

УДК 159.938

DOI: 10.18413/2313-8971-2022-8-4-0-11

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Influence of psychophysiological functions on the ability of hockey forwards to perform effective assists at the age of 12-14

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*Received on September 29, 2022; accepted on December 12, 2022;
published on December 30, 2022*

Abstract. *Introduction.* There is little research on psychophysiological functions in children's and youth hockey. Determining the prospects of young hockey players aged 12-14 is an important aspect for team coaches. At the stage of sports specialization, hockey groups are small, so there is a need for an objective selection for the enrollment and expulsion of young hockey players. The Federal standard for hockey describes tests that evaluate the physical qualities and abilities of young hockey players. In this study, we want to consider the dependence of high indicators of psychophysiological functions on the ability of forwards to perform effective assists. Young hockey players aged 12-14 were tested on the following indicators: simple visual-motor reaction; reaction to a moving object; discrimination reaction; choice reaction; assessment of attention; noise immunity. *The aim of this work* is to empirically study the characteristics of psychophysiological functions and determine their correlation with the ability of forwards in youth hockey to perform assists. *Study participants.* The study involved 80 young 12-14-year-old hockey players (forwards) from youth hockey schools, participants of regional championships of the Russian Federation. *Methods.* Testing was carried out using psychophysiological and psychological diagnostics on special equipment of the Neurosoft company. *Results and its discussion.* Based on the results of the study, tables describing psychophysiological and statistical (goal assists) indicators were formed. The tables were compiled in such a way as to make the described grading system understandable. *Conclusions.* It was found, when comparing performance and noise immunity, that this psychophysiological quality is most likely to affect the ability of forwards to make productive passes in hockey. Simple hand-eye reactions, discrimination reactions, choice reactions, reactions to moving objects, and attention do not correlate with high scores in performance (goal assists). It was determined that when using a group assessment, there is no general pattern between high success in psychophysiological tests and the ability of forwards aged 12-14 to perform assists. As practice shows, coaches, who want to have hockey players with high statistical indicators on their team, need to conduct pedagogical observation and analyze the statistics of forwards over the past few years.

Keywords: simple visual-motor reaction; discrimination reaction; choice reaction; reaction to a moving object; noise immunity; attention

Information for citation: I.I. Zapparov (2022), "Influence of psychophysiological functions on the ability of hockey forwards to perform effective assists at the age of 12-14", Research Result. Pedagogy and Psychology of Education, 8 (4), 147-159, DOI: 10.18413/2313-8971-2022-8-4-0-11.

Заппаров И.И. 

Влияние психофизиологических функций на способность нападающих в хоккее выполнять результативные передачи в возрасте 12-14 лет

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*Статья поступила 29 сентября 2022; принята 12 декабря 2022;
опубликована 30 декабря 2022*

Аннотация. *Введение.* Исследование психофизиологических функций в детско-юношеском хоккее проводится в малом количестве. Определение перспективности юных хоккеистов в возрасте 12-14 лет является важным фактором для тренеров команд. На этапе спортивной специализации наполняемость группы небольшая, в связи с чем появляется необходимость объективного отбора для зачисления и отчисления юных хоккеистов. В федеральном стандарте по виду спорта хоккей описываются тесты, которые оценивают физические качества и способности юных хоккеистов. *Гипотеза:* рассмотреть зависимость высоких показателей психофизиологических функций со способностью нападающих выполнять результативные передачи. Юные хоккеисты в возрасте 12-14 лет проходили тестирование по показателям: простая зрительно-моторная реакция; реакция на движущийся объект; реакция различения; реакция выбора; оценка внимания; помехоустойчивость. *Целью исследования* является эмпирическое изучение характеристик психофизиологических функций и определение их корреляции со способностью нападающих в детско-юношеском хоккее выполнять результативные передачи. *Материалы и методы:* в исследовании приняли участие 80 юных хоккеистов (нападающих) в возрасте 12-14 лет, занимающиеся в детско-юношеских школах по хоккею и участвующие в региональных первенствах Российской Федерации. *Методики.* Тестирование проходило с использованием психофизиологической и психологической диагностики на специальном оборудовании компании «Нейрософт». *Результаты исследования и их обсуждение.* Были сформированы таблицы, в которых описываются психофизиологические и статистические (голевые передачи) показатели. Таблицы сформированы таким образом, чтобы была понятна описанная бальная система оценивания. *Заключение.* Выявлено, что при сравнении результативности и помехоустойчивости, данное психофизиологическое качество наиболее вероятно сказывается на способности нападающих выполнять результативные передачи в хоккее. Простая зрительно-моторная реакция, реакция различения, реакция выбора, реакция на движущийся объект и внимание не коррелируют с высокими показателями в результативности (голевые передачи). При использовании групповой оценки, общая закономерность между высокими показателями в психофизиологических тестированиях и способностью нападающих в возрасте 12-14 лет выполнять результативные передачи отсутствует. Тренерам необходимо проводить педагогическое наблюдение и анализировать статистику нападающих за последние несколько лет.

