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OBESITY AND SUPPLENESS IN SCHOOL CHILDREN

OTYŁOŚĆ A GIBKOŚĆ DZIECI SZKOLNYCH

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S u m m a r y

I n t r o d u c t i o n . Obesity is a common phenomenon and more frequently it is concerning the younger generations. Its distant consequences are alarming, especially in the area of health and the level of physical fitness. One of its components is suppleness; retaining its proper level seems essential as it delays experiencing various health conditions. The aim of this study was to compare the level of suppleness in school children with correct body mass and those overweight or obese. It was assumed that the suppleness level of boys and girls would be similar and that the groups of both younger children and those with correct body mass would be characterized by a higher level of the tested feature.

M a t e r i a l a n d m e t h o d s . The study included 120 students of year 2 and 5 in state primary schools from medium sized cities in the central area of the country. Body height and mass were measured and BMI was calculated. Suppleness was evaluated based on depth of sitting forward bend and sitting side bends. Data was differentiated according to age and BMI value.

R e s u l t s . A large percentage of overweight and obesity occurring in the studied groups of children was established, both in the beginning and at the end of young school development period, which to a greater extent concerns boys than girls. A similar level of suppleness in younger and older children was observed, with the exception of girls with correct body mass. Moreover, groups of overweight and obese children were characterized by worse suppleness results and greater dimorphic differences of this motoric feature.

C o n c l u s i o n s . The increasing phenomenon of obesity among school children and its negative influence on the level of suppleness proves that hitherto prophylactic and educational process concerning health promoting has not been efficient enough, both in school environment and among adult members of the society. It justifies the necessity to introduce systemic changes in those areas based on holistic physical education of the whole society.

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S t r e s z c z e n i e

W s t ę p . Otyłość jest zjawiskiem powszechnym i w coraz większym stopniu dotyczy młodych pokoleń. Jej odległe skutki są niepokojące, szczególnie w obszarze zdrowia i poziomie sprawności fizycznej. Jedną z jej składowych jest gibkość, a utrzymywanie należnego jej poziomu wydaje się konieczne, ponieważ pozwala na opóźnienie wystąpienia wielu problemów zdrowotnych. Celem pracy uczyniono wiec próbę porównania poziomu

gibkości dzieci szkolnych o prawidłowej masie ciała oraz z nadwagą bądź otyłością. Założono, że poziom gibkości chłopców i dziewcząt będzie podobny oraz, że zespoły dzieci młodszych i o prawidłowej masie ciała będzie cechował wyższy poziom ukształtowania badanej cechy.

M a t e r i a ł i m e t o d y. Badaniami objęto 120 uczniów klas II i V państwowych szkół podstawowych z średniej wielkości miast centralnej części kraju. Zmierzono wysokość i masę ciała oaz obliczono wskaźnik BMI. Gibkość oceniono głębokością skłonu tułowia w przód w siadzie i do boku. Materiał zróżnicowano wiekiem i wielkością wskaźnika BMI.

W y n i k i b a d a ń. Stwierdzono duży odsetek występowania nadwagi i otyłości w zespole zbadanych dzieci zarówno z początku jak i końca okresu rozwojowego młodszego szkolnego, co w większym stopniu dotyczy jednak chłopców niż dziewcząt. Zaobserwowano podobny poziom gibkości dzieci młodszych i starszych, z wyjątkiem dziewcząt o prawidłowej masie ciała a także, że zespoły z nadwagą i otyłe, obu grup wieku, cechują gorsze wyniki gibkości i większe różnice dymorficzne tej właściwości motorycznej.

W n i o s k i. Narastające zjawisko otyłości wśród dzieci szkolnych i jej negatywny wpływ na poziom gibkości świadczy o małej skuteczności dotychczasowego procesu profilaktyki oraz edukacyjnego w zakresie promocji zdrowia, zarówno w środowiskach szkolnych jak i dorosłej części społeczeństwa. Uzasadnia to konieczność wprowadzenia w tych obszarach, zmian systemowych opartych o holistyczne wychowanie fizyczne całego społeczeństwa.

