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Sprawność fizyczna chłopców z nadwagą i otyłością zamieszkujących wschodnie województwa Polski

Streszczenie

Wstęp. Postęp cywilizacyjny w wielu krajach Europy i świata przyczynia się do zmiany sposobu życia całych społeczeństw. Mimo, iż otyłość uważa się za problem społeczeństw wysokorozwiniętych, to również zaczyna on być dostrzegany w regionach o wolniejszym tempie rozwoju.

Cel. Celem doniesienia jest określenie poziomu sprawności fizycznej chłopców z nadwagą i otyłością będących w różnych fazach rozwoju biologicznego.

Materiał i metody. Z obszernego materiału obejmującego rozwój fizyczny oraz sprawność fizyczną dzieci i młodzieży ze wschodnich regionów kraju wybrano badania 8236 chłopców z województw: podlaskiego, lubelskiego i podkarpackiego. Próby sprawności fizycznej wykonywane były zgodnie z wymaganiami Międzynarodowego Testu Sprawności Fizycznej. Informacje dotyczące daty urodzenia i środowiska, w którym wzrastały dzieci i młodzież zebrano przy pomocy ankiety. Następnie materiał badawczy podzielono na kategorie uwzględniające etapy rozwoju biologicznego, klasyfikując chłopców do grup: przedpokwitaniowej, pokwitaniowej i popokwitaniowej. W oparciu o pomiary wysokości i masy ciała obliczono wskaźnik masy ciała BMI. W prezentowanej pracy podstawą do zakwalifikowania badanych chłopców do grupy nadwagi czy otyłości były zalecenia International Obesity Task Force w oparciu o wartości graniczne opracowane przez Cole i wsp. 2000.

Wyniki. Z przeprowadzonej analizy materiału badawczego wynika, że chłopcy otyli uzyskali lepsze rezultaty w porównaniu z przeciętnymi uczniami ze wschodniej Polski jedynie w sile ręki, a ich rówieśnicy z nadwagą ponadto w szybkości lokomocyjnej i zwinności. W pozostałych zdolnościach motorycznych u ocenianych chłopców odnotowano niższy poziom wyników w zestawieniu z grupą odniesienia. Podobny obraz zależności stwierdzono we wszystkich analizowanych fazach rozwoju, a różnice pomiędzy nimi wystąpiły jedynie w poziomie rezultatów.

Wnioski. Z przeprowadzonych badań wynika, że nadwaga oraz otyłość różnicują poziom sprawności fizycznej chłopców.

Słowa kluczowe: chłopcy, nadwaga, otyłość, sprawność fizyczna.

Physical fitness of boys with overweight and obesity living in the eastern provinces of Poland

Abstract

Introduction. In many European countries and worldwide the civic development contributes to changes in the lifestyle of entire societies. Although obesity is claimed to be a problem of highly-developed countries, it is also becoming noticeable in regions with a lower rate of development.

Aim. The study was aimed at determining the level of physical fitness of boys with overweight and obesity being at different stages of the biological development.

Material and methods. Out of the extensive material of the study, which took place in the years 1986, 1996 and 2006, covering the physical development and physical fitness of children and adolescents 8236 boys from the following Provinces: Podlaskie, Lubelskie and Podkarpackie, which were surveyed in 2006, were selected for the study. Trials of physical fitness were conducted following guidelines of the International Test of Physical Fitness. Next, the experimental material was divided into categories taking into account stages of the biological development, thus classifying the boys into three groups: pre-pubescence, pubescence and post-pubescence. Based on body height and body mass measurements, BMI values were calculated for each subject. In the reported study, the boys were classified to a group of overweight or obesity based on recommendations of the International Obesity Task Force, taking into account boundary values elaborated by Cole et al 2000.

Results. The analysis of the experimental material indicates that, as compared to the average data, the obese boys achieved better results only in the hand grip test and their peers with overweight additionally in locomotive speed and agility. In the case of the other motor capabilities, the evaluated boys achieved worse results as compared to the reference group. Similar tendencies were observed in all stages of development, and differences between them occurred only in the level of results.

