

ORIGINAL ARTICLE

Development of coordination abilities of football players taking into account the strength of their nervous system

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ABSTRACT

This article analyzes the results of applying the methodology of differential development of specific coordination abilities of players 11-12 years old, with a variety of typological features displays properties of the nervous system. An analysis of the results of the pedagogical experiment revealed changes in terms of coordination abilities, mental processes and conditional abilities of young players. However, higher indices changes made players experimental group compared to controls. Moreover, the experimental group, these changes are significant and reliable. The authors conclude that the use of experimental techniques of differential development of coordination abilities of the players of 11-12 years with the typological features of display properties of the nervous system leads to an improvement of all parameters of test exercises that characterize the level of development of specific coordination abilities and mental processes, such as short-term memory, volume, intensity, stability and switching attention, and operational thinking. This ultimately improves the quality of technical readiness and effectiveness of the competitive activities of young football players.

Keywords: football, coordination abilities, methods, differentiated development.

INTRODUCTION

The level of sportsmanship in football largely depends on the extent to which the player has mastered all the variety of technical and tactical techniques of football, how he learned to use these techniques in variable game situations, in conditions of active resistance from the opponent¹⁻².

The intensity of competitive activity of football players observed in recent years places high demands on the level of development of coordination abilities, which determine the effectiveness of performing game actions in dynamically and unpredictably changing game situations. The role of coordination abilities in the technical training of athletes has long been recognized by experts as leading³⁻⁴.

One of the ways to improve the process of developing coordination abilities in football players at the initial stages of sports training is the implementation of a differentiated approach⁵⁻⁶. A number of studies have found that the effectiveness of training actions is associated with the influence of various properties of the nervous system of the athlete's nervous system – strength, mobility and balance of the processes of excitation and inhibition⁷⁻⁸.

However, it was not possible to find scientific studies, the subject of which would be the method of differentiated development of coordination abilities in young football players, developed taking into account their typological features of the manifestation of the properties of the nervous system.

This indicates the relevance of scientific research in this direction and their prospects.

In order to solve the scientific problem, a method of differentiated development of specific coordination abilities in football players aged 11-12 years was developed and tested, taking into account the typological features of the manifestation of the properties of the nervous system.

METHODS

Participants: The study involved 40 young football players. 20 children in the control group (CG) and 20 children in the experimental group (EG). Before the start of the study, all the children were healthy and allowed by a medical professional to play football.

All procedures met the ethical standards of the 1964 Declaration of Helsinki. Informed consent was obtained from all parents of the children included in the study.

Procedure: The experiment was conducted in 2019 (May 15-August 20), Kirov, Russia. Classes were held three times a week for 60 minutes.

The children from the CG were engaged in the usual program (9), the children of the EG additionally performed physical exercises, such as jumping, working with the ball at speed, pull-ups, push-ups, and some others. All tasks were performed by children with different loads, taking into account their typology. Children with a strong nervous system performed intensive work. Children with a weak nervous system – voluminous work. Before starting the study, all the players took control tests:

1) Tapping test-determined the strength of the nervous system by the process of arousal.

The essence of the test: children at the command of the teacher should quickly put the dots in the square number 1 (on a piece of paper with a pencil). Then move on the signal to the second square and so on to the 6th square. You must move from square to square at the teacher's command every 5 seconds. Based on the test results, a graph is constructed and the strength of the nervous system is determined. (7).

2) Tests that determine the level of development of coordination abilities, physical and mental qualities (9).

Mathematical and statistical processing of the results was carried out using Microsoft Excel. The average values and standard deviation in the intellectual ability test scores were determined, and their percentage increase by the end

of the experiment was determined. The Student's T-Test Was used.

RESULTS

As a result of using the experimental technique, the

following results were obtained.

Table 1 shows the changes in the indicators of coordination abilities in young football players from the beginning to the end of the pedagogical experiment.

