



COMPARATIVE ANALYSIS OF THE MOTOR ABILITIES OF ADOLESCENT VOLLEYBALL PLAYERS

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ABSTRACT

The aim of the study is to establish the level of motor skills and optimize the volleyball training process with 12-year-olds adolescent volleyball players (girls). The subject of the study are the signs of the motor abilities of a total of 72 adolescent volleyball players. To establish the level of physical fitness, a sports-pedagogical test was conducted on 9 main signs. To achieve the goal of the study, a variation and comparative analysis was applied. It was found that 12-year-olds volleyball players significantly outperform 11-year-olds in terms of the explosive power of the lower limbs in both vertical and horizontal muscular effort and the static power of the comfortable upper limb.

Key words: volleyball, girls, physical ability

INTRODUCTION

Bulgaria has been always in the top rankings of the world's leading volleyball countries. Although in recent years, our national teams have lost several places in the rankings, we are still a great competitor. Our success on the international field and our hosting of high-level international matches greatly influence the motivation of teenagers to engage in this beautiful and attractive sport (1).

The preconditions for future development in Bulgarian volleyball can easily remain unattainable if the traditions and the champion spirit in the native volleyball are not preserved. It is the qualified work with teenagers that is a guarantee for preserving the strong traditions in volleyball.

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In order to reach a good level of proficiency in volleyball or professional sports, adolescents must go through a long training process in which to get acquainted and improve in a number of areas. The level of development and improvement of motor skills largely depends on the sports and technical improvement. We can say that sports and technical skills are directly dependent on motor skills, so the permanent control of motor skills is the subject of research by a number of authors (2, 3) and is an important factor for planning and improving the learning process in all age groups, including adolescents. This basic fact is the basis of our study.

At the same time, we can not fail to note the fact, that in recent years there is a growing objective need for attractive regular exercise and sports to stimulate the active participation of adolescents and improve their level of motor skills and health status. In this context, the system sports activities are an important factor, not only for peak athletic performance in professional sport, but also

for good health and social status of the modern generation. (4-6)

PURPOSE

The aim of the study is to optimize the volleyball training process with 12-year-olds adolescent volleyball players by revealing the level of motor skills.

METHODS

The study is of an ascertaining nature and was conducted in February 2020.

Subject of the study were the signs of physical preparedness of adolescents volleyball. The total number of tested adolescent volleyball players is 72, divided into 3 age groups, as follows:

- ✓ 12-year-olds - total 24 girls from two volleyball clubs ("Academic Volleyball Club Volley" and "Central Police Volleyball

Club"), which are the main object of our attention;

- ✓ 11-year-olds - 24 girls from the same sports clubs, the results of which are used for the purposes of comparative analysis;
- ✓ 13-year-olds - also 24 - for the purposes of comparative analysis.

To achieve the set goal and tasks of the research, the following research methods have been applied: *review research and theoretical analysis; pedagogical observation; sports and pedagogical testing.*

The included test battery allows information to be collected on 9 signs. The tests included in it meet the requirements of sports statistics for reliability, validity, objectivity and standardization (**Table 1**).

Table 1. Indicators examined

Indicators	Measuring units	Measurement accuracy	Direction of growth
<i>1. Volleyball T-test</i>	s	0,01	-
<i>2. Vertical jump from static position</i>	cm	1,0	+
<i>3. Vertical jump with acceleration</i>	cm	1,0	+
<i>4. Long jump from static position</i>	cm	1,0	+
<i>5. Dynamometry – comfortable limb</i>	kg	1,0	+
<i>6. Dynamometry – uncomfortable limb</i>	kg	1,0	+
<i>7. Throwing medicine ball</i>	m	0,05	+
<i>8. Abdominal presses for 30s</i>	number	1,0	+
<i>9. Flexibility – lean forward</i>	cm	1,0	+

We believe that the applied tests are traditional, therefore in the presented material we will present a description only of Indicator № 1 - *T-test*, specific for volleyball and providing information about the special speed and agility.

