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Assessment of the risks of cardiovascular system functional disorders developing in young people aged 18–25 years

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Abstract

Background. In recent years, the proportion of young people with functional disorders and diseases of the cardiovascular system has increased, in the formation of which behavioral risk factors play an important role.

Aim. To assess the risk of functional disorders developing in young people aged 18–25 depending on social status and lifestyle.

Material and methods. An observational one-stage uncontrolled study, the object of which was young people aged 18–25 years (1978 people), was conducted. The study sample was divided into four groups: working (n=200) and studying (n=313) males, working (n=526) and studying (n=939) females. To assess the relative cardiovascular risk, the groups were divided according to social status, to assess the impairment of adaptive capabilities — according to the presence of a behavioral risk factor. Comparison of independent groups was performed using the Mann–Whitney test. Testing null hypotheses about the absence of differences between the shares was carried out using the χ^2 test and calculating the odds ratio.

Results. Relative cardiovascular risk was found in 21.8% of young people. The chances of risk occurrence were higher in males than in females ($p < 0.001$), in working youth compared to students ($p < 0.001$). The chances of reducing the adaptive capacity of the cardiovascular system were 2.1 times higher in smoking males ($p < 0.001$) and 2.6 times higher in smoking females ($p < 0.001$) compared to non-smoking respondents. In males with excessive alcohol consumption, in females with irregular meals and low physical activity, cases of tension in the mechanisms of adaptation of the cardiovascular system were more often noted (by 1.8; 1.4 and 1.7 times, respectively) compared with control groups.

Conclusion. The risk of functional disorders developing was more common in young males than in females, in workers in comparison with students; cigarette smoking in both sexes, alcohol consumption in males, irregular meals and low physical activity in females contributed to a decrease in the reserve capacity of the circulatory system.

Keywords: lifestyle, students, working youth, relative cardiovascular risk, adaptive potential.

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Background

The functional state of the cardiovascular system is key to evaluating human health and adaptability [1]. Recent works have shown an increasing proportion of young people with cardiovascular functional disorders and diseases, including hypertension, stroke, myocardial infarction, and sudden death syndrome [2]. The significance of risk behaviors and lifestyle in shaping health is highlighted in the priority projects of the Ministry of Health of the Russian Federation [3] and the literature [4, 5]. The World Health Organization has reported that smoking, excessive alcohol

consumption, irrational nutrition, and insufficient physical activity are the most significant behavioral health risk factors that contribute to preventable deaths [6].

It is crucial to study modifiable risk factors in young adults to improve health promotion programs and to develop appropriate health interventions to address noncommunicable diseases in educational and workplace settings.

Research on the evaluation of behavioral health risk factors among students is more prevalent in the literature [4, 7, 8], but the literature on this topic among the working youth cohort is limited [9].

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Aim

The objective of this work was to assess the risk of functional disorders in young adults aged 18–25 based on their social status and lifestyle.

Materials and methods

An observational one-stage uncontrolled study was conducted with 1,978 young people aged 18–25 years who permanently reside in the Yaroslavl region. No other inclusion or exclusion criteria were applied. Data were collected from 2010 to 2017 at the Yaroslavl Regional Clinical Hospital of War Veterans. Approval was given by the local ethical committee of P.G. Demidov Yaroslavl State University on December 15, 2015. For evaluation of the relative cardiovascular risk, gender groups were divided by social status: young men (200 working, 313 students) and young women (526 working, 939 students). In addition, impaired adaptive capacity was assessed by the presence of a behavioral risk factor. This study focused on lifestyle factors as the most controllable factor in preventing noncommunicable diseases. Individuals aged 18–25 years are of interest because of their biological maturation, definitive morphofunctional indicators, and establishment of attitudes toward independent living, which greatly impact human health.

