Coordinating Abilities Development in Young Hockey Players Taking into Account Power and Weakness of Nervous System

Ilsiyar S. Mutaeva[1][a], Roman E. Petrov[1][b], Zinaida M. Kuznetsova[2][c] and Aleksandr S. Kuznetsov[2][d]
[1]*Elabuga Institute of Kazan Federal University, 89, Kazanskaya Street, Elabuga, Russia*
[2]*Tchaikovskiy State Institute of Physical Culture, 67, Lenin Str., Tchaikovskiy, Russia*

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Abstract: The purpose of the manuscript is to study the indicators that characterize the development of young hockey players coordination abilities, depending on the strength and weakness of the nervous system properties manifestation to optimize training effects. The strength of athletes nervous system, in comparison with weakness, is characterized by its endurance to the effects of varying intensity physical exertion. There is the difference between the strength and weakness of the nervous system due to the manifestation of the excitation and inhibition process. Young athletes with a weak nervous system can quickly get excited, and then go into a slow state. Athletes with a strong nervous system train well, play effectively, and show stability in the manifestation of coordination abilities. We used the teppeng test method (Russia) to determine the properties of the nervous system. It allows us to quickly and accurately determine the individual characteristics of students nervous system. The main methodological approach is to differentiate training tools taking into account the strength and weakness of young hockey players nervous system. We defined seven significant factors, which perform the function of coordinating abilities markers, taken into consideration in sports training of young hockey players. The first place took the most important marker of coordinating abilities development in training of young hockey players: the age and identification of sensitive periods of coordinating abilities demonstration (1,09±0,02) and dependence on the characteristics of athletes' nervous system (1,12±0,02). An optimal ratio of the means in physical qualities complex development was the following: endurance – 25%; power 10%; flexibility- 10%; speed -25%; coordination – 30%.

1 INTRODUCTION

The mental state of young athletes in game sports is determined by individual characteristics of the nervous system properties.

The problem of taking into account the manifestation of strength and weakness of young athletes nervous system to improve the effectiveness of all aspects of training is relevant.

Young hockey players sports training can be successfully realized taking into consideration age-related characteristics of motor function formation, in terms of competent use of pedagogical influence means and methods. They correspond with physical development and physical training objectives, taking into account the strength and weakness of the nervous system. The main factors, which condition physical qualities change in young hockey players, are the sensitive periods of motor abilities development, the peculiarities of the chosen kind of sport and innovative methodology of training. Under the influence of the systematic trainings biological regulations of physical qualities development don't change significantly. The training lessons don't change significantly typical for school age characteristics of morphological components of physical development transformation. They stimulate the dynamics of physical qualities development, especially coordinating abilities. This is the demonstration of the ability to realize kinetic

[a] https://orcid.org/0000-0002-9387-7033
[b] https://orcid.org/0000-0001-9352-971X
[c] https://orcid.org/0000-0002-5558-474X
[d] https://orcid.org/0000-0003-4294-3755

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differentiation of motor actions. Secondly, this is quick reaction, reformation, balance, the sense of rhythm and adaptation to space orientation demonstration (Kuznetsova et al., 2015, Zhestkova et al., 2019, Chow et al., 2009, Button & Bennet., 2009).

Many specialists mention that coordinating abilities have genetic base. It is demonstrated by the features of nervous system. However, sports practice shows that coordinating abilities can be trained more effectively, than other qualities. It depends on general part of demand at the stages of training. In hockey a player needs power, balance, mobility, dynamism, plasticity of nervous processes depending on the situation in a game and demonstrated physical loads. In this connection real research was organized in order to test the methodologies of coordinating abilities development in young hockey players, taking into account power and weakness of nervous system. The question has practical value in the context of physical culture lessons and also in the context of sports training (Abramov, 2011, Bryzgalov, 2013, Ziganshin & Krasnov, 2012, Nazarenko, 2003, Petrov et al., 2018, Kuznetsova et al., 2018, Kuznetsov et al., 2017).

