Received: 05 May 2021 / Accepted: 15 July 2021 / Published online: 31 August 2021

DOI 10.34689/SH.2021.23.4.014

UDC 618.3-008.9-039.11

HEALTH STATUS IN PERSONS OF REPRODUCTIVE AGE WITH METABOLIC SYNDROME

Kamshat Akhmetova [1-2], https://orcid.org/0000-0003-4225-3025
Tamara Vochshenkova [1], https://orcid.org/0000-0003-0935-6217
Erbolat Dalenov [2], https://orcid.org/0000-0002-7009-583X
Aigul Abduldayeva [2], https://orcid.org/0000-0002-1310-3290

[1] Medical Center Hospital of the President's Affairs Administration of the Republic of Kazakhstan, Nur-Sultan c., Republic of Kazakhstan.
[2] Astana Medical University, Nur-Sultan c., Republic of Kazakhstan.

Abstract

Introduction. As noted in the state program for the development of healthcare of the Republic of Kazakhstan for 2020-2025, the emphasis on non – communicable diseases with high prevalence rates and prone to steady growth is one of the characteristic features of healthcare in Kazakhstan and all developed countries. Among the signs important for understanding health, a special place is occupied by the state of health of the population of reproductive age. Since it is a necessary condition for the well-being of future generations and the guarantee of a sufficient population in the state.

Objective: To determine the health condition of the reproductive age people of suffering from MS.Methods. Study design: observational, simultaneous, case-control. The study involved 1065 people aged 18 to 49 years, the average age was 40.2 years. Metabolic syndrome in respondents was determined according to the IDF criteria (2005). Statistical analysis was performed in the SPSS 24 program. Pearson's test, $\chi 2$, Welch T test in two samples, non-parametric Mann-Whitney test for independent groups were performed. The statistical reliability of the indicators was assessed at the level of $p < 0.05$.

Research results. Hemogram indices, lipid profile, body weight, waist volume, visceral fat index, liver enzymes, renal function indices, the state of the common carotid artery layers, biological age indices and the aging rate coefficient were higher in study participants with metabolic syndrome compared with respondents without metabolic syndrome ($p < 0.05$).

Conclusion. Thus, it was found that patients with metabolic syndrome suffer from obesity, which is accompanied by an excessive accumulation of visceral fat, an increase in the waist volume and body mass index. In patients with metabolic syndrome, the functions of the liver, kidneys, heart are impaired, and the indices of general clinical and biochemical blood tests are changed. In connection with these changes, a greater biological age of patients was revealed, i.e., a faster aging process. In addition, individuals with metabolic syndrome were found to have abnormalities in the structure of the heart and changes in the carotid artery, leading to atherosclerosis.

Key words: *reproductive age, metabolic syndrome, visceral fat index, obesity.*

Резюме

СОСТОЯНИЕ ЗДОРОВЬЯ У ЛИЦ РЕПРОДУКТИВНОГО ВОЗРАСТА С МЕТАБОЛИЧЕСКИМ СИНДРОМОМ

Камшат Ахметова [1-2], https://orcid.org/0000-0003-4225-3025
Тамара Вощенкова [1], https://orcid.org/0000-0003-0935-6217
Ерболат Даленов [2], https://orcid.org/0000-0002-7009-583X
Айгуль Абдулдаева [2], https://orcid.org/0000-0002-1310-3290

[1] Больница Медицинского центра Управления делами Президента РК, г. Нур-Султан, Республика Казахстан.
[2] НАО "Медицинский Университет Астана», г. Нур-Султан, Республика Казахстан.

Введение. Как отмечено в государственной программе развития здравоохранения Республики Казахстан на 2020-2025 годы, акцент на неинфекционные заболевания, имеющие высокие показатели распространенности и склонные к устойчивому росту – одна из характерных черт здравоохранения Казахстана и всех развитых стран. Среди признаков, важных для понимания здоровья, особое место занимает состояние здоровья населения репродуктивного возраста. Поскольку оно является необходимым условием благополучия последующих поколений и залогом достаточной численности населения в государстве.

Цель исследования: оценка состояния здоровья лиц репродуктивного возраста, страдающих метаболическим синдромом.

Материалы и методы. Дизайн исследования: обсервационное, одномоментное, случай-контроль. В исследовании приняли участие 1065 человек в возрасте от 18 до 49 лет, средний возраст составил 40,2 года. Метаболический синдром у респондентов определяли по критериям IDF (2005). Статистический анализ выполнен в программе SPSS 24. Был проведен тест Пирсона, χ2, тест Welch T в двух образцах, непараметрический тест Манна-Уитни для независимых групп. Статистическая достоверность показателей оценивалась на уровне p<0,05.

Результаты исследования. Показатели гемограммы, липидный профиль, масса тела, объем талии, индекс висцерального жира, печеночные ферменты, показатели почечной функции, состояние слоев общей сонной артерии, показатели биологического возраста и коэффициент скорости старения были выше у участников исследования с метаболическим синдромом в сравнении с респондентами без метаболического синдрома (p < 0,05).

Заключение. Таким образом, установлено, что пациенты с метаболическим синдромом страдают ожирением, которое сопровождается избыточным накоплением висцерального жира, увеличением объема талии и индекса массы тела. У пациентов с МС нарушены функции печени, почек, сердца и изменены показатели общеклинических и биохимические анализов крови. В связи с этими изменениями выявлен больший биологический возраст больных, т. е. более быстрый процесс старения. Кроме того, у индивидуумов с МС выявлены нарушения строения сердца и изменения сонной артерии, приводящие к атеросклерозу.

