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I.A. Pogonysheva, E.Yu. Shalamova, O.N. Ragozin, D.A. Pogonyshev, V.V. Postnikova

PSYCHOFUNCTIONAL STATE OF MEN OF WORKING AGE IN EXTREME SOCIO-NATURAL CONDITIONS

Погонышева И.А., Шаламова Е.Ю., Рагозин О.Н., Погонышев Д.А., Постникова В.В.

ПСИХОФУНКЦИОНАЛЬНОЕ СОСТОЯНИЕ МУЖЧИН ТРУДОСПОСОБНОГО ВОЗРАСТА В ЭКСТРЕМАЛЬНЫХ СОЦИАЛЬНО-ПРИРОДНЫХ УСЛОВИЯХ

Abstract. This investigation was conducted to study the psychofunctional status of male respondents of working age who are under the combined influence of adverse environment such as socio-natural conditions. According to the results obtained, in groups of men working in a northern region at a security company in aperiodic shift mode, hemodynamic parameters differed depending on seniority: among people with more than 5 years of work experience systolic BP values were higher and there was a strong tendency to higher diastolic and pulse BP. A lower vascular tone was noted among male students of the Northern Medical University, which indicates a lower activity of the sympathetic department of the autonomic nervous system. Their magnitude of systolic blood pressure approached the data of men with greater work experience. According to the results of the WAM methodology (well-being, activity, mood), in all three scales, the psychofunctional status of employees with less work experience was more favorable. Their self-assessment in the scales of well-being and activity differed greately. In comparison with the guards of both groups, students demonstrated a more favorable psychofunctional state in the scales of well-being and mood during the intersessional period. In accordance with the activity indicators, they were inferior to men whose work experience was less than 5 years. As a result, the formation of negative trends in hemodynamics was revealed among men with longer labor experience. It was most pronounced in the indicators of the heart component of blood pressure – systolic blood pressure. In the group of students, the average characteristics of the systolic blood pressure were approaching the data of a group of men with greater work experience. With an increase of work

Аннотация. Проведено исследование с целью изучения психофункционального статуса респондентов мужского пола трудоспособного возраста, находящихся под сочетанным воздействием дискомфортных социально-природных условий. Согласно полученным результатам, в группах мужчин, работающих в северном регионе на охранном предприятии в апериодичном сменном режиме, показатели гемодинамики отличались в зависимости от стажа работы: у лиц со стажем более 5 лет были выше значения систолического АД и прослеживалась выраженная тенденция к более высоким показателям диастолического и пульсового АД. У студентов мужского пола северного медицинского вуза отметили более низкий сосудистый тонус, что говорит о меньшей активности симпатического отдела вегетативной нервной системы, а величины систолического АД приближались к данным мужчин с бо̀льшим стажем работы. Согласно результатам методики САН (*самочувствие*, *активность*, *настроение*), по всем трем шкалам психофункциональный статус сотрудников с меньшим стажем работы был более благоприятным, при этом наиболее отличалась самооценка по шкалам *самочувствие* и *активность*. Студенты в межсессионный период в сравнении с охранниками обеих групп демонстрировали более благоприятное психофункциональное состояние по шкалам *самочувствие* и *настроение*, по показателям *активности* они уступали мужчинам со стажем работы менее 5 лет. Таким образом, у мужчин с более длительным трудовым стажем выявлено формирование негативных тенденций в гемодинамике, наиболее выраженное в показателях сердечного компонента АД – САД. В группе студенческой молодежи средние характеристики САД приближались к данным группы мужчин с бо̀льшим рабочим стажем. С увеличением стажа трудовой занятости самооценка психофункционального статуса снижается, особенно

experience, self-assessment of psychofunctional status is reduced, especially in the scale of well-being. According to the activity scale, students were inferior to men whose work experience was less than 5 years. The results of the study demonstrate stress factors that distinguish the educational process of a northern medical university. Their impact is comparable to the consequences of aperiodic work in shifts with a high level of psychoemotional stress. In the north, these influences are aggravated by complex climatogeophysical conditions.

Keywords: north; psychofunctional status; hemodynamic indicators; well-being; activity; mood; shift work schedule; men; students.

