

Physical Fitness

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INTRODUCTION

Physical fitness is defined as the ability of body to function effectively, to enjoy leisure, to be healthy, to resist disease, and to cope with emergency situations. Physical fitness is categorized into two categories that have similar meaning: health-related (health state and well-being), skill-related (the ability to perform certain aspects of sports or occupations) (Hian et al., 2013). Physical fitness components such as muscular fitness (Ruiz et al., 2009), flexibility, cardiorespiratory fitness (Olds et al., 2006; Photiou et al., 2008) and speed-agility (Ortega et al., 2008), are strongly related to health in children and adolescent and must be considered when assessing one's health status.

Physical fitness is partially genetically determined, but it can also be influenced by environmental factors. Physical activity is one of the main determinants of the physical fitness (Ruiz et al., 2006; Hussey et al., 2007). Life in areas with different population size can be associated with different dietary habits, access to sports facilities and the possibility of physical activity, among other things. This exposure to the environment can affect lifestyle and cardiovascular risk (Roemmich et al., 2006; De Vries et al., 2007), and this may be related to the level of physical fitness.

Several studies have researched the relation between the place of residence (urban or rural) and the level of physical fitness in children and adolescents all around the world, e.g. USA (McMurray et al., 1999), Turkey (Özdirenç et al., 2005), Switzerland (Kriemler et al., 2008), Cyprus (Tinazci & Emiroglu, 2009), Greece (Tsimeas et al., 2005), Mexico, (Peña Reyes et al., 2003), Australia (Dollman et al., 2002) and Oman (Albarwani et al., 2009), Spain, Slovak and observed inconsistent results.

The differences between the places of residence are specific in different countries and regions, and the obtained data from different countries are necessary for better understanding the relation between the place of residence and the physical fitness of young people. In addition, habits related to physical education and lifestyle in schools can be distinguished between children and adolescents, and it is interesting to further investigate whether the relationship between place of residence and fitness is different between children and adolescents.

The aim of the research was to determine the differences in the various components of physical fitness among urban and rural children who live in the municipality of Strumica, Republic of Macedonia. In addition, the survey included the differences in the anthropometric characteristics, the body composition and the social status among urban and rural children and adolescents.

METHODS

The research was conducted on a sample of 5076 respondents, representing 97% of the total population of students at the researched age, from the primary schools in the Municipality of Strumica, Republic of Macedonia. There are 9 primary schools in the municipality, out of which 5 are in rural and 4 in urban areas. The sample is divided into two sub-units according to gender and that 2610 (1821 from urban and

789 rural) male respondents and 2466 (1723 urban and 743 rural) female respondents. The average age of the respondents of the two gender was $9,94 \pm 2,41$ years.

In the example entered all students from whom parents gave their consent to participate in the project and they were psycho-physically healthy and regularly attendant physical and health education. The respondents were treated in accordance with the Helsinki Declaration.

The measurement was realized in March, April and May 2013, in standard school conditions at regular classes in physical and health education. The measurement was carried out by experts in the field of kinesiology and medicine, who trained in the past to measure certain tests and measures.

Anthropometric measurements

Anthropometric measurements were taken according to standard methodology of International Society for the Advancement in Kinanthropometry (ISAK). Weight was measured in underwear and without shoes with an medical decimal weight scales, to the nearest 0.1 kg, and height was measured barefoot in the Frankfort horizontal plane with a telescopic height measuring instrument (Martin's anthropometer) to the nearest 0.1 cm. Body mass index (BMI) was calculated as body weight in kilograms divided by the square of height in meters.

Evaluation of Physical Fitness

Prior to starting the study, the researchers involved in the project undertook training sessions in order to guarantee the standardization, validation, and reliability of the measurements (Moreno et al., 2003). Seven tests, forming part of the EUROFIT battery, validated and standardized by the European Council, were applied in the following order:

Sit and Reach test. With the subject seated on the floor and using a standardized support, the maximum distance reached with the tip of the fingers by forward flexion of the trunk is measured. Test indicative of amplitude of movement or flexibility.

Hand Grip test. With the use of a digital Takei TKK 5101 dynamometer (range, 1-100 kg), the maximum grip strength was measured for both hands.

Standing broad jump test. The maximum horizontal distance attained, with feet together, was measured. This test evaluates lower limb explosive-strength.

