5, 3.5 and 4.5 $km \cdot h^{-1}$. Metabolic and gait parameters (ventilation, gas exchanges, stride count and length) were recorded.
Results: PD patients exhibited higher energy consumption values ($P < 0.05$) (and other metabolic parameters), and shorter strides and reduced cadence ($P < 0.05$), if compared to the healthy subjects, independently of walking technique. However, both PD and healthy individuals had longer strides when walking with poles ($P < 0.001$), especially at the lowest speed; only CR subjects had higher significant values of energy consumption ($P < 0.05$). By comparing the two techniques, no other significant differences have been observed.
Conclusions: Despite the absence of changes in metabolic parameters when walking with poles, we demonstrated that a significant improvement in the length of the cycle has been obtained for this kind of pathology.

3 TFE
Does Sprint-Interval-Training program in addition to a standard weightlifting training can enhance snatch and clean performance?

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Aim: Snatch and Clean and jerk are two power and dynamic strength lifts of weightlifting competition. The main ability for the success of these lifts is the power expressed by the lower limbs. Some studies on top fighters have shown that a Sprint-Interval-Training (SIT) program leads to an improvement in lower limb power. We aimed to evaluate effect of SIT added to traditional weightlifting training on lower limb power and Olympic lifts performance.
Methods: Eleven young weightlifters (mean ± SD, 15.6 ± 1.55 years, 59.1 ± 7.59 kg) were assigned each to an experimental (EXP) or a control (CON) group. Both groups followed a traditional training of weightlifting for 4 weeks. In addition, EXP group completed 2 sessions per week of a running-based SIT protocol. SIT consisted of 6 25-m sprints at maximum effort with a 10-s recovery between each sprint. Before and after the 4-week training program, each subject performed 4 tests: long jump, triple jump, snatch and clean from the blocks. Mann–Whitney U test was used to determine statistically significant mean difference ($p < .05$) between groups.
Results: EXP group showed improvements in long jump (+6.57%), triple jump (+2.28%) snatch and clean from blocks (+4.35%; +5.74%) compared with pretesting. Similarly, CON group showed improvements in snatch and clean from blocks (+2.80%; +2.92%) compared with pretesting but not in long and triple jump (−6.22%; −1.13%). EXP group showed better results in all tests compared to CON group but only long jump test has been a significant improvement ($p = .009$).
Conclusion: The current findings indicate that addition of SIT to a standard weightlifting program produces positive effects on lower limb power but it seems not effective to enhance performance on Olympics lifts.

4 TFE
Change of direction differences between professional and amateur under 20 soccer players

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Aim: Recent research focused more on agility and reactive agility in rugby and Australian football (Sheppard et al., 2006; Gabbett et al., 2008), while very few studies investigated change of direction speed in soccer. Therefore, the purpose of the present study was to investigate the possible differences between change of direction test between soccer players of different level.
Methods: Sixteen soccer players (age: 18 ± 1 years-old; height: 1.78 ± 0.06 m; weight: 71 ± 9 kg; BMI 22.4 ± 2.4 kg/m^2) divided in professional (P, n = 7) and amateur (A, n = 9) were enrolled in the study. Both groups performed into two days 8 different change of direction test (5-0-5, 10 × 5-m shuttle run, modified T-test, Illinois Agility Test, 20-yards Shuttle Run, 3-cone drill, slalom test and box test).
Results: Un-paired t-test showed significant differences between professional and amateur soccer players in speed performance in 5-0-5 (P: 2.42 ± 0.10 s vs A: 2.58 ± 0.12 s, $P < 0.05$), 20 Yards Shuttle Run (P: 4.74 ± 0.18 s vs A: 5.17 ± 0.25 s, $P < 0.01$), Illinois Agility Test (P: 14.91 ± 0.52 s vs A: 16.45 ± 1.14 s, $P < 0.01$), slalom test (P: 5.56 ± 0.11 s vs A: 6.28 ± 0.35 s, $P < 0.001$), box test (P: 14.89 ± 0.40 s vs A: 18.33 ± 1.96 s, $P < 0.001$). No significant differences in the other tests considered were found.
Conclusion: Results suggest that professional perform better in change of direction test respect amateur soccer players. In conclusion, training for change of direction speed and agility have to involve highly specific training that recognizes the specific athletes' level
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5 TFE
Anaerobic profile in youth rowers

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Aim: Although from youth to senior levels rowers undergo extensive aerobic training, anaerobic contribution to performance is approximately 30–35%. Moreover, recent evidence showed that muscle power output could be an important predictor of successful rowing competitions. Therefore, the purpose of this study was to evaluate the anaerobic profile of youth rowers.
Methods: In three consecutive days, seventeen young male rowers (15.8 ± 2.0 years) performed a 20-s and a 60-s all-out, and a 2000-m indoor rowing. Mean power (W_{20}, W_{60}, W_{2000}) and 2000-m time (t_{2000}) were considered for the analysis. To allow comparisons, W_{20} and W_{60} were normalized as percentages of W_{2000}. Associations between variables were determined by means of Pearson correlation coefficients (r).
Results: W_{20}, W_{60} and W_{2000} were 525.1 ± 113.7, 476.1 ± 91.0 and 312.9 ± 56.0 W, respectively. Highest values emerged for normalized W_{20} (168%) and lowest for W_{60} (153%). Negative relationships emerged between t_{2000} (418.5 ± 23.1 s) and W_{20} ($r = -0.952$ $P < 0.0001$) and W_{60} (W_{60} $r = -0.930$ $P < 0.0001$).
Conclusions: These findings indicate that mean power during 20- and 60-s all-out tests are significant predictors of 2000-m rowing ergometer performances. Furthermore, normalized W_{20} and W_{60} can be used to evaluate athletes and as a reference for planning anaerobic training sessions, on rowing ergometer.
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6 TFE
The development of the instep in young classical ballerinas

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Aim: The scope of this research is to verify the effects of a workout program for young classical ballerinas using elastic bands on their feet, hypothesizing important anthropometric variations on the development of the instep of the foot and of its musculature.
Methods: The sample group was made up of 40 ballerinas. The Experimental Group (EG) was comprised of 29 subjects aged 6 to 12 ($M = 9.52 \pm 1.54$); the Control Group (CG) consisted of 14 girls from 6 to 12 years old ($M = 9.75 \pm 1.20$). The EG and CG followed a protocol of classical dance training of 60 min sessions, two times a week for 6 months. The EG also followed a specific protocol of activity using elastic bands. The examined anthropometric variations were measured by an anthropometer and a medical meter.
Results: From reading the collected data one understands that the circumference of the instep of the right foot for the EG presents to T1 measurements from 16.5 to 22 cm and to T2 measurements from 17 to 22.5 cm. The circumference of the right foot's instep for the CG showed T1 measurements from 19 cm to 22.5 and T2 from 19 to 22.5 cm.
Statistically speaking there are significant differences on this parameter, for $p < 0.05$, for the EG with respect to the CG.
Conclusions: The increment registered to the dorsal level indicates the possibility of increasing the strength of the instep of the foot in young subjects, generating a better predisposition towards stability and postural control when en pointe.
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7 TFE
Jump performance and thigh muscles cross sectional area in young female rhythmic gymnasts

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Aim: It has been shown that stress and intensive trainings impact growth in young rhythmic gymnasts (RG) and they show remarkable delays in skeletal and puberty, with impairment of muscle mass with possible reason of the aesthetic requirements of the performance. Few data exist about jumping ability and thigh muscle cross-sectional area in young RG girls. Aim of the present study was to investigate associations between jump characteristics and anatomical cross sectional area of thigh (ACSA) in young RG.
Methods: Forty girls aged 9–16 years old, (mean age 12.4 ± 1.8 years, body mass 41 ± 8.73 kg, height 152.15 ± 9.09 cm) participated in the study. ACSA was calculated by the Knapik et al. (1996) equation. Explosive strength (squat jump, SJ), elastic strength (counter movement jump, CMJ), and counter movement jump with arm swing, (CMJA) were analysed.
Results: Fat Free Mass and BMI were $15.3 \pm 3.3\%$ and 17.6 ± 2.9. RG demonstrated greater jumping ability at CMJ and CMJA as compared to SJ (jump heights for CMJ, CMJA and SJ were 33.63 ± 6.47 for 37.29 ± 7.62 and 32.1 ± 7.11 cm, respectively). SJ significantly differed from CMJA and CMJ significantly differed from CMJA ($p = 0.000$) but no differences between SJ and CMJ. The difference between CMJ and CMJA (3.66 cm), demonstrated a good coordinative ability (Bosco et al., 1983). ACSA of thigh muscle was 88.9 ± 15.43 cm^2 (range 61–122 cm^2). ACSA positively correlated with age ($r = 0.619$, $p = 0.001$). No significant correlations were found between jump heights and ACSA.
Conclusions: Results of the study did not reveal the associations between lower extremities explosive strength and thigh ACSA in RG. We can hypothesise the aesthetic requirements for an ectomorphic body type with diet restrictions impairs in the growing RG the development of muscle mass and the relationship mass/strength. Exercise to keep and develop muscle mass should be prescribed in RG.

8 TFE
HR-index: a valid and practical way to estimate VO_2 and energy expenditure in rugby players

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Aim: Measurement of Oxygen consumption (VO_2) allows the determination energy expenditure during aerobic and mixed activities. While the direct measure of VO_2 remains the gold standard, indirect estimation through Heart rate-index (HR_{index}) offers an inexpensive, simple and valid alternative in healthy and diseased populations [1]. Yet, the applicability of the HR_{index}-based approach to the quantification of VO_2 in sport has not been validated. Our aim was to verify the performance of HR_{index} in predicting VO_2 during running treadmill in rugby players.
Methods: 15 players of the Italian Rugby First Division (24 ± 3 years, 100 ± 13 kg, 185 ± 9 cm, $16 \pm 6\%$ fat mass, 47 ± 4 ml kg^{-1} min^{-1} VO_{2max}) performed a running incremental test on a treadmill ($V0 = 8 + 0.5$ km h^{-1} per min) while oxygen uptake and heart rate (QuarkB^2, Cosmed, Italy) were recorded breath-by-breath. HR and VO_2 (10-s averages at the end of each step) were calculated. HR_{index} was calculated (actual HR/subject's resting HR) and was used to predict VO_2 ((6*HR_{index}-5) 3.5). Measured and predicted VO_2 were compared by two-way RM-ANOVA.
Results: As expected, VO_2 increased as a function of speed during the incremental exercise; however, values of measured and predicted VO_2 at the different intensities were not significantly different and they were highly correlated ($R = 0.87$). Finally, the Bland–Altman analysis showed a very small and non-significant bias

(0.8 ml kg^{-1} min^{-1}, $z = 0.5$) between values, with an imprecision of 4.8 ml kg^{-1} min^{-1}.

Conclusions: HR_{index} based estimates of VO_2 provide a simple, low cost and valid alternative to direct measurement to quantify and monitor energy expenditure during running in rugby players. The quantitative knowledge of the energy demands of specific tasks is essential to optimise physical recovery, food intake and training periodization.

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9 TFE

Effects of intra-cyclic velocity variations on resisted swimming with parachute

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Aim: In-water training methods, including resisted swimming, are considered more effective than those based only on dry-land exercises thanks to their specificity. Swimming parachutes are a common tool for resisted swimming training (Telles, 2011). Some studies have assessed the overall additional drag provided by swimming parachutes (Schnitzler, 2011), while little focus has been placed on how intra cyclic velocity fluctuations affect the parachute's resistance. Therefore, the purpose of this study aimed to assess the drag provided by swimming parachutes of different characteristics in conditions of velocity variations.

Methods: A flat square shaped parachute and a truncated cone shaped parachute were towed at a range of constant velocities, and with 10–40% velocity changes around a velocity of 1.6 m/s. For each trial, the average, maximum and minimum drag values were calculated.

Results: The flat parachute showed 2.1–12.9 N higher average drag than the cone parachute at constant velocities,. For both the parachutes, the average drag showed small differences between constant and fluctuating velocity (mean difference 3.6 ± 1.9 N). The maximum drag, on the contrary, was higher in conditions of velocity fluctuations than under stationary velocity due to accelerations/decelerations, although this trend was more evident in the cone shaped parachute only.

Conclusions: The present findings indicate that different training parachutes can be used if the main goal is modulating the average drag or, rather, increasing/decreasing the maximum resistance provided.

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10 TFE

Effect of fatigue on jump performance in Beach volleyball players

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Aim: Explosive strength in the form of vertical jump is a significant factor in the beach volleyball performance. Medeiros et al. (2014) reported about 112 jumps performed by players during a beach volleyball match. Considering that amateur beach volleyball tournament is scheduled for only one day, the aim of this research is to compare counter movement jump (CMJ) performance of beach volleyball players at the beginning and the end of a 1-day tournament.

Methods: Forty-eight male amateur beach volleyball players (age: 26.5 ± 10 years; range: 14–52 years; height: 181.1 ± 6.9 cm; weight: 76.1 ± 10.4 kg; BMI: 23.2 ± 2.7 kg/m^2) participated in this study. Before the start of the tournament, each subject performed three CMJ on the sand. At the end of his last match of the tournament, each subject returned for the final jump evaluation. The height of the jumps was detected by GyKo inertial sensor system (Microgate, Bolzano, Italy). Paired t-test was used to assess statistical differences ($p < 0.05$) in CMJ heights before and at the end of the tournament. The ANCOVA was used to examine the influence of the first CMJ performance in the CMJ changes.

Results: Jump performance increased significantly ($p < 0.001$) after the tournament: the average height of the CMJ before the tournament was 42.3 ± 7.6 cm while the data after the tournament was 46.1 ± 8.8 cm. Deeply analyzing the data, we found that best performance in the first CMJ was correlated with lower increasing in the post-tournament CMJ height.

Conclusions: Findings of this study confirm the results of a study of Magallhães et al. (2014) with no influence of fatigue on the jump performance at the end of a beach volleyball match. Probably, other factors could affect fatigue of beach volleyball players like repeated jumps or reaction time. Thus other types of test should be used for the investigation of fatigue in beach volleyball.

