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ANALYSIS OF VARIABILITY OF CARDIO RHYTHM IN MALE ADOLESCENTS IN DIFFERENT ETHNIC GROUPS, THE INHABITANTS OF TYVA REPUBLIC.

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Abstract. *We analyzed the indices of vegetative nerve system with complex technical program ORTO Valeo in male adolescents (56 Russians and 47 Tyvins), the inhabitants of Saryg-Sep village of Tyva Republic. We revealed varieties in vegetative regulation in adolescents of different ethnic groups at rest and in orthostasis. In Russian boys both at rest and in orthostasis sympathetic influences of VNS prevailed. Baseline vegetative tonus was characterized by domination of regulation of sympathetic type. In the Tyvins the most frequent type of baseline vegetative tonus was vagotony. Eutonia was frequent as well, which proves high efficiency of vegetative regulation processes in them.*

Key words: *the Russians, the Tyvins, vegetative nerve system.*

Health state in children and adolescents is one of the most popular problems in modern medical science because exactly in these ages the intensive morphologic and functional restructuring of all physiological systems takes place [5, 6, 10]. The peculiarities of many Siberian regions are severe climate, remoteness, temperature drops, cold [8]. Tyva Republic matches Extreme North territories by its severe climatic conditions, which govern functional state of local children organisms. Cardio rhythm indices under the processes of growth and development closely depend on gender, age and the stage of adaptation to the environment [12]. It is known that adaptation to the environment in the course of ontogenesis is being controlled by vegetative and hormone mechanisms, which define the norm of adaptation reaction [3]. This determines the necessity of studying vegetative reactions in alien and local population under extreme climatic and geographical conditions.

Materials and Methods.

We examined 103 boys in ages from 13 to 16 years of socially secured families of Saryg-Sep village of Tyva Republic picked up by random as 20% implementing the generator of random numbers. These ages in boys are classified as adolescence (IIV All-Union Conference for Age Morphology, Physiology and Biochemistry of USSR Academy of Pedagogical Sciences, 1965). There were 56 Russians (average age 14.38±0.14 years), born in Tyva Republic and 47 Tyvins (average age 14.6±0.16 years). All schoolchildren belonged to I and II health groups. Examination took place in late September – early October. Cardio rhythm was registered by complex technical program ORTO Valeo (SPE «Life Systems», Kemerovo), in prone and then in orthostasis activities. We evaluated the following: frequency of cardiac beat (**FCB**), median (**M**), mode, (Mode), mode amplitude (**MoA**), variation range (**ΔX**), stress index (**SI**) both in rest and orthostasis, basic vegetative tonus (**BVT**), functional state (**FS**). Distribution normality was determined by Kolmogorov-Smirnov criterion. Median (Me) and lower and upper quartiles (C_{25}-C_{75}) were determined if distribution within samples differed from normal. Hypothesis verification in regard to statistical significance of two samples was carried out by Mann-Whitney criterion. Comparison of the groups with qualitative signs was carried out with χ^2-square test. Research had been made under Russian Humanitarian Scientific Foundation grant № 08-06-18o12e.

Results and Discussions.

Analysis of cardio rhythm variability is the method for estimating the state of mechanisms of physiological functions regulation, ratio between parasympathetic and sympathetic sectors of vegetative nerve system [2].

Frequency of cardiac beat (FCB) was used as unbiased index of organism functional state (cardio vascular system in the first turn) as well as characteristics of shifts under this or that load and is the result of interaction between parasympathetic and sympathetic sectors of autonomous nerve system [1]. Though FCB in rest both in the Russian and the Tyvins stayed within the limits of age norm, in Russian schoolchildren this index was evidently higher than in Tyvin ones (Table 1).

Mode is the most frequent cardio interval meaning within dynamics rank. Russian boys showed significantly lower Mode meaning at rest than Tyvin boys (Table 1). It points to the lowering of parasympathetic influence of vegetative nerve system in them.

