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Dysfunkcja narządu słuchu jako stan warunkujący poziom zdolności koordynacyjnych 11-13-letnich dziewcząt i chłopców

Hearing organ dysfunction as the condition for co-ordination skills level in 11-13-year-old girls and boys

Streszczenie

Wstęp. Sprawność motoryczna obejmuje zdolności kondycyjne, koordynacyjne i kompleksowe. Zdolności koordynacyjne oparte są o procesy informacyjne naszego organizmu, czyli związane są z funkcjonowaniem centralnego układu nerwowego i przesyłaniem z niego określonych informacji do narządu ruchu. Utrata słuchu, z racji integracji z systemem nerwowym i kanałami półkolistymi, może oddziaływać na zdolności motoryczne (równowaga, szybkość i dokładność ruchów). Również sam fakt nie odbierania z otoczenia żadnych dźwięków powoduje, że ruchy wykonywane przez niesłyszących są zbyt gwałtowne i nieskoordynowane.

Cel. Celem niniejszej pracy jest rozpoznanie poziomu różnic zdolności koordynacyjnych między wybraną grupą dziewcząt i chłopców z dysfunkcją narządu słuchu a ich słyszącymi rówieśnikami. Ustalenie poziomu różnic stanie się pomocne w efektywnym kształtowaniu zdolności motorycznych tej grupy dzieci oraz tym samym w programowaniu wychowania fizycznego. W pracy hipotetycznie założono, że dzieci niesłyszące charakteryzują się niższym poziomem zdolności koordynacyjnych niż słyszące oraz, że dziewczęta różnią się od chłopców poziomem zdolności koordynacyjnych.

Materiał i metoda. Badania przeprowadzono wśród osób w wieku 11-13 lat. Objęto nimi łącznie 120 osób. Wykorzystano testy opisane przez Raczka (2003). Określono poziom siedmiu zdolności koordynacyjnych (kinestetyczne różnicowanie, orientacja przestrzenna, szybkość reakcji, równowaga, rytmizacja, sprzężenie ruchów, częstotliwość ruchów).

Wyniki i wnioski. Dziewczęta i chłopcy niesłyszący posiadają zbliżony do ich słyszących rówieśników poziom zdolności koordynacyjnych. Dziewczęta i chłopcy niesłyszący różnią się od siebie tylko poziomem zdolności kinestetycznego różnicowania oraz dostosowania ruchów. Ukierunkowana i zorganizowana aktywność ruchowa może być czynnikiem stymulującym rozwój zdolności koordynacyjnych. Współczesne metody terapii i oddziaływania pedagogicznego umożliwiają taką pracę z dziećmi niesłyszącymi.

Słowa kluczowe: dysfunkcja słuchu, zdolności koordynacyjne, dziewczęta, chłopcy.

Summary

Introduction. The motricity includes fitness, co-ordination and extensive capabilities. Co-ordination capabilities result from information processes, which occur in our body, that is from central nervous system function and sending specific information from it to the locomotor system. Hearing loss can affect – because of the integration with the nervous system and semicircular channels – also motor capabilities (balance, speed and precision of movements). Also the fact, that the person does not receive any sound signals from the environment, makes that hearing-impaired movements too sudden and not co-ordinated. The aim of this study is to identify the differences in co-ordination capabilities between the chosen group of girls and boys with hearing organ dysfunction and their normal peers. Establishing the differences level can be helpful in motor capabilities development in this group of children and the same in physical education programming. Authors hypothetically assumed that hearing-impaired children are distinguished by lower level of the co-ordination capabilities than the normal ones, and that girls differ from boys in the co-ordination capabilities. The research was carried out on 11-13-year-old children. It involved 120 people in total. The tests described by Raczek (2003) have been used. The level of seven co-ordination capabilities – kinaesthetic differentiation, spatial orientation, speed of responses, balance, rhythmisation, movements' coupling and movements' frequency – have been determined. Hearing-impaired girls and boys have similar level of co-ordination capabilities as their normal peers. Hearing-impaired girls and boys differ from each other only in kinaesthetic differentiation level and movements' adaptation.

Aimed and organised physical activity can be the stimulating factor for the co-ordination capabilities' development. Contemporary therapy and pedagogic methods enable this kind of work with hearing-impaired children.

Key words: hearing organ dysfunction, co-ordination abilities, boys, girls.

