

IMPORTANCE OF DEVELOPMENT OF COORDINATION ABILITIES FOR 13-15-YEAR-OLD VOLLEYBALL PLAYERS

Original scientific paper

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Abstract

Coordination abilities (CA) have vital role and are an important prerequisite for the precise and quick learning of new activities with a complex character, for building steady skills and habits in locomotor activities and sports. They determine the success in managing locomotor activities of varying complexity and coordination and thus become an essential prerequisite for future excellence in sports. According to many authors motor coordination as a function of the central nervous system is to a great extent genetically determined. It is considered that the best period for the development of coordination skills is between 7 and 11-12 years of age. Complexity of the volleyball game determines the starting point for this sport to be 9-10 years of age. Technical elements' complexity requires more difficult elements to be studied and mastered in the age 13-15 years. The importance of the CA for athlete' performance and knowledge of specifics in the growth determine our interest in athletes of this age. This interest led to the target of this study, i.e. tracking the importance of the coordination abilities' progress in 13-15-year volleyball players, obtained through experimental methodology with priority development of this type of capability. Subject of the study is sports-pedagogical process of development of coordination abilities of 13-15-year volleyball players. Object of the study are coordination abilities of boys age 13-15 years. Scope of the study are 36 athletes from volleyball teams of "VC - Sofia University", VC – Slavia from Sofia and VC Mine Worker from Pernik (boys born in the period January 2000 - December 2001). Two groups were formed, experimental and control. Tests with 14 indicators were used to establish the level of surveyed parameters. Two tests were carried out in the beginning and two – at the end of the experiment. Statistical methods were applied – Student's T-Criterion for dependent samples and indicators of normal distribution of data and a T-criterion of Wilcoxon for dependent samples and indicators of abnormal distribution. With the above instruments we compared the tested indicators and defined statistical significance in the growth of coordination abilities in the targeted athletes from both groups.

Keywords: *volleyball training program, volleyball athletes coordination abilities, motor tests, Student's T-Criterion for dependent samples, Analysis of variance physical and functional capabilities*

INTRODUCTION

Coordination abilities are part of human motor abilities and important component of human physical abilities. They have vital role and are an important prerequisite for the precise and quick learning of new activities with a complex character, for building steady abilities and habits in locomotor activities and sports.

Coordination abilities (CA) constitute from set of human abilities and competitive activities that show in the training process and also determine success in managing motor activities with different coordination complexity (Лях, 2002).

Coordination abilities (CA) are fundamental prerequisite for future excellence in sport (Mondoni & Ferrantelli, 1992-1993). This opinion is shared by many other authors and sports professionals in their publications. According to Aveyanov (Аверьянов, 2008) the appropriate level of development of various CA ensures further good results and good perspective in sport for young athletes.

Optimization of motor and coordination abilities should be considered inseparably with the overall educational work in school and extracurricular activities. This is a complica-

ted socio-pedagogical issue and its solution must be complex (Момчилова, (Момчилова),1984).

Volleyball is a team sport that sets high standards in terms of coordination viewing technical complexity of the game elements. Therefore, volleyball practice is valuable tool for the development of this type of abilities.

The volleyball motor abilities depend on complex of physical capacities and functional capabilities that disclose during the game. The success of the game is determined by the diversity of these qualities, which in turn ensures correct decision making and selection of gaming maneuvers under different conditions and situations characterized by serious shortage of time. Effectiveness in mastering the art of the game depends primarily on the already existing trainees' motor abilities and habits, and ability to quickly and timely use them in solving certain motor tasks. Thus the establishment of foundation for mastering the game incorporates the acquisition of a wide range of motor abilities and habits, as well as improvement of such motor abilities as the CA.

