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IMPACT OF WAR STRESS ON ORAL HEALTH

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Abstract

War conditions have a significant influence on the increased prevalence and severity of oral diseases for professional soldiers (military personnel). This study underscores the multifaceted impact of war on oral health, revealing a notable prevalence of periodontal problems, and varying rates of dental caries across affected populations. War conditions have a significant influence on the increased prevalence and severity of oral diseases for professional soldiers and internally displaced people.

Aim. The research aims to determine the relationship between stress and oral health in individuals exposed to chronic stress in wartime.

Materials and methods. The study was conducted on 68 professional soldiers in the Ukraine Army and 42 internally displaced persons. The control group consisted of 39 patients. The study was based on clinical examination and on a questionnaire.

Results. Significant differences between the war and peacetime groups according to the daily brushing frequency and diet were found. War group soldiers had significantly poorer oral health than in civilians. According to plaque index, among the military only 7.1% have good oral hygiene (plaque index 0.0), 53.6% was have fair oral hygiene (plaque index 0.1-1.9) and 39.3% have bad oral hygiene (plaque index 2.0-3.0).

Conclusion. Participation in war and time spent in battle fields have had a significant influence on increased prevalence and severity of periodontal disease, decay and diet.

Keywords: War, stress, oral health, military personnel, internally displaced people.

Introduction

Oral health plays a vital role in the physical, mental, social, and economic well-being of individuals and populations. The oral cavity and its surrounding structures are essential parts of the human body, integral to its daily functioning and contributing substantially to the overall well-being of individuals. The oral cavity also is the main conduit of human interaction with society. Humans use it to verbally communicate with others, to take in nutrients and participate in communal eating, and to convey emotion. The appearance of an individual's teeth and surrounding structures greatly influences how others perceive them and how they perceive themselves. This perception has an impact on an individual's ability to work, contributes to one's social status, and can affect a person's socioeconomic position in society [1, 2].

The main diseases associated with stress are caries, periodontitis, bruxism, burning mouth syndrome, xerostomia, cold sores, stomatitis [3]. Oral diseases can cause impaired duty performance, restricted activity, poor diet, difficulty pronouncing words, inability to sleep, and excruciating pain.

Bruxism leads to different oral problems, including muscle pain, hypersensitivity of teeth, enamel cracks, and pathological abrasion of tooth crowns, which is not associated with

the physiological process of chewing food. Individuals with bruxism develop a force of clenching teeth 4 times greater than usual, associated with violating proprioceptive sensitivity [4]. Anxiety and psycho-social factors play a leading role in the development of bruxism, which is the body's response to psychological stress [5]. Some authors suggest that the occlusion of the masticatory system plays a significant role in a person's capacity to cope with stress, which aids in psychological relief [6].

The most prevalent and consequential oral diseases globally are dental caries, periodontal disease and subsequent tooth loss.

Dental caries, otherwise known as tooth decay, is the most common, chronic, noncommunicable, preventable oral disease worldwide. Dental caries form through a complex interaction over time between acid-producing bacteria and fermentable carbohydrates and many host factors, such as teeth and saliva [7].

The primary factor is the breakdown of simple carbohydrates, such as sucrose, by oral microorganisms, notably streptococci and lactobacilli. It is a highly prevalent chronic disease globally, affecting individuals of all ages throughout their lifetime [8].

Periodontitis is a chronic inflammatory disease associated with dysbiotic biofilm in the subgingival environment of teeth. Periodontal diseases can be defined as multifactorial infectious diseases. The main etiological factor for the occurrence of periodontal disease is plaque accumulation [9]. Neglect of oral hygiene is common in stressful operational environments. Failure to properly remove plaque from the teeth and gums for a week or more usually results in the development of gingivitis in response to bacteria.

Among the numerous etiological factors of caries and periodontitis the key is stress, which is of a chronic nature. Stress-induced disorders of neuro-humoral regulation become specific triggers in relation to the development of caries.

In February 2022 the russian federation started a new invasion of Ukraine as an escalation of the ongoing war since 2014. The World Health Organisation (WHO) estimates that the majority of Ukraine's population may be experiencing distress caused by war.

