

PHYSICAL ACTIVITY INFLUENCE ON NUTRITIONAL STATUS OF PRESCHOOL CHILDREN

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The prevalence of excessive body weight and obesity among children is increasing in many countries, including our country. It is believed that one of the two most important reasons for this increase is insufficient physical activity of children. The aim of this study was to examine the state of the level of nourishment of preschool children in relation to their level of physical activity. The survey was conducted in preschools in Pancevo. The sample consisted of 193 children (88 boys and 105 girls), aged 4 and 5 years. The assessment of the level of nourishment of the children and their parents was done after the standard anthropometric measurements of height, body weight, determining the body mass index and waist circumference and comparing the obtained values with the growth plates given by the World Health Organization. Physical activity of the children was evaluated by a questionnaire which parents filled up. Inappropriate level of nourishment had 60 (31.1%) children, of which 26 (13.5%) with excessive body mass, obese 29 (15.0%), while 5 (2.5%) were malnourished. Children are most attracted to sports such as ballet or folk dances, ball games and swimming, but only 22 (15.83%) children are members of some sports club. The lack of finances and the lack of sports facilities and terrains are given as reasons by most parents. During the implementation of physical activities, 65.2% of children are never or sometimes exposed to excessive physical effort. The prevalence of insufficient physical activity among preschool children in Pancevo was high, particularly among children with excessive body weight and obese children. Socio-demographic and behavioral factors as well as behavior of parents significantly contributed to physical inactivity. *Acta Medica Medianae* 2010;49(1):17-21.

Key words: activity, nutritional status, preschool children

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Introduction

Prevalence of excessive body weight and obesity among children is increasing in many countries, even in ours (1-5). It is believed that one of the two most important reasons for this increase is insufficient physical activity of children (6,7). Activities in front of the screen such as video games, the Internet, telephone and home movies watching increases the time of sedentary activities, and reduces the time children spend in motion and playing games.

Regular implementation of physical activity from an early age contributes to the prevention of mass non-infectious diseases, which are the leading cause of death and illness in developed countries and countries in transition.

Physical inactivity increases the risk of ischemic heart disease by 15-20%, type 2 diabetes, breast cancer and colon cancer, as well as osteoporosis. According to the estimates of the World Health Organization, every year, at

least 1.9 million people worldwide die from the consequences of insufficient physical activity (8).

Regular physical activity helps in the prevention and control of risk behaviors such as smoking, alcohol consumption and abuse of psychoactive substances, and it impacts on diet and prevents violence, particularly in children and young people. Physical activity and sport among young people also promote psychological well-being and reduce stress, anxiety, depression and loneliness (9).

Because of the proven positive effects on health, the World Health Organization provides support to member countries in strengthening policies which promote physical activity. A global strategy on diet, physical activity and health was adopted in 2004, with the fundamental aim to improve health through proper nutrition and physical activity.

It is believed that all quality national programs which raise the level of physical activity should include children and adolescents (10), and preschool and school facilities play an important role in creating habits that contribute to health improvement such as promotion of different types of physical activities.

The level of physical activity among children depends on individual impact and influence of parents and environment, and the differences by gender (boys are usually more

physically active than girls), and according to age (children are more physically active than adolescents) are also present.

Economic conditions, proximity to places for recreation, as well as parents' support, their education, socioeconomic status and other factors also influence the intensity of the implementation of physical activity in childhood and adolescence (11). The European Union's degree in sports among children varies depending on region, and the time children spend in physical activity decreases with aging (12).

Aim

The aim of this study was to examine the state of nourishment of preschool children in relation to their level of physical activity. A special aim of this study was to examine the relationship between the state of nutritional status of children and nourishment of their parents, as well as the connection between the implementation of physical activity of parents and physical activity of children.

Examinees and methods

The survey was conducted in the nursery facility, "Children's Joy" in Pančevo during 2008. A total of 193 children aged 4-5 years were examined, of which 88 (45.6%) boys and 105 (54.4%) girls, which represents about 10% of the total number of children who attend this institution.

The assessment of nourishment of children was based on the following anthropometric indicators: body height, body weight, body mass index and waist circumference. Subjects were measured in underwear. Body height was measured by floor anthropometer with the possibility of reading the value to the nearest 0.5cm. The head was put in the "Frankfurt plane", in a horizontal position so that the line that connects the tragus helix of the left ear with the lower edge of the eye orbit was parallel to the surface (13). Body weight was measured by digital medical scales with precision of 0.1kg. Body mass index (BMI) was calculated according to the formula:

$$\text{BMI} = \text{body weight (kg)} / \text{body height (m}^2\text{)}$$

Measured values of body height and body weight as well as calculated body mass index values were compared with reference values in the growth plates and development of children, given by the World Health Organization (WHO) in 2007 (14).

