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Dysfunkcja narządu słuchu jako czynnik warunkujący asymetrię funkcji ciała młodzieży w wieku gimnazjalnym

Hearing dysfunction as the factor influencing the body asymmetry in 13-15 year-old youth

Streszczenie

Wprowadzenie. Jednym z obszarów kształtowania się człowieka jest rozwój fizyczny. Jednym z jego aspektów jest lateralizacja. Wraz ze swoimi następstwami, w postaci asymetrii, lateralizacja uznawana jest za prawidłowość rozwoju, której określony poziom decyduje o sprawnym działaniu. W funkcjonowaniu społecznym człowieka niezmiernie ważną rolę odgrywa słuch. U dzieci głuchych może zaistnieć znacznie więcej zaburzeń w zakresie kształtowania się stronności. Jest to spowodowane wpływem głuchoty na pewne struktury neurologiczne i zachowania niesłyszącego.

Cel. Celem poznawczym badań było rozpoznanie i porównanie asymetrii funkcjonalnej w wybranej grupie młodzieży gimnazjalnej niesłyszącej. Dokonano także porównania do słyszących rówieśników i rozpoznania zagadnienia w aspekcie płci badanych.

Materiał i metoda. Badania przeprowadzone zostały wśród uczniów niesłyszących jednego z Ośrodków Szkolno-Wychowawczych dla Niesłyszących w południowej Polsce oraz wśród słyszących uczniów publicznego gimnazjum w tej samej miejscowości. Do badań wykorzystano wrocławski test asymetrii autorstwa Koszczyc i Sekity.

Wyniki. W badanych grupach dziewcząt i chłopców słyszących i niesłyszących dominuje prawostronny kierunek asymetrii funkcjonalnej. Obie grupy badanych dziewcząt oraz badani chłopcy słyszący mają dominujący jednorodny profil asymetrii funkcjonalnej. U chłopców niesłyszących dominował profil skrzyżowany. U dziewcząt i chłopców słyszących dominują te same kierunki i profile asymetrii funkcjonalnej. Uczniowie niesłyszący mają odmienny profil asymetrii funkcjonalnej, ale ten sam jej kierunek.

Wnioski. Można stwierdzić, iż wada słuchu determinuje lateralizację, co jest szczególnie widoczne u chłopców niesłyszących. Natomiast w przypadku dziewcząt, uszkodzenie słuchu również wpływa na lateralizację, jednak w mniejszym stopniu. Nie występują istotne różnice dymorficzne w zakresie zlateralizowania ciała.

Summary

Introduction. Physical development is one of the human development areas and lateralization is one of its aspects. Lateralization, with its consequences as an asymmetry, is considered to be a developmental regularity and the lateralization level decides on effective operation. Hearing is very important for social life. Many more lateralization disorders could take place in hearing-impaired children. It is related to the influence of deafness on neurological structures and hearing-impaired people's behaviour.

Aim. The cognitive aim of the study was to identify and compare functional asymmetry in a chosen group of 13-16 year-old hearing-impaired youth. The comparison with hearing peers and identification of a problem in the context of the subjects' gender was also carried out.

Material and method. The study was carried out in hearing-impaired students of a Hearing-Impaired Education Centre placed in the south of Poland and in hearing students of public secondary school in the same localisation. The Wrocław Asymmetry Test by Koszczyc and Sekita was used during the study.

Results. The right-sided functional asymmetry dominates in examined groups of hearing and hearing-impaired girls and boys. Both groups of examined girls and group of examined hearing boys have dominant uniform profile of functional asymmetry. In case of hearing-impaired boys the combined profile prevails. The same directions and profiles of functional asymmetry are observed in hearing girls and boys. Hearing-impaired students have different functional asymmetry profiles, but the same directions.

Conclusions. One can reach the conclusion, that the hearing defects determine lateralization, what is observed especially in hearing-impaired boys. Hearing defects in girls influence the lateralization as well, but to the smaller extent. Significant dimorphic differences in body lateralization are not observed, either.

Słowa kluczowe: słuch, dysfunkcja, asymetria, młodzież.

Key words: hearing dysfunction, asymmetry, teenagers.

INTRODUCTION

Hearing plays an extremely important role in social functioning of man. Not only it receives stimuli from space, but also it relates an individual with their entire environment, it provides confidence in contacts with the external world, and owing to speech it becomes the major source of communication between people. The language makes a child familiar with specific grammatical structures as well as norms of social behavior. When any malfunction of the acoustic analyzer occurs, not only mutual interactions between an individual and its environment are disturbed but also the entire social and mental development of individuals is damaged, as sound signals affect all the aspects of human personality [1, 2].