According to the WHO representative in Ukraine, Jarno Habicht, for the BBC said: “Stress can manifest with different symptoms. Some feel sadness, some feel anxiety, some have difficulties with sleep, and others feel fatigue. Some are getting angrier. Some people have unexplained somatic syndromes, be it just pain or feeling bad".

Survey report provided evidence of war effects on the mental health of the Ukrainian population as of March 2022, when researchers reported that 53 % of Ukrainian adults experienced severe mental distress, 54 % anxiety, and 47 % depression [10, 11].

The aim of the study was to determine the relationship between stress and oral health in individuals exposed to chronic stress in wartime.

Methodology

Data source

The present study is a cross-sectional study. The study was conducted at the Department of Dental Therapy I. Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine. The study was conducted on 68 professional soldiers in the Ukraine Army and 42 internally displaced persons. The control group consisted of 39 patients of the dental department and students Faculty of Dentistry Ternopil National Medical University. All participants of the study filled in a Consent Form for participation in the study. The study was based on clinical examination and on a questionnaire.

The inclusion criteria are - patient's servicemen of the Armed Forces of Ukraine, internally displaced persons, patients of the dental department

The criteria for exclusion: patients who exhibit any systemic disease that might have hindered periodontal clinical examination.

A developed questionnaire was used to collect socio-demographic information (age, gender, military rank, place of residence). All patients in the study and control groups agreed to participate and signed informed consent. All participants completed a self-administered medical and sociodemographic written questionnaire concerning past medical history, medications, allergies, and smoking habits.

Patients Examination

All patients underwent a thorough evaluation, including a full-mouth periodontal chart, occlusal analysis, and radiological examinations employing panoramic radiograph and/or a complete set of periapical radiographs.

Intraoral Examination

The following variables were assessed:

– dental caries was assessed by recording the caries index (number of decayed, missing and filled teeth). The score is the sum of carious, absent, and obturated teeth. The third molars were not considered in the count;

– intraoral hard and soft tissue pathologies.

Periodontal diagnostics

Oral hygiene was evaluated by examining the dental plaque present on the inner and outer aspects of the six index teeth, using the criteria of the plaque index of Silness and Löe.

Table 1 shows the criteria used for plaque index according to Silness-Löe.

Table 1.

Criteria used for plaque index (PI)

Score	Criteria
0	No plaque
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface
2	Moderate accumulation of soft deposit s within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye
3	Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin

The depth of the periodontal pockets was measured on 6 locations around each tooth. Each sextant was designed as: CPI code 0 - healthy, CPI score 1 - bleeding on probing, CPI score 2 - the presence of calculus, CPI score 3 - the depth of periodontal pockets 4-5 mm, and CPI score 4 - depth of periodontal pockets of 6 mm and more. In each sextant only the highest value for each sextant was scored and recorded [12].

Since it was a cross-sectional study, all clinical outcomes were recorded upon acceptance to the office- during the first appointment.

Ethical considerations

The participants all agreed to the use of the information collected for the purposes of this study. The Bioethics Committee of I. Horbachevsky Ternopil National Medical University Ministry of Health of Ukraine approved the study protocols. All the patient investigations conformed to the principles outlined in the Council of Europe Convention on Human Rights and Biomedicine (April 4, 1997), the World Health Association Helsinki Declaration on Ethical Principles for Scientific Research with Human Participation (1964–2000), and the Order of the Ministry of Health of Ukraine No. 281 of November 1, 2000; Declaration of Helsinki “World Medical Association Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects” (2001), Code of Scientist of Ukraine (2009). Doctors informed every patient about the study’s purposes. Patients signed their “consent of the patient”.

Statistical Analysis

The statistical analyses were performed using SPSS 20.0 statistical analysis software. Data collected were stored in Microsoft Excel format.

The measurements of the categorical variables are presented as counts (i.e., absolute frequencies) in each of the categories and as percentages of all the counts in the whole relevant set of categories (i.e., relative frequencies).

The variables were expressed as the mean ± standard deviation (SD) for continuous data, and numbers (%) for categorical data. In addition, comparisons were made between all groups.

