

COMPARATIVE CHARACTERISTICS OF PSYCHOPHYSIOLOGICAL FEATURES SKILLED BASKETBALL PLAYERS-WOMEN WITH HEARING AND SKILLED BASKETBALL PLAYERS HEALTHY

Kozina Zh.L., Sobko I.N., Klimenko A.I., Sak N.N.
Kharkov National Pedagogical University
Kharkov National Economic University
Kharkov State Academy of Physical Culture

Annotation. A comparative analysis of the psychophysiological features of skilled basketball players with normal hearing and impaired hearing aid. The study involved two women's basketball team to 12 people each. The study used a complex computer psychodiagnosis. The complex includes 20 psychophysiological and 18 personal psychological tests. The indicators of the time simple and complex reaction and average tapping test healthy skilled basketball players and basketball players are hearing impaired. There was a significant higher rates of visual-motor speed and reaction-tapping test in basketball players with hearing compared to healthy athletes. This is explained by compensatory mechanisms that occur in connection with the violation of the audition.

Keywords: basketball, hearing, compensation, analyzer, response, motion, test, psychophysiology.

Introduction

In modern women basketball it is important for sportswomen to be able to take quickly effective decisions in any game situation, to choose reasonable game technique, to fulfill it in optimal way considering time, space and muscular force, to control the results of own actions and the actions of adversary and to be ready for fulfillment of the next task [6]. For female basketball players with hearing problems this tasks becomes still more difficult owing to their specific features [1, 5, 8, 10, 11, 12].

Improvement of training system of highly qualified sportswomen is a subject of constant attention of scientists and coaches [3, 4, 6, 7, 9]. They devote their researches to studying of model characteristics of qualified basketball players (female), considering their game roles, they study statistic connections between indicators of psychomotor responses and efficiency of competition activity [4, 6].

Considering the fact that competition activity of highly qualified basketball players takes place in extreme conditions and is connected with high psychic stresses, the problem of consideration of sportswomen's psychophysiological abilities becomes specially important [6, 7]. For sportsmen perception and processing of visual information is one of important characteristics of neuro-psycho-physiological functions. Quickness of visual response depends on a number of factors, which condition effectiveness of sportsman's actions: afferent, receptor component of information's perception; central component of visual information's processing on CNS level; and efferent, executive component of neuro-psycho-physiological response [7]. That is why for controlling team coach shall have understanding of perception and thinking characteristics of basketball players (female) with hearing problems.

The work has been fulfilled as per topic of Ministry of education and science, youth and sports of Ukraine for 2011-2016, 91 "Theoretical-methodic principles of individualization in physical education and sports" (No of state registration 0112U002001) and as per state-financed subject 3-13 for 2013-2014 "Theoretical-methodic principles of application of information, pedagogic and medical-biologic technologies for formation of healthy life style" (No. of state registration 0113U002003).

Purpose, tasks of the work, material and methods

The purpose of the work is to compare psycho-physiological indicators of qualified basketball players (female) with normal hearing and with hearing problems.

Organization of the research. The research involved 12 sportswomen with hearing problem of combined women's basketball team of Ukraine and healthy female basketball players of Kharkov team of 1st league БК ХАИ XXI-БЕК – also 12 persons. We carried out examinations of psycho-physiological features of healthy basketball players and those, who had hearing problems, with the help of apparatus-program complex "Sports psychophysiological".

Apparatus-program complex (APC) "Sports psychophysiological" consists of apparatus part and program part. Apparatus (hardware) part is a panel with sensors and LEDs, device for tests, which are carried out with the help of visual sensor system in the form of tube with LEDs, pedal and earphones. Program part (software) is a specialized computer program. In total APC "Sports psychophysiological" contains 20 psycho-physiological and 18 personality-oriented psychological tests. APC "Sports psychophysiological" was designed on the base of scientific researches in the field of computer psycho-diagnostics. All methodic passed standard testing procedure.

