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Original Article

Designing a multifunctional tactical training method to improve the physical and occupational performance of Italian State Police Mobile Units: a brief report

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Abstract:
There is no standard physical exercise protocol that can guarantee adequate physical and working efficiency of police officers. However, integrated circuit training can be used to train more physical abilities by optimizing timing and promoting well-being and performance in job tasks. Therefore, the purpose of this preliminary study was to monitor and evaluate the physiological and perceptual impact of multifunctional tactical training (MTT) and to develop it as a specific method for increasing the physical and working abilities of the Mobile Units police officers. A total of 4 police officers (of different ages, seniority, and anthropometric characteristics) voluntarily participated in this study. They used the MTT method consisting of a series of multiple exercises that are specific and functional for the Mobile Units personnel and designed to develop strength, muscular endurance, cardiorespiratory endurance, speed, aerobic and anaerobic power, reaction time, coordination, dynamic balance, and agility. The MTT method was developed according to the principles of individualization, progressivity, variety and multilaterality of the load. Small tools and materials from riot gear were used. During the MTT session (approximately 40 min duration), the police officers' heart rate was constantly monitored, and the rate of perceived exertion was measured immediately before and after each execution of the circuit, which was performed three times. The obtained results show that MTT is a safe and effective method for training the cardiorespiratory system. In addition, functional exercises are necessary to prepare the police officers to efficiently perform tactical tasks while preventing the risk of injury. Further studies are needed to improve the MTT method with an objective of continuous physical-motor education among police officers.
Key Words: Celere Units; physical conditioning; cardiorespiratory fitness; functional training.

Introduction

Police personnel perform various professional duties involving physical exertion (Tomes, Orr & Pope, 2017) and are characterized by long periods of low-intensity activity interspersed with short periods of high-intensity activity (Bonneau & Brown, 1995). Research has demonstrated that a police officer's job is surprisingly often sedentary (Anderson, Plecas, & Segger, 2001; Bonneau & Brown, 1995), and it is recognized that physical fitness is an essential component of being prepared to do infrequent but often critical tasks, including pursuing fleeing subjects, controlling those resisting arrest, grappling, and handcuffing, as well as crowd control (Bonneau & Brown, 1995). The ability to perform these various physical responsibilities can determine the occupational effectiveness of a police officer. For instance, the police officers of the Mobile Units, require high levels of cardiovascular fitness, muscle strength and endurance (Boyce et al., 2008). However, it is well known that law enforcement officers have a higher risk of incurring injury or occupational diseases than most other occupations (Orr et al., 2019). In addition, greater cardiorespiratory capacity can reduce the risk of contracting cardiovascular diseases (Laukkanen et al., 2010). For this reason, it is essential to obtain an accurate baseline of existing performance levels (Alver, Sell, & Deuster, 2017) to both develop and assess an effective physical training program. Ideal exercise programming should train law enforcement personnel specifically for the movements and explosiveness they will require in their daily tasks.

In the Mobile Units of the Italian State Police, activities are carried out wearing riot gear, whose load can cause metabolic stress (DiVencenzo et al., 2014) and alter the body posture (Fowler, Rodacki, & Rodacki, 2006) causing, respectively, an increase in HR and VO_2 (Blacker et al., 2013), and musculoskeletal disorders (Marins et al., 2020). It is therefore necessary to develop intervention protocols to ensure psychophysical well-being and improve the quality of life of police officers (Da Silva et al., 2014; Greco, 2021; Schilling et al., 2019). To be effective, the exercise protocols must follow the principles of overload (i.e., a physiological system must be progressively and systematically stressed beyond the level to which it is currently accustomed) and specificity (i.e., the training effect is particular to the muscles involved, fibre types recruited, energy systems used, and velocity and type of contractions) (Alver et al., 2017).