Results

General characteristics of the sample

A total of 56 Ukraine military personnel were examined. There was a big disproportion in the number of male 96.42% and female 3.58% participants. Among the internally displaced people female 30.95% and male – 69.05%. The average age of the participants (military personnel) was 35.2 ± 8.46 years. The majority of participants aged 25-34 years (44.6%). The average age of the participants (Internally displaced people) was 43.4 ± 8.46 years. The general characteristics of the sample are presented in Table 2.

The proportion of participants consuming alcohol was 30.95% in group internally displaced people, 15.4% - control group versus 0% military personnel. However, the majority of the military personnel (52) (92.9%) were smokers.

Table 2.

General characteristics of the sample.

Characteristics/Variable	Military personnel, n=56	Internally displaced people, n=42	Control group, n=39
Gender			
Women	2 (3.58%)	13 (30.95%)	15 (38.46%)
Men	54 (96.42)	29 (69.05%)	24 (61.54%)
Age category (years)			
≤ 24	3 (5.4%)	1 (2.4%)	3 (7.7%)
25 – 34	25 (44.6%)	8 (19.9%)	12 (30.8%)
35 – 44	15 (26.8%)	24 (57.2%)	19(48.7%)
45 – 64	13 (23.2%)	9 (21.5%)	5 (12.8%)
Smoking (active cigarette smoker)			
Nonsmoking	4 (7.1%)	22 (52.4%)	34 (87.2%)
Smoker	52 (92.9%)	10 (476%)	5 (12.8%)
Alcohol consumption	0	13 (30.95%)	6 (15.4%)
Frequency of teeth brushing			
< once a day	29 (51.8%)	2 (4.8%)	0
once a day	27 (48.2%)	12 (28.6%)	1 (2.6%)
twice a day	0	26 (61.8%)	29 (74.4%)
> twice a day	0	2 (4.8%)	9 (23.0%)

The state of the teeth або condition of teeth

Analysis showed that military professionals was significantly associated with number of decayed teeth only among adults aged 35-44 years and 45-54 years. Adults aged 35-44 years had 29% more decayed teeth than civilian adults in the same age group, and between adults aged 45-54 years the difference between groups was 35%.

Oral hygiene behavior and status

Significant differences between the war and civilians groups to the daily brushing frequency. More soldiers in the war group brushed their teeth infrequently, the majority of

them less then once a day (51.8%), while the majority in the control group brushed twice a day (74.4%) (Fig.1).

