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INFLUENCE OF EATING BEHAVIOR ON THE PREVALENCE OF DISEASES OF THE CIRCULATORY SYSTEM AND THEIR RISK FACTORS

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Using a sociological research program to study the characteristics of the eating behavior of the population and their impact on the prevalence of diseases of the circulatory system, as well as an adapted version of the Dutch Eating Behavior Questionnaire, a study was conducted among 620 people. It was found that 32.9 % of the population had restrained eating disorders, 30.3±1.8 % had emotional eating disorders, 18.6±1.6 % had external eating disorders, and 48.6 % had adherence to certain eating behavior stereotypes. Various factors affecting the types and degrees of eating disorder and the prevalence of eating behavior stereotypes have been identified, and the influence of each of them on the development of circulatory system pathologies and the activation of risk factors has been determined.

Key words: eating behavior disorders, eating behavior stereotypes, restrained eating disorder, emotional eating disorder, risk factors for circulatory system diseases.

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ВПЛИВ ХАРЧОВОЇ ПОВЕДІНКИ НА ПОШИРЕННЯ ЗАХВОРЮВАНЬ СИСТЕМИ КРОВООБІГУ ТА ЇХ ФАКТОРИ РИЗИКУ

Було проведено дослідження, що охопило 620 осіб, з використанням соціологічної дослідницької програми з вивчення особливостей харчової поведінки населення та їх впливу на поширеність захворювань системи кровообігу, а також адаптованої версії Голландського опитувальника харчової поведінки. Встановлено, що у 32,9 % обстежених спостерігалися унікальні/обмежувальні порушення харчової поведінки, у 30,3±1,8 % – емоційні порушення харчової поведінки, у 18,6±1,6 % – екстернальні порушення харчової поведінки, а у 48,6 % – прихильність до певних стереотипів харчової поведінки. Були виявлені різні фактори, що впливають на види та ступінь вираженості порушень харчової поведінки, а також поширеність стереотипів харчової поведінки, і визначено вплив кожного з них на розвиток патологій системи кровообігу та активацію факторів ризику.

Ключові слова: розлади харчової поведінки, стереотипи харчової поведінки, обмежувальний розлад харчової поведінки, емоційний розлад харчової поведінки, фактори ризику захворювань системи кровообігу.

Circulatory system diseases (CSDs) are one of the most common pathologies. The widespread prevalence of these diseases among working age population causes great medical and social losses [1, 8, 11]. Half of the adult population is affected by risk factors for CSDs [3, 10]. 25 % of the world's population suffers from these diseases. The incidence of CSDs has been increasing in Europe over the past 25 years. CSDs kill 3.9 million people each year and account for 45 % of all deaths [12]. The number of deaths from circulatory system diseases is predicted to exceed 22 million by 2030 [7]. In Turkey, the prevalence of CSDs ranges from 12–15 % in the population over 50 years of age. These diseases constitute the primary cause of the entire disease burden at the national level (19.4 %). Eating behavior (EB) plays an important role in the development of circulatory system diseases. Eating disorders (EDs) are widespread [3, 4, 12] and result in serious medical, psychiatric, and psychosocial problems, negatively impacting quality of life [5, 9]. Eating disorders also play an important role in the development of circulatory system diseases [1, 3, 6]. There are quite contradictory opinions in the literature about the causes of eating disorders and adherence to eating behavior stereotypes (EBS), their impact on the normal function of the circulatory system, the prevalence of CSDs and their risk factors [9, 10]. Some researchers link the emergence of eating disorders to biological, social, lifestyle, and environmental factors [2, 4]. Others believe that the causes of eating disorders are not fully understood [8]. Determining the influence of various factors and their complexes on the eating characteristics of the population, the formation of eating disorders and eating behavior stereotypes is currently of great relevance.

The purpose of the study was to establish the characteristics of the prevalence of eating disorders and stereotypes among the population and their impact on the activation and level of risk factors for circulatory system diseases.

