



Adherence to Mediterranean Diet of children living in small Southern Italian villages

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Manuscripts

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4 **Adherence to Mediterranean Diet of children living in small Southern**
5 **Italian villages**
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1 Adherence to Mediterranean Diet of children living in small Southern 2 Italian villages

3 A cross-sectional study was conducted in the primary schools of five small villages of
4 Salento Peninsula to evaluate the adherence to the Mediterranean Diet (MD) of 282 6-8-
5 years old children in relation to lifestyles and socio-economic factors. The parents of
6 children completed a self-administered questionnaire to evaluate the prevalence of
7 personal, behavioral and socio-economic factors of their sons. Children's
8 anthropometric measurements were also taken. The adherence to the MD was assessed
9 using the Mediterranean Diet Quality Index for Children and Adolescents (KIDMED).
10 The chi-square test was used to detect any differences among groups of children.
11 Overall, 27.0% of children showed low adherence to the MD (KIDMED ≤ 3), 59.6%
12 medium adherence (KIDMED 4-7) and 13.5% high adherence (KIDMED ≥ 8). The
13 adherence to the MD was associated with the educational level (whether graduated or
14 not) of the mother and the occupational status (whether employed or not) of both
15 parents.

16 Keywords: Mediterranean diet; food habits; lifestyles; children; KIDMED.

17

18 **Introduction**

19 The Mediterranean Diet (MD) is a nutritional model inspired by the eating habits widespread
20 among the populations living in the Mediterranean olive-growing areas in 1960s (Metelas et
21 al. 2000; Bach et al. 2006). It is not very caloric diet, based on varied, fresh, local and
22 seasonal products (Willett et al. 1995; De Lorgeril et al. 1999; Davis et al. 2015),
23 characterized by high consumption of pulses, unrefined cereals, fruit and vegetables,
24 moderate to high consumption of fish, moderate consumption of dairy products (mostly as
25 cheese and yogurt) and poultry, moderate wine consumption, and low consumption of red or
26 processed meat (Bach-Faig et al. 2011). Olive oil is the main source of dietary fat: this results
27 in a high monounsaturated/saturated fat ratio (Panagiotakos et al. 2005).

28 The MD is considered one of the healthiest eating patterns. Recent meta-analysis of
29 observational studies demonstrated that high adherence to the MD is associated to an
30 increased life expectancy (Martinez-Gonzalez and Martin-Calvo 2016), lower morbidity and
31 mortality (Sofi et al. 2014), lower incidence of chronic diseases such as cardiovascular
32 diseases (Grosso et al. 2017); and cancer (Schwingshackl and Hoffmann 2015). If acquired
33 from the earliest stage of life, this food model contributes, together with a correct lifestyle, to
34 maintain an optimal health status even in adulthood (van der Laar et al. 2013).

35 The MD is not just an eating pattern but also a lifestyle that is part of a broader cultural and
36 social context, so that it was acknowledged as intangible cultural heritage of humankind by
37 UNESCO, which initially recognized this heritage belonging to Italy, Morocco, Greece and
38 Spain and then extended it to Cyprus, Croatia and Portugal (UNESCO 2013).

39 In the last decades, however, people living in the Mediterranean countries, especially children
40 and adolescents, are replacing their traditional diet with other less-healthy eating habits
41 (Hebestreit et al. 2010; Bonaccio et al. 2014).

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3 42 The progressive globalization of food products contributed (Lazarou et al. 2009) to the spread
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5 43 of high energy density nutritional models, rich in saturated fats and poor in vitamins. This
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7 44 phenomenon is also related to the increase of childhood obesity in the Mediterranean area
8
9 45 including Italy and specifically the Southern Italian regions (Bonaccio et al. 2012; Tognon et
10
11 46 al. 2014).

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14 47 Although the spread of the Mediterranean dietary pattern has been widely studied in the adult
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16 48 population in different parts of the world, studies exploring adherence to the MD in paediatric
17
18 49 samples are scarce, especially among Italian children.

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21 50 In this paper, the eating habits and the level of adherence to the MD of 6-8-years old children
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23 51 living in five small villages located in Salento (Southern Italy) were assessed by a cross-
24
25 52 sectional study. Lifestyle and socio-economic factors were also taken into consideration. The
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27 53 results were then compared with those of other studies involving Italian children of the same
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29 54 age.

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34 35 56 **Material and methods**

36 37 57 *Study design*

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40 58 The present cross-sectional study was part of the “Early Biological Effects of Environmental
41
42 59 Pollution in the Population of the Union of Municipalities of Terre d'Oriente” (EFFE.B.I.P.)
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44 60 Study, a research project aimed to detect early DNA damage associated to environmental
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46 61 exposure and lifestyles in 6-8-years-old children living in a central-eastern area of Salento
47
48 62 Peninsula. The study, following the MAPEC_LIFE project protocol (Feretti et al 2014),
49
50 63 provided for: a) the recruitment of children attending primary school in a central-eastern area
51
52 64 of Salento Peninsula; b) the administration of a questionnaire to the parents of children
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54 65 recruited concerning lifestyles and eating habits of their children; c) the sampling of
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56 66 exfoliated buccal cells of children to detect Micronuclei, as biomarkers of genotoxic effect
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3 67 associated to environmental pollution and lifestyles; d) the monitoring of air quality through a
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5 68 high volume sampler placed in the schoolyard in the same days of the biological sampling.
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10 70 ***Study population***

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12 71 The children involved in the study was part of the 6-8-years-old population, counting 518
13
14 72 children, living in five small villages of the Province of Lecce (Cursi, Giurdignano, Muro
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16 73 Lecce, Otranto and Uggiano la Chiesa) with a total population of 21,177 inhabitants
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18 74 (ISTAT 2018).