Conclusion. The results obtained in this study allow us to conclude that boys who are overweight and obese have different physical fitness levels.

Key words: boys, overweight, obesity, physical fitness.

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INTRODUCTION

In many European countries and worldwide the civic development contributes to changes in the lifestyle of entire societies. Apart from the positive, it exerts also an adverse effect on man's body, for changes in the organization of everyday life include an increasing number of hours spent on learning at school, extra-school activities or passive forms of spending leisure time. The possibility of travelling around and communicating with the whole world without leaving one's room equipped in a computer with Internet connection as well as overuse of television result in reduced physical activity of young people. This affects paucity of the physical fitness amongst children and adolescents, especially in the regions characterized by faster economic development [1], which, when coupled with increased availability of food products, leads to an increase in the number of persons with excessive body mass. In some countries, the percentage of children with overweight and obesity has doubled in the last decade [2, 3]. Although obesity is claimed to be a problem of highly-developed countries, it is also becoming noticeable in regions with a lower rate of development [4,5]. Investigations conducted with adolescents from the eastern regions of Poland provided a corroborating evidence for intensification of this phenomenon [6]. It is worthy of remembering that obesity is implicated in the development of many health disorders, including: heart ischaemia, hypertension, type 2 diabetes, colon cancer, prostate cancer, etc. [6-8].

It seems interesting, therefore, to estimate the extent of this problem in adolescents inhabiting regions of Poland that are ecologically pure but poorly developed economically. Hence, the objective of this study was to determine the size of a population of boys with proper body height-body mass proportions and their peers with overweight and obesity, and to indicate differences in the level of physical fitness between these populations.

AIM

The study was aimed at determining the level of physical fitness of boys with overweight and obesity being at different stages of the biological development.

MATERIAL AND METHODS

The research took place in years 2005 and 2006 and covered 20113 subjects (9303 schoolgirls and 10810 schoolboys) from schools in Podlaskie, Lubelskie and Podkarpackie provinces. There were randomly chosen 150 schools from lists of educational institutions provided by the local school boards, according to the settlement structure. The equal numbers of examined schools represented in the study from each province were ensured. In order to make the research more efficient only one form out of each age category was surveyed. To make sure all environments were given equal representation in case there was more than one form in a school to choose from, the form for survey was also randomly chosen. Only complete unambiguous research spreadsheets were taken into consideration statistically. The research which took place in years 2005 and 2006 followed the research in the years 1986 (covered 3971 schoolgirls and 3188 schoolboys) and 1996 (covered 4623 schoolgirls and 4446 schoolboys). All the research studies were conducted by members of Faculty of Physical Education and Sport in Biala Podlaska staff and students specially trained to conduct that kind of research.

Out of the extensive research material into physical development and physical agility of children and youth in eastern Poland the study covered 8236 boys at the age of 8-18 years. Tests of physical fitness were performed following recommendations of the International Physical Fitness Test [9], whereas anthropometric measurements were conducted according to standard anthropometric techniques. Measurements of body height and body mass enabled calculating the BMI, being a quotient of body mass expressed in kilograms and squared body height. Based on BMI values, the whole population of surveyed boys was divided into groups, boys who developed normally (group I), overweight (group II) and obese (group III), accordingly to recommendations of the International Obesity Task Force and extreme values (Table 1) elaborated by Cole et al. [10]. The range of normality was defined by means of deducting underweight, overweight and obese subjects from all. Population numbers achieved in this way enabled computing percentages of boys with overweight and obesity, for all research material as well as for selected development stages. Findings of Savvas et al. [11], who compared research results carried out in other countries, as well as Oblacińska and Jodkowska [6] served as reference material. (Table 1)

TABLE 1. BMI values constituting criteria of boys division into groups (Cole et al. 2000)