Unfortunately, there is no standard physical exercise protocol necessary to ensure adequate physical and work efficiency (Bonneau & Brown, 1995); however, aerobic capacity, anaerobic power, muscle strength and

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endurance, agility, age, and body composition are related to occupational performance (Beck et al., 2015; Stanish et al., 1999; Strating et al., 2010). Therefore, it would be desirable to design integrated training that can simultaneously develop the physical skills required of the police officer to optimize performance in work tasks (Beck et al., 2015; Dawes et al., 2017). Circuit training has the peculiarity of training more physical skills, optimizing times (Willis et al., 2019) and promoting psychophysical well-being in police officers (Norris et al., 1990; Norvell & Belles, 1993).

Based on previous studies and modern tactical training methodology (Alver et al., 2017), in this study, a Multifunctional Tactical Training (MTT) method was designed and developed consisting of a series of multiple specific and functional exercises for Mobile Units officers. Thus, this study had the dual purpose of *i)* monitoring and assessing the physiological and perceptual impact of MTT and *ii)* developing an MTT method to increase the physical and working abilities (Beck et al., 2015; Strating et al., 2010) of the Mobile Units officers.

Materials and methods

Participants and procedures

A total of 4 police officers from the XV Mobile Unit (Taranto, Italy), of different ages, seniority, and anthropometric characteristics, voluntarily participated in the study and gave their informed consent. The study was approved and authorized by the Head of the Mobile Unit and monitored by paramedics. A week before the experiment, the study participants received instructions from State Police instructors experienced in physical conditioning to familiarize themselves with the MTT protocol lasting about 60 minutes. Immediately before the session, the officers provided their age, body height and body weight data, and declared that they had no pathology and then performed the entire session in gym clothes at a local gym. In addition, the body fat percentage was measured by using the Tanita UM-076 scale for body analysis (Tanita Online GmbH).

During the session, supervised by experienced physical conditioning instructors, the heart rate was constantly monitored, and the intensity of perceived exertion was measured immediately before and after the entire session and before and after each execution of the circuit performed three times. For the development of the circuit, various gym and riot gear materials were used, the weight of which is indicated as it is responsible for the progression of the training loads. The following materials were used: n. 1 Italian police baton (weight 0.6 kg), n.1 round shield (weight 3.5 kg), n.1 rectangular shield (weight 4.5 kg), n.1 u-bott (weight 1.7 kg), n. 1 gas mask without filter (weight 0.5 kg), n.1 climbing rope, n.1 step 30 cm, n. 2 elastic bands 5.5 m, slam ball 4 kg, n.1 bench, n.1-speed ladder 4 m, n.2 dumbbells 2 kg, n.8 cones.

Measures

Heart Rate Monitoring. The participants used a heart rate monitor (RS800; Polar Electro OY, Kempele, Finland) to measure HRmax (bpm) recorded continuously every second. HR data was downloaded using specific software (Polar Pro-Trainer, Kempele, Finland).

Rating of Perceived Exertion. The intensity of perceived exertion was measured with the Borg scale CR10 at 10 points (0-10), which is a measure of a person's perception of the intensity of exertion required for a given task (Borg, 1982). The officers were asked to evaluate the perceived exertion level before and immediately after the training session as well as before and immediately after the execution of each circuit.

Multifunctional Tactical Training (MTT)

The MTT was developed following the principles of individualization (adapted to the subject), progressivity (easy-difficult, simple-complex, monoplane-multiplanar, stable-unstable), variety (different types of exercises, combinations of exercises) and multi-laterality (simultaneous development of physical and cognitive abilities using various, alternating, and multifunctional exercises) of the load. Besides, the limited time that police officers must train and therefore the need to optimise results in short training sessions has been considered. The MTT method aims to develop muscle strength and endurance, cardiorespiratory endurance, speed, aerobic and anaerobic power, reaction time, coordination, dynamic balance, and agility (i.e., speed, anticipation, visual scanning speed, response to a stimulus). Additionally, this unconventional training could be effective in managing body composition. In this study, the MTT session was developed to a basic level of difficulty and composed of the following phases (for more details contact the corresponding author):

a) General activation phase with preventive and compensatory motor activity exercises (i.e., stretching, motor coordination exercises, pushes, pulls, extra- and intra-rotation of the shoulders with elastic bands, CORE strengthening)

b) Central phase: basic level circuit performed n. 3 times with 6 minutes of active recovery (stretching and light jog); n. 7 stations consisting of multiple general physical conditioning exercises + 1 special exercise series (tactical task).

