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The influence of the state of nutrition on the efficiency in tests of children's motor abilities

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Abstract: *The aim of the research was to determine whether the state of nutrition has an effect on the efficiency in tests of motor skills. The research was conducted on 30 children aged 5 to 6 years. The sample of variables consisted of five tests of motor skills (coordination, repetitive strength, explosive strength, balance and speed) and measurements of height and weight, on the basis of which the body mass index was calculated and nutrition percentiles. The obtained results showed that there are differences in efficiency between boys and girls. Showed how the state of nutrition in boys affects efficiency in the coordination test, and in girls in the repetitive strength test. More precisely, those boys who have lower values of the body mass index and percentile of nutrition achieve a better result in the backward polygon test than those boys with higher values, while girls with lower values of nutrition achieve a better result in the abs in 30 seconds test than girls with higher values.*

Key words: motor ability, children, testing, nutrition



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Introduction

The motor pattern of behavior in children represents the motor activity that is performed during play, engaging in various sports, physical activities in the home environment, teaching at school, as well as in free time. Carrying out physical activity in order to fulfill various needs represents motor functioning. Motor functioning of children depends on the development of motor abilities and motor skills. Because of all this, the main goal of working with children is the development of their motor skills and, more broadly, their motor behavior, as well as proper posture through various means of physical exercise, but without competitive pretensions.

Childhood represents a period of rapid physical, emotional and social changes and a time in which children acquire their first life habits and attitudes that significantly affect health and disease prevention. In this period of the fastest growth and development, research and monitoring of nutrition and nutritional status of children and youth are particularly important for proper development and prevention of health problems such as obesity.¹ When it comes to teaching physical education, it is based on motor activity, with the help of which certain teaching goals are achieved. In addition to developing motor skills, physical activity contributes to maintaining a healthy body weight (prevention), i.e. regulation of excess body weight, as well as the acquisition of motor skills. If you want to significantly influence the anthropomotor abilities of school children, you need to choose a means of physical exercise of a general character, and apply them with increased intensity, compared to what is the current practice.

The World Health Organization warns of the problem of obesity among young people, emphasizing that the most important long-term consequence is its retention in adulthood, which is manifested by increased morbidity and mortality from chronic diseases.² Monitoring physical growth and defining the level of nutrition of children and young people is particularly important during their growth and development. The reasons for this are multiple. An important reason is in daily preventive and clinical work due to the assessment of the child's growth and nutrition in response to the question of whether it is within the limits characteristic for age and gender or if there are deviations. Another reason is public health, because changes in the level of nutrition are a very sensitive indicator of the health status and nutrition of the population, if the influence of genetic potential is appropriately excluded.³ The state of nutrition also affects certain motor skills, which is proven by numerous studies. A whole series of research was carried out, which tried to determine whether there is a connection between the state of nutrition and different motor abilities.

One of such studies is the one conducted by Štekeljić, Štamatović, Martinović and Pelemiš.⁴ The goal of their research was to compare the motor skills of boys with different body mass indices and determine whether the children are obese or overweight and to what extent their motor skills are underdeveloped, compared to normally fed children. The sample of respondents consisted of 180 fourth-grade students. Based on the body mass index results, the sample was divided into four subsamples: undernourished children (N=30), normally nourished children (N=90), overweight children (N=30) and obese children (N=30) .

Assessment of nine motor skills was carried out using a battery of 18 tests. The results of the research showed that the group of children with excessive body weight and the group of obese children have certain difficulties in the motor dimension in the segment of muscle strength and power, in the segment of achieving speed and in the segment of balance. A similar study was conducted by Prskalo, Badrić and Bogovčić¹, whose aim was to determine the differences in the level of motor skills with regard to the percentage of body fat in 87 boys and girls in the fourth grade of primary school. The results of the research showed that in boys who were classified according to fat percentage, there was a statistically significant difference only in some motor skills. Boys with an acceptable body fat percentage performed significantly better in explosive strength and agility than obese boys. Results for girls show similar score values.