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11 TFE
Anthropometric analysis of young Italian tennis players

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Aim: Aim of our study is to observe specific body differences induced by training in young agonist tennis players at pre-pubertal and pubertal age, using anthropometry.
Methods: We analyzed 101 tennis players (27 females and 74 males) coming from South Italy, aged 8–14, which played tennis from at least 1 year. Anthropometric measurements like wrist, mid-thigh, mid-arm circumferences and arms length were compared between dominant and not dominant side of the body.
Results: The mean Z-score for females was 0.9627, corresponding to the 83.22th centile of Italian growth chart, the mean Z-score for males was 1.0157, corresponding to 84.51th centile of Italian growth chart. For weight the mean Z-score for females was 0.2394 (59.46th centile) and the mean Z-score for males was 0.4032 (65.66th centile). The mean Z-score for females Body Mass Index was −0.1451 (44.23th centile), instead the mean Z-score for males was −0.0768 (46.94th centile). The Wilcoxon test reported a statistically significant difference between dominant and not dominant wrist circumferences regardless of sex (p-value = 1.87e-10).
Conclusions: Our study revealed that playing tennis starting from childhood may be useful for a regular growth. Analysis of wrist circumference and height may confirm the osteogenic potential of the sport.
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12 TFE
Effects of gender on the biomechanical determinants of front crawl speed in young swimmers

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Aim: Swimming speed is generally larger in males (M) than in females (F). However, before puberty, F can swim faster than M, the more so the longer the swimming distance (Fox et al., 1995). This depends on differences in morphological maturation due to an earlier growth spurt in F (at about 10–12 years of age) while this occurs 1–1.5 years later in M (Rowland, 1996). An analysis of the finishing times (front crawl, short course) of M and F swimmers aged 9–18 years (http://finveneto.org/nuoto_class_stag.php) indicates that the F/M ratio is indeed lower than 1 at 9–12 years of age and larger than 1 thereafter. The aim of this study was to investigate the determinants of the differences in speed in a group of M and F competitive swimmers of this age range.
Methods: 14 males (11.7 ± 0.7 years; 41.7 ± 5.4 kg; 1.52 ± 0.10 m; 7.5 ± 1.8 years experience) and 10 females (11.3 ± 0.5 years; 42.4 ± 7.0 kg; 1.56 ± 0.10 m; 6.8 ± 1.7 years experience) participated to the study; they were asked to swim 25 m at constant speed (V) and stroke rate (SR) at slow and fast pace. Stroke length (SL) was calculated as V/SR.
Results: At fast pace V was larger in M than in F (1.43 ± 0.16 vs. 1.40 ± 0.11 m s^{-1}) but at slow pace V was larger in F than in M (1.14 ± 0.09 vs. 1.09 ± 0.10 m s^{-1}). SR was larger in M than in F both at fast (0.91 ± 0.09 vs. 0.88 ± 0.12 Hz) and slow pace (0.64 ± 0.09 vs. 0.63 ± 0.07 Hz). SL was larger in F than in M both at fast (1.60 ± 0.14 vs. 1.58 ± 0.13 m) and slow pace (1.83 ± 0.18 vs.1.73 ± 0.17 m).
Conclusions: Even if no significant differences were observed between genders at both paces, these data suggests that, in this age range, F can outswim M because of a larger SL and a lower SR. This can be attributed, among the others, to their larger mass and stature.
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13 TFE
Analysis of dropout from high-level alpine ski

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Aim: Few studies have analysed dropout in elite young athletes (Pizzuto et al., 2017). To date, dropout in alpine ski has not been investigated. The aim of the present study was to analyse how many top 10 (T10) athletes in downhill (DH), giant slalom (GS), super G (SG) and slalom (SL) of the International Ski Federation (FIS) Alpine Junior World Ski Championships (AJWSC) had dropped out from high-level competitions.
Methods: Alpine skiers who achieved their first T10 result in AJWSC between 2000 and 2009 were included in the analysis. All the AJWSC disciplines were considered: downhill, super G, giant slalom, slalom. Dropout was assessed when athletes scored points in World Cup for less than 3 years starting from the year after AJWSC participation. For those still competing at elite level, their careers were monitored. Alpha was set to < 0.05 a priori for differences.
Results: Of the 361 subjects taken into consideration, 164 (45.4%) were considered as a dropout from the high-level performance. Of whom, 39.0% were women and 61.0% were men. SG showed the highest percentage of athletes (53.1%) absent for a minimum of two consecutive years from World Cup classification; the lowest was shown by GS (41.4%). The highest dropout rate was found among Swiss athletes (58.5%). On the other hand, Swedish athletes showed the lowest dropout rate (28.6%). There is a large evidence of dependence between dropout from high-level performance, gender ($p = 0.026$) and RAE ($p = 0.012$).
Conclusions: The dropout rate is similar to that found in previous studies in track-and-field athletes. In the present study, men showed a higher dropout rate compared to women.
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14 TFE
Agility training study in 8-9 years old rugby practitioners

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Aim: Rugby, like soccer and basket, requires decision-making skills and high reaction speed. These characteristics together with rapidity in changing direction are grouped in agility performance. Differently from soccer and basket, few data are available on the effects of specific agility training programs on rugby players performance. Our aim was to evaluate functional improvement in children (aged 8–9 years, rugby practitioners) after a guided agility training program.
Methods: the training program was composed of 8 exercises on agility, speed, coordination and equilibrium, to be performed for 30 min twice a week during a period of four months (march-june). Ninety children were randomized in three groups (30 children trained in the gym, t_g; 30 children trained on the field, t_f and 30 children untrained, ctrl). The "Zigzag run test" (Ré et al. 2016; Jakovljevic et al. 2012; Ortiz et al. 2005) was used to measure the efficacy of the program, both before (T0) and at the end (T1) of the training.
Results: We observed a significant (ANOVA test $p = 0.007$) decrease in time spent to perform zigzag test, thus an increase in agility skills, in t_g and t_f vs ctrl. Of note, we could not observe any significant difference between indoor and outdoor trained groups.
Conclusion: The guided agility training program was significantly effective in increasing agility of 8-9 year old rugby practitioners, independently from the environment.
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15 TFE
Effects of swimming velocity on the drag and thrust force balance in front crawl swimming

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Aim: It was previously assumed that, at average constant swimming speed, the thrust force should equal the drag force, otherwise an acceleration/deceleration of the body would occur (Toussaint, 1992). This assumption, however, has been verified only at maximal swimming speed. This study aims to test the hypothesis that the force to overcome the water opposition and the force generated by the swimmer to move forward equal each other at a range of different swimming speeds.
Methods: Eleven male swimmers of national or international level were involved. The swimmers completed a passive drag test (Dp) was performed to estimate the active drag (Da) force. An incremental protocol constituted by six 25-m all-out front crawl swimming trials, performed while pulling six different costant loads (semi-tethered test) was used to reproduce the swimming velocity in a range of speeds from 0.5 m/s to maximal speed. The force to overcome the drag (Fd) was calculated as the sum of the load provided and the Da. The force to move forward (Ft) was assess using a fully tethered swimming test constituted by a single 15-s all-out trial.
Results: The mean (±sd) values of Fd and Ft were 179.9 ± 24.3 and 180.8 ± 21.7 N, respectively. The mean difference between each Fd as measured at the examined velocities and Ft was 1.1 ± 14.4 N, and in any case <28.6 N. This finding reflects the data presented in the literature on the Fd/Ft balance at maximal swimming speed.
Conclusions: The present study shows that the swimmer's thrust force is close to the force needed to overcome the swimmer's drag at different velocity conditions. Thus, the theoretical hypothesis of a balance between drag and thrust force in front crawl swimming is confirmed by experimental evidence.
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16 TFE
Comparison between competition and physical training in figure skating. An observational study

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Aim: Figure skating is an extremely difficult sport that requires a combination of grace, artistry, flexibility, speed and power. To date, research mainly focused on the technical elements of the performance. On the other hand, limited information are available about the physical efforts of athletes during training and competition. Therefore, the aim of this study was to investigate the heart rate (HR) differences and training load between competition and high intensity interval training (HIIT) in figure skating.
Methods: Eight elite figure skating athletes (age: 23 ± 6 years old; height: 1.70 ± 0.08 m; weight: 61 ± 12 kg; BMI 21.0 ± 2.0 kg/m^2, weekly training volume 28 ± 2 h) were enrolled in the study. Mean and maximal HR (Firstbeat Tecnologies Oy) during short and free program, and HIIT sessions was monitored and different training zones (recovery: 50–60 HR_{max}; Aerobic Zone 1: 60–70% HR_{max}; Aerobic Zone 2: 70–80 HR_{max}; Anaerobic Threshold Zone: 80–90% HR_{max}; High Intensity: 90–100% HR_{max}) were retrieved. Moreover, session training impulse (TRIMP) was calculated.
Results: One-way ANOVA with Tuckey post hoc test showed significant between short and free program with HIIT in HR mean (short vs interval, $P < 0.01$; free vs interval, $P < 0.0001$), Anaerobic Threshold Zone (short vs interval, $P < 0.01$; free vs interval, $P < 0.0001$) and TRIMP (short vs interval, $P < 0.05$; free vs interval, $P < 0.01$). No significant differences for the other variables were detected.
Conclusions: Results showed that during short and free program HR was higher that 80% of $HR_{max.}$ On the other hand, HIIT produced

higher levels of HR. In conclusion, because figure skating is a discipline in which there is characterized by bouts of exercises from 5 to 10 s separated by brief periods of partial but often not a full recovery, HIIT seems to be a practical solution to enhance the physical condition of figure skaters.

17 TFE
Low levels of vitamin D affect physical performance in elite soccer players

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Aim: Literature about vitamin D in sports performance is contradictory and not exhaustive. The purpose of this study is to relate blood level of vitamin D and physical performance during official football matches.
Methods: In seven elite soccer players (age 27.1 ± 3.4 years, height 180.2 ± 3.1 cm, weight 72.6 ± 4.4 kg) low level of vitamin D were found during routine blood sample analysis in March: nutrition and supplement strategy has therefore begun. In order to verify the effectiveness of this intervention were perform blood samples in May and we analyzed the parameters for physical performance retrospectively in February and in April. Vitamin D level in March and in May, parameters related to physical performance in February and April were compared (t-test for paired data). Correlation between differences (Δ) in vitamin D level with difference in physical performance parameters were also perform.
Results: Vitamin D level improve from 22.7 ± 3.8 to 29.39 ± 4.22 ng/mL (Δ = 6.3 ng/mL; $p < 0.001$). During February soccer players attend to 7 matches and 15 training session, in April 5 matches and 18 training session. During official matches: total distance improves from 10924.3 ± 1017.1 to 11385.0 ± 1056.0 m (Δ = 460.7 m; $p < 0.05$), distance speed >25 km/h improves from 303.7 ± 111.3 to 356.3 ± 132.6 m (Δ = 52.5 m; $p < 0.05$), maximum speed improves from 32.5 ± 1.4 to 33.5 ± 0.8 km/h (Δ = 1,5 km/h; $p < 0.05$), number of sprint >25 km/h improves from 24.5 ± 9.3 to 29.4 ± 7.2 (Δ = 4.9; $p < 0.05$). Correlation shown a relationship between Δ vitamin D and Δ number of sprint >25 km/h ($r = 0.75$). No differences in training session data.
Conclusion: It is possible to associate low level of vitamin D with a poor physical performance in football. However, should not to be consider as an increase in vitamin D is associate with an improvement of performance, rather as an additional attention to keep blood chemistry parameters in the normal range throughout regular season.
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18 TFE
Gender differences in match performance in elite beach volleyball players

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Aim: Beach volleyball is a team sport played by two teams of two players on a sand court divided by a net. To date, research has mainly focused on male beach volleyball players. Therefore, the aim of this study was to assess work-rest ratio and physical actions between males and females according to their role.
Methods: Twenty-four elite beach volley players (12 males and 12 females) were filmed during 12 beach volleyball matches of the Swatch Major Series 2016 of the beach volleyball World Tour in Poreč in (Croatia). Duration of point rallies, work rest ratio and the number of jumps and hits performed by the players according to their role (blockers and defenders) were recorded.
Results: Twenty-one teams 12 males and 9 females were recorded and 12 matches with 11 sets for males and 9 sets for females were analysed. Males scored a total of 428 points whereas females scored 440 points. Un-paired t-test did not show significant differences between males and females. Two-way analysis of variance showed a significant difference in the jumps performed between blockers and defenders and not between males and females. No significant differences in the other variables were detected.
Conclusions: These results could suggest a similarity between male and female beach volleyball performance. Moreover, the difference in the number of jumps performed by blockers and defenders could give precious information for the distribution of training loads.
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19 TFE
Effects of partial-body cryotherapy on running performance in athletes

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Aim: In literature only one study (Kruger et al., 2015) analized the effects of a single whole-body cryotherapy (WBC) session on acute recovery of endurance performance. Our purpose was to examine the psychophysical response on an incremental exercise to exhaustion carried out after partial-body cryotherapy (PBC) session.

Methods: Nine endurance-trained males (age 23.86 ± 1.65 years) visited the laboratory 3 times. The first visit was a familiarization with test procedures and PBC, then subjects were tested twice in a randomized crossover design. The protocol consisted of a running incremental ramp-test to individual exhaustion. preceded by a single PBC session (PBC group) or a standard warm-up (Control group).Time to exhaustion (Tlim), Skin temperature of the lower limbs, perception of effort and heart rate has been measured during the test.
Results: No statistical differences in time to exhaustion (Tlim) (PBC-CON: 2.56; $P > 0.05$), rating of perceived exertion (RPE) ($P > 0.05$) and heart rate (HR) ($P > 0.05$) was found between the PBC and Control group unless the HR tends to be lower in PBC group. Skin temperature (Tskin) of the femoral quadriceps was statistically lower in PBC group compared to the control in pre-test measurament (PBC-CON: Pre: -6.07; $P < 0.05$) while the difference was not significant during the test ($P > 0.05$).
Conclusions: PBC does not alter the psycophysical responses on a incremental exercise. We can assume PBC could be performed also before a training session if required.
Reference
Krüger M., De Mareés M., Dittmar K., Sperlich B., Mester J., 2015. Whole-body cryotherapy's enhancement of acute recovery of running performance in well-trained athletes. International Journal of Sports Physiology and Performance 10, 605–612.