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21 75 These municipalities are located in a central-eastern area of Salento Peninsula, bordering
22
23 76 Adriatic Sea, characterized by a predominantly agricultural economy. Furthermore, the
24
25 77 prevalence of farms in these municipalities (26.7%) is higher than in the whole Province
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27 78 (14.1%) (Lecce Chamber of Commerce 2019).
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33 80 ***Recruitment***

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35 81 The recruitment was made randomly on voluntary basis among children that in the school
36
37 82 year 2017-2018 attended the first, second and third classes of the primary schools in the five
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39 83 villages. Children's parents were involved in meetings held at school where members of the
40
41 84 research team explained the study aims and methods as well as the exclusion criteria (age
42
43 85 below six years or equal/above nine, residence in cities other than those involved in the study,
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45 86 presence of serious illness, exposure to radiographic testing in the month preceding the
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47 87 investigation, exposure to radiotherapy or chemotherapy in the 12 months preceding the
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49 88 investigation, use of dental braces).
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56 90 ***Questionnaire administration***
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3 91 Parents who consented to the participation of their children in the study, signed the Consent
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5 92 Form and filled in a self-administered questionnaire in April 2018, developed by Zani et al.
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7 93 (2015) to obtain the following information: child's personal information (sex, date and nation
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9
10 94 of birth); child's health status; domestic environment (traffic ~~level-intensity~~ near the home,
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12 95 fuel used for heating and cooking, people who smoke inside the dwelling, use of solvents for
13
14 96 hobbies); information on child's lifestyle (physical exercise, staying in the kitchen during
15
16 97 food cooking, consumption of barbecued, griddled, fried, toasted or smoked food); parents'
17
18 98 characteristics (nation of birth, level of education, occupational status, smoking habits);
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20 99 child's dietary habits. The dietary section was based on ARCA questionnaire (Barba et al.
21
22 100 2012), modified with the addition of some information regarding breakfast and weekly fast
23
24 101 food frequency, contained a total of 109 items on frequency of food consumption including a
25
26 102 short section on the type of fat used for preparing, cooking and dressing the food.
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29 103 For each item there were seven different options of consumption frequency, listed in
30
31 104 ascending order from "never" to "2 times or more a day". Nine categories for frequency of
32
33 105 drinking sugar-sweetened beverages from "never" to "6 times or more a day" were included,
34
35 106 since it was assumed that several doses could be consumed a day. For the olive oil, the
36
37 107 consumption unit corresponded to 1 tablespoon of oil (about 10 g) while for the butter to a
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39 108 knob of butter (about 10 g).
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47 ***Anthropometric measurements***

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49 111 Anthropometric measurements were taken, according to WHO recommendations (1995), at
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51 112 school during the morning hours before break time. Weight and height data were used to
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53 113 calculate the children's body mass index (BMI) (weight [kg]/height [m]squared). This was
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55 114 used in turn to assess whether the child was underweight (UW), of normal weight (NW),
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57 115 overweight (OW) or obese (OB). The cut-off points used to classify weight status categories
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3 116 were those established by World Obesity Federation (WOF), formerly International Obesity
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5 117 Task Force (IOTF), that define UW, OW and OB with reference to the BMI threshold values
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7 118 for boys and girls aged 2-18 years on the basis of adult values (underweight = 18.5 kg/m²;
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9 119 overweight = 25 kg/m²; obesity = 30 kg/m²) (Cole and Lobstein 2012).
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14 121 *Data analysis*

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17 122 All data obtained from the questionnaires administration were entered into a Microsoft Excel
18
19 123 database and statistically processed using MedCalc Software version 12.3 (MedCalc Software
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21 124 bvba, Ostend, Belgium).

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24 125 The answers were analysed in order to assess the average values and the standard deviation
25
26 126 (SD) of quantitative variables (i.e. age, height, weight, BMI), and the relative frequency,
27
28 127 expressed as percentage (%), of qualitative variables. The chi-square test was used to detect
29
30 128 any differences in the level of adherence among groups of children with specific
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32 129 characteristics. Differences were considered significant at $p < 0.05$.

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35 130 In order to determine the average weekly consumption of the main food categories, the
36
37 131 different items listed in the food frequency section of the questionnaire were divided as
38
39 132 follows: bread, pasta and rice, pizza and focaccia, pulses, vegetables, fresh fruit, nuts, red and
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41 133 processed meat, poultry, fish, eggs, milk and dairy products, cakes, snacks, soft and fizzy
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43 134 drinks. The options of consumption frequency for each food and beverage category was
44
45 135 transformed as follows: the option 'never' became '0 times per week', 'less than 1 time per
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47 136 week' became '0.5 times per week', '1–2 times per week' became '1.5 times per week', '3–4
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49 137 times per week' became '3.5 times per week', '5–6 times per week' became '5.5 times per
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51 138 week', 'once per day' became '7 times per week', '2 times per day' became '14 times per
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53 139 week', '4 times per day' became '28 times per week' and '6 times per day' became '42 times
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55 140 per week'.
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5 142 ***Adherence to the MD***

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7 143 In order to evaluate the adherence of the children's diet to the Mediterranean model we used
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9 144 the “Mediterranean Diet Quality Index for children and adolescents” (KIDMED) (Serra-
10
11 145 Majem et al. 2004). It is based on the principles sustaining Mediterranean dietary patterns as
12
13 146 well as those that undermine it. It includes 16 yes or no questions. Questions indicating a
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15 147 negative connotation with respect to the MD were assigned a value of -1 (going more than
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17 148 once a week to a fast-food (hamburger) restaurant, skipping breakfast, having commercially
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19 149 baked goods or pastries for breakfast, taking sweets and candy several times every day) and
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21 150 those with a positive aspect +1 (taking a fruit or fruit juice every day, having a second fruit
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23 151 every day, having fresh or cooked vegetables regularly once a day, having fresh or cooked
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25 152 vegetables more than once a day, consuming fish at least 2-3 times per week, eating pulses
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27 153 more than once a week, consuming pasta or rice 5 or more times per week, having cereals or
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29 154 grains for breakfast, consuming nuts at least 2-3 times per week, using olive oil at home,
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31 155 having a dairy product for breakfast, taking two yoghurts and/or some cheese daily). The total
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33 156 score ranges from -4 to 12 and wasis classified into 3 levels: ≥ 8 reflects a high adherence to
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35 157 the MD; 4–7, moderate adherence; ≤ 3 , low adherence.
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44 159 ***Ethical aspects***

