

PHYSICAL FITNESS OF BOYS PERTAINING TO UNDERWEIGHT, OVERWEIGHT AND OBESITY

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Abstract. *Together with the changing socio-economic status of the Polish society, differences in the nutritional status of children and youth and their lower physical fitness levels are becoming more noticeable. The aim of this research was to define changes that occurred over a 10-year period regarding physical fitness of boys with proper weight-height proportions and of their underweight, overweight and obese counterparts. In 2004/05, somatic features and physical fitness were examined in 16116 and 9507 boys, respectively, aged 10-18. Ten years later somatic features and physical fitness assessments were repeated in 6972 and 6834 boys aged 10 to 18. The participants performed Eurofit tests and their body height and body mass were measured in order to calculate the Body Mass Index (BMI). The ten-year differences in physical fitness were expressed on a T point scale, while their extent was estimated with the Student's t-test for independent data. The frequency of occurrence of underweight and overweight was expressed in percentage values and verified with the use of the χ^2 test. In the analysed decade, an increase in the frequency of occurrence of both overweight and serious underweight was noted. It resulted in a lower level of physical fitness in children and youth belonging to the aforementioned groups. The most serious negative changes were noted in boys aged 13-15. It can be concluded that unless remedial programmes are implemented, the young generation will experience biological deterioration in the decades to come, which may result in an epidemic of lifestyle diseases in younger and younger individuals.*

Key words: *Physical Fitness, Boys, Body Mass Index, Eurofit Tests*

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INTRODUCTION

In numerous countries a continuous increase in the number of cases of overweight and obesity among children and youth is observed. At the same time the problem of insufficient body mass can be noted (UNICEF, World Health Organization-WHO & World Bank, 2020; WHO, 2020). This problem persists in economically developed countries but it also occurs in developing countries (Shirasawa et al., 2015; Forouzanfar et al. 2016; Hurbo, Skryhan, Radyhina, & Pamazanau, 2018). It has to be highlighted that these changes are not equal throughout the country, since regional differences can be noted (Lebel, Kestens, Clary, Bisset, & Subramanian, 2014; Abarca-Gómez et al., 2017; Akseer, Al-Gashm, Mehta, Mokdad, & Bhutta, 2017; Sandjaja et al., 2018). An increase in excessive body mass in children and youth exerts a negative influence on their physical activity (PA). This, in turn, results in lower levels of physical fitness (Katzmarzyk & et al., 2015; Tsiros et al., 2016). The aforementioned negative changes in height-weight proportions and lower levels of physical fitness also affect the development and health of children, youth and adults, which increases the risk of developing chronic non-infectious diseases (Kostić, Pantelić, Miletić, Uzunović, & Aleksandrović, 2012; Cvejić, Pejović, & Ostojić, 2013). In turn, an insufficient body mass may lead to lower stamina and performance levels, as well as a higher risk of bronchitis and pneumonia (Almirall, Bolibar, Balanzo, & Gonzalez, 1999; Dobner & Kaser, 2018; Van Nieuwpoort, Vlot, Schaap, Lips, & Drent, 2018).

After Poland had joined the European Union, faster socio-economic development was observed. It led, inter alia, to significant economic variability of its citizens, which, in turn, resulted in greater disproportions in the economic status of the Polish society. These processes differed depending on the region, which was also noticeable in the differences in the nutritional status of children and youth (Wolnicka, Jarosz, Jaczewska-Schuetz, & Taraszewska, 2016; Suder et al., 2020) and in their level of physical fitness (Przewęda & Dobosz, 2005; Dobosz, 2012). In the literature we can find numerous diagnoses of the biological state of children and youth. However, there is scarcity of data concerning the question whether the issue of lower physical fitness levels refers to all the observed children and whether it results from the changes in height-weight proportions.

The aim of this research was to define the changes that occurred over a 10-year period regarding physical fitness of boys with proper weight-height proportions and of their underweight, overweight and obese counterparts.

METHODS

Participants

Children from primary schools and youths from lower - and upper-secondary schools from Eastern Poland were initially examined in 2004/05. Taking into account the demographic structure of the regions, 220 schools were randomly selected from the list of educational facilities obtained from the Regional Educational Authorities. Particular attention was paid to maintaining equal population size in all the regions. The results of anthropometric measurements of 16116 boys aged 10-18 were obtained during 2004/05. The measurements were repeated in the same schools in 2014/15. This time a lower number of the anthropometric measurements were performed, i.e., the results of 6972 students aged 10-18 were obtained. Due to long-term PE exemptions and the lack of parental consent to perform

the test, PA was also assessed in a lower number of participants (N=6834) than in 2004/05 (N=9507).