Mode amplitude (MoA) reflects stabilizing effect of centralization of cardio rhythm management, which is mainly caused by the stage of activation of regulating sympathetic link. The meaning of this index at rest was higher in group of Russian boys as compared to the Tyvins, but we didn't mark statistically valid differences (Table 1).

Physiological meaning of variation range (ΔX) is usually associated with the activity of parasympathetic sector of vegetative nerve system. In Russian schoolchildren this index was lowered (Table 1), but statistical difference was not reached.

Table 1.

*Meanings of cardiointervalgraphy indices in the examined groups at rest (*Me, C_{25}-C_{75} *)*

index	the Russians (n=56)	the Tyvins (n=47)
FCB	76.3; 68.4 - 84.8 P_T =0.026	71.9; 65.1 - 76.6
Mediana	0.79; 0.71 - 0.88 P_T =0.024	0.83; 0.78 - 0.92
Mode	0.77; 0.69 - 0.85 P_T =0.003	0.82; 0.76 - 0.93
MoA	39.5 ; 26.5 - 56.5	34; 28 - 44
ΔX	0.24; 0.18 - 0.35	0.26; 0.21 - 0.31
SI	107.2; 24.4 - 233.6	68.7; 44 - 104

Stress index (SI) shows the stage of both centralization in managing rhythm and prevalence of regulation sympathetic link over parasympathetic. This index is very sensitive to the strengthening of sympathetic nerve system tonus and moderate load (physical or emotional) increases SI 1.5 – 2 times. At rest SI meaning in Russian adolescents was 1.5 times higher than in the Tyvins, which can indicate the increase of sympathetic influence of VNS, but the difference in not statistically valid.

Changes in cardiointervalgraphy in Russian adolescents, Tyva Republic inhabitants, before activity proves the prevalence of basic sympathetic activity in vegetative nerve system resulted in the decrease of parasympathetic influences. In natives of Tyva Republic at rest cardiointervalgraphy meanings testify the prevalence of parasympathetic influences. Orthostatic probe is one of the most informative methods for revealing latent changes in cardio vascular system and mechanisms of its regulation [1, 15].

Table 2

*Meanings of cardiointervalgraphy indices in the examined groups in orthostasis (*Me, C_{25}-C_{75} *)*

index	the Russians (n=56)	the Tyvins (n=47)
FCB	96.3; 85.2 - 104.0 P_T=0.009	88; 81.4 - 97.2
Mediana	0.624; 0.576 - 0.705 P_T=0.009	0.628; 0.617 - 0.737
Mode	0.62; 0.56 - 0.69 P_T=0.005	0.68; 0.62 - 0.74
MoA	53; 40 - 70 P_T=0.025	43; 34 - 57
ΔX	0.18; 0.13 - 0.22	0.19; 0.14 - 0.24
SI	249.9; 136.1 - 473.3 P_T=0.039	166.1; 95.7 - 315.3

FCB in Russian boys in orthoprobe was evidently higher than in Tyvin ones (Table 2). Mode and median meanings were significantly decreased as compared to comparison group. MoA index in orthostasis was significantly higher in Russian schoolchildren than in natives, which points to stronger influence of sympathetic nerve system on cardio rhythm in orthostasis (Table 2). Cardio rhythm index ΔX in orthostatic position in Russian adolescents didn't differ significantly as compared to the Tyvins (Table 2). SI meaning in orthostasis in Russian boys was higher than in the Tyvins. The highest augmentation of this index in orthoprobe was marked in Russian adolescents as well.

Basic vegetative tonus (BVT) characterizes background activity of structures, which regulate organism functions in the course of adaptation activity and can be considered as one of the features which form the type of organism response to the influence of outer factors. BVT in Tyvin boys was characterized by substantial predominance of vagotony over eutonia and sympathicotonia. We paid much attention on sympathetic variant as predominant BVT type in Russian adolescents (Table 3).