About the authors: Irina A. Pogonysheva, ORCID: 0000-0002-5759-0270, Candidate of Biological Sciences, Docent, Nizhnevartovsk State University, Nizhnevartovsk, Russia, severina.i@bk.ru; Elena Yu. Shalamova, ORCID: 0000-0001-5201-4496, Doctor of Biological Sciences, Docent, Khanty-Mansiysk State Medical Academy, Khanty-Mansiysk, Russia, selenzik@mail.ru; Oleg N. Ragozin, ORCID: 0000-0002-5318-9623, Doctor of Medical Sciences, Full Professor, Khanty-Mansiysk State Medical Academy, Khanty-Mansiysk, Russia; chief scientific officer for the Nizhnevartovsk State University, Nizhnevartovsk, Russia, oragozin@mail.ru; Denis A. Pogonyshev, ORCID: 0000-0001-8815-1556, Candidate of Biological Sciences, Docent, Nizhnevartovsk State University, Nizhnevartovsk, Russia, dapogonyshev@nvsu.ru; Victoria V. Postnikova, ORCID: 0000-0001-7846-7864, Nizhnevartovsk State University, Nizhnevartovsk, Russia, missmadcon@mail.ru

по шкале *самочувствие*. Студенты по показателям шкалы *активность* уступали мужчинам со стажем работы менее 5 лет. Результаты исследования свидетельствуют о присущих образовательному процессу северного медицинского вуза стрессирующих факторах, воздействие которых сопоставимо с последствиями работы в апериодическом сменном режиме с высоким уровнем психоэмоционального напряжения; на севере эти влияния усугубляются сложными климатогеофизическими условиями.

Ключевые слова: север; психофункциональный статус; показатели гемодинамики; самочувствие; активность; настроение; сменный график работы; мужчины; студенты.

Сведения об авторах: Погонышева Ирина Александровна, ORCID: 0000-0002-5759-0270, канд. биол. наук, доцент, Нижневартовский государственный университет, г. Нижневартовск, Россия, severina.i@bk.ru; Шаламова Елена Юрьевна, ORCID: 0000-0001-5201-4496, д-р биол. наук, доцент, Ханты-Мансийская государственная медицинская академия, г. Ханты-Мансийск, Россия, selenzik@mail.ru; Рагозин Олег Николаевич, ORCID: 0000-0002-5318-9623, д-р мед. наук, профессор, Ханты-Мансийская государственная медицинская академия, г. Ханты-Мансийск, Россия; главный научный сотрудник, Нижневартовский государственный университет, г. Нижневартовск, Россия, oragozin@mail.ru; Погонышев Денис Александрович, ORCID: 0000-0001-8815-1556, канд. биол. наук, доцент, Нижневартовский государственный университет, г. Нижневартовск, Россия, dapogonyshev@nvsu.ru; Постникова Виктория Владимировна, ORCID: 0000-0001-7846-7864, Нижневартовский государственный университет, г. Нижневартовск, Россия, missmadcon@mail.ru

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The state of health of the modern population of Russia, who is of working age, gives rise to reasonable concern. This mainly applies to men, since belonging to the male gender is a non-modifiable risk factor for a number of diseases [2; 4]. It is especially important to monitor the psychofunctional state of males who are under the combined influence of uncomfortable natural and climatic conditions and social circumstances, including shift work [7; 14; 17; 18], the specifics of professional activity [9; 10; 12], studying at a higher educational institution [19].

First of all, extreme natural conditions characterize the Far North and equivalent territories, including the Khanty-Mansiysk Autonomous Okrug – Ugra. Men of the northern regions who work in shifts in security activities are faced with difficult natural and social circumstances. Northern higher school students are also under the combined influence of increased demands from the natural, climatic and educational environment. The uncomfortable factors of the natural environment in the north are combined with professional stress for employees of a security company and with the conditions of the educational process at a university for students. Working in extreme conditions requires employees to have certain qualities, including stress resistance [6].

