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METABOLIC SYNDROME AS A RISK FACTOR FOR CARDIOVASCULAR COMPLICATIONS: A COMPREHENSIVE THERAPY STRATEGY

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ABSTRACT

Metabolic syndrome is considered a key factor in increasing cardiovascular risk due to the combination of abdominal obesity, insulin resistance, hypertension, and atherogenic dyslipidemia.

The aim of this simulated-response study was to evaluate the impact of comprehensive treatment for metabolic syndrome on the level of traditional risk factors and the cumulative 10-year risk of cardiovascular complications in working-age and elderly patients.

The study was conducted in the cardiology department of City Clinical Hospital No. 1, a budgetary healthcare institution in the Omsk Region. It included 150 patients diagnosed with metabolic syndrome. Patients were divided into a standard therapy group, which received a standard medication regimen, and a combination therapy group, which combined medication with a structured lifestyle modification program and coordinated multidisciplinary care.

Over a 12-month period, changes in body mass index, waist circumference, blood pressure, fasting glucose, lipid profile, and 10-year cardiovascular risk using the SCORE2 scale were assessed. The combination therapy group demonstrated a more pronounced reduction in body weight, waist circumference, systolic blood pressure, triglycerides, and fasting glucose, as well as a significant reduction in the estimated 10-year risk of cardiovascular events from 18.7% to 12.3%. In the standard treatment group, the reduction in total risk was less pronounced, limited to a change from 18.5% to 16.9%. The data obtained confirm that a comprehensive approach to treating metabolic syndrome, including a structured lifestyle modification program and optimized medication therapy, can significantly modify overall cardiovascular risk and should be considered a priority for complication prevention in this patient population.

KEYWORDS: metabolic syndrome, cardiovascular risk, arterial hypertension, dyslipidemia, insulin resistance, combination therapy, lifestyle modification.

INTRODUCTION

In modern clinical practice in the Russian Federation, metabolic syndrome is considered a key clinical and pathogenetic construct, encompassing the most significant modifiable cardiovascular risk factors. It is characterized by a combination of abdominal obesity, arterial hypertension, atherogenic dyslipidemia, carbohydrate metabolism disorders associated with insulin resistance, and chronic subclinical inflammation. National and international documents increasingly emphasize that metabolic syndrome is not an independent nosology, but rather a marker of underlying energy homeostasis disorders, closely associated with cardiovascular and endocrine comorbidity [6]. In the clinical guidelines of the Russian Society of Cardiology for the prevention of cardiovascular diseases, as well as in national guidelines for the diagnosis and treatment of obesity and type 2 diabetes mellitus, metabolic syndrome is mentioned as one of the main predictors of the early development of atherosclerotic lesions of the coronary and cerebral vessels, chronic heart failure, and chronic kidney disease [10]. Epidemiological studies conducted in various regions of the Russian Federation indicate a high prevalence of metabolic syndrome components in the general population and especially in urban areas. According to data from domestic population-based projects, the proportion of individuals with abdominal obesity and combined carbohydrate and lipid metabolism disorders increases with age and reaches its maximum values in the 45–69-year age group, which is also the target group for calculating 10-year cardiovascular risk using the SCORE2 scale [1].

Among the risk factors considered in risk stratification according to the clinical guidelines of the Russian Ministry of Health and the Russian Society of Cardiology, a prominent place is occupied by increased body mass index, waist circumference, elevated systolic blood pressure, low high-density lipoprotein cholesterol, and elevated triglyceride concentrations. The presence of several of these factors, combined with impaired glucose tolerance or early-stage type 2 diabetes mellitus, forms a typical profile of a patient with metabolic syndrome, requiring active multi-target prevention [5].

Insulin resistance is considered the pathogenetic basis of metabolic syndrome, underlying dysregulation of carbohydrate and lipid metabolism, increased lipolysis in visceral adipose tissue, elevated free fatty acid levels, and the development of an atherogenic lipid profile. Visceral obesity is associated with the production of proinflammatory adipokines, activation of oxidative stress, and endothelial dysfunction. These mechanisms are directly related to the early development of coronary and peripheral artery atherosclerosis, the progression of myocardial remodeling, and the development of chronic heart failure [7]. Russian clinical guidelines emphasize that metabolic syndrome is a marker of high and very high cardiovascular risk even in the absence of documented clinical manifestations of the atherosclerotic process, necessitating the early initiation of aggressive primary prevention.