Age in years	BMI values			
	Uderweight	Normal range	Overweight	Obesity
pre-pubertal stage				
8	below 14.15	14.16-18.43	18.44-21.59	21.60 and more
9	below 14.35	14.36-19.09	19.10-22.76	22.77 and more
10	below 14.64	14.65-19.83	19.84-23.99	24.00 and more
pubertal stage				
12	below 15.35	15.36-21.21	21.22-26.01	26.02 and more
13	below 15.84	15.85-21.90	21.91-26.83	26.84 and more
14	below 16.41	16.42-22.61	22.62-27.62	27.63 and more
post-pubertal stage				
16	17.54	17.55-23.89	23.90-28.87	28.88 and more
17	18.05	18.06-24.45	24.46-29.40	29.41 and more
18	18.50	18.51-24.99	25.0-29.99	30.0 and more

The results obtained were elaborated statistically. Arithmetic means and standard deviations were calculated for particular trials of the fitness test in each group considering the calendar age of the boys. The statistical significance of differences between mean values obtained for the normal population and for groups of boys with overweight and obesity was verified by the Student's t-test. Next, the experimental material was divided into categories based on stages of biological development of the boys, i.e. category I – indicated the pre-pubertal stage and covered boys at the age of 8, 9 and 10 years, category II – indicated the pubertal stage and cov-

ered boys at the age of 12, 13 and 14 years, and finally category III – indicated the post-pubertal stage and covered boys at the age of 16, 17 and 18 years. Results obtained in overweight boys from group II and obese boys from group III were normalized to the results of the whole normal population using the T scale. The resultant points enabled calculating arithmetic means of particular developmental stages.

RESULTS

Before analysing the main problem addressed in this study, it would be advisable to determine the percentage of boys with overweight and obesity in the eastern Provinces of Poland and to identify whether the frequency of this civilization-linked problem is higher in their case than in the Polish population and in these of other countries (Table 2, Figure. 1). An analysis of percentage frequency of this phenomenon in the analysed material demonstrated that out of the whole examined boys in year 2006, 13.40% of the surveyed boys were overweight, whereas 1.38% of the boys were obese. It was also shown that the highest percentage of the boys with overweight occurred in the pubertal stage (16.22%), followed by the post-pubertal stage (14.04%), whereas the least percentage of overweight boys was noted in the pre-pubertal stage (9.94%). The average values presented above were higher than the respective average values noted for the Polish population and for the German adolescents, whereas lower – as compared to the average values reported for peers from the other reference countries, classified by means of BMI index. The frequency of obesity occurrence was the highest in the youngest boys surveyed and was observed to decrease along with the increasing age of the respondents, and the percentage of boys affected by this problem in the subsequent developmental stages accounted for: 2.62%, 1.27%, and 0.72%. However, these values are not high as compared to the peers from other countries. Only the youngest boys surveyed in our study in the year 2006 were more obese than their German peers. In turn, the boys analysed in our study were characterised by the lowest frequency of obesity when compared to the average population of Polish adolescents and these from other countries. (Table 2, Figure 1)

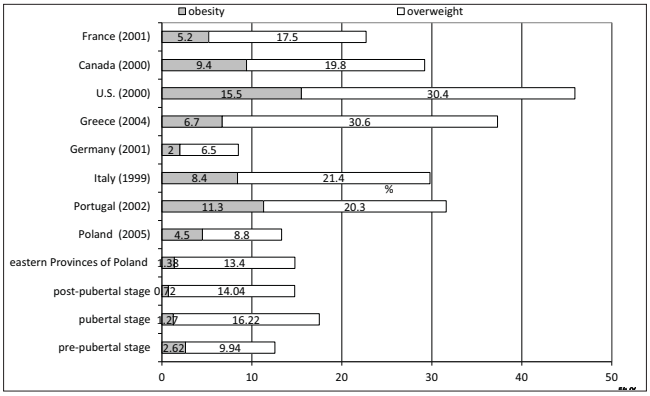

FIGURE 1. Frequency of overweight and obesity occurrence in boys inhabiting eastern Provinces of Poland against the background of young people from other countries (source: Savvas i wsp. 2006, Oblacińska, Jodkowska 2007)

TABLE 2. Frequency of overweight and obesity occurrence in the boys surveyed in 2006.