Ключевые слова: репродуктивный возраст, метаболический синдром, индекс висцерального жира, ожирение.

Түйіндеме

МЕТАБОЛИЗМДІК СИНДРОМНАН ЗАРДАП ШЕГЕТІН РЕПРОДУКЦИЯЛЫҚ ЖАСТАҒЫ АДАМДАРДЫҢ ДЕНСАУЛЫҚ ЖАҒДАЙЫ

Камшат Ахметова [1-2], https://orcid.org/0000-0003-4225-3025

Тамара Вощенкова [1], https://orcid.org/0000-0003-0935-6217

Ерболат Даленов [2], https://orcid.org/0000-0002-7009-583X

Айгуль Абдулдаева [2], https://orcid.org/0000-0002-1310-3290

[1] ҚР Президенті Іс Басқармасы Медициналық орталығының Ауруханасы, Нұр-Сұлтан қ., Қазақстан Республикасы

[2] «Астана медицина университеті» КеАҚ, Нұр-Сұлтан қ., Қазақстан Республикасы

Кіріспе. Қазақстан Республикасының денсаулық сақтау саласын дамытудың 2020-2025 жылдарға арналған мемлекеттік бағдарламасында атап өтілгендей, жоғары көрсеткіштерге ие және тұрақты өсуге бейім, инфекциялық емес ауруларға баса назар аудару – барлық дамыған елдердің денсаулық сақтау саласына тән сипаттардың бірі. Денсаулықты сипаттайтын маңызды белгілердің ішінде репродукциялық жастағы адамдардың денсаулық жағдайы ерекше орын алады. Себебі, ол мемлекеттегі халық саны мен кейінгі ұрпақ жақсы өмір сүруінің кепілі болып табылады

Мақсаты: Репродукциялық жастағы МС зардап шегетін адамдардың денсаулық жағдайын бағалау.

Материалы и методы. Зерттеу дизайны: обсервациялық, бірмезгілді, жағдай-бақылау. Зерттеуге 18 бен 49 жас аралығындағы 1065 адам қатысты. Олардың орташа жасы 40,2 жылға тең болды. Респонденттердегі метаболизмдіек синдром IDF (2005) критерийлері бойынша анықталды. Статистикалық талдау SPSS 24 программасында жасалды. Екі үлгідегі Welch тесті, Пирсон тесті, χ2, және тәуелсіз топтар үшін параметриялық емес Манна-Уитни тесті жүргізілді. Көрсеткіштердің статистикалық шынайылығы p < 0,05 деңгейінде бағаланды.

Зерттеу нәтижелері. Метаболизмдік синдромынан зардап шегетін зерттеушілерде гемограмма көрсеткіштері, липидтік профиль, дене салмағы, белдің көлемі, висцеральды май индексі, бауыр ферменттері, бүйрек функциясының индекстері, ұйқы артериясы жалпы қабаттарының жағдайы, биологиялық жас көрсеткіштері мен қартаю коэффициенті метаболизмдік синдромы жоқ респонденттерге қарағанда жоғары болды (p < 0,05).

Қорытынды. Осылайша, МС бар науқастар висцералды майдың артық мөлшерде жиналуымен, бел өлшемінің және дене салмағы индексінің артуымен жүретін семіздіктен зардап шегетіндігі анықталды. Сондай-ақ, бауыр, бүйрек, жүрек қызметі бұзылыстары мен осы мүшелер қызметімен байланысты жалпы клиникалық және биохимиялық қан өзгерістері, липидті профильдің өзгерістері анықталды. Осы өзгерістерге байланысты науқастардың биологиялық жасының үлкендігі, яғни қартаю процессінің тез жүріп жатқандығы, сәйкесінше оларда жүрек құрылымының бұзылыстары мен атеросклерозға алып келетін ұйқы артериясының өзгерістері анықталды.

Түйінді сөздер*: репродукциялық жас, метаболизмдік синдром, висцеральды май индексі, семіздік.*

Bibliographic citation:

Akhmetova K., Vochshenkova T., Dalenov E., Abduldayeva A. Health status in persons of reproductive age with metabolic syndrome // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2021, (Vol.23) 4, pp. 130-137. *doi 10.34689/SH.2021.23.4.014*

Ахметова К., Вощенкова Т., Даленов Е., Абдулдаева А. Состояние здоровья у лиц репродуктивного возраста с метаболическим синдромом // Наука и Здравоохранение. 2021. 4(Т.23). С. 130-137. *doi 10.34689/SH.2021.23.4.014*

Ахметова К., Вощенкова Т., Даленов Е., Абдулдаева А. Метаболизмдік синдромнан зардап шегетін репродукциялық жастағы адамдардың денсаулық жағдайы // Ғылым және Денсаулық сақтау. 2021. 4 (Т.23). Б. 130-137. *doi 10.34689/SH.2021.23.4.014*

Introduction

As it was pointed out in the state program for 2020-2025 on the development of the Health Care field of the Republic of Kazakhstan, to pay a great attention to non-infectious diseases which are high in rate and which can have constant growth is one of the characteristics of health Care of all the developed countries [1]. It is because, health being connected with the development of human resources of a country is considered to be the base of medical and social problems [22]. The reproductive health takes an important place among those, which forms it [14]. As the health of those who are a reproductive age, their abilities to realize it and the ability of the women to bring a child to the world are considered to be the important aspects of the health of inhabitants, the number of populations is closely connected with the reproductive health of inhabitants. Nowadays the spread non-infection disease are the main reasons of morbidity and mortality. One of the non-infections disease, which are widely spread in the world, is metabolic syndrome (MS). MS is the pathophysiologic case without any symptom which goes along with obesity, insulin resistance (IR), hypertension, disglycemia and dislipidemia [17]. Because of the complicated pathophysical condition of MS in those who have MS the risk of developing of the ischemic case of the heart is higher for 2-3 times, of the type 2 diabetes mellitus (T2DM) is higher for 3.5-5 times, death case is higher for 1.2-1.6 times than in those who do not have MS [20]. That is why it is important to enhance the prophylactic measures and prior to improvement of the prophylactic measures it is of a great importance to determine the health condition of the people who suffer from MS.

