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PECULIARITIES IN THE MANIFESTATION OF THE LOWER LIMBS' EXPLOSIVE POWER IN CHILDREN OF PRESCHOOL AGE

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ABSTRACT

Physical Education is a vital aspect of the preschool curriculum in the education system. Its main tasks are aimed at a child's comprehensive development. It influences health, physical fitness, and communication skills, helps cognitive growth, and provides emotional satisfaction from motor activity. One of the key activities in the subject's curriculum is the development of children's motor skills. The work on explosive power is essential here, as it directly influences the mastery and subsequent improvement of natural movements. Based on the above, **this study aims** to reveal the peculiarities in the manifestation of the lower limbs' explosive power in children of preschool age. To realize the aim, we carried out a one-time test with 251 children (boys and girls) from two kindergartens in the territory of the city of Sofia. Each child's participation was confirmed by signing an informed consent form by their parents. **Methods:** We conducted the research by applying the following **tests**: standing long jump with two legs and consecutive single-leg hops. **Results:** We subjected the test data to variation and comparative analysis. The variation analysis results showed a normal distribution of the subjects' average achievements, which allowed us to apply a two-factor analysis of variance followed by the parametric Student's t-test. The data from the two-factor ANOVA showed significant effects of the factors of gender and age. The comparisons between different ages allow us to follow the dynamics of the development of the lower limbs' explosive power. **Conclusion:** After conducting research and processing the results, we found significant age and gender differences in preschool children's abilities regarding the lower limbs' explosive power. This allows us to recommend work on developing lower limbs' explosive power based on the inferred intergroup differences.

Key words: preschool education, explosive power, children

INTRODUCTION

A sedentary lifestyle today is one of the leading factors for numerous diseases, while physical activity is the primary means of counteracting it. Physical activity and regular engagement in physical exercises, games, sports, and tourism should be added to various methods for fighting the negative consequences of physical inactivity for individuals and society. According to (1), a scientifically structured daily routine requires the mandatory inclusion of physical activity. (2) believes that inactivity adversely affects one's health, physical development, and fitness.

Addressing the issue of physical activity in childhood and school age (3) underscores the pivotal role of physical education in the holistic development of children, particularly in the preschool age. This period is crucial for fostering health, physical conditioning, overall work capacity, and developing natural and practical skills and habits. The effectiveness of physical education in kindergarten is determined by the specific goals of physical education within our educational system and the standards that need to be met (4).

Authors such as (5-7) highlight the intricate interconnection between a child's physical development and other types of development, such as linguistic, social, and cognitive, during the preschool period. (8) defines physical development as a critical factor shaping physical fitness. The degree of influence that physical activity and sports have on physical development is influenced by various factors, such as genetic predisposition, age stage, the volume and intensity of activities, the type of sport, and others.

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The statements of the various authors support the assumption that physical education, as a mandatory part of preschool education, is fundamental to the full development of children. In the literature, explosive power is one of the child's motor abilities. Some authors also refer to it as 'dynamic strength.' It can be defined as one of the critical characteristics of a child's physical development.

A study of the literature allowed us to uncover the essence and characteristics of strength, specifically explosive power. For example, according to (9), 'strength is the ability (motor ability) of a person to exert or counteract physical objects from the external environment through muscle tension (contraction) transmitted via the system of levers in their body.' Muscular strength manifests in various forms. One of these forms, particularly interesting to us, is explosive power. Authors (9) define it as 'the maximum force a muscle can develop in the shortest possible time.' Another definition, provided by (10), describes explosive power as generating maximum force in minimal time when accelerating relatively light weights or one's own body. (11) states that 'the dynamic strength depends on both the breakdown and resynthesis of adenosine triphosphate (ATP) in the muscles.'

METHODS

Based on the analysis and interpretation of literary sources, as well as our observations during the examined age period, the goal we set for this study was to reveal the characteristics of lower limbs' explosive power in preschool children. To achieve this goal, we outlined the following tasks:

1. Analysis of the problem based on literary sources.
2. Sports-pedagogical testing of children from the 2nd, 3rd, and 4th age groups in preschool education.
3. Analysis and interpretation of the research results revealing the characteristics of lower limbs' explosive power in preschool children.

The object of the study is the manifestation of lower limbs' explosive power in preschool children. The subject of the study is the characteristics of the manifestation of lower limbs' explosive power in different age groups. The study was conducted over three months (March-May) in 2023 at kindergarten №16, 'Fairy Tale World,' and kindergarten №72, 'Never-ending Story,' in Sofia. Selected children from the 2nd, 3rd, and 4th groups were tested using the following tests: 'Standing long jump' and 'Consecutive single-leg hops.'