Anthropometric measurements and physical fitness

The research was conducted in compliance with the guidelines included in the Declaration of Helsinki and was accepted by the Ethics Commission of the University of Physical Education in Warsaw.

Anthropometric measurements were performed in accordance with the broadly accepted anthropometric techniques recommended by the International Biological Program. On the basis of the measurements of body height and weight, the Body Mass Index (BMI-body mass in kilograms divided by height in meters squared) was calculated. Physical fitness was assessed on the basis of EUROFIT tests (Adam et al., 1998). According to the recommendations of the International Obesity Task Force and on the basis of border values provided by Cole, Bellizzi, Flegal, & Dietz (2000) and Cole, Flegal, Nicholls, & Jackson (2007), the participants were divided into groups. Group I included individuals of the 3rd-degree underweight, group II – those of the 2nd-degree underweight, group III – participants of the 1st-degree underweight, group IV – individuals with proper weight-height proportions, group V – overweight boys, and group VI – obese participants.

Statistical Analysis

The obtained populations made it possible to calculate the percentage of boys with underweight, overweight and obesity. Statistical significance of differences between the number of individuals qualified to each group and the total population examined in 2005 and 2015 was defined with the use of the χ^2 test. The material collected in 2005 underwent further statistical analysis including arithmetic means and distribution of results obtained in particular EUROFIT tests. Taking into account calendar age, the calculations were performed both for the whole material and in particular groups with different height-weight proportions. These values were used as reference points in comparative analyses revealing differences between the boys from schools in eastern Poland examined in two different periods. For this purpose, all the individual results of physical fitness tests from 2015 were compared with the results of boys from 2005 (50 points) with the use of T point scale (Furdal, 1989).

Such an analysis made it possible to standardise the units of fitness tests, while the mean from all the motor measurements in a group helped to assess general fitness defined as a statistical notion (Przewęda & Dobosz, 2005). Such calculations were performed for the whole material and within particular groups selected according to the BMI criterion. Taking this rule into account, the results of obese boys assessed in 2015 were compared to the results of obese participants examined in 2005. Similar analyses were performed in the remaining groups. Due to a low number of participants of the 1st- and 2nd-degree underweight, these groups were assessed together, which enabled us to draw conclusions for bigger groups. Next, arithmetic means and the distributions of point results for motor abilities were calculated both for the whole material and for particular groups divided according to the stages of education (10-12 years – primary school, 13-15 years – lower-secondary school, 16-18 years – upper-secondary school). Statistical significance of the differences between the results obtained in 2005 and 2015 was verified with the use of Student's t-test for independent data.

RESULTS

Prior to the analysis of the main aspect of the work, ten-year-long changes in the occurrence of underweight, proper height-weight proportions and overweight in the examined boys were determined. In the decade between 2005 and 2015 a significant decrease in the percentage of boys with proper BMI was noted (by 7.16%), while an increased percentage of 3rd-degree underweight (by 0.35%), overweight (by 5.04%) and obesity (by 1.91%) was observed in the whole examined population. Differences were slight in the group of participants of the 1st- and 2nd-degree underweight (table 1). However, in the group of boys aged 10-12, a significant decrease was noted in the percentage of all the boys with proper BMI (by 8.64%) and of the 1st-degree underweight (by 1.66%). In turn, the number of overweight and obese students increased (by 8.64% and 1.16%, respectively). Fewer significant differences were observed in boys aged 13-15. In this group a significant decrease in the percentage of participants with 2nd-degree underweight and a significant increase in the percentage of obese boys was noted (by 0.55% and 2.12%, respectively). In the group of the oldest participants, a significant increase was noted only in the number of obese boys (by 2.89%). In the remaining groups selected according to BMI, only tendencies could be observed.