Table-1: Changes in the indicators of coordination abilities in EG and CG during the experiment period (M±m)

| Indicators | Nervous system | Experimental group | | | Control group | | | P (2-5) |
|---|----------------|--------------------|-----------------------------|-----------------------------|------------------|------------------|------------------|-----------------------------|
| | | Before | After | P | Before | After | P | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| Running around the racks (s) | Strong | 12,1±0,3 | 10,0±0,2 | t=6,08 P<0,01 | 12,4±1,3 | 11,9±0,8 | t=0,35 P>0,05 | t=2,38 P<0,05 |
| | Weak | 12,1±0,8 | 9,9±0,4 | t=2,19 P<0,01 | 12,6±0,6 | 12,4±0,4 | t=0,36 P>0,05 | t=4,25 P<0,05 |
| | | t=0,05 P>0,05 | t=0,15 P>0,05 | - | t=0,15 P>0,05 | t=0,58 P>0,05 | - | - |
| Hitting the goal with the ball (total points) | Strong | 5,0±0,9 | 7,0±0,6 | t=2,26 P<0,05 | 4,9±0,7 | 5,1±0,3 | t=0,35 P>0,05 | t=2,77 P<0,01 |
| | Weak | 5,3±1,1 | 7,9±0,3 | t=2,26 P<0,01 | 5,6±0,6 | 5,9±0,5 | t=0,36 P>0,05 | t=3,49 P<0,05 |
| | | t=0,2 P>0,05 | t=1,35 P>0,05 | - | t=0,75 P>0,05 | t=1,17 P>0,05 | - | - |
| Running to the "numbered" balls (s) | Strong | 16,2±0,5 | 14,9±0,2 | t=2,42 P<0,05 | 16,2±0,3 | 15,5±0,3 | t=0,62 P>0,05 | t=1,3 P>0,05 |
| | Weak | 15,8±0,4 | 14,8±0,5 | t=2,35 P<0,05 | 16,0±0,3 | 15,6±0,3 | t=0,83 P>0,05 | t=1,5 P>0,05 |
| | | t=0,08 P>0,05 | t=0,26 P>0,05 | - | t=0,47 P>0,05 | t=0,46 P>0,05 | - | - |
| Two-ball Slalom (s) | Strong | 6,4±0,2 | 5,7±0,1 | t=2,88 P<0,01 | 6,9±0,3 | 6,6±0,2 | t=1,11 P>0,05 | t=3,74 P<0,05 |
| | Weak | 6,2±0,2 | 5,6±0,2 | t=2,18 P<0,05 | 6,6±0,3 | 6,3±0,3 | t=0,51 P>0,05 | t=2,50 P<0,01 |
| | | t=0,62 P>0,05 | t=0,38 P>0,05 | - | t=0,94 P>0,05 | t=0,67 P>0,05 | - | - |
| Stopping a rolling ball with your foot (sm) | Strong | 251,4±4,6 | 231,4±5,9 | t=2,66 P<0,01 | 252,9±4,2 | 248,6±4,0 | t=0,74 P>0,05 | t=2,38 P<0,05 |
| | Weak | 252,9±4,2 | 234,3±8,1 | t=2,23 P<0,05 | 257,1±3,6 | 254,3±3,7 | t=0,56 P>0,05 | t=2,24 P<0,05 |
| | | t=0,23 P>0,05 | t=0,28 P>0,05 | - | t=0,78 P>0,05 | t=1,04 P>0,05 | - | - |
| Pulling up the ball with the foot (s) | Strong | 5,9±0,2 | 5,2±0,1 | t=2,88 P<0,01 | 6,2±0,4 | 6,0±0,4 | t=0,39 P>0,05 | t=1,92 P>0,05 |
| | Weak | 6,0±0,2 | 5,4±0,1 | t=2,61 P<0,01 | 6,0±0,1 | 5,8±0,1 | t=0,84 P>0,05 | t=2,70 P<0,01 |
| | | t=0,43 P>0,05 | t=1,5 P>0,05 | - | t=0,64 P>0,05 | t=0,52 P>0,05 | - | - |
| Turns on the gym bench (times) | Strong | 10,1±0,6 | 12,0±0,4 | t=2,85 P<0,01 | 9,9±0,4 | 10,2±0,4 | t=0,58 P>0,05 | t=3,1 P<0,05 |
| | Weak | 9,1±0,3 | 10,1±0,4 | t=2,20 P<0,05 | 9,4±0,6 | 9,6±0,6 | t=0,35 P>0,05 | t=0,7 P>0,05 |
| | | t=1,55 P>0,05 | t=3,36 P<0,05 | - | t=0,7 P>0,05 | t=0,78 P>0,05 | - | - |

Table 1 shows that there were no significant differences in the CG of football players with a strong and weak nervous system during the period of the pedagogical experiment for all seven indicators that characterize the specific coordination abilities of football players (P>0.05). At the same time, the level of all indicators of coordination abilities improved.

