

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Peculiarities Of The Formation Of A Vegetative Tonus In Adolescents In The Conditions Of Various Motor Activity Regimes.

Maria V Shaykhelislamova*, Natalia B. Dikopolskaya, Gulfia A. Bilalova,
Alena D. Komarova, and Timur L. Zefirov.

Kazan Federal University, 18, Kremlyovskaya Street, Kazan, 420008

ABSTRACT

On the basis of the mathematical analysis of a variation pulsogram features of vegetative regulation of heart rhythm for hockey players of 11-15 years are investigated, the comparative characteristic with indicators of the boys of a control class who are engaged in physical training in volume of comprehensive school is carried out. It is established that irrespective of the physical activity mode at all boys the instability of vegetative regulation of heart rhythm is observed, however the fullness and a percentage ratio of groups of the initial vegetative tone (IVT) at young athletes has the features: in 11, 12 and 13 years the sympathicotonic option prevails, the percent of children with vegathicotonic option of IVT increases with age. For boys who are not playing sports, opposite is correct – the strengthening of sympathetic influences on heart rhythm is observed. At the same time the number of boys with sympathicotonic option of IVT increases almost to 70.00%, and vagothonic decreases to 16.00% that is followed by pubertal "jump" of heart rate which value in control group increases from 13 by 14 years by reliable size. That is, systematic muscular trainings exert the dominating impact on formation of a vegetative tone of teenagers, suppressing the evolutive processes connected with puberty.

Keywords: heart rhythm variability, initial vegetative tone, hockey players of 11-15 years.

**Corresponding author*

INTRODUCTION

The fundamental and major indicator reflecting a condition of nervous mechanisms of regulation of functions of cardiovascular system (CCC) is the tone of the autonomic nervous system (ANS) [1, 2]. In the course of ontogenesis it can be modified under the influence of various endo- and exogenous factors, one of which are sports. The data which are available in literature reflecting features of blood circulation at young athletes are estimated in most cases as an indicator of sports improvement [3, 4]. At the same time morphological and functional changes CCC, its neurohumoral transformations to the puberty period which cause a powerful stream of the sympathetic impacts on heart and vessels reducing efficiency of adaptation of an organism [5] remain unaddressed. Influence of adrenergic regulation at teenage age is huge, it expediently also is necessary for formation of functions CCC. However sports activities can have pronounced stressful character, influence natural age processes and lead to development of cardiac pathology in athletes at early age. The symptoms of vegetative dystonia which are shown at children's and teenage age [5, 8] reduce adaptation opportunities of the blood circulatory system and efficiency of adaptive reactions of an organism in general. VNS tone at children is formed under the influence of a number of factors - it is constitutional typological features of mechanisms of regulation [9], difference on time of maturing of sympathetic and parasympathetic departments of VNS in ontogenesis [1]. Higher and higher told is of particular importance in the course of the occupation of children and teenagers sport which according to the destination has to strengthen health at early age. The question of insulation formation of VNS tone at the boys who are playing hockey is little studied. Playing hockey demands from children of development of coordination skills, power and high-speed abilities, is followed by nervous psychoemotional pressure of an organism, especially at the initial stage of adaptation [10].

The purpose of work was studying of features of vegetative regulation of heart rhythm and formation of a vegetative tone at young hockey players.

METHODS

The children from 11 to 15 years who are trained in sports classes of comprehensive school (the 66th persons), playing hockey were investigated. The beginning of sports trainings coincided with 11-year age. The comparative analysis of the obtained data with indicators of the boys who are not playing sports, having standard physical activities for the school student was in parallel carried out.

IVT was determined by a method of a variation pulsometry with application of the automated cardiopulmonary REACARD complex. The rhythm of heart was registered within 3 minutes in a prone position. Indicators of the heart rate (HR), fashion (Mo), amplitude of fashion (AMO), variation scope (ΔX) and the index of tension (IT) were analyzed. At assessment of IVT were guided by IN ($IN = AMO / (2Mo * \Delta X)$). Carried children at whom IN was in limits 72.0 up to 92.0 conventional units to normotension (N), to sympatho- and vagathonic (c, b) - children at whom IN went beyond values of normotonic option of IVT [11].

Statistical processing of the obtained data was carried out by methods of variation statistics with application of the software package of Microsoft Excel. The reliability of distinctions was determined by the T-test, Student's-criterion.