The results obtained from the testing were processed using the statistical software SPSS.v25. The data were subjected to variation and comparative analysis. A total of 251 children were studied, and their distribution in different age groups is presented in **Table 1.**

Table 1. *Distribution of the studied children by age.*

	Kindergarten 72	**Kindergarten 16**	**TOTAL**
II age group	42	46	88
III age group	51	41	92
IV age group	34	37	71
TOTAL	124	127	**251**

RESULTS

We started analyzing the results by examining the statistical criteria, which is a part of the variation analysis. Presenting and interpreting these results would help us select the appropriate statistical criteria for comparing the achievements of the different groups of subjects. We started by checking the values of asymmetry (As) and excess (Ex) coefficients, which provide information about the type and shape of the distribution. The values ranged between -0.29 and 1.23, which allowed us to define the distribution in our study on preschool children's explosive power as symmetrical and standard, with two exceptions.

The discussed values of asymmetry (As) and excess (Ex) coefficients enabled us to apply a two-factor analysis of variance and, subsequently, Student's parametric t-test for independent samples to reveal age and gender differences in the manifestation of lower limbs' explosive power in preschool children**.**

Table 2. *Results of the variation analysis of the data*

Test	Group	n	X_{min}	X_{max}	$\bar{X}$	S	V%	As	Ex
Standing long jump	II	88	30	112	75,92	16,24	21,56	-0,17	0,21
Consecutive single-leg hops - left leg			1,48	5,26	3,23	1,08	33,43	0,22	-1,03
Consecutive single-leg hops - right leg			1,54	6,69	3,27	0,89	27,21	0,61	1,09
Standing long jump	III	92	30	120	81,02	20,66	25,49	-0,29	-0,42
Consecutive single-leg hops - left leg			2,02	5,23	3,21	0,72	22,42	0,72	0,74
Consecutive single-leg hops - right leg			1,86	5,38	3,32	0,60	18,07	0,60	-0,27
Standing long jump	IV	71	49	134	95,92	18,13	18,90	-0,12	-0,11
Consecutive single-leg hops - left leg			1,88	5,53	3,07	0,68	22,14	0,87	1,23
Consecutive single-leg hops - right leg			1,85	4,72	3,02	0,59	19,53	0,35	-0,18

Another interesting indicator of the variation analysis was the coefficient of variation (V%). Its values provide information about the uniformity of the achievements within different groups. For the children in the preschool groups (II, III, and IV) we studied, the coefficient of variation values ranged between 18.07% and 33.43%, as shown in **Table 2.** This indicates approximate uniformity in most performance indicators, allowing us to assume the presence of significant individual differences in the motor abilities being examined. On the other hand, high values for the coefficient of variation suggest an undeveloped potential. When developing explosive power, carefully selecting the methods and tools used in pedagogical situations is essential. The selection of methods and tools should be tailored to the children's capabilities, which are influenced by various age and gender characteristics**.**

We will begin the interpretation of the indicators from the comparative analysis with the data from the ‘Standing long jump’ test.

Table 3. *Comparative analysis of the tests "Standing long jump with two feet" and ‘Consecutive single leg hops.’*

Test	Group	Boys $\bar{X}$	Girls $\bar{X}$	D	P(t)
Standing long jump	II	79,85	71,20	8,65	98,8
	III	85,22	76,23	8,99	96,3
	IV	99,86	89,89	9,97	97,7
Consecutive single-leg hops - left leg	II	3,09	3,39	- 0,3	80,5
	III	3,06	3,37	- 0,31	98,1
	IV	2,95	3,27	- 0,32	94,9
Consecutive single-leg hops - right leg	II	3,27	3,28	- 0,01	3,1
	III	3,26	3,38	- 0,12	52,4
	IV	2,97	3,10	- 0,13	63,6

The results of the ‘Standing long jump’ test are presented in **Table 3**. In the II age group, the mean values for boys were $\bar{X}$ = 79.85 cm, and for girls, $\bar{X}$ = 71.20 cm. We observed higher results among the boys, with a difference of 8.65 cm, supported by the necessary guaranteed probability P(t) 98.8%.

In the 3rd age group, the boys' average performance in the test was 85.22 cm, while the girls' was 76.23 cm. Here, the difference is 8.99 cm, with a guaranteed probability P(t) - 96.3%. We saw a significant increase in average test scores in the IV age group. For boys, $\bar{X}$ = 99.86 cm, and for girls, $\bar{X}$ = 89.89 cm. The difference between genders was 9.97 cm, the most

significant difference observed so far, with a guaranteed probability of 97%.

Our recommendation for the three age groups is to apply gender differentiation and adjust the exercises for boys and girls accordingly.