Materials and methods. The research was conducted among 620 people at the basis of Azerbaijan Medical University in the period of 2021–2022. A specially designed “sociological research program for the study of eating behavior” was used to assess the EB and the factors that shape it. To study the prevalence of eating disorders among the population, an Azerbaijani-translated and adapted version of the Dutch Eating Behaviour Questionnaire (DEBQ) was used. Each question has five answer options: “never”, “rarely”, “sometimes”, “often”, “very often”. These answers are rated from 1 to 5 points, respectively. The average scores for people with restrained, emotional, and external eating behaviors are 2.4, 1.8, and 2.7, respectively. A score above the mean on any scale was considered to be confirmed as having an eating disorder. Conditional criteria expressed in percentages were used to assess the degree of eating disorder. If it differs from the average by up to 19 %, it is very low, 20 %–39 % – low, 40–59 % – moderate, 60–79 % – high, 80–100 % – very high. The impact of various factors on eating stereotypes and indicators that determine the normal function of the circulatory system has been studied. For the identification of eating behavior stereotypes (EBS), the food products that people use more often were divided into eleven groups according to their general signs and composition characteristics. The first group includes foods rich in carbohydrates – white bread, brown bread, flour products, cereals, rice, pasta, potatoes; the second group includes butter, margarine, vegetable oils (olive oil, corn oil, sunflower oil); the third group includes meat products (mutton, beef, pork), the fourth group includes fish and seafood; the fifth group includes poultry (chicken, turkey, goose, etc.); the sixth group includes sausages, offal; the seventh group includes fresh fruits and vegetables; the eighth group includes sweets and confectionery products (chocolate, candy, cake, cookies, etc.); the ninth group includes milk and dairy products (yogurt, sour cream, cheese); the tenth group includes pickles; the eleventh group includes legume plants (beans, peas, corn, etc.). In accordance with the research program, data were obtained using the interview method on the frequency of use of systematized food products in eleven groups according to the established gradations (I do not use it, I use it rarely, 1–2 times a month, 1–2 times a week, I use it every day). The prevalence of eating behavior stereotypes among the population was assessed across the sample as a whole and across different groups of respondents based on various characteristics, including gender, age, employment status, education level, marital status, and per capita income in the family. The risk factors for circulatory system diseases were assessed as follows: Kettle index (KI), pelvic circumference (PC), systolic and diastolic arterial blood pressure (BP), total cholesterol, low-density and high-density lipoproteins (LDLP and HDLP), triglycerides, and glucose. The assessment of the normal function of the circulatory system was carried out taking into account the presence of arterial hypertension (AH), obesity, hypertriglyceridemia (HTGE), hypercholesterolemia (HCHE), hyperglycemia (HGE), high LDLP concentrations and low HDLP concentrations, and presence of ischemic heart disease (IHD). The identified latent factors were formed taking into account high (> 0.70) and medium ($>40<70$) factorial values of the frequency of use of food products. During the research work, recommendations on the integration of comprehensive health statistics and medical social research [9], the need to organize representative sample sets, situation modeling and the application of new technologies were taken into account. The study of the influence of various factors on the formation of eating behavior and SCDs was carried out using the principles of a systematic approach and systematic analysis methods. The scope of the study was determined by the appropriate methodology. Statistical processing of the obtained initial data was carried out using the methods of variation statistics, linear correlation, and one-factor dispersion analysis for quantitative characteristics.

Results of the study and their discussion. Analysis of the data obtained as a result of the conducted studies shows that 85.8 ± 1.5 % of the population has eating disorder. External eating disorders were found in 18.6 ± 1.6 % of the population, emotional eating disorders in 30.3 ± 1.8 %, restrained eating disorders in 32.9 ± 1.9 %, and mixed eating disorders in 4.0 ± 7 %. External eating disorders are more common among men (12.1 ± 1.7 %) than women (6.5 ± 1.0 %). Emotional eating disorders are approximately equally prevalent among men (14.85 ± 1.5 %) and women (15.5 ± 1.5 %). The restrained type of eating disorder was found to be more common in women (24.0 ± 1.7 %). Restrained eating disorder (40.2 ± 2.2 %) was more common than emotional (37.1 %) and external (22.7 %) types of eating disorder. Emotional (41.5 %) and external (33.8 %) eating disorders are more common among men, while restrained eating disorders are more common among women (52.3 %). Different types of eating disorders occur in varying degrees of severity. Among men, the share of those with very low, low and moderate levels of ED (9.0 ± 1.9 %; 25 ± 2.9 % and 29.3 ± 2.9 %, respectively) is higher than among women (6.7 ± 1.5 %; 22.1 ± 2.5 %; 24.2 ± 2.5 %), while the share of those with high and very high levels is lower (23.9 ± 2.9 % and 12.6 ± 2.2 % in men, and 27.0 ± 2.6 % and 20.0 ± 2.4 % in women, respectively). The gender factor ($\eta^2_x = 23.6$ %) has a very high impact on the prevalence of various types of ED among the population. The proportion of external disorders among the population group aged under 30 and over 66 is higher than in other age groups (6.3 ± 1.0 %). The incidence of emotional ED in the 50–65 age group is 8.1 ± 1.2 %, and in

the 66 and older is 10.3 ± 1.3 %. Emotional ED is more common among the population group under the age of thirty (14.0 ± 1.5 %). The high incidence of emotional ED in this age group can be explained by the high psycho-emotional stress in people during this period.