Indicator № 1 - Specific Volleyball T-test

From the starting position "high start", with a tennis ball in hand, after a signal short sprints are performed in the volleyball court with a change of direction on sections with length 9 and 4.5 m (**Figure 1**).

Before each change of direction of the respective line (middle and nine-meter line) there is a small hoop (15-20 cm in diameter) in which a tennis ball must be placed and the other one taken. 8 complete cycles are performed in a certain sequence. The start and finish are in zone 6 of the 9-meter line. The first cycle is to the midline in zone 3, the second is to the right, parallel to the midline, to the side line in zone 2, the third is a return to zone 3, the fourth is a return to zone 6. The next cycles from fifth to eighth are mirror images of the first, but to zone 4. The time is recorded, with an accuracy of 0.01 second.

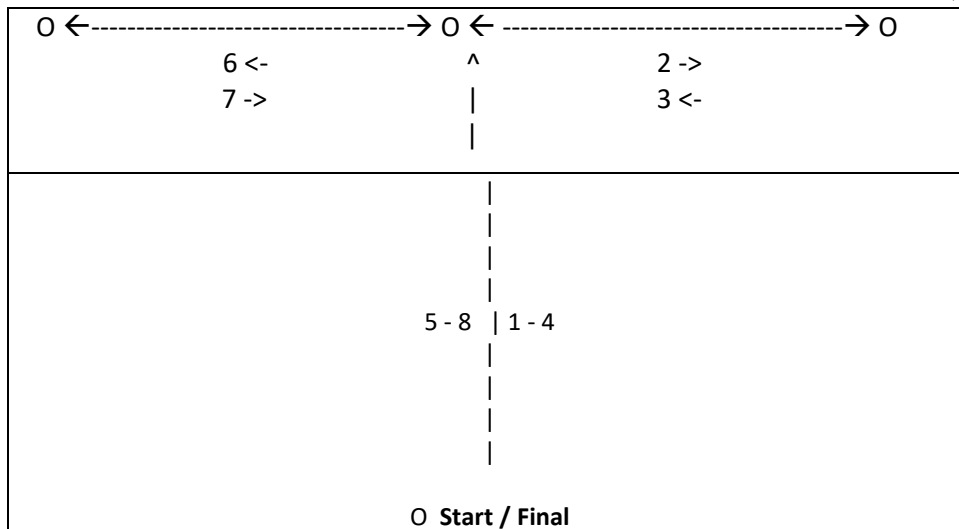


Figure 1. Volleyball T-test

For the needs of the research the following **mathematical and statistical methods** are applied :

1. Variation analysis - to determine the average level and variability of the studied signs of special physical fitness.
2. Hypothesis testing - To check the statistical significance of the differences between the mean levels of the studied traits in each of the two age groups, the Student's comparative t-test was applied, with a high level of statistical reliability ($P_t \geq 95\%$), which satisfies the needs of sports practice.

RESULTS

As noted above, the indicators included in our test battery provide information about the level of motor development of the 12 years old girls we studied, engaged in organized mini-volleyball.

The presented results in **Table 2** from the variational analysis of the initial data from the conducted sports-pedagogical testing show that the young volleyball players have covered the so-called volleyball T-test (indicator 1), which carries information about the level of development of special speed and agility, an average of 18.85 seconds.

However, as can be seen from the table, the individual results on this indicator range between 16.9 sec (max value) and 21.6 sec (min value). This naturally affects the coefficient of variation V, which in indicator 1 is only 8.39% and shows that this indicator is stable, and the group of 12-year- old girls studied is homogeneous in terms of special speed and agility.

A similar picture is observed in indicators 4 and 8 (long jump and abdominal press), which can also be attributed to the stable.

A good visual idea of the dissipation of all indicators characterizing the motor abilities of children is given in **Figure 2** .

As can be seen from the figure and **Table 1** , in this group of indicators the scattering of the individual cases around the average levels is in a relatively wider range.

The highest value of V is observed in the last 9th indicator ($V_9 = 31.90\%$). The reason for this is the very wide range of scattering - 21 cm ($X_{max} = 29$ cm, and $X_{min} = 8$ cm).