For the 'Consecutive single-leg hops' test performed on the left leg in the preschool 2nd age group, the mean values were 3.09 seconds for boys and 3.39 seconds for girls. The difference between the two genders was 0.30 seconds, but it was not supported by the necessary guaranteed probability, P(t)80.6%.

The mean values of the test results in the III age group were close to those of the previous group, boys 3.06 seconds and girls 3.37 seconds. The absolute difference (d) is 0.31 seconds. However, this difference between boys and girls has a high guaranteed probability, P(t)98.1%. Similar data were observed in the IV age group. The average value for boys was 2.95 seconds, and for girls, 3.37 seconds. The difference is 0.32 seconds, with a guaranteed probability of 94.9%, just below the required threshold of 95%.

The comparative analysis continues with the 'Consecutive single-leg hops' test performed on the right leg. The mean results for girls and boys from the II age group were 3.27 and 3.28 seconds, respectively. The difference is insignificant at 0.1 seconds, with a guaranteed probability of 3.1% for this age group, suggesting the difference may be due to random factors.

The mean values from the test in the III age group were 3.26 seconds for boys and 3.38 seconds for girls. The absolute difference is 0.12 seconds with guaranteed probability P(t) at 52.4%, which does not reach the required level. The results in the IV age group were also very similar. The mean values for boys and girls were 2.97 and 3.10 seconds, respectively, with a difference of 0.13 seconds and a guaranteed probability of 63.6%.

In all age groups, we see a low level of guaranteed probability and minimal differences between boys and girls. Therefore, we recommend including physical exercises and games suitable for the age group to improve lower limbs' explosive power. Given the slight gender differences in the 'Consecutive single-leg hops' test, there is no need to develop explosive power separately by gender.

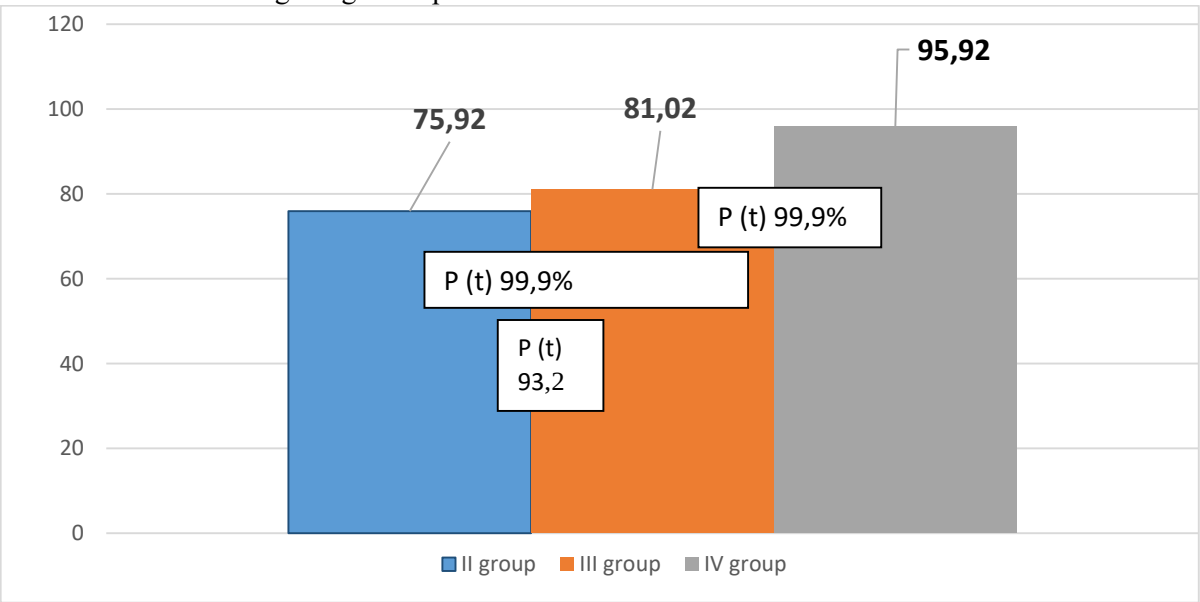

Figure 1. Comparisons of the average performances of the groups in the 'Standing long jump' test

Our attention focused on the differences in the studied subjects' various age groups. These results are presented in **Figure 1**. In the 'Standing long jump' test, there was an improvement in the mean values from the II to the IV age group, with a total increase of 20 cm. The subjects' performance improved throughout this period, with a guaranteed probability of 99%.

Regarding the changes between the II and III age groups, we observed an improvement in the mean values in the performance of the 'Standing long jump' exercise. Still, it can be considered statistically insignificant given the P(t)93.2%, with an absolute increase of 5.14 cm. This exercise's absolute increase between

the III and IV groups was 14.9 cm, with a guaranteed probability of 99.9%.