Among older people (66 and older), the prevalence of restrained ED was low (2.0 ± 0.6 %), up to 30 years old – 11.6 ± 1.4 %, 30–49 – 14.7 ± 1.5 %, 50–65 – 11.8 ± 1.4 %. The high incidence of restrained eating disorders among the population aged 30–49 is related to the worldviews of people in this age group regarding their attitudes towards their own body weight and its regulation. In general, the incidence of eating disorders decreases with age. The prevalence of ED in the population under the age of thirty is 32.0 ± 2.1 %, in the 30–49 age group – 23.7 ± 1.8 %, in the 50–65 age group – 25.8 ± 1.9 %, and in the 66 and older age group – 18.5 ± 1.7 %. Analysis of the ED by age and gender group of the population shows that women have a higher score (4.16) for restrained eating disorder. The very high average score on this scale among women (80–100 %) indicates that they are addicted to excessive restrictions. This type of ED leads to serious consequences, up to their falling into dietary depression. The average score on this scale among individuals with restrained ED in the entire group is 3.74. The reliability interval of the score on this scale varies between 2.82–4.66. Among men, this indicator is equal to 2.98. Among women, a dynamic decrease is observed with increasing age. The average score characterizing eating behavior among women under the age of thirty on this scale is 4.91, in the 30–49 age group – 4.63, in the 50–65 age group – 4.23, and in the age group 66 and older – 3.87. The prevalence of various types of ED among the population is strongly influenced by the age of the respondents ($\eta^2_x = 24.3$ %). Among women, the emotional type of ED (average indicator – 2.96) is significantly higher than the norm (1.8) and is typical. Among men, this indicator is relatively low – 2.91. The maximum level of this indicator among both men and women falls on the age period after 65 years (3.26 and 3.41, respectively). The average score for the entire set on this scale is 2.95 ± 0.76 . People with emotional type ED experience increased appetite during emotional stress, and food intake is stimulated not by real hunger, but by emotional discomfort, including excitement, anger, resentment, rage, and irritation. Food brings such people not only satiety, but also calmness and comfort. The highest score for the external type of ED is observed among men in the 50–65 age group (4.01). The prevalence of ED and its different types in the population is observed in varying degrees of severity. EDs are manifested in 7.7 ± 1.2 % of the population as very low, 23.5 ± 1.9 % as low, 26.4 ± 2.0 % as moderate, 25.6 ± 2.0 % as high, and 16.8 ± 1.7 % as very high. To study the impact of marital status on the prevalence of eating disorders among the population, the incidence rates of eating disorders and their individual types were assessed among married and single individuals. The prevalence of ED among married individuals (60.2 ± 2.2 %) is 20.4 % higher ($t=6.6$; $P<0.01$) than among single individuals (39.8 ± 2.2 %). External ED was formed at the same level in both groups (11.4 ± 1.4 and 11.2 ± 1.4 %). The specific weight of emotional ED among the married population group is higher than among the unmarried (22.7 ± 1.8 % and 15.0 ± 1.6 %, respectively) ($t=3.2$; $P<0.05$). The level of restrained ED is twice as high (95 %) among the married than among the unmarried. The influence of marital status (η^2_x) on the prevalence of various types of EDs among the population is 12.1 %.

