

Physiological Response of the Physical Capabilities of Adolescents with Sensorineural Hearing Loss to Regular Adaptive Handball

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Training within the framework of adaptive sports and especially handball helps to significantly increase the level of adaptation to social conditions in people with hearing system pathology. Regular practice of this sport increases the accuracy of motor acts and stimulates general adaptive capabilities. The study involved 31 male teenagers aged 13-14 with sensorineural hearing loss of I-II degree. Of these, two groups were formed: the observation group (14 adolescents), who began to engage in adaptive handball, and the comparison group (17 adolescents), who continued to engage in physical education at school. The results of the annual medical examination, the results of functional tests and control standards of physical fitness were used. The results were processed using the Student's t test and correlation analysis. Regular physical trainings within the framework of handball allowed to increase the coordination-motor potential and stabilize the vestibular-dynamic stability of adolescents. They increased their physical readiness and the accuracy of their motor actions fulfillment in the conditions of play and in everyday life. Regular training in adaptive handball in adolescents with sensorineural hearing loss increases coordination abilities, speed capabilities, strength qualities and general endurance.

Keywords: Adolescence, Sensorineural hearing loss, Adaptive handball, Coordination, Mobility, Physical fitness.

It is known that an increase in physical activity can increase the efficiency of the body's functioning under conditions of norm¹ and pathology². This is achieved as a result of regular physical education and sports by optimizing the general functional state and social adaptation at any age^{3,4}. It is possible to interest young people especially with health disorders in high

physical activity by involving them in systematic sports games⁵. Due to the increase in physical activity on an ongoing basis, young people achieve a functionally beneficial improvement in the indicators of the cardiorespiratory system and overall vitality⁶. The results of a systematic assessment of the effectiveness of various restorative methods of health-improving physical

culture in all cases confirm this opinion^{7,8}. In this regard, in modern conditions, it becomes very important to improve the methods of health improvement in adaptive sports, which should be aimed at achieving effective systemic integration of patients and disabled people into society and their involvement in professional activities^{9,10}.

Studies conducted in recent years have shown that the use of special complexes of physical activity in the framework of adaptive sports focused on certain types of diseases can significantly increase the adaptive reserves of the body of physically trained patients and disabled people^{11,12}.

Patients with sensorineural hearing loss of varying severity are attracting great attention of coaches in adaptive sports¹³. As a rule, they have low indicators of the development of physical qualities, low working capacity and are poorly socialized¹⁴. At the same time, regular training in adaptive sports has a very positive effect on their locomotor function and general physical conditions^{15,16}. As a result, a very promising direction in adaptive sports for people with hearing impairments is now being formed¹⁷.

Purpose of the study: to assess the influence of adaptive handball training on the motor characteristics of adolescents with sensorineural hearing loss of I-II degree.

MATERIAL AND METHODS

This study was supported at a meeting of the local ethics committee created at the Russian State Social University on September 15, 2017 (protocol¹¹).

The study involved 13-14-year-old male adolescents with a confirmed diagnosis of sensorineural hearing loss of I-II degrees, a total of 31 people. Of these, two groups were formed. The first group is the observation group (14 adolescents) who expressed a desire to start practicing adaptive handball and who started training. The second group - a comparison group (17 adolescents), consisted of persons who preferred to engage in physical education in the classroom in a secondary school (special medical group). In carrying out this study, the results of the annual medical examination, the results of functional tests in the examined adolescents and the results of assessing

their control standards of physical fitness were used. The study was carried out in 3 stages:

Stage 1 - the formation of a control group and a group of young men to practice adaptive handball, taking into account their personal consent to engage in adaptive sports and in the presence of an occupational pathologist's admission to these activities. An initial test of the physical fitness level of all subjects was carried out.

Stage 2 - assessment of the dynamics of indicators in the control and in the group of people engaged in adaptive handball after 6 months.

Stage 3 - analysis of the results obtained, determination of the dynamics of the physical state in both observation groups.

Statistical processing of the indicators of both study groups was assessed by the methods of variation statistics using the program "StatSoft, Inc." USA. The significance of differences in quantitative characteristics between the groups was assessed using the Student's t test. Correlation analysis was performed using Pearson's correlation coefficient.

