DOI 10.26724/2079-8334-2026-1-95-37-41
UDC 616.1-039.1-005-073-055.2-053.81

Bilovol O.M., Kniazkova I.I., Budnik T.V.[1], Barbashova V.O., Kirienko O.M., Kirienko D.O., Abramova L.P.
Kharkiv National Medical University, Kharkiv,
[1]National Scientific Center "Institute of Biology and Medicine" Taras Shevchenko National University of Kyiv, Kyiv

MAIN RISK FACTORS OF CARDIOVASCULAR DISEASES AND INDICATORS OF CENTRAL HEMODYNAMICS IN YOUNG WOMEN

e-mail: sskripka72@gmail.com

The purpose of the study was to assess the influence of the main risk factors for cardiovascular diseases on arterial stiffness and the condition of the carotid arterial wall in young women. Our study included 76 young women (mean age 28.6±4.3 years), of whom 27 had normal blood pressure (group 1), and 49 had high-normal blood pressure (group 2). The analysis of risk factors showed that 46 % were overweight, 32.9 % had abdominal obesity, 48.9 % were cigarette smokers, and 21.1 % had dyslipidemia. It was found that women with high normal blood pressure had a significantly higher pulse wave velocity compared to those with normal blood pressure, with the highest values in overweight and smoking subjects. It has been shown that young women with high normal blood pressure have thickening of the intima-media complex of the common carotid artery compared to individuals with normal blood pressure, regardless of smoking status.

Key words: cardiovascular disease risk factors, carotid intima-media complex, pulse wave velocity, smoking, high-normal blood pressure, overweight, young women.

Біловол О.М., Князькова І.І., Буднік Т.В., Барбашова В.О., Кірієнко О.М., Кірієнко Д.О., Абрамова Л.П.

ОСНОВНІ ФАКТОРИ РИЗИКУ СЕРЦЕВО-СУДИННИХ ЗАХВОРЮВАНЬ ТА ПОКАЗНИКИ ЦЕНТРАЛЬНОЇ ГЕМОДИНАМІКИ У МОЛОДИХ ЖІНОК

Метою дослідження було вивчити вплив основних факторів ризику серцево-судинних захворювань на артеріальну ригідність та стан судинної стінки сонних артерій у жінок молодого віку. В дослідження включено 76 молодих жінок (середній вік 28,6±4,3 років), серед яких у 27 жінок визначено нормальний артеріальний тиск (1-ша група) і у 49 жінок – високий нормальний артеріальний тиск (2-га група). Аналіз факторів ризику показав, що надмірну вагу виявлено у 46 %, абдомінальне ожиріння – у 32,9 %, статус куріння – у 48,9 % , дисліпідемію – у 21,1 % осіб. Встановлено, що у жінок з високим нормальним артеріальним тиском у порівнянні з особами з нормальним артеріальним тиском виявлено значне підвищення швидкості пульсової хвилі, причому з найбільшими значеннями у обстежених з надлишковою вагою та курців. Показано, що у жінок молодого віку з високим нормальним артеріальним тиском визначається потовщення комплексу інтима-медіа загальної сонної артерії у порівнянні з особами з нормальним артеріальним тиском незалежно від статусу куріння.

Ключові слова: фактори ризику серцево-судинних захворювань, комплекс інтима-медіа сонних артерій, швидкість поширення пульсової хвилі, куріння, високий нормальний артеріальний тиск, надлишкова маса тіла, молоді жінки.

Funding. *The work is a fragment of the research project "To determine the features of immunocytokine imbalance in comorbid patients with hypertension and type 2 diabetes and cardiovascular and renal complications", state registration No. 0123U101711.*

Cardiovascular disease remains the leading cause of morbidity and mortality worldwide, with the greatest burden in regions with low, low-middle, and middle levels of cardiovascular disease surveillance [3]. Cardiovascular health in middle age has been shown to be associated with cardiovascular disease incidence [4]. The risk of heart disease, stroke, and kidney failure has been shown to be significantly increased by arterial hypertension [6].

