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A LONGITUDINAL STUDY OF SOME ANTHROPOMETRICAL AND PHYSIOMETRIC INDICATORS OF STUDENTS AT MARINE ENGINEERING SPECIALITIES

The study of the anthropometrical and physiometric indicators of students carried out over many years would reveal some significant characteristics of their biological development and would allow us to draw some conclusions associated with the transmission of hereditary information to the posterity of the population as a whole.

The topicality of this problem is also determined by the fact that biological and functional maturity is a specific feature of the student's age and is a basis of the reproductive essence of generations. Good physical and mental health in this mature age is to a large extent a pre-condition for giving birth to children whose genetic characteristics will follow the ones of today's young generation.

Specific genetic studies of the studied contingent of students were not carried out because for such studies expensive equipment is necessary. Nevertheless, the results obtained and the trends outlined will allow us to draw some conclusions and make some recommendations that are of importance to the pedagogical practice and theory.

The student's age between 19 and 23 years is characterized by biological and functional maturity, as well as by wider views about social status.

In practice these students have already chosen their profession and are on their way to seeking their professional realization.

Methods and subject of the study

The methods include an in-depth scientific study of specialized literature, diagnostic study of some anthropometrical and physiometric indicators.

- Anthropometry: height, weight
- Physiometry: pulse at rest, suspension of breathing (apnea)

Subject of the study were 530 students at the Technical University of Varna between 19 and 23 years of age in their first year of studies over the period from 2000 to 2012. The obtained results were processed by variation analysis.

The participation of the students in the process of education and sport foreseen in the curricula of the Technical University of Varna facilitates changes in the organism's functional systems. Such changes are caused mostly by the change in the metabolism of the contracting musculature. The extent of change is in direct dependency from the intensity, duration and nature of the physical load and the muscular mass involved.

The muscle cell has the amazing ability to increase its metabolic processes many times more than any other tissue in the organism. This means that during load the processes of release of energy in it intensify significantly. At the same time all systems of the organism related to the energy exchange intensify significantly [1,2,4]. The physical load is performed on the basis of mobilization and exploitation of the organism's energy depots, as well as on their obligatory recovery. These processes are regulated by humoral and neural regulation. Their immediate performance is made by the heart muscle, blood circulation, breathing, as the energy sources of oxygen are transported by blood to the active muscle tissue. In parallel with this the products of metabolism are transported to the different organs and systems. [2,4,5]

All these processes require efficient interaction between many physiological and biochemical systems that are directly regulated by the central and vegetative nervous systems. The good health status and the optimal participation in the forms of physical education and sports would facilitate to a large extent the regulation of these processes in the students' organisms. The constantly worsening environment, conditions for sport and the lowering standard of living as result of the economic crisis have additional negative effect on the young people's social comfort.

Such studies are taken in consideration in the forms of control for the semester and the academic year in physical education and have allowed us to observe some changes in the physical development and the physiometric abilities of the students at the TU.

Table 1. Dynamics of the changes in some anthropometric and physiometric indicators of students at TU Varna

Indicators	Anthropometry								Physiometry									
	Years	n=	\bar{X}	d	V%	Average for the country	\bar{X}	d	V%	Average for the country	\bar{X}	d	V%	Average for the country	\bar{X}	d	V%	Average for the country
2000 r.	34	172		5,6	172,9	72	+2	7,9	69,7	76/111		23,6	49,6	47		28,6	48,2	
2001 r.	42	173	+1	7,1	min=155	74	+2	10,7	min=50	77/111	0	25,7	min=43	46	-1	29,4	min=39	
2002 r.	38	173	0	7,9	max=189,9	75	+1	12,4	max=95	78/112	+1	28,4	max=107	46	0	28,4	max=84	
2003 r.	44	174	+1	8,7	$\delta=7,4$	76	+1	14,2	$\delta=9,5$	80/112	+2	26,5	$\delta=13$	45	-1	29,6	$\delta=14,2$	
2004 r.	36	175	+1	9,2	V%=4,3	78	+2	12,6	V%=13,7	79/114	-1	28,7	V%=26,7	44	-1	31,8	V%=34,1	
2005 r.	51	176	+1	7,4		79	+1	14,1		80/114	+1	27,4		43	-1	33,4		
2006 r.	43	176	0	7,2		80	+1	16,2		81/115	+1	29,2		43	0	35,2		
2007 r.	39	177	+1	10,1		82	+2	15,1		82/116	+1	30,1		42	-1	36,7		
2008 r.	37	177	0	11,3		83	+1	14,7		83/117	+1	28,7		41	+1	37,2		
2009 r.	41	178	+1	12,4		85	+2	12,6		82/117	0	29,1		40	-1	38,1		
2010 r.	40	178	0	13,1		86	+1	15,2		84/118	+1	29,3		38	-2	39,7		
2011 r.	39	179	+1	12,6		87	+1	16,4		85/118	+1	28,9		37	-1	39,4		
2012 r.	42	179	0	14,2		88	+1	17,2		86/119	+1	29,4		36	-1	40,1		