Ключевые слова: простая зрительно-моторная реакция; реакция различения; реакция выбора; реакция на движущийся объект; помехоустойчивость; внимание

Информация для цитирования: Заппаров И.И. Влияние психофизиологических функций на способность нападающих в хоккее выполнять результативные передачи в возрасте 12-14 лет // Научный результат. Педагогика и психология образования. 2022. Т.8. №4. С. 147-159. DOI: 10.18413/2313-8971-2022-8-4-0-11.

Introduction. Conducting research within the framework of a simple visual-motor reaction is quite common in Sobolev V.I. works (Sobolev, 2020). It is noted there that a simple visual-motor reaction (SVMR) belongs to the category of the simplest. In terms of the structure, it is characterized by three parameters: sRT – simple reaction time, sDT – stimulus detection time and MIT – movement initiation time. Davids Woods confirmed in his paper that the simple reaction time (SRT) is the minimum time required to respond to a stimulus and it is the main measure of processing speed (Woods, Wyma, Yund, Herron and Reed, 2015). Ignatova J.V. in her work considers that the SVMR parameters characterize neurodynamic processes in the central nervous system such as the excitability of the cortical part of the visual analyzer, the speed of excitation along the reflex arc up to the effector (Ignatova, Makarova, Yakovleva and Aksenova, 2019).

Hockey is a sport where it is really important to make quick decisions, regardless of the external factor (Muller, 2001; Brennan, 2009). Being able to predict the actions of partners and opponents is supposed to matter (Dosil, 2005; Tabrum, 2012). In such cases, it is customary to speak of complex sensorimotor reactions. According to Polevshchikov M. M., one of the most well-known and widely used tests for studying the issues of predicting the course of events is a test for assessing the reaction time to a moving object (Polevshchikov, Dorogova and Rozhentsov, 2017). Also, as Markov K.K. notes in his work, a complex sensorimotor reaction, depending on the nature of the central moment, includes:

- choice reaction, if it is necessary to differentiate the desired motor response from a number of possible ones;
- a discrimination reaction, if one of the signals needs to make a certain movement, and no movement needs to be made to the others (Markov and Nikolaeva, 2013).

Sports activity, especially during competitions, takes place in extreme conditions, which requires excessive physical and psycho-emotional efforts from athletes, says Suntsov S.A. (Suntsov, 2013). Considering a big amount of distractions in hockey, attention and noise immunity must play an important role here. According to Kardanov A.K., it is attention that makes all our mental processes complete, and only it makes it possible to perceive the world around us (Kardanov and Kardanova, 2016). As Makarova N.G. notes, there is every second exposure to a huge number of stimuli on a person, so attention helps the consciousness to choose those objects that are worth paying attention to. This selection is caused by the interest or needs of the individual (Makarova, 2013). In the work of Rzhanov A.A., it is noted that attention is a skill being developed in athletes, on the basis of the analysis of various situations and their own experience. The development of finely differentiated direct attention is the most important condition for the successful implementation by an athlete of physical and psychological participation in competitions (Rzhanov, Nesmeyanov and Matrosova, 2020). Speaking of noise immunity, we can recall Notov S.V., who writes that in the presence of high noise immunity, a person is able to concentrate on a necessary object for a long time and perform a given activity regardless of environmental conditions. With low noise immunity, a long-term concentration of human attention is possible only in the absence of noise and other distractions (Notova, Alidzhanova, Kiyayeva and Akimov, 2015).

The aim of this work is to empirically study the characteristics of psychophysiological functions and determine their correlation with the ability of forwards in youth hockey to perform assists.

The hypothesis of the study is that an objective assessment of hockey players takes a big place when selecting and determining the role of

hockey players at the stage of sports specialization (training stage) (Tretyak, Rotenberg and Bure, 2020). It is important for the coaching staff to have data on hockey players for various characteristics. Determining the correlation, or lack of it, will help coaches evaluate young hockey players comprehensively (Dennis, 2018).