The volleyball game techniques are closely related to improvement of the CA. As a component of motor abilities

they meet the requirement for perfection, precision, finesse and amplitude of movements. Techniques determine the components of the activity, and coordination can combine them faster and more efficiently. Volleyball at the same time is a game characterized by uniqueness of gaming situations. Each situation in itself is different from the preceding in spatial, temporal, spatio-temporal and dynamic characteristics. The CA level here is of big importance as it enables the athlete to make fast and accurate responses to changes in the environment. The ability to apply various character techniques at a high level and rapid adaptation to intensive changing environment is a distinctive feature of competitors with well developed CA.

Meanwhile, the motor coordination, according to many authors as a function of the central nervous system, is to a big extent genetically determined (Лях (Лях), 1983). In this sense, some authors Nikolic & Paranosich (Николич & Параносич), 1984) suggest coordination of movements to be regarded as a constitutional quality that is not possible to influence or is influenced only to a negligible extent.

According to Hadziev (Хаджиев) (2009), coordination abilities are genetically limited, complex motor quality, which is the key to managing sports activities. Many authors (Balsevich & Zaporozhanov (Балсевич & Запорожнов), 1987; Starosta (Староста), 2000), believe that the most appropriate period for the development of coordination abilities is between 7 and 11-12 years age. These and many other studies show that person's capacity to master new motor abilities in time is only possible to a certain age. The peak in this development coincides with the prepubertal period, after that this capacity stabilizes.

The complexity of the volleyball game as mentioned above determines the starting age in this sport to be 9-10 years. The complexity of the technical elements requires more difficult ones as spike, block, jumper serve, offense elements as slide and landing to be studied and improved in the age period of 13-15 years or even at later stage. The importance of CA for athletic performance and knowledge of specifics in the age development, determines our interest in this age period. This interest led to the purpose of the study, namely - Tracking importance in the growth of coordination abilities for 13-15-year volleyball players acquired by using experimental methodology with priority on development of this type of abilities.

METHODOS

The subject of the study is sports-pedagogical development process of 13-15-year volleyball players coordination abilities.

The object of the study are coordination abilities of boys age 13-15 years.

The scope of the study are 36 athletes from volleyball teams of "VC - Sofia University", VC – Slavia from Sofia and VC Mine Worker from Pernik (boys born in the period January 2000 - December 2001)

The study was conducted in the time period September 2014 - June 2015.

For the survey purpose two groups were formed:

- ✓ Experimental group (EG) - 12 boys from Volleyball Club Sofia University;
- ✓ Control group (CG) - 24 boys from Volleyball Clubs Slavia and Mine Worker.

In the training methodology of EG group specially developed by us training program was applied. Alongside with the traditional methods, with a priority techniques are

applied aiming the CA development and improvement (Bozhilov (Божиллов), 2003) of growing up volleyball players.

In the CG a traditional methods were used to prepare the growing up volleyball players, tailored to their age specifics and methodology guidance programs for training of the relevant age group.

To establish the level of surveyed parameters a battery test with 14 indicators was used (Table 1.).

Table 1. Battery test

№	Indicators	Measurement
1.	Rotation sample 1 (time)	sec.
2.	Rotation sample 1 (deviation)	cm.
3.	Rotation sample 2 (time)	sec.
4.	Rotation sample 2 (deviation)	cm.
5.	Toss tennis ball to target with strong hand	Number
6.	Toss tennis ball to target with weak hand	Number
7.	Strokes on horizontal surface	number/sec.
8.	Irregular strokes	number/sec.
9.	Jumps in 12 squares – option 1	number/sec.
10.	Jumps in 12 squares – option 2	number/sec.
11.	Tapping test with the strong hand	number/sec.
12.	Tapping test with the weak hand	number/sec.
13.	Squeeze and vault	sec.
14.	3 rolls forward and 3 rolls backward	sec.

Two tests were carried out. The first is at the beginning of the experiment in September 2014. is aiming to determine the entry level of the examined players in terms of coordination indicators. The second testing was made in June 2015. and aims to determine the CA level of the players at the end of the experiment together with the expected positive changes.

Established the averages and variability in some of the studied coordination abilities can be used as quantitative indicators of volleyball players' biomotorics (Balsevich & Zaporozhanov (Балсевич, & Запорожнов, 1987).