20 TFE
Anthropometric and functional characteristics of female "Coppa Italia" rugby players

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Aim: Since the first World Cup open to woman in 1991, rugby union is increasingly practiced, non-professionally, by female athletes. To foster participation, the Italian Rugby Federation promotes a variation of rugby union, played by 7 players (2 props, hoocker, mid scrum, fly-half, centre, wing) in a ½ field, the so called "Coppa Italia" tournament. While the knowledge of the physiological and anthropometric characteristics of women players in general is scarce and dated, that of "Coppa Italia" players is totally absent. Aim was to provide normative data on selected, physiological and anthropometric variables in adult women "Coppa Italia" players.
Methods: We tested 32 women players (forwards (FW): prop, hoocker; backs (BK): mid scrum, fly-half, centre, wing) from three teams engaged in the regional Senior "Coppa Italia" tournament. Body mass, stature, % body fat and lean body mass, maximum oxygen consumption and vertical jump height were measured. Mean and standard deviation were calculated; FW and BK were compared by t test ($p < 0.05$).
Results: The athletes were 24 ± 6 years old, with a 4 ± 3 years playing experience (no difference between subgroups). FW were significantly heavier, had larger fat and lean mass and lower jump ability.

group	#	mass (Kg)	height (m)	fat (%)	lean mass (Kg)	VO_{2max} ($ml*kg^{-1}*min^{-1}$)	SJ (cm)	CMJ (cm)
FW	15	73±11*	1.63±0.6	30±4*	50±5 *	41±8	18±3*	20±3*
BK	17	63±10	1.62±0.6	26±6	47±5	44±10	23±3	25±3

* indicates a significant difference *vs* BK.

Conclusions: Our study provides the first available data on "Coppa Italia" women players. Role differences, similar to those of traditional, elite, women rugby players, appear between FW and BK in most of the measure anthropometric and functional characteristics. This suggest that specificity in the physical requirements in the two playing positions is present in "Coppa Italia" women tournament as well as in traditional 15-Rugby Union.

21 TFE
The effects of different types of warm-up on dynamic body balance

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Aim: Warm-up is a routine that all competitive athletes perform before training or competition, and this ritual is generally meant to enhance the athletic performance to follow (Tomaras, MacIntosh, 2011). The purpose of this study was to compare the effects of four different warm-up methods on dynamic body balance.
Methods: This study enrolled 10 individuals (32 ± 11 years old, 170 ± 9 cm, 69 ± 12 kg) who regularly perform non-competitive physical activity. The subjects carried out four different types of warm up: bicycle ergometer, treadmill, calisthenics exercises and arm-crank ergometer. They were tested on 4 different days by means of a proprioceptive platform Libra® (Easytech, Florence, Italy) and the dynamic body balance test was executed before and after the warm-up procedures.
Results: The warm-up performed on the treadmill was the only procedure to show a significant difference ($p < .05, ES = .66, -11\%$). The other kinds of warm-up did not show statistically relevant differences.
Conclusions: A warm-up routine on a treadmill positively affects body balance, allowing for better performances and reducing the risk of injury during training or competition.
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22 TFE
Postural and neuromuscular strategies during upright stance and hand standing

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Aim: Upright bipodalic stance represents a fundamental human posture. In order to maintain a vertical orientation the center of mass must be controlled. However, upright postural stance is not the only

form of human standing. During gymnastics for examples athletes are required to maintain their body in an inverted position. Thus the aim of this study was to understand the differences between the two vertical standing strategies from both a postural and neuromuscular perspective.

Methods: 13 skilled gymnasts (20.2 ± 4 years; 170.38 ± 7.41 cm; 66.00 ± 11.01 kg) were retained for investigation. Each participant underwent: a stabilometric assessment in upright stance and during a handstand; for each task the EMG examination of the gastrocnemius during upright stance and of the flexor carpi radialis during the handstand was retained for analysis.

Results: For both the standing and hand standing task the weight is equally distributed on the right and left limb (Upright stance L = 50.3 ± 1.8; R = 49.7 ± 1.8 and handstand L = 45.1 ± 4.9; R = 54.9 ± 4.9) with no differences between each limb and between the two tasks. However, during the upright stance the fore foot and rear foot are symmetric (F/R 49/51% weight distribution) for each foot whereas during the hand standing task the ratio is prevalently on the rear hand (F/R 27/73% weight distribution) for both hands with a significative difference between front and rear hand and with the standing tasks ($p < 0.01$). Normalized EMG amplitude showed significative differences during standing and hand standing (5.9 ± 2.6 vs. 80.4 ± 45.8% activation, $p < 0.01$), however over a 5 s period the normalized MDF value were similar for the two tasks (71.2 ± 18.5 vs 71.9 ± 14.0, respectively).

Conclusion: Standing and hand standing show similar postural weight managing patterns when analyzed on the frontal plane, however the weight managing strategies on the sagittal plane differ between the two tasks. In addition the neuromuscular patterns during a 5 s window differ for the time intensity domain but not for the frequency domain.

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23 TFE
Cryotherapy influence on hand grip strength

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Aim: The aim of the study was to evaluate the influence of a single partial-body cryotherapy (PBC) session on the maximum hand grip strength as measured by a hydraulic hand dynamometer.

Methods: Two-hundred healthy adults were randomly divided into an experimental group (EG, N = 100 50 males and 50 females, age:42 ± 13 years-old; height 1.71 ± 0.09; body mass: 70.7 ± 12.3; BMI: 24 ± 3 kg/m^2) and a control group (CG, N = 100, age: 38 ± 10 years-old; height 1.72 ± 0.08; body mass: 70.5 ± 11.4; BMI: 24 ± 3 kg/m^2). Subjects of the EG performed a PBC in a cabin with a temperature ranged between -130 and -160 °C, and they were instructed to turn around continuously with standing rotations for 150 s. Subjects of CG stated in a thermo-neutral room (22.0 ± 0.5 °C). Handgrip strength was evaluated before (T0) and after (T1) standing rotations

Results: Two-way analysis of variance with Tukey multiple comparisons test showed that at T0 there were no significant differences between EG and CG (CG: 39.48 ± 10.34 kg vs EG: 39.61 ± 13.16 kg, $p > 0.05$). Improvement over T0 was noted only the EG (T0: 39.61 ± 13.16 kg vs T1: 41.34 ± 12.59, $p < 0.05$). As compared with the CG, the EG improved the handgrip strength (CG: 40.01 kg vs EG: 41.34 kg, $p < 0.05$). Regarding gender differences the analysis reported that females respect to male showed a lower handgrip strength both in the EG (T0 female 28.47 ± 4.45 kg vs T0 males 50.75 ± 8.77 kg, $p < 0.05$; T1 female 30.43 ± 4.06 vs T1 male 52.27 ± 7.76, $p < 0.05$) and CG (T0 female 31.15 ± 5.43 kg vs T0 males 47.81 ± 6.74 kg, $p < 0.05$; T1 female 31.68 ± 4.99 vs T1 male 48.35 ± 6.54, $p < 0.05$).

Conclusions: Findings provide the first evidence that a single session of PBC lead to improve muscle strength in healthy people. The results of the study imply that PBC could be performed also before a training session or a sport competition, to increase hand isometric strength.

24 TFE
Do both submaximal exercise and exposure to progressive hypoxia impair endurance performance?

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Aim: Other than maximal oxygen consumption, acute exposure to hypoxia impairs time to exhaustion (TTE) trials, with an average of ~13% reduction every 1000 m of altitude gain (tested at different constant altitudes below 2800 m asl).[a] However, less is known about changes in TTE performance after an acute exposure to progressive normobaric hypoxia (PH), simulating a positive ascent, coupled with different submaximal efforts. Thus, the aim of this study was to evaluate TTE performance after exposure to PH (60′ session with a linear decrease in FiO_2 from 16.2 to 13.4%).

Methods: Twelve endurance-trained athletes primarily performed a maximal incremental test to obtain peak power output in either normoxia (PPO-N) or hypoxia (PPO-H, FiO_2 = 13.4%). Subsequently, they completed a TTE at 80% of their PPO-H (Hpre) in a non-fatigued state. Then, they performed again the same TTE after 3 randomized sessions divided at least by 48 h: (1) 60′ PH cycling at 50% of PPO-N (HN); (2) 60′ PH cycling at 50% of PPO-H (HH); and (3) 60′ PH in a resting condition (HNoPO).

Results: After HN, TTE lasted 254 ± 94 s. This was 36% (400 ± 102 s, P = 0.001), 35% (373 ± 103 s, P = 0.002) and 26% (357 ± 113 s, P = 0.009) shorter compared to Hpre, HNoPO and HH, respectively. No significant differences were found between the other sessions ($P > 0.05$).

Conclusions: The results showed that TTE (as index of endurance performance) after acute PH is more influenced by the effort intensity performed at the same altitude rather than by only the exposure to hypoxia, opening the discussion on the determinants of this

impairment. Further, the present study may be useful for coaches and athletes engaged in sports involving progressive hypoxia ascents.

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25 TFE
Reliability of a specific swimming-pool test for bodyboarders

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Aim: A PubMed search has revealed a mere 4 papers published on bodyboard, since 1995. The aim of the present study was to assess the reliability of a specific swimming-pool test for bodyboarders by measuring variability of mean velocity.

Methods: Ten national elite male bodyboarders (more than 4 years of training) volunteered for the study. Their age, body mass and height were: 21.3 ± 5.0 years, 64.7 ± 8.6 kg and 1.72 ± 0.06 m. Subjects performed a specific swimming-pool test. Testing was performed in a 50-m indoor heated swimming pool (26–27°) and consisted of a 400 m individual time trial. The subjects paddled on a standard bodyboard using bodyboard swim fins. The test was repeated 72-h after. Reliability of repeated measurements was assessed by the coefficient of variation and Intraclass correlation coefficient (ICC); significance level was set at $p \leq 0.05$.

Results: This was the first study to propose this test and to assess its reliability by the mean velocity during a swimming-pool specific test for bodyboarders. Due to weather and tide constraints during natural bodyboarding it is difficult to have a reliable physiological response under field conditions. Hence, we propose herein a swimming-pool specific test based on a surfing specific swimming-pool test. In the present study, for mean paddling velocity the average measures with the two tests was 1.27 ± 0.09 m/s with a coefficients of variation of 1.7%, and ICC of 0.92.

Conclusion: We conclude that the 400-m bodyboard paddling specific swimming-pool test is a reliable measure of performance (mean velocity).

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26 TFE
Differences between internal and external training load in elite open-water swimmers during the Olympic season

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Aim: Internal (I-TL) and external (E-TL) training load (TL) quantification is basic to evaluate an endurance athlete's responses to training (Mujika, 2017). The aim of the present study was to compare I-TL perceived by athletes and E-TL proposed by coaches, in a group of open-water swimmers (OWS) during the Olympic season. We hypothesized that the athletes overestimate the impact of TL in low intensity and underestimate TL in high intensity.

Methods: Eight elite OWS (3-male and 5-female; 25 ± 2 years, 1.72 ± 0.06 m, 64.7 ± 8.1 kg) and two coaches were involved. TL was categorized according the 3-zone model Z1, light intensity; Z2, moderate intensity; Z3, high intensity and expressed as percentage of training volume. I-TL was evaluate using the rating of perceived exertion of OWS and classified by session-goal method (Seiler and Kjerland, 2006). E-TL was assessed by coaches after each training. Shapiro–Wilk test was used to verify the normal distribution of data and a t-test was performed to analyse differences between groups ($p < 0.05$).

Results: In total were collected 424 ± 31 training sessions from September 2015 to August 2016. The mean training volume per week was 85.38 ± 6.13-km. E-TL in Z1 (84.96 ± 3.75%) was significantly higher compared to I-TL (76.68 ± 8.43%; $p = 0.043$), while E-TL (11.23 ± 2.81%) in Z2 was significantly lower compared to I-TL (17.80 ± 7.01%; $p = 0.023$). The training in Z3 was not significantly different between groups (4.19 ± 0.48% in E-TL, 5.52 ± 5.93% in I-TL).

Conclusions: OWS perform the majority of training in Z1 but they spend more time in Z2 and less in Z3, compared to other endurance athlete. Contrary to our hypothesis OWS underestimate TL in Z1 and overestimate TL in Z2. These data confirm that I-TL of that each athlete was different to E-TL proposed by coaches. Monitoring external and internal workload is important to avoid the risk of injuries and non-functional overreaching.

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27 TFE
Cognitive responses to visual stimuli of Italian Firefighters compared healty subjects

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Aim: Various studies (1, 3) reported impairments in cognitive function after simulated firefighting without exposure to smoke. Robinson et al. (2) discovered that simulated firefighting emergency can exacerbate cognitive impairments, justifiyng maladaptive responses observed during fire suppression. The aim of the present study was to compare the cognitive responses (Reaction time; RT) of Italian Firefighters with healty active subjects.

