



# Features of Functional Asymmetry of the Brain of People Engaged in Sports



Kazakova Olga Mikhailovna<sup>1</sup>, Romanova Elena Veniaminovna<sup>2</sup>, Rudakova Elena Vyacheslavovna<sup>3</sup>, Grabinenko Elena Viktorovna<sup>4</sup> and Peregudova Tatyana Maratovna<sup>5</sup>

<sup>1</sup>Department of Foreign Languages of History Faculty, Altai State University, Russia

<sup>2</sup>Candidate of Philosophy, Altai State University, Russia

<sup>3</sup>School Teacher, Municipal budget educational institution, Russia

<sup>4</sup>Associate Professor, Altai State Pedagogical University, Russia

<sup>5</sup>Department of Physical Education, Altai State University, Russia

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**\*Corresponding author:** : Romanova Elena Veniaminovna, Candidate of Philosophy, Altai State University, Russia,  
Email: romanovaev.2007@mail.ru

## Abstract

The manifestation of such physical qualities as strength, speed, endurance depends on many factors. In our study, we tested the dependence on the type of interhemispheric organization of motor and sensory processes. Groups of young people aged 18-20 years were examined. The coefficients of lateralization in different sports are analyzed. The dependence of the functional asymmetry profile of the brain on sports specialization is established. We considered the type of functional asymmetry of the brain as a factor that determines the specificity of the course of higher mental processes, including motor functions. It has been revealed that in athletes the profile of functional asymmetry of the brain depends on the chosen sport and the qualification of the athlete, while athletes with a high level of skill involved in sports games increase the percentage of persons with ambidextral type of asymmetry, those engaged in cyclic sports with right-sided characteristics engaged martial arts - with left-handed, and the success of sports activity depends on the functional asymmetry of the brain. The foregoing was the basis for studying the features of the functional asymmetry of the brain and the coefficient of lateralization of athletes depending on the level of health. According to the lateralization coefficient, a high degree of asymmetry is observed in a group of young people engaged in sports, the lowest coefficient of lateralization in young people not engaged in sports.

**Keywords:** Functional interhemispheric asymmetry; Functional asymmetry; Lateralization coefficient; Sports games; Engaged in cyclic sports; Combat sportsmen; Interhemispheric asymmetry of the brain

**Abbreviations:** FIA: Functional Interhemispheric Asymmetry; FA: Functional Asymmetry; LC: Lateralization Coefficient; SG: Sports Games; ECS: Engaged in Cyclic Sports; CS: Combat Sportsmen; IAB: Interhemispheric Asymmetry of the Brain

## Introduction

In modern science, the question of the human brain is still complex and urgent. Scientists from different positions try to study the specificity of brain activity. There are very few developments on our subject, however, it is possible to note studies of Kirsanov VM [1], Romanov Yu N [2], Koryukalova Yu I [3], Dugnist P Ya [4], Strizhkova T Yu [5] and others.

One of the fundamental properties of the organization of the brain is its interhemispheric asymmetry. The concept of functional interhemispheric asymmetry (FIA) was introduced into the scientific nomenclature after P Broca and C Wernick discovered that the symmetrical formations of the right and left hemispheres play a different role in the brain. This applies not only to higher cortical functions, but also to the organization

of sensory and motor functions. The right-handed dominant is the left hemisphere (dominant), and left-handed (right-handed) (subdominant) [6].

According to modern psychophysiological views, the left hemisphere of the human brain in right-handed people specializes primarily in the performance of speech functions and controls operations with abstract symbols. The right hemisphere provides predominantly a specifically-shaped reflection of reality. In the processes of learning, cognition, the right hemisphere realizes the processes of deductive thinking (in the beginning, synthesis processes and then analysis are carried out). The left hemisphere mainly provides the processes of inductive thinking (first, the process of analysis, and then the synthesis). The motor functions obey the same laws of formation. The type

of functional interhemispheric asymmetry can be considered as a factor that determines the specificity of the course of higher mental processes, including motor functions. The manifestation of such physical qualities as strength, speed, endurance, depends also on the type of interhemispheric organization of motor and sensory processes.

It has been revealed that among athletes the profile of functional interhemispheric asymmetry depends on the chosen sport and qualification of the athlete, while athletes with a high level of skill engaged in sports games increase the percentage of persons with ambidextral type of asymmetry, those engaged in cyclic sports with right-sided characteristics engaged in martial arts - with left-handers [7], and the success of sports activity depends on the functional asymmetry of the brain [8].

### Study

The time of the research is 2017-2018. The study group is students of the Altai State Pedagogical University. The foregoing was the basis for studying the features of the functional asymmetry of the brain and the coefficient of lateralization of athletes depending on the level of health. The task was to study variants of functional asymmetry with determination of the lateralization coefficient.

Young people aged 18 to 20 years who were divided into three groups were examined:

- a) athletes engaged in sports games - basketball, volleyball, football - 25 people;
- b) athletes engaged in cyclic sports - 36 people (track and field athletics, skiing, swimming);
- c) sportsmen-martial arts - 36 persons.
- d) As a control group, young people of the same age were selected who did not actively engage in sports (41 people).

