Lateral phenotype in ethnic populations as one of the factors in adaptation to school

Lateralizacja fenotypowa wśród populacji etnicznych jako jeden z czynników procesu przystosowania do szkoły

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Wstęp. Powszechnie wiadomo, że procesy adaptacyjne organizmu uczniów wraz z ich obciążeniem nauką są uzależnione od wpływu czynników klimatycznych i geograficznych w regionie zamieszkania uczniów.

Cel. Zbadanie rozkładu lateralizacji fenotypowej wśród uczniów z różnych grup etnicznych, aby zidentyfikować związek Syberii – jako miejsca zamieszkania i lateralizacji fenotypowej – z pracą ucznia.

Materiały i metody. Zbadano 648 uczniów w wieku 7-16 lat mieszkających w mieście Krasnojarsk i Evenkia (powiat tungusko-chunski). Asymetria sensomotoryczna została oznaczona za pomocą badań eksperymentalnych.

Wyniki. Dokonano analizy dystrybucji lateralizacji fenotypowej wśród uczniów z różnych grup etnicznych z rejonu Syberii i ustalono powiązanie charakteru lateralizacji fenotypowej ze wskaźnikami wydajności nauki szkolnej, które należy wziąć pod uwagę podczas tworzenia fizjologicznie odpowiedniej metodyki edukacji potrzebnej do poprawy efektywność nauki.

Wnioski. Niezgodność typów półkuli u znacznej części dzieci z tradycyjnych rodzin w Evenkia, w połączeniu z dwujęzycznością (w rodzinie mówią w języku ojczystym, w szkole – w języku rosyjskim), komplikuje proces uczenia dziecka, a tym samym dostosowanie do szkoły.

Słowa kluczowe: *lateralizacja fenotypowa, uczniowie, grupy etniczne, Syberia*

Introduction. It is well known that the adaptive processes in the organism of pupils along with the school workload are determined by the influence of climatic and geographical factors of the region where the pupils live.

Aim. To investigate the distribution of lateral phenotype among students of different ethnic groups in order to identify the relationship of Siberia and the lateral phenotype with school performance.

Materials & Methods. 648 schoolchildren aged 7-16 years living in the city of Krasnoyarsk and Evenkia (Tungus-Chunskiy district) were examined. Sensorimotor asymmetry was marked using the experimental trials.

Results. The analysis of the distribution of lateral phenotype among the schoolchildren of different ethnic groups of Siberia was done and the interrelation of character of the lateral phenotype with school performance indicators was established that needs to be considered when creating a physiologically adequate educational methodology needed to improve the effectiveness of schooling.

Conclusion. The types of mismatched hemispheric response, significant in indigenous children of the Evenkia traditional (European) setting, combined with bilingualism (they speak their native language with the family, and Russian at school), complicates the process of teaching a child and therefore adaptation to school.

Key words: *lateral phenotype, schoolchildren, ethnic populations, Siberia*

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Nadesłano: 21.03.2014
Zakwalifikowano do druku: 24.03.2014

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Introduction & Aim of the study

At present, a considerable attention is paid to pupils adapting to the conditions of the educational process. It is well known that the adaptive processes in the organism of pupils along with the school workload are determined by the influence of climatic and geographical factors of the region where the pupils live [1]. It acquires special relevance in the north, and in particular, in Evenkia, where multifactor environmental conditions are of unfavorable nature and depend on the nature and intensity of environmental factors, and on the "readiness" of the body to resist them. Zaitseva et al. (2012) contends that staying in the Evenkia conditions for alien children is of an extraordinary

nature, while for the Evenkia children historically living in the area, the sub-extreme conditions of this region can be considered adequate, relevant to the phenotypic properties of the organism [2].

The character of interaction of the cerebral hemispheres of the brain is considered one of the most important prognostic indicators of an individuality of a person, defining the organism's resistance to extreme environmental conditions [3]. The features of functional brain asymmetry identify adaptation of personality traits. The ability of a certain kind of mental activity reflect the dominant mode of organization. It has been found that persons with different types of hemispheric asymmetry in different ways adapt to the extreme conditions of the North. The left-handed and ambidextrous persons have quality features that characterize a lesser degree of specialization of the cerebral hemispheres in contrast to the right-handers and are easier to adapt to extreme climatic and geographical conditions of the environment [4]. The type of hemispheric asymmetry is often determined by the lateral phenotype of the examined person, which is the set of peripheral sensorimotor asymmetries [5].

In this context, the aim of the present study was to investigate the distribution of lateral phenotype among students of different ethnic groups to identify the relationship of Siberia and the lateral phenotype with school performance.

Materials & Methods

648 schoolchildren aged 7-16 years living in the city of Krasnoyarsk and Evenkia (Tungus-Chunskiy district) were examined: vil. Vanavara and trading station "Arrow"-on-Chune). The examined schoolchildren were clinically healthy, of the average physical and sexual development. Two groups were formed: the first of 7-11-year olds and the second – of 12-17-year-olds.

The sensorimotor asymmetry was marked using the experimental trials, proposed by N.N. Bragina with co-author (1998) [5]. In all examined persons the degree of manual asymmetry - hand - sample 4 and 2 of anthropometric index, - foot - 3 trials, - eye - 3 samples and ear - 3 samples. The asymmetry of the arms, legs, eyes and ears was determined by the prevalence of left and right values in each case. If the sum of the left indicator was equal to the sum of the right indicators, symmetry was noted. Mixed profile was recorded at various combinations of left and right indicators [5].

The examined children were divided into groups according to the severity of symptoms of right-laterality. The first group consisted of children left with three indicators. The second group included students with a balanced performance; in the third group – with various combinations of left and right indicators. The fourth group consisted of children with three right-wing figures.