As it is shown in Table 1 and Diagram 1 illustrating the studied parametres for the period 2000-2012, the following trends are observed for the four indicators:

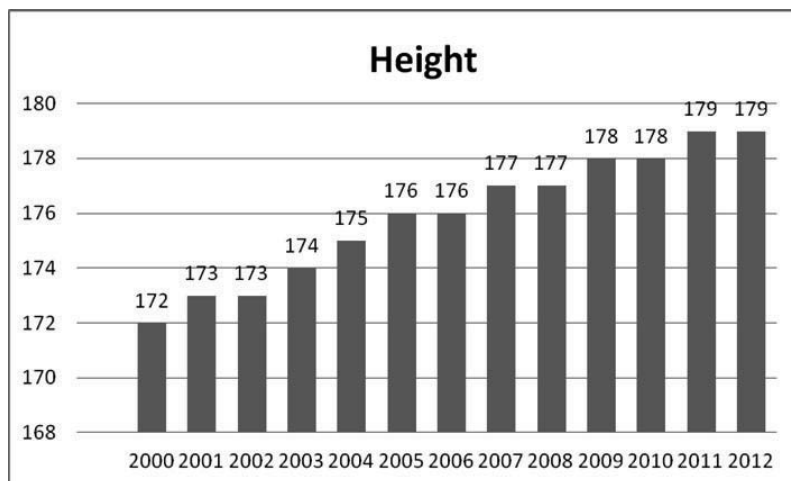


Diagram 1

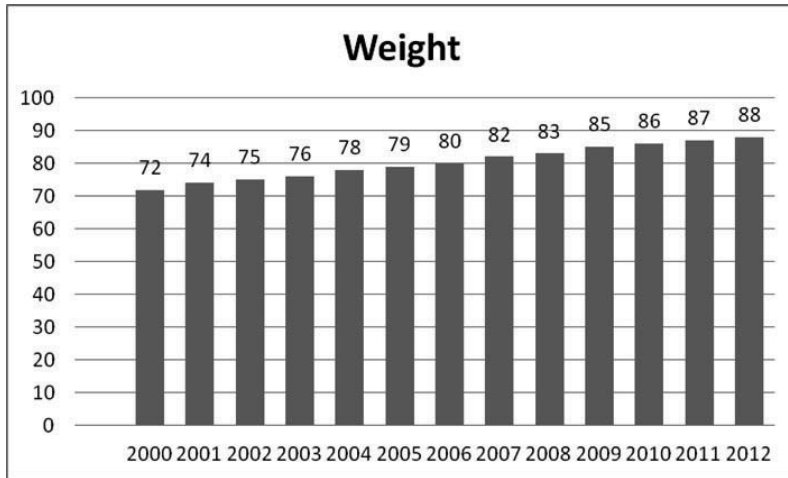
The average values of height for the studied period indicate that at the beginning it was 172 cm. Over the years, variations in changes in positive direction are observed: the highest growth is observed in 2009, when height reaches 178 cm. Comparing this indicator with the average values for the country, it should be underlined that there is a steady trend to increase, especially over the last four years. This trend could be due to the genotype factors transmitted by the previous populations. This to a large extent supports also the acceleration processes observed over the last 15-20 years.

Weight is an extremely important indicator of the harmonious development and affects to a large extent the vital tonus of the individual. Most often overweight is a cause of a number of diseases such as diabetes, stroke, heart attack, etc.