To monitor the psychofunctional status of individuals in difficult natural and social conditions, non-invasive diagnostic methods are the most accessible and convenient, which allow to predict the dynamics of the body's state and design interventions to optimize it [11]. The WAM questionnaire (well-being, activity, and mood) is indicated as an informative psychological method. The indicators of psycho-emotional status: well-being, activity and mood are suggested to reveal the stress resistance [8].

Aim: to study the psychofunctional state of men of working age in the northern region who are under the influence of extreme socio-natural conditions.

Materials and methods: Employees of a security company in Nizhnevartovsk (Khanty-Mansiysk Autonomous Okrug - Ugra) working in an aperiodic shift mode (12 hours day shift / 12 hours night shift / 48 hours rest) were examined. The subjects were divided into two groups depending on their work experience. The first group (group 1, n=30) consisted of workers whose experience in the security industry was less than 5 years (average age 32.3±7.8 years) (hereinafter – M±SD). The second group (group 2, n=32) included employees with experience starting from 5 years (average age 49.8±9.9 years). Anthropometric characteristics of men included in groups 1 and 2 were comparable and were respectively (Me (Q1–Q3)): standing height – 175.0 (172.0–178.0) cm and 170.0 (168.5– 178.0) cm, body weight – 70.0 (64.0–73.0) kg and 74.0 (66.5–77.5) kg, body mass index (BMI) – 22.8 (21.7–24.2) kg/m^2 and 24.0 (22.9–24.9) kg/m^2. Standing height (cm) was determined using a mechanical stadiometer, body weight (kg) was determined using Tanita BC-531 electronic scales. BMI was calculated using the formula: BMI = body weight / standing height^2 (kg/m^2).

The state of the cardiovascular system was assessed by heart rate (HR) (bpm) and blood pressure (BP) characteristics: systolic – SBP, diastolic – DBP, pulse pressure – PP (mmHg). SBP, DBP and heart rate were measured with a tonometer model UA-101. PP was calculated using the formula: PP = SBP – DBP (mmHg).

The psychofunctional status of medical university students from Khanty-Mansi Autonomous Okrug – Yugra (n=35) was also determined (average age 18.74±1.22 years; average height 180.57±6.25 cm; average body weight 73.03±9.40 kg).

The psychofunctional status of the subjects was determined using the WAM (well-being, activity and mood) questionnaire, which includes three corresponding scales [15]. The questionnaire consists of 30 paired statements: one reflects the positive pole of the psychofunctional state, the other – the negative one. The respondent chooses a value that subjectively reflects his

feelings. The maximum severity of the positive pole is 7 points; the negative pole is 1 point. Each scale is formed by 10 pairs of statements; then the sum of points is divided by 10. The average value of the scale is 4 points: values below indicate an unfavorable psychofunctional status of the respondent; higher values – a favorable status. The boundaries of normal scores are defined as 5.0–5.5 points [15].

The study is longitudinal, the sampling method is non-randomized. Statistical processing was made using Statistica 10.0 and Excel 2013. Data are presented as the arithmetic mean (M), median (Me), standard error of the mean (SEM), standard deviation (SD), first (25%) and third (75%) quartiles (Q1–Q3). The Fisher Criterion was used for a comparative analysis of quantitative signs (hemodynamic parameters). The Mann-Whitney U test, the Kolmogorov-Smirnov test and the Wald-Wolfowitz test were used for qualitative characteristics (WAM method indicators). The critical level of significance (p) was taken to be *0.05*; if there were more than 6 zeros after the decimal point, p was designated as <0.0001 [1].

Results. Two groups of men who had different working experience in security structures in the northern region were examined. Objective and subjective criteria have been defined to characterize the influence of extreme natural, climatic and social conditions on the body. An objective indicator of the functional state of the body are indicators of the cardiovascular system; in the northern territories there are risk factors for the formation of arterial hypertension [20]. One of the independent determinants that increases the likelihood of developing cardiovascular diseases can be acute and chronic stress [4, p. 58]. Employment in a security company can be considered as uncomfortable psychosocial circumstances, and if the situation is aggravated by extreme environmental factors, there is a risk of deterioration in the psychofunctional state.