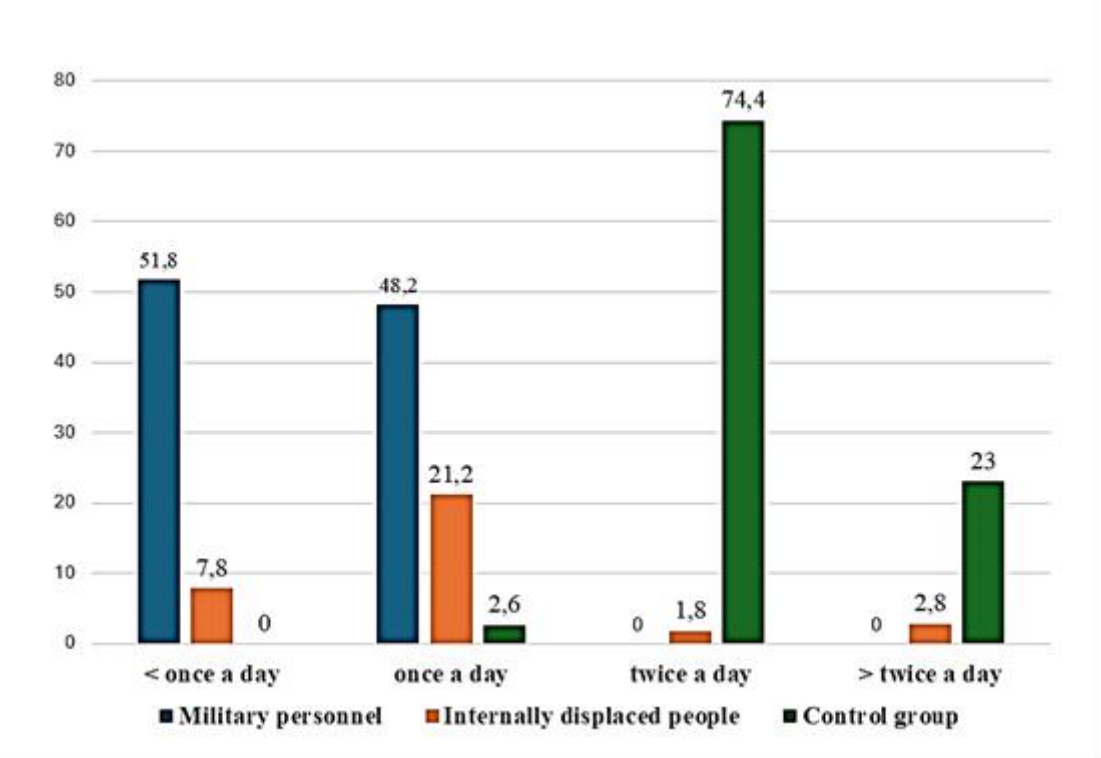

Figure 1. Frequency of teeth brushing.

Oral health status

Among the Military personnel examined 75.0% had gingivitis, internally displaced people 21.4%, in the control group respectively 7.7%. War group soldiers had significantly poorer oral health than in civilians.

According to plaque index, among the military only 7.1% have good oral hygiene (plaque index 0.0), 53.6 % was have fair oral hygiene (plaque index 0.1-1.9) and 39.3 % have bad oral hygiene (plaque index 2.0–3.0) (Fig.2).

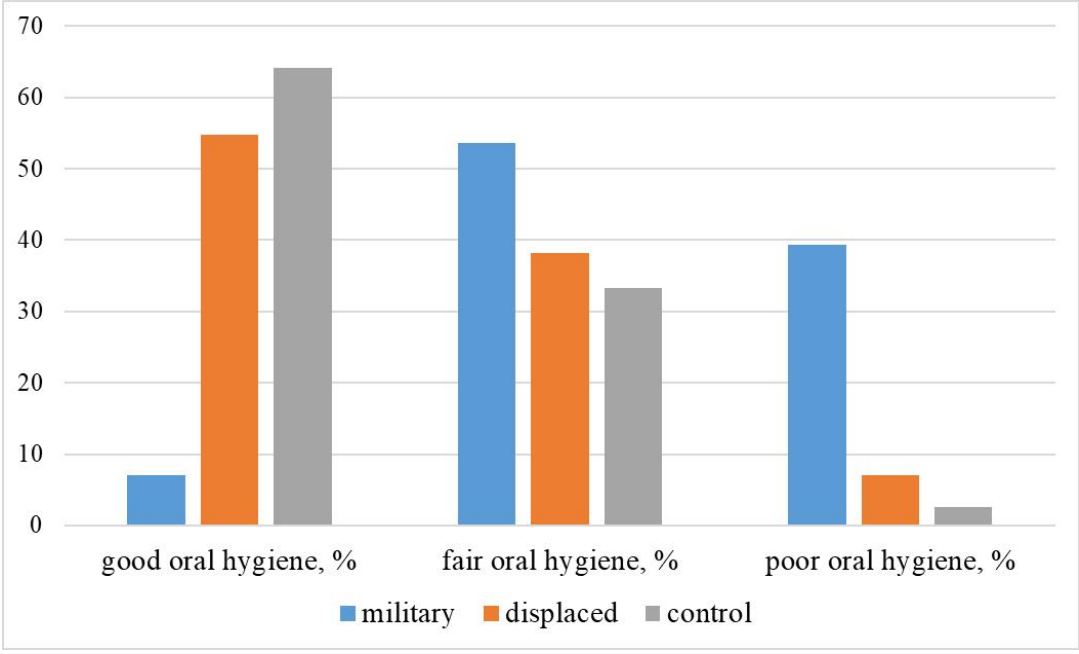

Figure 2. Oral hygiene level of different group of examined patients.

The presence of periodontal pockets (scores 3 and 4) was detected in very high percentage of tested subjects (41.07% military). Calculus was present equally in all patient groups, but significantly more civilians women had a completely healthy periodontium compared to men (26.9% vs 2.4%, respectively), as well as gingival inflammation (8.3% vs 11.5%, respectively).