Key words: boys, girls, early school period, BMI, forward bend, differences, suppleness dimorphism
Słowa kluczowe: chłopcy, dziewczynki, okres młodszy szkolny, BMI, skłony tułowia, różnice, dymorfizm gibkości

INTRODUCTION

Obesity of societies, especially in highly developed countries, is a fact, and this phenomenon is becoming more and more severe while more frequently concerning younger generations [1, 2, 3, 4]. It is common knowledge that distant health implications of obesity are alarming, with reflection on the motoric system functioning and the level of physical fitness [5,6,7,8,9]. One of its components is suppleness, a relatively hardly dimorphic feature, labile, conditioned by numerous factors and widely considered health aiding physical fitness components [10,11]. Due to relatively early regress in suppleness, retaining its proper level seems essential, which allows postponing numerous problems, including health problems resulting from a low level of physical activity [12,13].

The aim of this study was to compare suppleness level in groups of school children with correct body mass, overweight and obese, at the beginning and at the end of their ontogenetic development in early school period. This period was chosen due to its great importance in suppleness changes and person's motoric development.

When undertaking this study, it was assumed that suppleness level of boys and girls, expressed as the depth of bend in sagittal and frontal plane, would be similar in all groups included in it. Moreover, it was supposed that groups of younger children and those with correct body mass would be characterized by a higher level of formation of the studied feature than their older colleagues as well as overweight and obese students.

SUBJECTS AND METHODS

The study was performed in 2010 and included randomly selected group of students in year 2 and 5 from the primary school no. 3 in Płońsk and from the primary school no. 1 in Aleksandrów Kujawski. At each educational level a group of 30 boys and 30 girls were studied, which gave a total of 120 school children. A group selected in this manner, originating from state schools and medium sized cities in central part of the country can correspond to the population of Polish school children.

Body height and mass were measured as rudimentary morphological features, and BMI for each student was calculated from the means [14]. Suppleness, defined as vertebra mobility, was characterized by sitting forward and side bend in frontal plane [13, 15]. Readings were taken in identical conditions for all children.

BMI allowed evaluation of body mass and classifying a subject as correct body mass or overweight, which enabled differentiation of the study material into two groups [16]. It was developed with use of basic statistical methods by calculating mean values, their complements and dimorphic differences in suppleness level, while Student's t test was applied to evaluate differences in mean values of features characteristic for selected groups for independent trials; Mann – Whitney test was applied when data did not spread normally, which was verified by Shapiro – Wilk test [17]. The evaluation of dimorphic suppleness differences in the studied groups was based on the comparison of mean values with use of relative measurement – Mollison index [14].

RESULTS

Table 1 presents a configuration of size and mean values of basic morphological features in the studied groups.

Table I. *Morphological characteristics of the subjects (mean ± SD)*
Tabela I. *Wyniki badań cech morfologicznych (średnie ± SD)*

BMI characteristics	Boys year 2 (n =14 < norm) (n =16 > norm)	Boys year 5 (n =14 < norm) (n =16 > norm)	Girls year 2 (n =20 < norm) (n =10 > norm)	Girls year 5 (n =22 < norm) (n =8 > norm)
Body height (cm)				
< norm	141.36±8.45	151.71±6.66	136.05±9.96	156.03±5.63
> norm	142.85±7.80	146.49±7.67	137.41±9.02	156.25±6.50
Total	142.17±8.00	149.03±7.53	136.50±9.19	156.11±5.76
Body mass (kg)				
< norm	31.50±5.92	43.43±3.92	28,72±3,67	45,90±6,06
> norm	42.31±6.11	49.56±5.44	39,81±8,18	59,87±9,09
Total	37.27±8.07	46.70±5.64	32,42±7,61	49,63±9,27
BMI				
< norm	15.64±1.88	18.82±1.16	15.78±1.31	18.7±4.166
> norm	20.63±2.07	22.99±1.97	21.54±1.77	24.88±2.41
Total	18.30±3.20	18.30±3.20	17.69±3.12	20.36±3.31

As presented in the table, the size of boy's groups with BMI above norm exceeded half (53.33%) and were larger than girls' groups (30.00%), with percentage differences between those groups of 13.33% in year 2 and 26.67% in year 5.