The trend in recent decades has been an increase in the prevalence of arterial hypertension among young people. For example, in a study conducted by Alexander TJ [1], the prevalence of arterial hypertension among young people was 19.3 %.

It is known that the most important risk factors for arterial hypertension include smoking, alcohol consumption, overweight, and excessive salt intake [7]. At the same time, the patterns of cardiovascular health in young people are not well understood, which is important for determining preventive measures to prevent cardiovascular diseases and their complications in later life.

The purpose of the study was to assess the influence of the main risk factors for cardiovascular diseases on arterial stiffness and the condition of the carotid arterial wall in young women.

Materials and methods. The study included 76 women aged 18 to 35 years (mean age 28.6±4.3 years), who were on outpatient registration. Depending on blood pressure (BP) levels, the examined individuals were divided into 2 groups: 1st group with normal BP – 27 women (mean age 27.5±3.3 years) and 2nd group with high-normal BP – 49 women (mean age 29.3±3.7 years).

The studies were conducted in accordance with international standards regarding the informed participation of subjects, ethical aspects of research, and the collection of biological material. All participants provided written informed consent. The research adhered to the fundamental provisions of the "Ethical Principles for Medical Research Involving Human Subjects" as outlined in the Declaration of Helsinki (1964–2013), ICH GCP (1996), EEC Directive No. 609 of November 24, 1986, and Orders of the Ministry of Health of Ukraine No. 690 (September 23, 2009) and No. 616 (August 3, 2012).

Inclusion criteria: women aged 18 to 35 years without chronic diseases who did not take constant drug therapy. Exclusion criteria: age over 35 years, history of chronic diseases, constant medication, increased plasma glucose more than 5.6 mmol/l, professional athletes, pregnancy, and acute pathology during examination.

The study was conducted at the State Institution "National Institute of Therapy named after L.T. Mala, NAMS of Ukraine", Kharkiv.

Diagnosis of patients was carried out in accordance with the national recommendations of the Unified Clinical Protocol for Primary and Specialized Medical Care "Hypertensive Disease (Arterial Hypertension)", approved by Order of the Ministry of Health of Ukraine No. 1581 dated September 12, 2024. According to the protocol, normal blood pressure is considered (120–129/80–84 mm Hg), and high normal blood pressure is (130–139/85–89 mm Hg).

All patients underwent a general clinical examination, which included a questionnaire to identify risk factors for cardiovascular diseases, physical examination, physical examination, anthropometric measurements, office blood pressure (BP) measurement, a general blood and urine analysis (with determination of microalbuminuria (MAU) with a test strip), a biochemical blood test with determination of fasting glucose levels, total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides (TG), creatinine (with calculation of GFR (automatic biochemical analyzer "Humalyzer 2000", Germany) according to the SKD-EPI formula), and a 12-lead ECG on an ECG600G device (Heaco ltd, Great Britain).

The criterion for overweight was considered to be 25 kg/m² ≤ BMI < 30 kg/m², the criterion for obesity was BMI ≥ 30 kg/m², and abdominal obesity was a waist circumference in women of more than 80 cm.

Clinical BP measurements – systolic (SBP) and diastolic BP (DBP) were performed using validated oscillometric devices according to modern recommendations.

Central aortic pressure and arterial stiffness were measured using applanation tonometry with the SphygmoCor-PVx device (AtCor Medical Pty Ltd, Australia). The applanation sensor recorded the pulse wave on the radial artery, and the inverted transfer function method determined the pulse wave in the ascending aorta. The program automatically calculated the levels of systolic blood pressure, diastolic blood pressure, and pulse pressure (PP) in the aorta and the main characteristics of the central pulse wave (BP increase pressure) in the aorta, pulse wave velocity (PWV), amplitudes of systolic peaks P1, P2, augmentation index – augmentation index (AIx = TP/PP P2/P1), including normalized to a heart rate of 75 beats/min. (AIx @HR 75), time of appearance of the reflected wave (Tr), PP amplification.