Significant differences between the war and peacetime groups according to the daily brushing frequency and diet were found.

More soldiers in the war group brushed their teeth infrequently, the majority of them less then once a day (55%), while the majority in the control group brushed more then once a day (58%; $p<0.001$). Meals were less frequent (on average twice a day) and canned food was mainly eaten by the war group, while in the civilians groups food was mainly cooked and consumed three-times a day.

Discussion

When a person is stressed, the dental hygiene may suffer [13]. War conditions, time spent in combat, stress, altered dietary and oral hygiene practices, and the battlefield environment influenced soldiers' oral health.

Cortisol secretion, which is regulated by the brain, is a key mediator of the link between stress and well-being. Cortisol is released in response to negative feedback during a situation perceived as stressful, via the hypothalamic-pituitary-adrenal (HPA) axis [14]. Chronic stress is among the numerous etiological factors of caries and periodontitis in military personnel and internally displaced people.

Patients included in our study had a high percentage of carious teeth. Caries and generalized periodontitis have great social significance among the population worldwide. Their social burden is manifested in significant global costs for health care. Most patients with stress, anxiety during wartime have poor oral hygiene and periodontal disease. With prolonged emotions, the persistent narrowing of blood vessels can alter the supply of oxygen and nutrients to tissues [15].

Military personnel are generally deployed for fighting operations, which exposes them to stress, fatigue, excessive consumption of tobacco and/or alcohol, less body and oral hygiene time. All of these factors contribute to increase susceptibility of military personnel for oral diseases. Soldiers are at higher risk of developing dental problems than the civilian population. This is due to the constant exposure to psychological, physiological, and environmental stressors during their duty [16].

The lack of consistent daily living and working environments, along with complicated work schedules for military personnel, frequently results in inconsistent eating habits, sleep issues, and increased stress levels. Although they are trained to deal with such conditions, they are not immune to work stress-induced behavioral changes [17].

The main psychologically traumatic factors of combat operations are the following events: heavy and prolonged fighting; serious bodily injuries and wounds; death of comrades under enemy fire; suicides and murders; significant destruction and natural disasters causing suffering to the civilian population; death of civilians as a result of military operations [18].

Since oral health is closely related to behavioral factors, these changes can negatively affect the condition of teeth and gums. Occupational stress influence the risk of developing periodontal disease. Elevated stress levels results in decreased saliva production and more significant plaque accumulation. In response to emotional stress, the quantity and quality of saliva are disturbed, its chemical composition changes, and the secretion of Ig A is disturbed. Stress has an immune impact on the oral mucosa and periodontal tissues.

We found that periodontitis was more severe among military patients than patients internally displaced and the control group.

Considering that the military environment causes work and combat stress, depression in military personnel, they are therefore at high risk of tobacco use [14]. Smoking is perceived as a stress reliever, a sedative, and a mood enhancer. The prevalence of periodontitis is generally higher among smokers than among non-smokers, probably due to a deficiency in the local immune system. Circulating nicotine leads to vasoconstriction caused by the release of adrenaline and noradrenaline, which is thought to lead to a lack of nutrients for periodontal

tissues [18]. Smokers are at higher risk for periodontal disease than non-smokers, despite the effects of chronic stress. Studies have shown negative impacts of smoking on the metabolism of vitamin C, and recent research has verified that serum vitamin C levels are decreased in e-cigarette users compared to non-smokers [19]. Vitamin C is essential for the formation of dentin, pulp, cementum, periodontal fibers, blood vessels, gingival nerves, connective tissues, and periodontal ligaments. Throughout life, Vitamin C remains important for the regeneration of bone, teeth, and connective tissue [20].

Stress can affect the healing of oral wounds and influence the treatment of different oral conditions, like periodontitis, due to its effects on inflammatory and immune responses [21]. The clinical management of inflammatory periodontal diseases may benefit from exploring these relationships, mainly when the severity of the disease cannot be explained by established etiological factors and when there is no response to periodontal treatment or when there is a sudden, marked, and increased periodontal destruction [22].

Conclusions

This study underscores the multifaceted impact of war on oral health, revealing a notable prevalence of periodontal problems, and varying rates of dental caries across affected populations. War conditions have a significant influence on the increased prevalence and severity of oral diseases for professional soldiers (military personnel).