The methods of research are:

1. Informational research;
2. Sports - pedagogical experiment;
3. Mathematical and statistics methods:
 - Analysis of variance;
 - Comparative analysis Students' T-criterion;
 - Comparative analysis T-criterion of Wilcoxon.

The dynamics of performance results on the indicators aiming at determining the level of the coordination abilities from testing volleyball players from EG are presented in Table 1. and 2.

At the end of the experiment we observed improving performance for all indicators except one. In indicator rotation sample – linearity deviation (option 1), we noticed an increase in the average of 9.58 cm. to 22.9 cm. By our opinion, this difference is not a serious issue since it is due to the very good performance in the first test and only 9.58 cm. linearity deviations for walking five meters with covered eyes and significantly reduced time for passing the distance of 4.3 sec. at the beginning to 2.5 sec. at the end of the experiment. The accuracy of crossing the distance is compensated by increase of the speed. As a summary the volleyball players showed very good results at the end of the period in the development of:

- coordination abilities in differentiation between the strokes on horizontal surfaces and irregular strokes;
- performance of weaker hand - tapping test weaker hand;

- CA development locomotion by sight - jumps into 12 squares, especially Option 2, characterized by greater difficulty;
- CA orientation in space – vault, squeeze through and a 3 + 3 rolls;
- Improvement of the function of the vestibular system after strong external stimulation - rotating sample (option 2) - linearity deviation.

In order to check the statistical significance of differences between the first and second tests we used comparative Student's T-Criterion (Table 2.) for dependent samples and indicators of normal distribution of data and T-Criterion of Wilcoxon (Table 3.) for dependent samples and indicators of abnormal distribution.

All the obtained results are compared with the critical value for this sample - $t_{\alpha} = 2,18$. The Table 2. and Table 3., show that all coordination abilities indicators with the exception of two, have a high value ranging from $temp = 2,6$ to $temp = 7,1$. This confirms the alternative hypothesis that changes as a result of the experimental training methods performed with adolescent volleyball players of EG are significant and are backed by guaranteed high probability $P_t > 95\%$. In two of the indicators examined (option 2 rotary sample- jumps in 12 squares option 1) the values obtained for $temp = 1,38$, respectively $temp = 1,8$ are smaller than the critical value of the sample and are backed with lower guarantee probability $P_t < 95\%$, which gives us reason to accept H_0 as lack of statistically significant difference in studying the development of these indicators but for realized one due to random factors.

After processing the data with variation analysis for four indicators, the results show abnormal distribution, coefficient of asymmetry (As) and excess (Ex), larger than the critical study sample. These indicators are processed through comparative T-Criterion of Wilcoxon for depended sa-

mples and indicators of abnormal distribution. The results (Table 3.) confirm the hypothesis as stated above. In three of them the received empirical value expressed in standard units (Z) with values from 2.14 to 3.06 is greater than the critical one $Z = 1,96$, as well as empirical values for the significance level α are lower $\alpha = 0,05$, thus proving the H_1 . Only the indicator 9 has value of $Z = 1,65$ and $\alpha = 0,1$, thus confirming the H_0 .

The dynamics of indicators' results outlining the level of coordination abilities of volleyball players in the control group is represented in Table 4. It is observed that there is a decline in some of the indicators in the second test results. For three of the players this is observed in rotating sample - 1 (deviation), tossing a tennis ball to target with strong hand and efficiency of the weak hand, examined in the tapping test. For the other four indicators - rotating sample - 2 (deviation), jumping in 12 squares (option 2), vault, squeeze and a 3 + 3 rolls - very small, almost a negligible positive growth had been observed.

Regarding other indicators for the CA, a higher positive growth has been observed in the average of the results achieved by the representatives of this group. The highest values we get are for performance of the strong hand (tapping test) and for the pace achieved in the test strokes on the horizontal surfaces.