Table 3

Basic vegetative tonus in the examined groups (%)

BVT	the Russians (n=56)	the Tyvins (n=47)
vagotony	41.1	48.9
eutonia	16.1	31.9
sympathicotonia	42.9 (P_T=0.019)	19.2

Sympathicotonia share was evidently higher (P=0.019) in the Russians as compared to Tyvin schoolchildren. The frequency of mixed regulation (eutonia) was higher in natives in comparison with the Russians but the difference did not achieve statistical significance.

Table 4

Functional state in the examined groups (%)

Adaptation variants	the Russians (n=56)	the Tyvins (n=47)
satisfactory	42.9	48.9
stress	35.7	38.8
unsatisfactory	21.4	12.8

Having made the analysis of organism functional state we marked in both examined groups the predominance of satisfactory adaptation variants. In the Russians unsatisfactory adaptation variant was marked more often, though not significantly as compared to the Tyvins (Table 4).

We analyzed the indices of spectrum analysis of cardio rhythm variability. We didn't mark true difference in regard to any of the indices (Table 5). VLF index, which shows activity of oversegmentary VNS level was not evidently changed in any of the groups.

Table 5

Meanings of variability indices of cardio rhythm in the examined groups (Me; C_{25}-C_{75})

Index	the Russians (n=56)	the Tyvins (n=47)
HF	804; 299.5 - 2035	652; 379 - 1259
LF	1349.5; 753 – 2991.5	1417; 820 - 2277
VLF	1551; 786.5 – 3384.5	1556; 898 - 2823

Meanings of low frequency component (LF) were lower in Russian boys than in Tyvin schoolchildren, which points to lower activity of vasomotor center in them. HF-marker values of vagal regulation were higher in Russian schoolchildren, but not considerably.

Conclusion.

Current activity of sympathetic and parasympathetic sectors is the result of the response of multi-circuit multi-level system of blood circulation regulation, which changes its parameters from time to time in order to achieve optimum adaptation response, which reflects adaptation reaction of the whole organism [1]. Vegetative tonus, acting as one of the main signs of child's successful adaptation in a group of boys of Russian nationality was represented by considerable share of subjects with sympathetic trend of vegetative nerve system as compared to the natives. Changes in cardiointervalgraphy indices in Russian schoolchildren at rest prove the prevalence of basic sympathetic activity of vegetative nerve system and as a result the lowering of parasympathetic influences in them. We revealed true increase of cardiac beat number, the lowering of Mode, median, variation scope in the course of wedge-orthostatic probe in the Russians. All these testify on even greater offset of vegetative homeostasis towards the activation of tonus of sympathetic sector of vegetative nerve system. Russian boys were characterized by higher augmentation of SI in orthostasis as compared to the Tyvins, which proves their higher lability. The revealed changes in the group of Russian schoolchildren inform on strengthened sympatho-adrenal influences at rest and under load. They point to considerable stress in organism reserves. It is known that the beginning of schooling, including the first months after holidays is stress situation, which leads to mobilization of resources of children organism and tension in its functional systems [4, 10, 14]. Schoolchildren were examined in the beginning of academic year (late September – early October). The results can prove that Russian boys, the inhabitants of Tyva Republic are more vulnerable at a time when schooling starts as compared to their peers of Tyvin nationality. Adolescent age is accompanied by complicated reconstructions in organism. Disturbance of vegetative regulation reflects the imperfection of mechanisms connected with immaturity of regulatory centers of vegetative nerve system, typical for children in these ages [9, 13]. The revealed changes in vegetative regulation in Russian boys testify on the stress in cardio-vascular system performance, irrational way of supporting homeostasis. IVS in Tyvin natives, belonging to Mongoloid population in the most cases was represented by vagotony and eutony, which indicates higher efficiency of regulation and can be regarded as the result of passive adaptation. This goes in conformity with data from scientific literature [7] stating that the direction of adaptation of Mongoloid populations to extreme conditions of the North is energy consumption reduction. This is serious advantage for the survival under extreme conditions.

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