    1. Pull-ups on the climbing rope starting from the supine position: 30 sec.

2. Front plank 30 sec. + lateral plank on the right 15 sec. + lateral plank on the left 15 sec. + bipodalic front step jump 4 reps + bipodalic lateral step jump on the right 2 reps + bipodalic lateral step jump on the left 2 reps.
3. Blue elastics bands 5.5 m (resistance 2.6-3.9 kg) 30 sec.: combat position and shoulders circumductions back.
4. Slam ball throw (4 kg, 2 m from the wall), 2 reps lunge forward to the right and left alternating with start in maximum squat / half squat + one hand side throw, 2 reps, alternating right and left.
5. Triceps dips in back support on bench 30 sec. + speed Ladder n. 10 squares with frontal jumps and 90° rotation to the right and left alternating in combat position with a back lunge.
6. Arnold press modified (≥ 2 kg) 10 reps + Push-ups 5 reps.
7. Tactical agility training 10 m
   i. with a police baton
   ii. with a police baton and round shield
   iii. with u-bott and gas mask without filter, police baton and rectangular shield
8. Special exercise 30 sec.:
   i. with a police baton and action shot on a bag
   ii. with a police baton and round shield with action shot on moving bag
   iii. with u-bott and gas mask without filter, police baton and rectangular shield, thrust with shield and action shot on a bag

c) The cool-down phase consisted of light running, stretching of the main muscle groups involved, and postural exercises.

Results

The study participants completed the MTT session without experiencing muscle and joint problems and stated the Rate of Perceived Exertion (RPE) before and after the execution of each circuit and entire training session. Furthermore, the participants provided positive feedback on the feasibility and safety of the MTT session. Anthropometric characteristics and physiological and perceptual parameters of the participants are shown in Table 1.

Table 1. Anthropometric characteristics and physiological and perceptual responses of the participants

Participant	Age (yrs)	Seniority (yrs)	BMI (kg/m^2)	BF%	HRmax (bpm)	RPE[1] pre-post		
						Circuit 1	Circuit 2	Circuit 3
Officer n.1	43	14	24.6	23.6	171	2-5	3-6	4-7
Officer n.2	38	17	20.7	17.1	185	2-7	5-8	6-9
Officer n.3	52	26	29.8	27.7	192	3-5	3-6	4-7
Officer n.4	52	32	33.2	29.8	174	5-8	8-9	8-10

Notes. [1]RPE: Rating of Perceived Exertion measured by Borg scale CR10 at 10 points (0 = nothing at all to 10 = extremely strong)

The heart rate trend monitored during the entire training session is shown in Figures 1-4.