RESULTS

The conducted research showed that the 11-15-year age is the period of the expressed functional tension of CCC when intensive physical activities exert stress impact on it. Speaking about statistical characteristics of the histogram it should be noted that among all examined children, the sympathonic is common at 11-15 age by reliable reduction of $Mo * \Delta X$, increase in IN and AMO. At a ratio vagothonic between indexes gains other character. So, rather low values ΔX , components of 310.10 ± 1.00 and 251.64 ± 6.99 ms in a sports and control class respectively, in comparison with vagothonic who have them on 147.40 and 160.02 ms above ($r < 0.05$ are characteristic of sympathonic of 12 years (fig. 2); $r < 0.01$).

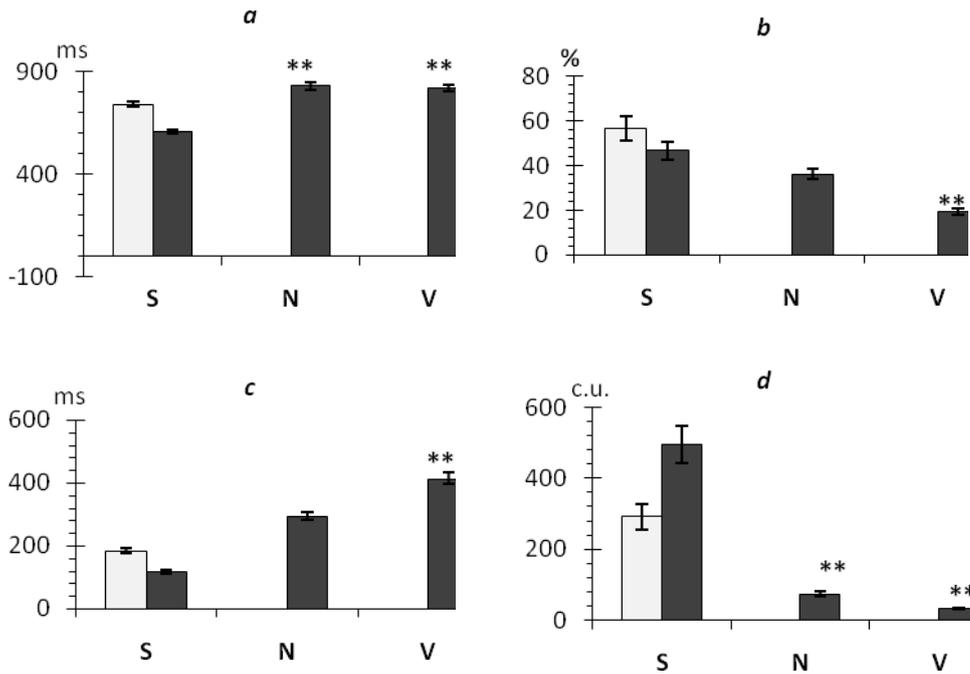


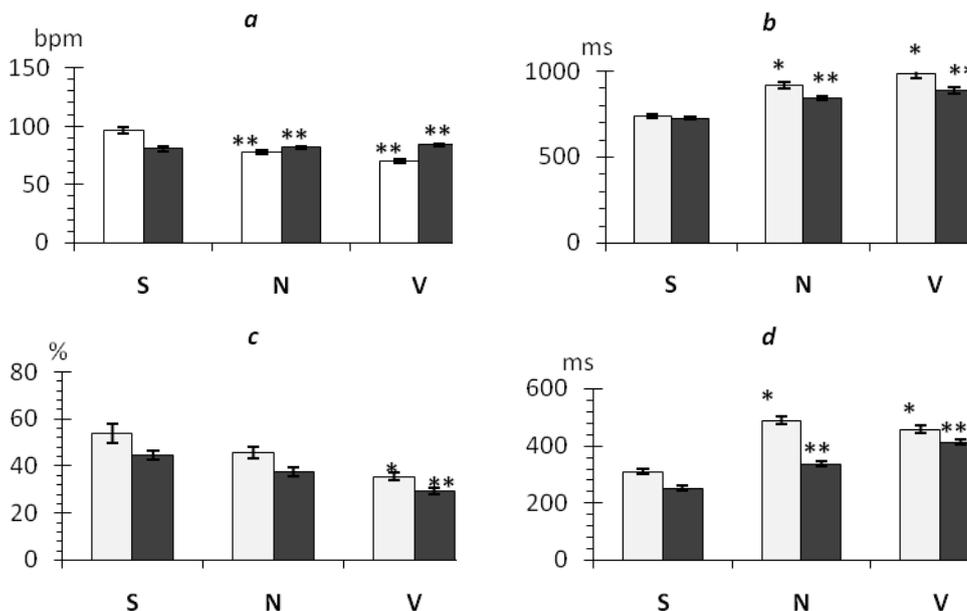
Fig (1): pulsogram for boys 11 years old with different initial vegetative tone

Note - Mo (mode), **b** - Amo (amplitude of mode), **with** - ΔX (variation range), **d** - TI (tension index);  - Sports Class,  - Control Class;

S-sympathicotonia, N - normotonia, V - vagotonia;

Differences are significant between IVT groups: "*" - $r < 0,01$ and above.

