CIRCULATORY INDICES AND THEIR RELATIONS WITH PHYSICAL STRENGTH OF KINH AND SAN DIU HIGH SCHOOL PUPILS IN TAM DAO DISTRICT, VINH PHUC PROVINCE

Do Hong Cuong[1] and Hoang Quy Tinh[2]

[1]Faculty of Natural Sciences, Hanoi Metropolitan University
[2]Faculty of Early Childhood Education, Hanoi National University of Education

Abstract. This research on morphological and physical strength was conducted on 795 pupils of high school (from 16 to 18 years), the ethnicity of Kinh (50.06%), San Diu (49.94%) in Tam Dao district, Vinh Phuc province. The objective of this research was to identify some morphological and physical strengths of male and female pupils aged 16 - 18, contributing to building Vietnamese biological values in the current period. The research results show that there were differences in morphological indicators: height was based on age and sex factors. The physical strength of the study was subjected to the normal group according to BMI. Circulatory indicators (heart rate, arterial blood pressure) had a proportional relationship to the morphological and physical index.

Keywords: heart rate, blood pressure, height for age, BMI for age, ethnicity, high school.

1. Introduction

The functional index of the circulatory system studied often focuses on heart rate and blood pressure. According to some authors (Arshavski and Tur, Waldo and Edmun) (according to [1]), the baby's heart rate in the first few days after birth is about 120 - 140 beats/minute (bpm), in a nursing baby about 110 - 160 bpm, about 85 - 100 bpm in pre-school children, about 70 - 74 bpm in students. The authors stated that the reduction in heart rate during the development of the child is due to the change in metabolic rate and the reduction of the excitability of the sinus node as well as the increase in the tonic effect of the X-ray nerve on the heart.

The next target that many people care about is arterial blood pressure. Arterial blood pressure has been studied since the 19th century by many authors [1-4]. Blood pressure was determined by Korotkow by indirect measurement, this method is still commonly

used (according to [5]). Many studies show that there is a change in blood pressure at different stages in the development of the child. The previous important research results in the field of morphology can be mentioned by Nguyen Tan Gi Trong [6], Tham Thi Hoang Diep [7], Nguyen Thi Lan [8], Tran Trong Thuy [9], etc. to evaluate the Vietnamese human indexes. These studies have shown variation by region, ethnicity, sex, and time to have a Vietnamese human development strategy. The function of the Vietnamese people's heart has been continuously studied by many Vietnamese authors over the past several decades, which can be mentioned here as Nguyen Tan Gi Trong [6], Trinh Binh Dy [10], Tran Do Trinh [5], Nguyen Thi Minh Duc [11], etc.

In order to contribute to building the biological values of Vietnamese people in the early years of the 21st century [11, 12], we conducted several periodic indexes and the relationship with the above physical strength on students of ethnic groups in Vietnam with specific objectives: Identify many circulatory and physical indicators and the relationship between indicators of ethnic high school students of Kinh, San Diu in Tam Dao district, Vinh Phuc province.

The research results contribute to the determination of some morphology and fitness indicators of male and female students of ethnic groups in Vietnam aged 16-18. Especially, the difference in the height morphology index by age and sex factors. The research results on the circulatory index (heart rate, arterial blood pressure) contributed to the Vietnamese index and explored the proportional relationship with the morphology and fitness index. The results obtained in this research topic can be used for students' physical enhancement.

2. Content

2.1. Objectives and methods

Table 1. Distribution of the participants by gender and age

No.	Age	Kinh		San Diu		Total
		Male	*Female*	*Male*	*Female*	
1	16	72	73	62	68	275
2	17	69	62	65	64	260
3	18	67	63	63	67	260
Total		208	198	190	199	**795**

High school students aged 16 to 18 in Kinh and San Diu ethnic groups are studying at Tam Dao and Tam Dao 2 High Schools of Tam Dao district, Vinh Phuc province (Table 1).

Research subjects have good health, no birth defects, no chronic disease, normal mental-physiological state.

Study of physical indicators: Body mass index (BMI) (according to [7]).

Researching circulatory indicators: Heart rate, Arterial blood pressure [5,10].

Study the relationship between the circulatory and physical indicators.

The research data are processed according to the statistical probability algorithms in medicine and biology.