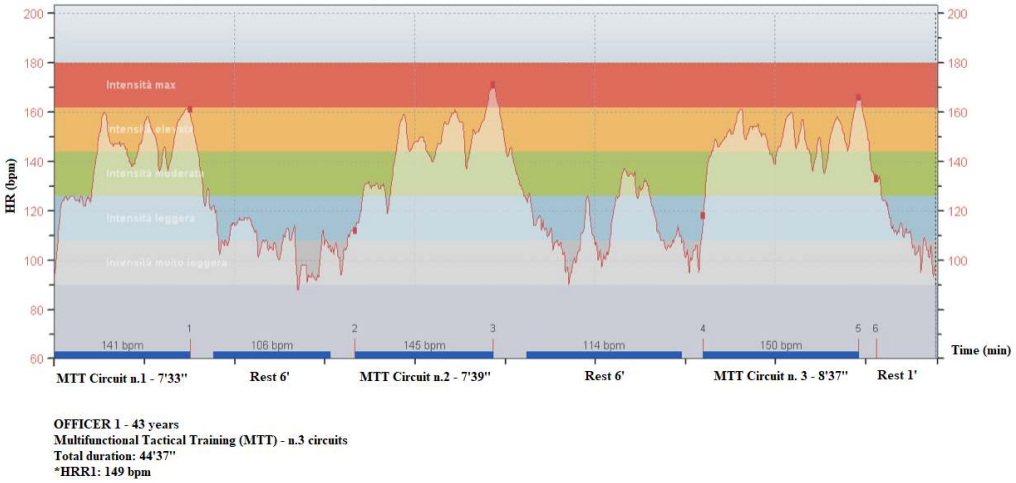

Figure 1. Monitoring of the Heart Rate of the officer n.1 during the performance of the Multifunctional Tactical Training. *HRR1: Heart rate recovery at one minute of rest.

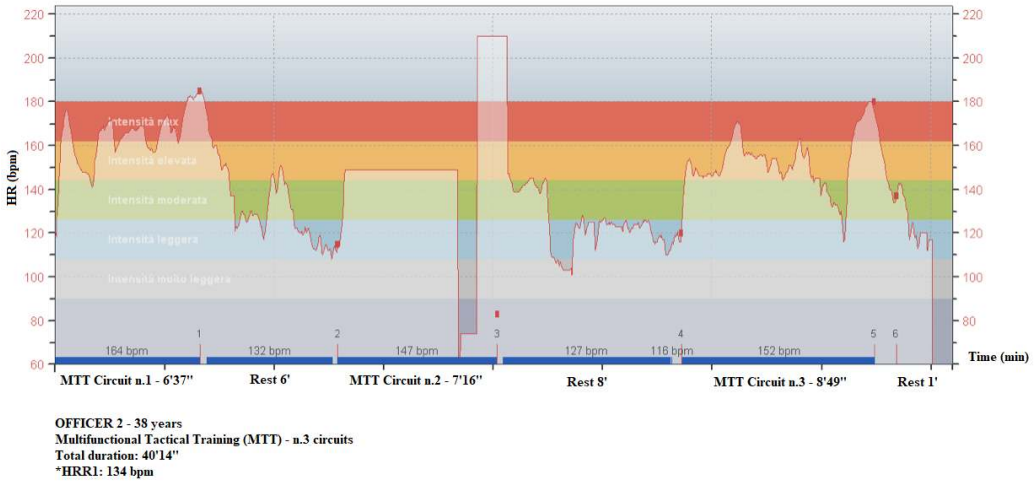

Figure 2. Monitoring of the Heart Rate of officer n. 2 during the performance of the Multifunctional Tactical Training. During the second circuit, there was a detachment of the cardio transmitter which resulted in a false value of the HRmax > 200 bpm. *HRR1: Heart rate recovery at one minute of rest.