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INTRODUCTION

The subject of motricity comprises an endless variety of motor combinations performed by humans. These motions are produced for the purposes connected with work, locomotion, fight, artistic work, artistic creativity, entertainment. Often they are aimless. The entire human life is full motion and it is hard to imagine life without it [1]. In such a context "motricity" is understood as a certain store of motor possibilities of an individual, i.e. only externally perceptible forms of motor activity. Yet, when discussing human motricity, the majority of scholars refer also to some intracorporeal mechanisms conditioning this activity. Thus, within the structure of motricity, two mutually related aspects may be clearly distinguished: potential, that is internal determinants, latent possibilities for movement, and effective, that is external manifestation, actual properties of motion [2]. The subject of the present paper is the potential aspect of motricity. Internal determinants of motor activities are connected with the nature of physiological processes of the human body and their mental functions. They include both properties of general nature, such as motor abilities, as well as the specific ones, that is motor skills. Motor abilities are defined as "a complex set of individual psychophysical properties (predisposition) developing on the basis of congenital genetic qualities, conditioning the effectiveness of motor activity" [3]. There are three basic groups of abilities: condition-based (energy-related) which include energy–related and morphostructural predisposition, coordination (information-related) mental and neurosensory predisposition, hybrid (comprehensive) – determined by the above mentioned factors without a clear dominant feature.

Within the set of potential properties of the human body determining the level of human motor fitness, a special role is played by coordination motor abilities. They are essential determinants of each form of motor activity, and they define the effectiveness of activities and motor behaviors of individuals in great measure. Raczek has defined them as "relatively consolidated and generalized forms of the course of psychophysical processes of motor control. They reflect complex relations existing between the neuro – psychic processes, enabling effective control and regulation of motor activities in humans" [3].

The research in the field of motor coordination abilities resulted in numerous concepts of its structuralization. The author has based her study on the concept devised by Raczek, who refers to eight coordination abilities: kinesthetic sensing, spatial and temporal imagination, maintenance of balance, rhythmization of movements, fast motor reaction time, receptor-movement coordination, speed-frequency of movements, coupling (combining) of movements, adjustment of movements, as well as high frequency of movements [3].

The world surrounding us is the source of diverse stimuli which affect our senses in their characteristic manner. Thus human psychological development and social functioning depends on senses, the quality and quantity of sensations provided by them. When one of the senses is damaged, the contact with reality is broken. This leads to misinformation about the environment, which in consequence may cause disturbance of balance of psychological processes and changes in psychomotor behavior. Such an exceptional situation is characteristic of the people with hearing impairment. Deafness undoubtedly belongs to the most severe impairments of man. The hearing-impaired persons appear not to know much about sounds, tunes, rhythms, and most of all they cannot hear the speech and all its intellectual, emotional and cultural richness [4].

A hearing-impaired child receives sensations, notices the system of symbols and notions, but the nature of these observations, ideas, symbols and terms varies slightly from that of a hearing child. It is disparate, however not only due to a lack of hearing, but also because of the resulting lack of oral speech [5]. It is widely acknowledged that it remains in close relationship with intellectual and emotional development of a child. The hearing impaired children perceive reality in a slower manner and less precisely than their hearing peers. They have difficulties connected with the process of visual analysis and synthesis. They notice objects and phenomena occurring in their environment, they even imagine them, just like the hearing children, but unfortunately, they do not connect it spontaneously to the word and semantic content. Therefore, their cognition is primarily based on images, it is not logical and notional. The characteristic feature of the thinking by the hearing-impaired is their egocentrism. It manifests itself through interpreting reality by generalization with simultaneous creation of their own notions and ideas. They express verbal speech sometimes globally, without going into details and analyzing the meaning of each word. Such situation may be referred to as distortion of information and assimilation of inadequate content. The research shows that generally their intelligence is on an average level but at the same time deafness has adverse affects on the so called abstract intelligence [6].