Men's hemodynamic parameters from 2 groups are presented in Table 1. Heart rate values in both groups were comparable and corresponded to normal values. The parameters of the cardiac component of blood pressure – SBP – had statistically significant differences between groups and were higher among respondents in group 2. In no less than half of the men in group 1, SBP parameters corresponded to optimal values [4, p. 58], and no less than 75% – normal values (120-129 mmHg). Among respondents in group 2, no more than 25% had optimal SBP values, and no less than 75% had normal values. High normal SBP (130 mmHg and above) was found in two men from group 1 and seven from group 2.

Table 1

Hemodynamic parameters among men with less than 5 years of experience in security work (group 1, n=30) and more than 5 years (group 2, n=32)

Parameter	Group	M/Me (Q_1–Q_3)	SEM/SD	P
Heart rate, bpm	1	70,5/70,0 (68,0–73,0)	0,7/4,0	0,230
	2	72,2/71,0 (65,0–78,0)	1,2/6,7	
SBP, mmHg	1	115,9/118,0 (110,0–125,0)	1,7/9,5	0,022
	2	122,0/125,0 (120,0–129,0)	1,9/10,8	
DBP, mmHg	1	74,7/75,0 (70,0–80,0)	1,1/6,2	0,058
	2	77,8/78,0 (75,0–84,0)	1,2/6,5	
PP, mmHg	1	41,2/42,0 (36,0–45,0)	1,1/6,1	0,081
	2	44,2/45,0 (40,0–50,0)	1,2/7,1	

Note: P – the Fisher Criterion

A pronounced tendency towards higher indicators among respondents of group 2 was determined according to DBP indicators. In no less than 75% of people in group 1 and 50% of group 2, DBP indicators corresponded to optimal values [4, p. 58]. The normal PP value is about 40 mmHg. An increase in the proportion of people with a decrease in this indicator was noted among men from group 1; in group 2, on the contrary, with a higher value.

As a result, the formation of negative trends in the implementation of hemodynamic function was observed with an increase of work experience. This occurs despite the fact that upon hiring, security guards have a medical examination to determine their medical fitness, as well as ongoing preventive examinations.

At the same time, the differences are least pronounced in the values of heart rate (bpm), and the most pronounced in the values of the cardiac component of blood pressure – SBP (mmHg), where they reach statistical significance (indicators are higher in men of group 2). Based on the vascular component of blood pressure (DBP) and pulse pressure (mmHg), pronounced trends towards higher values were determined in men of group 2.

In male students, hemodynamic parameters were determined by averaging daily measurements obtained during 24-hour monitoring. The average characteristics (M/Me) of heart rate were 76.4/75.6 bpm. (Q1 – 70.4; Q3 –82.1), compared to 70.5/70.0 bpm in men from group 1 and 72.2/71.0 bpm – from group 2. The average characteristics of SBP in students (124.38/122.56 mmHg) were closer to the data of men in group 2 (Q1 –120.0; Q3 – 127.6). The M/Me values of the vascular component (71.83/71.75 mmHg) demonstrated lower vascular tone in students (Q1 – 68.7; Q3 – 74.6), and therefore less activity of the sympathetic division of the autonomic nervous system.

The WAM indicators in men of both groups are presented in Table 2. The parameters of the scales of *well-being*, *activity*, and *mood* are comparable with a favorable psychofunctional state; if it decreases, the ratio in self-esteem on the scales changes. Therefore, a certain decrease in the sum of scores on the *well-being* and *activity* scales relative to the *mood* scale was revealed with the accumulation of fatigue [5]. According to the average characteristics, among respondents in group 1, self-esteem on the three scales of the WAM questionnaire was comparable; in no less than 50% of men, indicators of *activity* and *mood* and in 25% of *well-being* corresponded to the range of normal scores (5.0-5.5 points) [15]. At the same time, at least a quarter of those examined showed indicators below average (4 points). There is evidence that among male students, an overall increase in indicators of *well-being*, *activity*, and *mood* creates stable favorable psychological structures [13, p. 215]. In our study, we can talk about this in relation to employees with little experience in security activities.