Our study described the oral health status of a sample composed especially by pacients Armed Forces of Ukraine, internally displaced persons, patients of the dental department and students of Dentistry Faculty. Participation in war and time spent in battle fields have had a significant influence on increased prevalence and severity of periodontal disease and decay, as well as changes in dental behaviour and diet.

In this study, the individuals with anxiety had the poorest oral health of all studied patients; some needed immediate treatment.

This study determined that the reasons behind a person's periodontal status are specifically related to three distinct characteristics:

- neglected oral hygiene;
- decreased natural immunity;
- smoking habits, as tobacco alters the immune response, which may lead to periodontitis.

Limitations

The war in Ukraine and the participation of soldiers in hostilities, prevents a sufficient sample size.

Research prospects

Incorporating mental health evaluations within dental practices by utilizing a questionnaire for screenings to pinpoint patients susceptible to periodontal disease as a result of elevated stress levels, thereby facilitating proactive and thorough care. Forthcoming studies might offer greater insight into the intricate relationship between chronic stress and periodontal disease, indicating enhanced strategies for treatment and prevention.

Author Contributions

SB: Conceptualization**,** Investigation, Data collection and analysis, Writing-review & editing; NCh: Validation, Writing-review & editing, Supervision; ML: Validation, Writing-review & editing, Supervision; LP: Investigation, Data collection and Formal analysis, Writing-review & editing; KhP: Investigation, Data collection and Formal analysis, Writing-review & editing; NM: Conceptualization, Investigation, Writing-original draft; MZ: Writing-review & editing, Supervision; All authors have read and agreed to the published version of the manuscript**.**

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Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data availability

The datasets for this study can be found in the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no competing interest. Або We declare no conflict of interests of any researchers who contributed to the study.

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References

1. Committee on an Oral Health Initiative. Advancing oral health in America. National Academies Press; 2012 Jan 5.
2. Peres MA, Macpherson LM, Weyant RJ, Daly B, Venturelli R, Mathur MR, Listl S, Celeste RK, Guarnizo-Herreño CC, Kearns C, Benzian H. Oral diseases: a global public health challenge. The Lancet. 2019 Jul 20;394(10194):249-60. https://doi.org/10.1016/S0140-6736(19)31146-8
3. Boitsaniuk SI, Levkiv MO, Fedoniuk LY, Kuzniak NB, Bambuliak AV. Acute herpetic stomatitis: clinical manifestations, diagnostics and treatment strategies. Wiad Lek. 2022 Jan 1;75(1 pt 2):318-23. https://doi.org/10.36740/WLek202201229
4. Domagała I, Przystupa K, Firlej M, Pieniak D, Gil L, Borucka A, Naworol I, Biedziak B, Levkiv M. Analysis of the statistical comparability of the hardness and wear of polymeric materials for orthodontic applications. Materials. 2021 May 28;14(11):2925. https://doi.org/10.3390/ma14112925
5. Stetsyk AO, Jero NI. BRUXISM: CAUSES, DIAGNOSTIC METHODS AND TREATMENT. Молодий вчений. 2016:336.
6. Slavicek R, Sato S. Bruxism-a function of the masticatory organ to cope with stress. Wiener Medizinische Wochenschrift (1946). 2004 Dec 1;154(23-24):584-9 https://doi.org/10.1007/s10354-004-0129-1
7. Tsai KZ, Tsai SC, Lin KH, Chang YC, Lin YP, Lin GM. Associations of decayed teeth and localized periodontitis with mental stress in young adults: CHIEF oral health study. Sci Rep. 2022;12(1):19139. Published 2022 Nov 9. https://doi.org/10.1038/s41598-022-23958-4
8. Selwitz RH, Ismail AI, Pitts NB. Dental caries. Lancet. 2007;369(9555):51-59. https://doi.org/10.1016/S0140-6736(07)60031-2
9. Denefil O, Chorniy S, Boitsaniuk S, Manashchuk N, Chornij N, Levkiv M, Tverdokhlib N, Loza K. Analysis of microbiocenosis of a gingival sulcus and periodontal pockets of patients with periodontal diseases associated with systemic pathology. Exploration of Medicine. 2023 Dec 11;4(6):942-55. https://doi.org/10.37349/emed.2023.00186
10. Wisén N. Stress in military settings. Karolinska Institutet (Sweden); 2023.
11. Xu W, Pavlova I, Chen X, Petrytsa P, Graf-Vlachy L, Zhang SX. Mental health symptoms and coping strategies among Ukrainians during the Russia-Ukraine war in