Age in years	All	Normal range	Overweight	Obesity	Underweight
	N	N (%)	N (%)	N (%)	N (%)
pre-pubertal stage					
8	483	362 (74.95)	46 (9.52)	14 (2.90)	61 (16.47)
9	434	304 (70.05)	62 (14.29)	16 (3.69)	52 (15.05)
10	1030	864 (83.88)	58 (5.63)	21 (2.04)	87 (15.96)
pubertal stage					
12	1234	930 (75.36)	160 (12.97)	18 (1.46)	126 (19.5)
13	1025	634 (61.85)	282 (27.51)	14 (1.37)	95 (15.74)
14	958	719 (75.05)	177 (18.48)	9 (0.94)	53 (27.64)
post-pubertal stage					
16	933	748 (80.17)	145 (15.54)	11 (1.18)	126 (19.5)
17	883	717 (81.20)	128 (14.50)	3 (0.34)	95 (15.74)
18	1256	1044 (83.12)	154 (12.26)	8 (0.64)	53 (27.64)
Total	8236	6322 (76.76)	1212 (14.72)	114 (1.38)	588 (7.14)

Owing to a low number of subjects in group II, the analysis of the level of physical fitness was conducted based on mean scores on the T scale calculated for particular developmental stages (Figure 2-4) and for the boys surveyed in the year 2006 (Figure 5). Concluding on more numerous groups will enable more reliable presentation of the described dependencies. Based on these data, it was observed that in the analysed stages of biological development, the boys with overweight achieved similar results in all trials of the fitness test compared to their average peers from the eastern Poland. Differences between the evaluated categories did not exceed 3 points, which corresponds to 0.3 of standard deviation. Only the boys with overweight being in the stage of pubescence appeared to be stronger (by 4.22 pts) in the dynamometric trial of hand than the boys from the comparative group. Substantially greater differences were noted between the obese boys and scores computed for the whole population of boys surveyed. The boys from category III achieved better scores only in the hand grip test – by 6.57 points, whereas worse score in running endurance – by 8.34 points, arm strength – by 7.48 points, locomotive speed – by 4.65 points, trunk strength – by 3.23 point and explosive strength – by 3.03 points. Similar mean values in both categories were noted only in the case of agility and suppleness. The average number of points achieved in all trials of the fitness test – characterizing the overall physical fitness – accounted for 47.10 points. A similar motor profile was noted in all described stages of biological development. It should be emphasized, however, that the greatest above-described differences occurred in the case of the boys being in the pubertal stage, followed by these in the post-pubertal stage, whereas the least ones – in the case of the youngest boys. The overall physical fitness in these categories accounted for: 44.35 points, 48.14 points, and 48.91 points, respectively.

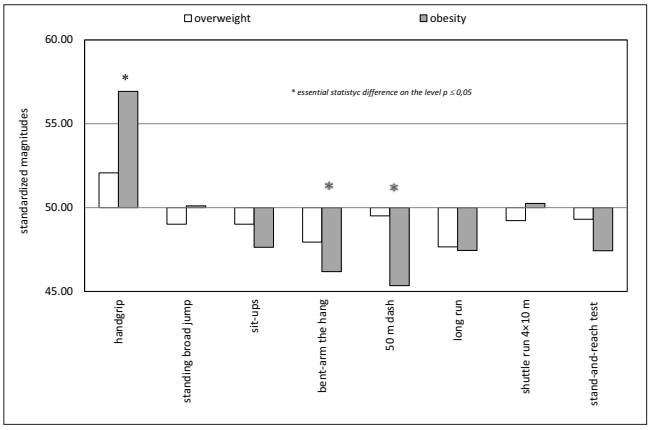

FIGURE 2. Results of physical fitness of the boys with overweight and obesity normalized to results of the whole population (pre-pubertal stage)