Waist circumference was measured in the middle, between the rib port and iliac bone on the linea aksilaris medius, so that the ribbon was placed parallel to the surface(15). Limit values of boys and girls in relation to age were used (16).

Assessment of nutritional status of the parents was based on body mass index. Anthropometric surveys included 120 mothers and 141 fathers.

To assess physical activity of children, the originally structured questionnaire was used, and for assessing physical activity of parents a questionnaire taken from the project «My heart, healthy heart» that the parents filled out independently was used (17).

Processing of the results was performed by using the statistical software package Statistical Package for Social Science (SPSS v13.0) and WHO Anthro, v3.0.1. For borderline level of significance of differences error probability $p < 0,05$ was adopted

Results and discussion

Of the total of 193 children, there were 88 (45.6%) boys and 105 (54.4%) girls. Children aged 5 years were numerically superior in the sample, and they represented about two-thirds of respondents (Table 1).

Table 1. Distribution of investigated children by sex and age

Age of the child (year)	Sex	(N)	Total N (%)
4	M	30	70 (36.3)
	Z	40	
5	M	58	123 (63.7)
	Z	65	
Total N (%)	M	88	193 (100.0)
	Z	105	

For children aged 4 years, the middle value for height was $109.10 \pm 4.78\text{cm}$ (minimum was 96cm, maximum 122cm), and for children aged 5 years, the middle value for height was $116.26 \pm 5.65\text{cm}$ (minimum was 105cm, maximum 132cm).

Middle value for body mass in four-year-old children was $19:43 \pm 3.76\text{kg}$ (minimum was 14kg and 38kg maximum), and in children aged 5 years - $21:41 \pm 3.67\text{kg}$ (minimum was 15kg and 38kg maximum).

Middle value of body mass index in children aged 4 years was $16.23 \pm 2.20\text{kg/m}^2$ (minimum was 13kg/m^2 , and the maximum 26kg/m^2), and in children aged 5 years it was $15.79 \pm 1.78\text{kg/m}^2$ (minimum is was 13kg/m^2 , and the maximum 22kg/m^2).

The obtained values are in keeping with the values obtained in similar surveys in Serbia (3,4,15,17), which indicates the validity of the conclusion regarding the impact of physical activity on nutritional status of children.

Percentile values for body mass, height and BMI of the tested children were not statistically significant regarding age. Assessment of nutritional status of tested children showed that in the sample there were 60 children (31.1%) inadequately nourished, of which there were 26 (13.5%) with excessive body mass, obese 29 (15.0%) and 5 (2.5%) of them were malnourished (Table 2).

In similar studies conducted in our country that have included children of the same or similar age, the percentage of obese children (BMI > 95-th percentile) was 9.21% and percentage of

children with excessive body weight (BMI between 85th and 95th percentile) was 13.49%(18,19).

Tabela 2. Prevalence of malnutrition, pre-obesity and obesity in tested children

Age of the child (year)	Malnourished <P5	Overweight P85-P94	Obese ≥P95	Total N (%)
4	3 (4.3%)	11(15,7%)	14(20.0%)	28(40.0%)
5	2 (1.6%)	15(12.2%)	15(12.2%)	32(26,0%)
Total	5(2.5%)	26(13.5%)	29(15.0%)	60(31.1%)

The values of waist circumference above the limit values (16) for the type of abdominal obesity was found in 17 (8.80%) boys and 23 (11.92%) girls, out of the total of 40 (20.25%) children. The difference between boys and girls was not statistically significant concerning this parameter ($\chi^2 = 0195$, $p = 0,659$).

The statistical significance of $p < 0.01$ between body mass index and waist circumference was determined by Pearson's correlation (Table 3). Children who are pre-obese and obese had larger waist circumference compared to the reference value, which indicates that waist circumference can be used as valid and easy for determination of the parameter for the assessment of obesity, especially abdominal obesity among preschool children.

There is a correlation between parents' and their children's nutritional status, and particularly was proved the association between obesity of a mother and obesity of a child ($\chi^2 = 5133$, $p = 0,023$). Children who have elevated body mass often have mothers with increased body mass in relation to the group that was malnourished and normally nourished (Table 4). Epidemiological

studies have shown that there is higher frequency of obese children who have obese parents.