The changes in the mean values of the test results between the II and IV age groups also showed an improvement amounting to 20 cm, which can be considered statistically significant given the P(t)99%. The changes discussed above suggest that, during this age period, targeted development of lower limbs' explosive power could lead to a significant improvement.

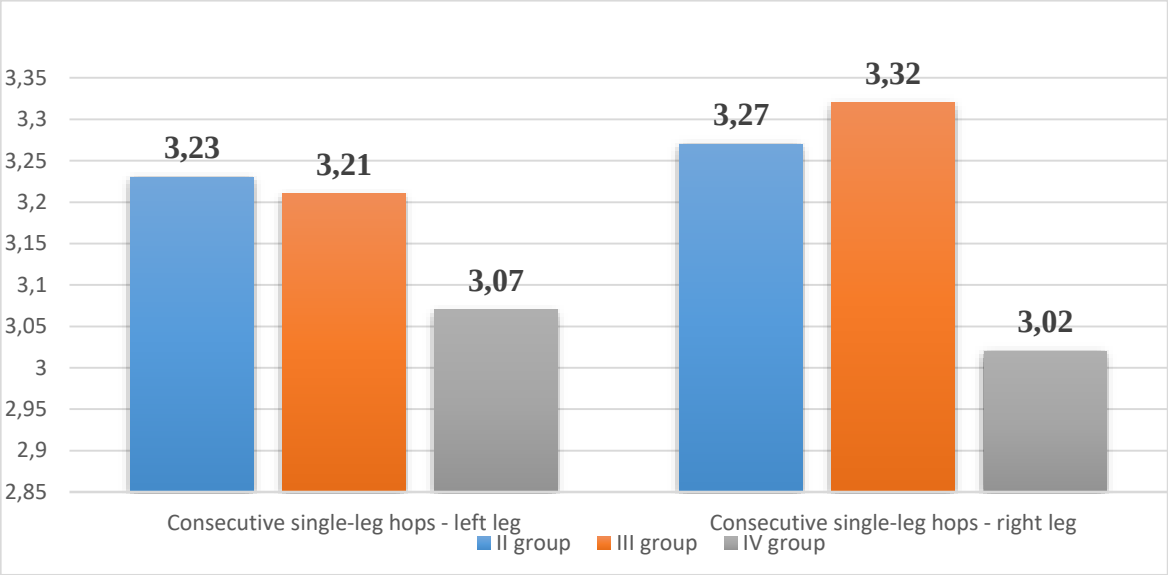

Figure 2. Comparisons of the average performances of the groups in the test 'Consecutive single leg hops – left and right'

Results from the 'Consecutive single-leg hops - left leg' test are presented in **Figure 2**. Once again, we observed differences between the three groups. Regarding the changes between the second and third age groups in executing the hops on the left leg, the absolute increase (d) was 0.02 seconds. This difference is minimal, with a guaranteed probability of 15.4%, which can be considered statistically insignificant.

Between the third and fourth groups, there was an increase of 0.14 seconds in the test performance, with a guaranteed probability of 76.9%, which is again insignificant. Similarly, between the second and fourth age groups, there was an improvement in the mean value of 0.16 seconds. However, this cannot be considered significant, given the P(t)69.8%.

The changes in the average performance of the 'Consecutive single-leg hops - right leg' exercise, as presented in Fig. 2, showed an increase of 0.25 seconds over the observed age period. Between the second and third age groups, there was an improvement in the mean value with a minimal increase of 0.05 seconds. Still, the required guaranteed probability, P(t) 27.6%, does not support this difference. However, between the third and fourth groups, there was an increase of 0.14 seconds in performance, with a guaranteed probability P(t) 99%.

For the second and fourth age groups, there was again an improvement in the mean value of 0.25 seconds in the test performance, which could be considered significant, given the guaranteed probability P(t) 95.7%.

CONCLUSION

In summary of the data analysis conducted, it can be noted that the condition of the children studied is good. However, there is a need to further develop strength, notably lower limbs' explosive power, in preschool-aged children by applying age-appropriate methods and tools in educational activities. We recommend preschool teachers focus on children's proper physical development, mainly working with the non-dominant leg. Based on the results of the study and data interpretation, we suggest increasing the motor activity of children in preschool education. (12) proves that the dispute contributes to the socialization of the personality.

The data from the conducted tests draw our attention to the children's difficulty in single-leg hopping. The 'Standing Long Jump' test results indicate significant lower limbs' explosive power development. At the same time, there is minimal improvement in the other analyzed test, which we can attribute not to the state and development of motor ability but to the level of mastery of the motor skill. In this regard, planning and implementing activities to

improve the ability to hop on one leg is necessary.

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