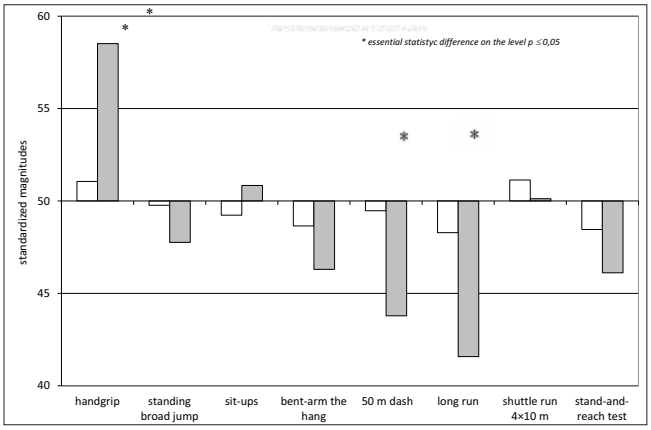

FIGURE 4. Results of physical fitness of the boys with overweight and obesity normalized to results of the whole population (post-pubertal stage).

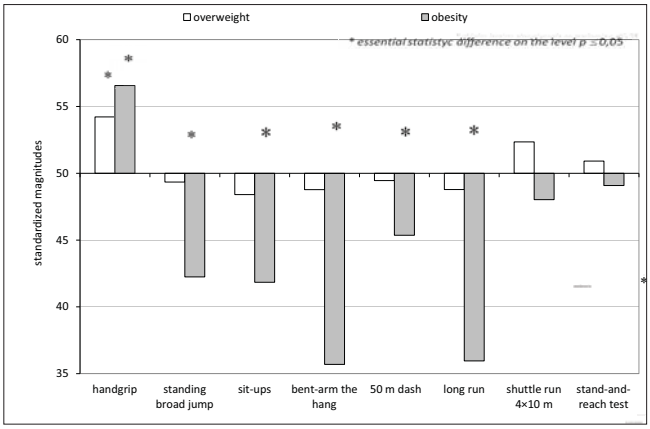

FIGURE 3. Results of physical fitness of the boys with overweight and obesity normalized to results of the whole population (pubertal stage).

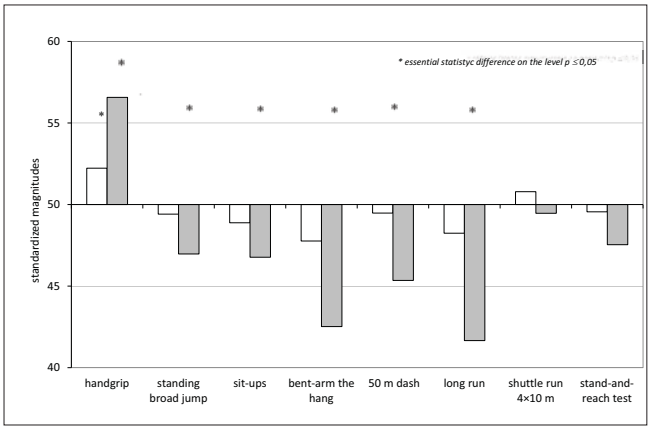

FIGURE 5. Results of physical fitness of the boys with overweight and obesity normalized to results of the whole population.