Objective: To determine the health condition of the reproductive age people of suffering from MS.

Materials and methods:

To reach the objective of the research the observative-analytic state-observing method of studing was used. The measuring which are not to be taken for the research: like the case which needs the first-medical aid service, up to 18 years of age, people of over 49 years and pregnancy. The measuring for the research included those who are between 18 years old and 49 who have been living in the city of Nur-Sultan for more than 10 years. For selection there was used ordinary presumptive selection using the random numbers generator from the list of those who are at reproductive age that are registered in the clinics of Nur-Sultan.

There were 1065 persons involved in the research from 18 up to 49 years of age. Their average age was 40.2. They were determined according to the criteria of MS IDF (2005). According to IDF measurings alongside with the abdominal obesity (in men waist circumference (WC) >94 cm, in women >80 cm) if there are two out of four factors that indicated below, in that case MS will be diagnosed:

1 The high level of triglyceride (TG) ≥150 mgr/dl (1.7 mmol/l) or special treatment according to this disturbance.

2 Decreasing of the number of high density lipoproteins (HDL): in men <40 mgr/dl (1.03 mmol/l), in women <50 mgr/dl (1.29 mmol/l) or a special treatment according to this disturbance.

3 High blood pressure: systolic blood preasure ≥130 or dystolic blood pressure ≥80 mm on the Hg or a special treatment according arterial hypertension (AH).

4 The increase of glucose level in plasma: ≥100 mgr/dl (5.6 mmol/l) or T2DM.

During the clinical studying there were taken blood pressure in order to diagnose the MS and for anthropometric indices of the patients.

The anthropometric studying included the weight and the measurements of waist and thigh of the patients.

The body weight of the patient who was involved in the studying was measured on the standard medical scales without the clothes and without the shoes. The body weight was measured at about 0.1 kgr and it was taken into the questionnaire as the measurement unit kilogram (kgr).

The height of the patient was measured by the height measurement device without the shoes. The patient stood looking forward with his back touched the device, keeping his/her heels together, putting the external angle of his eyes and the top part of the holes of his/her external hearing ways onto one horizontal line. The height measuring line was brought down to the head of the patient perpendicularly and his/her height was taken into the questionnaire with the approximate 1 cm mistake with the measurement unit meter (m).

The assessment of the obesity level of the respondents was reached by determining the body weight indicates Quetelet (Body mass index, BMI) and measuring the anthropometric indications. With the help of the body weight indicates it is possible to determine the risk of developing of the circumstantial disease and the proportional level of the weight to the height: $I=m/h^2$.

Here, m-body weight, by kilogram, h-weight, by meter.

The waist measurement is measured with a soft centimeter band putting the respondent standing horizontally and it was measured at breathing out from the middle part of the last rip and the front upper part of the thigh bone.

The blood samples for the analysis of overall clinical indications of the blood were taken from the shoulder (forearm) vein of the patients after their 12 hours hunger. Overall clinical indications of the blood - erythrocyte sedimentation rate (ESR), hemoglobin, hematocrit,

erythrocytes, leucocytes, neutrophiles, lymphocytes, monocytes, thrombocytes, hematological automatic analyzator XN-3000 (Sysmex Corp., Kobe, Japan) were determined.

By centrifugalizing the blood during 10 minutes 1000 × g (4C) plasma was taken and it was kept at -30 C^0 temperature for biochemical analysis. On the day of the blood sample the plasma was used for the analysis after the centrifuge. In the biochemical analyzator Abbott Architect with 8000 (Abbott Laboratories, US) glucosa-hexokinase, levels were determined with the help of the method of glycated hemoglobin using the liquid chromatography of a high effect.

Uric acid was determined at mkmol/l with the photometric method in the Abbott Architect with 8000 analyzator.

For biochemical studying indication the lipid spectrum of the blood was determined with the help of spectrophotometric method putting the total cholesterol (TCH), TG, low-density lipoprotein (LDL), HDL, into the Abbott Architect with 8000 analyzator. Their results were with determined by mmol/l. The non-high-density lipoprotein (non-HDL) was determined according to the formula which is written below: non-HDL= TCH-HDL.

In clinical practice some indices indicators which show the atherogenic and antiatherogenic lipoproteins relation which characterize the lipid spectrum of blood plasma, are well-known. The simplest and also the highly informative indicator is the atherogenic coefficient (AC) of the cholesterol [13]. It is determined by the following formula: AC= (TCH-LDL)/HDL.

The coefficient of a biological age (BA) and aging rate (ARC) were determined by the method patented by the Russian scientists A.G. Gorelkin and B.B. Pinkhasov [2].

For women: BA=ARCx(CA-18)+18;

$ARC=WCxBM/HCxH^2x(14,7+0,26xAD+0,001xAD^2)$.

For men: BA=ARCx(CA-21)+21;

$ARC=WCxBM/HCxH^2x(17,2+0,31xAD+0,0012xAD^2)$.

Here,

BA- biological age (year);

ARC- age rate coefficient;

CA- calendar age (year);

WC- waist circumference (cm);

BM- body mass(kgr);

HP- hip circumference (cm);

H- height (cm);

AD-age difference (year).