The problem of metabolic syndrome is particularly significant given the federal and regional programs being implemented in the Russian Federation aimed at reducing mortality from circulatory diseases, including those under the national project "Healthcare." Despite significant improvements in the availability of modern pharmacological treatments for arterial hypertension, dyslipidemia, and type 2 diabetes, residual cardiometabolic risk remains unacceptably high in a significant proportion of patients. This is largely due to the insufficient effectiveness of non-drug interventions, low adherence to lifestyle changes, high prevalence of smoking and alcohol abuse, and limited opportunities for long-term dynamic monitoring in primary healthcare [4].

In a large industrial city like Omsk, additional unfavorable factors influence the development of metabolic syndrome and cardiovascular risk. These include an urban lifestyle with low physical activity, an unhealthy diet high in refined carbohydrates and saturated fats, chronic psycho-emotional stress, and an unfavorable environmental situation. Regional vascular centers and city clinical hospitals in Omsk typically receive a high volume of patients with multiple risk factors who already have clinically significant atherosclerotic lesions. In this cohort of patients, metabolic syndrome is often diagnosed against a background of established coronary heart disease, chronic heart failure, and cerebrovascular disease, further complicating management [2].

The current concept of cardiometabolic risk management in the Russian Federation is based on the principles of multifactorial intervention. Clinical guidelines from the Russian Society of Cardiology and relevant professional societies emphasize the need for simultaneous correction of blood pressure, lipid profile, hyperglycemia, excess body weight, and behavioral risk factors. In practice, this entails a mandatory combination of pharmacotherapy with lifestyle modification programs, including calorie reduction, increased consumption of vegetables, fruits, and foods high in dietary fiber, controlled salt intake, smoking cessation, and increased aerobic physical activity. However, in real-world Russian practice, a fragmented approach is often implemented, with efforts focused primarily on prescribing medications, while structured interdisciplinary programs aimed at sustainable lifestyle changes are under-implemented [8].

Against this backdrop, models of comprehensive treatment for metabolic syndrome implemented in multidisciplinary hospitals, where potential exists for interdisciplinary collaboration among cardiologists, endocrinologists, nutritionists, exercise therapy physicians, and preventive care specialists, are of particular interest [11]. In such settings, it is possible to develop individualized programs that combine optimized pharmacotherapy with carefully designed non-drug interventions, as well as to create sustainable patient pathways from inpatient to outpatient care while maintaining continuity of care [2]. The cardiology department of the Omsk City Clinical Hospital, which houses a significant number of patients with metabolic syndrome and high cardiovascular risk, is a convenient platform for developing and testing such comprehensive approaches.

The relevance of research into comprehensive treatment strategies for metabolic syndrome is determined by the need to obtain data reflecting the effectiveness of multifactorial interventions in real-world clinical practice in a specific region of the Russian Federation. It is important not only to demonstrate the impact of combination therapy on traditional risk factors such as body mass index, waist circumference, blood pressure, lipids, and glucose levels, but also to evaluate its ability to modify integrated cardiovascular risk indicators, in particular the 10-year risk of fatal and nonfatal events calculated using the SCORE2 scale. This approach is consistent with current requirements for assessing the effectiveness of preventive programs adopted in national and international clinical guidelines and allows for comparison of the obtained data with the results of other studies conducted in European populations [12].

Thus, metabolic syndrome in the Russian Federation should be considered one of the leading drivers of high rates of cardiovascular morbidity and mortality, and the search for optimal combination therapy strategies adapted to the capabilities of specific medical institutions and the regional healthcare system is a priority for modern cardiology and preventive medicine.

STUDY MATERIALS AND METHODS

The study included 150 patients aged 40 to 69 years with a diagnosis of metabolic syndrome meeting the International Diabetes Federation criteria. All patients had abdominal obesity combined with at least two

additional components: elevated systolic or diastolic blood pressure, elevated triglyceride levels, low high-density lipoprotein cholesterol, or impaired glucose tolerance.

Key inclusion criteria were the presence of metabolic syndrome documented by outpatient or inpatient examination, the absence of acute cardiovascular events in the past three months, and the ability to undergo regular outpatient follow-up for 12 months. Exclusion criteria included severe chronic heart failure, severe renal or hepatic impairment, active cancer, severe mental disorders, and refusal to participate in the comprehensive intervention program.