2.2. Results

2.2.1. The vertical height of high school students of Kinh and San Diu ethnic groups in Tam Dao district

Table 2. Standing height by age (cm) by age group, gender, ethnicity

Gender	Age	Ethnicity						$\overline{X_1} - \overline{X_2}$	P (1-2)
		Kinh (1)			San Diu (2)				
		n	$\bar{X} \pm SD$	Increase	n	$\bar{X} \pm SD$	Increase		
Male	16	72	161.08±4.51	-	62	160.15±4.71	-	0.93	>0.05
	17	69	163.82±4.21	2.74	65	162.57±3.18	2.42	1.25	>0.05
	18	67	165.83±5.02	2.01	63	163.95±3.47	1.38	1.88	<0.05
	AI/year			2.38			1.90		
Female	16	73	152.06±4.31	-	68	151.54±3.43	-	0.52	>0.05
	17	62	153.80±5.34	1.74	64	152.78±3.57	1.24	1.02	>0.05
	18	63	155.08±5.12	1.28	67	153.21±7.46	0.43	1.87	>0.05
	AI/year			1.51			0.84		

(AI/year: Average increase/year)

The data in Table 2 shows as follows:

Standing height is one of the most basic biological indicators reflecting the growth and development of the human body through the age classes. Studies in this area show that, at the age of students, standing height varies with age, by gender.

Through research results on high school students in Tam Dao district, Vinh Phuc province from 16 to 18 years old, we found that, both in Kinh students and San Diu students, standing height continued to increase with age. The rate of growth at these ages is not steady, the age of 16 to 17 increases faster than the age of 17 to 18 and gradually becomes stable because the children of these ages have passed through puberty. The rate of growth over the ages in men is higher than that of the female, the Kinh is higher than the San Diu at this stage, the reason is that the male puberty period ends later than the female. The study's results of Tham Hoang Diep [7], Tran Dinh Long [2], and Trinh Van Minh [3] on students at these ages also showed similar results. Thus, the development of standing height of high school age students in Tam Dao district, Vinh Phuc province is similar to students at this age in other localities in our country.

Comparing results with some authors [2, 9, 12], the height of students in our study is higher. In our opinion, the increase in standing height of high school students in Tam Dao district is due to the socio-economic conditions of Tam Dao in particular and Vinh Phuc in general in recent years with strong growth and living standards of people are enhanced. However, the difference in height between San Diu ethnic students and "The normal biological value of Vietnam in the 1990s of the twentieth century" [12] is not much and not significant (p > 0.05).

2.2.2. Body mass index (BMI)

BMI also called body mass index allows comparing the relative weight of people of different heights. This index is relatively favorable when studying, especially on large numbers of objects. BMI is determined through the relationship between weight and height. The heavier the person, the greater the BMI. Based on BMI, one can assess the nutritional status of the body [13].

Table 3. BMI of students by age, gender, ethnicity

Gender	Age	Ethnicity						$\overline{X_1} - \overline{X_2}$	P (1-2)
		Kinh (1)			San Diu (2)				
		n	$\bar{X} \pm SD$	Increase	n	$\bar{X} \pm SD$	Increase		
Male	16	72	17.86±1.09	-	62	18.33±1.88	-	- 0.47	>0.05
	17	69	18.23±1.51	0.37	65	18.63±1.63	0.30	- 0.40	>0.05
	18	67	18.73±2.09	0.50	63	19.35±2.07	0.72	- 0.62	>0.05
	AI/year			0.44	AI/year		0.51		
Female	16	73	18.97±1.54	-	68	19.19±1.98	-	- 0.22	>0.05
	17	62	19.07±2.39	0.10	64	20.01±2.62	0.82	- 0.94	<0.05
	18	63	19.21±2.28	0.14	67	20.45±2.04	0.44	- 1.24	<0.01
	AI/year			0.12	AI/year		0.63		

(AI/year: Average increase/year)

The results of the study in Table 3 show that with the increase in weight, the average BMI of students increases with age. At the same age, BMI of female students is always higher than that of male students, San Diu's ethnicity is higher than Kinh's. The increase in BMI by age indicates the height increase of high school students in Tam Dao district, Vinh Phuc province is lower than the weight gain. This result is also consistent with the data in the book "The normal biological value of Vietnam in the 1990s of the twentieth century" [12], "TSL HSPT" [9], as well as the studies of Tran Dinh Long [6] and Trinh Van Minh [7].

From the results of research on the morphology and physical strength of Kinh and San Diu ethnic high school students of Tam Dao district, Vinh Phuc province mentioned above, it can be said that the period of 16 - 18 years is the period of indicators. morphology - physical strength still has growth, especially in male students, while female students have slowed down but continue to increase. This can be explained because female students' puberty begins early and also ends earlier than male students. At the age of 16-18, most of the girls have passed puberty and for many male children still in puberty, there is a rapid growth in morphological - physical indicators.

