

THE IMPACT OF WEATHER AND CLIMATIC CONDITIONS ON THE DENTAL HEALTH OF MILITARY PERSONNEL

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<https://doi.org/10.51847/JBHRQIFjR>

ABSTRACT

The study is devoted to studying the dental status of military doctors while adapting to extreme weather and climatic conditions and strenuous official activities in the Donetsk People's Republic. The dental status of military personnel has been studied. The content of mineral substances in the blood serum of 20 servicemen who arrived on a business trip from the country's central region was determined. They were previously sanitized in their places of residence. The individuals in this group were monitored from the second to the third day of acclimatization during the hottest period of the year - July. Their nature of work was carried out in an open area in conditions of irregular working hours and increased psycho-emotional stress. The repeated examination of the military personnel was carried out after 20 days. Against the background of a violation of the electrolyte balance of the body, the phenomena of demineralization of hard dental tissues increased, the pH and volume of saliva secreted, and its mineralizing potential decreased. According to electroodontodiagnostics, the sensitivity of intact central incisors did not significantly change. The data obtained indicated a decrease in the caries resistance of military personnel.

Key words: Military personnel, Extreme conditions, Adaptation, Dental health.

Introduction

According to the World Health Organization, more than 98% of the adult population is susceptible to dental caries [1, 2]. In military personnel, the prevalence of this pathology has no significant differences and is 94.7% on average [3, 4]. In addition, recently there has been a positive trend in the growth of the prevalence and intensity of the carious process, the dominance of non-sanitized foci of odontogenic infection against the background of poor oral hygiene [5, 6].

Dental caries is one of the most common diseases in the world [7]. Dental caries is a polyetiological disease [8, 9]. The main factors in the development of caries are plaque microorganisms, the nature and diet, the amount and quality of salivation, extreme effects on the body, and the general condition of the body [10-12]. As internal factors contribute to the development of dental caries, it is necessary to consider the state of the oral fluid, the presence of chronic systemic diseases, and the level of resistance of the body [13-15]. External factors are nutrition, socio-economic, and behavioral factors [16-18].

World practice has proven that the introduction of prevention programs leads to a sharp decrease in caries, prevention of the development of foci of odontogenic infection, and early tooth loss [19, 20]. The cost of preventive measures is up to 20 times lower than the cost of

treating existing dental diseases [21]. Over the past three decades, the results of the prevention of dental caries indicate its decline in many regions of the world in all age groups [22].

The effectiveness of methods of population and individual prevention when using fluoride preparations has been proven [23, 24]. Fluoride ions contribute to the formation of fluorapatite in enamel but in the presence of calcium and phosphate ions, which affects the process of enamel demineralization [25]. However, the most important thing is to conduct research on the prevention of caries in the early stages through non-invasive intervention to ensure the remineralization of foci [26]. This may be an important step in the treatment of this disease.

Dental diseases in military personnel of law enforcement agencies and the processes caused by them reduce the combat capability and working capacity of personnel, leading to the appearance and development of diseases of internal organs and systems that affect the general condition of the body [27]. The prevalence and course of pathological processes of the dental system are significantly influenced by the specific living conditions and combat activities of military personnel, which requires appropriate methods of prevention and treatment [28].

At the same time, the conditions of professional activity of military personnel affecting the incidence of dental caries of hard tissues have not been studied in depth enough to date [29, 30]. Of particular interest is also the study of caries prevention measures based on nutrition optimization [15, 20]. The combination of the above mentioned problems has determined the relevance of this study.

The purpose of the study: clinical and laboratory assessment of risk factors for the development of dental caries in military personnel.

Materials and Methods

The object of surveillance was military personnel who arrived on a business trip from the central region of Russia to the Donetsk People's Republic aged 23 to 25 years. They were monitored from the second to the third day of acclimatization during the hottest period of the year (July). It was found that the body is affected by a whole range of adverse factors [31-38]: weather and climatic conditions, insufficient intake of fluoride from drinking water, and factors of professional activity (physical, psycho-emotional stress, irregular working hours, etc.) [39-41]. Among the main reasons for non-compliance with the regulatory requirements of drinking water quality are the increased content of calcium and magnesium salts (total hardness), nitrogen-containing compounds, arsenic, and low content of fluorine, and iodine [42-44].

Significant concentrations of arsenic are detected in the waters of various regions of the Donetsk People's Republic [45, 46]. More than 200 thousand people consume water with a high iron content in the republic [47].

It should be noted that the territory of the Donetsk People's Republic is a biogeochemical province, where a natural area of risk to public health has naturally developed [48-51].

The servicemen carried out their work in an open area in conditions of irregular working hours and increased psycho-emotional tension. They were housed in military camps, and ate in an organized manner in the conditions of a field kitchen; when working outside the territory of permanent deployment, they used an individual diet for food [52, 53].

The work uses hygienic, clinical laboratory, sanitary and chemical, instrumental, radiological, computational, and statistical research methods. The research was conducted

based on organized military collectives in the Donetsk People's Republic. An assessment of the working conditions of military personnel according to the degree of harmfulness and danger was carried out. According to the data obtained from the hydrometeorological center of the republic, the weather and climatic conditions were assessed.