The base for the methodology creation was the opinion of the specialists. For example, A.A. Abramov (2011) considers methodology of training children, who go in for hockey, on the basis of time rationalization. It is given to skating technique mastering (Volkov, 2012). G.A. Bryzgalov (2013), considers the necessity to identify sensitive periods of young hockey players' development (Konovalov et al., 2013).

Some specialists pay great attention to taking into account the markers of coordinating abilities, not only complex estimation and special coordinating training, sports need, but also health-improving orientation (Krylova, 2000, Boychenko et al., 2002, Hirtz, 1994, Hirtz, 2002).

S. V. Krylova (2000) notes that especially in groups of young skaters, the optimal training load depends on the strength and weakness of the nervous system She notes that for a weak nervous system, volume loads are necessary, and for strong ones – intensive. It is also noted that the time for coordination and difficult-coordination exercises should be allocated different duration of time. Young athletes with a weak nervous system should be given 16.6% of the time to develop coordination abilities, and with athletes strong nervous system-11.1% of the total time (Poolton et al., 2006).

Thus, the purpose of this manuscript is to study the development of coordination abilities in young hockey players depending on the manifestation of strength and weakness of the nervous system.

The novelty of this study was the identification of inter-group differences in the characteristics of the experimental method influence on the manifestation of coordination abilities depending on the strength and weakness of the nervous system.

2 RESEARCH METHODS

For the set objectives realization we used the following methods: Information sources analysis and summarizing, physical readiness testing, methods of statistical analysis in Microsoft Excel 2010. The participants of the experiment were 10-11 year-old hockey players (44 people). The base of the experimental research was a sports school. The originality of the present research work is in intergroup differences revelation in the peculiarities of the experimental methodology influence on the coordinating abilities demonstration.

2.1 Participants

44 boys, who go in for hockey at a sports school took part in the research work. According to the methodological manual of sports training in hockey a chosen age corresponds with the initial training. The average age of the chosen contingent of children was 11,77 ± 1,11 years-old. The sampling of children was formed in a way that all children had almost the same length of training period.

2.2 Instruments

In terms of the research work we revealed the importance of coordinating abilities for hockey players with the help of questionnaire survey. The questionnaire included the following questions: the age determination, which is suitable for coordinating abilities demonstration, important abilities in hockey, the place of the specific coordinating abilities in training young hockey players. Specific weight, which coordinating abilities take from general duration of the training lesson, if the level of coordinating abilities is taken into account. If it is taken into account then how? The respondents – specialists and respondents-highly qualified hockey players answered according to the degree of the coordinating abilities demonstration factors significance. Also, the respondents were asked to define the rank of the defined factors according to the significance in the system of young hockey players sports training. Conducted To measure

manifestations of strength and weakness of the athlete's nervous system tepping test (E. P. Ilyin, Russia) was conducted, on standard forms divided into squares. Young hockey players set the maximum number of points for 5 seconds. They moved to the next square on command, without interrupting their work. The result is determined by counting the number of points made in six squares. The analysis of the performance curve constructed to determine of young hockey players the strength and weakness of the nervous system was carried out.

The analysis of features of the nervous system properties manifestation in young hockey players has shown that the strength and weakness of the nervous system has a significant impact on the response to stress and the selection of tools for improving the physical qualities of athletes.

A method for developing the coordination abilities of young hockey players is developed, taking into account the peculiarities of the manifestation of strength and weakness of the nervous system. The content of the methodology includes training complexes. They contain exercises of varying coordination complexity.

It is noted that young hockey players with a strong nervous system display leading coordination abilities more effectively.

The effectiveness of the developed method is characterized by a significant increase in indicators in test exercises.

Confirmation of the experimental method effectiveness will allow specialists to work with young athletes taking into account individual characteristics, as the basis for the redistribution of time spent on training sessions, for the development of coordination abilities, and this is necessary in game sports.

Coordinating abilities testing in young hockey players was held according to general tests. They are used in sports practice of hockey, observing all rules of organization (Wulf & Printz, 2003, Wulf & Shea, 2002).