RESULTS AND DISCUSSION

At the beginning of the study, the initial level of physical fitness of all the surveyed was determined (table). The state of the registered initial speed-strength qualities was determined in the tests: 30 m running (5.8 ± 0.7 s), 60 m running (10.2 ± 1.1 s), standing long jump (1.69 ± 0.14 m). The initial state of endurance development in the study was judged by the distance that the subjects were able to overcome in 6 minutes running (980.0 ± 70.0 m). The severity of strength qualities in the outcome was judged by the number of pull-ups on the bar (5.4 ± 3.8 repetitions). The development of coordination abilities in adolescents in the outcome was judged by the results of shuttle running 4x6 (10.9 ± 1.7 s) and by the number of jumping rope jumps for 25 s (27.0 ± 9.4 repetitions). The results obtained in adolescents made it possible to speak of an insufficient initial level of development of their physical capabilities.

By the end of the observation in the comparison group, there were no significant changes in all considered indicators. As a result of regular handball in the observation group, after 6 months, a significant increase in the level

of physical development was achieved (table). This was judged by an increase in speed-power qualities (acceleration of a 30-meter run by 23.4%, an acceleration of a 60-meter run by 20.0%, an increase in the long jump distance from a standing position by 17.7%), an increase in power qualities (an increase in the number of pull-ups on the bar by 1.5 times, an increase in the number of lifts of the trunk from a prone position in 1 minute by 34.6%), according to the activation of coordination abilities (acceleration of shuttle running by 18.5%, an increase in the number of jumps performed using a rope in 25 seconds by 42.9%), as well as by increasing endurance (increasing the distance covered during 6 minutes of running by 12.4%) over the entire observation period.

During physical training in the observation group, the following technical elements turned out to be the most difficult to master:

1. High-speed movement with a given vector of a sharp change in the direction of movement;
2. Movement backwards along a given trajectory;
3. Performing running exercises with abrupt start and stop;
4. Execution of throws of the ball and reception of the ball in motion and when jumping with a change in the trajectory of movement;

5. Execution of false movements with the simultaneous execution of throws and ball reception.

At the beginning of the training sessions in the experimental group, there was a rapid fatigability of the trainees, which was expressed in an increase in errors when performing dynamic complex coordination exercises, in a decrease in attention and in a decrease in speed indicators. A characteristic feature of mastering the game elements of adaptive handball in the observation group was the presence of a statistically significant correlation between an increase in results in shuttle running and running with a sharp change in the direction of movement vector ($r = 0.655$; $p < 0.047$). An increase in the effectiveness of rope exercises fulfillment per unit time showed a significant correlation with the performance of jumping and throwing elements ($r = 0.509$; $p < 0.049$). Pronounced changes in the increase in speed qualities in the form of sharp accelerations when running along a given trajectory had a correlation relationship with an increase in the distance covered during standing jumps ($r = 0.619$; $p < 0.042$).

After 6 months of training, the observation group showed a statistically significant decrease

Table 1. Dynamics of the indicators taken into account

Indicators	The initial state, M±m, n=31	At the end of the observation, M±m observation group, n=14	comparison group, n=17
Running at 30 m, s	5.8±0.07	4.7±0.09 p<0.01	5.9±0.11
Running at 60 m, s	10.2±1.1	8.5±0.9 p<0.01	10.0±1.0
Long jump from a spot, m	1.69±0.14	1.99±0.11 p<0.01	1.70±0.16
Distance for 6 minutes of running, m	980.0±70.0	1102.0±67.3 p<0.05	988.0±82.3
Pull-up on the bar, reps	5.4±0.7	8.1±0.8 p<0.01	5.7±0.10
Lifting the trunk from a prone position in 1 minute, reps	25.7±3.8	34.6±2.5 p<0.01	26.3±2.6
Shuttle run 4x9, s	10.9±1.7	9.2±1.2 p<0.01	10.8±1.9
Jumping rope in 25 s, reps	27.0±9.4	38.6±8.0 p<0.01	28.0±9.2

Note: p is the reliability of the dynamics of the indicators taken into account during the observation.