At the same time indicators of AMO and IN at boys-sympathonic prevail and $54.02 \pm 4.02\%$ and 241.11 ± 16.79 are equal. Share in a sports class, $44.54 \pm 2.00\%$ and 290.17 ± 23.57 conventional units. In control which at 1.7-4.5 time surpass indicators of vagothonic ($r < 0.01$), and on IN - and values of normotension. In other age groups of a ratio between characteristics of various options of IVT are similar.



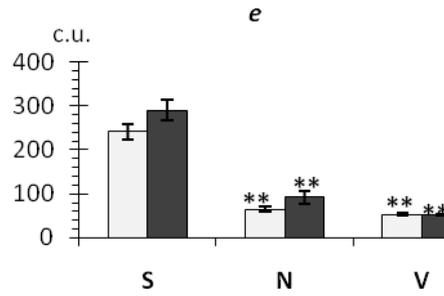


Fig (2): pulsogram for boys 12 years old with different initial vegetative tone

Note - HR (heart rate), **b** - Mo (mode), **with** - Amo (amplitude of mode), **d**-ΔX(variation range), **e**-TI (tension index);  - Sports Class,  - Control Class; S-sympathicotonia, N - normotonia, V - vagotonia; Differences are significant between IVT groups: "*" - p < 0,05; "***" - r < 0,01 and above.

The analysis of fullness of the IVT groups showed that for hockey players of 11 years strengthening of adrenergic influences on heart rhythm takes place - 100% are made by boys-sympathonic (fig. 1) at which IN values correspond to hypersymathonia [2,11]. In 13 and 12 years - other picture, however, also as well as at 11-year-old the hockey players with the increased sympathetic influences on heart activity making 54.54% and 61.50% though also vagothonic - in 12 years - 23.07% appear, in 13 - 27.20% prevail, and in group of 13-year 18.26% teenagers in a condition of an eytoniya make(fig. 3). Strengthening of sympathetic influences observed at young hockey players at a stage of urgent adaptation to sports activities is regarded by us as a condition of a physical and psychoemotional stress. It corresponds to earlier results of research CCC [12] according to which during an initial stage of adaptation of children to systematic sports activities increase in heart emission and indicators of arterial blood pressure is observed.

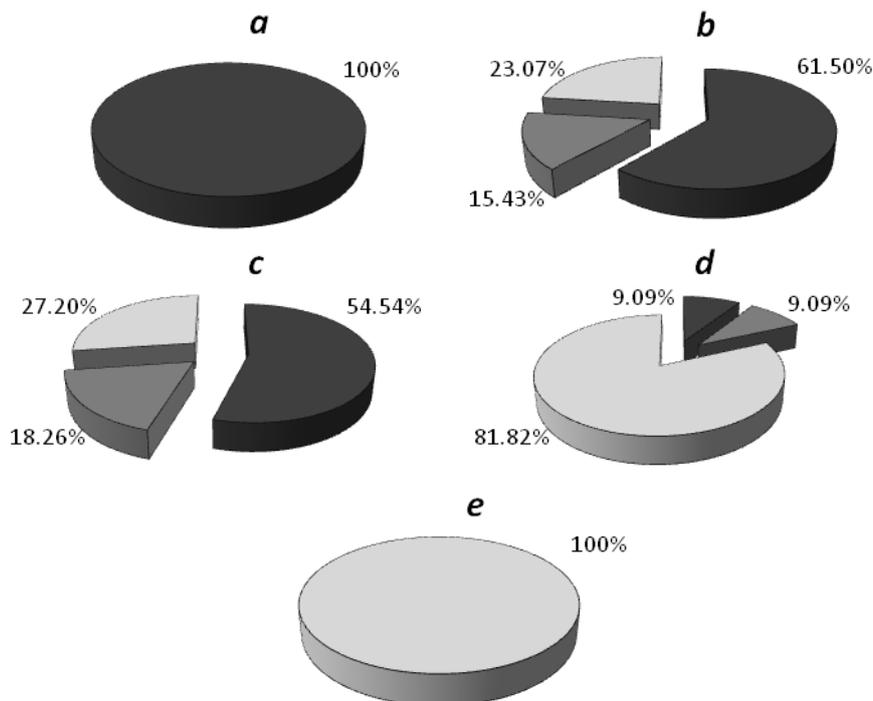


Fig (3): ratio of different options for the initial vegetative tone among boys in the sports class: 11 years - a, 12 years - b, 13 years - c, 14 years - d, 15 years - e.