Physical development is the element of human development. Through physical development we are able to understand all biological processes characteristic of life forms. Thus it covers both the development of the motor apparatus as well as shaping the motoricity of the body to adjust to the conditions in which humans live [3]. Quantitatively physical development of a hearing-impaired child seems to be similar to the development of a hearing child; there are certain qualitative differences. Some hearing-impaired children do not show any or just little disorders in physical development. Hearing-impaired children should not be perceived as entirely disordered in terms of their physical sphere, and any disorders should be referred to the damaged hearing organ. In hearing-impaired children, more frequently than in hearing children we can see: disorders of the sense of balance, anomalies in the development of the central nervous system, overwork-related eye conditions, worse development of the chest and breathing organs. In addition, the gait of a hearing-impaired child is quite typical, hesitant, faltering for often its vestibular organ is damaged. The research showed also that hearing-impaired children, apart from poorer static coordination, show worse integration of motor activities of the body. Moreover, it was discovered that hearing-impaired girls show better physical fitness than boys and hearing-impaired children are generally less fit than their hearing peers [1, 4-6].

One aspect of physical development is the process of lateralization. This is a process of emerging predominance of one side of the body over the other connected with the supremacy of one of the cerebral hemispheres [7]. Along with its outcomes, such as symmetry or asymmetry, lateralization has been considered as a regularity of development, the specific level of which determines effective and efficient action. All disorders of this process have been treated as causes of retardation in mental and motor fitness in children [8]. In most children predominance of the hand is settled in their first year of education, and finally one-sided lateralization is settled around the age of 12 years [7]. In human body the following types of asymmetry may be enumerated: morphological, functional and dynamic. Morphological asymmetry refers to differences in external build on both sides of the median plane of the body. Functional asymmetry is associated with the frequency of use of a given limb or sense organ while performing everyday activities. Dynamic asymmetry shows the degree of a difference between the sides of the body, e.g. in terms of strength-force or speed [9]. In literature one may distinguish between several models of lateralization, in other words sidedness of the body:

- a) Homogeneous lateralization, when sense and motor organs predominate over one side of the body axis: right-sided (the right hand, foot, eye predominate), left-sided (left hand, foot, eye predominate),
- b) Heterogeneous [non-homogeneous] lateralization: cross (functional dominance of motor and sense organs, but on both sides of the body, e.g. when a child is right-handed and left-eyed and right-footed) – this is determined lateralization, undetermined lateralization, in other words: weak (no predominance of specific motor and sense organs e.g.: two-handedness, both two-eyedness and two-footedness) [7].

The process of lateralization is of vital significance to the proper functioning of man, yet any disorders of this process in many areas of life significantly impede and sometimes even prevent any effective action. At present, lateralization disorders are not perceived as a problem of left-handedness which is not considered incorrect. The research on sidedness revealed that disorders relating to human functioning in this field refer to heterogeneous lateralization (undetermined and cross lateralization). The difficulties experienced by children due to improper lateralization pertain to both graphic activities and manual skills, as well as motor abilities and spatial imagination in the left and the right part of the body schema. Cross lateralization relating to the hand and the eye causes disorders of motor and visual coordination, hinders visual control of hand action in children [7]. This problem involves children with the dysfunction of the hearing sense and is especially vital to them for by writing and reading they effectively compensate for the lack of information resulting from shortage or limitation of speech. Moreover, rehabilitation is hindered and requires more time as the function of the left hemisphere must be shifted to the right hemisphere. As regards the lateralization process in hearing-impaired children, there may be significantly more disorders relating to sidedness. This is caused by the influence of deafness on certain neurological structures and behavioral factors, which may induce disorders of the lateralization process [1, 6].

The interest in issues pertaining to body lateralization and problems of disability made the author focus on the research the present paper has focused on. The cognitive objective of the research was to identify and compare functional asymmetry in the selected group of secondary education hearing-impaired youth. Also the comparison with their hearing peers was made as well as the analysis of the issue in terms of gender of subjects. The practical objective, however, was to popularize knowledge on lateralization as human developmental regularity.

The following questions have been posed in this paper:

1. What is the direction of functional asymmetry in examined groups of girls and boys?
2. What is the functional asymmetry profile in examined groups of boys and girls?
3. What is the comparison between hearing and hearing-impaired girls and boys?

