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Features of the distribution of the obesity phenotype depending on age

The article analyzes the prevalence of the metabolically healthy obesity (MHO) phenotype concerning age and gender. Similar to global studies, the criteria for this phenotype are actively being investigated in Kazakhstan. In 2017, the Kazakhstan Cardiology Center (KCC) presented a draft of recommendations regarding obesity. A key question revolves around the feasibility of classifying patients with metabolically healthy obesity phenotypes. It has been suggested that phenotype should be defined for each body mass index (BMI) group based on the waist-to-hip ratio. The findings indicate that the frequency of metabolic syndrome varies significantly depending on the classification used. Among women, metabolically healthy obesity phenotype occurs more frequently than in men, though its prevalence decreases with age. Individuals with metabolic syndrome, an increase in mean arterial pressure while maintaining normal levels of cholesterol, triglycerides, and high-density lipoproteins, regardless of the classification used. When using the KCC criteria to define MHO, the frequency of cardiometabolic risk factors was higher compared to other criteria. The conducted study revealed variability in the frequency of metabolic syndrome depending on the criteria used for classification: International Diabetes Federation (IDF) (2021) — 23.2 %, KCC (2021) — 27.1 %, NCEP ATP III (2021) — 41.8 %. Depending on age, the frequency of MHO phenotype in menopausal women showed a statistically significant increase across all classifications. A notable decline in the prevalence of is observed in statistical indicators among women over the age of 55.

Keywords: obesity, metabolically healthy obesity phenotype, metabolism, age and gender characteristics, arterial hypertension, diabetes mellitus.

Introduction

In economically developed countries, including the Republic of Kazakhstan, 22 % of children and 55 % of adults — comprising 58 % of women and 53 % of men — are overweight or obese. Excess weight is clearly associated with a significant increase in the risk and frequency of arterial hypertension, insulin-independent diabetes, atherosclerosis, and coronary heart disease. The progression of Type 2 diabetes mellitus has been demonstrated to be linked to elevated blood pressure, dyslipidemia, and metabolic irregularities prevalent in individuals with obesity. With a decrease in body weight, the development of atherosclerosis slows down, blood pressure normalizes or decreases, and the fight against diabetes improves.

Epidemiological research indicates that individuals with excess weight are at a higher risk of developing musculoskeletal disorders such as spinal osteochondrosis and metabolic-dystrophic polyarthritis. Additionally, they are more prone to hepatobiliary issues, including gallbladder dyskinesia, chronic cholecystitis, and cholelithiasis. Moreover, there is an elevated likelihood of local tumor development, encompassing lung cancer, breast cancer, and cancers of the uterus and ovaries.

Against the background of obesity in women, menstrual-ovarian dysfunction and infertility are often observed. Additionally, timely intervention in body weight can normalize the menstrual cycle. Patients

suffering from obesity are most often on hospital admission sheets. Such individuals experience more complications and surgical interventions after anesthesia. According to statistics, people with sensory problems are more likely to die in transport accidents and other types of accidents. Excess weight reduces average life expectancy by 3–5 years, and the life expectancy of people with high obesity is reduced to 15 years. Human mortality occurs in two out of three cases from diseases associated with impaired fat metabolism and obesity. It has been found that if humanity could solve the problem of obesity, average life expectancy would increase by 4 years. For comparison, if the cancer problem were solved, average life expectancy would be only 1 year longer.

The prevailing obesity epidemic stands out as a significant health challenge in our era. Typically, obesity is linked to an unfavorable metabolic profile, including disruptions in carbohydrate metabolism, alterations in lipid profile, elevated blood pressure, systemic inflammation, and changes in liver enzymes, among others [1]. This constellation of changes associated with obesity is commonly referred to as metabolic syndrome (MS). Nevertheless, recent findings indicate that obesity does not universally result in detrimental metabolic consequences, highlighting its non-homogeneous nature [2].

Approximately 10–30 % of individuals classified as obese exhibit a metabolically healthy state despite having an excessive accumulation of body fat. This phenomenon is commonly referred to as the metabolically healthy obesity phenotype (MHOP) in contemporary literature [3]. However, gaining a comprehensive understanding of the epidemiology and long-term implications of MHOP is challenging due to conflicting findings in various studies [4–6]. Moreover, there is inconsistency in the prevalence of MHOP across studies, with some attributing variations to the diverse definitions employed. This discrepancy underscores the disconnection between this phenotype and its associated health outcomes.