in the level of fatigue. This was confirmed by subjective sensations and dynamics of the heart rate, which corresponded to the optimal values throughout the exercise (heart rate 119.0 ± 10.0 beats per minute). The most difficult to learn for adolescents in the observation group were the simultaneous execution of jumping and throwing movements, as well as the simultaneous transmission and reception of the ball in the process of movement. A positive effect in mastering the reception and transfer of the ball and throwing the ball into the target was observed when outdoor games with throwing elements were included in the structure of occupations against a background of high emotional uplift and in the absence of strict regulation of ball possession. A significant decrease in gross errors in the technique of ball handling and in the implementation of jumps, as well as an increase in the effectiveness of throwing the ball at the target, achieved in the observation group after 6 months of regular training, apparently, should be associated with the achievement of an increase in the level of general physical readiness with a significant increase in the general development of basic physical qualities^{18,19}.

During the registration of locomotor stability under the influence of external factors, it was possible to reveal that the time to cover a distance along a given trajectory with resistance to the defense of the opposing team was somewhat reduced. This indicated an increase in their muscle activity²⁰ and an increase in the available arsenal of movements and an increase in the level of general physical fitness²¹. In addition, in the observation group, after 6 months of training, an increase in locomotor stability was noted with a situational change in the direction of movement, transmission and reception of the ball, which should be associated with the activation of vestibular and muscular mechanisms that ensure an increase in body stability in space²².

CONCLUSION

The positive effect of increased physical activity on the overall functional state of the body has been the subject of many studies. It is most realistic to achieve this in adolescents through systematic sports games. They provide an effective increase in physical activity and improve the performance

of the cardiorespiratory system. As a result of regular six-month sessions of adaptive handball in adolescents with sensorineural hearing loss, it was possible to achieve a significant increase in the level of development of strength characteristics, speed-strength qualities, coordination abilities and endurance. Regular visits to physical culture lessons by another group of their peers with a similar pathology could not provide reliable dynamics of all the considered indicators, keeping them at their initial low level. It can be considered that systematic training in adaptive handball can have a pronounced positive effect on the development of locomotor capabilities and the general level of physical fitness in adolescents with sensorineural hearing loss.

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Conflict of interest

No conflict of interest is declared.

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Ethics Committee Resolution

The study was approved by the local ethics committee of the Russian State Social University on September 15, 2017 (protocol '11).

REFERENCES

1. Medvedev, I.N. Platelet functional activity in clinically healthy elderly. *Advances in gerontology*, **29(4)**: 633-638.(2016)
2. Makhov, A.S., Medvedev, I.N. Physiological and morphological peculiarities of children with Down's syndrome: A brief review. *Bali Medical Journal*, **9(1)** : 51-54. DOI:10.15562/bmj.v9i1.1099 (2020a)
3. Medvedev, I.N., Gusev, A.V., Malyshev, A.V., Mikhailova, O.D., Garina, E.V., Petina, E. Sh., Tagirova, N.Dz. Influence of the Experience of Health-Improving Jogging on the Level of Functional Activity of Platelets in Men of the Second Mature Age. *Systematic Reviews in Pharmacy*, **11(8)** : 432-438.(2020)
4. Tkacheva, E.S., Medvedev, I.N. Physiological