2.3 Data Acquisition

Results were analyzed according to the questionnaire survey during the Russia competitions among students-hockey players. During the competitions the questionnaire survey was held among the coaches of the teams: hockey club "Chelny", "Yelabuga 1000", youth team "Ak Bars", sports school team "Neftekhimik", Russia (Seasons 2015-2016; 2016-2017; 2017-2018). Each participant took part in the questionnaire survey voluntarily, understanding the aim of the questionnaire. The questionnaire was filled by each athlete and a specialist during 10-15 minutes. Some specialists agreed to distant questionnaire survey through Instagram online.

2.4 Statistical Analysis

The questionnaire survey and testing were thoroughly analyzed and statistically handled in standard statistical programs Microsoft Excel 2010 using Stat 20. The indices of coordinating abilities measurement was held with the help of testing. The study of nervous system characteristics in hockey players was held with the help of tepping test [E.P. Ilin, Russia]. The results of the questionnaire survey were ranked according to the significance of the defined factors.

3 RESULTS AND DISCUSSION

The questionnaire survey among the specialists and highly-qualified hockey players helped to reveal the leading role of coordinating abilities.

Table 1 presents the respondents' answers ranking according to the importance. Table 2 presents coordinating abilities testing among the children, who went in for hockey during the period of the experiment.

3.1 The Opinions Analysis among the Specialists and Highly-qualified Hockey Players According to Coordinating Abilities Markers Demonstration among Young Hockey Players

According to the received results, presented in table 1, the most significant markers of coordinating abilities demonstration and development in training young hockey players is the age and sensitive periods identification (1,09±0,02) and the dependence on the characteristics of nervous system (1,12±0,02).

In the opinion of the respondents, we defined seven significant factors. They perform the function of coordinating abilities markers, taken into consideration in young hockey players sports training. The first place took the most important marker of coordinating abilities development in training of young hockey players: the age and identification of sensitive periods of coordinating abilities demonstration (1,09±0,02) and dependence on the characteristics of athletes' nervous system (1,12±0,02). It means that in order not to miss

sensitive periods of coordinating abilities development and the features of nervous system demonstration it is necessary to pay special attention to coordinating abilities development during childhood. The dominant position of the second marker is explained by the fact that children are different (slow, labile, nervous, passive) and taking this into consideration would provide sports training effectiveness improvement. It is so important for modern children's sport. Physiological base of nervous system power demonstration forms the process of excitation and inhibition. It is demonstrated and characterized by the working capacity and endurance. Physiological base of nervous system weakness is characterized by intemperance, mobility inhibition and confidence, working capacity and endurance decrease.

Table 1: The significance of coordinating abilities in the system of young hockey players sports training according to the results of the questionnaire survey.

Significance	Markers of coordinating abilities	M±σ
I	Age and sensitive periods of coordinating abilities demonstration identification	1,09±0,02
II	Dependence of coordinating abilities on the characteristics of the athletes nervous system	1,12±0,02
III	Dependence on the specificity of physical-sports activity	1,13±0,03
IV	The place of coordinating abilities in the system of hockey players sports training	1,21±0,04
V	The initial level of coordinating abilities demonstration	1,22±0,05
VI	Specific weight of coordinating abilities in the training lessons	1,27±0,06
VII	Coordinating abilities ratio in the complex realization of physical training means	1,28±0,06

3.2 Coordinating Abilities Methodology Characteristics in Hockey Players Taking into Account Power and Weakness of Nervous System Demonstration

The training process of young hockey players included the experimental methodology of coordinating abilities development, taking into account nervous system characteristics. We differentiated the training means, directed toward coordinating abilities development, taking into account nervous system characteristics of young hockey players.

The first stage of methodology means realization was directed toward preconditions creation for the basis of hockey players' physical, technical training, where during the preparatory period an optimal ratio of means in a complex physical qualities development was the following: endurance – 25%; power 10%; flexibility- 10%; speed -25%; coordination – 30%.