In a family where one parent was obese and the other was normally nourished, obesity was confirmed in about 50% of children. In families where both parents were obese, the percentage was up to 75%, while in families where both parents are normally nourished, the percentage of obese children was only 9%(20). Studies have shown that extremely obese children often have extremely obese mothers in relation to normally nourished and moderately obese children (21).

The results of physical activities' analysis which were implemented among preschool children are given in tables 5 to 7.

According to parents, when not in kindergarten, children spend on average less than 2h outside in winter and more than 4h in summer. Based on the statements of parents, the implementation of very intense physical activity that causes sweating, or fast breathing was reported in 48 children (34.8%), while about two-thirds of the tested children (65.2%) never gasped and sweated (Table 5). This piece of information indicates that even if children spend the time out, it does not mean that they are physically active.

Parents subjectively assessed that their children were active enough compared to their peers. Less active during the game compared to other children were only 8 children (5.7%), according to the estimation of their parents, while others were equally or more active compared to their peers (Table 6). To compare data from tables 5 and 6 it is necessary to apply different methodologies to determine the intensity of physical activity, as parents were subjective in their assessments.

Table 3 Percentile distribution of nutritional status of a child in relation to waist circumference

Waist circumference of a child	Malnourished	Adequate Nutritional status	Risk of obesity	Obese	Total
	<P15	P15 -P84	P85-P94	≥P95	
Below the reference value	5	126	16	6	153
Above the reference value	0	7	10	23	40
Total	5	133	26	29	193

$$\chi^2=0.639, p=0.000$$

Table 4. Correlation between nutritional status of children and their parents

Nutritional status of children	Malnourished and normal weight (BMI<25.0)		Increased body weight and obese (BMI> 25.0)	
	mothers	fathers		mothers
Malnourished and normal weight	41	20	12	29
Increased body weight and obese	51	26	36	49
Total	92	46	48	78

Nutritional status of children in relation to increased body mass of mothers: $\chi^2 = 5.133$, $p=0.023^*$
 Nutritional status of children in relation to increased body mass fathers: $\chi^2 = 0.480$, $p=0.488$

Table 5. Implementation of intense physical activity in tested children

Physically active	n	%
Never	10	7.2
Sometimes	80	58.0
Often	40	29.0
Almost always	8	5.8
Total	138	100.0

Table 6. Parents' subjective assessment of their children's physical activities in relation to other children of the same age

In comparison to other children	n	%
Significantly less	1	0.7
Less	7	5.0
Almost	74	53.2
Little more	43	30.9
More	14	10.1
Total	139	100.0

Table 7. reasons for physical inactivity of children according to parents' estimations

The reason for physical inactivity	n=77	%
Lack of adequate sports facilities and sports grounds	16	20.78
Lack of time and indifference of parents	12	15.58
Lack of adequate sporting facilities	6	7.79
Lack of sports clubs	27	35.06
Too young child's age	35	45.45

Table 8. Relation between physical activity and state of children's nutritional status

Physical activity child	Nourishment of the child		Total
	Malnourished and normal weight	Excessive weight and obese	
Active	35	13	48
Inactive	49	41	90
Total	84	54	138

$$\chi^2 = 4.485 \quad p = 0.034 \quad p < 0.05^*$$

Table 9. Relationship between physical activity of children and parents

Physical activity of a child	Physically active parent		Physically inactive parent	
	mothers	fathers	mothers	fathers
Active	31	34	54	77
Inactive	11	9	34	41
Total	42	43	88	118

Physical activity of children in relation to physical activity of mothers: $\chi^2 = 1.946$, $p = 0.163$

Physical activity of children in relation to physical activity fathers: $\chi^2 = 5.695$, $p = 0.017^*$

Uninterested in the sport (of $N = 139$ children) were only 12 children (8.63%), while

other children were interested in sports such as ballet dancing or folk dances, ball games and swimming. Only 22 children (15.83%) were members of sports clubs.

A possibility to increase physical activity of their children ($N = 139$), parents - 73 (52.52%) see in organized activities in kindergartens, inclusion in the sports clubs - 82 (58.99%), while 53 parents (38.13%) see such possibilities in joint activities of parents and children. The reason for physical inactivity parents often seen in the lack of finances and lack of sports facilities and grounds (Table 7).

Defining the state of children's physical activity (active / inactive) was done on the basis of subjective assessments of parents ($N = 138$) and showed statistical significance ($\chi^2 = 11,256$, $p = 0.0007$) in relation to nutritional status (Table 8). Obese children with excessive weight ($N = 54$) are physically inactive ($N = 41$) compared to malnourished and adequately nourished children ($N = 84$) who were physically active ($N = 5$). It is significant that the majority of children ($N = 90$) regardless of the state of nutritional status are physically inactive.