The analysis of changes in the indicators of specific coordination abilities in young football players aged 11-12 years in the EG from the beginning to the end of the pedagogical experiment showed the following.

In running around the racks, the result of football players with a strong nervous system improved from 12.1±0.3 s to 10.0±0.2 s (P<0.01), and in football players with a weak nervous system from 12.1±0.8 s to 9.9±0.4 s (P<0.01), which corresponds to the age-related development of specific coordination abilities for adaptation and rearrangement of motor actions at an above-average

level [6]. The result in hitting the ball at the goal improved in players with a strong nervous system from 5.0±0.9 points to 7.0±0.6 points (P<0.05), and with a weak nervous system from 5.3±1.1 points to 7.9±0.3 points (P<0.01), which corresponds to the age-related development of a specific coordination ability to differentiate movement parameters to a level above average [3, 4]. The indicators of running to "numbered" balls improved in players with strong and weak nervous systems to 14.9±0.2 s (P<0.05) and 14.8±0.5 s (P<0.05), respectively, and the age level of development of the ability to spatial orientation became higher than average [4]. The two-ball slalom performance increased in players with a strong nervous system to 5.7±0.1 s (P<0.01), and with a weak nervous system-5.6±0.2 s (P<0.05), and the age level of development of the ability to coordinate (connect) movements became high [4]. In the test "Stopping a rolling ball with the foot", the indicators of football players with a strong nervous system improved

from 251.4±4.6 cm to 231.4±5.9 cm (P<0.01), and in football players with a weak nervous system from 252.9±4.2 cm to 234.3±8.1 cm (P<0.05), Such indicators correspond to the average level of development of the ability to react [4]. The indicators of pulling the ball with the foot with the leading foot improved in players with a strong nervous system to 5.2±0.1 s (P<0.01), and with a weak nervous system - to 5.4±0.1 s (P<0.01) and the age level of development of the ability to rhythm became higher than average [6]. In the test "Turns on the gymnastic bench" in football players with a strong nervous system, the indicators improved from 10.1±0.6 times to 12.0±0.4 times (P<0.01), and in football players with a weak nervous system from 9.1±0.3 times to 10.1±0.4 times (P<0.05), which corresponds to the age-related development of the ability to balance at an above-average level [4].

Comparing the final indicators of testing specific

coordination abilities in EG and CG in football players with strong and weak nervous systems, we can conclude that more significant changes in the indicators of coordination abilities occurred in football players with strong and weak nervous systems engaged in experimental methods. In the EG, changes in all indicators of coordination abilities are significant at the 1% and 5% levels of significance. The results indicate the advantage of the experimental method of differentiated development of specific coordination abilities in football players aged 11-12 years, taking into account the typological features of the manifestation of the properties of the nervous system.

Table 2 shows the changes in the indicators of conditioned abilities (physical qualities) of football players with strong and weak nervous systems in EG and CG during the period of the pedagogical experiment.

Table-2: Changes in indicators of physical qualities of football players aged 11-12 years in the study (M±m)

| Indicators | Nervous system | Experimental group | | | Control group | | | P (2-5) |
|--|----------------|--------------------|-------------------------|-----------------------------|------------------|------------------|------------------|-----------------------------|
| | | Before | After | P | Before | After | P | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| Long jump from a standing position (cm) | Strong | 177,6±4,1 | 188,3±2,0 | t=2,36 P<0,01 | 180,3±1,3 | 181,9±1,2 | t=0,89 P>0,05 | t=2,76 P<0,01 |
| | Weak | 183,9±3,2 | 188,7±3,4 | t=1,04 P>0,05 | 184,4±2,6 | 187,4±2,7 | t=0,79 P>0,05 | t=0,29 P>0,05 |
| | | t=1,21 P>0,05 | t=0,12 P>0,05 | - | t=1,41 P>0,05 | t=1,9 P>0,05 | - | - |
| Running at 30 m (s) | Strong | 5,4±0,1 | 5,0±0,1 | t=2,75 P<0,01 | 5,6±0,1 | 5,5±0,1 | t=0,44 P>0,05 | t=3,64 P<0,05 |
| | Weak | 5,6±0,1 | 5,3±0,1 | t=2,35 P<0,05 | 5,4±0,1 | 5,3±0,1 | t=0,58 P>0,05 | t=0,42 P>0,05 |
| | | t=1,29 P>0,05 | t=2,54 P<0,01 | - | t=0,75 P>0,05 | t=1,08 P>0,05 | - | - |
| 6-minute run (m) | Strong | 1336,6±7,0 | 1350±6,9 | t=1,36 P>0,05 | 1308,3±16,1 | 1303,7±19,8 | t=0,03 P>0,05 | t=2,21 P<0,05 |
| | Weak | 1275,3±28,3 | 1345,6±12,8 | t=2,26 P<0,05 | 1291,7±29,3 | 1315,3±14,7 | t=0,72 P>0,05 | t=1,55 P>0,05 |
| | | t=2,02 P>0,05 | t=0,3 P>0,05 | - | t=0,49 P>0,05 | t=0,47 P>0,05 | - | - |
| Leaning forward from a sitting position (cm) | Strong | 7,6±0,6 | 8,3±0,4 | t=1,01 P>0,05 | 6,3±0,8 | 6,4±0,8 | t=0,13 P>0,05 | t=2,23 P<0,05 |
| | Weak | 5,6±0,9 | 6,9±0,8 | t=1,04 P>0,05 | 6,4±0,6 | 5,9±0,5 | t=0,75 P>0,05 | t=1,08 P>0,05 |
| | | t=1,77 P>0,05 | t=1,63 P>0,05 | - | t=0,14 P>0,05 | t=0,65 P>0,05 | - | - |