A systematic review addressing the prevalence of MHOP suggests a wide range, from 6 % to 75 %. The review also posits that socio-demographic factors, such as gender, age, and ethnicity, may contribute to this variability. When the analysis is stratified by gender and age, it reveals a higher prevalence of MHOP in women and young individuals compared to men [7–9].

It is crucial to acknowledge that researchers may incorporate diverse criteria such as excess body weight, obesity, or various metabolic syndrome (MS) indicators within the concept of metabolically healthy obesity phenotype (MHOP). Consequently, participants who exhibit no metabolic alterations or possess one or two MS symptoms, as per recent findings, might be included in the study. Despite the variations in research methodologies, there is a need for additional studies to establish the frequency of MHOP through comparative analyses. The study's objective is to evaluate the sex-age characteristics of MHOP prevalence, considering various classifications, and to examine its metabolic features.

Research materials and methods

The research was carried out on patients between 2021 and 2023 at the "Clinic of Internal Diseases", situated at 50a Raiymbek Ave., Almaty. The sample consisted of 350 individuals classified as obese (BMI ≥ 30 kg/m2), with 85 men (26.8 %) and 265 women (73.2 %). The primary methods employed in the study included anthropometric indicators and biochemical blood tests. Additionally, the research considered social behavior parameters, such as smoking habits, educational attainment, marital status, and levels of physical activity.

Blood pressure was assessed through three consecutive measurements using an Omron M5-I automatic tonometer from Japan, with a 2-minute gap, on the right hand, while the individual was seated following a 5-minute rest. Height measurements were taken with the person standing, without outerwear and shoes, using a standard height meter. Body weight was determined on calibrated lever scales, without outerwear and shoes, ensuring a measurement accuracy of 0.1 kg. The body mass index was computed using the formula:

$$\text{BMI (kg/m2)} = \text{weight (kg)} / \text{height (M2)}.$$

Peripheral blood for biochemical analyses was collected from a vein using vacuum tubes after a 12-hour fasting period. The levels of high-density lipoproteins, glucose, triglycerides, and cholesterol were determined using enzymatic methods on the KONELAB 300 automatic biochemical analyzer (Thermo Scientific, USA). The conversion of serum glucose values obtained on an empty stomach to blood plasma values was carried out using the formula proposed by researchers from the European Association for the

study of diabetes (2007): Plasma glucose concentration (mmol/L) = -0.137 + 1.047 × serum glucose concentration (mmol/L).

Three sets of criteria were employed to identify the metabolically healthy phenotype of obesity:

BMI ≥ 30 kg/m2 and IDF (2021) (International Diabetes Federation):

For men, waist circumference ≥ 94 cm; for women, waist circumference ≥ 80 cm.

Presence of at least one of the following metabolic syndrome (MS) components: Triglycerides (TG) ≥ 1.7 mmol/L; High-density lipoproteins cholesterol (HDL-C) < 1.0 mmol/l in men and HDL-C < 1.3 mmol/L in women; Blood Pressure ≥ 130/85 mmHg; Fasting plasma glucose (FPG) ≥ 5.6 mmol/L or the presence of Type 2 diabetes.

NCEP ATP III (2021) (National Cholesterol Education Program):

Presence of at least one of the following MS components: Waist circumference > 102 cm in men and > 88 cm in women; TG ≥ 1.7 mmol/L; HDL-C < 1.0 mmol/l in men and HDL-C < 1.3 mmol/l in women; Blood Pressure ≥ 130/85 mmHg; Fasting plasma glucose (FPG) ≥ 6.1 mmol/L.

KCC (2021) (Kazakhstan Cardiology Center):

An index of ba/ba ≤ 0.9 was applied for men, and Ba/Ba ≤ 0.85 for women. Statistical analysis was carried out using MS Office Excel 2019, and the significance of differences was assessed using the Student's t-criterion for two-group comparisons. The normality of the distribution of variables was examined using the Kolmogorov–Smirnov criterion. In cases where the distribution deviated from normal, parametric criteria were applied after transforming indicators using natural logarithm. The data presented in tables and text include absolute and relative values (n, %), as well as M±σ, where M represents the arithmetic mean, and σ is the standard deviation. Statistically significant differences were indicated as *p < 0.05; **p ≤ 0.01 — highly significant, ***p ≤ 0.001 — exceptionally significant.