 - Sympathotonic;  - Normotonics;  - Vagotonics.

It is considered that the increased physical activities during urgent adaptation make stress impact on an organism and further cause the training effect [13]. However, the obtained data indicate also that the physiological level of sympathetic influences at boys athletes is high therefore the jump of arterial blood pressure and the progressing growth of peripheral resistance of vessels from 11 by 15 years is observed [12]. Coming back to results of this work, it should be noted that with age and in the course of increase in sports skill the number of the boys athletes belonging to the IVT various groups changes, amplifies a role of the wandering nerve in blood circulation regulation, the group of vagothonic in a sports class increases to 100.00%. Similar vegetative reactions are not characteristic of puberty age and can specify about strengthening of vagal regulatory influences on heart of children under the influence of the increased physical activities [13]. Unlike boys of a control class at whom the quantity of sympathonic in 11 years is 62.55%, and group with normo-and vegathicotonic option of IVT - 10.00% and 27.45% respectively (fig. 4). Possibly, it is caused by one of peaks of sympathetic influences which are noted at 11-year age [1].

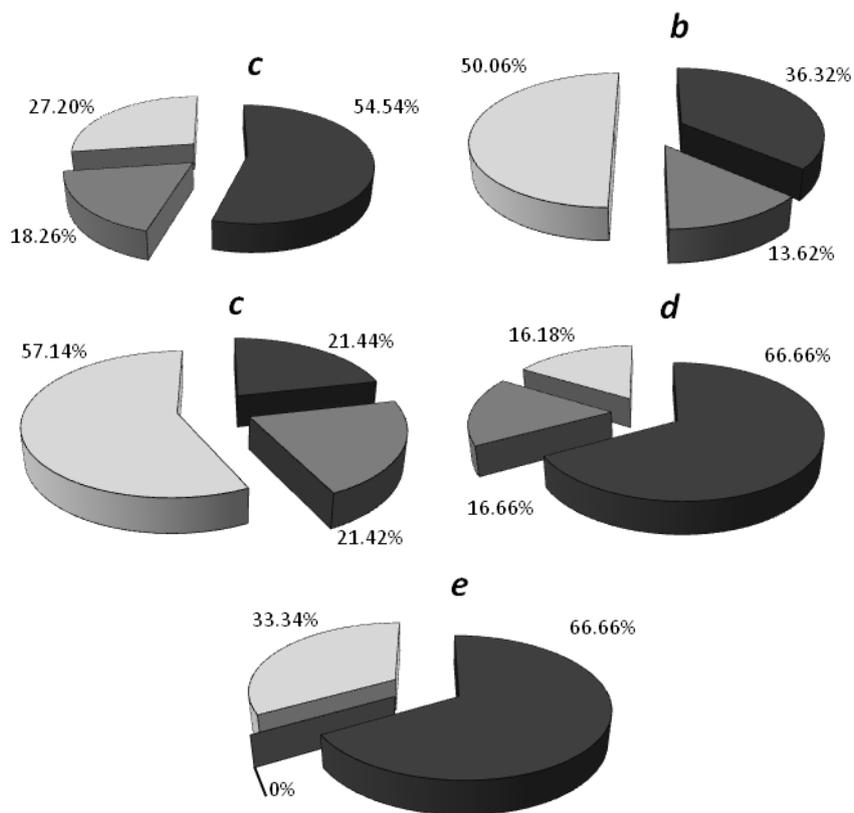


Fig (4): The ratio of the different variants of the initial vegetative tone among the boys in the control class: 11 years - a, 12 years - b, 13 years - c, 14 years - d, 15 years - e.

■ - Sympathotonic; ■ - Normotonics; ■ - Vagotonics.