The analysis of changes in indicators of physical qualities of football players with strong and weak nervous systems in EG and CG from the beginning to the end of the pedagogical experiment showed the following.

During the period of the pedagogical experiment, no significant differences were found in the CG of football players with both strong and weak nervous systems for all four indicators characterizing the physical fitness of young football players (P>0.05), although there is a positive trend in the changes in the studied indicators.

In the EG during the period of the pedagogical experiment, significant and reliable changes occurred in the following indicators. In football players with a strong nervous system, the performance of the long jump from a standing position increased to 188.3±2.0 cm (P<0.01), which indicates the age-related development of speed and strength abilities at an above-average level [9]. Football players with a weak nervous system improved their performance in the "6-minute run" test from 1275.3±28.3 m to 1345.6±12.8 m (P<0.05). These indicators correspond to the average level of development of the physical quality of

endurance [9]. In the 30 m run, both football players with a strong nervous system from 5.4±0.1 s to 5.0±0.1 s (P<0.01) and football players with a weak nervous system from 5.6±0.1 s to 5.3±0.1 s (P<0.05) improved their performance, and the age level of development of speed of movement became high [9]. In the "Leaning forward from a sitting position" test, the results of players with strong and weak nervous systems improved, but the differences in indicators were not significant (P>0.05) [9].

Positive changes in the indicators of conditioned abilities are due to the influence of factors of age-related development of motor function and the pedagogical impact of physical exercises used in the training process. At the same time, the duration of the formative pedagogical experiment was not sufficient for the observed changes to become statistically significant.

Table 3 shows the changes in the indicators of mental processes of young football players with a strong and weak nervous system during the period of the pedagogical experiment.

Table-3: Changes in indicators of mental processes in young football players of EG and CG (M±m)