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46 160 The study was approved by the Ethical Committee of the Lecce Local Health Authority
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48 161 (ASL/LE) on February 5, 2018 with deliberation n°15. Participation in this study was
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50 162 voluntary. All parents of eligible children received oral and written information on the study
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52 163 and, in case of acceptance of participation, expressed their consent by signing the informed
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54 164 consent. Even the children expressed their assent to participation through a specially prepared
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56 165 assent form. All data were collected and analysed confidentially in accordance with Italian
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3 166 laws (Legislative Decree n. 196 of 30/6/2003 and subsequent additions), for research
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5 167 purposes.
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10 169 **Results**
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12 ~~As reported in Table 1,~~ 170 The parents of four hundred fifty-five 6-8-years old children that in
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14 171 March 2018 attended the first, second and third classes of the primary schools were invited to
15
16 172 participate in the study. Of these, 310 (68.1%) accepted by signing the consent form and,
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18 173 subsequently, filling the questionnaire on lifestyle and eating habits of their children.
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20 174 The final sample, excluding the invalid questionnaire (9.0%) because of the incomplete
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22 175 filling, was of 282 children corresponding to 54.3% of the population aged 6-8 years living in
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24 176 the municipalities involved in the study ([Suppl.T1](#)).
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30 178 ~~[Table 1 near here]~~
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35 180 The characteristics of study population were reported in Table [12](#). All children were born in
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37 181 Italy, 157 of them (55.7%) were males and 125 (44.3%) females. At the time of the
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39 182 recruitment, 79 children (28.0%) were 6 years old, 96 (34.0%) were 7 years old and 107
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41 183 (37.9%) were 8 years old with a mean age of 7.62 ± 0.84 .
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45 184 The recruited children had a mean weight of 28.1 ± 6.8 kg, a mean height of 127.9 ± 7.1 cm
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47 185 and a mean BMI of 17.0 ± 2.8 kg/m². According to IOTF cut-offs, 60.3% of subject were
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49 186 normal weight, 30.1% were overweight, included obese (9.2%), while 9.6% were
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51 187 underweight.
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54 188 One hundred forty-eight children (53.2%) regularly practiced a sport and 196 (70.0%) played
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56 189 outdoor every day for more than 1 hour. Only 39 children (13.9%) were considered “inactive”
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58 190 because they didn’t practice any sport or played outdoor for less than 1 hour per day.
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3 191 With reference to parents' educational level, 18.9% and 10.7% of children had respectively
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5 192 graduated mother and father. Moreover, 47.0% of mothers and 86.4% of fathers were
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7 193 employed.
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12 195 [Table 12 near here]
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17 197 The weekly consumption of food and beverages \pm standard deviation (SD) by the children
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19 198 participating in the study is shown in Figure 1. On average, fresh fruit, vegetables, milk and
20
21 199 dairy products, cakes, pasta and rice were consumed more than once a day; bread, red or
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23 200 processed meat about once a day; soft and fizzy drinks two to five times a week; eggs, pizza
24
25 201 and focaccia, potatoes, nuts, poultry, fish, snacks about once a week; pulses less than once a
26
27 202 week. As for the condiments, olive oil (8.22 tablespoons of oil per week) was used more
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29 203 frequently than butter (0.97 knobs of butter per week).
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35 205 [Figure 1 near here]
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40 207 In the month preceding the survey many children consumed food prepared using cooking
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42 208 methods considered "risky" for the production of toxic substances (Table 23). In particular,
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44 209 91.4% of children consumed fried food, 78.3% wood-fired pizza and 54.7% grilled food.
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49 211 [Table 23 near here]
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53
54 213 Table 34 shows the mean KIDMED score \pm SD and the level of adherence to the MD of the
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56 214 children recruited in the EFFE.B.I.P. Study. It was classified according to KIDMED index
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58 215 scores as low (KIDMED \leq 3), medium (KIDMED 4-7) or high (KIDMED \geq 8) and evaluated
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216 according to some characteristics or lifestyles of the participants. Overall, 27.0% of recruited
217 subjects displayed low adherence to the MD, 59.6% medium adherence and 13.5% high
218 adherence, with a mean KIDMED score of 4.93 ± 2.30 .

219 The adherence to the MD was significantly associated ($p < 0.05$) with the educational level (if
220 graduated or not graduated) of the mother and the occupational status (if employed or
221 unemployed) of both parents. Instead, it seemed to be independent from sex, age, city of
222 residence, weight status and physical activity.

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224 [Table 34 near here]

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226 Table 45 shows the frequency (%) of children who answered “yes” to each question posed by
227 the KIDMED test. Among the items consistent with the MD, children seemed to follow
228 mostly “using olive oil at home” (96.8%), “consuming pasta or rice 5 or more times per
229 week” (89.4%) and “taking a fruit or fruit juice every day” (82.6%). On the contrary, the
230 percentage of children who consumed vegetables more than once a day (23.8%), pulses more
231 than once a week (40.1%), cereals or grains for breakfast (14.5%), nuts regularly (19.5%) and
232 yoghurt and cheese daily (27.7%) appeared insufficient. In addition, 62.4% had commercially
233 baked goods or pastries for breakfast and 60.6% of children consumed sweets and candies
234 several times every day. Finally, it should be underlined the prevalence of children who
235 skipped breakfast (23.4%) and went more than once a week to a fast-food restaurant (9.9%).

236 The responses were also evaluated according to sex, weight status, sport activity and
237 socioeconomic variables (educational level and employed situation of parents).

