

THE ETHNIC PECULIARITIES TO ADAPTATION OF THE CARDIOVASCULAR SYSTEM OF STUDENTS LIVING IN TUVA REPUBLIC

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The study demonstrates the adaptation processes of the cardiovascular system of students of tuvinian and russian nationalities at period of the education in high school. It is shown that the adaptation processes to education are affected not only by age, gender, but also by ethnic peculiarities of the students, living in extreme climate-geographical conditions. At the first course the tuvinian students have lower adaptive possibilities to education, than Russian ones, but at the last course they perform more adaptive response to education.

The students present the special social group characterized by young age, specific conditions of the labor and lives. They present the group of elevated risk because of high and extensive emotional tension [7,9,19], which differs from other social groups [1,8,14]. Education in high school demands the activation of adaptive and compensatory mechanisms in their organism [11]. The literature data are indicated that during training in high school the students reveal homeostatic shifts in different physiological systems of the organism, including cardiovascular system that is accompanied with the negative results in the education [10,12,20].

Adaptation processes in student's organism alongside the mental load are caused by the influence of climate-geographical conditions of the residence [6,12,13,15, 20,23,27]. Moreover, the nature of adaptive response depends on ethnicity of the population [2]. The functional reserves of the organism of the scolded population are indicators of the best adaptation to extreme natural-climatic conditions in contrast to Russians, living in given region [5,15,17,21, 22,25]. In this connection the study of the adaptive peculiarities of students of the different nationalities, living in severe climate-geographical region of Russia, is of great interest.

The subjects of the study were formed from the students of original nationality and stranger of the population (Russians in the 2-3-d generations) from the 1-st till the 5-th courses. The next parameters of the cardio-

vascular system (CVS) were determined: the heart rate/min (HR), systolic (SBP) and diastolic (DBP) blood pressure by Korotkov (mm Hg). Using standard methods [7,24,26] of calculation we determined the pulse pressure (PD), the average dynamic pressure (ADP), the stroke volume (SV, mL), the cardiac output (CO, L/min), and their indexes per m^2 body surface (SVI and COI). To evaluate the balance of vegetative nervous system we used the vegetative index Kerdo (VIK) [8,16]. For estimation the level of regulatory mechanisms controlling the cardio-vascular system it was used the adaptation potential (AP) [4]. The level of physical condition (UPC) was defined by E.A. Pirogovova [18]. As a criterion of the CVS functional condition was used the factor of the double product (DP) [3].

The benchmark analysis of the main indexes of CVS between national groups have shown that at the 1-st course both groups did not have an essential difference on SBP, DBP, ADP. However, the variety of factors characterizing the adaptive possibilities of CVS (SV, CO, PD, HR) among tuvinian students on the 1-st course was worse than among russians. On the 3-d-5-th courses the adaptation possibilities of tuvinian students, particularly girls, were developed that expressed in significant lower contribution of HR in CO (table 1). According to age changes, the the reduction of HR was noted in all investigated groups from the 2-d course. But, the HR elevation in Russian students at the 5-th course could indicate the

reinforcement of the sympathetic influence on cardiac function.