Among the population group with an average level of income, external (12.2 ± 1.5 %) and emotional (20.1 ± 1.8 %) eating disorders are characteristic, while among those with a high income level, restrained (13.4 ± 1.5 %) eating disorders are characteristic. Emotional ED are more common (6.3 ± 1.0 %) among the low-income population group. By applying factor analysis, it was determined that the economic situation has a strong effect (η^2_x) (11.8 %) on the prevalence of various types of eating disorders among the population. Among individuals with higher education, the proportion of those with ED (37.9 ± 2.2 %) is lower than among individuals without higher education (62.1 ± 2.2 %) ($t=8.1$; $P<0.001$). Among population group without higher education, the emotional type of ED is more common (29.2 ± 2.0 %), while among the population group with higher education, restrained ED is more common (23.9 ± 1.9 %). External (6.1 ± 1.1 %) and emotional (7.9 ± 1.2 %) types of ED are lower compared to individuals without higher education. The results of a one-factor analysis of variance showed that the prevalence of various types of ED among the population is strongly influenced by the level of education of people ($\eta^2_x = 9.8$ %). The employment status of the population directly and indirectly affects the occurrence of EDs among the population. EDs were detected in 57.8 ± 2.2 % of employed individuals and in 42.2 ± 2.2 % of unemployed individuals. The highest incidence of ED among employed persons is observed for the restrained type (28.4 ± 2.0 %), and among the unemployed for the emotional type (16.0 ± 1.6 %). External ED is more common among the unemployed (14.3 ± 1.6 %) than among the employed (8.3 ± 1.2 %). The prevalence of ED is strongly influenced by the employment of the population ($\eta^2_x = 11.8$ %).

People with emotional eating disorders are more likely to have circulatory system diseases. Among the population with emotional ED, the share of patients suffering from IHD is 50.8 ± 6.4 %, arterial hypertension – 48.7 ± 4.4 %, excess body weight (EBW) – 58.1 ± 4.1 %, and hypertriglyceridemia – 50.9 ± 4.0 %. Among individuals with arterial hypertension, the level of emotional type of ED (48.7 ± 4.4 %)

is 2 ($p<0.01$) and 1.8 ($p<0.05$) times higher than those with external ($24.4\pm4.9\%$) and restrained ($29.5\pm5.8\%$) types of ED, respectively. The proportion of this type of ED is higher among people with EBW and obesity ($58.1\pm4.1\%$). Paradoxically, among people with restrained ED, the level of this indicator is $30.4\pm3.8\%$. This situation can be explained by the fact that people tend to follow strict and restrictive diets precisely to get rid of excess weight and obesity. The incidence of HTGE ($50.9\pm4.0\%$), HDLP below the norm ($47.3\pm3.7\%$), LDLP above the norm ($46.2\pm3.5\%$), HCHE ($50.6\pm3.8\%$), and HGE ($48.8\pm4.4\%$) is higher in individuals with external and restrained type of ED. The factor that has the strongest influence on the occurrence of AH is the emotional type of ED ($\eta^2_x \pm m_{\eta^2_x} = 32.2\pm1.5\%$; $F_{st}=21.4$; $P<0.001$) (Table 1).

Table 1

Impact of EDs on the quality indicators of the circulatory system

Indicators	Types of eating disorders											
	External				Emotional				Restrained			
	η^2_x	$m_{\eta^2_x}$	F_{st}	p	η^2_x	$m_{\eta^2_x}$	F_{st}	p	η^2_x	$m_{\eta^2_x}$	F_{st}	p
IHD	5.6	3.3	1.7	>0.05	11.2	2.1	5.3	<0.001	6.5	2.8	2.3	>0.05
AH	6.4	3.2	2.0	>0.05	32.2	1.5	21.4	<0.001	7.3	2.9	2.5	<0.05
Obesity, EBW	30.9	2.5	12.4	<0.001	14.3	1.8	7.9	<0.001	4.2	3.1	1.3	>0.05
HTGE	6.8	3.2	2.1	>0.05	14.9	1.8	8.2	<0.001	8.5	2.6	3.1	<0.05
↓HDLP	1.7	1.3	0.1	>0.05	18.2	1.7	11.0	<0.001	9.8	2.5	3.9	<0.05
↑LDLP	23.5	2.6	9.8	<0.001	16.8	1.8	9.3	<0.001	4.8	3.1	1.5	>0.05
HCHE	16.4	2.8	5.9	<0.001	17.3	1.7	10.1	<0.001	5.2	2.9	1.8	>0.05
HGE	7.9	3.2	2.5	<0.05	22.3	5.0	4.46	<0.001	4.9	3.0	1.6	>0.05

External type of ED is the strongest risk factor for obesity and EBW ($\eta^2_x \pm m_{\eta^2_x} = 30.9\pm2.5\%$; $F_{st}=21.4$; $P<0.001$) and high LDLP ($\eta^2_x = 23.5\pm2.6\%$; $F_{st}=9.0$; $P<0.001$). The effect of external type of ED on HCHE is $16.4\pm2.8\%$ ($F_{st}=5.9$; $P<0.001$); and that of emotional type of ED is $17.3\pm1.7\%$ ($F_{st}=10.1$; $P<0.001$). The restrained ED has a stronger effect on the formation of ↓HDLP at a low level ($\eta^2_x = 9.8\pm2.5\%$; $F_{st}=3.9$; $P<0.05$).