To objectively study the caries resistance of military personnel, an assessment of the content of minerals in the blood serum of persons who arrived at military training (potassium, sodium, chlorine, phosphorus, calcium, magnesium) was carried out. The research was conducted using standard methods;

- measurement of the vital activity of the pulp by an electroodontodiagnostic device [54];
- conducting an enamel resistance test to the action of a standard 0.1% acid solution followed by staining with 1% methylene blue [55];
- determination of the acid-silk balance of saliva (pH) using indicator strips (RochDiagnostics Switzerland);
- determination of salivation rate by saliva collection technique for 10-15 minutes without additional stimulation;
- determination of the mineral-forming composition of saliva using a complex of automated microscopy with a telemedicine function for hematological, cytological, and histological studies "Mekos-C2" with an increase of 4×10 [56].

Statistical data processing was carried out using the Statistica program. Statistical data analysis was performed for dependent (Wilcoxon criterion) samples.

Results and Discussion

The study involved 81 servicemen who arrived in the Donetsk People's Republic in 2023. The average age of men was 28.4 ± 0.55 years.

According to the assessment of climatic conditions, the average daytime temperature in the open area on some days reached 27.4°C , and the maximum was 30.0°C . The relative humidity of the air exceeded the limits of the norm ($77.3 \pm 2.6\%$), reaching 80.0-100.0%. The minimum wind speed was 2.0 m/s, the maximum was 7.0 m/s (4.3 ± 0.3 m/s). An assessment of the content of electrolytes and trace elements [57] in the blood serum of persons who arrived on a business trip in a hot, humid climate showed that they were within the reference boundaries (**Table 1**).

Table 1. Comparative indicators characterizing the dynamics of the levels of electrolytes and trace elements in the blood serum of the examined persons, $M \pm m$

№	Mineral substance	Reference limits, mmol/l	Observation period	
			Initial data	After 21 days
1	Potassium	3.5-5.1	4.01 ± 0.14	$3.56 \pm 0.15, p=0.0038$

2	Sodium	136-146	135.2±0.62	128.5±1.33, p=0.003
3	Chlorine	97-107	102.2±0.95	100.0±1.17, p=0.00384
4	Calcium	2.15-2.57	2.13±0.06	2.04±0.06, p=0.106
5	Phosphorus	0.87-1.45	0.93±0.03	1.16±0.08, p=0.0104
6	Magnesium	0.80-1.00	0.92±0.02	0.95±0.05, p=0.22

However, after 20 days of acclimatization, a significant decrease in the content of potassium and sodium was determined: on average - by 11.2% and 5.0%, respectively. At the same time, the sodium level was below the normal limits. Chlorine levels decreased in 80.0% of individuals by an average of 2.2% [58-64]. According to individual indicators, 46.7% of the studied individuals had reduced potassium levels, and 13.3% had chlorine levels. Sodium levels were below normal in all military personnel. This indicated a violation of the body's water-electrolyte balance [65-68]. The calcium level did not significantly change, but

it decreased in the majority of the examined individuals. Initially, it was below the norm at 53.3%, by the end of the follow-up it was at 66.7%. The phosphorus level, on the contrary, increased within the reference boundaries, which was noted in 86.7% of individuals [69-79]. Only the magnesium level remained within the same limits. This is directly related to changes in mineral metabolism in the oral cavity and a decrease in caries resistance of hard dental tissues [80-83], as shown in the studies presented below (**Figure 1**).

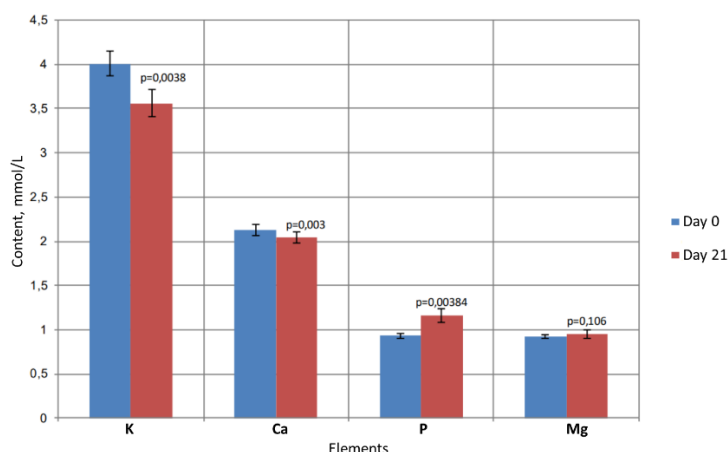


Figure 1. Dynamics of potassium, calcium, phosphorus, and magnesium content during adaptation to extreme conditions

