



THE VALUES OF FREE FATTY ACIDS IN THE BLOOD IN WOMEN WITH METABOLIC SYNDROME IN THE POSTMENOPAUSAL PERIOD

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Abstract

Metabolic syndrome (MS), which includes a number of systemic clinical and biochemical processes (insulin resistance, abdominal obesity, dyslipidemia, arterial hypertension), attracts close attention of general practitioners. The risk factors and pathological processes leading to the development of this syndrome remain controversial. Several hypotheses for the development of MS have been proposed, of which the theory of insulin resistance is the leading one. To date, all possible causes and mechanisms for the development of MS have not been finally disclosed. Non-esterified fatty acids play an important role in the development of MS.

Keywords: metabolic syndrome, insulin resistance, fatty acids, blood, glucose

Introduction

It is known that insulin resistance stimulates increased lipolysis and the release of large amounts of free fatty acids, which, in combination with elevated blood glucose levels, provides an additional amount of substrate for the synthesis of triglycerols in the liver [1, 2, 3, 4]. Hyperinsulinemia, which occurs due to inhibition of insulin degradation in the liver, further enhances peripheral insulin resistance. The proposed and known mechanisms of the relationship between MS and free fatty acids predetermine the need to study the role of free fatty acids in the formation of MS in postmenopausal women [6, 7].

Purpose of the research

To study the level of free fatty acids in the blood of women with MS in the postmenopausal period.

Material and Methods

We examined 54 women with MS in the postmenopausal period, the duration of postmenopausal ranged from 2 to 14 years (average 8.4-1.53 years, the average age of the examined was 55.2±4.73 years).

The following exclusion criteria were used for inclusion in the main group: cardiovascular diseases, bronchial asthma, oncopathology, viral hepatitis, blood and kidney diseases.

The control group consisted of 14 postmenopausal women without manifestations of MS.

Metabolic syndrome in the examined women was diagnosed according to the criteria proposed by the experts of the US National Cholesterol Education Program (2004). The criteria for MS were waist circumference greater than 88 cm, blood pressure 130/85 mm Hg. and above, the content of triglyceride in the blood serum is 1.7 mmol / l or more, HDL

cholesterol (high-density lipoprotein cholesterol) is less than 1.3 mmol / l, the level of glucose in the blood plasma on an empty stomach is 6.1 mmol / l or more.

For the study of carbohydrate metabolism, the determination of the content of fasting glucose in the blood serum was used, and 2 hours after the oral glucose load, the level of insulin by the enzyme immunoassay method, using the kits of the DRG-Diagnostics form, the HOMA index was calculated. Hyperinsulinemia was diagnosed when the fasting insulin level was above 12.5 $\mu\text{U}/\text{mm}$, and when the HOMA index was above 2.77, patients were considered insulin resistant.

The content of free fatty acids in the blood serum was determined using the NEFAFS test system from Diasys (Germany), the determination of C-reactive protein in the blood serum was carried out using the BioChemMac test kits (Russia). The analyzers of the firms "MINDRAY" and "HUMAN" were used in the studies.

Statistical data processing was carried out by the method of variation statistics using Student's t-test. The results were processed using the Statistica software package.

Results and Discussion

The analysis of the results of the studies presented in the table showed the presence of significant changes in the studied biochemical parameters of the blood of the examined postmenopausal women with MS. In patients with elevated levels of triglyceride in the blood, dyslipidemia was observed, which exceeded that of healthy individuals by an average of 3 times ($P < 0.05$).

Table

Biochemical parameters of blood in women with metabolic syndrome in the postmenopausal period (M + m).

Index	Healthy women $n=14$	Women with MS PM and PP $n=54$
Blood glucose mmol/l (on an empty stomach)	$4,01 \pm 0,24$	$5,28 \pm 0,21^*$
Blood glucose mmol/l	$4,43 \pm 0,27$	$6,74 \pm 0,63^*$
Blood glucose mmol/l in 2 hours	$7,89 \pm 1,04$	$19,6 \pm 1,64^*$
Insulin in blood $\mu\text{U}/\text{ml}$	$1,43 \pm 0,14$	$4,33 \pm 0,24^*$
HOMA index	$0,54 \pm 0,05$	$1,81 \pm 0,19^*$
Glycerin in the blood mmol / l	$0,33 \pm 0,02$	$0,79 \pm 0,16^*$
Free fatty acids in the blood	$0,013 \pm 0,001$	$0,12 \pm 0,01^*$

Note: *-significance of differences $P < 0.05$ when compared with healthy individuals

Along with an increase in the level of triglyceride, an increase in the concentration of free fatty acids in the blood of the examined persons was noted on average by 2.4 times ($P < 0.05$).

According to Titov V.N., an increase in free fatty acids in the blood disrupts the functional state of insulin receptors and the uptake of glucose by cells, which leads to an increase in blood glucose levels [5]. As can be seen from the data obtained in the examined patients, the level of glucose in the blood on an empty stomach and after 2 hours, respectively, showed an excess of the initial values by 1.3 and 1.5 times ($P < 0.05$). The state of hyperglycemia and

hyperlipidemia in postmenopausal women with MS contributed to a 2.5-fold increase in blood insulin levels, thus indicating the effect of lipotoxicity.

Violation of the receptor-mediated transport of fatty acids and glucose against the background of insulin resistance and hyperinsulinemia leads to disruption of the structure of cell membranes and metabolic processes occurring in liver hepatocytes.

It has been shown that oxidative stress and increased formation of oxygen free radicals play an important role in the destruction of hepatocyte membranes. At the same time, the main generator of reactive oxygen species are mitochondria, in which up to 1-2% of reactive oxygen species from the total amount of molecular oxygen is formed. Moreover, when observing the process occurring in the mitochondria, it was found that the process is accelerated by increasing the level of free fatty acids, since the oxidation of fatty acids further increases oxygen consumption. Active oxygen, or free radicals, promote oxidation of LDL (low density lipoprotein), and thereby induce inflammation, which is also confirmed by an average increase in C-reactive protein by 10 times ($P < 0.05$).

Conclusion

Thus, metabolic disorders that occur during MS in postmenopausal women are manifested by a state of insulin resistance and an increase in the level of free fatty acids, lead to inhibition of the process of glycolysis and activation of gluconeogenesis in hepatocytes of the liver, inflammation in the vessels, all this indicates involvement in the pathological process of the liver and of cardio-vascular system.

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