Table 2. Mean values and variability of the studied signs of physical fitness - 12-year-old volleyball players

№	Indicators	\bar{X}	S	V	min	max
1.	<i>Volleyball T-test</i>	18,85	1,58	8,39	21,6	16,9
2.	<i>Vertical jump from static position</i>	25,33	6,64	26,20	12	37
3.	<i>Vertical jump with acceleration</i>	31,50	5,73	18,20	21	42
4.	<i>Long jump from static position</i>	156,04	12,42	7,96	135	185
5.	<i>Dynamometry – comfortable limb</i>	19,42	3,73	19,21	12	30
6.	<i>Dynamometry – uncomfortable limb</i>	17,17	2,84	16,54	12	22
7.	<i>Throwing medicine ball</i>	4,79	0,59	12,29	3,9	6
8.	<i>Abdominal presses for 30s</i>	23,67	2,41	10,17	20	27
9.	<i>Flexibility – lean forward</i>	18,83	6,01	31,90	8	29

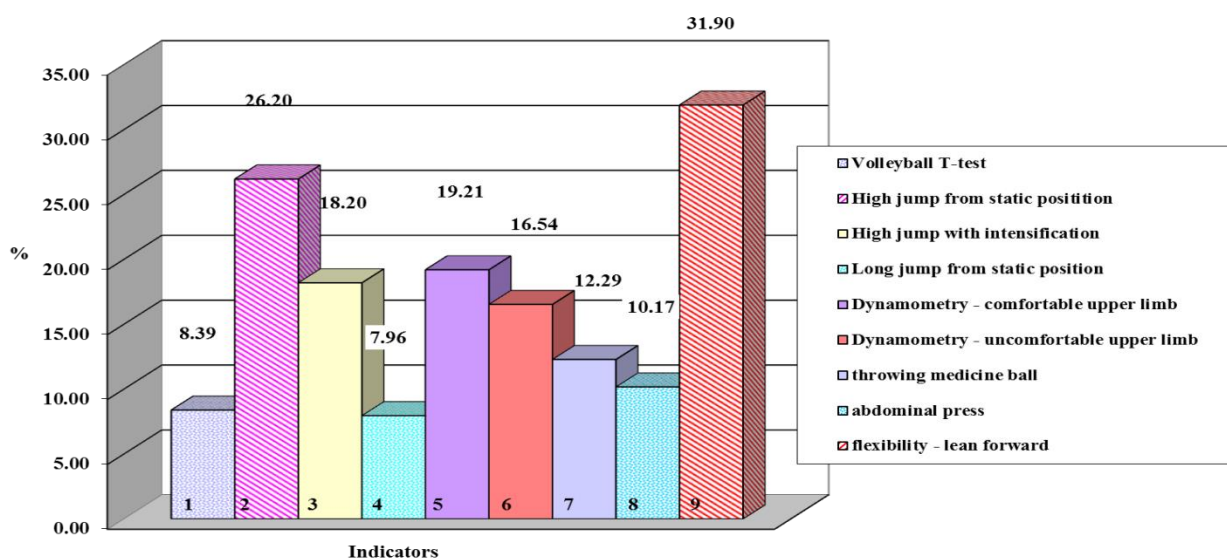


Figure 2. Dispelling the signs of motor fitness of 12-year-old volleyball players

Therefore, it can be argued that the group of 12-year-old girls we studied is inhomogeneous in terms of flexibility.

The indicators presented under № 2 and № 3 carry information about the level of development of the explosive power of the lower limbs during muscular efforts in the vertical plane. The analysis shows that the average rebound of 12-year-olds volleyball players is 25.33 cm from the ground and 31.50 cm - after strengthening. The scattering of these two indicators is in the zone of relative stability ($V_2 = 26,20\%$ and $V_3 = 18,20\%$). For the other indicators characterizing the motor abilities of the studied population, the

coefficients of variation are in the range between 12.17% and 19.21% (**Figure 2**), which is evidence of the relative homogeneity of the group in terms of the signs for which these indicators provide information .