Study participants. 80 young hockey players (forwards) aged 12-14 years old who are involved in youth hockey schools and participate in the regional championships of the Russian Federation took part in the study.

Methods. Testing was carried out using psychophysiological and psychological diagnostics on special equipment of the Neurosoft company. The following psychophysiological methods were used:

1. Method "Simple visual-motor reaction".
2. Method "Reaction to a moving object".
3. Technique "Discrimination reaction".
4. Method "Choice reaction".
5. Methodology "Assessment of attention".
6. Methodology "Noise immunity".

Statistical methods. When evaluating the most important psycho-physiological quality for forwards in hockey, we will conditionally set points for average performance (assistance) during one sports season, based on the young hockey players under study:

- from 0.00 to 0.16 = 1 point (80-61 places in the rating of assists);
- from 0.17 to 0.30 = 2 points (60-41 places in the rating of assists);
- from 0.33 to 0.58 = 3 points (40-21 places in the rating of assists);
- from 0.59 to 1.06 = 4 points (20-1 places in the rating of assists).

The following method for assessing psychophysiological qualities is proposed in the research. In the study of 80 forwards in hockey,

we divided the subjects into 4 groups of 20 people (tables 1, 2, 3, 4, 5 and 6). Further, for each psychophysiological quality, an assessment score will be calculated. The calculation will be carried out in the following way:

- formation of a table from the maximum to the minimum indicator for psychophysiological quality;
- summation of scores according to the proposed evaluation criterion;
- description of brief conclusions on the tables.

Suggestions of a practical nature. The results of the study can be used in the process of training specialists for work in youth hockey. The revealed results will help coaches to determine the importance of characterizing the psychophysiological functions of hockey players aged 12-14 years.

Research novelty. It has been established that during the process of describing the characteristics of psychophysiological functions in psychophysiology, one should take into account that the following criteria do not play a decisive role for the ability of forwards in hockey to perform assists:

- the speed of a simple visual-motor reaction;
- speed of discrimination reaction;
- speed of choice reaction;
- assessment of attention;
- reaction to a moving object.

Research Results and Discussion. As a result of the study, there were compiled some tables describing psycho-physiological and statistical (assist) indicators. The tables were compiled in such a way as to make the described grading system understandable.

In the values of the indicators between assists and the speed of a simple visual-motor reaction, it can be seen that the forwards from 61 to 80 points in the rating list received a total of the lowest score of 44 compared to other players.

Table 1

Indicators of hockey forwards' effective assists and simple visual-motor reaction

Таблица 1

Показатели результативных передач нападающих в хоккее и простой зрительно моторной реакции

The list	Group №	Average amount of assists	SVMR	The list	Group №	Average amount of assists	SVMR
1 to 20	2	0,24	181	21 to 40	1	0,08	217
	2	0,23	185		2	0,27	217
	2	0,25	187		1	0,06	218
	3	0,45	193		3	0,33	218
	2	0,18	195		4	1,00	218
	2	0,23	196		4	1,00	218
	2	0,30	199		1	0,14	219
	4	0,62	199		3	0,58	219
	3	0,50	202		1	0,15	221
	3	0,56	207		4	0,65	223
	2	0,20	209		3	0,58	224
	2	0,22	211		1	0,12	225
	4	1,06	211		2	0,19	226
	2	0,17	213		2	0,23	226
	3	0,50	213		2	0,24	226
	1	0,10	214		1	0,00	227
	2	0,25	215		4	0,90	227
	4	1,00	215		4	0,80	228
	1	0,12	216		4	1,00	228
3	0,43	216	1	0,13	229		
The sum	49			The sum	48		
41 to 60	4	0,68	229	61 to 80	3	0,46	243
	1	0,10	230		3	0,50	245
	4	0,65	230		1	0,00	249
	4	0,82	230		3	0,42	250
	3	0,37	231		1	0,05	251
	1	0,08	233		1	0,15	251
	3	0,41	233		2	0,25	252
	1	0,15	234		2	0,26	254
	1	0,15	234		2	0,18	255
	2	0,24	234		2	0,25	257
	4	0,72	234		4	0,59	259
	3	0,36	235		4	0,94	261
	3	0,43	236		2	0,25	266
	4	0,77	236		4	0,60	267
4	0,67	237	1	0,08	272		