The frequency of consumption of food products used in the population's diet determines the identification of four groups of potential (latent) factors. The first factor (F_1) combines the frequencies of consumption of milk, yogurt, sour cream, cheese, yogurt ($P=0.59$), fish and seafood ($P=0.54$) (Table 2).

Table 2

Correlation dependence between food products consumed and latent factors

No.	Food products	Potential (latent) factors			
		F_1	F_2	F_3	F_4
1	Flour products, cereals, rice, pasta, potatoes	0.06	0.14	0.25	0.71 [∞]
2	Butter, margarine, vegetable oils	0.08	0.09	0.68 [°]	0.32
3	Mutton, beef, pork, meat products	0.04	0.72 [∞]	0.36	0.09
4	Fish and seafood	0.54 [°]	0.16	0.11	0.08
5	Poultry (chicken, turkey, goose, duck, etc.)	0.06	0.54 [°]	0.14	0.12
6	Sausage, offal, etc.	0.07	0.76 [∞]	0.14	-0.08
7	Fresh fruits, vegetables, berries	0.32	0.24	0.32	0.64 [°]
8	Sweets and confectionery (chocolate, candy, cake, etc.)	0.14	0.18	0.57 [°]	0.16
9	Milk, yogurt, sour cream, cheese, yogurt, etc.	0.59	0.08	0.28	0.19
10	Pickles and salted products	0.12	0.59 [°]	0.12	0.18
11	Legume plants (beans, peas, corn, etc.)	0.01	0.16	0.31	0.66 [°]
	Share of variance	13.8	11.6	6.4	12.6

Note: ° – moderate dependence; ∞ – severe dependence.

The second factor (F_2) has a high and moderate correlation dependence in accordance with the frequency of use of meat ($P=0.72$) sausages, offal ($P=0.76$), poultry meat ($P=0.54$), pickles and salted products ($p=0.59$). The third factor (F_3) has a strong, moderate correlation with the frequency of use of oils ($P=0.68$), confectionery products ($P=57$), and the fourth factor (F_4) has a strong, moderate correlation with the frequency of use of flour products, rice and potatoes ($P=0.71$), fruits, berries, vegetables ($P=0.64$), and legume plants ($P=0.66$). Adherence to EBS was found in about half of the population (48.6%). Adherence to EBS is influenced by factors characterizing the socio-hygienic characteristics of the population. Depending on the factors, the population's adherence to EBS is also formed at different levels. In general, $10.6\pm1.2\%$ of the population was found to be dependent on F_1 -conditioned EBS1, $14.0\pm1.4\%$ on F_2 -conditioned EBS2, $12.2\pm1.3\%$ on F_3 -conditioned EBS3, and $11.8\pm1.3\%$ on F_4 -conditioned EBS4. Adherence to the eating behavioral stereotype is $7.2\pm1.5\%$ among men and $14.8\pm1.9\%$ among women. This type of eating behavior stereotype is more characteristic of women, with a 7.6% higher level of