238 The analysis showed that boys had a significantly higher ($p < 0.05$) tendency to consume the
239 second fruit of the day than girls (66.2% vs 48.0%). The frequency of children who consumed
240 nuts at least two times per week is higher among sons of graduated mothers (30.2%), while

241 the rate of children who consumed fish at least two times per week is higher among sons of
242 employed parents (86.4% for occupied mothers and 79.3% for occupied fathers) and among
243 children who practiced regularly sport (82.4%). Finally, the sons of employed fathers had a
244 greater attitude to consume vegetables (58.3%), in contrast with the sons of unemployed
245 fathers (39.5%) who, instead, went more frequently to fast-food restaurants (28.9%).

246

247 [Table 45 near here]

248

249 **Discussion**

250 The EFFE.BI.P. Study involved 282 6-8-years old children attending the primary school in
251 five cities (Cursi, Giurdignano, Muro Leccese, Otranto e Uggiano la Chiesa) located in the
252 central-eastern area of the Province of Lecce with a population range of 1.943 (Giurdignano)
253 to 5.799 (Otranto) inhabitants (ISTAT 2018).

254 The level of participation was high (68.1%), even higher than that observed in the
255 MAPEC_LIFE study (56.2%), which involved Italian children of the same age recruited using
256 the same method (Bagordo et al. 2017).

257 Data analysis on eating habits of recruited subjects, revealed that the consumption of some
258 food appeared to be altered if compared to the Mediterranean food model (Davis et al. 2015).

259 In fact, children consumed on average low level of pulses as well as high level of sweet
260 drinks, butter and red or processed meat while the average consumption of fish, pasta,
261 vegetables and fresh fruit seemed to be consistent with the MD. This results in a high intake
262 of simple sugars and saturated fats, with a tendency to reverse the ratio of
263 monounsaturated/saturated fatty acids, in contrast with the principles of the Mediterranean
264 food pattern (Panagiotakos et al. 2006).

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3 265 The level of adherence to the MD measured by the KIDMED index (Serra-Majem et al. 2004)
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5 266 indicated that the diet of most children was not consistent with the Mediterranean pattern. It
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8 267 reflects a poor diet for 27.0% of children and good one only for 13.5% of them. The survey
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10 268 also allowed to detect a frequent consumption of food prepared by cooking methods
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12 269 (barbecued, griddled, fried, toasted, smoked) considered “risky” for the health due to the
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14 270 production of toxic compounds such as acrylamide, heterocyclic amines, nitrosamines and
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16 271 polyaromatic hydrocarbons (Lodovici et al. 1995; Jägerstad and Skog 2005; Katic et al.
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18 272 2010).
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20
21 273 Grosso and Galvano (2016) reported the results of several studies performed to describe the
22
23 274 level of adherence to the MD among European children and adolescents. Many studies
24
25 275 concluded that the adherence to the MD of young population in Spain, Greece and Italy was
26
27 276 mainly poor and highlighted the need of an effective nutritional education program. In Italy, a
28
29 277 study on 1135 subjects aged 13-16 years old (Grosso et al. 2013) reported a general poor
30
31 278 quality of food consumption in adolescents away from the MD, especially among those living
32
33 279 in urban areas. In addition, two big studies were carried out in order to evaluate the eating
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35 280 habits of Italian children attending primary school. These studies could be considered to
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37 281 compare the level of adherence to the MD between the children recruited in the present
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39 282 research and other Italian children of the same age (Table 56). The former, the ZOOM8 Study
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41 283 (Roccaldo et al. 2014), was conducted in 2009 and included 1740 8-9-years old children from
42
43 284 all Italian regions. In this study the adherence to the MD was evaluated by the KIDMED
44
45 285 Index, using the Food Frequency Questionnaire (FFQ) developed according to Willett (1998).
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47 286 The latter, the MAPEC_LIFE Study, was carried out in 2014-2016 on 1164 6-8-years old
48
49 287 children living in five Italian towns (Lecce, Brescia, Torino, Pisa and Perugia) using the FFQ
50
51 288 developed by Barba et al. (2012) and the Italian Mediterranean Index (IMI) (Agnoli et al.
52
53 289 2011) modified by Zani et al. (2016).
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3 290 The adherence to the MD of children recruited in the present research seemed to be higher
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5 291 ($p < 0.01$) than what observed in [the MAPEC_LIFE Study](#) and [the ZOOM8 Study](#).
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10 293 [Table [56](#) near here]
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14 295 These results could be related to the specific characteristics of the cities involved in the
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16 296 EFFE.B.I.P. Study. In these little villages, mainly characterized by an agricultural economy
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18 297 (Lecce Chamber of Commerce 2019), there could be a greater and easier availability of
19
20 298 “Mediterranean” food, such as fish, fruit and vegetables, the latter often deriving from family
21
22 299 farms. Moreover, in these areas the gastronomic traditions of the peasant culture, typical of
23
24 300 the MD, still survive. This trend was also observed in a recent study conducted in another
25
26 301 area of the Province of Lecce (Idolo et al. 2018) and confirmed the results found by Roccaldo
27
28 302 et al. (2014) who underlined a higher adherence to the MD of Italian children living in cities
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30 303 with a population less than 10.000 inhabitants compared to those who live in larger cities.
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34 304 However, the ZOOM8 Study considered the low consumption of fruit and vegetables as one
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36 305 of the factors responsible for the low adherence to the MD observed in ~~reeriuited~~[recruited](#)
37
38 306 children. Instead, in our study the low level of adherence to the MD was mainly attributable
39
40 307 to the low consumption of vegetables, cereals or grains for breakfast and nuts, as well as high
41
42 308 consumption of commercially baked goods or pastries for breakfast, sweets and candies.
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45
46 309 The adherence to the MD was associated to socio-economic factors. Indeed, children who
47
48 310 have graduated mother and employed parents had eating habits closer to the MD. On the
49
50 311 contrary, sex, weight status, age, city of residence and physical activity seemed to have no
51
52 312 effect on the adherence level to the MD. The cultural level of parents was previously found to
53
54 313 play a decisive role in determining the dietary pattern of both Mediterranean (Roccaldo et al.
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56 314 2014) and non-Mediterranean children (Patrick and Nicklas 2005). However, this study also
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3 315 added the importance of families' economic position, expressed as parents' occupational
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5 316 status, in the choice of food: families with economic availability choice better quality
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7 317 products (such as varied, fresh, local, organic or seasonal products) even if at higher costs
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9 318 (Costarelli et al. 2013; Tong et al. 2018) such as fish or fresh vegetables; unlike economically
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11 319 disadvantaged families choice less healthy alternatives such as fast-food.
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14 320 Among the different aspects of lifestyle, it is interesting to note that the most of children, with
15
16 321 a higher prevalence than that observed in other Italian studies (Donatiello et al. 2013;
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18 322 Bagordo et al. 2017), performed regular physical activity compatible with a healthy lifestyle,
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20 323 practicing a sport or playing outdoor for at least one hour a day. This seems to reflect on the
21
22 324 BMI and the prevalence of obese children, lower than that previously observed in same-age
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24 325 children living in Lecce (Grassi et al. 2016) and, more generally, in Southern Italy (Nardone
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26 326 et al. 2016).
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30 327 In the light of the above, the strategic role of a correct and effective nutritional education in
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32 328 health-promoting interventions is confirmed. It should be carry out by strategies and tools to
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34 329 overcome socio-cultural inequalities and to reach all interested parties more attractively than
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36 330 misleading advertising and unhealthy information spread through popular communication
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38 331 channels such as internet, social network, etc.
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41 332 As stated by a previous study (Carducci et al. 2016), children demonstrate to learn very
42
43 333 quickly the concepts about the correct lifestyles to prevent adverse health effects. However, it
44
45 334 is crucial to teach parents and the community about the hazards for children's health linked to
46
47 335 incorrect lifestyles, educating them about the special vulnerability of children and the
48
49 336 practices to be adopted to reduce individual risk factors (Norton et al. 2003; Dziubanek et al.
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51 337 2013). Previous studies indicated that active communication with the paediatricians (Galvez
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53 338 et al. 2007), the information through mass-media (Dziubanek et al. 2013) and the involvement
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3 339 of parents in school education programs (Golley et al. 2011) could contribute to adopt health-
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5 340 promoting behaviours.