Table 1. The main cardio-vascular system parameters of investigated students

Course / group	1	2	3	4	5
n	422	130	311	100	161
HR, per /min					
Tuvinian youths	73,5±1,0	80,2±2,3	72,8±1,7	74,2±1,5	71,6±1,8**
Tuvinian girls	76,2±0,7*	75,9±1,9	74,7±1,2*	74,0±1,9*	71,4±1,2
Russian youths	74,1±1,8	77,1±3,7	75,4±3,5	74,3±2,9	81,7±4,5
Russian girls	72,5±1,4	84,2±3,3	82,1±2,9	81,6±2,9	70,2±1,9
SBP, mm Hg.					
Tuvinian youths	116,7±1,2 ##	122,7±4, 5#	116,4±1,5*** ###	111,7±1,6*** ###	119, 8±2,4####
Tuvinian girls	110,7±0,8	112,9±1,5	110,0±1,1	107,7±1,5*	110,6±1,4
Russian youths	117,6±2,5	129,5±4,8	128,5±4,2	130,3±2,4	119,2±2,0
Russian girls	111,8±2,0	119,0±2,9	110,5±1,6	114,1±1,9	112,5±2,7
DBP, mm Hg					
Tuvinian youths	74,3±0,9	75,1±2,1	76,9±1,5	66,4±2,0**	78,2±2,1#
Tuvinian girls	73,5±0,7	73,4±1,2	77,0±1,2	67,0±1,1*	74,0±1,2
Russian youths	74,7±2,0	74,6±4,1	83,7±2,5	74,4±2,1	80,0±3,7
Russian girls	70,6±1,7	74,7±2,1	75,5±1,8	78,0±1,8	75,9±3,0
PD, mm Hg					
Tuvinian youths	42,4±1,1# ##	47,6±4,5# #	39,5±1,9###	49,3±3,8###	42,0±2,1#
Tuvinian girls	37,0±0,9	39,5±1,5	32,7±1,2	40,9±1,5*	36,5±1,4
Russian youths	42,6±2,3	50,2±2,6	40,5±2,6	55,9±4,3	39,4±1,3
Russian girls	41,1±2,0	43,9±1,7	35,0±1,9	36,1±1,3	36,6±3,0
ADP mm Hg					
Tuvinian youths	88,5±0,9# #	91,0±2,6	90,1±1,3* #	80,5±2,1***	92,2±1,9###
Tuvinian girls	85,9±0,6	87,0±1,3	87,8±0,9	80,6±1,0***	86,2±1,1
Russian youths	88,7±2,3	88,8±2,4	98,7±0,6	93,1±1,0	94,3±1,2
Russian girls	84,3±1,5	86,6±2,2	87,2±1,5	87,2±1,5	88,1±2,5
SV, mL					
Tuvinian youths	66,3±1,0	68,2±2,6	62,4±1,72	70,8±2,2##	61,89±1,87
Tuvinian girls	64,2±0,8*	64,8±1,0	59,4±1,4	68,3±1,2***	61,4±1,2
Russian youths	66,6±2,0	71,3±2,2	61,4±1,7	71,7±3,3	59,1±1,3
Russian girls	68,3±1,7	66,9±1,7	60,9±1,8	59,8±1,4	60,2±1,9
CO, L/min					
Tuvinian youths	4,9±0,1	5,5±0,3	4,5±0,2	5,3±0,2	4,4±0,1
Tuvinian girls	4,9±0,1	4,9±0,2 **	4,4±0,1 *	5,0±0,2	4,4±0,1
Russian youths	4,9±0,2	5,5±0,2	4,5±0,2	5,3±0,3	4,9±0,5
Russian girls	4,7±0,2	5,6±0,2	5,0±0,2	4,9±0,2	4,2±0,2
UPS, conventional units					

Tuvinian youths	0,666±0,0 1	0,588±0,0 3	0,660±0,02**	0,712±0,02*	0,642±0,03* ###
Tuvinian girls	0,660±0,0 1 **	0,666±0,0 2 *	0,658±0,013	0,712±0,02 ***	0,692±0,01
Russian youths	0,670±0,0 2	0,612±0,0 3	0,572±0,02	0,626±0,030	0,572±0,015
Russian girls	0,744±0,0 2	0,589±0,0 3	0,591±0,04	0,575±0,03	0,688±0,03
SVI, mL / m ² .					
Tuvinian youths	2,9±0,1##	3,2±0,1	2,6±0,1###	2,9±0,13#	2,5±0,1###
Tuvinian girls	3,7±0,1	3,2±0,1*	2,9±0,1	3,3±0,1*	2,8±0,1
Russian youths	2,7±0,11	3,11±0,1	2,4±0,1	2,9±0,2	2,5±0,1
Russian girls	3,6±0,2	3,6±0,2	3,2±0,1	3,0±0,1	2,7±0,2
COI, L/min*m ² .					
Tuvinian youths	38,7±0,6# ##	39,5±1,5# #	36,3±1,0###	39,1±1,5	34,1±1,1##
Tuvinian girls	48,8±0,8	42,3±0,8	38,9±1,0	44,5±0,9	39,7±0,8
Russian youths	37,0±1,3	39,2±1,4	31,7±0,7	38,7±2,1	30,9±0,5
Russian girls	52,4±2,0	42,8±1,3	39,1±1,4	36,6±1,0	38,4±2,2
VIK, conventional units					
Tuvinian youths	-3,7±1,9#	4,8±3,6	-8,4±3,8	11,3±3,6*	-11,4±3,8
Tuvinian girls	1,4±1,5	0,2±2,4	-6,8±3,0***	7,1±3,0	-5,9±2,7
Russian youths	-2,6±4,4	9,1±2,8	-13,7±4,6	-2,7±4,5	-4,5±3,7
Russian girls	0,7±2,7	5,7±4,7	7,1±2,2	2,2±4,0	-9,6±5,7
DP, conventional units					
Tuvinian youths	85,7±1,5	98,3±4,7#	84,7±2,2#	82,3±1,85**	87,5±3,3###
Tuvinian girls	84,0±1,1	86,3±2,6	82,0±1,6*	79,7±2,3**	78,9±1,7
Russian youths	85,6±2,5	97,6±4,5	96,0±3,5	97,0±4,5	95,3±2,0
Russian girls	76,6±3,3	96,6±3,6	91,2±4,1	93,7±4,4	79,0±3,0
AP, conventional units					
Tuvinian youths	2,1±0,0	2,2±0,1	2,1±0,04*** ###	2,0±0,1*** #	2,2±0,1###
Tuvinian girls	2,0±0,0	2,1±0,1	2,1±0,0	1,9±0,0**	2,0±0,0
Russian youths	2,1±0,1	2,1±0,1	2,4±0,0	2,3±0,0	2,4±0,0
Russian girls	1,9±0,1	2,2±0,1	2,1±0,1	2,15±0,1	2,0±0,1