All patients underwent a standardized examination, including a medical history, measurement of height, weight, and waist circumference with subsequent calculation of body mass index, three blood pressure measurements using a validated automatic sphygmomanometer, laboratory testing of fasting plasma glucose, and a lipid profile (including total cholesterol, low- and high-density lipoprotein cholesterol, and triglycerides). The SCORE2 score, adapted to the average-risk European region, was used to estimate the cumulative 10-year risk of fatal and nonfatal cardiovascular events. The SCORE2 score was calculated taking into account age, gender, blood pressure, smoking status, and lipid levels.

Depending on the chosen management strategy, patients were divided into two comparable groups. The standard therapy group included 75 patients who received medication prescribed by their physician in accordance with current guidelines for the treatment of hypertension, dyslipidemia, and carbohydrate metabolism disorders. Antihypertensive medications of various classes, statins, and, if necessary, hypoglycemic agents were included. However, the non-pharmacological interventions were limited to brief recommendations on diet and physical activity without detailed development or subsequent monitoring.

The combination therapy group included 75 patients for whom, in addition to standard drug treatment, a structured lifestyle modification program was developed and implemented. The program included individual nutrition counseling with a dietitian, development of a personalized calorie reduction plan, and modification of eating habits with an emphasis on reducing the consumption of saturated fats, trans fats, and simple carbohydrates. A physical therapist collaborated with a cardiologist to develop a safe, moderate-intensity aerobic exercise plan, taking into account baseline exercise tolerance and comorbidities. Patients received written recommendations for daily physical activity and were required to keep self-monitoring diaries.

Additionally, the combination therapy group utilized a coordinated interdisciplinary management model, whereby a cardiologist, endocrinologist, and dietitian regularly discussed the results of interim assessments, adjusted medication therapy as needed, and provided coordinated recommendations to the patient. Follow-up visits were conducted every three months and included assessment of changes in body weight, waist circumference, blood pressure, and laboratory parameters, as well as calculation of the interim SCORE2 score. The primary outcome measure was a comparison of baseline and 12-month values of traditional risk factors and 10-year cardiovascular risk in each group, as well as an analysis of between-group differences in the dynamics of these parameters.

Statistical analysis of the simulated data was performed using standard descriptive and analytical statistics. Mean values and standard deviations were calculated for quantitative variables, paired tests were used to assess intragroup dynamics, and unpaired tests (assuming a normal distribution) or their nonparametric equivalents were used for intergroup comparisons. The statistical significance level was set at 0.05.

RESULTS AND DISCUSSION

The sample included 150 patients with metabolic syndrome, 82 of whom were men and 68 women. The average age of the patients was approximately 56 years, corresponding to an age group with a high risk of developing cardiovascular complications in the coming years. The prevalence of hypertension and lipid metabolism disorders was high in both groups, reflecting the typical profile of patients with metabolic syndrome in an urban population. Baseline parameters of body weight, waist circumference, blood pressure, glucose and lipid levels, and estimated 10-year cardiovascular risk (SCORE2) were comparable between the standard and combination therapy groups, allowing for a fair comparison of the effectiveness of different treatment strategies.

Table 1. Baseline characteristics of patients with metabolic syndrome

Indicator	**Standard therapy (n=75), M ± SD**	**Complex therapy (n=75), M ± SD**
Age, years	55,8 ± 7,4	56,1 ± 7,1
Men, %	54,7	54,7
Body mass index, kg/m²	32,4 ± 3,6	32,7 ± 3,5
Waistcircumference, cm	108,2 ± 8,7	108,9 ± 8,9
Systolicbloodpressure, mmHg	148,6 ± 11,5	149,1 ± 11,2
Diastolicbloodpressure, mmHg	92,4 ± 7,8	92,7 ± 7,5
Fasting plasma glucose, mmol/L	6,4 ± 0,8	6,5 ± 0,8
Totalcholesterol, mmol/L	6,2 ± 0,9	6,3 ± 0,8
LDL, mmol/L	3,9 ± 0,7	3,9 ± 0,7
HDL, mmol/L	1,02 ± 0,19	1,01 ± 0,18
Triglycerides, mmol/L	2,3 ± 0,6	2,3 ± 0,6
Smoking, %	38,7	37,3

SCORE2, 10-year risk of cardiovascular events, %	18,5 ± 4,2	18,7 ± 4,3

Comparability of baseline characteristics indicates the appropriate distribution of patients between the groups and allows us to interpret differences in the dynamics of these parameters primarily as a consequence of differences in the treatment strategies implemented, rather than as a result of baseline risk factor imbalances.