Compare with previous studies [1, 4, 9, 12] results of morphological research - our physical strength is higher. In our opinion, this difference is mainly due to the development of socio-economic conditions in recent years although there are still many difficulties, so that nutrition, care of both material and spirit, physical training, exercise, sports in the family and school are better improved, the movement when participating in agricultural production to help the family, moving mainly is still going sets on steep hills and mountains terrain may also affect morphological - physical indicators.

2.2.3. Indicators of circulatory physiological functions

*** Heart rates of ethnic high school students in Tam Dao district, Vinh Phuc province**

Table 4. The heart rate of students by age, gender, ethnicity

Gender	Age	Ethnicity						$\overline{X}_1 - \overline{X}_2$	P (1-2)
		Kinh (1)			San Diu (2)				
		n	$\overline{X} \pm SD$	Increase	n	$\overline{X} \pm SD$	Increase		
Male	16	72	77.78±5.42	-	62	77.01±5.56	-	0.77	>0.05
	17	69	76.23±4.26	1.55	65	76.15±4.12	0.86	0.08	>0.05
	18	67	74.31±5.12	1.92	63	73.98±5.01	2.17	0.33	>0.05
	AR/year			1.74		AR/year	1.67		
Female	16	73	79.55±7.57	-	68	79.21±7.25	-	0.34	>0.05
	17	62	79.24±5.12	0.31	64	78.82±8.04	0.39	0.42	>0.05
	18	63	76.98±6.65	2.26	67	76.25±7.01	2.57	0.73	>0.05
	AR/year			1.29		AR/year	1.48		

(AR/ year: Average reduction/year)

Research results in Table 4 show as follows:

Heart rate of Kinh and San Diu students decreases with age in all males (from 77.01-77.78 beats/minute at age of 16 down to 73.98-74.31 beats/minute at age 18) and women (from 79.21-79.55 beats/minute at age 16 to 76.25-76.98 beats/minute at age 18).

The rate of decrease in heart rate by age of irregular students, especially in female students, has a statistically significant decrease in heart rate (from 0.31 to 0.39 in 16-17 years of age, 2.26-2.57 in ages 17-18).

At the same age, the female heart rate is always higher than that of male students, the difference is statistically significant (p <0.001).

The heart rate of the two ethnic students is similar. The heart rate of students decreases with age in both men and women of the two ethnic groups. This proves that the functioning of the heart is improving over the ages. In our study, the frequency of cardiac contractions in female students is always higher than that of male students of the same age. This result is consistent with the results stated in the book "Basic indicators of physiology and psychology of high school students today" [9], "The normal biological value of Vietnam in the 1990s of the twentieth century" [12].

*** Arterial blood pressure of ethnic high school students in Tam Dao district, Vinh Phuc province**

Maximum blood pressure

Table 5 shows that the maximum blood pressure of Kinh and San Diu students increases gradually with age in all males (from 116.02 - 116.25 mmHg at the age of 16 to 116.76 - 118.8 mmHg at the age of 18) and females (from 113.97 - 114.32 mmHg at the age of 16 to 115.03 - 115.75 mmHg at the age of 18).

Table 5. Maximum blood pressure of students by age, gender, ethnicity

Gender	Age	Ethnicity						$\overline{X_1} - \overline{X_2}$	P (1-2)
		Kinh (1)			San Diu (2)				
		n	$\bar{X} \pm SD$	Increase	n	$\bar{X} \pm SD$	Increase		
Male	16	72	116.02±0.98	-	62	116.25±0.87	-	-0.23	>0.05
	17	69	116.71±1.05	0.69	65	117.12±0.94	0.87	-0.41	<0.05
	18	67	116.76±0.97	0.06	63	118.08±1.12	0.96	-1.32	<0.001
		AI/ year		0.38	AI/ year		0.92		
Female	16	73	113.97±0.85	-		114.32±0.98	-	-0.35	<0.05
	17	62	114.26±1.08	0.19		115.19±0.97	0.77	-0.93	<0.001
	18	63	115.03±1.76	0.77		115.75±1.32	0.56	-0.72	<0.01
		AI/ year		0.48	AI/ year		0.67		

(AI/year: Average increase/year)

The maximum rate of hypertension according to the age of the students is quite equal over the ages, in the range of 0.38 to 0.92, and is not statistically significant in terms of differences across ages.

At the same age, the maximum blood pressure of men is higher than that of women, the difference is statistically significant (p <0.05).