| Indicators | Nervous system | Experimental group | | | Control group | | | P (2-5) |
|--|----------------|--------------------|------------------|-----------------------------|------------------|------------------|------------------|-----------------------------|
| | | Before | After | P | Before | After | P | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| Short-term memory (points) | Strong | 6,93±0,5 | 8,43±0,2 | t=2,83 P<0,01 | 6,82±0,3 | 7,14±0,4 | t=0,6 P>0,05 | t=2,77 P<0,01 |
| | Weak | 7,25±0,2 | 7,71±0,3 | t=1,29 P>0,05 | 7,11±0,2 | 7,32±0,3 | t=0,62 P>0,05 | t=1,08 P>0,05 |
| | | t=0,6 P>0,05 | t=2,04 P>0,05 | - | t=0,7 P>0,05 | t=0,36 P>0,05 | - | - |
| Attention span (number of units) | Strong | 5,29±0,4 | 5,86±0,3 | t=1,29 P>0,05 | 5,14±0,3 | 5,43±0,4 | t=0,57 P>0,05 | t=0,95 P>0,05 |
| | Weak | 5,00±0,3 | 6,0±0,2 | t=2,65 P<0,01 | 5,29±0,3 | 5,43±0,2 | t=1,3 P>0,05 | t=1,92 P>0,05 |
| | | t=0,6 P>0,05 | t=0,42 P>0,05 | - | t=0,32 P>0,05 | t=0,34 P>0,05 | - | - |
| Intensity, Stability, and Attention switching (points) | Strong | 1,06±0,1 | 1,22±0,04 | t=2,59 P<0,01 | 1,03±0,1 | 1,09±0,1 | t=1,12 P>0,05 | t=2,18 P<0,05 |
| | Weak | 1,03±0,1 | 1,19±0,02 | t=2,6 P<0,01 | 1,02±0,1 | 1,1±0,1 | t=0,63 P>0,05 | t=0,2 P>0,05 |
| | | t=0,39 P>0,05 | t=0,55 P>0,05 | - | t=0,12 P>0,05 | t=0,06 P>0,05 | - | - |
| Operational thinking (s) | Strong | 37,14±3,3 | 24,4±2,9 | t=2,89 P<0,01 | 39,14±2,3 | 37,4±2,2 | t=0,53 P>0,05 | t=3,52 P<0,01 |
| | Weak | 40,29±4,1 | 28,7±2,7 | t=2,36 P<0,05 | 38,57±2,6 | 36,4±2,2 | t=0,64 P>0,05 | t=2,23 P<0,05 |
| | | t=0,6 P>0,05 | t=1,08 P>0,05 | - | t=0,17 P>0,05 | t=0,32 P>0,05 | - | - |

Table 3 shows that all the indicators of the studied mental processes during the formative pedagogical experiment in football players of CG and EG increased, which is due to the influence of age factors and sports training.

A comparative analysis of the indicators of mental processes detected in football players with strong and weak nervous systems in EG and CG after the completion of the pedagogical experiment showed that there were no significant differences in all indicators of mental processes in CG (P>0.05).

In the EG during the period of the pedagogical experiment, there were significant changes in the following indicators. In football players with a strong nervous system, the indicators of short-term memory increased to 8.43±0.2 points (P<0.01), which corresponds to a high level of age-related development of short-term memory [10]. Football players with a weak nervous system improved their performance in the "Attention Span" test from 5.00±0.3 units to 6.0±0.2 units (P<0.01). Such indicators correspond to the development of the volume of attention at an above-average level [10]. In the Proofreading test, players with a strong nervous system improved from 1.06±0.1 points to 1.22±0.04 points (P<0.01), the results of players with a weak nervous system increased from 1.03±0.1 points to 1.19±0.02 points (P<0.01), and the age level of development of intensity, stability and attention switching became higher than average [10]. The indicators of operative thinking in football players with a strong nervous system improved to 24.4±2.9 s (P<0.01), and in football players with a weak nervous system to 28.7±2.7 s (P<0.05), which indicates the age-related development of operative thinking at an above-average level [10].

DISCUSSION

Comparing the indicators of mental processes from the beginning to the end of the pedagogical experiment of EG and CG in football players with a strong and weak nervous

system, we can conclude that as a result of the application of the experimental method of differentiated development of specific coordination abilities of football players aged 11-12 years, taking into account the typological features of the manifestation of properties of the nervous system, the mental processes of young football players significantly develop.

An integral indicator confirming the effectiveness of the developed differentiated methodology for using a set of physical exercises, methodological techniques and load components for the development of specific coordination abilities is the results of the performance of football teams formed from EG football players and CG football players in the Kirov Football Championship in 2019, which was attended by 11 teams.

Thus, the EG boys 'team, which used an experimental technique, took the 4th place in the competition, while the CG boys' team, which trained in accordance with the content of the standard sports training program, only took the 9th place.

The problem of physical development, activity of children and adults, in schools and sports sections is urgent and requires constant research [11-14].

CONCLUSION

Thus, the application of the developed experimental methodology for the differentiated development of specific coordination abilities leads to significant changes:

- indicators in test exercises that characterize the level of development of coordination abilities: "running around the racks", "hitting the ball on target", "running to numbered balls", "slalom with two balls" and "stopping the rolling ball with your foot", "pulling the ball up with your foot" and "turns on the gym bench" ; in test exercises that characterize the level of development of conditioned abilities: "long jump from a standing position", "30 m run" and " 6-minute run»; in test exercises that characterize the

level of development of mental processes: short-term memory, volume, intensity, stability and switching of attention and operational thinking;

- the quality of technical and competitive activity of football players, both weak and strong in the process of excitation of the nervous system.

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