The comparative analysis of the results of the conducted sports-pedagogical tests to establish the level of development of the signs characterizing the motor abilities of the studied age groups shows that, in general, 13-year-olds have a much higher level of motor skills development, compared to with the girls who are the main subject of our study (12-year-olds).

The analysis of **Figure 3** shows, for example, that they have passed the route shown in **Figure 1** (see Study Methodology) 1.8 seconds faster, reached a greater height, when bouncing both from static

place (by about 8 cm) and after reinforcement (by about 6.5 cm), landed farther when jumping from static place (by almost 7 cm), etc.

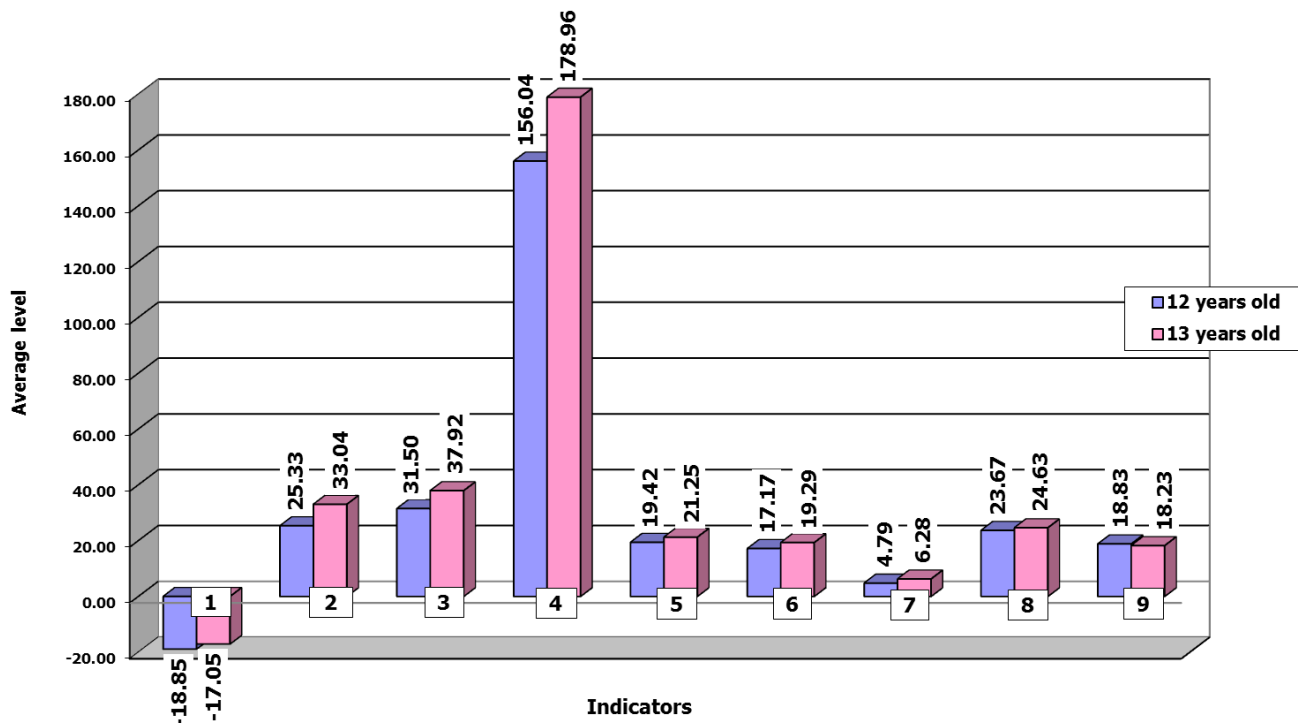


Figure 3. Comparative analysis of the signs, characterizing the motor abilities with 13-year-olds

In the analysis it is noticeable that only in the last 9th indicator ("leaning forward"), which carries information about the flexibility of the body, the average achievement of 12-year-olds is higher than that of 13-year-olds (respectively 18.83 cm against 18.23 cm for 13-year-olds).