The list	Group №	Average amount of assists	SVMR	The list	Group №	Average amount of assists	SVMR
	3	0,36	238		3	0,35	285
	3	0,47	238		1	0,13	294
	4	0,70	238		1	0,00	320
	4	0,73	238		3	0,33	326
	3	0,33	241		1	0,16	490
The sum	59			The sum	44		

Table 2

Indicators of hockey forwards' effective assists and discrimination reaction

Таблица 2

Показатели результативных передач нападающих в хоккее и реакции различения

The list	Group №	Average amount of assists	Discrimination reaction	The list	Group №	Average amount of assists	Discrimination reaction
1 to 20	2	0,18	217	21 to 40	2	0,27	273
	2	0,23	229		1	0,08	273
	2	0,25	235		1	0,12	275
	1	0,00	235		4	1,00	275
	4	0,80	235		3	0,41	276
	2	0,20	236		3	0,37	279
	2	0,24	237		1	0,08	280
	3	0,43	239		1	0,06	280
	2	0,23	242		1	0,08	280
	3	0,50	244		4	0,73	280
	4	1,00	256		4	0,65	281
	1	0,13	256		4	0,72	281
	4	1,06	257		3	0,45	284
	2	0,18	257		4	1,00	285
	2	0,25	261		2	0,25	286
	1	0,10	261		3	0,56	289
	4	1,00	264		1	0,13	290
	1	0,10	265		3	0,58	293
2	0,19	267	3	0,47	293		
4	0,62	272	4	0,68	295		
The sum	48			The sum	52		
41 to 60	1	0,00	297	61 to 80	2	0,24	323
	4	0,67	298		3	0,46	326
	4	0,59	298		4	0,60	326
	3	0,33	298		3	0,36	330
	2	0,22	299		1	0,05	331
	3	0,58	300		2	0,24	332

The list	Group №	Average amount of assists	Discrimination reaction	The list	Group №	Average amount of assists	Discrimination reaction
	3	0,50	304		4	0,70	332
	3	0,43	305		2	0,17	333
	4	0,94	309		3	0,50	333
	2	0,23	310		2	0,25	333
	1	0,15	313		1	0,15	336
	3	0,36	314		1	0,15	341
	2	0,26	314		1	0,16	345
	1	0,14	317		3	0,35	347
	1	0,15	317		4	0,90	348
	3	0,33	318		1	0,00	357
	4	0,65	318		3	0,42	357
	4	0,82	318		2	0,30	366
	4	0,77	319		3	0,33	389
	1	0,12	323		2	0,25	398
The sum	53			The sum	47		

It can be noted that there is no connection between effective assists and the speed of discrimination reaction.

Table 3

Indicators of hockey forwards' effective assists and choice reaction

Таблица 3

Показатели результативных передач нападающих в хоккее и реакции выбора

The list	Group №	Average amount of assists	Choice reaction	The list	Group №	Average amount of assists	Choice reaction
1 to 20	2	0,23	270	21 to 40	3	0,33	354
	2	0,20	275		1	0,13	355
	2	0,24	294		4	1,06	355
	2	0,23	295		3	0,46	359
	2	0,30	298		3	0,58	361
	1	0,06	308		1	0,05	364
	2	0,25	309		1	0,15	366
	2	0,18	310		4	1,00	367
	2	0,27	319		4	1,00	367
	4	0,72	324		4	1,00	368
	3	0,43	325		2	0,23	370
	1	0,00	327		1	0,08	371
	2	0,24	330		4	0,65	372
	2	0,25	338		4	0,62	374

The list	Group №	Average amount of assists	Choice reaction	The list	Group №	Average amount of assists	Choice reaction
	1	0,13	338		3	0,36	375
	2	0,25	339		1	0,08	376
	2	0,17	342		1	0,08	376
	4	0,80	345		4	0,73	376
	2	0,22	352		3	0,41	377
	3	0,37	353		3	0,50	379
The sum	43			The sum	54		
41 to 60	3	0,50	380	61 to 80	3	0,58	418
	3	0,50	384		1	0,16	421
	3	0,45	389		4	0,59	425
	3	0,47	391		4	1,00	429
	2	0,19	392		1	0,14	432
	3	0,33	392		1	0,10	435
	3	0,33	392		4	0,68	436
	2	0,26	393		1	0,00	441
	4	0,65	397		1	0,15	446
	3	0,35	397		4	0,70	448
	1	0,15	401		4	0,90	452
	2	0,18	402		4	0,60	458
	2	0,24	407		2	0,25	460
	3	0,36	407		3	0,42	461
	1	0,12	409		4	0,77	465
	2	0,25	409		4	0,82	468
	3	0,43	411		1	0,10	476
	1	0,15	411		1	0,00	530
4	0,67	414	4	0,94	546		
3	0,56	417	1	0,12	563		
The sum	51			The sum	52		

In the values of indicators between assists and the speed of choice reaction, you can see that the forwards from 1 to 20 points have the

lowest score. In general, the speed of choice reaction is not related to the performance of the forwards in hockey.