March 2022. Int J Soc Psychiatry. 2023;69(4):957-966. https://doi.org/10.1177/00207640221143919

12. Lushchak O, Velykodna M, Bolman S, Strilbytska O, Berezovskyi V, Storey KB. Prevalence of stress, anxiety, and symptoms of post-traumatic stress disorder among Ukrainians after the first year of Russian invasion: a nationwide cross-sectional study. Lancet Reg Health Eur. 2023;36:100773. Published 2023 Nov 6. https://doi.org/10.1016/j.lanepe.2023.100773
13. Bassani DG, Silva CM, Oppermann RV. Validity of the Community Periodontal Index of Treatment Needs'(CPITN) for population periodontitis screening. Cadernos de saude publica. 2006;22:277-83.
14. Amaliya A, Pribadi S, Akbar YM, Sitam S. Periodontal disease: a rise in prevalence in military troops penyakit periodontal. Odonto: Dental Journal. 2021;8(1):6-17.
15. Denefil O, Chorniy S, Romanovych V, Levkiv M, Chornij N, Tverdokhlib N, Gryniuka I. Morphological changes of the hepatobiliary system and salivary glands under the influence of stress. Journal of Education, Health and Sport. 2023 Dec 21;48(1):186-96. https://doi.org/10.12775/JEHS.2023.48.01.013
16. Palle AR, Tripathi R, Punj A, Vasudevan S, Abhinav A, Bommala M. An Evaluation of Occupational Stress and Periodontal Status Among Indian Army Male Personnel: A Cross-Sectional Study. Cureus. 2024 Jun 14;16(6):e62411. https://doi.org/10.7759/cureus.62411.
17. Puzyrov JV, Izvekov VV. Bojovyj stres ta jogo naslidky dlja vijs' kovosluzhbovciv [Combat stress and its consequences for military personnel]. Psyhologija nacional'noi'bezpeky ta bezpeky zhyttjedijal'nosti–Psychology of national security and life safety, 34 1 (75), 205-209 [Internet]. 2023 https://doi.org/10.32782/2709-3093/2023.1/33
18. Gunepin M, Derache F, Trousselard M, Salsou B, Risso JJ. Impact of chronic stress on periodontal health. Journal of Oral Medicine and Oral Surgery. 2018 Jan 1;24(1):44-50. https://doi.org/10.1051/mbcb/2017028
19. Carnevale R, Sciarretta S, Violi F, Nocella C, Loffredo L, Perri L, Peruzzi M, Marullo AG, De Falco E, Chimenti I, Valenti V. Acute impact of tobacco vs electronic cigarette smoking on oxidative stress and vascular function. Chest. 2016 Sep 1;150(3):606-12 https://doi.org/10.1016/j.chest.2016.04.012
20. Sørensen LT, Toft BG, Rygaard J, Ladelund S, Paddon M, James T, Taylor R, Gottrup F. Effect of smoking, smoking cessation, and nicotine patch on wound dimension,

vitamin C, and systemic markers of collagen metabolism. Surgery. 2010 Nov 1;148(5):982-90. https://doi.org/10.1016/j.surg.2010.02.005

21. Goyal S, Gupta G, Thomas B, Bhat KM, Bhat GS. Stress and periodontal disease: The link and logic!!. Industrial psychiatry journal. 2013 Jan 1;22(1):4-11. https://doi.org/10.4103/0972-6748.123585
22. Boitsaniuk S, Chorniy S, Manashchuk N, Chornij N, Pohoretska K, Patskan L, Levkiv M. Oral cavity health and remedy options to stimulate epithelization of oral mucosa. Journal of Education, Health and Sport. 2023 May 9;27(1):53-65. https://doi.org/10.12775/JEHS.2023.27.01.005