It is the physical development, besides numerous factors, that affects the formation of the personality in a hearing impaired child greatly. Numerous observations and experimental research showed that in many cases, deafness has an adverse affect on motor functions of an individual. Especially, a clear relationship between motricity and damage of the inner ear is noticeable, which often results in balance disorders in the hearing impaired. Many scholars have reported retardation of motor development equal to 0.5 to 1.5 year in children with hearing loss [7, 8]. Maszczak finds also that mean values of body height and mass in hearing impaired children are lower than those of hearing children. The analysis of evaluation of the physical fitness level showed that the most developed features of motricity in the ontogenetic development in children with impaired hearing are: agility and stamina, whereas the weakest are respectively: power and force. Yet their physical fitness is on an average level of the hearing children. In addition, in girls, a higher level of physical fitness than in boys can be observed. As can be seen from the results obtained by Maszczak, deafness does not determine significantly the possibilities of physical development and physical fitness of the hearing-impaired children, but it determines a longer way towards the achievement of those same effects in physical fitness in comparison with hearing children [9].

The research purposes of the present paper are to identify and compare the level of coordination abilities in hearing-impaired as well as hearing girls and boys. The author wishes to analyze the sexual dimorphism of the investigated coordination abilities as well.

Its practical objective is to disseminate knowledge on the coordination abilities. Such knowledge is essential for revalidation of the hearing-impaired boys and girls, as it may facilitate a proper choice of methods and forms of work during physical education classes and extracurricular sports and recreational classes.

MATERIALS AND METHODS

The tests regarding the present paper were carried out among 11-13-year-old students. The study group consisted of 30 hearing-impaired girls and 30 hearing-impaired boys from three School-Educational Centers for the Deaf. The control group included 30 girls and 30 boys without hearing disorders from two primary schools.

The description of the research material is supplemented with data on basic morphological parameters of the study group (Tab. 1, 2).

TABLE 1. Morphological features in groups of girls.

		Hearing girls	Hearing--impaired girls	Student's t test
Body mass [kg]	Mean	47.79	42.90	-1.70794
	Standard deviation	11.84	10.26	
Height [cm]	Mean	152.31	148.58	-1.35517
	Standard deviation	9.14	12.00	

TABLE 2. Morphological features in groups of boys.

		Hearing boys	Hearing--impaired boys	Student's t test
Body mass [kg]	Mean	45.96	44.59	-0.42595
	Standard deviation	13.43	11.26	
Height [cm]	Mean	151.16	153.43	0.92888
	Standard deviation	7.61	10.98	

The comparison of body mass and height of the hearing and hearing-impaired shows no statistically significant differences both among girls and boys.

In the present study, tests discussed by Raczek were used. For each of eight coordination abilities, one trial was selected. The choice of tests was conditioned primarily by the ability to perform them by hearing impaired subjects as well as the possibility to carry them out at school (safety and equipment). The following tests were selected:

1. Kinesthetic differentiation – test: "Throwing a ball at a target while standing with one's back to the target" [points];
2. Spatial imagination – test: "marching to the target" [cm];
3. Reaction time – test "stopping the rolling ball" [cm];
4. Maintaining balance – test: "making turns on the wooden slat of the gymnastic bench" [number];
5. Rhythmization – test: "rhythmical drumming with one's hand" [number];
6. Coupling of movements – test "three rolls forward" [s]
7. Adjustment of movements – test "standing long jump forwards and backwards" [cm];
8. High frequency of movements – test: "skipping while clapping under knees" [number].

ANALYSIS OF RESULTS

On the basis of obtained results, basic parameters for specific coordination abilities were calculated. The author began the analysis with general comparison of all particular tests in both hearing-impaired and hearing girls and boys (tables 3-6).

TABLE 3. Compilation of results: coordination abilities of hearing-impaired girls.

Tested ability	Mean	Standard deviation	Minimum	Maximum
Kinesthetic differentiation [points]	3.80	2.35	1.00	9.00
Spatial imagination [cm]	78.81	37.62	18.00	149.60
Reaction time [cm]	114.20	20.65	78.00	165.00
Maintaining balance [number]	5.35	1.70	3.00	9.00
Rhythmization [number]	8.86	2.60	1.00	14.00
Coupling of movements [s]	6.73	1.61	4.08	10.04
Adjustment of movements [cm]	51.93	15.62	17.00	89.00
Frequency of movements [number]	31.66	8.54	6.00	44.00

TABLE 4. Compilation of results: coordination abilities of hearing-impaired boys.