The questionnaire and survey method was employed for lifestyle assessment based on the form No. 025-CZ/u “Health Center Card” (Appendix No. 2 to the order of the Ministry of Health and Social Development of the Russian Federation No. 597n dated August 19, 2009). Questions included social status, bad habits (alcohol consumption and cigarette smoking), nature of motor activity, duration of night sleep, and regularity of meals. The nature of motor activity was determined through systematic physical training and sports (i.e., regular training at least twice a week). The normal duration of night sleep was considered to be 7–9 h per day. Dietary intake was assessed according to the frequency of meals. Eating meals three to four times a day at regular times was considered regular.

The adaptation potential (AP) integral index, a parameter that reflects the organism’s ability to adapt, was calculated using R.M. Baevsky’s formula [10]:

$$AP = 0.011 \times HR + 0.014 \times SPB + 0.008 \times DBP + 0.014 \times A + 0.009 \times BW - 0.009 \times BL - 0.27,$$

where HR refers to heart rate (per minute), SPB refers to systolic blood pressure (mm Hg), DBP refers to diastolic blood pressure (mm Hg), A refers to age (years), BW refers to body weight (kg), and BL refers to body length (cm).

Evaluation of adaptation reserves is based on AP values: in general, AP values below 2.10 in-

dicate satisfactory, AP values of 2.11–3.20 indicate tension in adaptation mechanisms, AP values of 3.21–4.30 indicate unsatisfactory reserves, and AP values over 4.31 indicate a failure of adaptation mechanisms.

The study assessed the relative cardiovascular risk using the Systematic COronary Risk Evaluation scale (SCORE) in accordance with clinical guidelines [6]. Calculations of the relative cardiovascular risk considered total blood cholesterol levels, blood pressure indices, and smoking addiction. Total cholesterol levels were determined using the SD LipidoCare analyzer after fasting.

Statistica 10.0 was employed for data processing. The distribution of quantitative data was evaluated using the Kolmogorov–Smirnov criterion. The median, lower quartile, and upper quartile (Me [Q1; Q3]) were used as descriptive measures. Comparison of two independent groups was conducted by the Mann–Whitney test. Qualitative data were described using specific gravity and a 95% confidence interval (95% CI) for the proportion. Pearson’s χ^2 test and Fisher’s exact test were used to test the null hypothesis of no differences between the proportions. The odds ratio (OR) and 95% CI for the OR were calculated to compare the frequencies of binary traits in two independent groups. Statistical significance was set at $p < 0.05$.

Results

The results showed that 21.8% (95% CI 19.9–23.8) of young people aged 18–25 years have a relative cardiovascular risk. Gender was a significant factor, with young men having a higher relative cardiovascular risk than young women (OR 2.65; 95% CI 2.08–3.61, $p < 0.001$). The relative cardiovascular risks in young men and women were reported to be 35.2% (95% CI 30.8–39.6) and 17.1% (95% CI 15.1–19.2). As observed in Table 1, working young men and women have 2.8 and 4.7 times higher risk of cardiovascular disease than student respondents, indicating a correlation between social status and cardiovascular risk in youth, respectively.

The results also observed that cigarette smoking significantly increases the risk of decreased cardiovascular adaptive capacity in young men (2.1-fold increase, 95% CI 1.39–3.06, $p < 0.001$) and young women (2.6-fold increase, 95% CI 1.84–3.56, $p < 0.001$). Moreover, 52.3% (95% CI 44.4–60.2) of young men who smoke and 34.6% (95% CI 29.3–39.9) of young men who do not smoke have weakened internal self-regulatory mechanisms ($\chi^2 = 13.25$, $df = 1$, $p < 0.001$). Similarly, 27.5% (95% CI 21.9–33.1) of young women who smoke and 12.9% (95% CI 11.1–15.1) of young women who do not smoke have weakened internal self-regulatory