The research was conducted in compliance with ethical standards.

Research results and analysis

The prevalence of the metabolically healthy phenotype of obesity exhibited significant variation based on the applied criteria (Fig. 1). According to the IDF (2021) criteria, it was 23.2 % (n = 43 subjects), NCEP ATP III (2021) — 41.8 % (n = 173 subjects), KCC (2021) — 27.1 % (n = 134 subjects), ***p<0.001. Notably, the KCC (2021) criteria revealed a specificity of 3 % in men for the incidence of MSF, highlighting a pronounced prevalence of abdominal obesity.

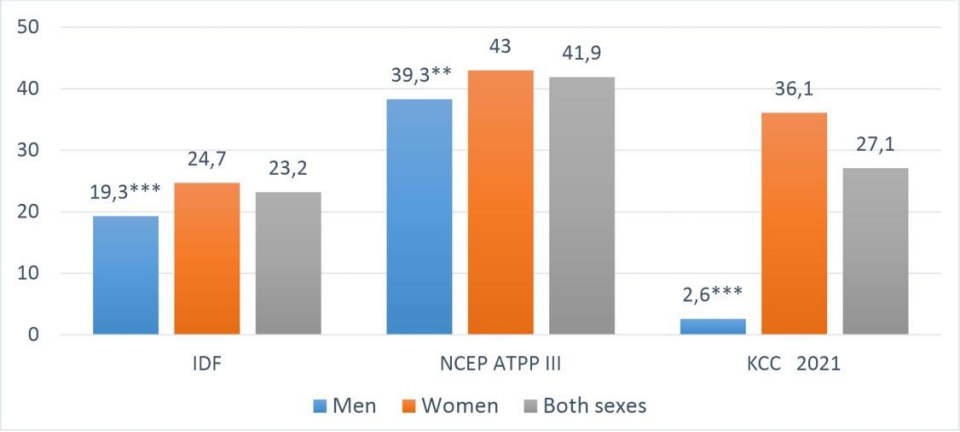
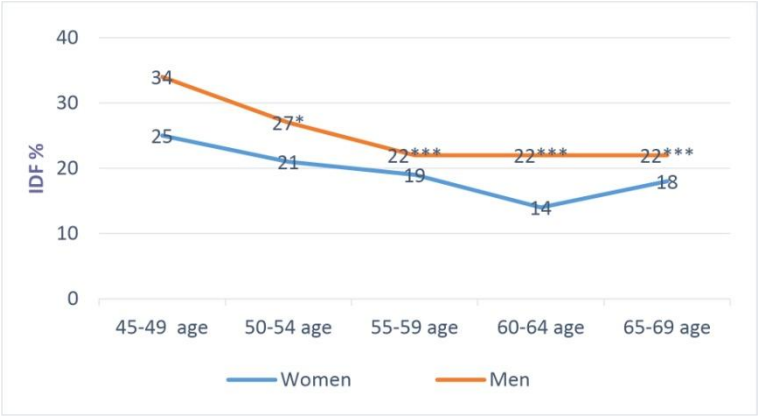
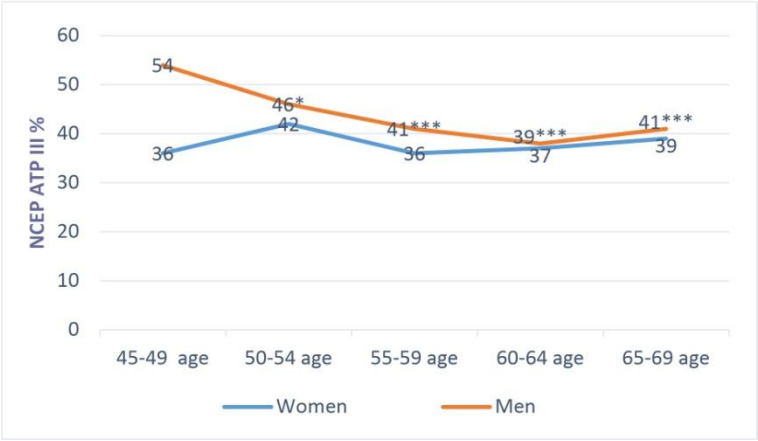


Figure 1. Distribution of the metabolically healthy obesity phenotype according to different classifications: * * p < 0.01; ** * p < 0.001-statistical significance of differences between men and women

The prevalence of MHOP is higher in women compared to men, as depicted in Figure 2. Recognizing the significance of age and gender as factors influencing the development of MHOP, its frequency was assessed across various age groups.