adherence to it than men ($t=3.2$; $P<0.01$). Conversely, the level of adherence to EBS2 is 16.3 % higher in men (12.0 %) than in women (4.3 %) ($P>0.05$). According to the level of adherence to EBS3, a statistically significant difference was found between men (15.6 %) and women (10.3 ± 1.6 %) ($t=2.1$; $P<0.05$). Women are more likely to use fish and seafood, milk, yogurt, cheese, yogurt, fresh fruit and vegetables (EBS1) than men, and less likely to use food products such as mutton, beef, pork, pickles, sausages, offal, poultry (EBS2), sweets and confectionery (EBS3). The level of adherence to EBS4 is at the same level among men (11.6 %) and women (11.9 %). Due to age, a certain regularity is traced in the frequency of adherence to EBS. With increasing age, the frequency of adherence to EBS4 also increases. Among the population under the age of 30, the frequency of adherence to EBS4 is 8.4 %, at the age of 31–40 – 9.4 %, at the age of 41–65 – 13.6 %, at the age of 66 and older – 13.8 %. Adherence to EBS2 is relatively high among respondents under the age of 30 (19.2 %). In older age groups (66 and more), this indicator drops to 9.0 %. A relative decrease in adherence to EBS3 is observed after 31–40 years (13.4 %). It reaches 11.4 % in people aged 41–65, and 11.2 % in people aged 66 and older. The proportion of people with higher education who adhere to the stereotype of eating behavior (48.5 %) is about the same as that of people without higher education (49.2 %). The level of adherence to EBS1 and EBS4 among family people (9.8 % and 10.7 %, respectively) is lower than among non-family people (12.8 and 14.1 %). The frequency of individuals with adherence to EBS2 among the employed population group (13.9 %) is 8.6 % higher than in the unemployed population group (5.3 ± 0.05 %). The level of adherence of the employed population to EBS4 (17.9 %) is lower than that of the unemployed (12.0 ± 1.8 %) by 6.9 % ($tP<0.05$). The main factor that strongly influences the level of adherence to EBS1 is gender ($\eta^2_x=36.2$ %). The minimum level of adherence to EBS1 is observed among men. Adherence to EBS is related to the level of education of the population ($\eta^2_x=32.4$ %), gender ($\eta^2_x=22.6$ %), age ($\eta^2_x=16.2$ %). EBS1 contains a complex that has a beneficial effect on the qualitative functional indicators of the circulatory system. Only one person with ischemic heart disease was identified who had EBS1. Among individuals with ischemic heart disease or with primary signs of this disease, there were more people with adherence to EBS2 (35.6 %) and EBS3 (35.5 %). There is a direct and strong relationship between the level of use of products included in EBS2 and the incidence of IHD.

The incidence of IHD is 35.1 % among those who consume fatty foods, low-fat foods – 21.4 %, lean foods – 6.4 %. The influence of the degree of fatness of food on the occurrence of IHD is 11.6 %. Adherence to the overuse of meat and meat products also plays an important role in the formation of IHD. The frequency of its occurrence among such individuals is 66.7 %. 8.1 % give preference to daily consumption of meat and meat products. The incidence of this disease among people who did not consume meat was higher than among those who consumed a small amount of meat (10.5 %). The incidence of arterial hypertension among people with adherence to EBS1 (18.4 %) is lower than that of people with adherence to other stereotypes, and compared to EBS2 (33.3 %) the likelihood of arterial hypertension is much lower (1.8 times), and compared to EBS3 (30.3 %) is 1.6 times lower. Hypertension is more common in people who do not adhere to a diet (40.0 %), eat more than 4 meals a day (29.7 %), eat fatty foods (33.7 %), eat meat in large quantities (88.9 %), or do not eat meat (36.8 %), follow a monotonous diet (44.7 %), drink alcoholic beverages (62.0 %). The share of obesity and EBW in people with adherence to EBS1 is 27.7 %, to EBS2 – 65.0 %, to EBS3 – 68.4 %, to EBS4 – 28.7 %. Adherence to EBS2 and EBS3 has a negative effect on the prevalence of EBW and obesity among the population, while adherence to EBS1 and EBS4 has a positive effect. Triglyceride levels are considered an important qualitative indicator for diagnosing diseases of the circulatory system. The incidence of HTGE among population groups with adherence to EBS1 and EBS4 (21.6 % and 21.9 %, respectively) is lower than among population groups with adherence to EBS2 and EBS3 (41.4 ± 6.8 % and 50.0 ± 5.7 %, respectively). The probability of developing HTGE among people who consume more than 200 grams of meat per day is 85.0 %, and among those who consume up to 100 grams – 27.0 %. The probability of developing HTGE among individuals with a preference for fatty foods (78.4 %) is significantly higher than among those who prefer low-fat and fat-free foods (28.4 % and 45.1 %, respectively) ($p<0.05$). Among respondents with EBS1 and EBS4, the incidence of HDLP (32.3 and 12.3 %) below the recommended limit and LDLP (33.8 and 16.4 %) above the intended norm is significantly lower compared to respondents with EBS2 and EBS3 (43.7; 48.7 % and 44.8; 46.0 %, respectively). The specific weight of subnormal indicators of HDLP in persons with addiction to EBS4 is statistically significantly different compared to EBS2 ($p<0.01$) and EBS3 ($p<0.05$). The share of individuals with high levels of LDLP is low on EBS4 ($p<0.05$). This shows that the use of foodstuffs that are characteristic to EBS1 is not sufficient to prevent low-density lipoproteins from being above normal. The proportion of people with high LDLP levels (83.8 %) who prefer fatty foods is about twice as high as compared with the proportion of people who consume low-fat foods (42.9 %) ($P<0.05$). Adherence to EBS2 and EBS3 has a negative association with ensuring optimal levels of lipoproteins in the blood. 51.6 % of the population suffers from cholesterinemia. Hypercholesterinemia is more common in people who do