The state of nutrition is one of the significant indicators of the state of health and physical ability of an individual and the entire population, as well as psychophysical possibilities and potential for normal and healthy growth and development. In addition to being an important indicator of the current state of health, it also represents an opportunity to improve the state of health in the future.⁵

With the aim of monitoring growth and development parameters, and recognizing deviations from established nutrition criteria in certain life stages, the state of nutrition is of great importance, especially in childhood.⁶ It is influenced by food intake, quality and quantity of food, and health status and affects the outcome and recovery from various injuries and diseases.⁷ Nutritional status is determined according to internationally recognized standards.²

Research results in Serbia show that almost one fifth of children and youth aged 7 to 19 (18%) are moderately overweight and obese, which represents an increase compared to 2000⁸. The increase in the number of moderately overweight and obese children in Serbia is a consequence of bad eating habits and insufficient physical activity, and this indicates a significant health problem. More recent studies also show that children of younger school age are obese in 4.6-8.2% of cases, that is, in 11.3-32% of cases, they are overfed.⁹⁻¹¹

Prskalo, Badrić and Kunješić¹² conducted a study whose aim was to determine the prevalence of overweight among primary school students and to determine the differences in motor skills between children of normal weight, overweight and obese children. The study was conducted in two elementary schools, where a total of 333 students aged 7 to 11 (178 boys and 155 girls) were measured. Four anthropometric and seven motor variables were used to analyze differences in children's motor skills. Children were divided into three groups within gender based on their body mass measures. Through research, they proved that children with a normal weight have better results in explosive strength, coordination, static arm and shoulder strength than children who are overweight and obese.

Lopes, Stodden, Bianchi, Maia, and Rodrigues¹³ analyzed the association between coordination and body mass index during childhood and early adolescence. The sample consisted of 7175 children (3616 boys and 3559 girls), aged 6-14 years. Children's BMI was calculated and the Kiphard-Schilling coordination test was performed. The results showed

that overweight and obese children of both sexes showed significantly lower results in the coordination test than children of normal weight

Methods

Participants

The research was conducted on a sample of 30 children (N=30), 20 boys (n=20) and 10 girls (n=10). At the time of the measurement, the children were between 5 and 6 years old. The measurement was carried out in January 2024. Each child was measured individually in seven variables.

Subjects were free of injuries or illness prior to testing and were informed, as were parents, of the objectives and protocols of testing and gave written consent to participate in the study. To avoid potential bias, participants were not informed of the theoretical background and did not receive feedback from the tester. The study was conducted in accordance with the Declaration of Helsinki.

Sample of variables

Body height (BH) and body mass (BM) were measured for the purposes of the study. Based on this, a body mass index (BMI) was calculated, which was then added to the CDC BMI growth-for-age chart to arrive at a percentile rank for each individual child.

After that, five motor variables were measured, based on which motor abilities can be assessed, i.e. coordination, balance, explosive strength, static strength, repetitive strength and speed. Abilities were measured with a battery of the following tests: standing on one leg (SOL), backstroke polygon (BSP), hand tapping in 10 seconds (HT10s), standing long jump (SLJ) and sit-ups in 30 seconds (SU30s).

All tests were performed under the same conditions (20-25 °C), in the same field indoors. Participants were introduced to the test procedure, through explanations and demonstrations.

Statistical procedure

All statistical analyzes were performed using SPSS Statistics 21 software (SPSS Inc., Chicago, IL). Standard statistical procedures were used to calculate the basic descriptive parameters of the variables: arithmetic mean (AS), minimum score (MIN), maximum score (MAX), standard deviation (SD). To analyze the difference between boys and girls, a t-test analysis was performed. For the purpose of determining the connection between nutritional status and efficiency in motor ability tests, correlation analysis was used. The alpha level was set to $p < 0.05$ to indicate statistical significance.

Results whit Discussion

Table 1 shows the descriptive parameters of all participants and from it we can read that 30 participants participated in the research with an average body mass index of 14.83 and an average nutrition percentile value of 31.92 (Percentile ≥ 5 and < 85 , Healthy weight), which falls within the value of normal body mass.

Table 1. Display of descriptive parameters of all participants

	AS	MIN	MAX	SD
BH	115.2	108.00	127.00	5.60
BM	19.68	15.00	24.00	2.61
SOL	23.47	13.00	29.00	5,70
BSP	19.33	14.65	24.34	4.24
SU30s	13.28	9.00	16.00	2.34
SLJ	117.37	103.20	148.00	10.36
HT10s	13.23	10.00	18.00	3.33
BMI	14.83	13.70	17,30	1.37
NP	31.92	5.00	85.00	31.60

Table 2 shows the results of the t-test of data analysis by gender in all variables. From it, we can conclude that there is a difference between boys and girls ($p < 0.05$) in the tests of polygon back, sit-ups in 30 seconds and long jump from a standing position, as well as in body mass index values and nutrition percentiles (NP) in favor of boys. That is why the correlation was done individually for each gender.