A)



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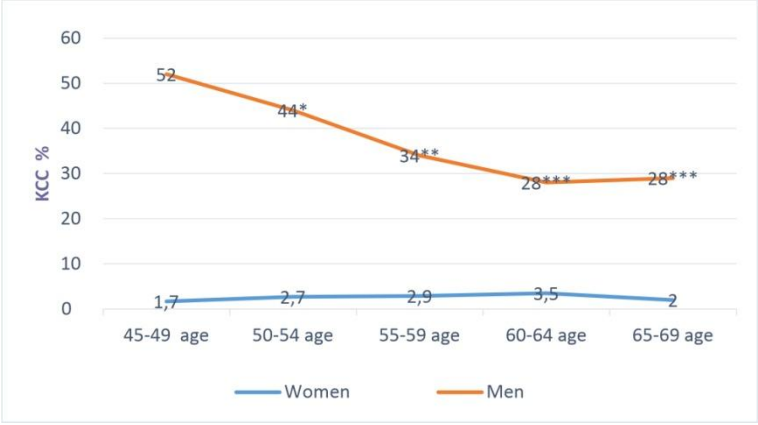

C)

Figure 2. Age and gender characteristics of the prevalence of MHOP: A) IDF, B) NCEP ATP III, C) according to the criteria of the KCC * p<0.05, *** p<0,001 — 45 — 69 statistical significance of age differences

The highest occurrence of the metabolically healthy obesity phenotype among women occurred in the age group of 45–49 years, with rates of 34.1 % (IDF, 2021), 54.0 % (NCEP ATP III, 2021), and 52.9 % (KCC, 2021). In women aged over 55, MHOP is notably less prevalent compared to the 45–49 age group, with a significant difference, $p<0.001$. For men, there was no statistically significant difference in the frequency of MHOP across all age groups, $p>0.05$.

The study results highlight a greater occurrence of the metabolically healthy obesity phenotype in women compared to men, with a decline noted in women aged over 55. When analyzing the frequency of

risk factors among individuals with the metabolically healthy obesity phenotype, a higher prevalence of abdominal obesity was observed in both men and women. A gender-based comparative analysis revealed that, across various criteria (NCEP ATP III, IDF, KCC), women exhibited higher prevalence rates than men: for NCEP ATP III — 90 % in women and 71 % in men ($p<0.001$); for IDF — 99 % in women and 97 % in men ($p < 0.001$); and for KCC — 99 % in women and 86 % in men ($p < 0.001$).

The average age at the point of inclusion in the control group was 58.2 ± 6.8 years for men and 58.7 ± 7.0 years for women. The initial examination involved the analysis of various data, including age, anthropometric indicators, blood pressure measurements, total cholesterol (TC), triglycerides (TG), high-density lipoproteins cholesterol (HDL-C), low-density lipoproteins cholesterol (LDL-C), and fasting blood plasma glucose (FPG), as detailed in Table 1.

Table 1

The main clinical and biochemical indicators of the studied objects at the age of 45–69 years, m ± σ

Indications	Men n = 43	Female n = 173	Two sexes n = 134	pe/a
Systolic BP, mmHg	154,6 ± 24,3	151 ± 23,5	152,3 ± 26,7*	p<0,57
Diastolic BP, mmHg	96,5 ± 12,1	96,6 ± 12,3	98,1 ± 12,1*	p<0,001
BMI, kg/m2	36,1 ± 2,0	34,9 ± 3,2	36,4 ± 3,0*	p<0,001
Fasting glucose, mmol/l	6,7 ± 2,4	6,5 ± 1,5	6,6 ± 2,4*	p<0,001
Total cholesterol, mmol/l	5,3 ± 1,5	6,8 ± 1,7	6,7 ± 1,3*	p<0,001
LDL-C, mmol/l	5,1 ± 1,0	4,6 ± 1,1	5,3 ± 1,3*	p<0,001
HDL-C, mmol/l	1,4 ±0,3	1,7 ± 0,4	1,4 ± 0,6*	p<0,001
TG, mmol/l	1,7 ± 1,0	1,8 ± 0,7	1,9 ± 0,9*	p<0,001

Information regarding a history of elevated blood pressure and recent use of antihypertensive medications within the last two weeks was gathered in advance during the screening of participants. In instances where individuals had a prior diagnosis of arterial hypertension (AH) but were currently taking blood pressure-lowering medications, both those with normotension and those with AH were included in the screening.