Boys and girls at studied educational levels, differentiated by BMI, did not differ as far as body height was concerned, while stated significant differences in body mass means resulted from assumed differentiation. However, it needs to be pointed that only single cases with BMI indicating underweight were discovered in the studied groups.

Table 2 shows comparative characteristics of suppleness readings in students differentiated by educational level and BMI classification. As concluded from the classification, studied groups of boys and girls with normal BMI were characterized by greater mean depths of bends than groups of subjects with the index above norm. With the exception of left – side bend of boys in year 2, stated differences were statistically significant.

Table II. *Comparative characteristics of spine vertebra data in studied groups*
Tabela II. *Charakterystyka porównawcza pomiarów gibkości kręgosłupa badanych grup*

Boys (n=60)				Girls (n=60)		
Category	(mean ± SD)	t	p	(mean ± SD)	U/t	p
Sitting forward bend (cm)						
Year 2 < norm	17.07±6.04			19.41±2.33	t	
Year 2 > norm	10.75±5.53	2.9909	0.0057**	15.39±2.41	4.3868	0.0001*
Year 5 < norm	19.07±3.93			19.45±3.45	U	
Year 5 > norm	12.31±4.16	4.5548	0.0001**	13.62±1.41	8.00	0.0001*
Sitting right–side bend (cm)						
Year 2 < norm	16.57±4.10			16.15±2.37	U	
Year 2 > norm	13.00±5.04	2.0358	0.0513	14.63±2.01	59.50	0.0481**
Year 5 < norm	18.86±4.52			21.27±2.96	t	
Year 5 > norm	13.13±4.18	3.6088	0.0012**	16.13±1.73	4.6053	0.0001*
Sitting left–side bend (cm)						
Year 2 < norm	16.32±4.20			16.12±2.22	U	
Year 2 > norm	12.47±4.76	2.4945	0.0188**	14.51±1.78	56.50	0.0425**
Year 5 < norm	16.64±4.01			21.13±2.92	t	
Year 5 > norm	11.00±3.16	4.1571	0.0003**	16.01±2.07	4.5580	0.0001*

*statistically significant difference p< 0.01
**statistically significant difference p< 0.05

Suppleness means of the studied groups from different educational levels underwent statistical evaluation, identical classification resulting from BMI value. There were no differences observed in the depth of bends in groups of boys and girls with higher index values. The group of older girls with normal indices was characterized by higher means of all suppleness trials, and right – side bend (D-5.12; t=6.1482; p=0.0000) and left – side bend (D=5.01; t=6.2467; p=0.0000) with statistically significant differences at the level o 0.01. The relation of basic morphological features and results of performed tests was evaluated, proving low values of correlation indices of body height in the studied subjects with the results of suppleness trials (boys year 2 > norm -0.12 – -0.34; boys year 5 > norm -0.01 – -0.47 ; girls year 2 > norm 0.20 – 0.39 ; girls year 5 > norm 0.28 – 0.62).

Differences of means of bend depth in boys and girls from groups differentiated by BMI were evaluated, after their normalization to mean square deviation of boys' results, which is shown in table 3.

Table III. *Values of Mollison Index for the results of suppleness trials*
Tabela III. *Wartości wskaźnika Mollisona wyników prób gibkości*

Category	Forward bend	Right – side bend	Left – side bend
Year 2 < norm	-0.39	0.10	0.05
Year 2 > norm	-0.84	-0.32	-0.43
Year 5 < norm	-0.10	-0.53	-1.12
Year 5 > norm	-0.31	-0.72	-1.58

Dziewczynki młodsze n=30
wys,c.137,41+-9,01; skłony I. 15,39+-2,41; II. 14,51+-1,78; III. 14,63+-2,01

Dziew. starsze n=30
wys.c. 156,25+-6,50; skłony I. 13,62+-1,41; II. 16,01+-2,07; III. 16,13+-1,73
Chł. młod, n=30
wys,c.142,87+-7,80; skłony I. 110,75+-5,53; II. 12,47+-4,76; III. 13,00+-5,04
Chł. star.
wys.c. 146,69+-7,67; skłony I. 12,31+-4,16; II. 11,00+-3,16; III. 13,13+-4,18

Among students at both educational levels, greater absolute Mollison index values, reflecting dimorphic differences, characterized overweight or obese children.