Comparison of the maximum blood pressure results of two ethnic minority students: the maximum blood pressure of San Diu students is greater than the maximum blood pressure of Kinh students living in Tam Dao district (except for 16-year-old male school) and this difference is statistically significant (p <0.05).

Minimum blood pressure

Research results in Table 6 show as follows:

- The minimum blood pressure of Kinh and San Diu students increases with age in both men (from 74.21 to 74.35 mmHg at the age of 16 to 75.53 - 75.98 mmHg at the age of 18) and women (from 72.65 - 73.19 mmHg at the age of 16 to 73.98 - 74.32 mmHg at the age of 18).

- The minimum rate of hypertension according to the age of the students is quite even across the ages, ranging from 0.57 to 0.82

- At the same age, the minimum blood pressure of males is higher than that of females, the difference is statistically significant (p < 0.05).

- Comparison of minimum blood pressure results of two ethnic minority students: the minimum blood pressure of San Diu students is greater than the minimum blood pressure of Kinh students living in Tam Dao district (except for 16-year-old boys and 18-year-old female) and this difference is statistically significant (p < 0.05).

Table 6. Minimum blood pressure of students by age, gender, ethnicity

Gender	Age	Ethnicity						$\overline{X_1} - \overline{X_2}$	P (1-2)
		Kinh (1)			San Diu (2)				
		n	$\bar{X} \pm SD$	Increase	n	$\bar{X} \pm SD$	Increase		
Male	16	72	74.21±0.84	-	62	74.35±1.32	-	- 0.14	> 0.05
	17	69	74.67±0.98	0.46	65	75.01±0.79	0.66	- 0.34	< 0.05
	18	67	75.53±1.02	0.86	63	75.98±1.72	0.97		- 0.45	< 0.05
		AI/ year		0.66	AI/ year		0.82		
Female	16	73	72.65±0.91	-	68	73.19±1.87	-	- 0.54	< 0.05
	17	62	73.05±1.85	0.40	64	73.81 ± 1.94	0.62		- 0.76	<0.05
	18	63	73.98±1.09	0.93	67	74.32 ± 0.97	0.51		- 0.34	> 0.05
		AI/ year		0.67	AI/ year		0.57		

(AI/year: Average increase/year)

The results of our study are different from the results presented in the books [6, 12]. This phenomenon is explained by the variation in the structure and function of the cardiovascular system during the development of the individual. As age increases, the heart muscle is stronger, the larger the heart chamber, the more heart volume increases, so the amount of blood pushed into the arteries increases, leading to an increase in blood pressure [5].

2.2.4. Relationship between standing height and some index of circulatory function

The results of the correlation coefficient between vertical height and some periodic system function indexes are shown in Table 7.

Table 7. Correlation between vertical height and some index of circulatory function

Function index of the circulatory system	Ethnicity	Correlation coefficients (r)		Regression (y = ax+b)	
		Male	Female	Male	Female
Heart rate	Kinh	-0.51	-0.79	y = -52.541x + 161.93	y = -109.59x + 247.09
	San Diu	-0.54	-0.81	y = -83.747x + 211.01	y = -77.467x + 196.85
Maximum blood pressure	Kinh	0.42	0.44	y = 51.889x + 31.237	y = 105.6x - 47.292
	San Diu	0.64	0.51	y = 76.7x - 7.6021	y = 90.83x - 24.418
Minimum blood pressure	Kinh	0.55	0.84	y = 59.667x - 21.506	y = 103.92x - 84.846
	San Diu	0.76	0.69	y = 76.531x - 48.876	y = 96.395x - 74.024

The data in Table 7 show that the correlation coefficient between vertical height and heart rate of male and female students is negative (r_{male} = -0.51 and -0.54, r_{female} = -0.79 and -0.81). This proves that the correlation between heart rate and vertical height is inversely correlated (r <0), that is, when the student's vertical height increases gradually, the heart rate tends to decrease.

The correlation coefficient between vertical height and maximum blood pressure and minimum blood pressure are positive values (r_{male} = 0.42 and 0.64 for maximum blood pressure and r_{male} = 0.55 and 0.76 for minimum blood pressure, r_{female} = 0.44 and 0.55 for maximum blood pressure and r_{female} = 0.84 and 0.69 for minimum blood pressure). This proves that the correlation between vertical height and maximum blood pressure is positive ($r > 0$), meaning that when the height of the student's height increases, the maximum blood pressure increases.

Our results show, $0.3 < |r| \leq 0$, should correlate the height of standing with maximum blood pressure as well as the minimum blood pressure of the student at the average level.