For individuals with the metabolically healthy obesity phenotype (MHOP), the analysis was conducted based on various classifications, where the average values of systolic and diastolic blood pressure were determined. The key components of this analysis are presented in Table 2.

The prevalence of arterial hypertension (AH) in the NCEP ATP III group is similar between men and women, with $p>0.01$. According to KCC criteria, there is a higher incidence of AH in men (91 %) compared to women (84 %) with $p<0.001$. In the IDF group, AH is more frequently observed in women than in men, accounting to 70 % and 67 %, respectively, with $P<0.05$. Carbohydrate metabolism disorders, as per NCEP criteria, have a lower frequency in individuals with the metabolically healthy obesity phenotype (MHOP) according to ATP III and IDF criteria. However, according to KCC criteria, the prevalence of hyperglycemia is 36 %, with 26 % in women, $p<0.001$.

Various lipid spectrum disorders, such as hypertriglyceridemia (HyperTG) and low high-density lipoprotein cholesterol (HypoHDL-C), have low frequencies in MHOP according to IDF and NCEP ATP III criteria. The statistical significance of the differences between men and women was not observed. However, based on KCC criteria, there is a high prevalence of hypertriglyceridemia (HyperTG) and low high-density lipoprotein cholesterol (HypoHDL-C) in women (39 % and 31 %, respectively), while the frequency of hypertriglyceridemia in men is lower (27%) and low HDL-C levels are observed in 9% of men, with $p<0.001$ for these indicators.

Table 2

Clinical and biochemical indicators of people with MHOP, M ± σ

Indicators	IDF n= 43	NCEP ATP III n= 173	KCC n=134
Systolic BP, mmHg	141,9 ± 25,5	144,4 ± 26,1	145,7 ± 25,3
Diastolic BP, mmHg	89,8± 13,0	91,0 ± 13,5	91,5 ± 12,5
BMI, kg/m2	32,7 ± 3,6	32,7 ± 3,6	33,1 ± 4,1
Fasting glucose, mmol/l	100,0 ± 9,6	100,3 ± 9,6	95,1 ± 7,9
Total cholesterol, mmol/l	4,3 ± 0,7	4,5 ± 0,7	4,8 ± 1,2
LDL-C, mmol/l	6,1± 1,0	6,2± 1,1	6,3± 1,2
HDL-C, mmol/l	3,8± 0,9	4,1± 1,0	4,3± 1,1
TG, mmol/l	1,6± 0,2	1,6± 0,2	1,6±0,3

Recent research papers have highlighted the absence of a standardized approach utilizing a consistent set of criteria and threshold values for identifying metabolic disorders, particularly in studies focusing on obesity. This lack of uniformity serves as a primary contributor to the substantial variability observed in the prevalence of the metabolically healthy obesity phenotype (MHOP) [10-11]. Epidemiological data reveal that the group prevalence of MHOP can vary widely, ranging from 3.7 % to 57 %, depending on the classification used in each specific study. This broad spectrum of MHOP conditions leads to conflicting findings regarding the investigation of cardiovascular and metabolic outcomes, presenting a significant challenge in comprehending its long-term implications.

Metabolically healthy obesity is generally characterized by the absence of metabolic abnormalities, with many researchers defining it as obesity without significant cardiometabolic disorders, such as metabolic syndrome. Studies like HUNT-II suggest that indicators of abdominal obesity, like the BA/BA index, might serve as better predictors of coronary artery disease compared to the DSI. Similar results were observed in the Australian National Diabetes, Obesity and Lifestyle Study (AusDiab), where individuals with a large waist and a small hip circumference had the highest prevalence of diabetes. Another study highlighted the occurrence of hypertension and undiagnosed dyslipidemia in individuals with this condition who were not previously diagnosed [12].