ARC from 0.95 to 1.05 shows the moderate aging process, if it is less than 0.95 it shows the slow aging, if it is higher than 1.05 then it shows the quick process of aging.

The research was done in according with the laws of Kazakhstan and principles of Helsink Declaration [6]. The respondents made their own decision to take part in the research and filled in the informative agreement paper. The permission of carrying out the research was approved by the Local ethic Committee of Medical Center Hospital of the President's Affairs Administration of the Republic of Kazakhstan (№4, 23.12.2019).

The statistic analysis was held on SPSS 24 program. In determining the consequent disease and general carotid artery layers in the respondents with and without MS there was Pirson x^2 test. For assessing the body mass in two groups there was used Welch t test, of 2 types, for the rest indications which were assessed during the research there was used non-parametric Manna-Whitney test which are designed for independent groups. The statistic authenticity of the indications was assessed at $p < 0.05$ level.

The results of the research

The results of the research are shown in the table 1. The heights of the respondents with MS (170 cm ± 8.7) were higher than those of without MS (167 cm ± 8.8) ($p<0.001$). The body mass in MS patients were for about 9 kgr more (87 kgr ± 15) than of those without MS (78 kgr ± 16) ($p<0.001$). Also there was over weigth in the patients without MS (BMI=28 ± 4.6), in the patient with MS there was obesity (BMI=30 ± 4.6) ($p<0.001$). The WC was equal to 102 cm in those with MS, in the observing group this indication was 94 cm ($p<0.001$). Waist-to-hip ratio (WHR) in the patients with MS was equal to 1, in the observing group to 0.99 ($p<0.001$). Visceral fat index (VFI) in the patients with MS was equal to 2.7, in the observing group it was 1.5.

In the patients under the research BA in the respondents without MS was equal to 43 years old, in those with MS 49 years old ($p<0.001$). Thus, the difference between the calendar age and BA in those with MS was determined statistically by 8 years more. Though ARC was not more, there was a difference (1.3 and 1.4; $p<0.001$).

Indications of blood (hemoglobin, hematocrit, erythrocyte, neutrophil, lymphocyte, MCHC) were high in those respondents with MS ($p<0.001$).

In the group with MS the TCH number was (5.4 ± 1), tg (1.8 ± 0.72), AC (3.9 ± 1.3), non-HDL (4.2 ± 1.1) level was high and the level of HDL (1.1 ± 0.25) was low ($p<0.001$).

The level of glucose in the patients with MS was 5.7 mmol/l, in the patients without MS it was 5.1 mmol/l, uric acid 335 mmol/l and 298 mmol/l, the level of gamma-glutamyl transpeptidase (GGTP) was 37 mkmol/l and 27 mkmol/l.

In our research, the ferments ALT which show the function of a liver (28 ± 13) and AST (21 ± 6.1) levels in the patients with MS were higher ($p<0.001$). Also, in this group of patients bilirubin (12 ± 4.9) ($p=0.002$) and alkaline phosphatase (APh) (77 ± 20) ($p<0.001$) level was higher.

In the patients with MS the level of glomerular filtration rate (GFR) of the kidney is lower (106 ± 14) ($p <0.001$) and the level of creatinine in the respondents without MS was lower than in those with MS (74 ± 13 mmol/l) ($p <0.001$).

Between two groups during the comparison of standard EchoCG-parameters, the size of the last diastole of the atrium (SLDA), the thickness of the posterior wall of the left ventricle (TPWLV), the thickness of the ventricle interval section (TVIS), the comparative thickness of the wall (CTW), myocard left ventricle mass indices (MLVMI) the average was higher in the patient with MS.

In the patients with MS the carotid artery intima-media complex (CAIMC) was 0.84, in the patients without MS 1.0 ($p<0.001$). The layers of total carotid artery in the patients with MS were 25%, locally disrupted, in the observation group only 6% of local disruption was noted. LTCA were reserved in 65% respondents with MS, 91% in those without MS ($p<0.001$).

Discussion

Obesity is one of the main indications of MS. In the research in comparison with the people without MS, the

case of obesity in the patients with MS we can see from the higher indications of the BMI of these group patients. Though BMI is considered to be the ordinary method of determining the obesity BMI indication cannot differentiate the fat from other tissues and cannot determine the distribution of the fat in the organism and the main cause of the systemic inflammation which causes the chronic disease and diseases of cardia vascular system (CVD) is not the fat in general which is in the body, but the abdominal fat [23]. That is why in the patients under the research work the indications of not only BMI were determined, but also the indications of WC, HC, WHR and the VFI. And as far as the indication of WC increases, the death caused by CVD diseases also increases [10].

Table 1.