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7 341 Results of the present study should be considered in light of some limitations. Firstly, it
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9 342 should be noted that the recruitment was conducted on voluntary basis, so that, a selection
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11 343 bias caused by cultural or motivational factors cannot be excluded. Secondly, with the
12
13 344 exception of the anthropometric parameters, all information is self-reported, therefore, it is
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15 345 possible that the consumption of individual food has been underestimated or overestimated
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17 346 depending on the subjective perception of the quantity consumed. Furthermore, in some
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19 347 cases, the tendency to conceal or minimize the behaviour of children considered incorrect by
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21 348 parents may be prevailed.
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27 28 350 **Conclusions**

29
30 351 The dietary habits of children living in five small Municipalities-villages of Salento Peninsula
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32 352 were partly far from the Mediterranean pattern and underlined a high consumption of food
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34 353 rich in saturated fats and simple sugars. However, a higher adherence to the MD was
35
36 354 highlighted compared to that observed in larger Italian cities due to a greater consumption of
37
38 355 “Mediterranean” food such as fish, fruit and vegetables. The socio-economic level of families
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40 356 seemed to be decisive in the choice of the dietary model. This underline, once again, the
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42 357 importance of health-promoting actions to overcome socio-cultural inequalities and avoid the
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44 358 spread of unhealthy information.
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20 368 Pollution in the Population of the Union of Municipalities of Terre d'Oriente” (EFFE.BI.P.).
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Table 1. Data on recruitment of children to the EFFE.B.I.P. Study.

| Municipality | Invited | Consents N (% of invited) | Invalid | Recruited N (% of consents) |
|---------------------|----------------|--------------------------------------|----------------|--|
| Cursi | 102 | 80 (78.4%) | 15 | 65 (81.3%) |
| Giurdignano | 62 | 36 (58.1%) | 4 | 32 (88.9%) |
| Muro-Leccese | 83 | 54 (65.1%) | 5 | 49 (90.7%) |
| Otranto | 106 | 69 (65.1%) | 2 | 67 (97.1%) |
| Uggiano-La Chiesa | 102 | 71 (69.6%) | 2 | 69 (97.2%) |
| TOTAL | 455 | 310 (68.1%) | 28 | 282 (91.0%) |

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Table 12. Data on personal and behavioural variables of the children participating in the study. (UW=underweight; NW=normal weight; OW=overweight; OB=obese; *children who didn't practice any sport or played outdoor for less than 1 hour per day).

| Variable | Unit of measure | Value |
|------------------------------|----------------------------|-----------------|
| Sex | | |
| Males | N (%) | 157 (55.7) |
| Females | N (%) | 125 (44.3) |
| Born in Italy | N (%) | 282 (100.0) |
| Age | | |
| 6 years-old | N (%) | 79 (28.0) |
| 7 years-old | N (%) | 96 (34.0) |
| 8 years-old | N (%) | 107 (37.9) |
| Average age | years \pm SD | 7.62 \pm 0.84 |
| City of residence | | |
| Cursi | N (%) | 65 (23.0) |
| Giurdignano | N (%) | 32 (11.3) |
| Muro Leccese | N (%) | 49 (17.4) |
| Otranto | N (%) | 67 (23.8) |
| Uggiano La Chiesa | N (%) | 69 (24.5) |
| Average height | kg \pm SD | 127.9 \pm 7.1 |
| Average weight | cm \pm SD | 28.1 \pm 6.8 |
| Average BMI | kg/m ² \pm SD | 17.0 \pm 2.8 |
| Weight status | | |
| UW | N (%) | 27 (9.6) |
| NW | N (%) | 170 (60.3) |
| OW (excluding OB) | N (%) | 59 (20.9) |
| OB | N (%) | 26 (9.2) |
| Sports | | |
| Outdoor play (>1 hours/day) | N (%) | 196 (70.0) |
| Inactive children* | N (%) | 39 (13.9) |
| Parents' level of education | | |
| Mother graduated | N (%) | 53 (18.9) |
| Father graduated | N (%) | 30 (10.7) |
| Parents' occupational status | | |
| Mother employed | N (%) | 132 (47.0) |
| Father employed | N (%) | 242 (86.4) |