Methods: We recruited 8 male healthy volunteers Firefighters (FG; 42 ± 8 yr; 86.8 ± 9.5 kg; 177 ± 5 cm; 27.4 ± 2.5 kg/m^2) and 8 male healthy active volunteers subjects (CG; 38 ± 5 yr; 86.8 ± 8.5 kg; 1.80 ± 0.07 cm; 27.5 ± 2.6 kg/m^2) to assess their RT to visual stimuli by Fitlight Trainer® (FitLight Sports Corp, Ontario, Canada). The 3-min test consisted of 3 trials differing in the single stimulus duration and interval between stimuli: (1) 1 s of stimulus duration and 1 s interval between stimulus and the other (T1), (2) 0.5 s of stimulus duration and 1 s interval between stimulus

and the other (T2), (3) and 0.5 s of stimulus duration and 0.5 s interval between stimulus and the other (T3). Mann–Whitney U test between groups was applied to assess differences ($p < 0.05$) in total time-to-completion (TTC), mean of reaction time (TRM), and errors made (subject wasn't not quick to touch the disc activated; E).
Results: No difference emerged in T1 and T2, whereas FG made more Erroros than controls in T3 (12 ± 6 vs 4 ± 3; $p < 0.05$).
Conclusions: Firefighters perform strenuous muscular work in variable working conditions, dangerous environments and chaotic conditions, under time urgency and psychological stress. Considering that rapid information processing and movement responses are essential in occupational activity of firefighters to victims's safe and firefighter's personal safety, RT training programs with high frequency variation of stimulus should be improved.
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28 TFE
Experimental approach of three different protocols on speed agility in basketball. A case study

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Aim: The agility in sport is a multifactorial parameter; is correlated with body stability, rapidity and speed. In order to understand which parameters have more prominence in output performance, we decided to follow a PRE-POST case study, based on three different training protocols and a control group.
Methods: The study was made following an Italian amateur team of 20 basketball athletes (age 23 ± 4, height 1.86 ± 0.07 mt and weight 86 ± 9 kg) during the regular season period for a 8 weeks of aspecific and specific training program. The team was divided randomly in 4 homogeneous groups, each formed by 5 athletes. The four groups performed different athletic workout programs during their regular weekly basketball tactical and technical training. The groups were: Control Group (CG), Stability Group (SG), Rapidity Group (RG) and Stability and Rapidity Group (SRG). The Line Drill Test[1] (LDT) was execute with the use of the Witty photocells (Microgate, Bolzano, Italy). The data collection was made with Excel (Microsoft, USA), and to understand which protocols was better to increase agility performance was used a t-student test ($p < 0.05$) to verify if improvements were significant or not.
Results: The data analysis shows that, on average, the whole team has achieved improvements with a value a PRE value of 9.47 ± 0.43 and a POST value of 9.12 ± 0.36, with a decreasing of -3.34%. The SRG group obtained the best percentage decreasing even with the highest average value in the PRE analysis, with an average time decreasing of 0.73 s. Applying the T-Student test, was calculated the p-value, to determinate if the observed change could be considered relevant or not, only SRG group receive a statistical significance level $p = 0.0119$ ($p < 0.05$).
Conclusion: This study shows that the use of stability and rapidity aspecific and specific exercise programme can influence positively the agility of a basketball player, evaluated by LDT. It is unclear if the improvements obtained in LDT can be transferred during matches' performance.
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29 TFE
Oxidative stress on human skeletal muscle regeneration of healthy elderly after endurance and resistance training

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Aim: The aim was to determine whether endurance and resistance training affects oxidative level of skeletal muscle regeneration on elderly healthy subjects.
Methods: Myogenic precursor cells (MPCs) from the *Vastus lateralis* skeletal muscle of healthy elderly subjects was obtained using Tiny Percutaneous Needle Biopsy. The MPCs were analysed before and after 12 weeks of stimulation. The volunteers were trained in endurance using cycloergometer and specifically pedaling at constant intensity monitored by heart rate (HR). The training HR was monitored with a cardiofrequenzimeter Polar Accurex Plus (Polar, Finlandia). The resistance training consisted of three sessions per week, with three series of 12 repetitions at increasing intensities. The intensities of the training were based on the one repetition maximum (1RM) and included decreasing repetitions: 1st to 4th week at 60% of 1RM; 5th to 8th week at 70–75% of 1RM; and 9th to 12th week at 80% of 1RM. The 1RM was measured every 4 weeks.
Results: The endurance training reduced while the resistance training did not modify the oxidant molecules (mainly superoxide anion) on MPCs.
Conclusion: Endurance training seems able to reduce oxidative stress better than resistance training on elderly.
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30 TFE
Considerations about the "Middle Blocker" 's jump typology in women's volleyball

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Aim: Some studies highlights how the jump is every team players' apanage, what are the quantity of the jumping actions is in the different roles (Fontani 2000), and what are the possible implication referred to accidents (Boden 2010). The jumping execution modes

can be many and they differ base on tactical aspects, in the technical-skills and conditional aspects.
Methods: Nine volleyball match in the women's B1 series championship has been analysed. Middle blocker players (n:5) has been analysed based on the kind of jumps made (total jumps: 1524). The following characteristics has been catalogued: block or spike jump, stationary jump or preceded by a shift (at least one step before the jump), double or single leg jump-push, double or single leg jump-landing.
Results: The players taken into account shown a big difference between them in the average number of actions they do during the match (115/77) and in every set (29/9). The examined subjects do on average 76 ± 33 jumps every match (mJ) and 18 ± 7 jump every set (sJ). The block jumps (mJ:55 ± 28; sJ:13 ± 7) are on average more than the attack jumps (mJ:20 ± 4; sJ:5 ± 1) with a rapport of 2,8.
Conclusion: There are individual differences between the players; the jumps made after a run-up (86%), jump are done with double leg split (85%), the landing is double leg 53% and single leg 47%. The 85% the block jumps are preceded by a shift and the 15% is done staying still. The defensive action is ever with double leg split; the single leg jump-landing is 61%. The attack jump are done by a shift (89%), the split is equally distributed between single and double leg (50%), the jump-landing is double-leg (92%).
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31 TFE
Validity and reliability of different systems for measuring the vertical jump height

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Aim: The purpose of the study was to assess the validity and reliability of a selection of systems for measuring the jump height in jumping tests.
Methods: The height of vertical jumps was obtained with two types of devices: foot-contact (Force Plate (FP) and Optojump optical device (OJ)) and inertial-based (Sensorize (SE) and Gyko (GY)). A high-frequency Stereophotogrammetric System (SS) was taken as the gold standard for jump height. SE and GY were placed on a four-markers rigid cluster and positioned on L5 vertebra while performing the jumps. The jumps were performed on the FP, around which the OJ's bars were placed. All five instruments simultaneously acquired the jump height. After a standardized warm-up, 12 athletes were asked to perform 3 squat jump (SJ) and 3 countermovement jumps (CMJ) trials with a rest of 3 min between each jump. The reliability was assessed using Cronbach's alpha and the Intraclass Correlations Coefficient (ICC), while the validity was assessed using the Bland Altman method.
Results: For the SJ test, alpha was 0.97, 0.97, 0.98, 0.96 and 0.97 for SS, FP, OP, GY and SE, respectively, while ICC ranged from 0.86 to 0.99. For the CMJ test, alpha 0.96, 0.98, 0.98, 0.89 and 0.98 for SS, FP, OP, GY and SE, respectively, while ICC ranged between 0.72 and 0.99. For SS, FP, OP, GY and SE, the ranges of agreements were respectively equal to 6.6, 7.0, 11.3 and 9.2 cm (SJ), and to 6.5, 6.4, 18.8 and 13.7 cm (CMJ).
Conclusions: Foot-contact based systems (FP and OP) showed higher reliability, higher validity and a smaller range of agreement compared to the inertial based systems (SE, GY), both for the CMJ and SJ test. However, SE and GY may provide valid devices and their low cost, portability and easiness to use allow their application in several sport fields.
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1 TEC
Innovation, training and swim drills by the tool with methods REVFIN

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Aim: REVFIN has the aim to stretches your rachis and leg/foot muscles when you swim because it moves either the legs or the whole body through the water.
Methods: for the study we have been involved 24 random subject for age among the 30/55 years with the pathology "lombalgia aspecifica". We have divided them in two groups: the first experimental (OGS) that will be submitted to a program of exercises in water with temperatures between 33/34 °C three times a week with use of fins REVFIN that determines the effect drag to the motion in water; the second group of control (GC) will exclusively be submitted to a protocol of riabilitation with classical fins. Duration of the session 45/60 min.
Results: through the use of REVFIN we have seen improvements in the time of recovery of the articolar functions, the improvement of the painful perception and the efficiency of working activity.
Conclusions: the results provide a clear indication of the presence of two distinct mechanisms (with REVFIN and without it). In the use of REVFIN is very important to balance the techniques and the power training aspects according to the athlete feedback.
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2 TEC
Effectiveness of an innovative damping device in reducing shotgun recoil

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Aim: Clay shooting exposes the shooter to a great number of fires and recoils that could induce to feel pain in the chest. Pain has the potential to affect shooting performance as long as the competition proceeds. The effectiveness of the "Progressive Comfort System" [1] in reducing shotgun recoil was assessed using skin temperature responses and overall shooting performance comparisons.
Methods: A 'Compak Sporting' simulated competition was carried out using two over/under shotguns (model 828U, Benelli Armi S.p.a., Urbino, Italy) differing in the presence or absence of the Progressive Comfort System. 6 male subjects (age 26.8 ± 4.6 yrs; BMI 22.9 ± 1.5 kg/m^2) with a minimum of 4 years of shooting experience were recruited. Each shooter fired with both shotguns and was blinded to which one was firing with. Shooting sessions were separated by 30 days of rest. Since injuries are related to blood flow variations that reflect to the skin[2], infrared thermography images of the upper trunk were used to compare temperature variation between before and after two shooting series (72 shots at all). Performance was evaluated as the percentage of the shots that hit the 50 cm wide (diameter) target, placed at a distance of 30 meters from the shooter. A one-way ANOVA was used to compare temperature variations within the region of interest (the interface area between the shotgun and the shooter was prior identified inside the infrared images).
Results: Using the damping device yielded a significantly ($p < 0.001$) lower temperature increase (0.43 ± 0.26 °C) than using the other shotgun (0.82 ± 0.5 °C). Performance did not change significantly when shooting with or without the damping device.
Conclusion: The Progressive Comfort System reduces the temperature increase of the anatomical area in contact with the recoil pad and does not influence overall shooting performance.
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3 TEC
The effects of a mattress on actigraphy-based sleep quality in professional volleyball players

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Aim: Elite athletes constantly attempt to obtain high levels of performance. To achieve this, they must also reach the right balance between training and recovery. Growing evidence suggests that elite athletes do not obtain sufficient sleep (Sargent et al., 2014). We aimed to evaluate the impact of a new mattress on sleep quality in professional volleyball players.
Methods: Twenty-five elite volleyball players (Vero Volley; age: 25.6 ± 2.3; BMI: 21.7 ± 1.1; 13 females and 12 males) wore an actigraph (Actiwatch, Philips) to detect their sleep behavior in three different time frames: PRE (week 1), POST 1 (week 2) and POST 2 (week 4). We studied their Sleep Efficiency (SE, %), Immobile Time (IT, %), Sleep Latency (SL, min) and the Fragmentation Index (FI, %). The subjects were divided into two groups: Intervention (INT; N = 12) and Control (CON; N = 13). INT changed, at the end of week 1, the usual mattress with the new "Dorelan reactive" mattress.
Results. At PRE, no differences were observed between INT and CON. In POST 1 and POST 2, all the sleep parameters differed between groups: INT had higher SE, IT and lower SL and FI compared to CON ($p < 0.05$). In addition, INT significantly improved their sleep quality in relation to the time frames: their SE was 83.6 ± 1.9 at PRE and increased in POST 1 and POST 2, respectively to 86.7 ± 2.1 and 88.4 ± 1.7.
Conclusion: Professional athletes' sleep quality seems to be positively influenced by the use of the new "Dorelan reactive" mattress.
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1 BM
Temps levé sauté performance (jump height) is unaffected by the use of pointe/demi-pointe shoes

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Aim: The aim of this study was to assess whether differences in temps levé sauté performance (jump height) could be detected by using either pointe (P) or demi-pointe (DP) shoes; the latter are most often used to train dancers who are new to pointe technique and serve to strengthen ankles and feet in preparation for dancing en pointe in pointe shoes. The toe box of demi-pointe shoes is softer and wings are typically not as deep as those found in pointe shoes. Differences in performance (jump height) could be expected because of differences in proprioception, in the range of motion of the foot's arch and in the elastic response of the lower extremities (1).
Methods: Ten female dancers were recruited for this study (17.8 ± 2.6 years of age, 12.1 ± 3.6 years of experience). The performance under analysis was the temps levé sauté: dancers take off and landed from a demi-plié position (arms and feet on 1st position) and fully extended their legs and ankles during the flight. Ten consecutive jumps (rebounds) were performed by each dancer over a dynamometric platform (Kistler, CH, type 9281C, 1000 Hz) with either P or DP shoes.
Results: No significant differences were observed (paired t-test = NS) between DP and P but larger values were systematically observed with DP in contact time (0.336 ± 0.06 and 0.334 ± 0.06 s), flight time (0.375 ± 0.04 and 0.365 ± 0.05 s), jump height (0.175 ± 0.05 and 0.171 ± 0.06 m) and peak force (1760 ± 278 and 1740 ± 306 N) for DP and P, respectively.
Conclusion: Even if not at a significant level, the observed differences are in line with the hypothesis that softer shoes could improve performance (jump height).
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2 BM
Effects of pole length in the kinematics of uphill running

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Aim: The aim of this study was to investigate the kinematic effects of two different pole lengths during uphill running at three different inclinations.
Methods: Nine male sky-runners performed 9 submaximal trials on at treadmill (Saturn h/p/Cosmos, G) at three different inclinations (+15, +20 and +25%) and at constant vertical speed (1.23 $km \cdot h^{-1}$, as suggested by Giovannelli et al. 2016) in the following conditions: without poles (WP), with long poles (LP) and with short poles (SP). In each trial, 5 stride cycles were recorded with a camera (Casio Elixim, 100 Hz). Contact (CT) and flight (FT) times, step length (SL), step frequency (SF) and vertical displacement of the center of mass (vCOM) were calculated as suggested by Daviaux et al. (2012).
Results: CT increased as a function of treadmill inclination ($P < 0.001$) while FT, SL, SF and vCOM decreased when the inclination increased ($P < 0.01$). No significant differences in these parameters were observed among conditions at +15%; at +20% WP was significantly different than LP and SP, but no differences were observed between LP and SP; at +25% all conditions were significantly different from each other. The use of short poles assumes a significant role at +25% by reducing vCOM and SF and increasing SL and CT compared to LP and WP: CT = 0.35 ± 0.05 s (SP), 0.33 ± 0.05 s (LP) and 0.32 ± 0.05 s (WP); SL = 0.50 ± 0.08 m (SP), 0.47 ± 0.06 m (LP) and 0.46 ± 0.08 m (WP); vCOM = 0.28 ± 0.02 m (SP), 0.29 ± 0.03 m (LP) and 0.33 ± 0.03 m (WP); SF = 2.52 ± 0.24 Hz (SP), 2.53 ± 0.19 Hz (LP) and 2.59 ± 0.16 Hz (WP).
Conclusion: At +25% the use of SP allows to reduce vCOM and to increase SL compared with LP and WP. The use of the poles is thus recommended when the planimetry of the racecourse is equal or larger than +25%.