Bent Arm Hang test. A standardized test was used to measure the maximum time hanging from a fixed bar. This test estimates the upper limb endurance- strength.

Sit-ups 30 sek. Maximum number of sit ups achieved in 30 seconds. This test measures the endurance of the abdominal muscles.

Shuttle run: 4×10 meters. This test provides an integral evaluation of the speed of movement, agility and coordination. The subject does four shuttle runs as fast as possible between 2 lines 10 meters apart. At each end the subject places or picks up an object (a sponge) beside the line on the floor.

Statistical methods

Regarding the statistical analysis, the characteristics of the sample are presented as mean (standard deviation) or frequencies (percentages) stratified by gender and age. The normal distribution of the applied variables was verified by the Kolmogorov-Smirnov method. The differences in the anthropometric measures, the body condition and the fitness tests among urban and rural children and adolescents have been determined by one-way analysis of covariance (ANCOVA) including,

socioeconomic status, age and gender as covariates. Mean differences among rural and urban data and 95% Confidence Interval (CI) were calculated. Effect size statistics was assessed using Cohen's d (standardized mean differences and 95% CI). Taking into account the cut-off established by Cohen, the effect size can be small (~0.2), medium (~0.5) or large (~0.8). Interactions of gender (boys and girls) and age group (children and adolescents) with urban and rural residence were studied in all the models. Bonferroni adjustments for multiple comparisons were used. The significance level was set at 5% and all calculations were performed using SPSS v.22.0 software for Windows.

RESULTS

The chart characteristics of the sample by gender and age are shown in Table 1. Table 2 shows the data on the anthropometric and physical fitness variables in relation to the place of residence. Descriptive data, mean differences, effect size and 95%CI are presented. Statistically significant differences were found in all researched variables, except in the variable sit and reach. The ANCOVA analyses showed that rural children and adolescent have lower height ($p = 0.007$; mean difference = 0,6 cm; Cohen's d = 0.13), body mass ($p < 0.001$; mean difference = 1.3 kg; Cohen's d = 0.03), BMI ($p = 0.002$; mean difference = 0.3 kg/m²; Cohen's d = 0.04) and body fat % ($p < 0.001$; mean difference = 1,5 %; Cohen's d = 0.25) than their urban peers. Rural children and adolescent had higher muscular mass % ($p = 0.016$; mean difference = 0.22%; Cohen's d = 0.19), cardiorespiratory fitness ($p < 0.001$; mean difference = 3,43; Cohen's d = 0.16) and speed-agility ($p < 0.001$; mean differences = 0.58 s; Cohen's d = 0.46) than urban young people. Regarding muscular fitness, the results differed depending on the fitness test selected. Rural children and adolescent had a better performance in standing long jump ($p < 0.001$; mean difference = 2.87 cm; Cohen's d = 0.21), handgrip strength ($p < 0.001$; mean difference = 0.37 kg; Cohen's d = 0.26), bent arm hang ($p < 0.001$; mean difference = 1,18 s; Cohen's d = 0.23) while they had a lower performance in sit-ups in 30 s ($p < 0.001$; mean difference = 0.90 n; Cohen's d = 0.08), compared to their urban peers.

The associations were consistent in boys and girls, and in children and adolescents for most of the fitness tests studied. It was not found a clear age and gender interaction in any fitness tests. A borderline significant age-interaction was found for sit-ups 30 s test ($p = 0.005$) and bent arm hang test ($p = 0.005$). A borderline significant gender-interaction was found for Standing long jump test ($p = 0.002$), handgrip strength test ($p = 0.040$) and three minute step test ($p = 0.010$).

DISCUSSION

The results from our research indicate that students of different residential status differ significantly in anthropometric measures, the body composition and the level of physical fitness. Rural children and adolescents had a healthier anthropometric, cardiorespiratory fitness, speed-agility and muscular fitness (except for sit-ups) profile than their urban peers. There were no statistically significant differences in the flexibility between urban and rural children and adolescents. However, all fitness tests show small mean differences and small to medium size effects among rural and urban participants, that can explain a large percentage of the variance in fitness (e.g. genetics).