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3 522 Table 23. Children who consumed food subjected to risky cooking methods in the month
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5 523 before the survey.
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| Variable | N (%) |
|--------------------------------|------------|
| Fried food | 254 (91.4) |
| Wood-fired pizza | 217 (78.3) |
| Barbecued food (wood/charcoal) | 152 (54.7) |
| Food cooked on the griddle | 147 (53.8) |
| Toasted bread | 132 (48.2) |
| Smoked food | 52 (18.8) |

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525 Table 34. Mean KIDMED score and adherence to the MD \pm SD of the children recruited in
 526 the EFFE.BI.P. Study.

| | Mean-KIDMED Mean score \pmSD | Low (KIDMED\leq3) | Adherence to the MD | | | <i>p</i>-value |
|------------------------------|--|---|-------------------------------|---|--|-----------------------|
| | | | Medium (KIDMED4-7) | High (KIDMED\geq 8) | | |
| Total | 4.93 \pm 2.30 | 27.0 | 59.6 | 13.5 | | |
| Sex | | | | | | |
| Male | 4.96 \pm 2.43 | 29.9 | 53.5 | 16.9 | | 0.075 |
| Female | 4.89 \pm 2.14 | 23.2 | 67.2 | 9.6 | | |
| Age | | | | | | |
| 6 years old | 5.04 \pm 2.20 | 22.8 | 65.8 | 11.4 | | 0.765 |
| 7 years old | 4.91 \pm 2.22 | 29.2 | 56.3 | 14.6 | | |
| 8 years old | 4.87 \pm 2.46 | 28.8 | 57.9 | 14.0 | | |
| City of residence | | | | | | |
| Cursi | 5.15 \pm 2.38 | 26.2 | 58.5 | 15.4 | | 0.159 |
| Giurdignano | 4.41 \pm 2.08 | 50.0 | 40.6 | 9.4 | | |
| Muro Leccese | 4.57 \pm 2.26 | 28.6 | 61.2 | 10.2 | | |
| Otranto | 5.15 \pm 2.56 | 20.9 | 62.7 | 16.4 | | |
| Uggiano La Chiesa | 5.00 \pm 2.08 | 21.7 | 65.2 | 13.0 | | |
| Weight status | | | | | | |
| Normal weight | 5.11 \pm 2.30 | 25.3 | 60.6 | 14.1 | | 0.339 |
| Obese | 4.81 \pm 1.77 | 26.9 | 69.2 | 3.8 | | |
| Sport | | | | | | |
| Yes | 5.06 \pm 2.30 | 25.0 | 60.1 | 14.9 | | 0.538 |
| No | 4.75 \pm 2.32 | 30.0 | 58.5 | 11.5 | | |
| Outdoor play | | | | | | |
| > 1 hour/day | 5.01 \pm 2.41 | 28.1 | 55.6 | 16.3 | | 0.069 |
| < 1 hour/day | 4.75 \pm 2.05 | 25.0 | 67.9 | 7.1 | | |
| Mothers' educational level | | | | | | |
| Graduated | 5.23 \pm 2.05 | 13.2 | 73.6 | 13.2 | | 0.038 |
| Not graduated | 4.87 \pm 2.36 | 29.8 | 56.6 | 13.6 | | |
| Fathers' educational level | | | | | | |
| Graduated | 5.57 \pm 1.98 | 13.3 | 66.7 | 20.0 | | 0.149 |
| Not graduated | 4.84 \pm 2.33 | 28.8 | 58.8 | 12.4 | | |
| Mothers' occupational status | | | | | | |
| Employed | 5.13 \pm 2.67 | 19.7 | 66.7 | 13.6 | | 0.038 |
| Unemployed | 4.77 \pm 2.33 | 32.9 | 53.7 | 13.4 | | |
| Fathers' occupational | | | | | | |

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| status | | | | | | |
|------------|-----------|------|------|------|-------|--|
| Employed | 4.98±2.32 | 24.8 | 60.7 | 14.5 | 0.048 | |
| Unemployed | 4.58±2.18 | 42.1 | 52.6 | 5.3 | | |