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3 BM
Analysis of the barbell trajectory as an index of technical ability in squat

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Aim: During a deep squat, the lateral kinematic trajectory of the barbell in the eccentric and concentric phases describes a V-shaped curve. The base of this triangular area represents the horizontal displacement of the barbell, not useful towards force expression. Based on the assumption that more skilled athletes would minimise the horizontal component of the barbell displacement, between the eccentric and concentric phase of the movement, we hypothesised that more skilled athletes would display smaller overall areas as a result of smaller horizontal barbell displacement.
Methods: 16 young males (26 ± 5 yrs), 6 High skilled power lifter (HS, >5 years experience) and 10 low skilled novice (LS, <2 years experience) performed three repetitions of barbell squat at 80% of 1RM with 3-min rest between lifts. Kinematic data from the three repetitions (area, vertical and horizontal barbell displacement) were measured using 2-dimensional motion analysis equipment (Sony's video camera, 25 Hz), normalised for the subject's stature and compared by unpaired Student's t-test.
Results: A significantly larger area of the barbell trajectory was found in HS than LS (1.6 ± 1.1 *vs* 0.8 ± 0.5 $cm^2\ cm^{-1}$, $p = 0.00$). While the vertical component of the movement was not different between groups, the absolute and stature-normalised horizontal barbell displacement was significantly larger in HS than LS (10.0 ± 3.0 *vs* 6.3 ± 2.6 cm or 0.58 ± 0.17 vs 0.35 ± 0.14 mm cm^{-1}, $p = 0.00$).
Conclusion: The triangular area and the horizontal displacement described by the lateral kinematic trajectory of the barbell in a deep squat are significantly different in athletes with distinct technical ability. However, in opposition with our hypothesis, more skilled athletes display larger overall areas as a result of larger horizontal barbell displacement. Other studies are needed to explore the possible role of the barbell trajectory kinematics as a synthetic index of the athlete's technical ability in a deep squat.

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4 BM
Comparative study of plantar pressure in athletes and dancers

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Aim: The obsessive pursuit of specific movements involving extension and control in classical dance may lead to problems in lower limbs. The aim of this research is to investigate the eventual differences that exist between the foot of a high level dancer who has undergone a prolonged training workload and that of a normal athletic subject.
Methods: The control group was made up of 60 subjects. Group A: 32 participants, ages 11–30, classical dancers and rhythmic gymnasts, with at least 4 years of competitive sports experience. Group B: 28 participants, ages 20–31, practicing various sports through the Faculty of Motor Sciences of Turin (volleyball, basketball, swimming).
The measurements were conducted in collaboration with a company in Turin using a baropodometric platform (Zebris Medical GmbH).

Results: From the reading of the collected data one does not interpret significant differences between the two groups regarding the percentage values of exerted pressure on the complete sole of the foot and on the partial forefoot of the demi-pointe. The numbers are always below the maximum difference accepted between the two foot placements.
In 84.38% of the ballerinas there was a presence of a cavoid foot of the 1st or 2nd degree, while in Group B, in a generic comparison, the percentage was reduced to 50% with a greater presence of flat feet in 35.7% of the cases.
Conclusion: The obtained results highlight the significant presence of a cavoid foot in athletes who practice classical dance and rhythmic gymnastics, underlining the need to take adequate preventive measures to keep the workload distribution under control.
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5 BM
Assessing lumbar spine loads during horse riding by means of a wearable GPS-aided inertial sensors

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Aim: Low back overuse injuries are very common in equestrian sports [1]. This because horse riding exposes the lumbar spine of the rider to high mechanical loads due to the horse-rider interaction. Aim of this study was to perform a mechanical characterization of the horse-rider interaction during selected horse gaits by means of a wearable GPS-aided inertial measurement unit (IMU).
Methods: Two male amateur (age:16 $\pm$ 1.4, BMI: 19.6 $\pm$ 0.4) and two male professional level riders (age: 21 $\pm$ 1.4, BMI: 20.3 $\pm$ 0.1) were enrolled in the study. The same horse was used by all the athletes. A wireless IMU was worn by athletes at lumbar spine level while a second sensor was fixed on the anterior part of the saddle. Inertial sensors data were collected simultaneously at 200 Hz. GPS data were sampled at 10 Hz. Progression velocity, peak axial force, and the coefficient of attenuation [2] were computed during a single trial composed of 20 s of canter, sitting trot, rising trot, sitting gallop and rising gallop.
Results: In both groups, the gait characterized by the highest force resulted the sitting gallop, whereas the fastest gait was the rising gallop. The average force was 3.03 and 3.67 times the athlete's bodyweight in professional and amateur athletes, respectively ($p < 0.05$). The average coefficient of attenuation was 1.53 and 2.09 in professional and amateur athletes, respectively ($p < 0.05$). Progression velocity was, on average, 3.15 m/s and 3.01 m/s in professional and amateur athletes, respectively ($p > 0.05$).
Conclusion: Gaits were well recognizable from the accelerometer's signal. At equal speed, force was significantly higher in amateur riders, while professional riders resulted more efficient in attenuating the force exchanged with the horse, proving that the technique has an influence on the lumbar stress.
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6 BM
Effect of local fatigue on muscle stiffness of the rectus femoris

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Aim: To determine the effect of local fatigue on stiffness of the muscle belly (MS) and muscle–tendon junction (MTS) of the rectus femoris muscle.
Methods: Twenty-one healthy men and women (26 $\pm$ 3.4 years of age) were recruited. After 5 min of warm-up on a stationary bike at 100 W, the volunteers lied supine on an isokinetic dinamometer (Biodex System III), with a trunk-thigh angle of 160°. The rectus femoris MS and MTS were measured at 1/2 and 1/6 of the muscle length, respectively, at two knee angles (45° and 0°, 0° = full extension). Measurements were taken using the Myoton-3 (Myoton AS), before and 0, 5, 10, 15, 20, 25 and 30 min after a fatigue protocol (FP) consisting of 70 maximal isokinetic knee extensions (knee ROM 90°–0°) at 90°/s (Wang et. al. 2017).
Two-way RM-ANOVAs were conducted to assess if MS and MTS were affected by the knee angle and/or time. If the time resulted significant, contrasts (Bonferroni corrected) compared each time point against the pre-fatigue values. Alpha level was set at 0.025.
Results: Knee angle affected both MS and MTS ($p < 0.001$), with mean differences between 0° and 45° of -14.2 ± 13.0 N/m and -22.0 ± 21.0 N/m, respectively. Whereas the time was significant only for MS ($p < 0.001$). The contrasts showed that MS was higher in the recovery. However, MS was significantly higher ($p < 0.001$) than the pre-fatigue values only at 0 and 5 min post-fatigue.
Conclusions: Stiffness values were affected by both knee angle and measurement point. Moreover, the MS and MTS showed different responses after the FP over time. It appears that fatigue has a different effect on stiffness of different portions of the muscle–tendon unit with potential implications on physical performance.
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1 GS
Evaluation of polymorphisms in PPARγ and ADRB3 genes and expression of Irisin in Italian Water Polo Players

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Aim: Response to exercise is regulated by environmental factors and genetic predisposition; polymorphisms in genes implicated in energy expenditure could affect the effectiveness of physical exercise. SNPs in the peroxisome proliferator–activated receptor (PPARγ) gene such as Pro12Ala (rs1801282), and in the beta-3-adrenergic receptor (ADRB3) gene such as Trp64Arg (rs 4994) are associated with insulin sensitivity and obesity. Adipose and muscle tissues secrete adipokines and myokines involved in energy expenditure; among the others, adiponectin and irisin were associated with benefits derived from physical activity. The purpose of this study was to test presence/absence of polymorphisms in ADRB3, PPARγ genes in professional water polo players (WP) and the association of these polymorphisms with the expression of adiponectin and irisin in WP players.
Method: 22 WP players and 40 age- and sex-matched volunteers were recruited respectively from yacht club Posillipo and CEINGE-Biotecnologie Avanzate staff. The anthropometric and biochemical parameters of control and WP were assessed; presence of Pro12Ala and Trp64Arg SNPs was analyzed by PCR followed by direct sequencing. Adiponectin and Irisin serum levels were evaluated through western blotting.
Results: We identified the Pro12Ala polymorphism in two WP players and two controls while the Trp64Arg polymorphism only in one WP player; both polymorphisms were not related to biochemical, hormonal parameters as well as to irisin and adiponectin expression. Serum adiponectin and irisin levels were similar between WP athletes and controls.
Conclusion: Our study suggested that the influence of two PPARγ and ADRB3 common polymorphisms on Adiponectin and Irisin expression in WP athletes is limited, if it existed at all. Further studies are needed to clarify if the positive effects mediated by physical training may pass through the regulation of Irisin, adiponectin and genetic background.

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2 GS
Effects of physical activity on serum concentrations of Adiponectin in patients affected by Cystic Fibrosis

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Aim: Cystic fibrosis (CF) is an inherited disease characterized by alterations in lipid and glucidic metabolism. Physical activity may contribute to modify CF outcome. Adiponectin exerts beneficial effects on energy metabolism and inflammation processes. In order to investigate the effects of a regular, supervised and prolonged physical activity on CF metabolism, we studied adult CF patients that performed physical exercise in the last three years and compared them to both adult sedentary CF patients and to a control population.
Method: 59 CF patients and 58 age- and sex-matched controls were recruited.
Patients were divided into two groups (29 *versus* 30) on the basis of physical activity. Anthropometric and biochemical features of CF patients and controls were evaluated and compared. In the serum of patients and controls, adiponectin levels were measured by ELISA.
Results: Physical exercise has significant effects on lipid and glycemic metabolism of CF patients. Indeed, the group of patients that performed exercise is characterized by significant decrease of either VLDL, cholesterol and triglycerides, border-line significant decrease of either total cholesterol/HDL and non-HDL cholesterol/HDL ratio and by trend decrease of total, LDL and non-HDL cholesterol, although not significant. It's to highlight that physical exercise significantly reduces glycemia and HOMA-IR and increases serum albumin. However, physical exercise does not modify the adiponectin concentrations that, on the other hand, result significantly higher in all CF patients compared to controls.
Conclusion: In conclusion, even if peripheral muscle abnormalities and respiratory factors limit exercise in patients with CF, our study indicated that physical activity has beneficial effects on lipid and glycemic metabolism in patients affected by CF. The beneficial effects obtained through a regular and prolonged physical exercise seems to be not associated with Adiponectin serum concentrations.

3 GS
Cytokine modulation in gonarthrosis after intra-articular treatment of highly-purified hyaluronic acid with molecular weight between 800-1.200 kDa

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Aim: Different molecular weight of hyaluronic acid (HA) has been shown to both stimulate and inhibit inflammatory responses depending on cell type and disease model. The objective of our research was to examine chemokine modulation of intra-articular injection of HA with molecular weight between 800 and 1.200 kDa for a comprehensive clinical assessment and better therapeutic effect.
Method: Eligible gonarthrosis (GA) patients from both "dry" knee and articular fluid knee groups (14 and 15, respectively) were treated with HA [(Regenyal Starter - 32 mg/2 ml highly-purified HA, with

molecular weight between 800-1.200 kDa (T0 = 0d) and Regenyal Bio-Plus - 75 mg/3 ml mg 1 M, 2 M and 500 thousand Da, after 8 days (T1 = 8d)]. Study design consisted of 40 weeks of follow up (T2 = 90d), HA was administered intra-articularly after 180 and 188 days (T3 = 180d and T4 = 188d, respectively). Clinical assessment of knee function was recorded by visual assessment scale (VAS 0-10) for pain intensity, Range of Motion (ROM) and HHS questionnaire. Blood and synovial fluid were collected. Cytokines were determined through the 27-plex panel of Pro^{TM}Human Cytokine27-plex Assay (Bio-Rad Labs).

Results: Worse scale quality of life was observed in GA patients with "dry" knee, mostly due to higher joint stiffness. Viscosupplementation treatment improved VAS scores. Patients received Regenyal Starter injections improve knee injury symptoms.

In a preliminary survey, the comparison between plasma cytokine levels at baseline (T = 0) *vs* Regenyal Starter HA injection (T = 1) showed that several inflammatory cytokines, chemokines and growth factors, such as IL-1beta, IL-6, IL-8, MCP-1, and PDGFbb, significantly decreased.

Conclusion: Clinical data indicate that viscosupplementation with highly-purified HA with between 800-1.200 kDa promotes pain reduction and knee function improvement within articular fluid and "dry" knee joints. Of particular interest is the down regulation of several plasma inflammatory cytokines induced by Regenyal Starter HA, data particularly useful for clinical assessment and therapeutic efficacy.

4 GS Effects of exercise on breast cancer triple-negative cell proliferation in vitro

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Aim: Inactivity is associated with an increased risk of breast cancer (BC) including the Triple Negative subtype (TNBC). The cellular and molecular mechanisms related to this evidence are still unknown. The purpose of the study is to examine if systemic responses to acute exercise in sedentary healthy women could modulate TNBC cell proliferation in vitro.

Method: Pre-menopausal women performed 65 min of moderate to baseline vigorous intensity aerobic exercise on a treadmill. First 20 min subjects run at a heart rate reserve (HRR; ≈42%) corresponding to 50% of their own estimated VO_{2max}, then exercise intensity was increased to 65% of VO_{2max} (60% HRR) and maintained for 45 min (Rundqvist H et al., 2013).

Blood samples were collected before exercise, immediately after the end of exercise, and 2 h post-exercise.

The TNBC MDA-MB-231 cell line was exposed to the three blood samples. TNBC cells were seeded at a density of 2500 cells/well in 96 well plates. After overnight incubation, culture medium was changed with red-phenol free DMEM (0.8 or 1.2 mg/mL glucose) conditioned with 5% of human serum, and cell proliferation was evaluated using MTS assay after 72 h.