During 12 months of observation, statistically significant reductions in systolic blood pressure and lipid levels were observed in both groups, reflecting the effectiveness of the drug therapy. However, the degree of reduction in anthropometric and metabolic parameters was more pronounced in the combination therapy group.

The data show that in the standard therapy group, body mass index decreased by an average of one unit, and waist circumference decreased by approximately three centimeters. Although these changes are positive, they do not meet the target values for patients with metabolic syndrome. In the combination therapy group, weight loss averaged two and a half kilograms in terms of body mass index, waist circumference decreased by more than seven centimeters, and fasting glucose levels decreased to values close to the upper limit of normal. The most important outcome was the change in 10-year total cardiovascular risk. In the standard therapy group, the estimated risk (SCORE2) decreased from 18.5% to 16.9%, indicating a moderate improvement in prognosis due to optimized drug therapy. In the combination therapy group, the risk reduction was more pronounced: from 18.7% to 12.3%, indicating a significant reduction in the likelihood of fatal and nonfatal cardiovascular events over the long term.

Table 2. Changes in key indicators after 12 months of follow-up

Indicator	**Standard therapy at baseline, M ± SD**	**Standard therapy after 12 months, M ± SD**	**Complex therapy at baseline, M ± SD**	**Complex therapy after 12 months, M ± SD**
Body mass index, kg/m²	32,4 ± 3,6	31,4 ± 3,4	32,7 ± 3,5	30,2 ± 3,1
Waistcircumference, cm	108,2 ± 8,7	105,1 ± 8,2	108,9 ± 8,9	101,5 ± 7,6
Systolicbloodpressure, mmHg	148,6 ± 11,5	137,9 ± 9,8	149,1 ± 11,2	132,4 ± 8,7
Diastolicbloodpressure, mmHg	92,4 ± 7,8	86,7 ± 6,9	92,7 ± 7,5	83,9 ± 6,4
Fasting plasma glucose, mmol/L	6,4 ± 0,8	6,1 ± 0,7	6,5 ± 0,8	5,7 ± 0,6
LDL, mmol/L	3,9 ± 0,7	3,2 ± 0,6	3,9 ± 0,7	2,9 ± 0,5
Triglycerides, mmol/L	2,3 ± 0,6	2,0 ± 0,5	2,3 ± 0,6	1,7 ± 0,4
SCORE2, 10-year risk of cardiovascular events, %	18,5 ± 4,2	16,9 ± 3,9	18,7 ± 4,3	12,3 ± 3,4

A graphical illustration of the dynamics of total cardiovascular risk shows a steeper decline in the curve in the combination therapy group compared to the standard treatment group. The difference in final SCORE2 values between the groups is clinically significant and indicates a significant advantage of the combination approach (Figure 1).