The purpose of APC "Sports psychophysiological": study of psycho-physiological peculiarities, of psychomotor abilities and psychological features of different age sportsmen and sportswomen. The distinctive feature of this APC is certain set of tests, which ensure complex evaluation of important for sport activity psycho-physiological characteristics. It also permits to evaluate psycho-motor abilities both of upper and lower limbs.

System requirements to computer.

Configuration: minimally: PC Pentium I 100 MHz, RAM 16 Mb, screen resolution not less than 800 x 600 pixels; optimal variant: PC Pentium IV (Celeron) 1700 MHz, RAM 256 Mb, screen resolution 1024 x 768 pixels; with applying of remote panel PC must have one USB port.

Program provision: operational system Windows 95 with installed MS Internet Explorer of 5.5 version and higher; Windows 98 with installed MS Internet Explorer of 5.5 version and higher; Windows NT 4.0 SP5 and higher with installed MS Internet Explorer of 5.5 version and higher; Windows ME; Windows 2000; Windows 2003; Windows XP; Windows Vista; Windows 7.

Software MS Office (Word, Excel) 97/2000/XP/2003/2007/2010 (for reading and generating of files with test results in formats DOC and XLS) or Open Office (for reading of files with tests' results in RTF and CSV – tables) is desirable. Simultaneously with saving of tests' results in files they can be automatically sent to printing.

From psycho-physiological indicators we registered the time of simple and complex responses under different test conditions. In our research testing was carried out in the following way. The tested looks in tube with one eye, in which, on special screen, there appears light signal. With direct testing the tested should press computer's button at the moment, when he sees signal, with the similar in relation to looking eye hand. With fulfilling of this test for legs – press pedal with similar, relatively to the looking eye, foot. With cross testing the tested does the same actions but with opposite to looking eye hand or foot. In the same way measuring of direct and cross response of choice was carried out.

For studying of psycho-physiological abilities we used the following tests: crisscross senso-motor response of right hand and left eye; crisscross senso-motor response of left hand and right eye; crisscross senso-motor response of choice by right hand and left eye; crisscross senso-motor response of choice by left hand and right eye; simple senso-motor response of right leg; simple senso-motor response of left leg; crisscross senso-motor response of right leg and left eye; crisscross senso-motor response of left leg and left eye; indicators of tapping test, with fulfillment of which the tested quickly pressed button by right and left hand alternatively during 1 minute, the pressed pedal by foot in the same manner. We registered results of pressings after every 10 seconds (i.e. at every stage of testing).

Results of the researches

As a result of psycho-physiological tests it was found out that female basketball players with hearing problems have confidently less latent period of simple and complex responses to light irritator in comparison with healthy sportswomen. This feature we can explain by compensatory function of visual analyzer in connection with absence of hearing analyzer's functioning. Accordingly, basketball players with hearing problems have better psycho-motor processes, which are connected with participation of only visual analyzer (see fig.1).

Compensation of one analyzers' deprivation by other – is usual physiological phenomenon, which in our research has found experimental ground. Many researches noted possibility of replacing of one analyzers' not functioning by increased development of other as well as the facts of different authors' empiric observations.

For example, well-known psychiatrist A. Adler (http://rovesnikiveka.ru/izvestnyi_avstraliiskii_psihiatr_aadler-3.html) noted that specially organized education can help disabled people to compensate drawbacks in analyzers' functioning. The author explains it by the fact that human brain is built so that one certain drawback can be compensated by other organ of perception, by other analyzer. So, having no possibility to use hearing, person has to use eyesight, touch and other organs of perception in unusual for them functions.