MATERIALS AND METHODS

The research was carried out among the hearing-impaired students of one of the School and Education Centers for the Hearing-impaired in the southern part of Poland

and among hearing students of the public secondary school in the same town. Both institutions had similar infrastructure and organization of the educational process. The tests involved 35 female and 35 male students aged 13-15 years. This is a very specific but at the same time interesting period in human life. The stability of childhood is followed by the time of extremely intense changes occurring in most processes of development. This period is maturation age, a transition from childhood to early adulthood. This stage is considered quite difficult. It is characterized by accelerated physical and sexual development and search for one's own identity. In the initial period of maturation physiological changes seem to be the most important events. Changes in the body build itself and its functions occur to begin with so-called pubertal growth spurt, that is fast growth of the body which takes place in boys around the age of 12 and 15 years, in girls however, it occurs approximately two years earlier. Physical development in this period covers anatomical and physiological changes, and thus increasing height and weight of the body, changes in proportions of organs and general shape of the body and physiological maturation primarily mirrored in puberty. These changes definitely affect the development of motoricity. In the secondary school period the differences between girls and boys become increasingly noticeable in terms of physical fitness [3, 10].

For the purposes of author's own research, Wrocław Direction Functional Asymmetry Test developed by Koszczyc and Sekita was used. During the test students perform ten trials in which based on observation of free choice of the eye, hand and foot perform the assigned motor task made by the subject, the direction of functional asymmetry and its profile, so-called sidedness model is determined [3].

Functional asymmetry of examined girls

In the examined groups of hearing and hearing-impaired girls, in all motor and sense organs in question the right direction predominates. It is most apparent in footedness and eyedness. Among the hearing-impaired no cases of undetermined eyedness have been reported, whereas among the hearing girls no undetermined footedness has been noted. In hearing-impaired girls a higher percentage of subjects has undetermined handedness. Generally, the determined direction is more emphasized in hearing girls (Figure 1).

TABLE 1. Functional asymmetry profile in examined groups of girls (%).

Type of profile	Hearing-impaired	Hearing
Determined homogenous	53.0	74.0
Determined heterogeneous	0	17.0
Undetermined	47.0	9.0

In the examined group of hearing-impaired girls, a determined homogenous profile was dominant (53%). However as many as 47% of the subjects had an undetermined profile (Table 1). Among the hearing girls, as many as 74% displayed a determined homogenous profile and only 9% had an undetermined profile. It may be said that, the examined hearing and hearing-impaired girls differ significantly in terms of functional asymmetry profiles.

Functional asymmetry of examined boys

In the investigated groups of hearing and hearing-impaired boys, as regards all the examined motor and sense organs the right direction prevails. It appears to be most vivid in hearing-impaired boys in handedness, and in hearing boys in their eyedness and footedness. Among the hearing boys a high percentage of those with undetermined handedness (34%) is reported and no subjects of undetermined footedness occur. Generally, the determined direction is more enhanced among hearing boys (Figure 2).

In the examined group of hearing-impaired boys a determined heterogeneous profile was dominant (50 %) and among hearing boys a determined homogenous profile prevailed (52%). Among hearing boys as many as 34% and among hearing-impaired 28%, respectively, demonstrated an undetermined profile (Table 2). Therefore it may be concluded that the examined hearing and hearing-impaired

TABLE 2. Functional asymmetry profile in examined groups of boys (%).

Type of profile	Hearing-impaired	Hearing
Determined homogenous	22,0	52,0
Determined heterogeneous	50,0	14,0
Undetermined	28,0	34,0