Table 1 The percentage of participants in the groups of boys with proper BMI, underweight, overweight and obesity including stages of education

| Age (years) | Year of research | 3 rd -degree underweight | 2 nd -degree underweight | 1 st -degree underweight | Proper BMI | Overweight | Obesity |
|-------------|------------------|-------------------------------------|-------------------------------------|-------------------------------------|------------|------------|---------|
| 10-12 | 2005 | 0.84 | 1.19 | 7.05 | 74.83 | 14.52 | 1.57 |
| | 2015 | 1.26 | 1.16 | 5.39 | 66.29 | 23.16 | 2.74 |
| | χ^2 test | 3.77 | 0.01 | 9.22* | 13.45* | 76.04* | 14.07* |
| 13-15 | 2005 | 0.59 | 1.21 | 5.2 | 75.25 | 16.64 | 1.11 |
| | 2015 | 0.84 | 0.66 | 4.55 | 74.79 | 15.93 | 3.23 |
| | χ^2 test | 1.09 | 3.89* | 1.04 | 0.02 | 0.34 | 29.65* |
| 16-18 | 2005 | 0.26 | 0.64 | 2.59 | 81.92 | 13.85 | 0.74 |
| | 2015 | 0 | 0.93 | 3.27 | 76.01 | 16.16 | 3.63 |
| | χ^2 test | 2.39 | 1.261 | 1.774 | 2.746 | 3.539 | 54.48* |
| 10-18 | 2005 | 0.56 | 1.00 | 4.88 | 77.46 | 14.97 | 1.13 |
| | 2015 | 0.91 | 0.99 | 4.76 | 70.29 | 20.01 | 3.04 |
| | χ^2 test | 8.309* | 0.002 | 0.143 | 19.23* | 61.54* | 92.30* |

Legend: * statistical significance at the level of $p \leq 0.05$

In the decade discussed, a negative tendency of changes in physical fitness of the examined boys was also noted (table 3). In all the participants, a significant decrease was observed at the level of results of tests such as the flamingo balance (by 5.28 points), endurance shuttle run (by 4.69 points), standing broad jump (by 2.01 points), sit-and-reach (by 1.05 points) and the 10x5 m shuttle run (by 0.94 points). Similar results were noted in plate tapping and the bent arm hang. In turn, a significant improvement in the results of 30 s sit-ups (by 1.13 points) and the handgrip test (by 0.56 points) was revealed. On the basis of the mean obtained from all the tests, it was concluded that general fitness of the boys decreased by 1.39 points. A similar direction of changes but with a slight difference in the results was observed in the age groups (table 2).

Table 2 Physical fitness of boys (in T scale) from 2015 compared to the results from 2005 and statistical significance of differences (calculated with the Student's t-test) between the groups selected according to BMI and the total population