Specific weight determination of the means, directed toward coordinating abilities development, varied during the sports season, taking into account the power and weaknesses of young hockey players' nervous system. At the training lessons we used the means, combined into the training complexes, directed toward coordinating abilities development. In general we created 5 training complexes with the specific weight till 25-30% of the coordinating abilities development means from general part of general physical an special-physical training. The training complexes in different compositional combination include the following exercises: rhythmical exercises, fulfilled in different conditions; the order change of exercises fulfillment in a quick tempo and sequence; combined fulfillment of the exercises in different combinations; several pucks use in one direction; puck juggling using the hockey stick with the pass to a partner; the exercises with different orientation of fulfillment; reflex fulfillment of the exercises with a partner. Each created training complex according to complexity was realized in different parts of the training lessons. In the preparatory part – till 5 minutes, in the main part – till 20 minutes and in the final part- till 10 minutes. General volume and intensity were regulated owing to the parameters of exercises duration and intensity change, taking into account power and weakness of hockey players' nervous system.

3.3 Comparative Analysis of the Coordinating Abilities Development Results in Young Hockey Players before and after the Experiment

We tested the indices of coordinating abilities in hockey players from the experimental and control group, taking into account power and weakness of nervous system according to the following tests: "Shuttle run 4x9 m", "Skipping during 30 seconds", "Shuttle run at skates 6x9 m", "Skating on small reverse Q face and back forward", "Dribbling of 5 stands with further throw into the gates".

Average statistical indices of coordinating abilities in hockey players of the experimental and

control groups before and after the experiment are presented in table 2.

Table 2: The indices of coordinating abilities development in young hockey players before and after the experiment.

Testing exercises	NS features	EG (n=22)		p	CG(n=22)		p	p (after EG and CG)
		1	2		1	2		
1. Shuttle run 4x9 m, sec.	Strong	11,5±0,33	11,0 ±0,41	**<0,01**	11,6 ±0,53	11,4±0,51	<0,01	**>0,05**
	Strong	11,8±0,4	11, 3±0,52	**<0,01**	11,8±0,38	11,7±0,39	>0,05	<0,05
2. Shuttle run at skates 6x9 m, sec.	Strong	17,3±0,55	16,2±0,68	**<0,01**	17,4±0,78	17,4±0,84	>0,05	<0,05
	Weak	17,8±0,65	17,2±0,77	**<0,01**	17,6±0,68	17,8±0,72	<0,01	>0,05
3. Skipping during 30 seconds, quantity	Strong	20,4±2,6	25,0±3	**<0,01**	20,2±3,8	21,0±3,6	>0,05	<0,05
	Weak	19,0±3	23.0±2,7	**<0,01**	19,8±3,5	20,3±3,8	>0,05	>0,05
4. Skating "on small reverse Q, sec.	Strong	31,6±1,39	27,3±1,56	**<0,01**	31,7±1,43	30,8±1,31	<0,01	<0,01
	Weak	33,0±1,62	30,4±1,38	**<0,01**	34,0±1,14	35,7±0,85	<0,01	<0,01
5. Dribbling of 5 stands with further throw into the gates, sec.	Strong	8,8±0,53	8,5±0,45		9,3±0,74			<0,05
	Weak	10,3±0,74	9,8±0,72		10,4±0,56			>0,05

The received results after testing characterize positive influence of the experimental methodology on coordinating abilities development of young hockey players. It was noted that taking into account young hockey players' nervous system power and weakness forms the base not only for physical qualities level regulation, but also for general working capacity and physical and psychic parts realization, as the condition for a young player's development.

In "Shuttle run 4x9 m" test hockey players from the experimental group with a strong nervous system had the following average value before the experiment 11,5±0,33 sec., after the experiment the average value was 11,0 ±0,41 sec. The increase during the period of the experiment was 4,37%, with the result improvement for 0,5 sec. Hockey players with the weak nervous system had the following indices in this test: at the beginning of the experiment 11,8±0,4 sec., at the end of the experiment 11, 3±0,52 sec. (4,23%).