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3 528 Table 45. Frequency (%) of children who answered “yes” to each questions posed by the KIDMED test. A= Takes a fruit or fruit juice every day;
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5 529 B=Has a second fruit every day; C=Has fresh or cooked vegetables regularly once a day; D= Has fresh or cooked vegetables more than once a
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7 530 day; E=Consumes fish regularly (at least 2-3 times per week); F=Goes more than once a week to a fast-food (hamburger) restaurant; G=Eats
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9 531 pulses more than once a week; H=Consumes pasta or rice almost every day (5 or more times per week); I=Has cereals or grains (bread, etc.) for
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11 532 breakfast; J=Consumes nuts regularly (at least 2-3 times per week); K=Uses olive oil at home; L=Skips breakfast; M=Has a dairy product for
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13 533 breakfast (yoghurt, milk, etc.); N=Has commercially baked goods or pastries for breakfast; O=Takes two yoghurts and/or some cheese (40 g)
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15 534 daily; P=Takes sweets and candy several times every day.
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| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Total | 82.6 | 58.2 | 55.7 | 23.8 | 77.0 | 9.9 | 40.1 | 89.4 | 14.5 | 19.5 | 96.8 | 23.4 | 64.2 | 62.4 | 27.7 | 60.6 |
| Male | 84.1 | 66.2 | 58.0 | 22.9 | 77.1 | 10.8 | 35.7 | 90.4 | 16.6 | 18.5 | 95.5 | 24.8 | 63.1 | 64.3 | 29.9 | 61.8 |
| Female | 80.8 | 48.0 | 52.8 | 24.8 | 76.8 | 8.8 | 45.6 | 88.0 | 12.0 | 20.8 | 98.4 | 21.6 | 65.6 | 60.0 | 24.8 | 59.2 |
| <i>p-value</i> | <i>0.573</i> | <i>0.003</i> | <i>0.455</i> | <i>0.821</i> | <i>0.929</i> | <i>0.714</i> | <i>0.116</i> | <i>0.640</i> | <i>0.363</i> | <i>0.734</i> | <i>0.309</i> | <i>0.619</i> | <i>0.750</i> | <i>0.533</i> | <i>0.410</i> | <i>0.750</i> |
| Not obese | 82.4 | 59.4 | 55.1 | 24.2 | 76.2 | 9.0 | 39.1 | 89.8 | 15.2 | 18.8 | 96.5 | 23.0 | 63.3 | 61.7 | 27.7 | 59.8 |
| Obese | 84.6 | 46.2 | 61.5 | 19.2 | 84.6 | 19.2 | 50.0 | 84.6 | 7.7 | 26.9 | 100.0 | 26.9 | 73.1 | 69.2 | 26.9 | 69.2 |
| <i>p-value</i> | <i>0.954</i> | <i>0.274</i> | <i>0.671</i> | <i>0.743</i> | <i>0.465</i> | <i>0.186</i> | <i>0.381</i> | <i>0.624</i> | <i>0.454</i> | <i>0.457</i> | <i>0.699</i> | <i>0.840</i> | <i>0.436</i> | <i>0.588</i> | <i>0.887</i> | <i>0.465</i> |
| Doing sport | 83.1 | 56.8 | 54.7 | 24.3 | 82.4 | 9.5 | 41.2 | 91.9 | 14.2 | 16.9 | 95.9 | 24.3 | 66.9 | 62.2 | 30.4 | 56.8 |
| Not doing sport | 81.5 | 59.2 | 56.9 | 22.3 | 70.0 | 10.8 | 39.2 | 86.9 | 13.8 | 20.8 | 97.7 | 22.3 | 61.5 | 63.1 | 24.6 | 63.8 |
| <i>p-value</i> | <i>0.853</i> | <i>0.767</i> | <i>0.805</i> | <i>0.799</i> | <i>0.021</i> | <i>0.871</i> | <i>0.830</i> | <i>0.247</i> | <i>0.927</i> | <i>0.500</i> | <i>0.630</i> | <i>0.799</i> | <i>0.421</i> | <i>0.973</i> | <i>0.346</i> | <i>0.279</i> |
| Mother graduated | 81.1 | 56.6 | 58.5 | 20.8 | 81.1 | 5.7 | 52.8 | 90.6 | 9.4 | 30.2 | 100.0 | 20.8 | 67.9 | 56.6 | 17.0 | 60.4 |

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|----------------------|--------------|--------------|--------------|--------------|--------------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Mother not-graduated | 82.9 | 58.8 | 55.3 | 24.6 | 75.9 | 11.0 | 37.3 | 89.0 | 15.8 | 17.1 | 96.1 | 24.1 | 63.6 | 63.6 | 30.3 | 61.0 |
| <i>p-value</i> | <i>0.917</i> | <i>0.893</i> | <i>0.785</i> | <i>0.684</i> | <i>0.524</i> | <i>0.364</i> | <i>0.054</i> | <i>0.937</i> | <i>0.334</i> | <i>0.048</i> | <i>0.299</i> | <i>0.733</i> | <i>0.664</i> | <i>0.430</i> | <i>0.075</i> | <i>0.938</i> |
| Father graduated | 93.3 | 63.3 | 56.7 | 36.7 | 73.3 | 6.7 | 43.3 | 96.7 | 13.3 | 26.7 | 100.0 | 13.3 | 76.7 | 56.7 | 16.7 | 63.3 |
| Father not graduated | 81.2 | 57.2 | 55.6 | 22.0 | 77.2 | 10.4 | 39.2 | 88.4 | 14.8 | 18.8 | 96.4 | 24.4 | 62.8 | 62.8 | 28.4 | 60.0 |
| <i>p-value</i> | <i>0.162</i> | <i>0.654</i> | <i>0.933</i> | <i>0.118</i> | <i>0.806</i> | <i>0.747</i> | <i>0.810</i> | <i>0.284</i> | <i>0.953</i> | <i>0.434</i> | <i>0.611</i> | <i>0.259</i> | <i>0.194</i> | <i>0.648</i> | <i>0.250</i> | <i>0.876</i> |
| Mother occupied | 81.1 | 59.1 | 57.6 | 21.2 | 86.4 | 9.1 | 40.2 | 90.2 | 15.2 | 22.0 | 99.2 | 22.0 | 67.4 | 64.4 | 27.3 | 58.3 |
| Mother not occupied | 83.9 | 57.7 | 54.4 | 26.2 | 68.5 | 10.7 | 40.3 | 88.6 | 14.1 | 17.4 | 94.6 | 24.8 | 61.7 | 60.4 | 28.2 | 63.1 |
| <i>p-value</i> | <i>0.640</i> | <i>0.911</i> | <i>0.673</i> | <i>0.404</i> | <i>0.006</i> | <i>0.794</i> | <i>0.918</i> | <i>0.818</i> | <i>0.935</i> | <i>0.422</i> | <i>0.064</i> | <i>0.671</i> | <i>0.385</i> | <i>0.571</i> | <i>0.970</i> | <i>0.488</i> |
| Father occupied | 82.2 | 55.8 | 58.3 | 24.8 | 79.3 | 7.0 | 40.5 | 89.3 | 14.5 | 20.7 | 96.3 | 23.6 | 63.2 | 62.4 | 26.4 | 60.7 |
| Father not occupied | 84.2 | 71.1 | 39.5 | 15.8 | 60.5 | 28.9 | 34.2 | 89.5 | 15.8 | 13.2 | 100.0 | 21.1 | 71.1 | 60.5 | 31.6 | 57.9 |
| <i>p-value</i> | <i>0.945</i> | <i>0.110</i> | <i>0.046</i> | <i>0.312</i> | <i>0.018</i> | <i><0.001</i> | <i>0.576</i> | <i>0.808</i> | <i>0.974</i> | <i>0.388</i> | <i>0.475</i> | <i>0.894</i> | <i>0.450</i> | <i>0.967</i> | <i>0.641</i> | <i>0.876</i> |