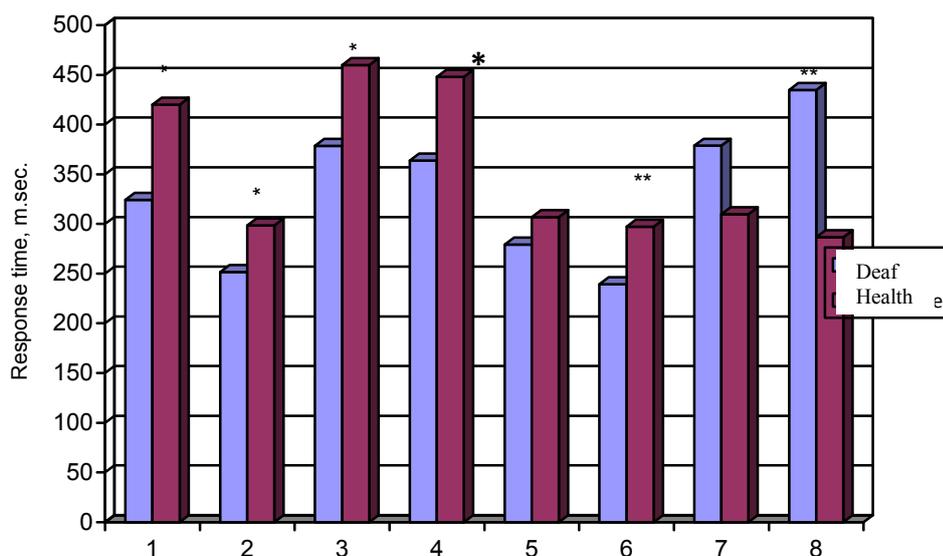


Fig 1. Indicators of psych-physiological tests of healthy female basketball players (n=12) and basketball players, who have hearing problems (n=12):

1 – crisscross senso-motor response of right hand and left eye; 2 – crisscross senso-motor response of left hand and right eye; 3 – crisscross senso-motor response of choice by right hand and left eye; 4 – crisscross senso-motor response of choice by left hand and right eye; 5 – simple senso-motor response of right leg; 6 – simple senso-motor response of left leg; 7 – crisscross senso-motor response of right leg and left eye; 8 – crisscross senso-motor response of left leg and right eye.

* - differences are confident with $p < 0.05$;

** - differences are confident with $p < 0.001$

For example, nobody from people with normal hearing perceives oral speech by eyes, because using of hearing is much more convenient. But with the absence of hearing, it is possible to use other opportunities: visual and touch perception of speech. –Reading lips”, person perceives not exactly oral speech but the work of speech apparatus. There are not so many sounds in a language, and, besides, they are formed with the help of different parts and organs of mouth cavity (lips, teeth, jaws, palate and so on) that is why every sound (or group of sounds) has its own mouth picture, which can be perceived visually.

The author notes, that possibilities of replacement of one analyzer by the other, are rather limited. In other words, reserves of inter—analyzers compensation are insufficient for making scientific ground for existing facts of impressive achievements of some physically handicapped persons. It permits to make conclusion that compensation should be regarded as phenomenon, connected, first of all, with high human intellectual and will functions (http://rovesniki-veka.ru/izvestnyi_avstraliiskii_psihiatr_aadler-3.html).

The facts of outstanding achievements of certain physically handicapped people are rather impressive. And there are many such facts. For example, English astronomer John Hadrane (1764-1786), who was born being completely deaf, since 18 years old was carried away by astronomy and made important discovery – proved periodic character of oscillations of star’s –Bet” gleam in constellation Perseus.

Well-known Russian scientist Konstantin Eduardovich Tsiolkovskiy was deaf since his childhood. Quite possible, that exactly deafness became a stimulator of his development. In his autobiography K.E. Tsiolkovskiy wrote: –Deafness was my driver, my lash, which urged me during all my life. It alienated me from people, made to concentrate, to give myself to cast by science thoughts. Without it I would not have done and finished so much work” (Cited by: –The life of deaf”. 1967. - № 1 - c. 11).

A.Adler (1870-1937) believed that the main factor of personality’s development is presence of conflict between feeling (complex) of inferiority and in-born human strive for dominancy, for overcoming of inferiority complex and all these conditions different kinds of compensation (http://rovesniki-veka.ru/izvestnyi_avstraliiskii_psihiatr_aadler-3.html).