Ultrasound examination of the brachiocephalic arteries was performed on an ultrasound diagnostic scanner "LOGIQ 5" with a 7 MHz linear sensor ("Medical System", Germany) and Ultima PA (RADMYR, Ukraine) with a 5-12 MHz linear sensor. The common carotid artery (CCA) was examined in a standard projection. The diameter was assessed at rest (after 10 minutes). According to the Consensus of the American Society of Echocardiography, measurements of the thickness of the ICM were performed, and an individual approach was used to determine normal values, taking into account gender and age: the threshold value of ICM for women under 45 years of age is 0.7 mm, 45–60 years of age is 0.8 mm, and over 60 years of age is 0.9 mm. When atherosclerotic plaques were detected, their qualitative and quantitative assessment was performed.

Statistical processing of the results was performed using Statistica 10.0. For quantitative indicators measured on an interval scale, the mean value, standard deviation, and error of the mean were calculated. For "qualitative" and "ordinal" indicators, the percentage frequency of detection or the frequency of registration of different rank estimates, respectively, was determined. When analyzing intergroup differences in indicators, the Student's t-test was used to calculate the value. For indicators measured on a nominal scale, the reliability of differences in the frequency of indicator detection between the two groups was assessed using Student's t-test with Fisher's transformation, and linear correlation coefficients and rank correlations were calculated. Differences in mean values and correlations were considered statistically significant at $p < 0.05$.

Results of the study and their discussion. In our study, women aged 18–35 years had a high prevalence of risk factors: smoking (48.9 %), dyslipidemia (21.1 %), and abdominal obesity (32.9 %). Among the examined individuals, BMI ≤24.9 kg/m2 was observed in 41 (54 %) women, and BMI >25 kg/m2 in 35 women (46 %). Abdominal obesity was detected in 25 women (32.9 %). The average values of office BP measurements are presented in Fig. 1.

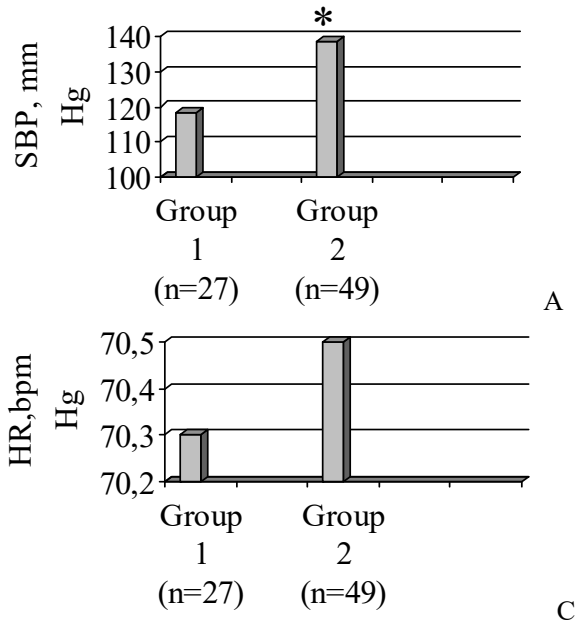
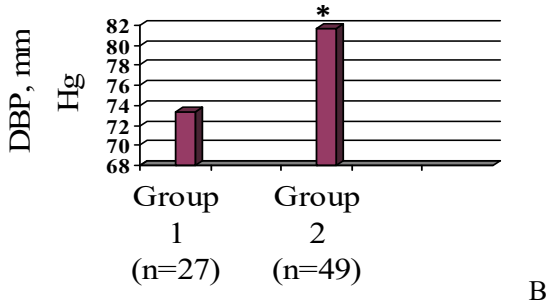


Fig. 1. Clinical SBP (A), DBP (B), and HR (C) indicators in the examined individuals. Note: * – probability of differences compared to the group with normal BP – p < 0.001.