Results: Post exercise sera were less c APAble of inducing cell proliferation in comparison to sera collected before exercise. Particularly, the proliferation of cells cultured with 2 h post-exercise serum lowered about 10%. Results were statistically significant (One-way ANOVA, Bonferroni post hoc test; $p < 0.05$) with a physiological concentration of glucose (0.8 mg/mL).

Conclusions: The systemic responses to acute exercise in sedentary pre-menopausal healthy women, in particular 2 h post exercise, reduced TNBC cell proliferation. Therefore, even a single exercise session seems to have the potential to add a positive effect to the overall beneficial influence of exercise on TNBC.

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5 GS
Relationship between genetic background and performance in professional basketball players

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Aim: The purpose of this study was to determine the probability of basketball players having the best genetic background that could increase performance, evaluating the polymorphism that are considered Performance Enhancing Polymorphism (PEPs) like ACE and BDNF genes. Particularly, we investigated how each polymorphism works directly or through the other polymorphism to distinguish elite athletes, of a particular anaerobic–aerobic alternate performance, from non-athletic population.

Method: Twenty-one professional basketball players (age 26 ± 6) and seventeen healthy volunteers (age 24 ± 6) were enrolled. Saliva sample was used to prepare genomic DNA, sergeant and handgrip-test was used to evaluate athletics performance. The polymorphic sites were scanned using PCR–RFLP protocols with different enzyme. We used a multivariate logistic regression analysis to demonstrate an association between the two PEPs and elite phenotype.

Results: We found statistical significance difference between control group and basketball players in handgrip performance in right hand ($p < 0{,}001$) and left hand ($p < 0{,}0001$). Particularly, we noticed that BDNF AA genotype was associated with a best handgrip performance in basketball player ($p < 0{,}048$); besides the group with BDNF AA genotype was in average higher than other players without this genotype ($p < 0{,}016$). ACE polymorphism had not shown a statistical significance with athletic performance.

Conclusion: In conclusion, this is an explorative work to identify a perfect genetic background that can induce an elite fenotype expression in basketball players. Futher investigation will need to replicate the current finding.

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1 NS
Reliability of a dietary questionnaire on food habits, eating behaviour and food supplements of sport teams

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Aim: Adequate dietary intake is an important factor that affects the ability of athletes to maintain optimal physical condition and to work effectively. Studies so far conducted have reported a lower average caloric intake than recommended and, consequently, inadequate dietary habits (Mutsumi et al. 2012). However, these studies have adopted different survey methods and are not validated on the target population surveyed. It is therefore essential to create a survey tool on the athletes' eating habits. The goal is to examine questionnaire's reliability and comparison of types of sports.
Methods: A cross-sectional study on 101 athletes of University of Pavia in 2017. The questionnaire was self-administered to study participants twice with 7 days between each administration and divided in three main sections (Frequency of Food Consumption (B), Food Habits (C) and Food Supplements (K)). Participants were also given the PREDIMED questionnaire to investigate adherence to the Mediterranean Diet (MD). Reliability was assessed using the Cronbach's alpha and the Pearson correlation coefficients.
Results: Cronbach's alpha for section C and K were 0.71 and 0.75 respectively, indicating a good internal consistency. The Pearson correlation coefficients were 0.90 (C) and 0.87 (K) showing a good temporal stability of the questionnaire. The external validation analysis showed that athletes with a high adhesion index to MD have a statically higher C section score than those with a lower index (39 ± 4 *vs* 35 ± 6, $p = 0.015$). The comparison between rugby players and canoeing athletes showed a statistically significant difference in the K score (7 ± 4 *vs* 13 ± 7, $p = 0.0001$).
Conclusion: The questionnaire has a good ability to measure the eating behaviour of athletes. The different use of food supplements suggests to analyze in-depth diet habits of sport teams.
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1 PAFH
Gross Motor Coordination in Urban, Peripheral and Rural children

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Aim: Some researches describe how area of residence influences children physical fitness (Chillòn, 2011; Andrade, 2014) but, to the authors knowledge, no study investigate the possible differences in gross motor coordination. Our study want to verify whether, in children of 8-11 years, coordination levels are different depending on the area of residence. In particular, urban (U), peripheral (P) and rural (R) areas have been investigated.
Methods: Research involved one hundred and forty-five subjects (ages 8-11y, 70 females and 75 males) from three different areas of population density: urban area (density 1272 inhabitants/km^2, 55 subjects); peripheral (density of 376 inhabitants/km^2; 57 subjects) and rural (density of 57 inhabitants/km^2; 33 subjects). Measurement of gross motor coordination was collected with Körperkoordinationstest *für Kinder* (KTK). Physical Activity Questionnaire for Children (PAQ-C) was adopted.
Results: Physical activity shows an improvement from rural area to peripheral and urban area ($p < 0.05$ for tendency). Rural children practice more physical activity than the urbans ($R = 2.91 \pm 0.19$; $P = 2.68 \pm 0.16$; $U = 2.52 \pm 0.19$; $p < 0.01$ R vs U). KTK scores are different in the three areas ($p < 0.001$ for tendency). Rural children shows best score ($R = 409.7 \pm 26.1$), urbans have an intermediate score ($U = 384.16 \pm 22.44$) while peripheral children have the lowest score ($P = 354.80 \pm 26.47$) ($p < 0.01$ between all couple). Eight years old children shows a KTK scores better than ten and eleven (Eight $= 398.99 \pm 14.01$; Ten $= 375.87 \pm 12.43$; Eleven $= 367.66 \pm 13.82$; $p < 0.01$). Correlation between PAQ_C and KTK is low ($r = 0.24$; $p < 0.01$).
Conclusion: Data seems indicate that residence area influence gross motor coordination but not only via physical activities.
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2 PAFH
Influence of circadian typology on physical performance in adolescent

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Aim: Morning, Evening and Neither chronotypes (M-, E- and N-types) differ in the circadian rhythm of many physiological variables. M-types, also called *larks*, use to wake up and go to bed early and have their best performances in the first part of the day, otherwise E-types, also called *owls*, go to bed and wake up late and have the peak performances in the evening. N-types have intermediate characteristics between the previous groups (Roveda et al., 2017). Many studies revealed a trend toward morningness in children, then after evolving gradually toward eveningness. Eveningness reaches its peak at about 20 years, then decling toward morningness in the third decade of life.
Aim of this study was to evaluate the influence of Circadian Typology (CT) on physical performance in high school students.
Methods: We recruited 118 students for this study. They filed the Morningness-Eveningness Questionnaire (MEQ) for the assessment of CT. All participants underwent height and weight measurements, to calculate BMI (kg/m^2). We recruited 21 subjects from the sample to assess the relationship between CT and physical performance: 7 M-, 11 N- and 3 E-types carried out three Eurofit Tests (push-up; standing broad jump; Cooper test) at 08:00 am and 04:00 pm.
Results: Preliminary results showed differences in physical performance between E- and M-types. In morning session M-types have better performance in standing broad jump ($p < .05$) compred to E-types. Also N-types have better performance with respect E-types for the same test ($p < .01$).

Conclusions: A difference between *larks* and *owls* was clearly found: E-types seem to be disadvantaged compared to M-types in physical tests performed during school time.

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3 PAFH

Morningness and Eveningness: impact on academic performance in italian students

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Aim: In human species circadian rhythmic expression differs and it may be classified with the concept of Circadian Typology (CT), which consists of three chronotypes: Morning-types (M-types), that go to bed early, wake up early and achieve their peak mental and physical performance in the early part of the day; Evening-types (E-types), that go to bed and wake up late and have their best performance in the end of the day; Neither-types (N-types), that show intermediate characteristics between the previous samples. Circadian preferences can also influence academic achievement, sport performance and job activities (Enright and Refinetti, 2017).
Aim of this study was to evaluate the impact of the chronotype on academic achievement, in particular regarding the grades in sports matters.

Methods: We recruited 427 students for this study, 294 males and 133 females, attending the School of Exercise Science at the University of Milan. All participants filed the Morningness-Eveningness Questionnaire (MEQ) for the assessment of chronotype. They have been classified according to their chronotype (M-types = 44, N-types = 280 and E-types = 103) and have been evaluated taking into consideration their grades in sports matters.

Results: M-types showed a significantly higher academic performance compared to E-types ($p < .05$). M-types performed better also than N-types ($p < .01$). Instead, the comparison between E- and N-types unrevealed statistically significant difference.

Conclusions: The present results provide a clear indication of a better academic performance in M-types compared to E-types. The italian academic organization seems to be less favorable for E-types.

Reference

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4 PAFH

Comparison of the effect of TRX Suspension Training and Functional Training on phase angle and handgrip strength in older men

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Aim: Handgrip strength plays an important role in the autonomy and quality of life in the elderly, while phase angle (PhA), an impedance parameter, is considered a predictive indicator of muscular function and risk of mortality. The purpose of this study was to assess the effect of different modalities of physical exercises on PhA and handgrip strength in older adults, after 12 weeks of training.

Methods: Thirty older men (age 65 ± 6.46 years) were randomly divided into three groups: Suspension Training (TRX, n = 10) and Functional Training (FG) groups that underwent a different physical exercise program, and the control group (CG), which did not perform any additional type of exercise during the intervention period. Whole-body impedance measurements and Bioelectric Impedance Vectorial Analysis (BIVA) were performed in order to assess phase angle and body composition, while handgrip strength was measured with a dynamometer.

Results: Data analysis showed that after the intervention period, in the TRX there were significant increases in PhA and handgrip strength and a decrease in percentage of fat mass (%F). In addition, in the group who performed the suspension exercise, total body water (TBW) and intracellular water (ICW) values increased. No significant change was recorded for any of the variables analysed in the FG. On the contrary, an increase in %F and a decrease in PhA were observed in the CG following the 12-week period.

Conclusions: Exercise practice has a positive impact on elderly health, countering the physiological effects of aging. In this regard, suspension training is an inexpensive and practical method that can be offered to elderly people.

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5 PAFH

Sub-acute vascular response to different type and intensity of exercise in obese people

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Aim: Obesity is known to be accompanied by several comorbidities such as diabetes, hypertension, and cardiovascular disease. Several studies have focused on the role of chronic exercise in improving cardiovascular conditions in obese people. Studies about the sub-acute response to different kind and intensity of exercise are poor, showing contrasting results. Thus, aim of this study is to compare the sub-acute vascular response to different type and intensity of exercise in obese adults, compared with a group of healthy adults.

Methods: Obese and healthy adults were recruited. Subjects took part in four exercise sessions: high intensity aerobic training (HA), low intensity aerobic training (LA), high intensity strength training (HS), and low intensity strength training (LS), as well a control session. Test procedures included flow mediated dilation test (FMD) before and 2 h after the exercise.

Results: So far, seven obese people and seven healthy people were recruited. FMD at basal condition was 10% in healthy people and 6% in obese. After HA FMD was 50% in healthy and 40% in obese; after LA FDM was 30% in healthy and 55% in obese. After HS FMD was

30% in healthy and 60% in obese, after LS FMD was 30% in healthy and 40% in obese.

Conclusion: Preliminary results of this study show that obese people have poorer vascular function compared with healthy people. Although obese people show a different vascular response to exercise compared with healthy people, they showed a greater augmentation of dilation c APAcity. The amplitude of this augmentation seems to be type- and intensity dependent.

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6 PAFH

Fat content and muscle quality assessment using electrical impedance myography: inter-day repeatability of a new portable device

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Aim: Recently, Electrical Impedance Myography (EIM) has been proposed as a non-invasive approach for the assessment of fat content (FM) and muscle quality (MQ) [1]. A new portable device (Skulpt®Chisel) has been developed to estimate these parameters. The present study aimed to assess FM and MQ in a population of healthy young participants and to evaluate the inter-day repeatability of EIM measures with this novel and portable device.

Methods: Twenty-five participants (17 M, 8F; mean ± SD: age = 26.6 ± 5.2yrs; stature = 1.74 ± 0.08 m; body mass = 69.1 ± 13.1 kg) underwent two EIM measurements within the same week at the same time of the day. FM and MQ were assessed by the same operator using the Skulpt (Skulpt®Chisel), which is portable, battery-operated, and connected to a smartphone via Bluetooth®. EIM involved high-frequency (50 kHz), low-intensity electrical alternating current applied to the muscle belly using 12 surface electrodes. Resulting voltages on the skin surface were detected and analyzed to produce EIM measurements by an internal algorithm. The device was applied on three body muscles (*triceps brachii*, *rectus abdominis* and *quadriceps femoris*) for total FM and MQ estimations. Inter-day correlation coefficients with 95% confidence interval (ICC), and standard error of measurements as percentage (SEM %) were calculated. Paired Student's *t*-test was used to assess differences between measures ($p < 0.05$).

Results: FM values were 21.2 ± 5.4% and 20.9 ± 5.1%, at day 1 and 2, respectively ($p = 0.469$). Inter-day ICC was 0.970 (0.900–0.998) with SEM% = 4.31%. MQ values were 59.3 ± 18.0 A.U. and 59.7 ± 18.6 A.U., at day 1 and 2, respectively ($p = 0.633$). Inter-day ICC was 0.998 (0.997–0.999) with SEM% = 3.38%.

Conclusion: FM and MQ assessed by EIM employing the Skulpt yielded highly reproducible results with very high inter-day ICCs, narrow confidence limits, and low SEM values. Further studies are needed to compare the Skulpt outputs with gold-standard techniques for body composition assessment (e.g. DEXA) for its validation.

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7 PAFH

Practicing outdoors sports brings benefits for society

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Aim: to gather seminal studies concerning the social, psychological and physical benefits elicited by the practice of regular outdoor sports. Cutting-edge technologies and the rapid urbanization have led to several benefits for mankind and society, however such benefits have been accompanied with the alarming diffusion of sedentary disorders, metabolic diseases, depression and socialization problems, affecting global economy dramatically. Literature reports the association between the pandemic expansion of chronic diseases and physical inactivity. Contemporaneously, International Olympic Committee have included five new sports—primarily outdoors ones—into Olympic Games, remarking a somewhat interest for the inner social and health-related values of outdoor sports.