Excessively nourished and obese ($N = 54$) children were physically inactive ($N = 41$) compared to malnourished and normally nourished children ($N = 84$) who were physically active ($N = 35$). It is significant that the majority of children ($N = 90$) regardless of the state of nutritional status were physically inactive.

There is statistical significance between physical activities of fathers and children ($\chi^2 = 5695$, $p = 0,017$), in other words, children who are physically active also have physically active fathers (Table 9). The relationship of physical activity of children in relation to physical activity of mothers ($\chi^2 = 1946$, $p = 0,163$) was not statistically significant.

A large number of risk factors for obesity of children have been investigated so far, and they are divided into several groups: eating habits (skipping meals, extensive meals, night snacks, nibbling between meals, dominance of certain kinds of food eg. sweets, snacks, carbonated soft drinks, etc.), physical (in)activity (the number of hours spent in front of the screen (television or computer), duration of physical activity in hours / inactivity during the day, duration of sleep in hours, type and duration of extracurricular activities, etc.), factors related to parents (obese mothers or both parents, mother's weight during pregnancy, smoking of mothers during pregnancy, educational level of parents, family size, etc.), as well as factors related to educational institutions: a meal at school or kindergarten (meal prepared at home, a meal provided at school, purchase of meals), the number of hours of physical education during a week etc. In our pilot survey, we examined only some of the determinants of physical activity of children, which opens up paths for new and more meaningful examinations.

Conclusion

Based on the results of examination of children of preschool age, it can be concluded

that about one third of children (31.1%) was inadequately nourished, of which 28.5% were obese and overweight.

In relation to the limit values for visceral type of obesity, every fifth child had a waist circumference value over the limit values; also, statistically significant correlation between body mass index and waist circumference of the child was determined.

Children who have increased body weight

or who are obese, more often had obese mothers or mothers with elevated body mass. Most of the tested children ($n = 90$) were never or only sometimes physically active, while less than one third of children had frequent or everyday activities.

Physically inactive children were statistically significantly more often overweight and obese compared to malnourished and normally nourished children..

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UTICAJ FIZIČKE AKTIVNOSTI NA STANJE ISHRANJENOSTI DECE PREDŠKOLSKOG UZRASTA

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Prevalenca prekomerne telesne mase i gojaznosti među decom u porastu je u mnogim zemljama sveta, pa i u našoj. Smatra se da je jedan od dva najvažnija razloga za ovaj porast nedovoljna fizička aktivnost dece. Cilj ovog rada bio je da ispita stanje ishranjenosti dece predškolskog uzrasta u odnosu na stepen njihove fizičke aktivnosti. Istraživanje je sprovedeno u predškolskim ustanovama u Pančevu. Uzorak je činilo 193 dece (88 dečaka i 105 devojčica) uzrasta 4 i 5 godina. Procena stanja ishranjenosti dece i njihovih roditelja rađena je nakon standardnih antropometrijskih merenja telesne visine, telesne mase, određivanja indeksa telesne mase i obima struka i poređenja dobijenih vrednosti sa tablicama rasta Svetske zdravstvene organizacije. Fizička aktivnost dece procenjivana je upitnikom koji su popunjavali roditelji. Neodgovarajuću ishranjenost imalo je 60 (31.1%) dece, od čega je sa prekomernom telesnom masom bilo 26 (13.5%), gojazno 29 (15.0%), dok je 5 (2.5%) bilo pothranjeno. Decu najviše privlače sportovi kao što su balet, ples ili folklor, igre sa loptom i plivanje, ali je samo 22 (15.83%) dece član nekog sportskog kluba. Kao razlog nedostatka fizičke aktivnosti roditelji najčešće navode nedostatak finansija i nedostatak sportskih objekata i terena. Tokom sprovođenja fizičke aktivnosti, nikad ili ponekad se izlaže preteranom naporu 65.2% dece. Prevalenca nedovoljne fizičke aktivnosti među predškolskom decom u Pančevu je visoka, posebno među decom sa prekomernom telesnom masom i gojaznim. Sociodemografski i bihevioralni faktori, kao i ponašanje roditelja značajno doprinose fizičkoj neaktivnosti. *Acta Medica Medianae* 2010; 49(1):17-21.

Ključne reči: fizička aktivnost, stanje ishranjenosti, predškolska deca