During the subsequent age periods the role of parasympathetic department in regulation of a rhythm of heart amplifies - vagothonic make more than 50.00%, the number of boys-sympathonic is ranging from 21.42% up to 36.32%. On similar changes of VNS tone it is specified also in other works [2] where authors come to opinion on strengthening of vagal influences on heart activity at boys 12, 13 years. According to our data, by 15 years the ratio between simpato-and vagothonic at school students changes - the number of the first increases almost till 66.66%, and the second - decreases to 16.18% that is quite explainable from the point of view of pubertal transformations in system nervous regulation of the CCC functions [5].

SUMMARY

1. Features of formation of VNS tone at young hockey players of 11-15 years are revealed. In 12, 13-year age sympathetic influences on heart rhythm prevail, by 14 years the number of vagothonic athletes increases; in 15 years all examined hockey players treat group with parasympathetic option of IVT.

2. For the teenagers who are not playing sports, also as for young hockey players, the instability of vegetative regulation of heart rhythm is characteristic, however in 14 and 15 years the quantity of sympathetic (66.66%) against the background of decrease in percent of boys with vegetothonic option of IVT (16.18%) sharply increases. It is followed by the CCC maximum values which in 14 years increases by 5:58 beats/min ($p < 0.05$).

CONCLUSION

The obtained data demonstrate that sports activities at children's age have significant effect on formation of mechanisms vegetative regulation of functions CCC. The prevalence of sympathetic adrenergic influences on heart rhythm at young hockey players during urgent adaptation of an organism to the increased physical activities is established. In the course of growing and increase in fitness of children natural strengthening of a role of parasympathetic department of VNS in regulation of adaptive reactions of the blood circulatory system is observed. Whereas at the boys who are not playing sports of the same age, opposite - sympathetic influences of CCC significantly increase.

ACKNOWLEDGEMENT

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

REFERENCES

- [1] Shlyk N.I. Heart rhythm and type of regulation at children, teenagers and athletes. Izhevsk: Udmurt university. - 2009. - 259 pages.
- [2] Eydukaytis A., Varonetskias G., Zhemaytite D. Change of nonlinear characteristics of heart rhythm variability under the influence of physical activity on function of cardiovascular system healthy and sick with coronary heart disease//Human physiology. - 2006. - T. 32. - No. 3. - Page 5.
- [3] Haliullin R.S. Features of pump function of heart of gymnasts in the competitive period and when performing functional loadings: Autoref. Cand. Bio. Sci. Kazan. - 2012. - 22 pages.
- [4] Elistratov D. E. Features of adaptation of heart of young men to physical activity depending on type of blood circulation and level of physical activity: Autoref. Cand. Bio. Sci. Kazan. - 2013. - 22 pages.
- [5] Spivak E.M., Pechnikova N.V. Features of vegetative regulation of cardiovascular system at primary arterial hypertension at teenagers//the Yaroslavl pedagogical bulletin. - 2012. - T.3. - No. 3. - Page 155.
- [6] Kolt G.S.A focus on children and adolescents in sport // J. Sci. Med. Sport.-2011. – p. 14.
- [7] Rao A.L., Standaert C.J., Drezner J.A., Herring S.A. Expert opinion and controversies in musculoskeletal and sports medicine: preventing sudden cardiac death in young athletes // Arch. Phys. Med. Rehabil. - 2010. - N 91. - P.958.
- [8] Shaykhelislamova M.V., Sitdikova A.A., Sitdikov F.G., Kayumova G. G. Influence of an initial vegetative tone on a condition of haemo dynamics of younger school students//Human physiology. - 2012. - T.38. - No. 4. - Page 89.
- [9] Vane A.M. Vegetative frustration. M.: Science. - 2003. - 480 pages.
- [10] Pletnev A.A. Features of a functional condition of cardiorespiratory system and static-kinetic stability of amateur hockey players: Autoref. Cand. Bio. Sci. - Chelyabinsk. - 2010. - 24 pages.
- [11] Bayevsky R.M. Physiological standard and concept of health//Russian physiological magazine. - 2003. - T. 89. - No. 4. - Page 473.
- [12] Shaihelislamova M.V., Hemodynamic Status of Prepubertal and Pubertal Hokey Players/M.V. Shaihelislamova, F.G. Sitdikov, T.L. Zefirov, N.B. Dikopolskaya//Human Physiology. - 2015. - Vol. 41. - No. 4. - pp. 420-427
- [13] Kudr O.N. Physiological features of vegetative ensuring muscular activity at sportsmen: PhD Thesis Bio Sci. Tyumen. - 2013. - 340 pages.