Average values of phenotypic indicators in respondents with and without MS

Indicators	MS-	MS+	All	p
age, year	39 ± 6.7	41 ± 6	40 ± 6.4	<0.001**
height, cm	167 ± 8.8	170 ± 8.7	169 ± 8.9	<0.001**
Body mass, кг	78 ± 16	87 ± 15	84 ± 16	<0.001***
Body mass index, кgm/m	28 ± 4.6	30 ± 4.6	29 ± 4.7	<0.001**
Hip circumference, cm	97 ± 11	99 ± 13	98 ± 12	0.039**
Waist circumference, cm	94 ± 13	102 ± 11	99 ± 13	<0.001**
Waist-to-hip ratio	0.99 ± 0.09	1 ± 0.097	1 ± 0.096	<0.001**
Visceral fat index	1.5 ± 0.98	2.7 ± 1.2	2.2 ± 1.3	<0.001**
systolic blood pressure	121 ± 8.4	125 ± 8.5	123 ± 8.7	<0.001**
diastolic blood pressure	77 ± 8.3	82 ± 7.6	80 ± 8.2	<0.001**
aging rate coefficient	1.3 ± 0.29	1.4 ± 0.26	1.3 ± 0.27	<0.001**
biological age, year	43 ± 8.1	49 ± 8	47 ± 8.4	<0.001**
hemoglobin, gr/l	139 ± 18	146 ± 18	143 ± 18	<0.001**
hematocrit, %	42 ± 4.7	43 ± 4.6	43 ± 4.7	<0.001**
erythrocytes, 10^12/l	4.8 ± 0.51	5 ± 0.52	4.9 ± 0.53	<0.001**
leucocytes, 10^9/l	6.8 ± 1.6	7.1 ± 1.6	7 ± 1.6	0.002**
neutrophiles, 10^9/l	3.8 ± 1.3	4.1 ± 1.3	4 ± 1.3	<0.001**
lymphocytes, 10^9/l	2.2 ± 0.62	2.4 ± 0.68	2.3 ± 0.66	<0.001**
MCHC, gr/l	334 ± 12	337 ± 12	336 ± 12	0.001**
Total cholesterol, mmol/l	5 ± 0.9	5.4 ± 1	5.2 ± 0.99	<0.001**
HDL, mmol/l	1.4 ± 0.26	1.1 ± 0.25	1.2 ± 0.28	<0.001**
Non-HDL, mmol/l	3.7 ± 0.96	4.2 ± 1.1	4 ± 1.1	<0.001**
Triglyceride, mmol/l	1.2 ± 0.54	1.8 ± 0.72	1.6 ± 0.72	<0.001**
Atherogenic coefficient	2.9 ± 1.1	3.9 ± 1.3	3.5 ± 1.3	<0.001**
Glucose, mmol/l	5.1 ± 0.49	5.7 ± 0.75	5.4 ± 0.72	<0.001**
GGTP, units/l	27 ± 17	37 ± 19	33 ± 19	<0.001**
bilirubin, mkmol/l	11 ± 4.7	12 ± 4.9	12 ± 4.9	0.002**
ALT, units/l	22 ± 12	28 ± 13	26 ± 13	<0.001**
AST, units/l	19 ± 6	21 ± 6.1	20 ± 6.1	<0.001**
alkaline phosphatase	71 ± 19	77 ± 20	75 ± 20	<0.001**
uric acid, mkmol/l	298 ± 79	335 ± 85	320 ± 85	<0.001**
creatinine, mmol/l	70 ± 12	74 ± 13	73 ± 13	<0.001**
glomerular filtration rate, mL/min/1.73m^2	111 ± 12	106 ± 14	108 ± 13	<0.001**
size of the last diastole of the atrium	4.7 ± 0.32	4.8 ± 0.37	4.8 ± 0.36	<0.001**
thickness of the posterior wall of the left ventricle	0.89 ± 0.11	0.95 ± 0.12	0.92 ± 0.12	<0.001**
thickness of the ventricle interval section	0.91 ± 0.12	0.99 ± 0.15	0.96 ± 0.15	<0.001**
comparative thickness of the wall	0.38 ± 0.04	0.4 ± 0.05	0.39 ± 0.04	<0.001**
myocard left ventricle mass indices	79 ± 15	87 ± 18	84 ± 18	<0.001**
Intima-media complex	0.84 ± 0.14	1 ± 0.19	0.94 ± 0.19	<0.001**
layers of carotid artery	0 (0%)	1 (0%)	1 (0%)	<0.001*
reserved	270 (91%)	295 (65%)	565 (75%)	
locally disrupted	17 (6%)	112 (25%)	129 (17%)	
disrupted	11 (4%)	38 (8%)	49 (7%)	

*Note: * Pirson x2 test; **- Manna-Whitney test; ***- Welch t test*

VFI is an useful indicator which determines the function of visceral fat which is connected with the cardio metabolism risk and as it is the reliable method which is calculated with a simple formula [7], in the research the VFI of the patients were determined. Because, though the magnet-resonance and computer tomography are considered to be the main standard in determining the fat in the organism, as they are not always easy to get in clinic practice they are used seldom. Amato with his colleagues found the relation between VFI>1,9 indications and MS

components [8]. In connection with it in our patients under the research with MS, we see a big deposit of visceral fat (VFI=2,7)and we noticed the fact that they caused the MS in those patients.

As the calendar age is not able to show the health condition of a man and the ability to work the physiologic and morphologic changes of an organism are determined by the BA indication which is the main criterium of process of aging is connected with many factors. In the result of the research due to the high indications of BA and ARC in the patients with MS, we can see the fast going of aging process.

In the patients with MS hemogram is the vital indication. Because, the biochemical changes during the MS influence the clinical signs of the blood overall. The high concentration of hemoglobin is due to the unfavorable profile of lipoprotein parts which increase during MS [15]. During the research the hemogram indications of the respondents with MS was found to be higher than those of without MS.

Due to the decrease of resistance to insulin, due to the decrease or the function of TG and lipoprotein lipase activity, during MS LDL amount increases and HDL amount decreases [12]. In the cohort research of FINRISK if the lipid profile indications - TCH, AC, TG, non-HDL are connected with CVD, then HDL on the contrary was connected with decrease of this risk [24]. Our work proved that results.