It was found that in individuals with normal levels of SBP, there was a significant difference from patients with high normal BP. Similar changes were noted in the examined patients and by DBP levels. No significant differences in HR between groups were found. The effect of BMI on BP in young women was also not found.

It is generally accepted that the "gold standard" for assessing arterial stiffness is pulse wave velocity (PWV). When analyzing PWV in the examined individuals, it was found that in women with normal blood pressure, this indicator averaged 8.7±0.2 m/s. In the group with high-normal blood pressure, PWV increased by 14.9 % (p<0.05) compared with individuals with normal blood pressure (Fig. 2).

Analysis of the PWV depending on smoking status showed that in all groups of examined women smokers, PWV was significantly higher than in non-smokers. Thus, in women with normal BP who did not smoke, this indicator was 8.3±0.2 m/s; in women who smoked, 9.1±0.3 m/s (p<0.05).

Similar changes were found in people with high normal BP: PWV in non-smokers was on average (9.1±0.4) m/s and (10.9±0.7) m/s in female smokers (p<0.05). In both groups of overweight women examined, an increase in PWV was found (p<0.05). Moreover, the highest values of PWV were found in female smokers with high normal blood pressure and overweight (p<0.05).

According to the data of ultrasound duplex examination of the neck vessels, the values of the thickness of the intima-media complex (IMC) were generally within normal values (0.9 mm) and did not exceed the value accepted as a criterion for vascular damage as a target organ.

The study of carotid artery ICM thickness revealed early structural changes in the vascular wall, manifested as thickening. Thus, the lowest values of this indicator were in the group with normal blood pressure values (Fig. 3). At the same time, in the group with high normal blood pressure, the thickness of the carotid artery ICM was significantly greater by 26.1 % compared to individuals of the same age with normotonia (0.58 and 0.46, respectively, p<0.05).

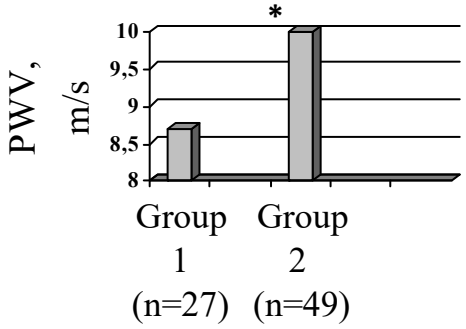


Fig. 2. Changes in PWV in women with normal and high normal BP of young age. Note. * – probability of differences with the group with normal BP (p<0.05).

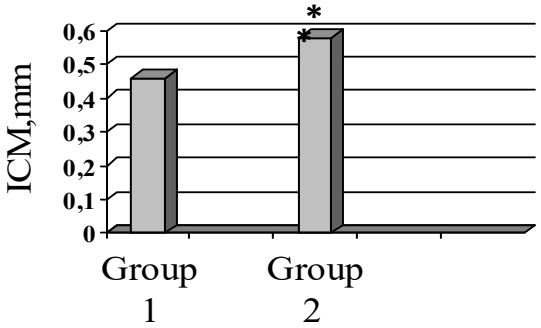


Fig. 3. ICM thickness of the CCA in women with normal and high blood pressure at a young age. Note. * – significant differences with the group with normal blood pressure (p<0.05).

At the same time, the analysis of the ICM thickness in the CCA in women in both groups with normal and overweight weight did not reveal significant differences (p>005).

Research in recent decades has shown a significant increase in arterial hypertension among young people. According to a study [1] conducted in the USA, the prevalence of arterial hypertension among young adults was 22.6 % (95 % CI: 19.5–25.7). For example, in the Indian study [9], the prevalence of arterial hypertension among young people was 18.4 % (n=92), with a higher prevalence in men (22.1 %) than in women (14.5 %). The key risk factors significantly associated with arterial

hypertension were obesity (OR=2.9, p<0.01), family history of arterial hypertension (OR=2.4, p=0.03), sedentary lifestyle (OR=1.8, p=0.04), and high salt intake (OR=2.1, p=0.02). Smoking and alcohol consumption showed a positive correlation but did not reach statistical significance (p > 0.05).