| Physical fitness test | Total | Groups I and II | Group III | Group IV | Group V | Group VI |
|-----------------------|---------|-----------------|-----------|----------|---------|----------|
| 10-18 years | | | | | | |
| Flamingo balance | 44.72** | 51.30 | 51.20 | 46.09** | 38.30** | 36.41** |
| Plate tapping | 49.88 | 49.48 | 51.64* | 49.80 | 50.04 | 48.24 |
| Handgrip test | 50.44* | 50.27 | 49.50 | 50.47** | 50.39 | 51.31 |
| Standing broad jump | 47.99** | 49.87 | 47.01** | 48.03** | 48.30** | 44.77** |
| Sit-ups | 51.13** | 48.67 | 50.57 | 51.39** | 50.88 | 48.34 |
| Bent arm hang | 49.99 | 52.35* | 52.11* | 50.15 | 49.00 | 47.60* |
| Endurance shuttle run | 45.31** | 50.76 | 49.37 | 46.15** | 41.49** | 38.58** |
| 10x5m shuttle run | 49.06** | 45.63** | 48.27* | 49.84 | 46.80** | 46.82* |
| Sit-and-reach | 48.95** | 49.99 | 50.19 | 48.97** | 48.55* | 48.40 |
| General fitness | 48.61** | 49.81 | 49.99 | 48.99** | 47.08** | 45.61** |
| 10-12 years | | | | | | |
| Flamingo balance | 44.16** | 50.86 | 50.71 | 45.56** | 37.83** | 35.79** |
| Plate tapping | 50.29 | 49.09 | 51.62 | 50.19 | 50.72 | 48.52 |
| Handgrip test | 49.04** | 50.73 | 48.13* | 48.75** | 49.65 | 52.75* |
| Standing broad jump | 47.90** | 49.45 | 46.48* | 47.91** | 48.55* | 43.78** |
| Sit-ups | 51.91** | 49.73 | 50.39 | 52.14** | 51.82** | 51.27 |
| Bent arm hang | 50.05 | 53.25* | 51.86* | 49.80 | 49.94 | 51.64 |
| Endurance shuttle run | 43.21** | 49.93 | 48.19* | 44.23** | 38.55** | 35.28** |
| 10x5m shuttle run | 48.58** | 45.11** | 48.14* | 49.18** | 47.21** | 46.60 |
| Sit-and-reach | 49.81 | 50.76 | 51.78* | 49.78 | 49.6 | 47.58 |
| General fitness | 48.33** | 49.88 | 49.70 | 48.62** | 47.10** | 45.91** |
| 13-15 years | | | | | | |
| Flamingo balance | 45.87** | 52.69 | 52.73 | 47.08** | 39.42** | 37.67** |
| Plate tapping | 49.04** | 50.69 | 51.73 | 49.08** | 48.42 | 47.67 |
| Handgrip test | 51.03** | 49.00 | 51.67 | 51.87** | 48.07* | 43.79** |
| Standing broad jump | 47.59** | 45.48 | 49.25 | 47.67** | 47.06** | 48.13 |
| Sit-ups | 48.75** | 41.63** | 49.46 | 49.24* | 47.56** | 44.56* |
| Bent arm hang | 48.25** | 47.69 | 54.29* | 48.32** | 47.44** | 44.43* |
| Endurance shuttle run | 47.94** | 53.31 | 50.52 | 48.90** | 43.50** | 40.35** |
| 10x5m shuttle run | 47.71** | 45.26* | 48.76 | 48.61** | 44.02** | 44.36** |
| Sit-and-reach | 47.60** | 48.86 | 47.71 | 47.67** | 46.73** | 50.70 |
| General fitness | 48.20** | 48.29 | 50.68 | 48.72** | 45.80** | 44.63** |
| 16-18 years | | | | | | |
| Flamingo balance | 44.96** | 51.78 | 51.72 | 46.32** | 38.63** | 36.73** |
| Plate tapping | 49.64 | 49.89 | 51.67 | 49.63 | 49.57 | 48.10 |
| Handgrip test | 53.72** | 49.41 | 53.10* | 53.39** | 55.66** | 53.67 |
| Standing broad jump | 48.67** | 60.89** | 47.02 | 48.76** | 48.87 | 44.37** |
| Sit-ups | 51.63** | 54.31 | 52.44 | 51.91** | 51.45 | 45.28* |
| Bent arm hang | 51.81** | 54.76 | 51.00 | 53.19** | 47.53** | 42.00** |
| Endurance shuttle run | 48.28** | 51.78 | 53.17* | 48.01** | 49.40 | 43.73** |
| 10x5m shuttle run | 51.98** | 49.90 | 48.37 | 53.03** | 48.60 | 48.92 |
| Sit-and-reach | 48.06** | 46.77 | 46.02** | 48.36** | 47.02** | 48.41 |
| General fitness | 49.86 | 52.17 | 50.50 | 50.29 | 48.53 | 45.69* |

Legend: * statistical significance set at the level of $p \leq 0.05$; ** statistical significance set at the level of $p \leq 0.01$

The above-mentioned tendencies of changes in the level of results of the EUROFIT tests do not provide information whether the direction of changes in all the groups selected according to BMI criteria was compliant with the trend noted for the whole population of boys from eastern Poland. It is also interesting which of the described groups demonstrated the largest and which the smallest changes in physical fitness over a ten-year period.

Based on general fitness results (table 3), it may be concluded that in the assessed decade the largest negative changes occurred in the boys with obesity (4.39 points), overweight (2.92 points) and those with a proper BMI (1.01 points). A similar secular trend was noted among 10-12-year-olds and 13-15-year-olds. In turn, in the oldest group of boys, lower physical fitness levels were noted only among obese boys. In the groups of underweight participants, no significant differences in the general fitness were noted. However, the differences were observed in the case of some tests only. As for the results of the participants from group I and II over a period from 2005 to 2015, a significant improvement in the bent arm hang (by 3.25 points) and a decrease in the 10x5 shuttle run (by 4.89 points) was noted. The boys from group III manifested positive changes in the bent arm hang results (by 2.11 points) and plate tapping (by 1.64 points), while negative changes were noted in the standing broad jump (by 2.99 points) and 10x5 shuttle run (by 1.63 points). It should be highlighted that in boys with a proper BMI the direction of changes in physical fitness was similar to that for the whole population. In turn, boys with overweight and obesity did not manifest an improvement in the results of any of the physical fitness tests. However, a deterioration of the results of overweight and obese boys was noted for the flamingo balance test (by 11.70 and 13.59 points, respectively), endurance shuttle run test (by 8.51 and 11.42 points, respectively), standing broad jump (by 1.70 and 5.23 points, respectively) and 10x5 shuttle run test (by 3.20 and 3.18 points, respectively). Moreover, overweight boys manifested lower results on the sit-and-reach test (by 1.45 points), while obese participants in the bent arm hang test (by 2.40 points).