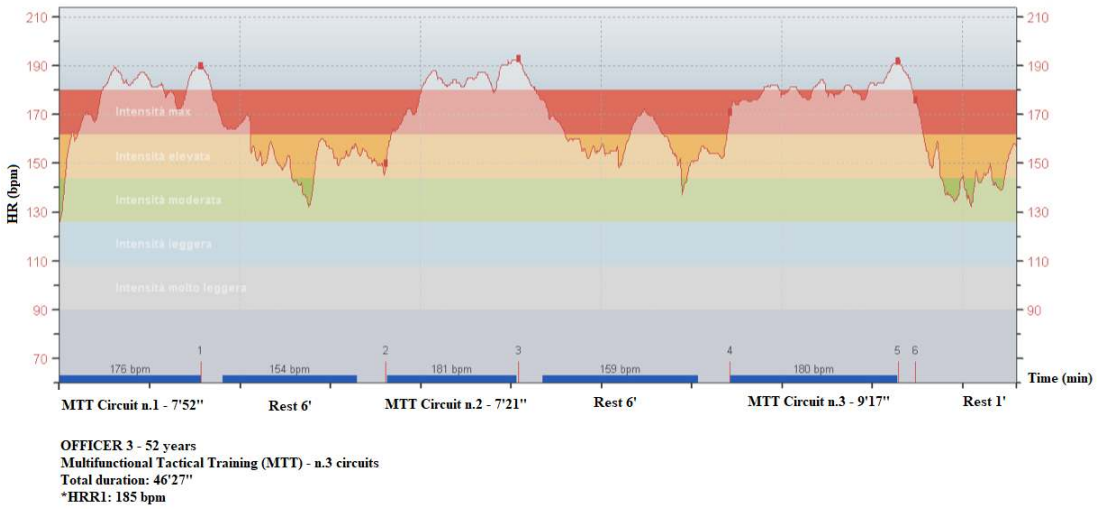

Figure 3. Monitoring of the Heart Rate of the officer n.3 during the performance of the Multifunctional Tactical Training. *HRR1: Heart rate recovery at one minute of rest.

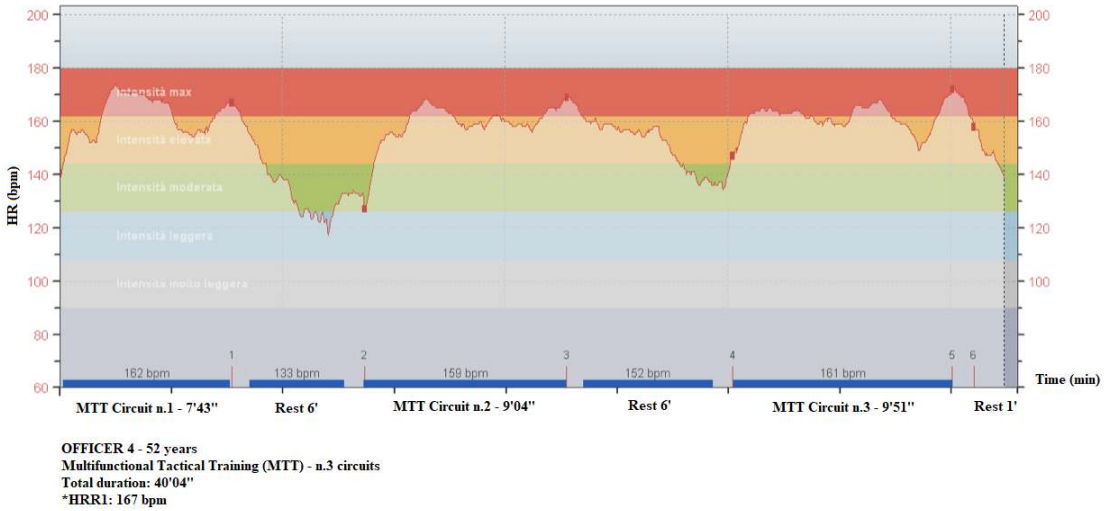

Figure 4. Monitoring of the Heart Rate of the officer n.4 during the performance of the Multifunctional Tactical Training. *HRR1: Heart rate recovery at one minute of rest.

Discussion

In this preliminary study, a new training method was designed and developed for tactical populations and specifically for the operators of the Mobile Police Units. The MTT was examined at a basic level of difficulty from which further levels (intermediate and advanced) will flow to be studied and adapted to the characteristics of the police officers. The first purpose of this preliminary study was to monitor and evaluate the physiological and perceptual impact of the MTT on the officers in the Mobile Unit to verify its feasibility, safety, and effectiveness in terms of cardiorespiratory performance. The results showed that the police officers coped with the session by training the cardiorespiratory system effectively and safely and that recovery times were adequate. Also, the police officers were free to self-pace while performing the various steps of the MTT circuits; this allowed the officers to adjust the intensity and effort at their discretion to complete the task in the most efficient manner possible. For example, officer n.4 (see Figure 4) showed a lower average heart rate in the second (159 bpm) than in the first (162 bpm) circuit because he tried to adjust the intensity of the training to finish the whole session. Thus, the physiological load that the MTT has produced in the police officers can be considered "training" and "safe" since, respecting the principles of the modern tactical training methodology (Alver et al., 2017), the circuit training is effective for the development of the physical and working ability of police officers as previous studies have shown (Norris et al., 1990; Norvell & Belles, 1993; Willis et al., 2019).