When assessing the dynamics of resistance indicators of oral fluid and enamel, it was determined that at the time of arrival of the subjects in the Donetsk People's Republic, the pH of saliva was slightly alkaline. After 20 days, the acid-base balance shifted to the acidic side (**Table 2**). At the same time, such a saliva reaction was noted in 86.7% of the examined individuals. Of these, 20.0% had a pH below 6.5 units. (average norm): up to 6.2 units. In the initial state, 53.3% had a score of up to 3 points, which indicated a significant resistance of the enamel to caries; The remaining individuals represented a risk group for caries (**Figure 2**) [8, 9, 23, 84]. By the end of the follow-up, all 100.0% of individuals

according to this indicator belonged to the risk group for caries, where the indicator of the enamel resistance test was more than 5 points. According to the average data, the mineralizing potential of saliva in the initial state was assessed as satisfactory (**Figure 3a**). In the dynamics of observation, a significant decrease in the mineralizing function of saliva towards demineralization was noted (**Figure 3b**) [24, 29, 30]. The rate of salivation also significantly decreased – by 5.5%; This was found in 86.7% of individuals. The data of electrodiagnostics and radiography have not changed significantly [85-95].

Table 2. Indicators characterizing the caries resistance of individuals, M ± m

№	Indicators	Reference limits	Observation period	
			Initial data	Initial data
1	Saliva pH	6.8-7.4 units.	7.25±0.08	6.66±0.08, p=0.0022
2	Saliva's mineralizing potential	1-5 points	2.8±0.2	2.6±0.18, p=0.0014
3	Enamel resistance test	1-10 points	3.4±0.22	5.1±0.17, p=0.0017

4	Salivation rate	18-111.0 ml/h	25.32±1.14	23.92±1.36, p=0.0007
5	Electrodontodiagnostics of intact central incisors of the upper jaw	2-6 μ A	4.88±0.14	5.17±0.12, p=0.47

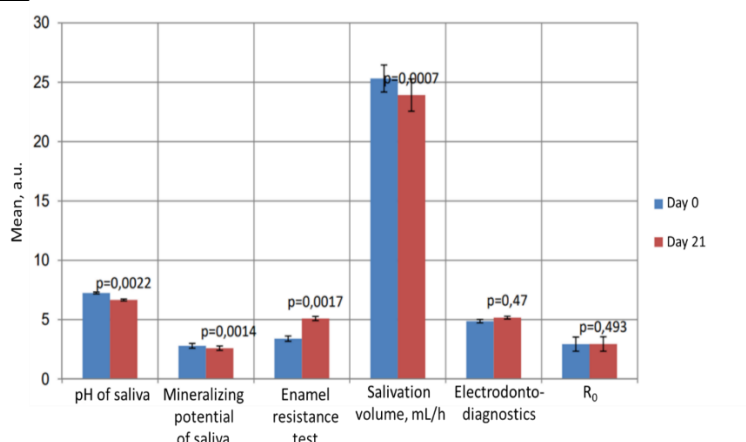
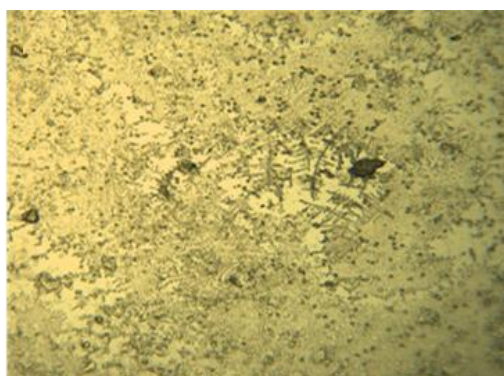
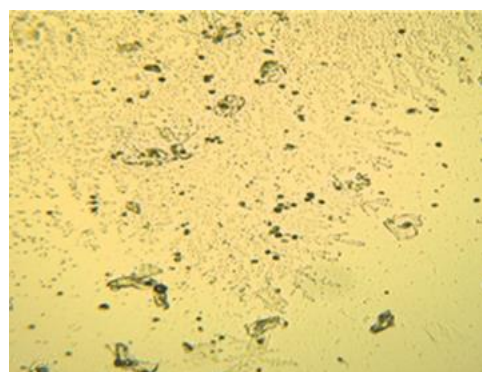


Figure 2. Dynamics of indicators of resistance of oral fluid and enamel



a)



b)

Figure 3. Photo (saliva mineralizing potential) in its initial state before arrival in the Donetsk People's Republic (a) and after 21 days of service (b)

Conclusion

Thus, as the results of the study showed:

1. Weather, climatic, and social factors affect the human body in a fairly short time (20 days after the change of location).
2. The Donetsk People's Republic is a biogeochemical province, which must be taken into account when temporarily residing in this territory.

Staying in this area is accompanied by a violation of the electrolyte balance of the body and a decrease in the mineralizing potential of saliva, which puts this category of employees at risk for the development of dental caries.

Acknowledgments: None

Conflict of interest: None

Financial support: None

Ethics statement: The military personnel under study were explained the goals and objectives of the study, after which

they gave written consent. The study was approved by the Ethic Committee of the institution (Protocol #3 Dated by August 3 2023).

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