In history of science there are a lot of names, which belong to deaf or weakly hearing people; most of them successfully graduated from the best HEIs of country and then defended scientific thesis in different branches of knowledge. In particular, such well-known scientists are: M. Chumakov, who in 1955 organized and headed institute of paleolith researches, Ye. Pavlovskiy – leading scientists in the field of parasitology, laureate of many prizes and other (http://rovesniki-veka.ru/izvestnyi_avstraliiskii_psihiatr_aadler-3.html).

Also are impressive the achievements of deaf from early childhood candidate of technical sciences, poet and translator Valentine Grygoriyevych Dmitriyev. His colleagues say that he works with inspiration, quickly and lightly.

In the works of other talented poetess (who also lost hearing) one can feel passion to contribute into common labor of people. Her verses are full with optimism and do not make impression that they are created by a person, deprived of hearing sounds (http://rovesniki-veka.ru/izvestnyi_avstraliiskii_psihiatr_aadler-3.html).

Thus, the obtained data about compensating of hearing analyzer's deprivation by increasing of visual perception are in compliance with empiric data, presented in literature, in which the questions concerning possibility of compensation of insufficient functioning of certain organs by increasing of functioning level of pother is discussed, as well as the problem, in some cases, of increasing of emotional sensitivity and intellect. This fact demolishes opinion of many coaches about delaying of deaf sportswomen by cognitive abilities from healthy basketball players, and points at presence of some peculiarities of psycho-physiological processes with increased activity of visual analyzer as compensatory mechanism.

Such peculiarities shall be considered by a coach when training team of basketball players with hearing problems; communication shall be built with maximal application of visual aids, of visualization of information, e.g., dynamic tactic-technical diagrams, systems of light signals, video analysis and so on.

It should be noted that obtained experimental facts of compensation of hearing analyzer’s deprivation by increased level of visual analyzer’s functioning are not single in our research. Besides, this fact we obtained also the data, which witness that weakly hearing basketball players have higher frequency of movements in tapping test and less expressed decline of frequency with durable fulfillment of tapping test (see fig.2). In fig.2 there are presented mean indicators of tapping test of healthy and weakly hearing sportswomen, who during 1 minute maximally quickly pressed button with right/left hands and then pressed pedal with right/left foot. In figure results of quantity of pressings for 10 seconds at the 2nd stage are shown, i.e., from 10th to 20th second and on 5th stage, i.e. from 40th to 50th second (see fig.2).

Results of tapping test of basketball players with hearing problems are confidently better than of healthy sportswomen that can be explained quicker efferent synthesis, which is a compensatory mechanism of slowed afferent signal, connected with hearing problems.

The revealed fact coincides with main principles of systemic approach, in particular with statements of theory of functional systems by P.K. Anokhin, who wrote that characteristic feature of systemic approach is the fact that in research work it is impossible to study analytically any particular object without precise identification of this particular in large system (P.K. Anokhin, 1978). This approach, being applied to live organisms, is based on the fact that conception about permanent character of inner medium of organism is a key mechanism of adapting.