A further aim of the study was to design and develop a new training method called MTT to increase the physical and working ability of the operators of the Mobile Units. The central phase of the MTT, i.e., the execution of the circuit developed respecting the principles of individualisation, progressiveness, variety, and multi-laterality of the load, performed under the supervision of State Police instructors experienced in physical conditioning, showed considerable cardiorespiratory effectiveness and safety of execution of tactical tasks. The results agree with a previous study that demonstrated the effectiveness of multilateral training in increasing physical performance in police officers (Fischetti & Greco, 2017). Furthermore, preventive, and compensatory motor education exercises have been included in the MTT method, which are considered fundamental for increasing physical and work performance (Beck et al., 2015; Greco & Fischetti, 2018; McGill, 2010) and for the prevention of injuries (McGill, 2015). In this study, elastic band exercises, slam ball throwing, planks, and speed ladders were performed; all functional exercises (Mauro, 2016) necessary for police officers, as the required work tasks stress the Core which is composed of the lumbar spine, the muscles of the abdominal wall, the back extensors and the quadratus lumborum and, also, from the multiarticular muscles such as the latissimus dorsi and the psoas and, for the anatomical and biomechanical synergy with the pelvis, from the gluteal muscles (McGill, 2010). In the exercises with elastic bands, we wanted to give importance to the development of neuromotor control and proprioceptive ability (Grosprêtre et al., 2019) to improve the postural control and neuromuscular efficiency of the police officer during work, preventing injuries. Training with elastic bands has been shown to increase power, strength, and peak speed, especially during eccentric contraction (Stevenson et al., 2010). Finally, the exercises with the slam ball as well as the Ladder have been developed to improve the power of the upper and lower limbs as well as the learning of the rotation of the pelvis in the execution of the "Combat" position, considered a "multipurpose position" for the tactical tasks of police officers (De Ronzi & Brindisi, 2002).

Conclusion

The MTT proved to be a valid, safe, and effective training method for the case examined, characterized by multiple and functional exercises and simulations of tactical tasks. Also, the optimization of training spaces and times could favour the adherence of police officers to this type of physical conditioning alternative to traditional training methods. The findings may confirm the effectiveness of multilateral training to improve the physical performance of police officers (Fischetti & Greco, 2017). As with multilateral training, MTT included preventive and compensatory motor training exercises, considered essential for increasing physical and working performance and preventing the risk of injury (Greco et al., 2019; Greco & Fischetti, 2018; McGill, 2010). It would be necessary to recommend continuous physical-motor education among police officers (Fischetti & Greco, 2017) and verify the effects of the MTT method on all components of physical fitness. Furthermore, it would be appropriate to design additional training protocols with increasing levels of difficulty included in integrated programs with a specific part dedicated to the development of maximum strength to improve the working efficiency of police officers. Finally, the preliminary results of the study lay the foundations for the future development of studies to be replicated on a larger sample, with longitudinal design lasting at least 6-8 weeks, with at least two sessions per week and, possibly, controlled to provide rigorous and generalizable scientific conclusions.

Authors' contributions

Roberto De Ronzi coordinated and carried out the study, developed the training method and revised the manuscript. Ottavio Andriani collected, processed, and interpreted the data and revised the manuscript. Gianpiero Greco contributed to the design of the study, the development of the training method, the interpretation of the data, wrote and revised the manuscript. All authors approved the final version of the manuscript.

Informed Consent Statement
Informed consent was obtained from all subjects involved in the study. The study was carried out following the recommendations relating to the epidemiological emergency from COVID-19

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Conflicts of Interest
The authors declare no conflict of interest.

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