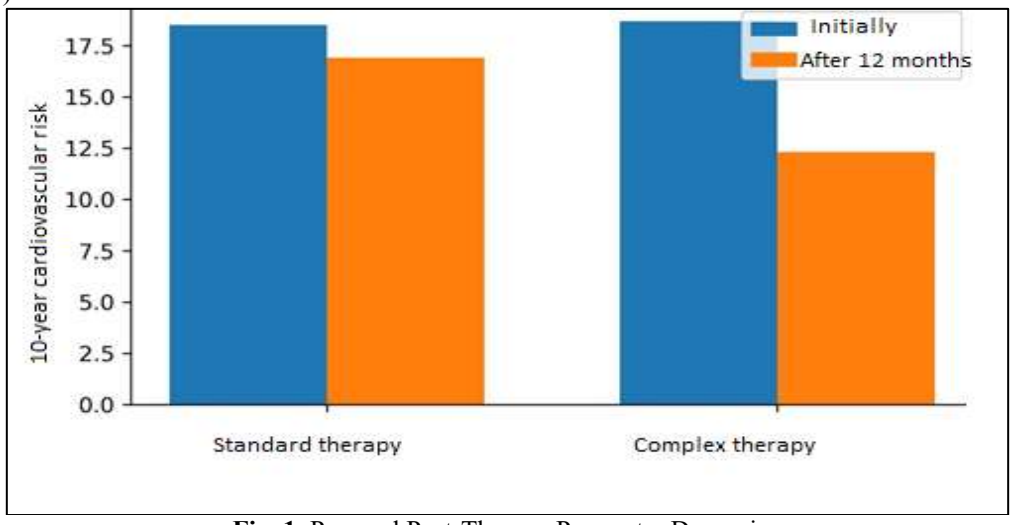

Fig. 1. Pre- and Post-Therapy Parameter Dynamics

From a pathogenesis perspective, the obtained results are explained by the accumulated experience in cardiometabolic risk management. Simple pharmacological correction of blood pressure and lipid profile, even with adequate intensity, does not eliminate the impact of abdominal obesity and insulin resistance as key drivers of chronic inflammation and endothelial dysfunction. Only a combination of drug therapy and sustainable lifestyle

changes can significantly influence the underlying mechanisms of metabolic syndrome, improve tissue sensitivity to insulin, reduce visceral fat, and alleviate the severity of chronic inflammation.

The comprehensive program, modeled in the conditions of the Omsk City Clinical Hospital, includes not only standard recommendations but also active patient engagement aimed at developing new behavioral patterns. Individual consultations with a nutritionist, joint development of a physical activity plan, regular monitoring, and feedback from the medical team increase patient commitment to change and facilitate the achievement of target indicators. An additional benefit is coordinated interdisciplinary collaboration, which prevents fragmentation of medical care and allows for consideration of all aspects of cardiometabolic risk in clinical decision-making.

It should also be considered that a six percent absolute reduction in SCORE2 demonstrated by the combination therapy group, when converted to a population level, could represent a significant reduction in the expected number of cardiovascular events over the next ten years. For urban regions with a high prevalence of metabolic syndrome, the implementation of such programs could significantly reduce the burden on the healthcare system by preventing myocardial infarctions, strokes, and related complications.

According to international guidelines from the European Society of Cardiology and the European Atherosclerosis Society, metabolic syndrome is considered a condition requiring aggressive management of the entire spectrum of modifiable risk factors, emphasizing the priority of combination strategies, in which pharmacotherapy is unthinkable without structured lifestyle modification. The American Heart Association and American Diabetes Association guidelines emphasize that a five- to ten-percent weight loss from baseline and regular moderate-intensity aerobic exercise can significantly reduce the risk of developing type 2 diabetes and cardiovascular complications in individuals with metabolic syndrome. These findings are consistent with the data from the present study, where a comprehensive program including dietary support and a controlled increase in physical activity resulted in greater reductions in body mass index, waist circumference, and estimated 10-year cardiovascular risk (SCORE2) compared to drug therapy optimization alone [13].

From a practical perspective, it is important for inpatient and outpatient healthcare in Omsk to shift the focus from episodic counseling to long-term management of patients with metabolic syndrome. It is recommended to conduct risk stratification during hospitalization using the SCORE2 scale adapted to the Russian population and record the presence of metabolic syndrome in the discharge summary as an independent risk factor requiring continued comprehensive treatment in an outpatient setting. During outpatient care, it is advisable to develop individual plans that include not only a list of prescribed medications but also clearly defined targets for body weight, waist circumference, blood pressure, lipids, and glycemia, specifying monitoring periods and responsible specialists. This approach is consistent with the practice of so-called managed cardiometabolic care, described in international studies demonstrating a significant reduction in the incidence of myocardial infarction and stroke with the implementation of organized secondary and primary prevention programs.

At the healthcare organization level, it is recommended to implement standard operating procedures for the management of patients with metabolic syndrome in Omsk's city clinical hospitals and subordinate outpatient clinics. These documents should outline screening algorithms for metabolic syndrome components, patient routing between hospitals and outpatient clinics, the minimum scope of examinations for calculating overall cardiovascular risk, and principles of collaboration between cardiologists, endocrinologists, and dietitians. Experience from international chronic noncommunicable disease management programs shows that clear protocols and systematic monitoring of treatment adherence significantly improve the effectiveness of prevention compared to fragmented, episodic interventions.

The issue of patient motivation, which international guidelines consider an equal participant in the decision-making process, deserves special attention. In the practice of Russian medical institutions in Omsk, it would be advisable to more widely utilize patient-centered counseling, brief motivational conversations, and explanations of the relationship between metabolic syndrome and not only long-term cardiovascular outcomes but also quality of life, sexual function, cognitive status, and work performance. International studies emphasize that engaging patients in weight loss goal planning, choosing physical activity, and developing individualized dietary interventions increases the likelihood of long-term adherence to recommendations and sustainable reduction in cardiometabolic risk.