Student's T-criterion for dependent samples and quantitative indicators with normal distribution was applied again to check the statistical significance of the differences between the first and second comparative tests (Table 4.). Some of the indicators in this group, after completion of the tests at the beginning and in the end of the experiment, indicate abnormal distribution of the data. T-criterion of Wilcoxon for dependent samples and indicators with abnormal distribution show the level of statistical significance of the above mentioned differences (Table 5.)

Table 2. Credibility of growth indicators in coordination abilities of EG established with Student's T-Criterion

№	Indicator	I test		II test		d	d %	T	P(t)
		X1	S	X2	S				
1.	Rotation sample 1 time	4,3	0,7	2,5	0,88	-1,8	-41,8	6,02	100
2.	Rotation sample 1 deviation	9,58	7,82	22,9	16,57	13,3	138,8	2,6	97,5
3.	Rotation sample 2 time	4,44	0,83	3,89	1,39	-0,55	-12,4	1,38	80,5
4.	Rotation sample 2 deviation	81,67	88,5	57,5	68,9	-24,17	-29,6	2,97	98,7
5.	Tennis ball to target strong hand	3,17	1,85	4,33	1,3	1,17	36,9	2,31	95,9
6.	Tennis ball to target weak hand	0,92	0,99	2	1,13	1,08	117,4	2,7	98
7.	Horizontal surfaces	149,2	29	226,4	54,4	77,25	51,8	5,6	100
8.	Irregular strokes	7,67	2,15	11,9	2,61	4,25	55,4	5,2	100
9.	12 squares 1	12,44	1,88	11,5	1,37	-0,94	-7,56	1,8	90,1
10.	12 squares 2	21,04	3	17,52	2,95	-3,51	16,7	3,4	99,4
11.	Tapping tests with strong hand	182,8	16,8	195,5	14	12,7	6,95	3,8	99,7
12.	Tapping tests with weak hand	155,7	14,9	176,2	16,6	20,5	13,2	4,8	99,9
13.	Vault and squeeze	17,6	2,58	15,07	2,13	-2,53	-14,4	5,1	100
14.	3+3 rolls	11,17	1,32	8,58	0,99	-3,51	-31,4	7,1	100

Table 3. Credibility of growth indicators in coordination abilities of EG established with T-Criterion of Wilcoxon

№	Indicator	I test		II test		d	Z	T	P %
		X1	S	X2	S				
4.	Rotation sample 2 deviation	81,67	88,5	57,5	68,9	-24,17	2,5	0,01	98,8
7.	Horizontal surfaces	149,2	29	226,4	54,4	77,25	3,06	0,002	99,8
9.	12 squares 1	12,44	1,88	11,5	1,37	-0,94	1,65	0,1	89,9
10.	12 squares 2	21,04	3	17,52	2,95	-3,51	2,5	0,02	98,8

Table 4. Credibility of growth indicators in coordination abilities of volleyball players of CG established with Student's T-criterion

№	Indicator	I test		II test		d	d%	T	P(t)
		X1	S	X2	S				
1.	Rotation sample 1 time	2,77	0,72	2,5	0,47	-0,27	-9,74	2,01	94,4
2.	Rotation sample 1 deviation	8,75	10,86	14,17	10,59	5,45	62,29	1,85	92,2
3.	Rotation sample 2 time	3,33	0,91	3,02	0,8	-0,31	-9,3	1,49	85,1
4.	Rotation sample 2 deviation	75,21	70,26	74,17	78,96	-1,04	-1,38	0,12	9,7
5.	Tennis ball strong hand	2,71	1,4	2,33	1,34	-0,38	-14	1,2	75,9
6.	Tennis ball weak hand	0,63	0,82	1,17	1,31	0,54	85,7	2,5	98
7.	Horizontal surfaces	162,6	41,13	174,1	44,59	11,46	70,48	1,95	93,7
8.	Irregular strokes	7,83	2,24	8,42	2,41	0,58	7,41	1,62	88
9.	12 squares 1	14,96	3,55	13,61	2,8	-1,35	-9,02	2,34	97,2
10.	12 squares 2	23,96	4,63	23,74	4,67	-0,21	-0,88	0,21	16,3
11.	Tapping test strong hand	177,8	19,18	188,7	25,28	10,83	6,09	3,29	99,7
12.	Tapping test weak hand	154,3	20,35	153,8	20,24	-0,54	-0,35	0,24	18,8
13.	Vault and squeeze	18,52	2,43	18,44	2,74	-0,08	-0,43	0,22	16,9
14.	3+3 rolls	10,49	1,49	10,35	1,14	-0,14	-1,33	0,66	48,6