DISCUSSION

The problem of an increasing number of persons with overweight and obesity noticed world wide has been observed to emerge also in Poland. In the years 1995-2005 the frequency of occurrence of excessive body mass and obesity in adolescents from gymnasium increased by 2.4% and 1.5% in the case of boys and by 2.0% and 2.0% in the case of girls, what was reported by Oblacinska and Jodkowska after examining 8067 pupils [6]. Results achieved in the present study enable concluding that the described problems of contemporary civilization are already appearing in the areas of eastern Poland. In view of results from seven world countries and results noted for an average Polish population, the boys surveyed in this study were characterized by the lowest frequency of obesity occurrence, whereas a lower percentage of adolescents with overweight was observed only in the German and Polish populations. Worthy of notice is, however, the fact that results of these investigations were elaborated based on different BMI criteria. According to WHO [12], the BMI value below 18.5 kg/m^2 corresponds to underweight, values in the range of 18.5-24.9 kg/m^2 correspond to correct body mass, values in the range of 25.0-29.99 kg/m^2 – to overweight, values in the range of 30.0-34.9 kg/m^2 – to the first degree obesity, values in the range of 35.0-39.9 kg/m^2 – to the second degree obesity, and these above 40 kg/m^2 indicate the third degree obesity. This division does not consider the calendar age of a child. In the method recommended by the Centers for Disease Control and Prevention [after 6], overweight is indicated by BMI values ranging from the 85th to 95th centile, whereas obesity by BMI values over the 95th centile. It assumes that in each population there occurs a specified percentage of persons with overweight and obesity. Hence differences are likely to occur in the extreme values of the index. Using the method which was applied by Oblacińska and Jodkowska [6] fourteen year old boys surveyed in the year 2006 were categorized as overweight with BMI values above 23.16 kg/m^2 and obese with BMI values above 26.84 kg/m^2. In contrast, the criteria adopted by Cole et al., which studied more then 70000 subjects from seven countries around the world, [10] account for 22.62 and 27.63 kg/m^2, respectively. If the method of the above-mentioned authors was applied in our study, the number of boys with overweight would be lower by 3.87% and that of the boys with obesity would double. Pursuant to WHO criteria, in that age category, there would only be one obese boy and only 5.01% of the boys with overweight. In view of the above, it seems essential to introduce uniform body mass evaluation criteria for children and adolescents.

Based on literature devoted to effects of somatic traits on the level of motor capabilities in children and adolescents it may be concluded that body mass value significantly differ-

entiates results achieved in various fitness tests [13.]. Also research works addressing physical fitness of school children as affected by the body mass index (BMI) demonstrate differences in results scored by subjects with various somatic built [14,15]. These observations enabled predicting the motor profile of boys with obesity, and the only unknown was the size of distances between these boys and the average whole population. The analysis of results recorded for the heaviest boys showed them to be characterized by a considerably lower level of running endurance and arm strength, and by poorer levels of locomotive speed, trunk strength and explosive strength. These differences were not as distinct as in the case of the above-described motor capabilities, but the tests used to evaluate them may be acknowledged as exercises in which the excess of body mass (passive tissues in particular) considerably impairs their performance. In the case of these boys, better results were recorded only in the hand grip test, i.e. in the motor test in which results are directly proportional to body mass value [13].

The evaluation of the level of motor capabilities demonstrated that in the case of boys with overweight the profile of these capabilities was similar to average values computed for the entire population participating in the study. It may, therefore, be concluded that a small excess of body mass has no significant effect on differences in the motor skills of the surveyed boys. The applied method of somatic built evaluation is insufficient to determine explicitly the percentage of active and passive tissues in the overweight boys. It may, hence, be speculated that the described proportions did not differ significantly, and that there were no distinct differences in the level of motor capabilities between the evaluated categories of boys.

CONCLUSIONS

The following conclusions and observations may be derived from the analysis of research material:

1. The boys surveyed in 2006 were characterised by a lower frequency of overweight and obesity cases compared to their peers from Canada, France, Greece, USA, Italy, Portugal and Poland, though higher frequency of overweight and obesity cases compared to their peers from Germany.
2. The obese boys demonstrated a lower level of physical fitness when compared to pupils of normal BMI values. This was especially tangible in the results of: running endurance, arm strength as well as locomotive speed, trunk strength and explosive strength.
3. No distinct differences were observed in the level of motor capabilities between the surveyed boys with overweight and their peers with correct body height-body mass proportions.

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