Methods: We scouted national and international studies focusing on the benefits of regular outdoors sports and -physical activities across all ages.

Results: According to a univocal literature, performing outdoor sports and -physical activities may bear social, psychological and physiological benefits. Preventive effects are similarly documented in youth and old people towards several diseases (myopia, multiple sclerosis and osteoporosis).

Conclusions: In the sight of the beneficial effects of outdoor sports and -physical activities, promotion strategies should be strongly advocated and developed nationally and globally. Simultaneously to this, dedicated research areas should convey efforts to draw up guidelines for the various outdoor activities, so to represent "the good practices" within the social scenario and the healthcare system.

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8 PAFH

Physical components of health related quality of life and physical fitness in treatment-seeking children and adolescents with severe obesity

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Aim: Treatment of pediatric obesity is based on comprehensive lifestyle management, including physical activity. This study addressed the impact of obesity on physical components of health related quality of life (P-HRQoL) and physical fitness in treatment-seeking obese children and adolescents (TS-OB), which may prevent the adherence to the treatment.
Methods: A cross-sectional study was carried out in 753 youth: 282 youth (46.1% boys) with obesity (age 10.9 ± 1.9 yrs, BMI-SDS 2.3 ± 0.4 kg/m^2) enrolling in a multidisciplinary treatment program at the Obesity Clinics, AORN Santobono-Pausilipon; 388 (44.3% boys) non obese youth (NOB) (12.6 ± 2.4 years; BMI-SDS 0.2 ± 0.9) and 83 (50.6% boys) non treatment seeking youth with obesity (NTS-OB) (11.9 ± 2.5; BMI-SDS 2.1 ± 0.4) were recruited in three public schools. Sports participation, sedentary time, P-HRQoL (physical limitations and musculoskeletal pain) were assessed by questionnaire. Aerobic (six minute walking test) and lower body muscular fitness (jump test) were assessed.
Results: TS-OB reported the highest scores in P-HRQoL and showed lower performances in aerobic and lower body muscular fitness compared to NOB and NTS-OB, after adjusting for age, gender and BMI-SDS ($p < 0.01$). Logistic regression in the whole sample showed that low muscular fitness was independently associated with sports participation (OR 0.907, 95%CI 0.846-0.972) and sedentary time (OR 1.121, 95%CI 1.017-1.236), while low aerobic fitness was only associated with sedentary time (OR 1.099; 95%CI 1.018-1.187), after adjusting for age, gender, BMI-SDS.
Conclusions: Weight loss interventions for obesity should consider the poor P-HRQoL and low physical fitness in treatment seeking youth. Sports participation and sedentary behaviors may influence the physical unfit condition in children and adolescents, independently of BMI excess.
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9 PAFH
Lifestyle risk factors in a construction workers population

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Aim: Inactive lifestyle is associated with elevated cardiovascular risk. Being involved in an active work is not necessarily correlated with an active lifestyle. Moderate and/or high levels of leisure-time physical activity (PA) are determinant to reduce cardiovascular risks together with low smoking habit and correct BMI levels. The aim of this work is to assess the health risk factors status (smoking habit, weight, physical activity level) in a construction workers population. Additionally we investigated the intentions to change lifestyle.
Methods: The sample included 603 construction workers (538 M and 30F) with a mean age of 41,76±10,16 years and Body Mass Index of 25,51 ± 3,63 kg/m^2. The study took place in Novara district during 2015 and 2016. Data were collected by self-reported questionnaires to investigate sex, age, height, weight, and smoking habit. Godin Leisure Time Questionnaire assessed PA level. Risk factor score (RFS) was calculated in presence of sedentary, overweight or obesity and smoking. Additional questions investigated the intentions of the individuals to change lifestyle behaviour (the will to lose weight and to begin to regularly exercise).
Results: PA level indicated that 428 (74,96%) workers were sedentary. 87 (14.43%) subjects presented level 3 RFS, 263 (43.62%) workers showed level 2 RFS, 191 (31.67%) subjects with level 1 RFS while only 62 (10,28%) showed a level 0 RFS. The most common risk factor was sedentary. 202 (48.79%) of sedentary said they would begin a PA program, while only 94 (32.75%) said they planned to lose weight.
Conclusion: The studied construction workers population is sedentary and show high cardiovascular risk factors. They should be informed of connected health-risks and encouraged to modify their lifestyle. Special PA approach programs should be designed to involve construct workers.

10 PAFH
Urinary incontinence correlates with both core endurance and ability in middle aged women

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Aim: Women's health related studies have recently focused their attention on urinary incontinence and pelvic floor muscles dysfunctions. Smith & colleagues (1, 2) showed that incontinent women have altered core muscles contraction patterns and impaired balance during static balance tasks on a force plate. However, core endurance and ability (stability and strength) in dynamic and daily life tasks are less known. This study aimed to evaluate the relationship between urinary incontinence and both core endurance and core ability.
Methods: We enrolled thirty-two middle aged women performing core training twice a week. Urinary incontinence was assessed through the international consultation in incontinence modular questionnaire (ICIQ). Core endurance was evaluated through McGill test while core ability through star excursion balance test and upper quarter Y balance test (UQYBT). Partial correlation among variables controlling for BMI was calculated.
Results: ICIQ score was inversely related to McGill back extension test ($r = -0.532$, $P = 0.002$, $df = 29$). When premenopausal women were excluded, the strength of the correlation increased ($r = -0.615$, $P = 0.003$, $df = 19$) and ICIQ score was also significantly and inversely correlated with the score obtained in the posteromedial direction of both sides of the UQYBT (right: $r = -0.414$, $P = 0.05$, $df = 20$; left: $r = -0.421$, $P = 0.05$, $df = 20$).
Conclusions: This study suggests that core endurance and ability decrease according to the severity of urinary incontinence, especially when a high amount of strength/endurance is required. Furthermore, special attention should be given to exercises for the pelvic floor in physically active women that regularly perform core training.
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11 PAFH
Italian anti-doping campaign in the national high school context

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Aim: The doping phenomenon poses a threat to sport worldwide, including in Italy. It undermines the principle of open and fair competition. It is a demotivating factor for sport in general, and puts athletes under unreasonable pressure. It dramatically dishonors the image of sport and poses a serious threat to individual health. Studies have revealed that doping is not only a plague affecting professional sports, but amateur athletes are also making increasingly use of performance-enhancing drugs [1]. Doping has thus become an issue afflicting the entire society. For these reasons, this project was targeted to spread a healthy anti-doping culture in sampled high schools of North Italy, and sports Lyceum nationwide.
Methods: A tailored education and a core anti-doping information was disseminated by 30 experts (FIDAL managers, academic lecturers) reaching 12,000 pupils of 104 public high schools, during 138 seminars from October 2016 through May 2017.
Results: According to a multifaceted body of information including questionnaires, scenario-analysis, and group discussion, gathered during a 2-h seminar in each school, young students resulted to be unprepared to the doping phenomenon however they revealed themselves as potential messengers of a fair philosophy of sport.
Conclusions: This project would represent a key strategy to protect the integrity of sport. It outlined a comprehensive education program to inform students and amateur athletes about their anti-doping rights and responsibilities, but also to engage young and pure human resources into the anti-doping battle.
Reference
https://www.wada-ama.org/en/resources

12 PAFH
Motor imagery in sport: *when* and *how* it is efficient

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Aim: Motor imagery (MI) represents a mental technique to enhance sport performance. Sport psychologists tried to determinate the best imagery perspective to improve the gesture.
This study is aimed to analyze the difference between internal imagery (first person perspective) and external imagery (third person perspective) in comparison to real execution of the gesture.
Methods: By means of a mental chronometry experimental paradigm, we compared forty-eight women (mean age: 38.75 SD ± 11.25) with different motor experience in Pilates (Expert, Novice, no-Practice) during a MI task in which they had to imagine themselves or their instructor perform two exercises with different levels of difficulty. The actual exercises execution time was also measured.
Results: Data obtained showed that in the Expert Pilates group first person perspective imagination and execution time was similar in both exercises, while in the Novice Pilates group similar imagination and execution time was seen in the third person perspective. In the no-Practice Pilates group, imagination and execution time resulted different in both exercises and perspectives.
Conclusions: The present data showed that experience influences MI, suggesting that mental training techniques finalized to improve the gesture might be personalized to motor experience of athletes.
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1 CRF
Cardiovascular responses to low and high intensity exercise after nitrate supplementation in young and elderly people

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Aim: The aim of the study was to evaluate the effects of nitrate supplementation (NS) on cardiovascular system in exercise of moderate and severe intensities in young (Y) and old (O) subjects. Nitrate ($NO3^-$) is an ergogenic nutraceutical that improves performance and reduces resting blood pressure. As NS can reduce blood pressure, we hypothesized that this leads to a decrease of vascular resistances and myocardial oxygen demand (RPP). Furthermore, this action should be more relevant in O than in Y, since elderly population shows an impairment of vascular system.
Methods: The study was a double-blind crossover design in 4 experimental phases. Subjects (10 young (Y) - 25 ± 3.9 year, 10 old (O) - 68 ± 4.6 year) were randomly assigned to NO_3^- (beetroot juice NO_3^- rich - 5,5 mmol) or placebo (Pl – beetroot juice NO_3^- depleted) treatment. The measures were performed in basal conditions (BDC1) and after 8 days of NS or Pl (PS1). After a 2 weeks washout period, basal measurements were made (BDC2), likewise after 8 days of Pl or NS (PS2). Subjects performed three 6 min square wave transitions at 2 different intensities 80% GET (1^{st} and 3^{rd} square wave), and 50%Δ (2^{nd}) (50% of the difference between GET and V'O_2max) preceded by resting phases R1,R2,R3. Heart rate (HR), Systolic (SYS) and Diastolic (DIA) pressures were measured by Portapres®; Mean arterial pressure (MAP), total peripheral resistance (TPR) and cardiac output (CO) were obtained by Modelflow® (Beatscope FMS™). Rate pressure product (RPP) was obtained.
Results: Main effects of NO_3^- supplementation were observed on MAP in O with a decrease during rest (R1—103.3 ± 7.1 vs 98.35 ± 11 mmHg, p = 0.0259, R2—105.8 ± 12.4 vs 99.7 ± 11.2 mmHg, p = 0.0056, R3—114.8 ± 10.3 vs

103.2 ± 15.4 mmHg, $p < 0.0001$), and during severe intensity exercise (155.7 ± 12.4 vs 141.8 ± 11 mmHg, $p < 0.0001$). Similar effects were observed on RPP at rest (R1—9759 ± 2231 vs 8914 ± 1926 mmHg bpm, $p < 0.0195$, R3—14854 ± 3563 vs 12671 ± 3792 mmHg bpm, $p < 0.0001$) and on severe intensities exercise (30967 ± 5767 vs 2848 ± 7316 mmHg bpm, $p = 0.0019$). No evident effects were recorded on Y.

Conclusions: In elderly people, cardiovascular system functionality improves by NS mainly at rest and after recovery in response to severe intensity exercise.

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2 CRF

Effects of nitrate on O_2 cost of exercise in young and elderly men

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Aim: The aim of this study was to investigate if nitrates (NO_3^-) are efficacious in reducing the energy cost of cycling in healthy men. Literature reports the ergogenic effects of nitrate supplementation (NS) on exercise tolerance. However, age and fitness could influence the effects of NO_3^- on energy demand. Because of aging effects, NS may determine more advantages in elderly men.

Methods: The study was a double blind, randomized, controlled, crossover design: 8 days beetroot juice (BJ) supplementation (NS 8-mmol NO_3^-/day) or nitrate-depleted BJ as placebo (PL - 0.8-mmol NO_3^-/day) separated by two weeks of washout. Subjects (10 young (Y) 25 ± 3.9 yr, 10 old (O) 68 ± 4.6 yr) ($V'O_{2max}$ (Y) 51.7 ± 6.8 mL/kg/min, (O) 36.2 ± 7.0 mL/kg/min). Breath-by-breath O2 uptake (Quark PFT, Cosmed, IT) were evaluated before (B) and after (A) intervention during two square wave transitions (6 min) on cycle ergometer (Excalibur Sport, Lode, NL) workload corresponding to 80% of GET (LI) and to 50%Δ ((GET-V'O2max)/2 - HI). In LI and HI, average values (30 s) were taken at the 6th min at rest and at the 3rd and 6th min of exercise.

Results: In (O) steady state LI O_2 uptake decreased by ∼ 7% with NS (1.4 ± 0.32 l/min (B), 1.3 ± 0.26 l/min (A)$P = 0.032$). In PL, it amounted to 1.4 ± 0.25 l/min (B), 1.4 ± 0.28 l/min (A).

In (Y) HI exercise, the $V'O_2$ slow component amplitude decreased by ∼ 18% in NS (0.38 ± 0.17 l/min (B) and 0.32 ± 0.17 l/min (A) $P = 0.034$; it remained the same with PL (0.34 ± 0.14 l/min (B) and 0.34 ± 0.19 l/min (A). In (O) HI and (Y) LI, there were no effects after NS or PL.

Conclusions: NS reduced the O_2 cost of LI exercise in (O). The $V'O_2$ slow component amplitude was reduced in (Y) HI exercise.

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1 PED

The role of in-classroom active breaks on children's physical activity: A pilot study in primary school

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Aim: Physical activity (PA) is essential to children well-being and school plays a crucial role in exercise promotion (WHO, 2010; Carraro & Gobbi, 2016). In the last years, active breaks programs have been developed with the aim to reduce sedentary time and to improve pupils' attention and behaviour (Carlson et al., 2015). The purpose of the present pilot study was to evaluate the relationship between in-classroom active breaks and pupil's PA levels during schooldays. Moreover, pupils' perception on the intervention program was evaluated.

Methods: Forty children (17 boys; mean age = 10 ± 0.2 years), in two-fifth-grade primary school classes, performed short 5-minute in-classroom active breaks twice a week for 6 weeks. The study compared four conditions: high-intensity PA breaks; low-intensity breaks; reading comics; and no-breaks. PA was monitored by using Actigraph GT3X + accelerometers. At the end of the intervention, pupils' perceptions on enjoyment, perceived efforts and attention, related to the different breaks were evaluated through three Visual Analogue Scales.