In our investigation, the examination of the distribution of the metabolically healthy obesity phenotype (MHOP) revealed a prevalence of 23.2 % based on IDF (2021) criteria and 41.8 % according to NCEP ATP III criteria. Notably, in women, the occurrence of MHOP is significantly more frequent than in men. However, outcomes from BioSHaRE researchers, who analyzed data from various epidemiological studies with standardized criteria, demonstrate considerable variability in the prevalence of MHOP across Asia. The highest percentage of MHOP was observed in the CHRIS and KORA studies, especially in women from NCDS, LifeLines, KORA, and CHRIS, while the lowest prevalence was noted in HUNT2 with Finnish cohorts.

Based on our findings, gender disparities in the prevalence of the metabolically healthy obesity phenotype (MHOP) were evident across different age groups. In women aged over 55, a notable reduction in MHOP was observed compared to men with advancing age. This decline may be attributed to the likelihood that women tend to experience menopause at a later stage in life. Existing literature supports the notion that components of metabolic syndrome, including abdominal obesity, hypercholesterolemia, low levels of high-density lipoprotein cholesterol (HDL-C), elevated triglycerides, and high glucose levels, indicate an increased prevalence of metabolic syndrome and its constituents in menopausal women [13].

Among men, a marginal decline in the prevalence of the metabolically healthy obesity phenotype (MHOP) was noted in older age groups. Our findings suggest that this trend is linked to the average life expectancy of men with MHOP in Kazakhstan, which, as of 2016 data, is reported to be 66.5 years [14].

An analysis of the primary components was conducted for individuals with the metabolically healthy obesity phenotype (MHOP) across various classifications. It was observed that the average values of both systolic and diastolic blood pressure, as presented in Table 2, were higher when compared to contemporary recommendations for the diagnosis and management of hypertension. The examination of lipid spectrum components revealed normal levels of triglycerides (TG) and high-density lipoprotein cholesterol (HDL-C) across all analyzed classifications. However, levels of low-density lipoprotein cholesterol (LDL-C) and total

cholesterol (TC) surpassed the reference values for the general population, indicating an increased cardiovascular risk even in individuals initially classified as low-risk.

Consequently, the observed variability in the distribution of the metabolically healthy obesity phenotype (MHOP), coupled with its elevated prevalence in younger individuals, corresponds with global trends. This situation introduces uncertainty regarding the future implications of this state, emphasizing the necessity for a unified classification of MHOP to ascertain outcomes like myocardial infarction, cerebral circulation disorders, type 2 diabetes, and others. The timing of medical intervention in lifestyle modifications for optimal health benefits to the patient remains ambiguous, necessitating further in-depth investigation.

It is important to acknowledge that metabolically healthy obesity phenotype (MHOP) is considered a transitional state, and there is a possibility of later addition of components associated with metabolic syndrome [15]. Our study revealed that individuals with MHOP, regardless of gender, exhibit the highest frequency of all cardiometabolic risk factors according to the defined criteria. While the Ba/Ba index is traditionally viewed as an indicator of abdominal obesity, our data showed a relatively high prevalence of abdominal obesity despite normal Ba/Ba index values in individuals with MHOP.

Analyzing the general population at the "Clinic of Internal Diseases" on 50a Raiymbek Ave., Almaty, we found that among individuals aged 45–69 years, based on NCEP-ATP III (2001) criteria, the most common components in those with metabolic syndrome were abdominal obesity (95 %) and elevated blood glucose (85 %). The observed variability in the distribution of MHOP and its high prevalence across different genders and age groups align with global trends. These findings underscore the relevance of considering MHOP in predicting outcomes such as myocardial infarction, cerebrovascular disorders, type 2 diabetes, etc., emphasizing the need for increased attention and further comprehensive study towards establishing a unified classification for the metabolically healthy obesity phenotype.

Conclusion

In summary, the study's findings reveal that the prevalence of the metabolically healthy obesity phenotype (MHOP) varies based on the classification used: IDF (2021) — 23.2 %, KCC (2021) — 27.1 %, and NCEP ATP III (2021) — 41.8 %. When considering age and menopause in a female sample, the frequency of MHOP exhibited statistically significantly higher values across all classifications. Particularly noteworthy is the significant decline in the frequency of MHOP among women aged over 55.

Among women, higher frequency indicators of all cardiometabolic risk factors were more pronounced compared to other MHOP criteria. Furthermore, the analysis of risk factors in individuals with MHOP, considering all studied criteria, revealed a heightened prevalence of abdominal obesity in both men and women. A gender-based comparative analysis underscored that women exhibited a higher prevalence than men.