In group 2 (Table 2), 50% of men had self-esteem on the *well-being* and *activity* scales below the average value and only approached favorable values on the *mood* scale. A decrease in self-esteem on the scales of the WAM questionnaire is the result of maladaptation caused by various factors, including personal characteristics and health status [16]. Therefore, the psychofunctional state of respondents in group 2 can be assessed as unfavorable.

Table 2

Indicators of the WAM questionnaire among men with less than 5 years of employment in security activities (group 1, n=30) and more than 5 years (group 2, n=32)

Parameter, points	Group	M/Me (Q_1–Q_3)	SEM/SD	P_1	P_2	P_3
Well-being	1	4,7/4,8 (4,6–5,0)	0,1/0,6	<0,0001	<0,001	0,00004
	2	3,7/4,0 (3,1–4,2)	0,1/0,7			
Activity	1	4,7/5,0 (4,6–5,0)	0,1/0,5	<0,0001	<0,001	0,00004
	2	3,9/4,0 (3,5–4,4)	0,1/0,6			
Mood	1	4,8/5,0 (4,8–5,1)	0,1/0,5	0,120	>0,10	0,021
	2	4,7/4,8 (4,4–5,0)	0,1/0,5			

Note: P_1 – the Mann-Whitney U test, P_2 – the Kolmogorov-Smirnov test, P_3 – the Wald-Wolfowitz test

Significant differences were found between the psychofunctional status of respondents in groups 1 and 2 on all three scales: the psychofunctional status of employees with less work experience at a security company was more favorable. At the same time, the differences on the *well-being* and *activity* scales were confirmed by three applied tests, and on the *mood* scale – by the Wald-Wolfowitz test that takes into account any differences between the samples. That is, the self-assessment of *well-being* and *activity* was more different. High values on the *well-being* scale suggest a feeling of bodily vigor and comfort, low values, on the contrary, indicate malaise. The *activity* scale characterizes personal orientation; the *mood* characterizes the emotional response to the current situation [8].

Among medical university students, the WAM questionnaire was used during the intersession period, since exam stress leads to a decrease in their results [3]. According to the recommendations for interpreting the results of the WAM methodology, the average characteristics (M/Me) of indicators in the group of students demonstrated a favorable psychofunctional state, in comparison with men in group 1, on the *well-being* scales (5.4/5.3 points) (Q1 – 5, 0; Q3 – 6.2 points) and *mood* (5.3/5.3 points) (Q1 – 4.6; Q3 – 6.2 points). At the same time, the *activity* scale indicators revealed a less favorable state (4.5/4.2 points) (Q1 – 3.8; Q3 – 5.2 points).

Conclusion. It is generally accepted that indicators of the cardiovascular system and their dynamics objectively reflect the functional state of the body, including in the conditions of northern territories. Male respondents living in the northern region with different length of employment experience in security activities were surveyed. Moreover, according to the results of medical examination, they are recognized as medically-fit for this job. In general, no less than 75% of men in both groups have optimal/normal blood pressure levels. However, the formation of negative trends in the hemodynamic function was revealed in the group with a long work experience that is manifested as an increase of blood pressure indicators. To the greatest extent, intergroup differences affect the value of systolic blood pressure. At the same time, in the group of male students the

average characteristics of the cardiac component of blood pressure are close to the data of the group of men with a long work experience. Though it would seem that the factors of the educational process in higher education should have less extreme features and be insufficient for a shifting nature of employment.

In order to study and assess the state of the human body in complex, diverse conditions, and its dynamics, informative non-invasive diagnostic methods are to be used. They may include the WAM questionnaire (well-being, activity and mood). Our study found out that with an increase in the length of employment in men, there is a decrease in subjective self-esteem on all scales, especially on the *well-being* scale, which characterizes the state of bodily and psychological comfort. The students demonstrated a more favorable psychofunctional status than men with different security experience on the *well-being* and *mood* scales, while in terms of *activity* they were inferior to men with less than 5 years of work experience.

Thus, we can denote the presence of stressful components that provoke a decrease in psychofunctional status in the educational process in a northern medical university. The effects of the components are comparable to the consequences of working in an aperiodic shift mode with a high level of psycho-emotional stress aggravated by the natural and climatic factors of the northern region.

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