Table 2. T-test data analysis for all variables

	t-values	df	p
BH	1.52	14.00	0.14
BM	-0.47	14.00	0.65
SOL	0.31	14.00	0.69
BSP	-2.24	14.00	0.02
SU30s	2.96	14.00	0.03
SLJ	3.56	14.00	0.00
HT10s	3.01	14.00	0.01
BMI	-2.98	14.00	0.01
NP	-3.61	14.00	0.00

Table 3 shows the correlation analysis of BM, BMI and NP with tests of motor skills for all participants. The results from this table show a significant association of body weight, body mass index and nutrition percentile with coordination (polygon backward test), and a significant negative association with repetitive strength (30 second sit-ups test). Percentiles and BMI also show a negative association with the explosive strength test.

Table 3. Correlation analysis of body mass, body mass index and nutrition percentile with tests of motor skills for all participants

	SOL	BSP	SU30s	SLJ	HT10s
BM	-0.04	0.66	-0.52	-0.16	0.09
BMI	-0.39	0.71	-0.79	-0.49	-0.21
NP	-0.29	0.70	-0.81	-0.51	-0.28

The development of motor skills in students is important both for physical development itself and for the development of health care habits. Developing motor skills, the child independently, in pairs or in groups, with or without props, static or dynamic exercise creates a habit, cooperates, respects the rules, but also participates in their formation. Sports and games are necessities, that is, necessities that follow a person from early childhood, representing a form of educational and social activity.

The aim of this research was to determine whether the state of nutrition affects the efficiency in tests of motor skills in preschool children. T-test analysis of data by gender in all variables showed that there is a certain difference in results between boys and girls. Thus, in boys, body mass, body mass index and nutrition percentiles had an impact on efficiency in the coordination test. Similar results were obtained by Prskalo, Badrić and Kunješić⁸, whose research, in addition to coordination, showed the connection between nutrition and explosive strength and static arm and shoulder strength.

In this study, the nutritional status of girls affected the results in the repetitive strength test in the same way as in the study conducted by Hasan, Kamal and Hussein.¹⁴ Their results showed a significant difference in muscle strength and endurance among groups of obese and overweight children compared to groups of normal weight children.

Correlation analysis of all participants shows how the state of nutrition in both boys and girls affected the efficiency in performing the long jump from a standing position, i.e. with motor skills of explosive power. Horvat, Hraski, Hraski and Mraković¹⁵ and Prskalo, Badrić and Bogovčić¹⁶ also came to the conclusion in their research that there is a significant relationship between body mass index and explosive strength. In contrast to the results obtained by Štekeljić, Štamatović, Martinović and Pelemiš,⁴ this research did not show a connection between nutrition and the motor abilities of speed and balance.

For children and young people, sport is a chance to learn, a space in which to practice for life, it has earned its great importance on the basis of numerous positive characteristics that influence young generations, among which physical, social and personal well-being can be singled out.¹⁷ Physical well-being is reflected in the improvement of motor skills, general health and the formation of movement habits. There is a wide range of different influences that can arouse interest in sports and the desire to engage children in it. Data from a survey conducted in 2007, which included respondents aged 11 to 15, showed that 58.3% of young athletes voluntarily chose to play sports, 22.3% stated that they entered sports under the

primary influence of their parents. peers 7.0%, sports idol 6.1%, and 3.6% under the influence of physical education teachers.¹⁸ Motives and main drivers for engaging in some physical activity within the club or not, children and youth find socializing, entertainment, travel, positive influence on appearance and health, and all this and much more is possible and provided by sport.

Conclusion

The main purpose of this research was to determine whether there is a connection between nutritional status and efficiency in tests of motor skills in preschool children. The research was conducted on a sample of 30 children and shows that there is a difference in test efficiency between boys and girls. The results showed that in boys there is a high correlation between nutritional status and efficiency in the coordination test, while in girls there is a high negative correlation between nutritional status and efficiency in the repetitive strength test.

The results of this and similar research indicate another important factor, namely the importance of a healthy diet and physical exercise. Motor skills are not only part of the kinesiology class, but also an important item in everyday life. Precisely because of this, it is important to emphasize that the preschool age is the period in which the development of these abilities is most influenced, as well as the adoption of healthy lifestyle habits.

It would certainly be good to upgrade this work by expanding it to a larger number of respondents, and to carry out the research in a longitudinal form, which would increase the precision of the results obtained.



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