Puteikis K. et al. [10] found that in young individuals with arterial hypertension, changes in cognitive markers were inversely proportional to pulse pressure and to markers of left ventricular damage, and directly associated with daytime diastolic blood pressure. The authors concluded that the association between cognitive impairment and cardiovascular dysfunction manifests earlier in young adults with arterial hypertension compared to middle-aged and elderly patients.

It has been demonstrated that the prevalence of arterial hypertension increases with body weight and BMI [1]. However, a study by Loo W.T.W. et al. [5] in a cohort of young adults found that approximately 40 % of new cases of arterial hypertension were diagnosed in non-obese individuals, and up to 20 % were among those with normal body weight. The authors also noted no statistically significant association between smoking and arterial hypertension, suggesting that the younger age of the subjects naturally corresponds to a lower cumulative smoking exposure.

Obesity and arterial hypertension have also been shown to share common pathophysiological mechanisms, including sympathetic nervous system hyperactivation, leptin resistance, chronic low-grade inflammation, renal fat deposition, endothelial dysfunction, and genetic predisposition [2]. Dietary factors, sedentary lifestyle, poor sleep, psychosocial stress, and environmental exposures further increase the risk.

A study [12] involving 182,364 participants (mean age 58.2 years, 69.0 % women) reported that 15.3 % were current smokers (mean 16.7 cigarettes/day, mean 30.0 pack-years) and 34.6 % were former smokers (median 19.0 years since cessation, mean 22.4 pack-years). A strong dose-dependent relationship was established between smoking-related parameters (intensity, pack-years, and time since cessation) and inflammation, thrombosis, and subclinical atherosclerosis as markers of subclinical cardiovascular damage.

In a study by Neuhauser H.K. et al. [8], carotid intima-media thickness percentiles were studied from a population-based sample of adolescents and young adults using improved techniques, standardization, and quality control, and the association of this parameter with elevated blood pressure and obesity was investigated. It was found that the determined carotid intima-media thickness percentiles by sex, age, and height confirm the association of subclinical atherosclerosis with elevated blood pressure and obesity in young adults.

The risk factors for cardiovascular disease among young women identified in our study confirm that modifiable risk factors are important. Their early identification and prevention strategies targeting young individuals are important to reduce the burden of cardiovascular disease in the future.

This approach is consistent with findings from large epidemiological studies [11], which suggest the widespread implementation of lifestyle change programs to reduce obesity, unhealthy eating habits, and sedentary lifestyles.

Limitations. The main limitation of this study is the absence of a larger-scale study to investigate the influence of combined cardiovascular risk factors on the thickness of the intima-media complex of the common carotid artery in young women.

Conclusions

1. Among the surveyed women aged 18-35, it was determined that 46 % were overweight (BMI>25 kg/m2), 48.9 % had a smoking status, 21.1 % had dyslipidemia, and 32.9 % had abdominal obesity.

2. It was found that women with high normal blood pressure had a significant increase in pulse wave velocity compared to individuals with normal blood pressure, with the highest values in overweight subjects and smokers.

3. Young women with high normal blood pressure had thickening of the intima-media complex of the common carotid artery compared to individuals with normal blood pressure, regardless of smoking status.