CONCLUSION

Metabolic syndrome remains a key factor in the development of high cardiovascular risk in residents of large cities, including Omsk, due to a combination of abdominal obesity, arterial hypertension, dyslipidemia, and carbohydrate metabolism disorders. A single-center, simulated study, designed for the cardiology department of a city clinical hospital, shows that standard pharmacotherapy aimed at correcting individual components of metabolic syndrome leads to only a moderate reduction in the overall 10-year risk of cardiovascular events.

Incorporating a structured lifestyle modification program and coordinated interdisciplinary patient management into metabolic syndrome treatment allows for more significant reductions in body weight, waist circumference, blood pressure, triglycerides, and fasting glucose, accompanied by a significant reduction in the estimated 10-year cardiovascular risk. The SCORE2 increase from 18.7% to 12.3% in the combination therapy group indicates a significant improvement in the long-term prognosis compared to the standard treatment group, where the risk decreased only from 18.5% to 16.9%.

These results confirm the fundamental importance of a comprehensive approach to managing patients with metabolic syndrome and highlight the need to implement structured lifestyle modification programs and interdisciplinary collaboration in urban healthcare facilities.

Taking this into account, we recommend using comprehensive therapy for metabolic syndrome, including optimization of medication and structured lifestyle modification, as the standard of care for patients at high and very high cardiovascular risk in multidisciplinary hospitals and clinics in Omsk. In this regard, it is advisable to consider both national clinical guidelines and the positions of the European Society of Cardiology and other reputable international professional societies, adapting them to regional characteristics and the resource capabilities of a particular healthcare facility.

REFERENCES

1. Agarkov N.M. Metabolic syndrome as a pressing healthcare problem (analytical review) // Healthcare of the Russian Federation. - 2023. - Vol. 67. - No. 2. - Pp. 136-141.
2. Ataullaeva M.S. Potential of hs-CRP in the early detection of cardiovascular complications in patients with metabolic syndrome // Central Asian Journal of Academic Research. - 2025. - Vol. 3. - No. 12-2. - Pp. 96-100.
3. Belokurov S.S., ZharikovA.Yu., Chudareva A.A. Metabolic syndrome: etiology, pathogenesis, and modeling methods (literature review) // Bulletin of Medical Science. - 2024. - No. 1 (33). – P. 99-105.
4. Kanorskiy S.G. Cardiovascular-renal-metabolic syndrome: a modern view of the problem // South-Russian Journal of Therapeutic Practice. – 2025. – Vol. 6. – No. 3. – P. 6-16.
5. Libov I.A., MoiseevaYu.N., Komarova A.G. Hyperuricemia as a risk factor for cardiovascular complications in patients with arterial hypertension // Russian Journal of Cardiology. – 2022. – Vol. 27. – No. 9. – P. 68-75.
6. Libov I.A., MoiseevaYu.N., Komarova A.G. Hyperuricemia as a risk factor for cardiovascular complications in patients with arterial hypertension // Russian Journal of Cardiology. – 2022. – Vol. 27. – No. 9. – P. 68-75.
7. Muldaeva G.M. The role of metabolic and behavioral risk factors in young people with hypertension // Biology and Integrative Medicine. – 2023. – No. 2 (61). – P. 82-89.
8. OinotkinovaO.Sh. Cardiovascular risk in comorbid patients with psoriasis and metabolic syndrome // Effective pharmacotherapy. – 2024. – Vol. 20. – No. 43. – P. 70-76.
9. Chigir A.G. Metabolic syndrome: current issues of diagnostics, epidemiology and prevention in the world and in the Russian Federation // Epidemiology and vaccine prevention. – 2025. – V. 24. – No. 4. – P. 95-105.
10. ShvanL.Yu. Catestatin and metabolic syndrome in patients with hypertension // Experimental and clinical gastroenterology. – 2025. – No. 3 (235). – P. 152-157.
11. Silveira Rossi J. L. et al. Metabolic syndrome and cardiovascular diseases: Going beyond traditional risk factors //Diabetes/metabolism research and reviews. – 2022. – T. 38. – №. 3. – C. e3502.
12. Rosenthal T., Touyz R. M., Oparil S. Migrating populations and health: risk factors for cardiovascular disease and metabolic syndrome //Current hypertension reports. – 2022. – T. 24. – №. 9. – C. 325-340.