Annotation: significant differences of the average values between tuvianian and russian youths and girls - * $p < 0,05$; ** $p < 0,01$; *** $p < 0,001$; between youths and girls - # $p < 0,05$; ## $p < 0,01$; ### $p < 0,001$.

Analysis of VIK indicated that in tuvianian youths the dominance of sympathetic activity was registered at the 2-d and the 4-th courses, while in russian youths - at the 2-d course only. Increasing of the parasympa-

thetic tone of the vegetative nervous system in tuvianian youths was found at the 5-th course, and in russian ones - at the 3-d course (-11,4 ±3,8 and -13,7 ±4,6 c. u. accordingly). In group of russian girls the sym-

pathetic activity was dominated at the 1-st – 4-th courses and only at the 5-th course the tone of the parasympathetic nervous system increased that indicated in the value of VIK - $9,6 \pm 5,7$ c.u. (table 1). Consequently, Russian girls demonstrated during four years of education the higher level of sympathetic activity unlike Tuvan girls which had more stable vegetative balance at the same period.

CO increase in Tuvan youths at the 1-st course was provided by HR increase ($r=0,6$), but in Russian youths - by SV elevation ($r=0,9$) while relationship between HR and CO was weak ($r=0,3$). Cardiac output increase in Russian youths at the 5-th course occurred due to significant HR rise ($r=0,8$), but in Tuvan ones it was resulted in SV elevation ($r=0,7$). Thereby, one can suggest that mechanisms controlling the heart work had the higher tension in Tuvan youths at the primary courses, but in Russian students a most disadvantage state of cardiac mechanisms was noted at the 5-th course that was indicated in significant increase of HR and reduction of SV and CO.

The CO value demonstrated the more economical working state of the heart in Tuvan girls, because the CO increase was correlated with the SV change while HR reduced during the period of study. In Russian girls at the 2-d – 4-th courses the CO change occurred due to the HR increase. The most efficient state of working heart in Russian students was demonstrated at the 1-st and 5-th courses, when CO rise was correlated with high SV ($r=0,7$; $r=0,9$, accordingly) and was not dependent on HR ($r=0,5$).

Conclusion

Thereby, one can conclude that the adaptation processes of Tuvan students to education developed from primary to senior courses, demonstrating the improvement of reserve possibilities of their organism. At the 2-d and 5-th courses the students regardless of nationalities had the negative trend of hemodynamic mechanisms. The deterioration of the main hemodynamic indexes at the 2-d course indicated on tension of organism functional state, connected with period of the

sloppy adaptation to mental load. The weakening of cardiovascular homeostatic mechanisms in students at the 5-th course, probably, was caused by reinforcement of emotional load, due to soon coming completion of the high school and prospect to further vital activity.

The mentioned periods of the deterioration of the adaptation possibilities indicated that adapting processes in the student's organism did not realized through determined straight, but run through phases depending on length of education, gender and nationality.

The girls possessed the more high adaptability, than youths of both national groups.

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