Tested ability	Mean	Standard deviation	Minimum	Maximum
Kinesthetic differentiation [pkt]	6.06	3.28	1.00	15.00
Spatial imagination [cm]	62.98	38.45	5.00	159.25
Reaction time [cm]	107.00	31.89	56.00	185.00
Maintaining balance [number]	6.20	1.97	2.00	10.00
Rhythmization [number]	9.03	3.14	2.00	16.00
Coupling of movements [s]	7.20	3.68	4.10	18.08
Adjustment of movements [cm]	65.23	23.06	29.00	103.00
Frequency of movements [number]	35.55	6.94	14.00	53.00

TABLE 5. Compilation of results: coordination abilities of hearing girls.

Tested ability	Mean	Standard deviation	Minimum	Maximum
Kinesthetic differentiation [points]	6.73	2.87	1.00	13.00
Spatial imagination [cm]	74.40	30.33	25.00	159.00
Reaction time [cm]	130.06	23.02	79.00	169.00
Maintaining balance [number]	5.85	1.05	4.00	7.50
Rhythmization [number]	10.56	3.03	4.00	15.00
Coupling of movements [s]	6.56	1.15	4.27	8.63
Adjustment of movements [cm]	44.10	16.42	11.00	71.00
Frequency of movements [number]	30.10	5.72	20.00	41.00

TABLE 6. Compilation of results: coordination abilities of hearing boys.

Tested ability	Mean	Standard deviation	Minimum	Maximum
Kinesthetic differentiation [points]	6.60	3.09	1.00	12.00
Spatial imagination [cm]	77.50	27.70	37.00	138.00
Reaction time [cm]	105.90	25.52	74.00	197.00
Maintaining balance [number]	5.81	1.17	3.00	8.50
Rhythmization [number]	9.86	3.20	3.00	16.00
Coupling of movements [s]	6.01	1.10	4.46	8.78
Adjustment of movements [cm]	53.30	12.55	33.00	78.00
Frequency of movements [number]	30.10	5.35	17.00	41.00

The comparison of results obtained by hearing-impaired and hearing children in every test for coordination abilities (table 7) followed.

TABLE 7. Comparison between hearing-impaired and hearing girls and boys in terms of tested coordination abilities.

Tested ability	Student's t test	P	Student's t test	P
	Girls		Boys	
Kinesthetic differentiation [points]	-4.3224	0.0000***	0.6397	0.5248
Spatial imagination [cm]	0.4997	0.6191	-1.6773	0.0988
Reaction time [cm]	-2.7815	0.0073**	0.1474	0.8832
Maintaining balance [number]	-1.3292	0.1891	0.9252	0.3587
Rhythmization [number]	-2.3257	0.0235*	1.0167	0.3134
Coupling of movements [s]	0.4506	0.6541	1.6023	0.1150
Adjustment of movements [cm]	1.8928	0.0633	2.4885	0.0157*
Frequency of movements [number]	0.8340	0.4076	3.3836	0.0012**

The obtained results indicate that the statistically significant difference between hearing and hearing-impaired girls occurs only in relation to three out of eight tested abilities, i.e.: kinesthetic differentiation, reaction time and rhythmization (table 7).

The comparison of results obtained by hearing-impaired and hearing boys shows that a statistically significant difference between hearing and hearing-impaired boys pertains only to two out of eight tested abilities, that is: adjustment of movements and frequency of movements (table 7).

Another comparison between both hearing-impaired and hearing girls and boys followed. Its objective was to determine whether there occur dimorphic differences pertaining to tested coordination abilities (table 8).

The results indicate that a statistically significant difference between hearing-impaired girls and boys occurs only in terms of two out of eight tested abilities, namely: kinesthetic differentiation and adjustment of movements.

TABLE 8. Comparison between hearing-impaired and hearing girls and boys in terms of tested coordination abilities.

Tested ability	Student's t test	P	Student's t test	P
	Hearing-impaired		Hearing	
Kinesthetic differentiation [points]	-3.0582	0.0033**	0.1729	0.8632
Spatial imagination [cm]	1.6110	0.1125	-0.4132	0.6809
Reaction time [cm]	1.0262	0.3091	3.8508	0.0002***
Maintaining balance [number]	-1.7338	0.0885	0.1152	0.9086
Rhythmiztion [number]	-0.2233	0.8240	0.8687	0.3885
Coupling of movements [s]	-0.6147	0.5413	1.7755	0.0816
Adjustment of movements [cm]	-2.6146	0.0113**	-2.4373	0.0178**
Frequency of movements [number]	-1.9121	0.0608	0.0000	1.0000

Statistically significant differences between hearing girls and boys occur only in relation to two out of eight tested abilities, namely: response rate and adjustment of movements.