References

1. Alexander TJ, Gauen AM, Petito LC, Kohli-Lynch CN, Carton TW, Smith SM. et al. Hypertension in Young Adults: Social Determinants of Prevalence, Awareness, Treatment, and Control. Am J Hypertens. 2025 Nov 13:hpaf203. doi: 10.1093/ajh/hpaf203.
2. Antza C, Anyfanti P, Poutachidis A, Poulis D, Belančić A, Kotsis V. Hypertension in young adults with obesity: new mechanisms and therapeutic options. Pol Arch Intern Med. 2026 Jan 23:17203. doi: 10.20452/pamw.17203.
3. Global Burden of Cardiovascular Diseases and Risks 2023 Collaborators. Global, Regional, and National Burden of Cardiovascular Diseases and Risk Factors in 204 Countries and Territories, 1990-2023. J Am Coll Cardiol. 2025 Dec 2;86(22):2167-2243. doi: 10.1016/j.jacc.2025.08.015.
4. Guo JW, Ning H, Allen NB, Perak AM, Walker JM, Pettee Gabriel K et al. Cardiovascular Health Changes in Young Adults and Risk of Later-Life Cardiovascular Disease. JAMA Netw Open. 2025;8(10):e2535573. doi: 10.1001/jamanetworkopen.2025.35573.
5. Loo WTW, Ho WHH, Lim DYZ, Thiagarajan N, Ang WK, Han JYJ. et al. Blood Pressure and Hypertension in Adolescents and Young Adults: Results From a Nationwide Screening Program. J Clin Hypertens. 2025;27: e70075. https://doi.org/10.1111/jch.70075.
6. Mancia G, Kreutz R, Brunstrom M, Burnier M, Grassi G, Januszewicz A, et al. 2023 ESH Guidelines for the management of arterial hypertension The Task Force for the management of arterial hypertension of the European Society of Hypertension: Endorsed by the International Society of Hypertension (ISH) and the European Renal Association (ERA). J. Hypertens. 2023, 41, 1874–2071.
7. Meher M, Pradhan S, Pradhan SR. Risk Factors Associated With Hypertension in Young Adults: A Systematic Review. Cureus. 2023 Apr 12;15(4):e37467. doi: 10.7759/cureus.37467.
8. Neuhauser HK, Büschges J, Schaffrath Rosario A, Schienkiewitz A, Sarganas G, Königstein K. et al. Carotid Intima-Media Thickness Percentiles in Adolescence and Young Adulthood and Their Association With Obesity and Hypertensive Blood Pressure in a Population Cohort. Hypertension. 2022 Jun;79(6):1167-1176. doi: 10.1161/HYPERTENSIONAHA.121.18521.

9. Niu C, Zhang P, Wei L, Dong J, Xu C, Yang Q. et al. The global burden of hypertension and its epidemiological impacts on adolescents and young adults: projections to 2050. Front Cardiovasc Med. 2025 Oct 24;12:1619445. doi: 10.3389/fcvm.2025.1619445.
10. Puteikis K, Ažukaitis K, Dadurkevičienė D, Mikučionytė D, Simanauskas K, Šileikienė V. et al. Cognitive Outcomes in Young Adults with Primary Arterial Hypertension: The Role of Cardiovascular Risk Factors and Hypertension-Mediated Organ Damage. Medicina (Kaunas). 2024;60(8):1353. doi: 10.3390/medicina60081353.
11. Vithalapara PK, Ramana NP, Chavada NM, Babriya DG. Prevalence and Risk Factors of Hypertension in Young Adults: A Cross-Sectional Study. Journal of Heart Valve Disease. 2025 Jun;30(6):69-72.
12. Yao Z, Tasdighi E, Dardari ZA, Jha KK, Osuji N, Rajan T. et al Association Between Cigarette Smoking and Subclinical Markers of Cardiovascular Harm. J Am Coll Cardiol. 2025;85(10):1018-1034. doi: 10.1016/j.jacc.2024.12.032.

Conflict of interest. The authors have no conflicts of interest to declare.

ORCID: Bilovol O.M. https://orcid.org/0000-0002-7003-4551, Kniazkova I.I. https://orcid.org/0000-0002-0420-8197, Budnik T.V. https://orcid.org/0000-0003-3956-3903, Barbashova V.O. https://orcid.org/0009-0006-7062-5403, Kirienko O.M. https://orcid.org/0000-0002-6470-4862, Kirienko D.O. https://orsid.org/0000-0001-5290-1159, Abramova L.P. https://orsid.org/0000-0002-4071-7431.