AC – is the highly informative indication to assess the lipid spectrum in the blood plasma which is used widely in clinic, also it shows the atherogenic coefficient of the TCH and it is the ratio of atherogenic lipoprotein. AC indication is the sensitive indication in prediction of the risk of CVD [13]. During the result of the research it was found out that AC, non-HDL, indications in the patients with MS are higher. The non-HDL is the independent predictor of CVD risk and is correlated with MS directly [26]. As it was determined during the study, the hyperlipidemia/dislipidemia which are caused by CVD are clearly seen in the patients with MS. Apart from dyslipidemia, during the research there was determined the high amount of hyperglycemia, hyperuricemia and GGTP.

The connection of hyperuricemia with MS was reported in many researches. According to MS in accordance with the epidemiologic research work. Uric acid is closely connected with the components of MS like BMI, WC and dyslipidemia [21]. Thus, hyperuricemia is the widely spread sign of metabolic disturbance. Also, the frequency of spread of MS is connected with the increase of GGTP concentration in the plasma [25]. The increase of the level of GGTP during MS is the indirect indication of the oxidation stress which is closely connected with MS and of the chronic inflammation [9].

According to the recent information, the level of metabolism disturbance is connected with the function of a liver. The liver helps to maintain the right level of glucose in blood. And when the function of a liver is disturbed, there will develop glycogenolysis and the formation of glucose in the liver increase. The high indication of liver ferments during the MS determined in the process of the research may be connected with the MS directly. Because, the increasing deviation of the liver ferments in the German grown-ups were found to be connected with MS [16], in the Iranians the increasingly number of the ALT average concentration was found out to be connected with metabolism disturbance [19].

In patients with MS the disturbance of kidney function often takes place. The kidney dysfunction in many cases develops the chronic insufficiency of a kidney which is caused by the hemodynamic and metabolism changes that are brought by CVD. In the disturbance of kidney function which is developed during long time period the coefficient of targeted filtration decreases step by step [5]. Because, the high level of creatinine in the plasma which was determined during the research is considered to be the main predictor in determign the changes of filtration coefficient.

During the research there was determined the remodeling of the heart in the patients with MS. The remodeling of the heart is the complex disturbance process of the heart structure and function which is characterized by the increase of myocardial mass, widening of the holes and the changes of ventricles geometric pictures [3]. This process goes quickly during . Insulin resistance, hyperinsulinemia, hyperglycemia together with atherosclerosis increase the complication of CVD and enhance the speed of development of disease [4]. The diastole dysfunction of the left ventricle during the MS is the marker which shows the change of a myocardia.

The changes of gross vessels structures and early stages of atherosclerosis development connected with MS can be determined by measuring the thickness of intima-media complex (IMC) of the carotid artery. MS components – obesity, glucose and HDL association with the age increase the risk of IMC of the carotid artery [6]. During the research in the patients with MS it was found out that the IMC was in the pathologic state, that is those patients have atherosclerosis ($p<0.001$). Because, if IMC thickness is 0.9 mm it will show the remodeling of the carotid artery. And, the increase of the thickness of IMC by 0.1 mm will increase the risk of stroke development by 18%, heart attack risk by 15% [18].

Thus, it was found out that the patients with MS suffer from the obesity which goes together with the deposit of visceral fat, with the increase of the WC and BMI. Also, the disturbance of liver, kidney, heart functions and the total clinical and biochemical blood changes which are connected with the function of those organs, the changes of the lipid profile were found out. Due to these changes the aging, according the disturbance of the heart structure and the changes of carotid artery which causes atherosclerosis, were also determined. Thus, the health condition of the people of the reproductive age who are suffering from the MS were found out.

Contribution of the authors:

Kamshat M. Akhmetova: processing of primary material, statistical processing of data, summing up the results, conclusions, English translation;

Tamara A. Voshchenkova: organization of the process, preliminary edit;

Aigul A. Abduldaevna: scientific supervisor, concept and design;

Erbolat E. Dalenov: scientific consultant, final revision.

The authors declare that there is no conflict of interest.

This article and parts of the materials of the article were not previously published and are not under consideration in other publishers.

Литература:

1. Государственная программа развития здравоохранения Республики Казахстан на 2020-2025 годы, утверждена постановлением Правительства Республики Казахстан от 26 декабря 2019 года № 982. URL: https://primeminister.kz/assets/media/gosudarstvennaya-programma-razvitiya-zdravookhraneniya-respubliki-kazakhstan-na-2020-2025-gody.pdf (дата обращения: 06.08.2020).
2. Горелкин А.Г., Пинхасов Б.Б. Способ определения биологического возраста человека и скорости старения // А.Г. Горелкин, Б.Б. Пинхасов, заявитель и патентообладатель ГУ НЦКЭМ СО РАМН – 2008130456/14; заяв. 22.07.2008; опубл. 27.04.2010. Бюл. №12.
3. Денисова А.Г., Татарченко И.П., Позднякова Н.В. Структурно-геометрические показатели левого желудочка в оценке электрического ремоделирования сердца при сахарном диабете // Доктор.Ру., 2016. № 11 (128). С. 36–41.
4. Котовская Ю.В., Ткачева О.Н., Рунихина Н.К. и др. Изучение долгожительства: современный статус проблемы и перспективы // Кардиоваскулярная терапия и профилактика. Часть 1. Том 16. № 3 (2017). С. 75-80.
5. Мадянов И.В. Гиперурикемия и сахарный диабет // РМЖ. Медицинское обозрение. 2019. №1(I). С. 20-24.
6. Akhmetova K.M., Vochshenkova T.A., Dalenov E.D., Abduldayeva A.A., Benberin V.V. The Interconnection of Metabolic Disorders and Carotid Atherosclerosis in the Kazakh Population // Sys Rev Pharm, 2020. 11(12): p. 2152-2159.
7. Amato M.C. et al. Visceral Adiposity Index: a reliable indicator of visceral fat function associated with cardiometabolic risk // Diabetes Care. 2010. 33(4): p. 920-2.
8. Amato M.C. et al. Cut-off points of the visceral adiposity index (VAI) identifying a visceral adipose dysfunction associated with cardiometabolic risk in a Caucasian Sicilian population // Lipids Health Dis. 2011. 10: p. 183.
9. Bo S. et al. Associations between gamma-glutamyl transferase, metabolic abnormalities and inflammation in healthy subjects from a population-based cohort: a possible implication for oxidative stress // World J Gastroenterol. 2005. 11(45): p. 7109-17.
10. Cerhan J.R. et al. A pooled analysis of waist circumference and mortality in 650,000 adults // Mayo Clin Proc. 2014. 89(3): p. 335-45.
11. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects, JAMA. 2013. 310 (20): p. 2191–2194. PMID 24141714, doi:10.1001/jama.2013.281053
12. Girona J. Et al. HDL Triglycerides: A New Marker of Metabolic and Cardiovascular Risk // Int J Mol Sci. 2019. 20(13).
13. Çakırca G., Çelik M.M. Lipid profile and atherogenic indices and their association with platelet indices in familial Mediterranean fever // Turk Kardiyol Dern Ars. 2018. 46(3): p. 184-190.
14. Hiam D., Patten R. Et.al. The effectiveness of high intensity intermittent training on metabolic, reproductive and mental health in women with polycystic ovary syndrome: study protocol for the iHIT-randomised controlled trial // Trials. 2019. 20: p. 221.
15. Hämäläinen P. Et al. Hemoglobin level and lipoprotein particle size // Lipids Health Dis. 2018. 17(1): p. 10.
16. Kälsch J. et al. Normal liver enzymes are correlated with severity of metabolic syndrome in a large population based cohort // Sci Rep. 2015. 5: p. 13058.
17. Lam D., LeRoith D. Metabolic syndrome // In: Feingold K.R. Anawalt B., Boyce A. Et al eds. Endotext [Internet]. South Dartmouth, MA: MDText.com, Inc; 2000. https://www.ncbi.nlm.nih.gov/books/NBK278936/
18. Lorenz M.W. et al. Prediction of clinical cardiovascular events with carotid intima-media thickness: a systematic review and meta-analysis // Circulation. 2007. 115(4): p. 459-67.
19. Nikniaz L. et al. Is within-normal range liver enzymes associated with metabolic syndrome in adults? // Clin Res Hepatol Gastroenterol. 2018. 42(1): p. 92-98.
20. Ranasinghe P., et al. Prevalence and trends of metabolic syndrome among adults in the asia-pacific region: a systematic review // BMC Public Health. 2017. 17(1): p. 101.
21. Tanaka K. et al. The relationship between body mass index and uric acid: a study on Japanese adult twins. // Environ Health Prev Med. 2015. 20(5): p. 347-53.
22. World Health Organization. The world health report 2002 – Reducing Risks, Promoting Healthy Life // World Health Organization 2002. P. 240.
23. Wildman R.P. et al., The obese without cardiometabolic risk factor clustering and the normal weight with cardiometabolic risk factor clustering: prevalence and correlates of 2 phenotypes among the US population (NHANES 1999-2004) // Arch Intern Med. 2008. 168(15): p. 1617-24.
24. Würtz P. et al. Metabolite profiling and cardiovascular event risk: a prospective study of 3 population-based cohorts // Circulation. 2015. 131(9): p. 774-85.
25. Yadav D. Et al. Combined Effect of Initial and Longitudinal Increases in γ-Glutamyltransferase on Incident Metabolic Syndrome: ARIRANG Study. // Yonsei Med J. 2017. 58(4): p. 763-769.
26. Zhang Y. Et al. Non-HDL-C is a Better Predictor for the Severity of Coronary Atherosclerosis Compared with LDL-C. // Heart Lung Circ. 2016. 25(10): p. 975-81.

References:

1. Gosudarstvennaya programma razvitiya zdravookhraneniya Respubliki Kazakhstan na 2020-2025 gody, utverzhdena postanovleniem Pravitelstva Respuliki Kazakhstan ot 26 dekabrya 2019 goda № 982 (The State Program for the Development of Healthcare of the Republic of Kazakhstan for 2020-2025, approved by the Decree of the Government of the Republic of Kazakhstan dated December 26, 2019 No. 982.) URL: https://primeminister.kz/assets/media/gosudarstvennaya-programma-razvitiya-zdravookhraneniya-respubliki-kazakhstan-na-2020-2025-gody.pdf (data obrachsheniya: 06.08.2020) (last sited: 06.08.2020). [in Russia]

2. Gorelkin A.G., Pinkhasov B.B. Sposob opredeleniya biologicheskogo vosrasta cheloveka I skorosti stareniya [Method for determining the biological age of a person and the rate of aging]. Gorelkin A.G., Pinkhasov B.B., zayavitel I patentoobladatel GU NCKEM SO RAMN – 2008130456/14; [Gorelkin A.G., Pinkhasov B.B. applicant and patentee of GI SCCEM SB RAMS] zayavlen [declared] 22.07.2008; opublikovan [published] 27.04.2010. Бюллетень [Bulletin] №12. [in Russia]

3. Denisova A.G., Tatarchenko A.G., Pozdnyakov I.P. Structurno-geometricheskie pokazateli levogo zheludochka v ocenke elekyricheskogo remodelirovaniya serdca pri sakharnom diabete [Structural and geometric parameters of the left ventricle in the assessment of electrical remodeling of the heart in diabetes mellitus]. Doctor.Ru [Doctor.Ru], 2016. № 11 (128). P. 36–41. [in Russia]