Table 4

Indicators of hockey forwards' effective assists and attention assessment

Таблица 4

**Показатели результативных передач нападающих
 в хоккее и оценки внимания**

The list	Group №	Average assists number	Attention assessment	The list	Group №	Average assists number	Attention assessment
1 to 20	3	0,43	260	21 to 40	4	0,68	287
	2	0,25	267		2	0,23	288
	3	0,33	267		1	0,08	290
	3	0,50	268		4	0,70	293
	2	0,24	270		3	0,33	294
	2	0,24	273		4	0,65	295
	3	0,58	274		3	0,43	295
	2	0,30	277		4	1,00	296
	4	1,00	277		4	0,67	296
	1	0,12	277		2	0,23	297
	4	0,80	278		1	0,06	297
	2	0,18	279		1	0,08	298
	2	0,27	280		1	0,08	298
	1	0,13	283		1	0,15	298
	4	0,62	285		3	0,56	299
	4	0,72	286		1	0,10	299
	2	0,23	287		4	0,82	300
	2	0,25	287		4	1,00	301
2	0,22	287	3	0,36	302		
3	0,33	287	3	0,37	303		
The sum	51			The sum	53		
41 to 60	3	0,50	303	61 to 80	2	0,25	320
	2	0,19	303		2	0,20	321
	3	0,42	303		4	0,60	323
	1	0,00	304		1	0,13	326
	2	0,17	304		4	1,00	327
	2	0,26	305		2	0,24	327
	3	0,50	307		4	0,65	330
	3	0,45	307		3	0,46	331
	4	1,06	308		1	0,15	335
	3	0,36	308		2	0,25	337
	1	0,10	309		1	0,16	346
	1	0,15	310		1	0,14	350
	1	0,12	311		1	0,00	353
	4	0,94	314		3	0,35	356

The list	Group №	Average assists number	Attention assessment	The list	Group №	Average assists number	Attention assessment
	1	0,05	315		3	0,58	358
	4	0,77	315		4	0,59	361
	4	0,73	317		1	0,00	361
	3	0,47	317		2	0,25	363
	4	0,90	317		2	0,18	378
	1	0,15	319		3	0,41	398
The sum	50			The sum	46		

In the scores between assists and attention grades, it can be seen that forwards from 61 to

80 on the ranking list received the lowest total score of 46 compared to other players.

Table 5

Indicators of hockey forwards' effective assists and noise immunity

Таблица 5

Показатели результативных передач нападающих в хоккее и помехоустойчивости

The list	Group №	Average assists number	Noise immunity	The list	Group №	Average assists number	Noise immunity
1 to 20	3	0,50	287	21 to 40	2	0,27	338
	2	0,25	293		4	0,65	338
	4	0,68	299		2	0,25	339
	3	0,37	312		3	0,43	341
	3	0,33	314		1	0,14	342
	1	0,08	315		3	0,56	344
	2	0,24	319		4	0,73	344
	4	1,00	320		4	0,90	345
	2	0,26	324		2	0,22	346
	4	1,00	325		3	0,36	346
	1	0,12	328		3	0,43	348
	4	0,77	330		2	0,17	350
	4	0,62	331		3	0,45	350
	1	0,15	331		2	0,25	351
	4	0,65	332		1	0,08	353
	3	0,41	332		2	0,18	354
	2	0,19	334		3	0,33	354
	2	0,24	335		4	0,67	354
	4	1,00	335		3	0,58	356
	1	0,15	337		1	0,06	358
The sum	54			The sum	52		
41 to 60	3	0,42	359		2	0,20	386