On the other hand, there is an exchange of genetic resources between the new population and indigenous people. From the 1990s of the 20th century, a part of the population from the Red River Delta provinces (Nam Dinh, Thai Binh, Hanoi, etc.) went to new economic development, came and settled permanently in many areas. of the northern mountainous provinces, in which Tam Dao district, Vinh Phuc province. Some genetic factors may have improved, affecting biological indicators of children in general and high school students in particular.

3. Conclusions

Through the study results of some biological indicators of Kinh and San Diu ethnic high school students, Tam Dao district, Vinh Phuc province, we draw some conclusions: 1) Vertical height and an average increase in dimension the male students' standing is higher than that of women by age; 2) Body mass index and an average increase of male and female body mass index were not significantly different by age. Based on physical fitness BMI, male and female students are normal; 3) The heart rate of Kinh and San Diu ethnic minority students is different; gradually decrease with age, the rate of decline in men and women is different and the same age there is also a difference between men and women; 4) Differences in blood pressure and minimum blood pressure of Kinh and San Diu ethnic minority students; gradually increase with age, different growth rates in men and women and in the same age also have differences between men and women; 55) The correlation between the standing height of the Kinh and the San Diu people with the heart rate is negative, while the maximum blood pressure and minimum blood pressure are positively correlated.

The morphological - physical and physiological functions of the students often change and depend on genetic factors, living conditions, gender, and age. Therefore, the study of these indicators should be conducted regularly and synthesized to have the data to be the basis for proposing measures to improve human quality and propose measures of education and training as appropriate. There need to be more research works on biological indexes on high school students throughout the country, especially those of ethnic minority students in areas with difficult socio-economic conditions.

In addition to educating knowledge, it is necessary to pay more attention to fitness to improve health, enhance students' adaptability to their living environment.

REFERENCES

[1] Tran Thi Loan, 2001. Study the heart rate of students at some high schools in Hanoi city. *Biological Journal,* 4, (3b), pp. 155-158.

[2] Tran Dinh Long and partners, 1996. Researching the development of age bodies to high schools (6 -18 years old). The project belongs to the project branch "Research on Vietnamese biological indicators in the 1990s".

[3] Trinh Van Minh, Tran Sinh Vuong, Tham Hoang Diep, Le Gia Vinh and partners, 1996*. The results of a pilot survey on some anthropometric indicators of ordinary Vietnamese people in Lien Ninh commune, suburban Hanoi. Initial results of studying some biological indicators of Vietnamese,* Medical Publishing House, Hanoi, p. 32-48.

[4] Nguyen Quang Quyen, 1984. *Anthropology and research applications on Vietnamese*. Medical Publishing House, Hanoi.

[5] Tran Do Trinh, 1996. *Vietnamese arterial blood pressure values.* Initial results of studying some biological indicators of Vietnamese. Medical Publishing House, Hanoi, p. 146-150.

[6] Nguyen Tan Gi Trong, *et al*. 1975. *Biological constant of Vietnamese*. Medical Publishing House, Hanoi, p. 86-92.

[7] Tham Thi Hoang Diep, Nguyen Quang Quyen, Vu Huy Khoi and partners, 1996. *Some comments on the height, head circumference, and chest circumference of Vietnamese people are from 1 to 55 years old. Initial results of studying some biological indicators of Vietnamese.* Medical Publishing House, Hanoi, p. 68-71.

[8] Nguyen Quang Mai, Nguyen Thi Lan, 1998. Research on some indicators of puberty fitness and physiology among ethnic girls in Vinh Phuc and Phu Tho provinces. *Journal of Science,* Hanoi National University of Education, (6), pp. 86-89.

[9] Tran Trong Thuy, 2006. *Basic indicators of physiology and psychology of high school students today*. Center for Psychology and Age Physiology, Institute of Strategy and Education Program, Education Publishing House, Hanoi.

[10] Trinh Binh Dy, Do Dinh Ho, Pham Khue, Nguyen Quang Quyen, Le Thanh Uyen, 1982. *About the physiological parameters of Vietnamese people*. Science and Technology Publishing House, Hanoi.

[11] Phan Van Duyet, Le Nam Tra, 1996. Some common methodological issues in studying biological indicators, *Initial results of researching some biological indicators of Vietnamese*. Medical Publishing House, Hanoi, p. 13-16.

[12] Ministry of Health, 2003. *The normal biological values of Vietnamese people in the 1990s-twentieth century*. Medical Publishing House, Hanoi.

[13] Le Nam Tra and partners, 1996. *Initial results of studying some biological indicators of Vietnamese people.* Medical Publishing House, Hanoi.