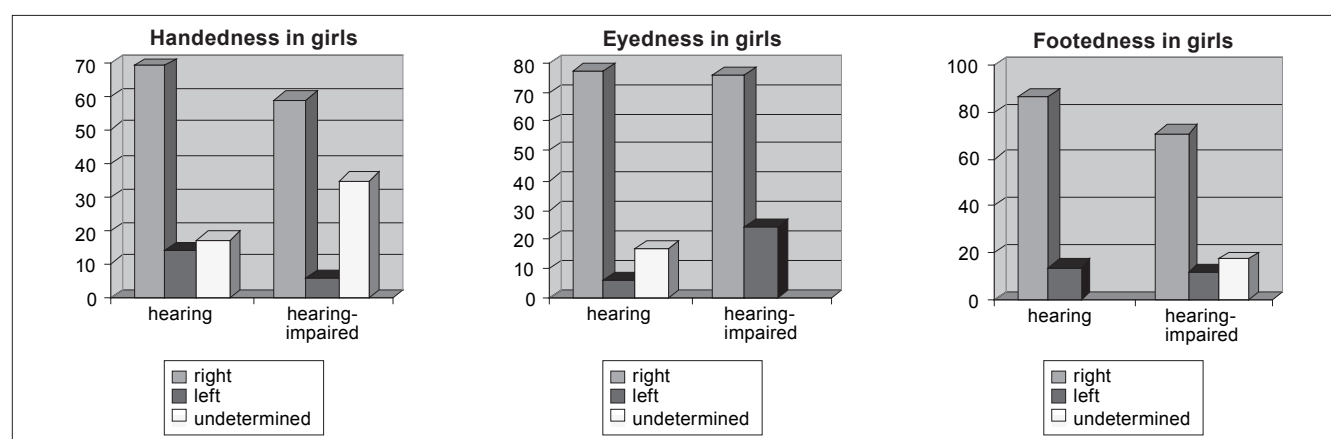


FIGURE 1. Comparison of handedness, eyedness and footedness direction in examined girls (%).

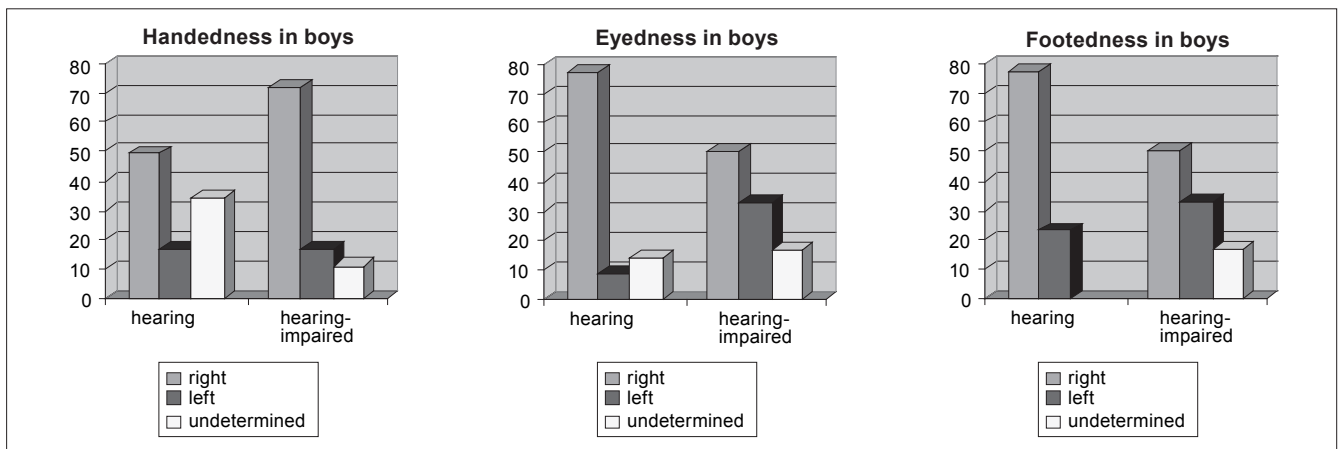


FIGURE 2. Comparison of handedness, eyedness and footedness direction in examined boys (%).