The list	Group №	Average assists number	Noise immunity	The list	Group №	Average assists number	Noise immunity
	1	0,00	362	61 to 80	2	0,23	391
	2	0,23	367		2	0,25	391
	4	0,82	367		4	1,00	393
	4	0,72	371		3	0,35	396
	1	0,12	372		1	0,15	397
	1	0,13	372		3	0,36	401
	3	0,46	374		3	0,33	403
	3	0,50	376		1	0,05	403
	2	0,25	376		3	0,58	411
	2	0,18	376		1	0,10	413
	4	0,94	378		1	0,13	418
	1	0,15	378		2	0,24	421
	4	0,80	380		1	0,08	430
	3	0,47	380		4	0,70	436
	1	0,10	381		1	0,00	439
	4	1,06	382		1	0,16	457
	4	0,59	383		2	0,23	458
	1	0,00	383		4	0,60	462
	2	0,30	386		3	0,50	496
The sum	50			The sum	44		

In the values of the indicators between assists and noise immunity, you can see that the forwards from 61 to 80 points in the rating list received a total of 44 points in comparison with other players. In general, when comparing the

effectiveness and noise immunity, it can be noted that this psychophysiological quality most likely affects the effectiveness of the forwards in hockey.

Table 6

Indicators of hockey forwards' effective assists and reaction to a moving object

Таблица 6

Показатели результативных передач нападающих в хоккее и реакции на движущийся объект

The list	Group №	Average assists number	(RMO) The number of accurate reactions %	The list	Group №	Average assists number	(RMO) The number of accurate reactions %
1 to 20	3	0,33	78%	21 to 40	4	0,65	54%
	4	0,68	72%		2	0,25	54%
	2	0,24	70%		4	0,73	54%
	3	0,50	70%		4	0,90	54%

The list	Group №	Average assists number	(RMO) The number of accurate reactions %	The list	Group №	Average assists number	(RMO) The number of accurate reactions %
	2	0,17	68%		4	1,06	54%
	2	0,23	68%		4	1,00	54%
	1	0,08	64%		1	0,15	54%
	1	0,08	64%		4	1,00	52%
	1	0,12	62%		3	0,45	52%
	2	0,18	62%		1	0,13	52%
	3	0,58	62%		4	0,80	52%
	2	0,25	62%		3	0,47	52%
	4	0,70	62%		3	0,37	50%
	2	0,23	60%		2	0,26	50%
	4	0,82	60%		3	0,36	50%
	1	0,10	60%		4	0,94	50%
	2	0,19	58%		3	0,33	50%
	1	0,15	56%		3	0,50	50%
	3	0,43	56%		3	0,50	48%
	4	0,72	56%		2	0,24	48%
The sum	47			The sum	61		
	1	0,14	48%		3	0,42	42%
	2	0,25	48%		4	1,00	40%
	1	0,08	48%		4	0,77	40%
	2	0,18	48%		2	0,20	40%
	1	0,15	48%		1	0,00	40%
	1	0,13	48%		1	0,12	38%
	2	0,24	48%		2	0,30	38%
	3	0,33	46%		1	0,16	38%
	4	0,62	46%		2	0,25	36%
	1	0,15	46%		3	0,58	36%
	3	0,46	46%		3	0,56	32%
	2	0,25	46%		4	0,60	32%
	4	0,65	44%		4	1,00	30%
	1	0,06	44%		3	0,35	30%
	2	0,23	44%		1	0,05	30%
	1	0,10	44%		2	0,27	28%
	3	0,41	42%		1	0,00	26%
	2	0,22	42%		4	0,59	26%
	3	0,43	42%		3	0,36	24%
	4	0,67	42%		1	0,00	22%
The sum	43			The sum	49		

In the values of indicators between assists and the speed of reaction to a moving object, it can be seen that the lowest score is found in the forwards from 41 to 60 points. It should also be noted that the highest score is 61. It refers to players from 21 to 40 points. It also includes 8 players from 4 groups. In general, the speed of reaction to a moving object is most inappropriate for interconnection with the performance of forwards in hockey.

Conclusions. When comparing the effectiveness and noise immunity, it can be noted that this psychophysiological quality most likely affects the effectiveness of the forwards in hockey. Reaction to a moving object and attention do not correlate with high performance indicators (assists).

It was determined that when using a group assessment, there is no general pattern between high success in psychophysiological tests and the ability of forwards aged 12-14 to perform assists. As practice shows, coaches, who want to have hockey players with high statistical indicators in their team, need to conduct pedagogical observation and analyze the statistics of forwards over the past few years.

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Информация о конфликте интересов: автор не имеет конфликта интересов для декларации.

Conflicts of Interest: the author has no conflict of interests to declare.

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