Studying weight of the young people over the whole period, a very clear positive trend to increase is observed, although with small variations. At the very beginning the weight of the studied contingent is little above the average values for the country 69,3 kg to 72 kg for the students. The balance in the physical development related to the weight proportions is to some extent comforting because both height and weight mark a trend to increase (Diagram 2).

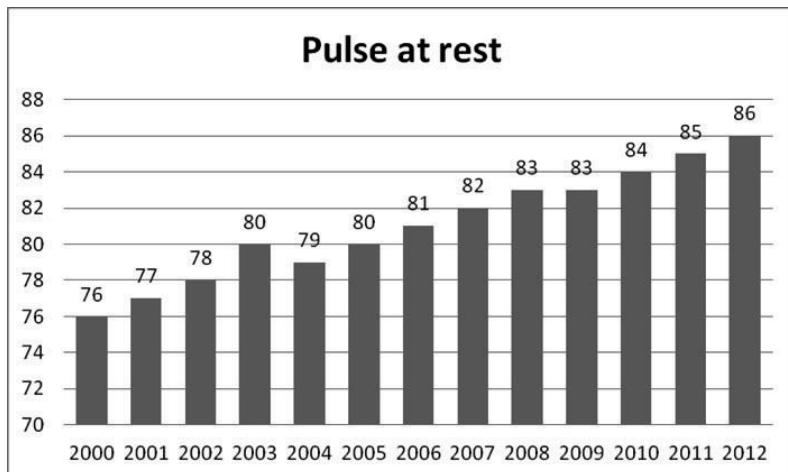
The weight gain is probably due to decreased motor activity, unhealthy diet, constant stress and the invasion of the computers that take up young peoples' free time.

It was of particular interest to us to study the physiometric indicators correlated to the largest extent to the forms of sport at TU and in young people's free time.

*Diagram 2*

The respiratory and heart system are closely related, performing the common task of satisfying the organism's need of oxygen. The measuring of the pulse rate at rest conveys information about the organism's general condition, the heart system and the organism's efficiency. In sport science it has been a known fact for a long time that under the effect of physical load a number of adaptation effects take place in the organism.

The most significant effect is the low heart rate as result of vagotonic states of the fit organism. It has been established that the lower are the values of the pulse rate, the higher is the organism's efficiency – sport bradycardia.

*Diagram 3*

We measured pulse by palpatory method for 10 seconds and multiplied it by 6 in order to obtain the pulse for one minute. The results illustrated in Table 1 and Diagram 3 indicate increased values at the very beginning of the measuring compared to the average for the country. For this indicator there is also a steady trend to increase. Only in 2004 a decrease is observed, and after that the pulse increases again. Although the values of increase are insignificant this steady trend is indicative of steady adaptation changes in the functioning of the heart system. We assume that this is probably due to the genetic memory derived from the preceding generations. Very bad and supported by similar trend are also the results of the maximum values for some of the students. In some of the cases as result of our insistence and after a medical examination, serious heart disease was established. It was found that a large number of the students had never measured their pulse and blood pressure.

The other indicator that is studied is the duration of the suspension of breathing. Breathing is a complex process by which oxygen is transported from the external environment to the organism's cells. The determination of breathing volumes and capacity is of significance both for health and for sport diagnostics. In most cases volitional abilities of the individual can be determined by the suspension of breathing after inspiration. In this case as result of the suspension of the exhalation of the carbon dioxide it ends up in blood. The consequence is an intense activation of the respiratory centre that causes exhalation. The duration of suspension of breathing is quite different and mostly depends on the general functional condition, health status and above all on the will of the individual being tested.