Table 1. Chances of cardiovascular risk in young people by social status

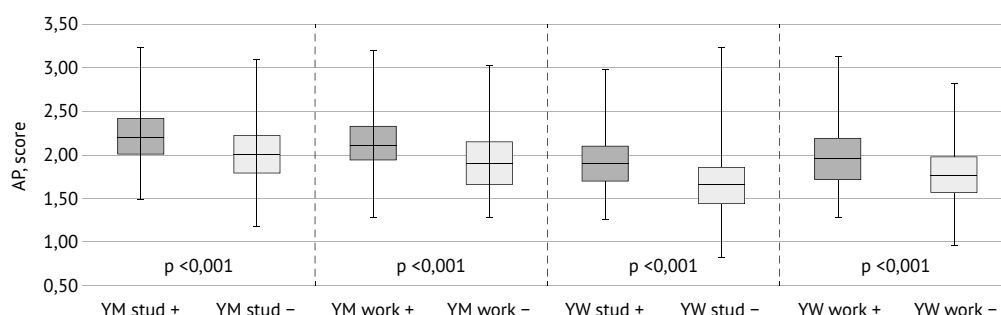
Gender	Study group	Risk factor is present		No risk factor		Intergroup differences	OR (95% CI)
		n	%	n	%		
Young men	Working	88	50,0	88	50,0	$\chi^2=27,31$, df=1, p<0,001	2,84 (1,91–4,22)
	Students	74	26,1	210	73,9		
Young women	Working	145	32,2	306	67,8	$\chi^2=111,01$, df=1, p<0,001	4,73 (3,49–6,42)
	Students	78	9,1	779	90,9		

Note: OR, odds ratio; CI, confidence interval; a comparison of the presence of relative cardiovascular risk in working young men and women compared with student respondents is presented.

Table 2. AP tension of the adaptation potential of the cardiovascular system in smoking and nonsmoking youth (proportion of those surveyed, %)

Study group	Smoking	AP tension is present		No AP tension		Intergroup differences	OR (95% CI)
		n	%	n	%		
Working young men	Yes	47	50	47	50	$\chi^2=8,69$, df=1, p=0,004	2,40 (1,33–4,32)
	No	30	29,4	72	70,6		
Male students	Yes	34	55,7	27	44,3	$\chi^2=6,61$, df=1, p=0,011	2,12 (1,19–3,79)
	No	76	37,3	128	62,7		
Working young women	Yes	41	24,0	130	76,0	$\chi^2=17,85$, df=1, p<0,001	2,87 (1,74–4,74)
	No	33	9,9	300	90,1		
Female students	Yes	27	36,5	49	64,5	$\chi^2=22,88$, df=1, p<0,001	3,31 (1,98–5,52)
	No	107	14,3	642	85,7		

Note: AP, adaptive potential of the cardiovascular system; OR, odds ratio; CI, confidence interval.

**Fig. 1.** Adaptation potential (AP) values in smoking and nonsmoking youth (Min, Q1, Me, Q3, Max); YM, young men; YW, young women; S, students; WY, working youth; “+” means presence of a risk factor; “-” means no risk factor

mechanisms ($\chi^2 = 32.43$, df = 1, $p < 0.001$). In addition, statistically significant differences were found in respondents of both genders based on social status (Table 2).

Figure 1 presents the mean values of AP in the studied groups. As observed, nicotine contributes to the development of insulin resistance and type 2 diabetes mellitus, as well as changes in the lipid profile in an atherogenic direction, increasing the risk of cardiovascular diseases [6].

Alcohol consumption has a significant negative impact on cardiovascular reserve capacity only in young men (OR 1.76; 95% CI 1.17–2.67, $p = 0.008$). AP tensions have been observed in 44.8% (95% CI

39.3–50.3) of young men who abuse alcohol and 31.5% (95% CI 24.0–39.0) of young men without this risk factor ($\chi^2 = 7.27$; df = 1, $p = 0.008$), which may be attributed to gender-specific variations in the amount and pattern of alcohol consumption.