All the subjects were offered a questionnaire to clarify the data on functional interhemispheric asymmetry and a history of life, testing functional interhemispheric asymmetry. The data were processed using online calculators to calculate statistical criteria. When examining the functional interhemispheric asymmetry and revealing the lateralization profile, testing was conducted using commonly accepted methods [9,10]. The determination of the functional asymmetry of the hands was carried out with the help of dynamometry, interlacing of fingers, "Napoleon's posture", a test of elongated hands, a test for applauding, a test "Raising an object"; tests were conducted to identify the leading leg: tossing the leg to the leg, getting up on the chair to his knees, descending from the chair; tests to identify the dominant eye: a test of Rosenbach (in the elongated hand the subject holds a pencil, fixing his gaze at a certain point in 3-4 meters with both eyes, alternately closes one and the other eye, closing the leading eye leads to the displacement of the pencil), eye screwing, slope head when recording a name, evaluation of visual acuity; tests to determine the leading ear: telephone listening, "Clock" test, listening to the clock, "Whisper" test; tests for the asymmetry of touch: a test for the localization of touch, a test for recognizing the figures drawn on the back surface of the brush.

Based on the test results, the lateralization coefficient (CL) was calculated:

$$CL = (RS-LS) / (RS + LS) \times 100\%;$$

where: CL - coefficient of lateralization;

RS is the right sign;

LS is the left sign.

The coefficient of the right hand (CRH) was considered positive (up to + 100%) for right-handers and negative-for left.

**Table 1:** Distribution of types of functional asymmetry by groups of sports specializations.

Types of functional asymmetry (FA)		Groups (% of total)		
		athletes engaged in sports games	athletes engaged in sports games	athletes engaged in sports games
Motor asymmetry	Right	36	50	37
	Left	13	33	47
	Both	51	17	16
Optical asymmetry	Right	27	16	26
	Left	45	83	39
	Both	28	1	35
Auditory asymmetry	Right	54	50	52
	Left	13	25	26
	Both	33	25	22
Tactile asymmetry	Right	31	41	47
	Left	9	16	4
	Both	60	43	49

When assessing the types of asymmetries (motor, visual, auditory, tactile) in Table 1, it can be seen that the study of motor asymmetry in the group of martial artists marked the largest variation, this is 37% of right-handers and 47% of lefties. The predominance of the right type is noted in cyclical sports (50%), the left type in martial artists (47%), in the sports games group more ambidextures (51%). The left type of visual asymmetry is noted in the group of athletes engaged in cyclic sports (83%). Hearing asymmetry has a predominance on the right side in all groups. In determining the tactile sensitivity noted in most cases, the response from both hands in all groups.

**Table 2:** The coefficient of lateralization in groups.

№	Groups	Lateralization coefficient (CL)		
		Righties	Lefties	Ambidextra
1	Control group	16, 78±2,13 (n=23)	-13,38±2,09 (n=14)	0 (n=4)
2	athletes engaged in sports games	22,93±3,37 (n=14)	- 34,38±10,6 (n=8)	0 (n=3)
3	athletes engaged in cyclic sports	36, 69±5,16 (n=16)	-30,57±7,51 (n=14)	0 (n=6)
4	sportsmen-martial arts	45,94±5,66 (n=16)	- 42,53±6,80 (n=17)	0 (n=3)

The distribution by types of functional asymmetry also showed the prevalence of lefties among martial artists, right-handers were more among those engaged in sports games, and in the cyclic sports group there was the largest number of ambidextures (Table 2). In the study of the lateralization coefficient (CL), the following indices were revealed in athletes. In the group of students engaged in sports games, the number of right-handers was 14, the average coefficient of lateralization (CL) was  $22.93 \pm 3.37$ , the number of left-handed people 8 with the lateralization coefficient (CL) was  $-34.38 \pm 10.6$ . In cyclic sports for right-handers (n = 16), the lateralization coefficient (CL) was  $36.69 \pm 5.16$ , for left-handed (n = 14) it was  $-30.57 \pm 7.51$ , the number of ambidextures in this sport was 6 human. When examining mono-wrestlers - right-handers (n = 16), the lateralization coefficient (CL) is  $45.94 \pm 5.66$ , for left-handed players -  $42.53 \pm 6.80$  (n = 17). Thus, there is an increase in the lateralization coefficient (CL) in right-wingers in comparison with cyclic species (25%) and sports games (100%).

In the control group (41 people), 23 people with right-sided asymmetry, 14 with left-sided asymmetry, 4 ambidextra were detected, which in percentage terms were 59%, 31% and 10%, respectively. In determining the lateralization coefficient (CL), he was  $3.88 \pm 2.73$  in the entire control group, in right-handers  $16.78 \pm 2.13$ , in left-handers  $-13.38 \pm 2.09$ . Thus, the lateralization coefficient (CL) tends to increase in right-handed fighters in comparison with groups of athletes engaged in sports games and cyclical sports and control group. The left-handers have the same tendency, except that the CL is slightly more pronounced in athletes engaged in sports games than in cyclical sports. The results of the study can serve as important measuring tools for studying emotional tension in the conditions of sports training of qualified athletes or the motivation of young people to engage in sports [11,12].

Based on the received test results, all the subjects were divided into three groups.

- The first group ("righties", dominance of the left hemisphere) - faces only with the right (all four) or predominantly with right asymmetries.
- The second group - ambidextra - faces with a mixed asymmetry profile.
- The third ("left-handed", domination of the right hemisphere) - faces with left (all four) or predominantly with left asymmetries.

### Conclusion

Functional asymmetry in athletes has regular features depending on the sport: among the fighters there are more people with left-handed asymmetry, among young people involved in sports games, more right-handed asymmetry, in cyclic sports more ambidextures. According to the coefficient of lateralization, a high degree of asymmetry is observed in the group of martial artists, the lowest the lateralization coefficient (CL) in the control group, that is, in young people who do not engage in sports.

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