The hockey players from the control group with the strong feature of the nervous system had the following average value before the experiment 11,6 ±0,53 sec., after the experiment the average value was 11,4±0,51 sec. The increase during the experiment was 0,2 sec. (1,72 %). In the group with a weak feature of nervous system the results were the following: 11,8±0,38 and 11,7±0,39 sec., where the increase was also insignificant (0,84%).

The time of distance overcoming according to "Shuttle run at skates 6x9 m" test in hockey players from the experimental group with a strong feature of nervous system was 17,3±0,55 sec., after the experiment - 16,2±0,68 sec. During the experiment the increase was 1,1 sec. (6,35%). In the group of hockey players with a weak feature of nervous system in EG before the experiment the result was 17,8±0,65 sec. and at the end it was 17,2±0,77 sec., the increase 3,37%. In the control group of young hockey players, both in the subgroup with strong and weak feature of nervous system, the indices change after the experiment was insignificant.

The indices in "Skipping during 30 seconds" test in the experimental group with strong feature of nervous system improved for 22,54% (20,4±2,6 and 25,0±3 times). In the hockey players with weak feature of nervous system average value according to the test at the beginning was 19,0±3 times, after the experiment the average value was 23.0±2,7 times (21,05%).

According to "Skipping during 30 seconds" and "Skating "on small reverse Q" tests the hockey players from the control group had insignificant changes.

According to "Skating "on small reverse Q" test face and back forward hockey players from the experimental group with a strong feature of nervous system had the following average value: before the experiment 31,6±1,39 sec., after the experiment - 27,3±1,56 sec., with the increase 13,6%. In hockey

players with weak feature of nervous system the average value before the experiment was 33,0±1,62 sec., after the experiment - 30,4±1,38 sec., with the increase 7,8% %.

Hockey players from the experimental group with a strong feature of nervous system before the experiment had the following index according to "Dribbling of 5 stands with further throw into the gates" test 8,8±0,53 sec., after the experiment- 8,5±0,45 sec., where the increase was 0,3 sec. (2,4%). Hockey players with a weak feature of nervous system before the experiment had the average value 10,3±0,74 sec., after the experiment - 9,8±0,72 sec., where the increase was 4,85%, as the proof of the presented methodology effectiveness.

The time of the task fulfillment according to "Dribbling of 5 stands with further throw into the gates" test in hockey players from the control group also improved, but these changes were not significant.

4 CONCLUSIONS

Thus, this research underlines the necessity to create the methodologies, taking into account the peculiarities of nervous system features demonstration in athletes. There should be differences in the traditional content of the training lessons as adaptive reactions of hockey players are demonstrated in different ways, starting from childhood. This, first of all, would help to improve the effectiveness of physical training and reveal the character of young athletes. During the experiment hockey players from the experimental group depending on power and weakness of nervous system had coordinating abilities indices increase. The main methods of coordinating abilities development, used in terms of the experimental methodology realization were the following: the method of the repeated exercise; the method of a varied exercise; competitive; game. The effectiveness of the experimental methodology confirmation would help the specialists in the work with young athletes to take into account individual features, as the base for time redistribution. It is spent at the training lessons for coordinating abilities development. It is necessary in sports games.

The analysis of features of the nervous system properties manifestation in young hockey players has shown that the strength and weakness of the nervous system has a significant impact on the response to stress and the selection of tools for improving the physical qualities of athletes.

A method for developing the coordination abilities of young hockey players is developed, taking into account the peculiarities of the strength and weakness of the nervous system manifestation. The content of the methodology includes training complexes. They contain exercises of varying coordination complexity.

It is noted that young hockey players with a strong nervous system display leading coordination abilities more effectively.

The effectiveness of the developed method is characterized by a significant increase in test exercises indicators.

Confirmation of the experimental method effectiveness will allow specialists to work with young athletes taking into account individual characteristics, as the basis for the redistribution of time spent on training sessions, for the development of coordination abilities, and this is necessary in game sports.

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