The survey conducted among working youth showed that young men consume alcohol with a strength of more than 30% and less than 9% more frequently than young women who tend to consume medium-strength alcoholic products (Table 3). In general, males consume more alcohol than females [11, 12]. Gender differences in dopamine release may explain the observed difference in the pleasurable effects of alcohol. Research suggests

Table 3. Consumption patterns of alcoholic beverages among working and studying youth (percentage of those surveyed, %)

Drink strength: frequency of consumption	Working youth (n = 178)			Young students (n = 418)			Significant intergroup differences (df = 1)
	Total	YM	YW	Total	YM	YW	
	1	2	3	4	5	6	
<9%:	68,4	74,0	56,9	43,8	46,9	42,9	1–4: $\chi^2=29,66$, $p<0,001$ 2–3: $\chi^2=5,24$, $p=0,023$
– Several times per week	12,4	14,8	6,1	1,7	6,5	0	—
– Several times per month	52,9	51,1	57,6	38,8	30,4	41,7	1–4: $\chi^2=5,82$, $p=0,016$
– Once per month	34,7	34,1	36,3	59,5	63,1	58,3	1–4: $\chi^2=17,78$, $p<0,001$
10–30%:	34,9	27,4	50,0	31,7	24,0	34,2	2–3: $\chi^2=9,51$, $p=0,003$
– Several times per week	0	0	0	3,2	8,3	1,9	—
– Several times per month	35,0	32,3	38,0	22,1	16,7	23,3	—
– Once per month	65,0	67,7	62,0	74,7	75,0	74,8	—
>30%:	44,0	51,3	29,3	12,3	22,7	9,0	1–4: $\chi^2=72,16$, $p<0,001$ 2–3: $\chi^2=7,60$, $p=0,006$ 5–6: $\chi^2=12,77$, $p<0,001$
– Several times per week	0	0	0	2,0	4,6	0	—
– Several times per month	26,0	25,0	29,4	24,0	31,8	17,9	—
– Once per month	74,0	75,0	70,6	74,0	63,6	82,1	—

Note: YM, young men; YW, young women.

that men experience a higher release of dopamine than women with the same dosage of alcohol [13].

Analysis of alcohol consumption patterns in the studied social groups revealed that working youth consumed low-alcohol and strong drinks more frequently than students. Additionally, the working youth group has a higher frequency of alcohol intake per month for products with a strength of less than 9%.

The World Health Organization reports that approximately one-third of all cardiovascular diseases are caused by poor nutrition [14]. A study found that young women with irregular diets are 1.4 times (95% CI 1.07–1.93, $p = 0.017$) more likely than the control group to have strained adaptation mechanisms and unsatisfactory cardiovascular system reserves. These conditions were observed in 18.3% (95% CI 15.4–21.7) and 13.5% (95% CI 11.2–16.2) of the respondents, respectively. A similar dependence was found for the factor of unsystematic physical activity (OR 1.72; 95% CI 1.20–2.46, $p = 0.003$). It was previously reported that a decrease in motor activity weakens venous and arterial vessels, impairs blood supply, and triggers the development of arterial hypertension and coronary heart disease [15].

Conclusions

1. The risk of developing functional impairment in individuals aged 18–25 years depends on gender, social status, and lifestyle.

2. This study found that young men have a higher relative cardiovascular risk than young women (OR 2.65, 95% CI 2.08–3.61, $p < 0.001$), with 35.2% (95% CI 30.8–39.6) and 17.1% (95% CI 15.1–19.2) of cases, respectively. In addition, working respondents have higher odds of risk occurrence than student respondents, with male and female respondents having 2.8 and 4.7 times higher odds, respectively.

3. This study found that both male and female respondents who smoke cigarettes have 2.1 and 2.6 times higher risk of reduced circulatory system reserve capacity, respectively. In addition, male respondents who consume alcohol have 1.8 times higher risk of reduced circulatory system reserve capacity.

4. Young women who have an irregular diet and low levels of physical activity experience tension in their cardiovascular system's adaptation mechanisms more frequently (1.4 and 1.7 times, respectively).

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