DISCUSSION

Hitherto analysis of the study material allowed considering rudimentary issues and summarizing particular results. Based on them, certain observations and statements come to mind, which, in the light of information derived from available literature and own studies, require a broader discussion.

1. Frequency of established overweight and obesity in groups of the studied children is significant; it concerns students both at the beginning and at the end of their early school development period, however, to a higher degree, boys than girls.

2. Suppleness level of the studied younger children is similar to the one established in older children, except for girls with correct body mass, among whom the older ones are characterized by a higher mean of the studied suppleness trials, especially side bends both to the left and right.

3. Overweight and obese children in both age groups are characterized by worse suppleness levels and greater dimorphic differences of this motoric feature.

When studying any phenomenon, its scope and frequency are basic information allowing proper analysis of results and further conclusions. In the presented study, a large percentage of children in both age groups presented BMI exceeding norm. Hence, the study results confirmed Nawarycz's ones, which pointed to this phenomenon occurring among children at any age , and its decrease in the group of the studied girls during puberty [18], as well as a comparable frequency of obesity among children in southern Europe, which is significantly higher than in its northern areas [19]. Such observations are particularly alarming when taking into account a large percentage of overweight boys included in the study, and previous results of Oblacińska et al, who stated a lower, only 12% and increasing after five years to 17%, frequency of overweight among Polish children. However, this study did not confirm a higher percentage of overweight among girls, which may result from the second motoric climax and decreasing of overweight during puberty that could concern the majority of girls in year 5 [3,4].

In the light of such changes in the studied phenomenon, it seems relevant to consider differences in suppleness level of the studied groups of children, especially girls with normal BMI, among whom stabilizing of its formation level was not established with age. Such observation may point to a longer period of developing suppleness in girls than in boys. Clear differences of suppleness level occurred among both age groups between children with correct body mass and overweight children. This statement and its greater dependence on body mass than body height indicate that overweight and obesity are basic factors restricting vertebra mobility in children of both sexes and at any age. It stands in accordance with the majority of previous studies by other authors, and is therefore alarming due to the fact that frequency of this phenomenon increases, as well as the differences in the depth of bends in studied groups of older children do [20,21,22]. However, those results are not confirmed by Ignasiak, who indicates a significant relation of vertebra suppleness to body height [23]. Therefore, it was assumed that with age, the influence of overweight on suppleness level increases, which is already observed in young people. It is also supposed that vertebra mobility is stabilized at an earlier stage in sagittal plane [24], which was confirmed by significant differences of side bends of girls with normal BMI, and indirectly by lack of differences among younger boys and their appearance among older subjects. Authors believe that the differences in time necessary for developing suppleness in both planes result from higher everyday frequency of performing forward bend than side bends, and from negligence of its shaping during realization of directed motoric exercise. When stating this assumption, however, one must maintain caution, as changes in body build might be a significant factor in older children, especially in girls [25]. A complement to the results of this study and their analysis are observations derived from the analysis of dimorphic differences of means of bend

depths in studied groups. They confirm a relatively low suppleness dimorphism, however, they point to its greater differences among overweight and obese children, which additionally attests to negative influence of overweight and obesity on the scope of vertebra mobility.

CONCLUSIONS

An accumulating phenomenon of obesity among school children and its negative effect on suppleness level attest to civilizational causes of this increasing health threat for younger generations, and to both insufficient prophylactics concerning overweight, as well as inadequate educational process in the health promotion subject – in school environment and in adult members of the society. It justifies the necessity of introducing changes in those areas – system changes based on holistic physical education of the whole society, during which pursuing correct body mass and proper level of suppleness would not be an aim itself, but a means to retaining good health, both in the physical and social sense.

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