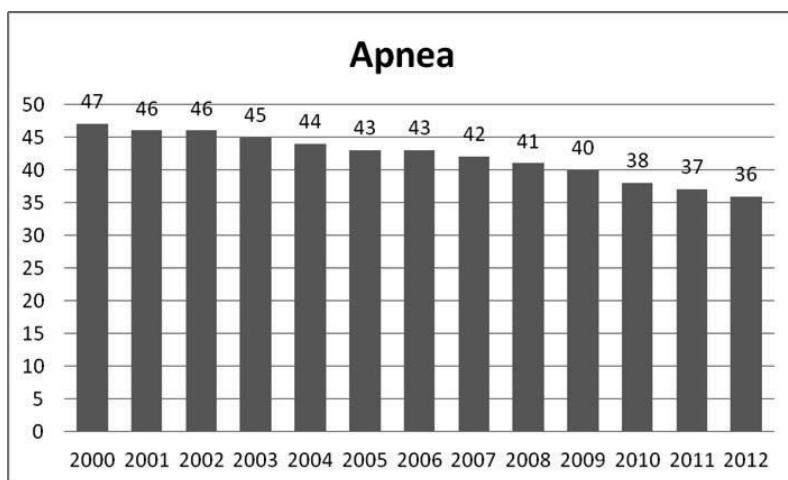


Diagram 4

The data for this indicator illustrated in Table 1 and Diagram 4 show a steady trend to regression. It is most clearly expressed in 2010 when it was also accompanied by a high coefficient of variation $V=39,7\%$. This indicator implies that in the studied

group the values for some of the students are well below the average. The large heterogeneity, as well as the mentioned lowest values for the country are a serious ground for concern about the health status of the rising generation.

In conclusion, some of the observed main trends of the diagnostic study carried out can be summarized.

- Despite the seemingly normal physical development, a minimum increase of height and significantly higher weight gain are observed.
- A serious ground for concern is the established trend to increasing the average values of pulse at rest, as well as the established maximum values for students between 21 and 23 years of age. Probably the higher indicators for weight, the diet and the lowered motor activity have had an effect on and will continue to transmit their genetic memory to every next generation.
- The genotype (inherited) factors determining every population necessitate a new vision of the problem of physical education and sport especially today in the conditions of urbanization and computerizing of society characterized by unhealthy diet and extremely low motor activity.

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A LONGITUDINAL STUDY OF SOME ANTHROPOMETRICAL AND PHYSIOMETRIC INDICATORS OF STUDENTS AT MARINE ENGINEERING SPECIALITIES

Health, as well as healthy lifestyle are and will be becoming in future increasingly topical because of the social, economic and ecological problems the present young generation is facing. The paradigm of man's ecological development is based on the understanding of the interdependence and harmony between the individual's physical, mental and personal development. With the development of the

scientific knowledge of biosystems, such as human organism, scientists established that they are an organic unity of structural and functional characteristics that are at the same time relatively independent. In other words, human physique has structural characteristics determining the body shape and size, and in particular the shape and the size of the motor apparatus, but also the functional characteristics determining the biomechanical parameters of the individual's motor activity. It is this motor activity, physical exercise and sport that are to play the most important social functions without which we could hardly imagine the prosperity of modern society, and in particular preserving and improving the individual's health and efficiency.

Considering the specifics of higher school and the constant dynamic changes in the social and economic life, the complex ecological and social problems in everyday life, as well as the decreasing motor activity of students, it was of interest to us to study the dynamics of the changes having occurred in some anthropometric and physiological indexes over a relatively long period of time.

Keywords: Longitudinal study, biosystems, physical, mental and personal development.

„Dan“, 26. februar 2013.

У СУСРЕТ НАУЧНИМ СКУПОВИМА ЦРНОГОРСКЕ СПОРТСКЕ АКАДЕМИЈЕ

Научници из 12 држава

За учешће на научним скуповима Црногорске спортске академије, који ће се од 4. до 6. априла одржати у Подгорици пријавио се чак 181 учесник из 12 земаља: Босне и Херцеговине, Србије, Хрватске, Словеније, Македоније, Бугарске, Грчке, Италије, САД, Турске, Украјине и Румуније. На списку радова од 51. до 60 налазе се: 51. Марта Бон, Мојца Доупона Топич (Универза у Љубљани, Факултет за спорт): „Однос до конфликтних ситуација рукометних тренера“, 52. Проф. др Драган Коковић, доц. др Јелица Петровић, Душан Ристић (Филозофски факултет, Универзитет у Новом Саду): „Социјални капитал као чинилац спортског достигнућа“, 53. Драган Мартиновић, Владан Пелемиш, Драган Бранковић, Владимир Живановић (Учитељски факултет Београд): „Релације морфолошких карактеристи-

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