The comparison of the results of the studied population with those of the 11-year-olds (**Figure 4**) shows that almost the same dependencies, again in favor of the older age group, are observed here. Again, the only motor quality that is better developed in younger girls is flexibility (indicator 9).

The verification of the significance of the observed differences between the arithmetic mean values of the different indicators in the 12-year-old girls we studied and the control group of 11-year-olds (**Figure 5**) shows that the values of the calculated Student's t - test range between -0.58 (for indicator 9) and 3.84 (for indicator 3). The critical value of this criterion (t_{tabl}) in our comparison is 2.01.

As can be seen from **Figure 5**, for 5 of the indicators the calculated t-criterion is lower than the critical value and only for indicators from 2 to 5 - it is higher than 2.01 (ranges between 2.11 and 3.84).

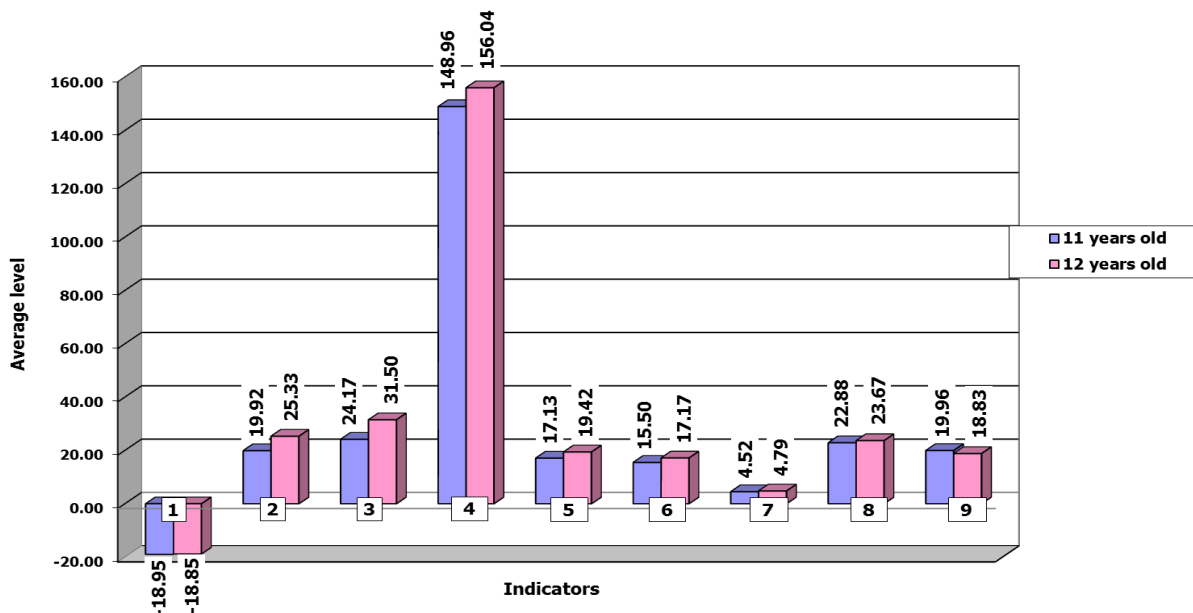


Figure 4. Comparative analysis of the signs, characterizing the motor abilities with 11-year-olds