Table 5. Credibility of growth indicators in coordination abilities of CG defined by T-criterion of Wilcoxon

№	Indicator	I test		II test		d	d%	T	P(t)
		X1	S	X2	S				
2.	Rotation sample 1 deviation	8,75	14,17	10,86	5,45	10,59	2,02	0,04	95,9
3.	Rotation sample 1 time	3,33	0,91	3,02	0,8	-0,31	1,66	0,1	90,7
4.	Rotation sample 2 deviation	75,21	70,26	74,17	78,96	-1,04	0,12	0,9	9,55
13.	Vault and squeeze	18,52	2,43	18,44	2,74	-0,08	0,6	0,6	45,2
14.	3 + 3 rolls	10,49	1,49	10,35	1,14	-0,14	0,24	0,8	18,97

The exported data in the table shows that only three indicators have statistically significant results' increase. Tennis ball toss to target with weak hand, jumps into 12 squares (option 1) and tapping test with strong hand give values temp greater than critical to this set of examined, which is $t\alpha = 2,07$ (Table 4.). This growth is supported by a sufficiently high warranty probability $Pt > 95\%$ and for them an alternative hypothesis is accepted. For all other eleven indicators $temp < t\alpha$, which means H_0 is still valid, i.e. there are no significant differences between the compared indicators and the received difference is due to random factors.

Processing of the data shows that five of the indicators examined in this group have abnormal distribution coefficients of asymmetry and kurtosis with higher than critical study sample values. The results are processed with T-criterion of Wilcoxon. The obtained results (Table 5.) demonstrate that in rotary indicator sample (option 1 - deviation), the resulting empirical value for $Z = 2,02$ is greater than the critical case of $Z = 1,96$, and the resulting empirical value for significance level $\alpha = 0,04 < \alpha = 0,05$, which confirms H_1 , according to which the growth of this indicator is significant. This result is not contrary to the result set with the Student's T-criterion for validity of H_0 on this indicator. This growth is due to weaker result achieved by CG in the second test value (deviation from $X = 8,75$ cm. from the line in first test was increased to $X = 14,17$ cm. deviation in the second), which is a greater number but a weaker result achieved.

The remaining four indicators confirm findings by the Student's T-criterion. The received empirical values, shown in standard units (Z) with values of 0.24 to 1.66, are smaller than the critical case of $Z = 1,96$, and the empirical values for the significance level α , ranging from 0, 08 to 0,9, are

higher than $\alpha = 0,05$. As to the above values we conclude that the H_0 is valid, according to which there are no significant differences between the compared indicators and the received difference is due to random factors.

CONCLUSIONS

- The studied age period is extremely important for the development of coordination abilities and maintaining the needed high level for the volleyball game;

- The development of coordination abilities in this age is possible by applying specially elaborated for this age methodology;

- 14 surveyed indicators aimed measuring the coordination abilities of adolescent volleyball players; the experimental group has achieved significant growth in 11 of them;

- More significant results are demonstrated for the CA for distinction/differentiation, CA for development of locomotion through vision, CA for orientation in space and efficiency of the weak hand;

- Worst results achieved by the EG are for functional capabilities of the vestibular system;

- The CG achieved significant growth only for three indicators, for other three results declined, and the remaining eight showed minor improvement;

- Higher volume of resources to improve the functional status of the vestibular apparatus is recommendable to be incorporated into the applied methodology.

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