not follow a diet (58.7 %), eat 4 or more meals a day (71.6 %), eat fatty foods (71.6 ± 5.3 %), drink alcoholic beverages (60.0 %), and consume a lot of meat and meat products (70.4 ± 9.1 %). The prevalence of HCHE among people with adherence to EBS4 is only 8.2 %. It can be concluded that adherence to EBS1 and EBS3 is favorable for lowering blood cholesterol levels, while EBS2 and EBS3 are unfavorable. Among individuals who always adhere to the nutritional regime, the share of those suffering from hyperglycemia (20.0 %) is minimal. The presence of various foods in the diet (36.5 %), meat consumed less than 100 grams per day (27.0 %), the use of lean foods (11.5 %), food intake no more than 3 times a day (31.8 %), regular use of soup (30.8 %) are important factors in reducing the prevalence of hyperglycemia among the population. Adherence to the first and fourth EBS has a direct relationship with optimizing the amount of sugar in the blood. The incidence of HGE among population groups with adherence to EBS1 and EBS3 is 18.5 % and 19.2 ± 4.6 %, which is lower than that of those with adherence to EBS3 and EBS4 (44.8 and 40.8 %, respectively) ($p < 0.05$).

Thus, our results confirm that eating disorders of the population and eating behavior stereotypes are factors that can negatively affect the state of the circulatory system, which is consistent with the results of other studies [6, 8, 12].

Boban M, et al (2019) emphasize that nutritional risks and their underlying causes should never be overlooked. Dietary interventions, in their view, ought to be recognized as a fundamental component of cardiovascular disease management. Alongside the use of cardioprotective medications – an essential element of cardiac care – it is necessary to consider potential drug – nutrient interactions, particularly in individuals receiving multiple pharmacological treatments [2]. Equally vital is the allocation of time and resources to educate not only patients and their relatives but also healthcare professionals about nutrition-related hazards. While these measures are crucial in the realm of primary prevention, they are even more critical in secondary prevention strategies [7, 9, 11].

Conclusions

1. 85.8 ± 1.5 % of the population has eating disorder: 32.9 % of the population had restrained eating disorders, 30.3 ± 1.8 % had emotional eating disorders, 18.6 ± 1.6 % had external eating disorders, and 48.6 % had adherence to certain eating behavior stereotypes.

2. People with emotional eating disorders are more likely to have circulatory system diseases. Among the population with emotional ED, the share of patients suffering from IHD is 50.8 ± 6.4 %, arterial hypertension – 48.7 ± 4.4 %, excess body weight (EBW) – 58.1 ± 4.1 %, and hypertriglyceridemia – 50.9 ± 4.0 %.

3. EBS2 has a favorable effect on preventing risk factors for the development of circulatory system pathologies, while EBS3 has a negative effect.

Thus, eating disorders of the population, the characteristics of the structure of food products used in actual nutrition, and eating behavior stereotypes play an important role in the activation of quantitative and qualitative indicators of the circulatory system, risk factors that negatively affect the health of the circulatory system, and the formation of pathologies.

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Стаття надійшла 30.08.2024 р.