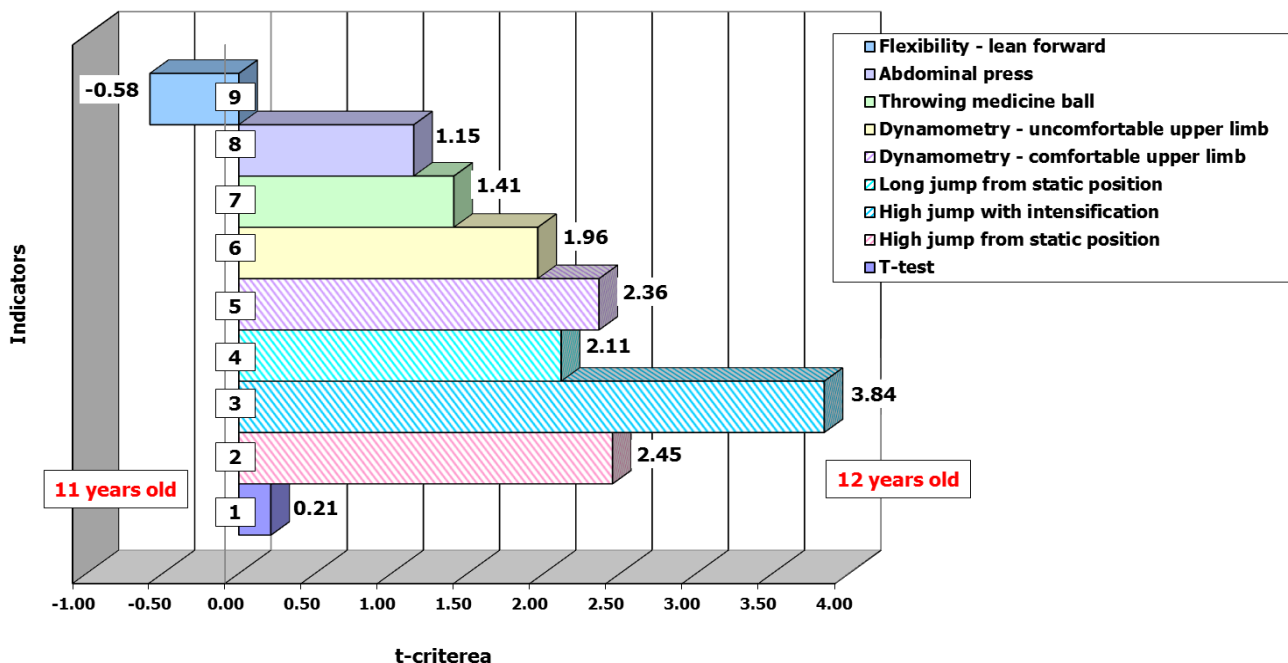


Figure 5. Significance of differences between the average levels of signs, characterizing motor abilities by 12-year-olds and 11-year-olds

A comparative analysis of the results of 12-year-olds with those of 13-year-olds shows (Figure 6) that the advantage of the older age group is more pronounced. In most of the indicators the values of the t-criterion are higher than the critical one (ranging between 2.81 and 7.44). This

is evidence of the statistical reliability of the observed differences between the average levels of the two groups, in favor of the higher, in terms of the signs for which indicators 1 to 4, as well as the 6th and 7th, bear information.