Article received: 15.02.2025.

DOI 10.26724/2079-8334-2026-1-95-41-45
UDC 616.314-002.4-02./-039.36:616-07

Brailko N.M., Pavlenko S.A., Zelensky D.R., Nazarenko Z.Yu., Tkachenko I.M., Gurzhiy O.V., Pisarenko O.A.
Poltava State Medical University, Poltava

SCREENING FOR RISK FACTORS FOR THE DEVELOPMENT OF CARIES

e-mail: n.brailko@pdmu.edu.ua

Dental caries remains a widespread chronic disease requiring effective risk assessment strategies. The purpose of the study was to identify risk factors for caries development and progression in young adults. The study involved 26 dental students aged 19–20 years, divided into three groups: caries-free, compensated caries, and subcompensated caries. Complex examination included assessment of salivary flow rate, viscosity, and pH, and plaque age using indicating tablets, as well as microscopic analysis of Gram-stained dental plaque. The results showed that salivary flow rate and pH (6.0–7.0) were within physiological norms for all groups. However, patients with caries exhibited increased salivary viscosity and a prevalence of mature dental plaque (>48 hours). Microbiological analysis revealed a dominance of Gram-positive cocci, morphologically similar to Streptococcus species, in the plaque of caries-active individuals. It is concluded that local factors, such as salivary viscosity and biofilm maturity, are critical determinants of risk even when general salivary parameters are normal.

Key words: dental caries, risk factors, saliva, salivary viscosity, dental plaque, oral microbiota.

Браїлко Н.М., Павленко С.А., Зеленський Д.Р., Назаренко З.Ю., Ткаченко І.М., Гуржій О.В., Писаренко О.А.

СКРИНІНГ ФАКТОРІВ РИЗИКУ РОЗВИТКУ КАРІЄСУ

Карієс зубів залишається поширеним хронічним захворюванням, що вимагає ефективних стратегій оцінки ризику. Метою дослідження було визначити фактори ризику виникнення та прогресування карієсу у молодих людей. У дослідженні взяли участь 26 студентів-стоматологів віком 19–20 років, розподілених на три групи: без карієсу, з компенсованою та субкомпенсованою формами карієсу. Комплексне обстеження включало оцінку швидкості слиновиділення, в'язкості, pH, давності нальоту з використанням індикаторних пігулок та мікроскопічний аналіз зубного нальоту, забарвленого за Грамом. Результати показали, що швидкість слиновиділення та pH (6,0–7,0) були в межах фізіологічної норми у всіх групах. Однак у пацієнтів з карієсом виявлено підвищену в'язкість слини та переважання зрілого зубного нальоту (>48 годин). Мікробіологічний аналіз виявив домінування грампозитивних коків, морфологічно подібних до видів Streptococcus, у нальоті осіб з активним карієсом. Зроблено висновок, що локальні фактори, такі як в'язкість слини та зрілість біоплівки, є критичними детермінантами ризику навіть за нормальних загальних параметрів слини.

Ключові слова: карієс зубів, фактори ризику, слина, в'язкість слини, зубний наліт, мікробіоценоз порожнини рота.

Funding. *The work is a fragment of the research project "Substantiation of the choice of methods of treatment of diseases of the oral cavity organs depending on their morphofunctional features", state registration No. 0124U004553.*

Dental caries remains one of the most common chronic noncommunicable diseases in the world and continues to be a significant public health problem, despite significant progress in preventive and restorative dentistry [2, 10]. According to current epidemiological data, caries affects individuals of all age groups and is accompanied by significant functional, psychosocial and economic consequences [9]. The current understanding of caries defines it as a biofilm-mediated, diet-modulated, multifactorial, and dynamic disease characterized by alternating processes of demineralization and remineralization of dental hard tissues [8, 9, 10].

Saliva plays a key role in maintaining oral homeostasis and protecting against caries through its buffering properties, antimicrobial activity,