Results: School day PA was significantly different ($p < .05$) in the four conditions. In the no-break days, sedentary time was higher and active time was lower in comparison to the active breaks days; whereas higher amounts of PA were recorded in the high-intensity breaks days. Moreover, the highest children's enjoyment was recorded in high-intensity PA breaks, whereas perceived attention was similar after the three kinds of break.

Conclusions: Results suggest that high intensity in-classroom active breaks could be an effective strategy to increase, in a pleasurable way, children daily PA.

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2 PED

The assessment of the flexibility of the posterior chain in a group of junior high school students

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Aim: The flexibility of the posterior chain decreases between the age of 11 and 14 years (Kendall et al., 1995), this is confirmed by the analysis of quantitative assessments that are usually adopted in the school context. The purpose of this study was to asses to a group of students using a qualitative and analytical assessment according to the Kendall's protocol in addition to Back-saver sit-and-reach, Sit and reach and Active leg raise tests (Mayorga-Vega et al., 2014)
Methods: A total of 108 students aged 11.7 ± 0.7 (60 males and 48 females). Their average anthropometric characteristics were: height 152, 9 ± 0.7 cm, weight 45.5 ± 14.5 kg and BMI 18.7 ± 5.2 kg/m^2. After the warm up all the participants were photographed while they were doing the sit -and-reach test and each student's position was graded according to Kendall's criteria.
Results: The analysis of the results shows that the 34% of the participants were classified as position 1 (normal flexibility); the 40% were classified as position 2 (hamstring muscles shorten), 26% were classified as position 3 and 4 (lower back, hamstring muscles and gastrocnemius in shortening). Overall, only 13% of male students showed standard (i.e. normal) flexibility compared to the 63% of the females.
Conclusions: These findings are in line with a previous literature and underline the appropriateness to include in the physical education teaching programmes the improvement of muscle–tendon flexibility.
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3 PED
Virtual teaching work in Physical Education: teaching knowledge and corporal practices

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Aim: The objective of this research was to understand how the teaching knowledge and the corporal practices (Silva et al. 2014) were treated pedagogically in a course of Degree in Physical Education, e-learning.
Methods: The research combined two data collection. In the first one, a documentary analysis of the physical education subjects into Modular Object Oriented Dynamic Learning Environment (Moodle). In the second stage, we conducted semi-structured interviews with eight teachers of that subjects. The data were submitted to content analysis (Bardin, 2010) by thematic categories: polydocence (Mill, 2010), teacher knowledge and corporal practices.
Results: The teaching work in a course of Degree Physical Education, e-learning, was possible to perceive that the corporal practices still have characteristics to an presencial educational modality, but advance in the determination of know-how, in seeking articulation between theory and practice of corporal practices through different pedagogical and technological resources such as videos, description and illustration of body movements.
Conclusions: The pedagogical knowledge related to technologies and the media has been incorporated into the teaching knowledge; Polydocence has been shown to be inherent in virtual teaching work; and the corporal practices, in the a course of Degree Physical Education, e-learning, sought to articulate the technical knowledge with the theoretical-scientific ones.
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4PED
The ObLoMoV project: Obesity and Low Motility Victims. Physical high-intensity short shocks and theatre short stories to convert inactive victims into players

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In Italy 56.9% of the population aged 15 years and over were insufficiently active (men 51.0% and women 61.8%), according to estimates generated for 2008 by WHO[1]. The "drop-out" of sport physical activity increases exponentially from 13 to 15 years producing thus a mass of potential sedentary people who are totally exposed to bad unhealthy practices. Oblomov is the well-known Russian novel by Ivan A. Goncarov which portrays a nobleman who is incapable of undertaking any important action. Oblomov is the incarnation of the indolent man. Laziness is a risk for the entire lifestyle as it involves other epidemic diseases such as overweight and obesity. Oblomov is the acronym of "Overweight/Obesity and Low Motility Victims" and, with this project, we propose a new pedagogic methodology in order to tackle the inactivity problem among young students of 11/13 years old, as an effective strategy to prevent the problem of physical inactivity among adolescents and related health issues. It intervenes through a pedagogic working path, based essentially on innovative theatrical techniques with the aim of raising their awareness about the importance of health-enhancing physical exercise as discussed in the "EU Physical Activity Guidelines"[2]. The theatrical strategy focuses on the decoding and transferring of the sport assumption that High Intensity Interval Training (HIIT) is the major strategy to drive out adolescents from inactivity. In addition, highly competent European partner universities (Slovenia, Greece, Finland and Belgium) are involved in this innovative scientific theory proposing short physical shocks, theatre decodes and transfers it to school teachers who create short theatre stories involving young students' awareness and capabilities. Finally, grassroots sports trainers take charge and/or care of the new young sport "actors", embracing and implementing the HIIT philosophy.
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1 PSY
Not winning but taking part: Oxytocin variation during competition in team sport players

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Aim: Oxytocin (OT) plays a key role in human social behaviours. The aim of this study was to investigate the change in salivary level of oxytocin during amateur team sport competitive matches. A secondary aim was to evaluate whether there was an effect of the result of the game (victory vs defeat) or the importance of the game (quarterfinal vs semi-final vs final) on neuroendocrinological changes in two different kind of sports.
Methods: 16 softball players (23,06 ± 6,55 yrs) and 13 volleyball players (6 men and 7 women: 31.4 ± 3.7 yrs) from Italian competitive teams were included in the study. Saliva samples were collected immediately before and after each match. We evaluated the effect of victory and defeat in the softball regular season while we investigated the increase in importance of the game in the volleyball playoff competition. Oxytocin was measured by means of ELISA kit. We conducted repeated measures ANOVAs time (pre, post) x experimental conditions (Softball: victory vs defeat; Volleyball: quarterfinal vs semi-final vs final). A mixed design ANOVA was used to assess the impact of gender on hormone change.
Results: We observed a significant increase in salivary oxytocin levels in players after matches in both sports ($p < .05$); this effect was not mediated by gender in the mixed gender volleyball team. This increase in oxytocin level showed a positive, although not statistically significant, trend: change in oxytocin levels tended to be higher in more decisive matches (quarterfinal vs semi-final vs final). We did not find a significant difference in oxytocin between victory and defeat.
Conclusions: Our results suggest that practicing a competitive team sport is associated with an increase of oxytocin secretion in the team components. Additionally, increase of oxytocin secretion during team sport competition seems to occur independently of result or importance of the game.

2 PSY
Evaluation the podalic support in subjects with dyslexia: the pilot study

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Aim: Postural stability must be maintained efficiently in everyday life and is controlled by several sensory inputs. In according to the literature, the postural control is influenced by dyslexia. The foot is a great access point for postural information. The aim this pilot study was to evaluate the podalic support in subjects with diagnosis of dyslexia.
Method: Sixty-three subjects were enrolled for this study. The subjects were divided into two groups: EG and CG. The EG was composed of 21 children (Age: 12,28 ± 1,67 years; Height: 154,38 ± 15,60 cm; Weight: 56,5 ± 14,3 kg) with diagnosis of dyslexia. The CG was composed of 42 subjects (Age: 12,90 ± 0,57 years; Height: 151,35 ± 8,15 cm; Weight: 46,6 ± 9,4 kg). Each subject underwent to a postural analysis. The analysis was measured through the FreeMed posturography system (by Sensor Medica). STATISTICA software was adopted to perform an unpaired t test.
Results: The groups showed significant differences (Table 1) in: Surface SX ($P < 0.0001$), Surface DX ($P < 0.0001$), Surface forefoot SX ($P < 0.0001$), Surface forefoot DX ($P < 0.0001$), Retro foot surface SX ($P < 0.0001$) and Retro foot surface DX ($P < 0.0001$). Furthermore, the groups showed significant differences in body mass index ($P < 0.001$). The two groups showed the same loading trend on the two feet (EG - Flat SX 50.80% vs CG Flat SX 49.47% and EG - Flat DX 49.20% vs CG Flat DX 50.52%).
Conclusions: The group of dyslexics seems to show a tendency to flat foot. Furthermore, the EG showed a BMI higher than the CG but in our opinion, not sufficient to justify the increase of foot surface. Further studies are needed to confirm these data, but if our conclusions are correct, it would be right to insert a training protocol to prevent flat foot in children with dyslexia.

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3 PSY
Physical abilities and motivation in adolescents not practicing sport

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Aim: To examine the relationship among motivational factors in physical education, fitness level, and intention to practice physical activity in the leisure time.
Methods: Middle school students ($N = 46$, 10 boys and 36 girls, aged 14-16 years) not practicing sport completed the Italian version of Situational Motivation Scale (SIMS; Guay et al., 2000), an 11-point item assessing perceived physical ability, and a 5-item scale on the intention to practicing physical activity in the leisure time. Sit-up, sit and reach, and beep-test were also administered to measure students' fitness level.
Results: Correlational results showed that the intention to practice leisure-time physical activity was positively related to intrinsic

motivation, identified regulation, and perceived physical ability. Perceived physical ability also correlated with performance in the beep-test. Stepwise regression analysis was conducted entering the intention to practice physical activity as dependent variable, and motivational variables and self-evaluation as predictors. Intrinsic motivation emerged as the only significant predictor ($\beta = .48$, $t = 3.65$, $p = < .001$). In a subsequent regression analysis, self-evaluation was introduced as a mediator in the relationship between intrinsic motivation and intention to practice. Mediation or moderation effects were not observed.

Conclusions: Physical education teachers can promote a supportive environment to meet the basic psychological needs of their students (autonomy, competence, and relatedness), improve motor abilities and skills, and foster the intention to practice physical activity in the leisure time.

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4 PSY
Sport participation and sleep in 11-13 years old Children

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Aims: Sport practice can be a regulator of sleep. Sleep norms have been suggested by experts to improve children's health. Leptin hormone, widely present in the CNS, can have an effect on nocturnal sleep duration. Aims of this study was to assess sleep duration in children practicing sport, if there are differences between the types of sport in influencing sleep hours, if sleep duration of in agreement with the recommended sleep norms for their age, and if leptin is connected with sleep duration.

Methods: A sample of 166 male children (mean age 11 ± 0,6 years) answered to a physical activity questionnaire with the help of their parents. 139 were involved in sport practice outside school (SPORT group) and 27 of them not practiced any sport outside school but only take part in physical education classes (NON SPORT). Leptin levels were measured after fasting overnight with ELISA methods.

Results: 52,5% of children in SPORT group and 81,4% in the NON SPORT group showed a shortening in sleep duration compared to recommended sleep hygiene norms. The type of sport practiced didn't influenced the sleep duration. Children who has low levels of leptin (mean 2,83 range 0,104-11 mM), sleep less than 7 h per night (n.11), compared to children who slept 7-8 h (nr. 66, mean 8,5, range 0,149-51 mM) and 9-10 h per night (nr. 59, mean 7,80, range 0,65-49 mM).

Conclusions: A large number of children non practicing sport sleeps less than the recommended standard for their age and have low leptin levels. Low leptin levels are connected with shorter nocturnal sleep duration in non-practicing sport children.

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5 PSY
Relation between different coaching styles and free-throw performance in male basketball players: a cross-sectional study

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Aim: In basketball the free-throw performance is a key-factor in order to determinate the winner and loser in a match (Brenkus, 2007). The aim of this study was to investigate the association among the different coaching styles, the psychological processes engaged in the relationship between coaches and athletes, and the free-throw performance in male basketball players.

Methods: One hundred and fifty-four male players ($M = 16 \pm 4$ years), who were practicing basketball ($M = 8 \pm 5$ years) in two different sport societies ["Atlavir" (Rivalta) and "P.M.S." (Moncalieri-San Mauro)], were enrolled in this study. Participants filled an open answer questionnaire investigating the relationship between coaches and athletes. Afterwards, the players performed 3 series of 10 free-throw shoots in a randomized order with 3 different coaching styles (laissez-faire or neutral, democratic and autocratic).

Results: A significant correlation among the psychological processes engaged in the relationship between coaches and athletes was observed. Furthermore, a negative association was observed between the wish of testing themselves in the basketball and the autocratic ($\beta = -0.267$, $p = 0.017$) and neutral styles ($\beta = -0.263$, $p = 0.031$). No significant differences between the three different coaching styles were observed in the free-throw shoots performance.

Conclusions: Data suggested that the laissez-faire style can improve the athlete's performance only with a relationship based on respect and collaboration, while the use of an autocratic style will increase the athlete's performance with a positive relationship. Instead of focusing the attention to the shooting technique or physical preparation only, this study wants to help coaches of various sports to understand the importance of sport-psychology, in particular how the relationship between them and their athletes might improve the performance.

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6 PSY
Motor Imagery is not altered in athletes with severe visus disorders

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Aim: In the Motor Imagery (MI) an individual rehearses mentally a given action. It is used in sport training and neurological rehabilitation, and in cognitive neuroscience and psychology to investigate the basis of actions' execution. The dynamic Motor Imagery (dMI) is a new form of MI, coupling simultaneously actual movements miming in part those mentally represented. In this study, we evaluated the temporal and spatial features of MI and dMI in different types of locomotion in athletes with visus disorders.

Methods: 10 male athletes (6: totally blind and 4 severe hypovisus, according to the international federation standard; 36.2 ± 6.5 years old) of the Goalball National Team and 10 male healthy subjects (34.4 ± 6.6 years old) were enrolled. Three different tasks (standard MI as sMI, dMI, and real performance, RP) were performed in four locomotor acts (natural walking, FW, light running, R, lateral walking, LW, backwards walking, BW) towards a 10 m distant target. Time and number of steps of the tasks were assessed.

Results: Time did not show significant differences between groups ($p = 0.605$). Post-hoc analysis showed FW, LW and R values significantly different between sMI and dMI for LW, while in BW there was a significant underestimation of the athletes with blind disorders. For the number of steps, dMI and RP were significantly different between groups ($p = 0.007$). This difference was mainly due to the LW ($p = 0.018$).

Conclusion: Data show as sMI had time performance equivalent to the RP in all the locomotor conditions, except the BW where it was underestimated, probably to a developed proprioceptive and sensorial feedback.

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