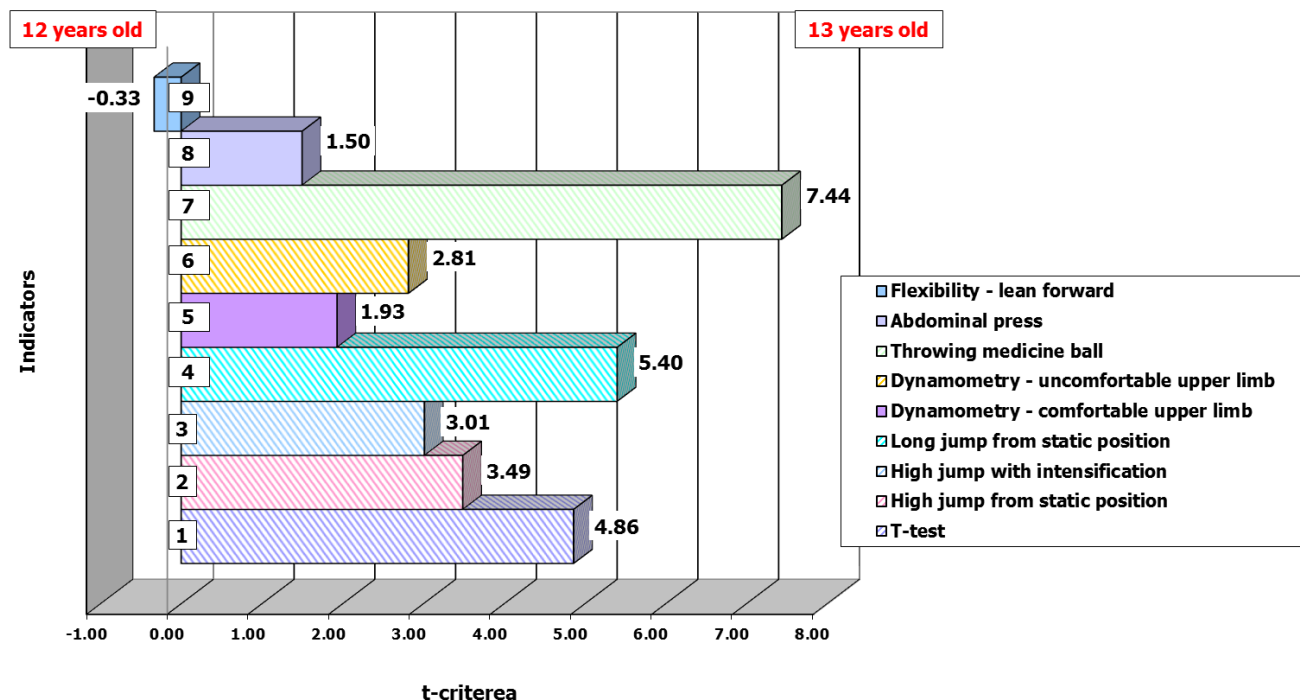


Figure 6. Significance of differences between the average levels of signs, characterizing motor abilities by 12-year-olds and 13-year-olds

DISCUSSION

The results show that the individual differences between the 12-year-old girls in the studied population in terms of the level of development of the special speed and agility of the athletes, as well as in terms of the explosive power of the lower limbs during muscular efforts in the horizontal plane, are too small and guarantee the stability of this indicator, which is an indicator of the homogeneity of the signs.

The fact established by us that the group of the studied 12-year-old volleyball players is inhomogeneous in terms of this motor quality, shows that in the future it is necessary to make serious efforts to increase the level of development of flexibility.

The explosive power of the lower limbs is a major driving force in volleyball. Comparing our results with the average performance of the students of 5th grade of bulgarians sports schools (7) prove that the 12-year-old volleyball players, subject of our study demonstrate good level of development of the explosive power of the lower limbs.

For the purposes of the study, the null hypothesis was tested on the significance of the differences between the level of preparedness of 12-year-olds and 11-year-olds, using the Student's comparative t - test . According to the norms of sports statistics (8), only for values of this criterion, which are lower than the critical value (t_{tabl}), which in our case is 2.01, there is reason to confirm the null hypothesis. At $t \geq t_{tabl}$, with a high guarantee probability ($P_t \geq 95\%$), it may be rejected the null hypothesis and adopted the alternative hypothesis. This gives reason to believe that the 12-year-old volleyball players we studied have a significantly higher level of development, compared to the 11-year-olds, in terms of :

- ✓ the explosive power of the lower limbs during vertical muscular efforts, manifested both from a place and after movement;
- ✓ the explosive power of the lower limbs under horizontal muscular effort and

- ✓ the static power of the comfortable upper limb.

The advantage of the other studied signs, that characterize the motor abilities of girls are insignificant and can be explained by random reasons.

At the same time, our 12-year-old girls showed significantly lower level of development in comparison with the 13-year-olds, in terms of:

- ✓ the explosive power of the upper limbs and the body;
- ✓ the explosive power of the lower limbs under horizontal muscular effort;
- ✓ special speed of movement on the terrain and agility;
- ✓ the explosive force of the lower limbs during vertical muscular efforts, both when bouncing off a place and after strengthening;
- ✓ the static power of the uncomfortable upper limb.

CONCLUSIONS

We believe that in order to increase the overall level of physical training, in the future the efforts of young 12-year-old volleyball players and their coaches should be focused primarily on developing those signs on which at the time of the study they showed significantly lower results from the older age group. Efforts to develop the signs, which have relatively closer results, will not cause the same training effect.

We also believe that it is necessary to periodically conduct such research, which will allow coaches to take timely measures to improve the training process with adolescent volleyball players.

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