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Жас ерекшеліктеріне қарай семіздік фенотипінің таралуының ерекшеліктері

Мақалада жасына және жынысына байланысты метаболикалық сау семіздік фенотипінің (МССФ) таралуы талданған. Әлемдік зерттеулерге ұқсас Қазақстанда осы фенотиптің критерийлері белсенді зерттелуде. 2017 жылы Қазақстан кардиология қоғамы (ҚКҚ) семіздік мәселесін шешу бойынша ұсынымдар жобасын ұсынды. Негізгі сұрақтардың бірі — метаболикалық сау семіздік фенотипі бар науқастарды жіктеудің маңыздылығы. Бұл фенотипті дене салмағының индексінің (ДСИ) әр тобында бел шеңберінен жамбас шеңберіне қатынасы негізінде анықтау ұсынылды. Алынған нәтижелер метаболикалық синдромның жиілігі қолданылатын жіктеуге байланысты айтарлықтай өзгеретінін көрсетті. Әйелдер арасында метаболикалық сау семіздік фенотипі ерлерге қарағанда айтарлықтай жиі кездеседі, бірақ оның таралуы жас ұлғайған сайын төмендейді. Метаболикалық синдромы бар адамдарда қолданылатын жіктеуге қарамастан, жоғары тығыздықтағы холестерин, триглицеридтер мен липопротеидтердің қалыпты деңгейін сақтай отырып, орташа қан қысымының жоғарылауы байқалды. МССФ анықтау үшін ҚКҚ критерийлерін пайдаланған кезде кардиометаболикалық қауіп факторларының жиілігі басқа критерийлерге қарағанда жоғары болды. Зерттеу барысында жіктеу кезінде қолданылатын критерийлерге байланысты метаболикалық синдром жиілігінің өзгергіштігі анықталды, яғни: Халықаралық қант диабеті федерациясы (IDF) (2021 ж.) — 23,2%, ҚКҚ (2021 ж.) — 27,1%, NCEP ATP III (2021 ж.) — 41,8%. Менопаузадағы әйелдердің жасына байланысты МССФ жиілігі барлық жіктеулер бойынша айтарлықтай өсуді көрсетті. Статистикалық көрсеткіштер бойынша МССФ таралуының айтарлықтай төмендеуі 55 жастан асқан әйелдер арасында байқалды.

Кілт сөздер: семіздік, метаболикалық сау семіздік фенотипі, зат алмасу, жас және жыныстық ерекшеліктер, артериялық гипертензия, қант диабеті.

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Особенности распространения фенотипа ожирения в зависимости от возраста

В статье анализируется распространенность метаболически здорового фенотипа ожирения (МЗФО) в зависимости от возраста и пола. Аналогично мировым исследованиям, в Казахстане активно изучают критерии данного фенотипа. В 2017 году Казахстанское кардиологическое общество (ККО) представило проект рекомендаций по решению проблемы ожирения. Одним из ключевых вопросов является целесообразность классификации пациентов с метаболически здоровым фенотипом ожирения. Предложено определять этот фенотип в каждой группе индекса массы тела (ИМТ) на основании соотношения окружности талии к окружности бедер. Полученные данные свидетельствуют о том, что частота метаболического синдрома существенно варьируется в зависимости от применяемой классификации. Среди женщин метаболически здоровый фенотип ожирения встречается значительно чаще, чем среди мужчин, однако его распространенность снижается с

возрастом. У лиц с метаболическим синдромом отмечено повышение среднего артериального давления при сохранении нормального уровня холестерина, триглицеридов и липопротеинов высокой плотности, независимо от применяемой классификации. При использовании критериев ККО для определения МЗФО частота кардиометаболических факторов риска оказалась выше, чем по другим критериям. В ходе проведенного исследования выявлена изменчивость частоты метаболического синдрома в зависимости от использованных при классификации критериев: Международная Федерация диабета (IDF) (2021 г.) — 23,2 %, ККО (2021 г.) — 27,1 %, NCEP ATP III (2021 г.) — 41,8 %. В зависимости от возраста у женщин в период менопаузы частота МЗФО показала значительное повышение по всем классификациям. Заметное снижение распространенности МЗФО наблюдается в статистических показателях среди женщин старше 55 лет.

Ключевые слова: ожирение, метаболически здоровый фенотип ожирения, обмен веществ, возрастные и половые признаки, артериальная гипертензия, сахарный диабет.

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