DOI 10.26724/2079-8334-2025-3-93-13-17

UDC 616.12-008.46:616.153:577.1:615.07

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CLINICAL SIGNIFICANCE OF NOVEL BIOMOLECULES SUCH AS GALECTIN-3, APOPTOSIS-INDUCING FACTOR, ENDOTHELIN, AND VEGF-A IN THE DIAGNOSIS OF CHRONIC HEART FAILURE

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The use of molecular biomarkers, alongside classical clinical and instrumental methods, is becoming increasingly relevant for the early diagnosis and prognosis of chronic heart failure. The study aimed to assess the diagnostic value of novel biomarkers (galectin-3, apoptosis-inducing factor, endothelin, and VEGF-A) by comparing their levels across various functional stages (I–II, III, IV) of chronic heart failure. The study involved 219 patients aged between 34 and 89 years who were diagnosed with CHF and examined and treated at the Clinical Medical Center between 2018 and 2024. The concentrations of the biomarkers galectin-3, AIF, endothelin, and VEGF-A in the blood serum were analyzed using the enzyme-linked immunosorbent assay (ELISA) method. More pronounced changes in the levels of the studied biomarkers were observed in patients with NYHA class IV chronic heart failure. In this group, compared to patients in NYHA class I, the concentration of AIF increased by 80 % ($p<0.001$), endothelin-1 by 51 % ($p=0.037$), and galectin-3 by 70 % ($p<0.001$), all of which were statistically significant. In contrast, the concentration of VEGF-A showed a tendency to decrease ($p=0.251$). Compared to NYHA class II, a statistically significant 2.4 fold decrease in VEGF-A concentration ($p<0.001$) was observed in the NYHA class IV. The analyses revealed that during chronic heart failure, the levels of galectin-3, AIF, endothelin-1, and VEGF-A change significantly depending on the functional stage of the disease, with a marked increase observed as the disease progresses.

Key words: chronic heart failure, galectin-3, AIF, endothelin-1, VEGF-A.

Ф.Ч. Алмаммадов

КЛІНІЧНЕ ЗНАЧЕННЯ НОВИХ БІОМОЛЕКУЛ, ТАКИХ ЯК ГАЛЕКТИН-3, АПОПТОЗ-ІНДУКУЮЧИЙ ФАКТОР, ЕНДОТЕЛІН І VEGF-A, У ДІАГНОСТИЦІ ХРОНІЧНОЇ СЕРЦЕВОЇ НЕДОСТАТНОСТІ

Застосування молекулярних біомаркерів поряд з класичними клінічними та інструментальними методами набуває все більшої актуальності для ранньої діагностики та прогнозу хронічної серцевої недостатності. Метою дослідження була оцінка діагностичної значущості нових біомаркерів (галектин-3, апоптоз-індуковувальний фактор, ендотелін та VEGF-A) шляхом порівняння їх рівнів на різних функціональних стадіях хронічної серцевої недостатності (I-II, III, IV). До дослідження було включено 219 пацієнтів віком від 34 до 89 років, яким було поставлено діагноз хронічна серцева недостатність та які проходили обстеження та лікування у Клініко-медичному центрі у період з 2018 по 2024 рік. Концентрації біомаркерів галектину-3, апоптоз-індуковувального фактору, ендотеліну та VEGF-A у сироватці крові визначалися методом імуноферментного аналізу (ELISA). Більше виражені зміни рівнів досліджуваних біомаркерів спостерігалися у пацієнтів із хронічною серцевою недостатністю IV функціонального класу за класифікацією NYHA. У цій групі порівняно з пацієнтами I класу концентрація апоптоз-індуковувального фактору збільшилася на 80% ($p<0,001$), ендотеліну-1 – на 51% ($p=0,037$), галектину-3 – на 70% ($p<0,001$); всі зміни були статистично значущими. Навпаки, концентрація VEGF-A мала тенденцію до зниження ($p=0,251$). У пацієнтів із хронічною серцевою недостатністю IV функціонального класу за класифікацією NYHA, порівняно з пацієнтами II класу, спостерігалось статистично значуще 2,4-кратне зниження концентрації VEGF-A ($p<0,001$). Проведений аналіз показав, що при прогресуванні хронічної серцевої недостатності рівні галектину-3, апоптоз-індуковувального фактору, ендотеліну-1 та VEGF-A змінюються залежно від функціонального класу захворювання, причому підвищення концентрацій більшості з них було більш вираженим на пізніх стадіях.

Ключові слова: хронічна серцева недостатність, галектин-3, апоптоз-індуковувальний фактор, ендотелін-1, VEGF-A.

Chronic heart failure (CHF) remains a serious social and medical problem worldwide, accompanied by high rates of disability and mortality. Affecting over 56 million individuals globally, with a prevalence of 1 %–2 %, HF has emerged as a significant public health challenge [8]. The main contributing factors to the development of chronic heart failure include arterial hypertension,