DISCUSSION

The problem of the increasing number of overweight and obese people which was described at the beginning of this work, affected Poland as well. Currently, Polish youths, including students from Eastern Poland, are less overweight and obese compared to their counterparts from the majority of European Union countries (Saczuk, Olszewska, Wasiluk & Olszewski, 2011; Garrido-Miguel et al., 2019). However, the research of Charzewska (2012) revealed that the frequency of occurrence of obesity in Polish children and youth in the last 30 years increased approximately three times in boys and as much as ten times in girls. The author's observations revealed that 16.4% of school children and youth aged 7-18 were overweight and obese. The discussed developmental indices differed depending on the region. Our findings revealed a similar direction of changes in BMI. However, including eastern regions of the country in the group of regions with a low risk of overweight and obesity among children, as suggested by Wolnicka et al. (2016) is a debatable idea. In turn, the research by Wasiluk & Saczuk (2015) revealed that in the years 1985-2005, i.e. within two decades preceding the present observations, changes in the frequency of occurrence of overweight and obesity among boys aged 7-12 were at the level of 7.27% and 1.45%, respectively, and were lower than the differences noted in the decade between 2005 and

2015. A similar direction of changes was also noted in the selected age groups. Thus, it can be concluded that a delay in socio-economic transformations observed in eastern Poland also brings about a delay in negative biological changes in a young generation, while the pace of these changes increases together with an improvement in the socio-economic situation of the inhabitants of these regions.

However, it is distressing that an increase in the percentage of students with a significant underweight can be noted, which is not seen in the national or international research results. It may prove their malnutrition and it may result in bronchitis and pneumonia, asthma, an improper functioning of the digestive system and emotional distress (Gurzkowska et al., 2017; Yen, Shi, Soeung, Seng, Dy, & et al., 2018). Such changes may result from the lifestyle of children and youths, their diet and the economic situation of their families. Our observations can be confirmed by the research of Żądzińskiej et al. (2012) in which it was concluded that among children and adolescents aged 7-18 in Łódź within 26 years of the transformation (both economic and political), an increase in body mass deficiency in the years 1977/1978 and 2002/2004 was noted, in the group of boys from 7.2% to 12.1% and in the group of girls from 11.0% to 20.2%. Moreover, Gurzkowska et al. (2017) found that among socioeconomic determinants, only gross domestic product per inhabitant in the region to be a risk factor for thinness. It needs to be highlighted that Eastern Poland belongs to the group of less economically developed regions of Poland, and the issue of unemployment affects these regions to a large extent (Central Statistical Office, 2015). In order to confirm these observations, broader social research should be carried out.

The economic crisis from the 1970s and 1980s as well as socio-economic changes which have occurred in Poland since 1989 and their different pace in particular regions of the country influenced the size of secular trends in physical fitness. It was confirmed by national research (Przewęda & Dobosz, 2005), in which large sample groups in the years 1979-1989-1999 were compared. In the first analysed decade, a slight improvement in the results of fitness tests in the assessed girls and boys was noted, while the second decade saw a decrease in the scores. Another national study carried out in the years 1999-2009 proved a further decrease in physical fitness. The only exception was the handgrip test, in which an improvement in the results was noted (Dobosz, 2012). Similar changes in eastern Poland were observed by Saczuk (2011) in the years 1986-1996-2006. On the basis of the results described earlier, it may be concluded that the level of physical fitness decreases. However, bigger negative changes were noted in students aged 10-15, while slight changes were seen in boys aged 16-18.

What is particularly distressing is the fact that the largest negative changes concerning motor tests were noted in overweight and obese boys, while changes in the groups of boys with proper BMI were smaller. The greatest deterioration of results in the aforementioned groups was noted in running tests and lower limb strength. It is highly disturbing since these are groups of children who already manifested the lowest levels of physical fitness (Saczuk et al., 2011). Such significant differences were not found in the underweight participants; the only changes occurred in single fitness tests. It must be highlighted that the biggest negative changes in physical fitness occurred in the groups of these boys who also demonstrated the biggest negative changes in weight-height proportions.