CONCLUSIONS

The interest in coordination motor abilities is connected with the increased considerable significance of such possibilities of men as: proper temporal and spatial imagination, precise differentiation of movements in terms of space and time and dynamics, fast reaction to signals, maintaining balance in static and dynamic conditions, rational adjustment of motor activities to changing conditions and situations, spatial and temporal integration and dynamic movement parameters and their correct rhythmization in the conditions of progressing technological and civilizational changes and transformations. Many contemporary professions to a large extent require so-called motor intelligence, high quality and stability of the function of receptors, dynamic variety of coordination dexterity. The man of 21st century is forced to change the type of a performed profession a number of times and therefore each time he has to acquire a set of new skills, also motor skills, based primarily on coordination possibilities. A high level of development of this ability is also a guarantee for safe motor conduct and behavior, and thus prevention of numerous accidents in complex situations of life. In addition, the role of the discussed ability for increasing the effectiveness of the process of physical education and sport training of children and youth is also vital. Coordination motor abilities affect the speed and quality of motor learning to a large degree [10].

Every man's dream is to be healthy, fit and wise. However, the nature distributes these gifts unevenly among people. In our lives there are situations when we lose these abilities as a result of the acts of God. Such losses are then referred to as disabilities. It is possible to distinguish many kinds of disabilities according to whether they are connected with impairment of the motor organ, mental handicap or damage of any of the receptors. The disabled live in every society. With the social changes, also the attitude towards such indi-

viduals has altered. At present we are more and more aware of the responsibility for the fate of these persons [11].

Generally, the contemporary literature on rehabilitation of the disabled does focus much attention on problems of physical and motor development in persons with hearing damage. The latest extensive work in this context was the research carried out more that 30 years ago by Maszczak on the entire population of hearing-impaired children in Poland. Unfortunately, today this knowledge became out of date and lost its relevance. In literature, there are not many works concerning coordination motor abilities of this group to a considerable degree. Most investigations treat these subjects with little attention, and are limited to a few selected coordination abilities only. This induced the author of the presented research to carry out tests and extend knowledge about the mentioned subject. This is an extremely significant and vital notion for all those who work with the hearing-impaired, including Physical Education teachers. A high level of coordination abilities significantly influences the effectiveness and economics of activity of men and thus their health and quality of life. In the contemporary world much is said and written about the necessity to make equal educational opportunities for children with special educational needs. In order to do this, first we must identify the existing state of development in special care children, and then try to stimulate it in an intentional and planned manner.

Having re-examined the tests performed and analyzed its results, in conclusion it may be said that the objective of the present work was attained. The tests enabled the author to identify and compare the level of coordination abilities in hearing-impaired and hearing children aged 11-13 years.

The results form the basis for the following conclusions:

1. Hearing-impaired girls and boys present a similar level of coordination abilities in comparison with their hearing peers.

Statistically significant differences within the groups of girls are connected only with three coordination abilities. Hearing girls seem to have a significantly higher level of the ability of kinesthetic differentiation and rhythmization of movements. Yet, hearing-impaired girls proved to have had a significantly higher level of reaction time. Among boys, statistically significant differences pertain to the ability to adjust movements and to the frequency of movements. Hearing boys showed a better ability of adjustment of movements, whereas hearing-impaired boys demonstrate a statistically higher level of frequency of movements.

2. The tested coordination abilities do not make a distinction between girls and boys both hearing and hearing-impaired in a significant manner.

The hearing-impaired differ significantly from each other only in terms of kinesthetic differentiation and adjustment of movements level. The boys show a substantially higher level of kinesthetic differentiation, whereas girls have a higher level of adjustment of movements. As for the spatial imagination, reaction time, maintaining balance, rhythmization of movements and frequency of movements, hearing-impaired boys seemed to have been slightly better, however the difference is statistically insignificant. Statistically significant differences, which occurred between hearing girls and boys, refer only to reaction time and adjustment of movements. Boys proved to have had a better reaction time and girls show a higher level of adjustment of movements. In addition, girls demonstrate a slightly higher level of kinesthetic differentiation, spatial imagination, maintaining balance, and rhythmization of movements, but the difference is statistically insignificant.

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