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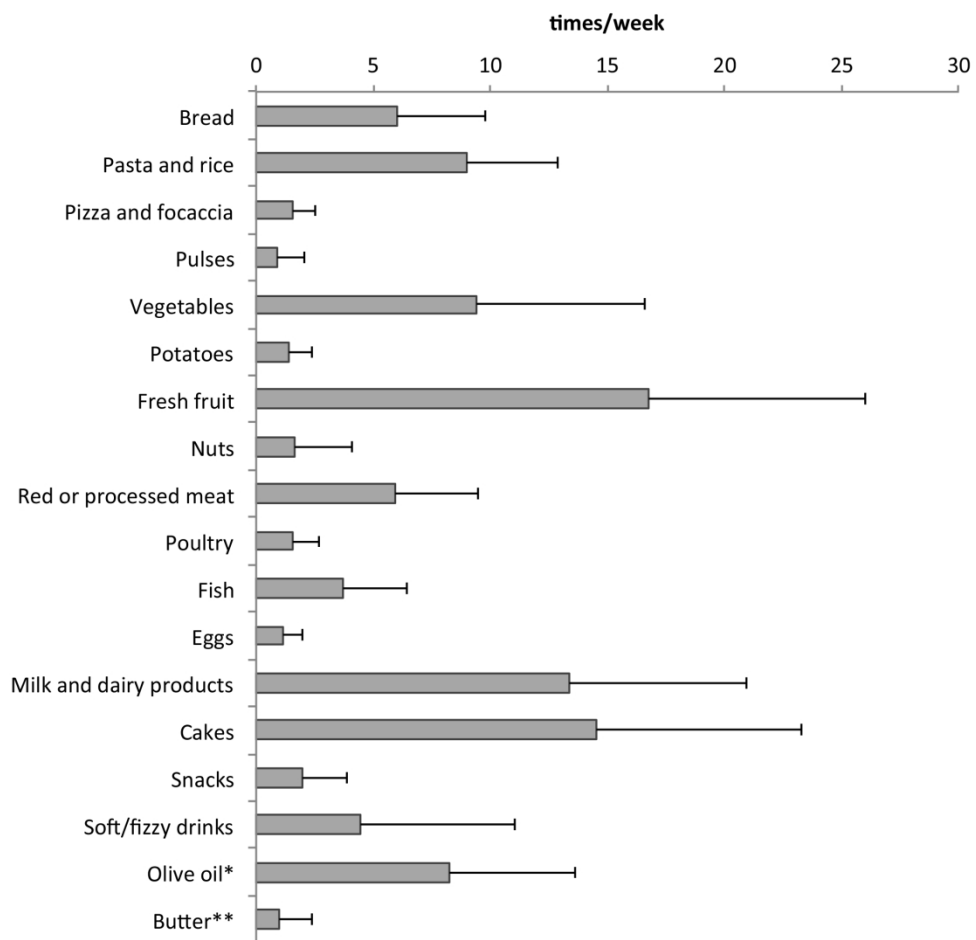
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3 536 Table 56. Adherence to the MD found in this study and in other two studies involving Italian
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5 537 children attending primary school. *Adherence evaluated by KIDMED score; **adherence
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8 538 evaluated by IMI score.
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| | n | Adherence to the MD (%) | | |
|--------------------------|-----|-------------------------|--------|------|
| | | Low | Medium | High |
| Roccaldo et al. (2014) * | | | | |
| North Italy | 635 | 35.1 | 58.9 | 6.0 |
| Centre Italy | 575 | 29.3 | 65.2 | 5.5 |
| South Italy | 530 | 35.7 | 60.0 | 4.3 |
| Zani et al. (2016) ** | | | | |
| Torino | 250 | 58.8 | 30.0 | 11.2 |
| Brescia | 227 | 56.4 | 32.1 | 11.5 |
| Pisa | 210 | 56.7 | 34.3 | 9.0 |
| Perugia | 235 | 56.6 | 28.5 | 14.9 |
| Lecce | 242 | 66.1 | 26.0 | 7.9 |
| This study* | 282 | 27.0 | 59.6 | 13.5 |

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3 541 Figure 1. Average weekly consumption of food and beverages, grouped in food categories, by
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5 542 the children participating in the study. *Tablespoons (about 10 g) of olive oil/week. **Knobs
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7 543 (about 10 g) of butter/week.
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38 Figure 1. Average weekly consumption of food and beverages, grouped in food categories, by the children
39 participating in the study. *Tablespoons (about 10 g) of olive oil/week. **Knobs (about 10 g) of
40 butter/week.

Suppl. T1. Data on recruitment of children to the EFFE.BI.P. Study.

| Municipality | Invited | Consents N (% of invited) | Invalid | Recruited N (% of consents) |
|---------------------|----------------|--------------------------------------|----------------|--|
| Cursi | 102 | 80 (78.4%) | 15 | 65 (81.3%) |
| Giurdignano | 62 | 36 (58.1%) | 4 | 32 (88.9%) |
| Muro Leccese | 83 | 54 (65.1%) | 5 | 49 (90.7%) |
| Otranto | 106 | 69 (65.1%) | 2 | 67 (97.1%) |
| Uggiano La Chiesa | 102 | 71 (69.6%) | 2 | 69 (97.2%) |
| TOTAL | 455 | 310 (68.1%) | 28 | 282 (91.0%) |

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