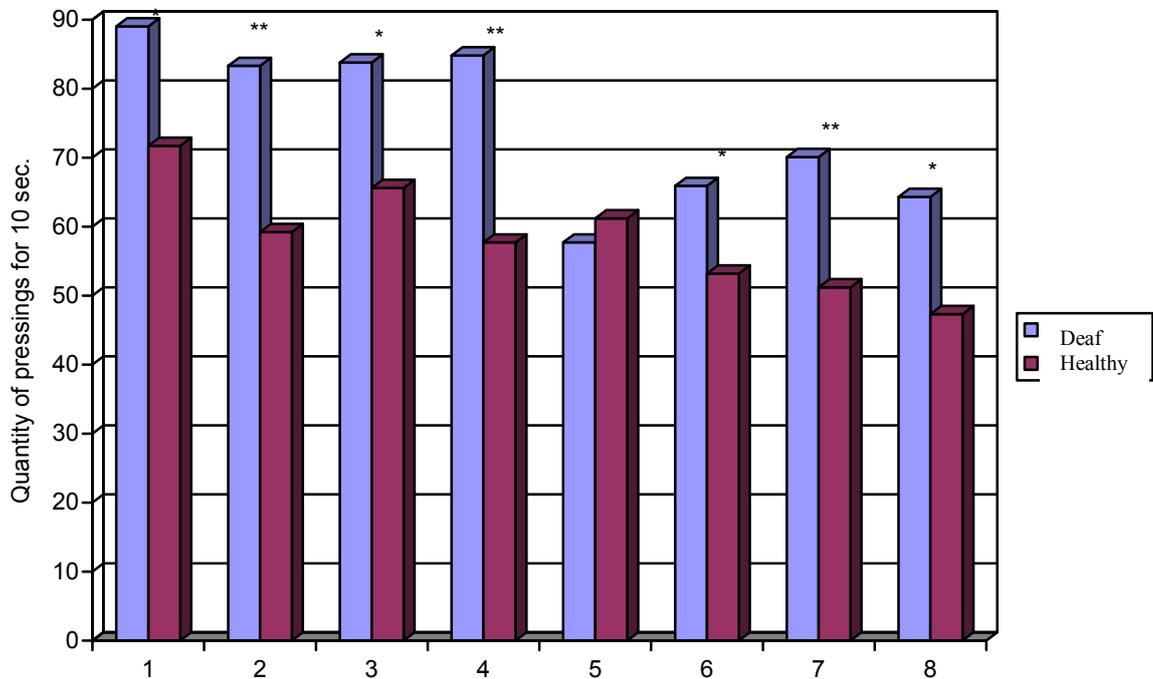


Fig 1. Indicators of tapping test of healthy female basketball players ($n=12$) and basketball players, who have hearing problems ($n=12$):

1 – right hand, 2nd stage; 2 – right hand, 5 stage; 3 – left hand, 2nd stage; 4 – left hand, 5th stage; 5 – right foot, 2nd stage; 6 – right foot, 5th stage; 7 – left foot, 2nd stage; 8 – left foot, 5th stage;

* - differences are confident with $p < 0.05$;

** - differences are confident with $p < 0.001$

C. Bernard (1878) considered homeostasis the main condition of organism's existence, or, by his words, "condition of free life", that should be understood as "such perfection of organism that any outside changes would be compensated and equalized every moment".

Coming from the obtained higher tapping test indicators of weakly hearing sportswomen in comparison with healthy ones, it would be logical to fix attention on compensation statements of P.K. Anokhin's theory of functional systems. Actually, theory of functional systems was developed by P.K. Anokhin (1935) as a result of researches, which were carried out by him and studied compensatory devices of organism's breached functions. As these researches showed any compensation of breached functions can take place only with mobilizing of significant quantity of physiological components, which are often located in different sectors of central nervous system and operating periphery, nevertheless which are always functionally combined on the base of the receiving of final adapting effect. Such functional combination of differently located structures on the base of receiving of final (adapting) effect was called "functional system" (P.K. Anokhin, 1968).

Considering the above mentioned conceptions the fact of better tapping test's indicators of weakly hearing basketball players is quite explainable: deficit of afferent synthesis, i.e., signals coming into brain from external medium, is compensated by increased efferent synthesis, i.e., signals, which come from central nervous system, one of whose manifestations is movement of hand or leg in tapping test.

Summary

1. It was found that velocity of basketball players' with hearing problems visual-motor response, registered in different modes by visual analyzer, is confidently higher by a number of indicators that of healthy sportswomen, that is explained by compensatory function of visual analyzer relatively to dysfunction of hearing analyzer.