Recent researches have shown contradictory results with regard to children and adolescents living in urban and rural areas, but large number of researches are largely in line with the results obtained in these researches (Dollman et al., 2002; Kriemler et al., 2008; Albarwani et al., 2009). Rural children and adolescents have higher level of fitness compared to their urban peers. The research that was obtained in

Australia suggests that rural children had higher level of cardiorespiratory fitness compared to children in urban areas. According to our research, the results obtained on rural Swiss children (Kriemler et al., 2008) and Oman adolescents (Albarwani et al., 2009), who had a higher level of cardiorespiratory fitness compared to their urban peers. Contrary to these studies, a US based research suggests that urban children have a higher level of cardiorespiratory fitness compared to their peers living in a rural environment (McMurray et al., 1999).

In other studies are determined different results in relation to each fitness test. For example, urban children from Mexico have shown better results in the explosive strength and strength of abdominal muscles, but weaker results in grip strength tests compared to children living in a rural environment. Among the Cypriot urban and rural children (Tinazci et al., 2009) were found differences in fitness tests - standing broad jump, sit-ups, 20 m shuttle run, and hand grip; while differences were not found in equilibrium balance tests - flamingo, sit and reach, plate tapping and speed shuttle run. On the other hand, in a study realized in Greece no differences in physical fitness were determined (flexibility, cardiorespiratory, muscular fitness, and speed and agility) between children from and rural areas. A research realized in Croatia showed that children from urban areas show better results in the fitness test - 20 m dash, standing long jump and timed sit-ups. Urban and rural boys and girls do not differ significantly in the flexibility. Also, in the research of Hian et al. (2013) and Eiben et al. (2005) is determined that children from urban areas achieve better results in certain fitness tests than their peers who live in rural areas.

The results of our research further point to high consistency with regard to gender and age groups. Similar tendencies have been determined for fitness and place of residence for boys, girls, children and adolescents. Less consistent results were obtained ion urban and rural Mexican children (Peña Reyes et al., 2003), where 3 (flexibility, speed and cardiovascular fitness) of 6 tests for assessing physical fitness showed different results between gender and age groups (6 to 9 years in relation to 10 to 13 years).

The results of the research indicate that children from urban areas achieve better results only in the fitness test sit-ups 30 s in relation to children from rural areas. Similar results were obtained in Mexican and Spanish children where the same was used - sit-ups test: the abdominal strength and endurance was better in urban than in rural children (Peña Reyes et al., 2003). These authors reported that sit-ups appeared a more familiar test to the urban than to the rural children. On the other hand, Turkish rural children have achieved better results than urban children (Özdirenç et al., 2005) in this test. However, the results should be accepted with a certain precautionary approach, because the urban and rural areas in the literature and in different countries are differently defined, which can partly explain the consistency of the results in these studies.

The increasing prevalence of sedentary lifestyle, especially among children living in urban environment, reduces overall physical activity, which also reduces the level of physical fitness and achievements. The results of our research suggest that boys and girls from rural areas achieve better results in tests for assessing physical fitness. The assumption is that children in the rural environment have more spontaneous physical activity on open space and more use of outer terrains than children living in urban areas, and this is probably the reason why they achieve better results, especially in the abilities in which the energy component diminishes. Despite the mentioned factors for the differences in the fitness level a huge influence has the socio-cultural differences between the urban and rural children.

The physical fitness in childhood and adolescence is positively related with present and future health-related outcomes such as risk for total fatness, high blood, hyperinsulinemia, abdominal adiposity, insulin resistance, skeletal health and mental health (Ortega et al., 2008). Therefore it is inevitable physical education curriculum can provide students with substantially more physical activity during physical education classes. Sallis et al. (1997) point out the fact that by raising the quality of teaching in physical education 97% of elementary school students may be potentially assisted.

The environment can have small impact on certain fitness related health, since residence area and housing type differences were small for majority of tests. It is important to note that the place of residence and the appropriate external motivation should be taken into account when building a state strategy and interventions through which it will promote physical activity and health.

CONCLUSION

Based on the obtained results, it can be concluded that children and adolescents from the rural environment show better results in cardiorespiratory fitness, muscle fitness of the upper and lower extremities and have better coordination, speed and agility from their urban peers. Because average differences and effect size were small for all the health indicators, the obtained results suggest that the environment may have light influence of many health-related factors, including fitness. The place of residence, apart from other environmental factors, should be taken into account when building a state strategy and interventions through which it will promote physical activity and health.

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