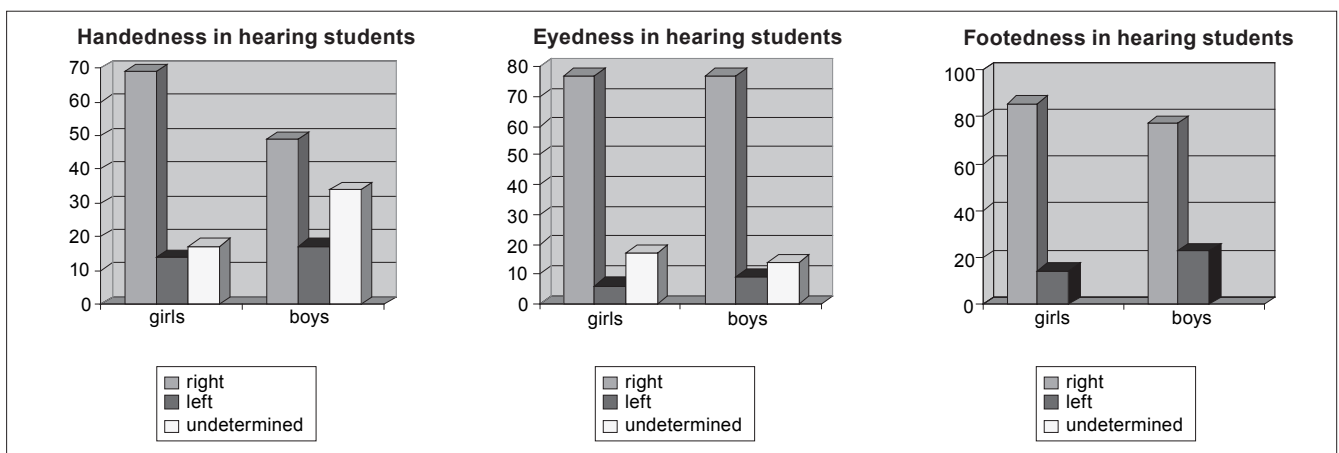


FIGURE 3. Comparison of direction of handedness, eyedness and footedness in hearing girls and boys (%).

boys differ significantly in terms of functional asymmetry profiles.

Comparison of functional asymmetry in girls and boys

In the compared groups of hearing boys and girls in terms of all the examined motor and sense organs the right direction predominates. It seems to be most clearly perceptible in terms of eyedness and footedness. In terms of footedness, in both examined groups there are no persons with an undetermined direction. As many as 34% boys have an undetermined direction of handedness, while there are only 17% girls with such a profile (Figure 3).

In the examined groups of hearing boys and girls a determined homogenous profile predominates, however among boys half of the subjects display it, whereas in girls as many as 74% have it. The fewest subjects have a cross profile. Twice as many boys as compared to girls have an undetermined profile (Table 3).

TABLE 3. Comparison of asymmetry profiles in hearing girls and boys (%).

Subjects	Asymmetry profile		
	Determined homogeneous	Determined cross	Undetermined
Hearing girls	74	9	17
Hearing boys	52	14	34

Groups of hearing-impaired female and male students have been compared. In both investigated groups, the right direction prevails. In hearing-impaired girls it seems to be most perceptible in terms of eyedness, with no subjects having an undetermined direction as well. Yet in boys the dominant direction is most clearly seen in their handedness (Figure 4).

In the group of female subjects a homogenous profile is dominant, no subjects with a cross profile have occurred. The investigated group of boys obtained quite opposite results. Most boys display a cross profile, the fewest number of boys has a homogenous profile (Table 4).

TABLE 4. Comparison of asymmetry profiles in hearing-impaired girls and boys (%).

Subjects	Functional asymmetry profile		
	Determined homogeneous	Determined cross	Undetermined
Hearing-impaired	53	0	47
Hearing-impaired boys	22	50	28

DISCUSSION

In the professional literature on the subject there are few publications pertaining to body lateralization in hearing-impaired children and youth. These are not very well investigated issues and the few existing papers are based