2. It was proved that basketball players with hearing problems have confidently better indicators of tapping test. The obtained data can be explained by compensatory mechanisms, which appear in connection with abnormalities of hearing analyzer. The discovered facts demolish opinion of many coaches about delay of deaf sportswomen by cognitive abilities from healthy basketball players, but point at the presence of certain peculiarities of psycho-

physiological processes, in connection with increased activity of visual analyzer and efferent synthesis as compensatory mechanisms.

3. The obtained data shall be considered by coaches with training of teams of basketball players with hearing problems and communication shall be built with maximal application of visual aids, means of information's visualization, e.g., dynamic tactic-technical diagrams, systems of light signals, video-analysis and so on.

The prospects of further researches stipulate development of means of visual and touch automatic representation of information in training process of female basketball players with hearing problems.

References:

- 1 Bojko G.M. *Pedagogika, psihologia ta mediko-biologicni problemi fizicnogo viovanna i sportu* [Pedagogics, psychology, medical-biological problems of physical training and sports], 2010, vol.11, pp. 16–19.
- 2 Briskin Iu.A. *Sport invalidiv* [Disabled sports], Kiev, Olympic Literature, 2006, pp. 202–210.
- 3 Verkhoshanskij V.Iu. *Teoriia i praktika fizicheskoi kul'tury* [Theory and practice of physical culture], 1991, vol. 2, pp. 24–31.
- 4 Vozniuk T.V. *Moloda sportivna nauka Ukraini* [Young sport science of Ukraine], 2007, vol.3, pp. 78–82.
- 5 Zavorotna O.A. *Pedagogika, psihologia ta mediko-biologicni problemi fizicnogo viovanna i sportu* [Pedagogics, psychology, medical-biological problems of physical training and sports], 2008, vol.4, 146 p.
- 6 Kozina Zh.L. *Individualizaciia podgotovki sportsmenov v igrovykh vidakh sporta* [Individualization of training athletes in team sports], Kharkov, Point, 2009, pp. 145–160.
- 7 Korobejnikov G.V. *Fiziologiiia cheloveka* [Human physiology], 1995, vol. 21(3), pp. 81–86.
- 8 Morozov A.P., Chesnokov N.N. *Uchenye zapiski universiteta imeni P.F. Lesgafta* [Proceedings of University of P.F. Lesgaft], 2012, vol. 9 (91), pp. 110 – 115.
- 9 Platonov V.N. *Sistema podgotovki sportsmenov v olimpijskom sporte* [The system of preparation of sportsmen in Olympic sport], Kiev, Olympic Literature, 2004, 808 p.
- 10 Syshko D., Mut'ev A. *Nauka v olimpijskom sporte* [Science in Olympic Sport], 2006, vol. 1, pp. 80–83.
- 11 Chudnaia R.V. *Adaptivnoe fizicheskoe vospitanie* [Adapted physical education], Kiev, 2000, pp. 137–155.
- 12 Sampaio Jaime. Discriminant analysis of game-related statistics between basketball guards, forwards and centres in three professional leagues. *European Journal of Sport Science*, 2006, vol. 6, pp. 173-178.

Information about the authors:

Kozina Z.L.: Zhanneta.kozina@gmail.com; Kharkov National Pedagogical University; Artema str. 29, Kharkov, 61002, Ukraine.

Sobko I.N.: sobko.kh@mail.ru; Kharkov National Economic University; Lenina boulevard 9a, 61001, Kharkov, Ukraine.

Klimenko A.I.: Zhanneta.kozina@gmail.com; Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkov, 61022, Ukraine.

Sack N.N.: Zhanneta.kozina@gmail.com; Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkov, 61022, Ukraine.

Cite this article as: Kozina Zh.L., Sobko I.N., Klimenko A.I., Sak N.N. Comparative characteristics of psychophysiological features skilled basketball players-women with hearing and skilled basketball players healthy. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.7, pp. 28-33. doi:10.6084/m9.figshare.735962

The electronic version of this article is the complete one and can be found online at: <http://www.sportpedagogy.org.ua/html/arhive-e.html>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/3.0/deed.en>).

Received: 24.03.2013
Published: 30.07.2013