The adaptation of the schoolchildren to the educational process was determined by taking into account the school performance ratings exhibited by the subjects during the quarter, term and year.

The data analysis was performed using a statistical software package Statistica, ver. 6.0. (Stat Soft Inc. USA) [6]. For qualitative traits the criterion c adjusted Yeats was used, and for small samples – the bilateral Fisher's exact test. The changes were considered to be statistically significant at a significance level of $P<0.05$.

Results & Discussion

The most numerous among schoolchildren in Krasnoyarsk was a group of students with right-laterality profile sensorimotor asymmetry 60.2% (group 4), less numerous – a group of students with mixed indicators lateral phenotype 24.3% (group 3). The pupils with symmetrical lateral phenotype indicators were 11.5% (group 2), and the smallest recorded group of schoolchildren with left-laterality profile sensorimotor asymmetry was 4% (group 1). It should be noted that children of primary school age were 1.8 times more numerous than in the first and second groups, while in other groups the difference in age aspect was not revealed (fig. 1).

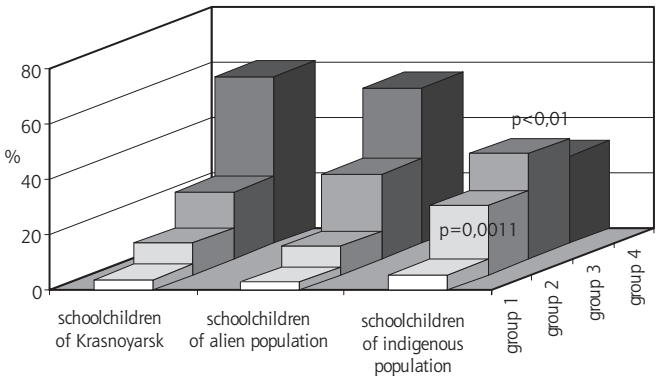

Fig. 1. The distribution of lateral phenotype among the schoolchildren of Krasnoyarsk and Evenkia

Note: statistical significance of differences between the alien children and the indigenous Evenkia children.

Similarly with the children of Krasnoyarsk the lateral phenotype distribution was noted among the children of Evenkia. Predominant in numbers was a group of children with sensorimotor right-laterality profile asymmetry 56% (group 4), less numerous

– a group of pupils with mixed indicators lateral phenotype 30.7% (group 3), the pupils with symmetrical figures lateral phenotype were 10.3% (group 2), the smallest in size was a group of pupils with a predominance of left-performance 3% (group 1).

The increase in the number of pupils of younger age at 2.44 times in the first and second groups explains a likely long maturation period for individual development mechanisms causing hemispheric dichotomy, outside of primary school age. These findings are consistent with those of other authors, indicating a low incidence of left-handers in Russia [7].

A somewhat different picture of the distribution of lateral phenotype was observed among the indigenous children of Evenkia. In the children of Evenkia against a high percentage of individuals with mixed indicators lateral phenotype was marked with a decline in the proportion of persons with right parameters ($P<0.001$) and an increase in the proportion of individuals with symmetrical figures lateral phenotype ($P=0.0011$) as compared with the newcomer children. Moreover, the so-called "pure lefties" were found in all groups observed in isolated cases. Age-related differences in the analyzed groups of Evenkia children (Mongoloids) were identified.

This situation may be due, probably, to a lesser degree of lateral phenotype transformation in right-laterality in the course of ontogenetic maturation of cerebral structures.

The peculiarity of the psychological organization of children due to different profiles of lateral phenotype affects the adaptation to the educational process at school, with the performance criteria as one of the most important.

Among the schoolchildren of different ethnic populations of Siberia right-laterality symmetrical and mixed indicators were manifested by the most numerous group of students (65%), who were "good" or "excellent". We should indicate that a group of schoolchildren with symmetric and mixed indicators performance was mixed (heterogeneous). The most successful among this group of schoolchildren was the part which determined the right-touch indicators. In the group of all schoolchildren with left figures, the number of schoolchildren who were "good" and "excellent" was 1.5 times lower (37%). These data confirm once again the focus of traditional pedagogy on the "right-brain type" response. From the above obvious is the need for such training and education of children, the conditions of their life contributing to their harmonious development, high social achievements not only for the right-handed, but equally for the left-handed.

Conclusions

1. In the children of various ethnic groups of Siberia there were revealed differences in the distribution of lateral phenotype characterized by an increase in the proportion of people with the right lateral phenotype indicators among children in Krasnoyarsk and of Evenkia (Caucasian).
2. A distinctive feature of the psychological organization of indigenous Evenkia children is to increase individual performance with symmetrical lateral phenotype. This picture seems to be more a consequence of their optimum potential to effectively adapt to the harsh effects of climatic and geographical factors, already emerging in early ontogeny.
3. The type of mismatched hemispheric response is a significant part of indigenous children of Evenkia in traditional (European) setting, which, combined with bilingualism (they speak their native language at home, they speak Russian at school), complicates the process of teaching a child and therefore adaptation to school.
4. To improve the efficiency of schooling of indigenous children there is a need to develop the North ethnopedagogy, taking into account the specifics of the psychological organization of indigenous peoples of the North. Obviously there is the need to integrate individual profile asymmetry students to select learning systems that should be different for the right- and left-handed, especially in the elementary grades.
5. In the learning process must identify motor asymmetry, especially hands. When training is desirable to keep lefties individual preferences and develop skills to use his left hand for a full disclosure of their natural inclinations. For better adaptation in the way of life must teach the lefties must be taught to use with right hand.

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