The present generation of children may be the first one for a long time to have a shorter life expectancy than their parents. It may result from lifestyle diseases caused by improper diet and insufficient amount of PA. Another reason may also be the level of awareness of children and their parents and the form of physical education (PE) classes in schools. In

their report titled “Physical education and sport in state schools”, the Supreme Audit Office negatively assessed the level of PE classes and sports facilities in the controlled schools (SAO, 2010). Apart from many other critical conclusions, the report also revealed that over 17% of primary school students, approximately 24% of lower-secondary school students and ca. 38% of upper-secondary school students did not participate in PE classes. As many as 74% of schools did not take any actions to prevent this phenomenon. The most common reason for PE exemptions included the lack of a sports outfit (33.10%), notes from parents (22.80%) and sick leaves (17.70%). However, many of the exemptions were not justified. Experts state that such exemptions should not be granted to children suffering from numerous diseases, e.g. spinal curvatures, asthma or diabetes. PA is one of the elements of treatment and should be taken up according to the doctor’s recommendation. Thus, it is necessary to encourage the youth to take up PA and create appropriate conditions which would facilitate it. Moreover, interdepartmental remedial programmes aimed at improving the PA of children and youth should be prepared and implemented, with a particular focus on students with excessive body weight, as this group manifested the biggest negative changes in PA. The current actions of state administration are insufficient and focus generally on a particular group of girls and boys, mainly those with a proper BMI. These actions include only 30-40% of the whole population of children and youths (SAO, 2010), while the state of health of children is more and more alarming.

CONCLUSIONS

Taking into account the analysis of the changes in weight-height proportions and in the level of physical fitness of the assessed boys, an urgent need for interdepartmental remedial actions aimed at improving PA among children and youths was indicated, with a particular focus on students with excessive body mass. Unless remedial programmes are introduced, the young generation will experience biological deterioration in the years to come. We should expect a further increase in the number of overweight and obese people, a lower level of average motor abilities and performance capabilities, and, as a consequence, an epidemics of lifestyle diseases which will affect younger and younger individuals.

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FIZIČKI FITNES DEČAKA UZIMAJUĆI U OBZIR POTHRANJENOST, PREHRANJENOST I GOJAZNOST

Zajedno sa promenljivim socijalno-ekonomskim statusom Poljskog društva, razlike u nutritivnom stanju dece i omladine i njihovoj nižoj telesnoj spremnosti postaju sve vidljivije. Cilj ovog istraživanja bio je da se definišu promene koje su se dogodile tokom desetogodišnjeg perioda u pogledu fizičkog fitnesa dečaka sa pravilnim proporcijama telesne mase i visine, kao i njihovih vršnjaka sa prekomernom težinom, prekomernom težinom i gojaznim. U 2004/05. godine, ispitivana su somatska svojstva i fizička sprema kod 16116 i 9507 dečaka, uzrasta od 10-18 godina. Deset godina kasnije somatske karakteristike i procene fizičke kondicije ponovljene su kod 6972 i 6834 dečaka u uzrastu od 10 do 18 godina. Ispitanici su testirani Eurofit testovima i izmerena je njihova telesna visina i telesna masa u cilju izračunavanja indeksa telesne mase (prema engl. Body Mass Indeks-BMI). Desetogodišnje razlike u fizičkom fitnesu izražene su u T bodovnoj skali, dok je njihov opseg procenjen Studentovim t-testom za nezavisne uzorke. Učestalost pojave pothranjenosti i prehranjenosti izražena je procentualno i proverena pomoću χ^2 testa. U analiziranoj deceniji primećeno je povećanje učestalosti i prehranjenosti i ozbiljne pothranjenosti. To je rezultiralo nižim stepenom fizičke spremnosti dece i omladine kvalifikovanih za pomenute grupe. Najozbiljnije negativne promene primećene su kod dečaka uzrasta od 13 do 15 godina. Može se zaključiti da ukoliko se ne sprovedu sanacioni programi, mlada generacija će doživeti biološko propadanje u narednim decenijama, što može dovesti do epidemije oboljenja u mladim i mlađim pojedincima.

Ključne reči: *fizička kondicija, dečaci, indeks telesne mase, eurofit testovi*