4. Kotovskaya Yu.V., Tkacheva O.N., Runikhina N.K. et. Al. Izuchenie dolgozhitelstva: sovremennyi status problemy i perspektivy [Study of longevity: current status of the problem and prospects]. *Kardiovaskulyarnaya terapiya i profilaktika.* Chast [Part] 1. Tom 16. [Cardiovascular therapy and prevention. Volume 16]. № 3 (2017). P. 75-80. [in Russia]

5. Madyanov I.V. Giperurikemiya I sakharnyi diabet [Hyperuricemia and diabetes mellitus]. *RMZH. Meditsinskoe obozrenie* [Mammary cancer. Medical review]. 2019. №1(I). pp. 20-24. [in Russia]

6. Akhmetova K.M., Vochshenkova T.A., Dalenov E.D., Abduldayeva A.A., Benberin V.V. The Interconnection of Metabolic Disorders and Carotid Atherosclerosis in the Kazakh Population. *Sys Rev Pharm*, 2020. 11(12): p. 2152-2159.

7. Amato M.C. et al. Visceral Adiposity Index: a reliable indicator of visceral fat function associated with cardiometabolic risk. Diabetes Care. 2010. 33(4): p. 920-2.

8. Amato M.C. et al. Cut-off points of the visceral adiposity index (VAI) identifying a visceral adipose dysfunction associated with cardiometabolic risk in a Caucasian Sicilian population. *Lipids Health Dis.* 2011. 10: p. 183.

9. Bo S. Et al. Associations between gamma-glutamyl transferase, metabolic abnormalities and inflammation in healthy subjects from a population-based cohort: a possible implication for oxidative stress. *World J Gastroenterol.* 2005. 11(45): p. 7109-17.

10. Cerhan J.R. et al. A pooled analysis of waist circumference and mortality in 650,000 adults // Mayo Clin Proc. 2014. 89(3): p. 335-45.

11. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects, JAMA. 2013. 310 (20): p. 2191–2194. PMID 24141714, doi:10.1001/jama.2013.281053

12. Girona J. Et al. HDL Triglycerides: A New Marker of Metabolic and Cardiovascular Risk. *Int J Mol Sci.* 2019. 20(13).

13. Çakırca G., Çelik M.M. Lipid profile and atherogenic indices and their association with platelet indices in familial Mediterranean fever. *Turk Kardiyol Dern Ars.* 2018. 46(3): p. 184-190.

14. Hiam D., Patten R. et.al. The effectiveness of high intensity intermittent training on metabolic, reproductive and mental health in women with polycystic ovary syndrome: study protocol for the iHIT- randomised controlled trial. *Trials.* 2019. 20: p. 221.

15. Hämäläinen P. et al. Hemoglobin level and lipoprotein particle size. *Lipids Health Dis.* 2018. 17(1): p. 10.

16. Kälsch J. et al. Normal liver enzymes are correlated with severity of metabolic syndrome in a large population based cohort. *Sci Rep.* 2015. 5: p. 13058.

17. Lam D., LeRoith D. Metabolic syndrome. In: Feingold K.R. Anawalt B., Boyce A. Et al eds. Endotext [Internet]. South Dartmouth, MA: MDText.com, Inc; 2000. https://www.ncbi.nlm.nih.gov/books/NBK278936/

18. Lorenz M.W. et al. Prediction of clinical cardiovascular events with carotid intima-media thickness: a systematic review and meta-analysis. *Circulation.* 2007. 115(4): p. 459-67.

19. Nikniaz L. et al. Is within-normal range liver enzymes associated with metabolic syndrome in adults? *Clin Res Hepatol Gastroenterol.* 2018. 42(1): p. 92-98.

20. Ranasinghe P., et al. Prevalence and trends of metabolic syndrome among adults in the asia-pacific region: a systematic review. *BMC Public Health.* 2017. 17(1): p. 101.

21. Tanaka K. et al. The relationship between body mass index and uric acid: a study on Japanese adult twins. *Environ Health Prev Med.* 2015. 20(5): p. 347-53.

22. World Health Organization. The world health report 2002 – Reducing Risks, Promoting Healthy Life. *World Health Organization*. 2002. P. 240.

23. Wildman R.P. et al.,The obese without cardiometabolic risk factor clustering and the normal weight with cardiometabolic risk factor clustering: prevalence and correlates of 2 phenotypes among the US population (NHANES 1999-2004). *Arch Intern Med.* 2008. 168(15): p. 1617-24.

24. Würtz P. et al. Metabolite profiling and cardiovascular event risk: a prospective study of 3 population-based cohorts. *Circulation.* 2015. 131(9): p. 774-85.

25. Yadav D. et al. Combined Effect of Initial and Longitudinal Increases in γ-Glutamyltransferase on Incident Metabolic Syndrome: ARIRANG Study. *Yonsei Med J.* 2017. 58(4): p. 763-769.

26. Zhang Y. et al. Non-HDL-C is a Better Predictor for the Severity of Coronary Atherosclerosis Compared with LDL-C. *Heart Lung Circ.* 2016. 25(10): p. 975-81.

Coresponding Author:
Kamshat Akhmetova – PhD student, Astana Medical University, Nur-Sultan, Republic of Kazakhstan.
Postal address: Republic of Kazakhstan, Nur-Sultan, Syganak street 5/1, apt 52
Phone: 8(702)230 22 23
E-mail: Kamshat2016a@gmail.com