- and biochemical status of newborn piglets. IOP Conference Series: Earth and Environmental Science, Innovative Development of Agri-Food Technology. 548 (8), 082090. [https://iopscience.iop.org/article/10.1088/1755-1315/548/8/082090\(2020a\)](https://iopscience.iop.org/article/10.1088/1755-1315/548/8/082090(2020a))
5. Rumyantseva, E.R., Ovchinnikov, A.V., Tokmakova, N.Yu. Education of the coordination abilities of hockey players with hearing impairment in groups of initial specialization. Bulletin of the Tula State University. *Physical education. Sport*, **4** : 187-192.(2017)
 6. Bobrovsky, E.A. Adaptive sports and physical culture as a method of rehabilitation for disabled people. *International Journal of Applied and Basic Research*, **4**(2) : 456-459.(2017)
 7. Makhov, A.S., Medvedev, I.N. Parent's motivations on sports participation of their children with Down's syndrome in Russia. *Bali Medical Journal*, **9**(1) :47-50. DOI:10.15562/bmj.v9i1.1111(2020b)
 8. Karpov, V.Yu., Medvedev, I.N., Romanova, A.V., Usov, S.S., Kozyakov, R.V. Functional Disorders in the Respiratory System in Adolescents with Bronchial Asthma. *Indian Journal of Public Health Research & Development*, **10**(8) : 1904-1909.(2019)
 9. Ostrenko, K.S., Medvedev, I.N., Galochkina, V.P., Lemiasheuski, V.O., Tkacheva, E.S., Ovcharova, A.N., Kutin, I.V. Effect of Lithium Ascorbate on the Biochemical Parameters of Sows. *Systematic Reviews in Pharmacy*, **11**(1) : 20-27. doi: 10.31838/srp.2021.1.04 (2020)
 10. Medvedev, I.N. Problems of human nutritional behavior in modern society. *International Journal of Pharmaceutical Research*, **1** : 1357-1365.(2020)
 11. Karpov, V.Yu., Medvedev, I.N., Komarov, M.N., Lapina, N.M., Sharagin, V.I. Physical Rehabilitation of Adolescents with Bronchial Asthma. *Indian Journal of Public Health Research & Development*, **10**(8) :1910-1914. (2019)
 12. Vorobyeva, N.V., Medvedev, I.N. Functional activity of platelets in new-born calves of black-marked breed. *Bulgarian Journal of Agricultural Science*, **25**(3) :570-574.(2019)
 13. Medvedev, I.N., Gusev, A.V., Malyshev, A.V., Mikhailova, O.D., Garina, E.V., Petina, E. Sh., Tagirova, N.Dz. Influence of the Experience of Health-Improving Jogging on the Level of Functional Activity of Platelets in Men of the Second Mature Age. *Systematic Reviews in Pharmacy*, **11**(8): 432-438. (2020)
 14. Sokolova, N.I., Krivolap, N.V. Dependence of the adaptation reserve of the body of athletes on the degree of manifestation of connective tissue dysplasia. *Pedagogy, psychology and medicobiological problems of physical education and sports*, **5** :182-186.(2007)
 15. Medvedev, I.N. The Effect of Complex Treatment on Platelet Aggregation Activity in Patients with Grade 3 Arterial Hypertension with Metabolic Syndrome. *Prensa Med Argent*, **104**(6). DOI: 10.41720032-745X.1000325 (2018)
 16. Karpov, V.Yu., Medvedev, I.N., Kazakov, D.A., Sibgatulina, F.R., Shulgin, A.M., Krasnov R.B. Physiological Basis of Rehabilitation for Ulnar Neuritis. *Biomedical & Pharmacology Journal*, **13**(2) : 585-590. [http://dx.doi.org/10.13005/bpj/1921\(2020\)](http://dx.doi.org/10.13005/bpj/1921(2020))
 17. Timokhina, V.E., Mehdieva, K.R., & Blyakhman, F.A. Connective tissue dysplasia in young and young athletes. *Man. Sport. The medicine*, **18**(3) :101-112.(2018)
 18. Medvedev, I.N., Karpov, V.Yu., Batrakova, I.A., Dorontsev, A.V., Skorosov, K.K., Rysakova, O.G. Physiologically Significant Rehabilitation Measures for Acute Respiratory Viral Infection. *Biomedical & Pharmacology Journal*, **13**(2) :537-542. [http://dx.doi.org/10.13005/bpj/1915\(2020\)](http://dx.doi.org/10.13005/bpj/1915(2020))
 19. Bratanovskii, S., Amankulov, Ye., & Medvedev, I. Multi-pointed field-emission cathode as a generator of high-frequency oscillations. *Periódico TchêQuímica*, **17**(36) : 542-553.(2020)
 20. Tkacheva, E.S., Medvedev I.N. Functional features of vascular hemostasis in piglets of milk and vegetable nutrition. IOP Conference Series: Earth and Environmental Science. 421 (2), 022041. doi:10.1088/1755-1315/421/2/022041(2020b)
 21. Vorobyeva, N.V., Medvedev, I.N. Functional platelet activity in Dutch newborn calves. IOP Conference Series: Earth and Environmental Science. 421(2), 022042. doi:10.1088/1755-1315/421/2/022042(2020)
 22. Amelina, I.V., Medvedev, I.N. Transcriptional activity of chromosome nucleolar organizing regions in population of Kursk region. *Bulletin of Experimental Biology and Medicine*, **147**(6) : 730-732.(2009).