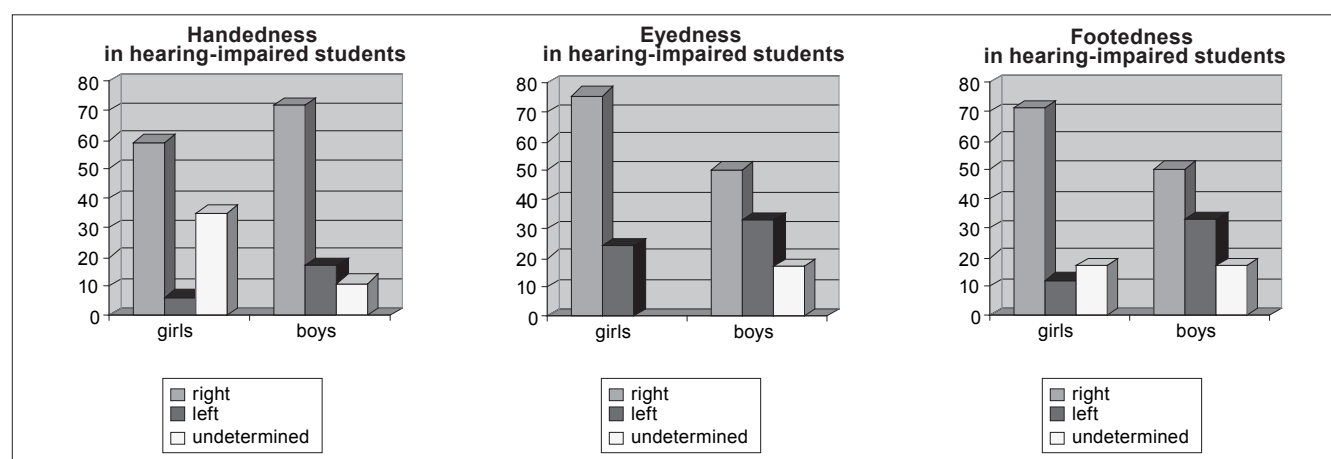


FIGURE 4. Comparison of direction of handedness, eyedness and footedness in hearing- impaired girls and boys (%).

on research carried out on little population, and refer to different age groups and use different tools. Myklebust [based on 6] claims that, early hearing damage is connected with specialization of hemispheres, which determines the course of lateralization causing its disorders. According to Zazzo [11] among hearing-impaired children in their pre-school age there are more frequent cases of heterogeneous predominance concerning the eye and foot (87% hearing-impaired and 67% in hearing children). The results obtained by Korzon [12] report far more pre-school incidence of cross lateralization and undetermined lateralization than in hearing children, lateralization which causes retardation of motor development and disorders of spatial orientation and motor and visual coordination. The type of lateralization disorders is connected with etiology of deafness. The research on body lateralization in the hearing-impaired using the same research tool was carried out by Krupa [13] as well as Sliżewska and Kordylas [14]. The investigation conducted by Krupa among 30 hearing-impaired girls and 30 hearing-impaired boys grades 4 to 6, showed that girls differ significantly from boys in terms of functional asymmetry profile and do not differ in terms of its direction. The research by Sliżewska and Kordylas carried out among hearing-impaired and hearing girls and boys aged 7 – 9 years showed that the asymmetry of body functions and activities is not a dimorphic feature. Only in terms of functional asymmetry profile of hearing girls and boys there are significant differences between genders. These results are similar to those obtained in the present investigation.

CONCLUSIONS

Bearing in mind how essential for effective functioning of a man, a proper level of body lateralization is, it seems crucial that teachers could be able to diagnose it and through properly selected tasks stimulate and at the same time prevent difficulties in learning. The research aimed at: identifying and comparing how functional asymmetry develops in a selected group of hearing and hearing-impaired secondary school youth, whether and if such differences occur between them in terms of the direction and profile of asymmetry and if dimorphic differences occur in terms of body function lateralization. The assumed objectives have been achieved and the obtained results enable the author to formulate a general conclusion that a hearing defect

determines lateralization and thus it is of significance in development of functional asymmetry of the body. Also detailed conclusions have been formulated:

1. The examined hearing girls show better lateralization in body functions than their hearing-impaired peers. Admittedly, in both groups the right direction prevails, in all examined motor and sense organs, but it is more consolidated among the hearing girls. The profile of asymmetry is a quality which diversifies the examined girls more than direction. Among the hearing students there are significantly more individuals with a determined homogenous profile and there are fewer individuals with undetermined profile.
2. The examined hearing and hearing-impaired boys have the same level of body function lateralization. There are certain qualitative differences, however. As regards the direction, the handedness in the hearing-impaired and eyedness and footedness in the hearing boys is more oriented. A homogenous determined profile predominates in hearing boys, yet also in this group there are more individuals with an undetermined profile.
3. Hearing boys and girls do not differ in terms of body function asymmetry. The same directions and profiles of functional asymmetry prevail in them.
4. Dimorphic diversification of body function occurs in hearing-impaired girls and boys. Hearing-impaired students have a different profile of functional asymmetry than their hearing-impaired female schoolmates. The cross profile is predominating in boys, whereas in girls the homogenous profile prevails. In both examined groups of the hearing-impaired the right direction of functional asymmetry predominates, although it is dominant in girls.

These conclusions allow the author to point out that the level of lateralization in the hearing-impaired youth is lower than that of their hearing peers. The data constitute the basis for taking up oriented programming of physical education classes of this group. The classes ought to be oriented at stimulating lateralization in order to prevent disorders of its development. The obtained results ought to support development of general syllabus/ curriculum in physical culture of the hearing-impaired and to indicate the directions of stimulating the motor and somatic development of the hearing-impaired. Such knowledge seems to be essential for improvement of educational process of the hearing-impaired in Poland.

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