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EFFECT OF DIET THERAPY AND NUTRICEUTIC SUPPORT IN METABOLIC SYNDROME IN WOMEN OF FERTILE AGE

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ANNOTATION

Metabolic syndrome (MS) is an urgent problem of modern medicine due to its high prevalence, constant increase in the number of patients and a high frequency of cardiovascular complications (Roitberg G.E., 2007).
According to modern concepts, the key factors leading to the development of metabolic disorders in MS are an increase in the mass of visceral fat and a decrease in the sensitivity of peripheral tissues to insulin with the development of compensatory hyperinsulinemia, which are associated with disorders of carbohydrate, lipid, purine metabolism and arterial hypertension (PH) [VNOK, 2009].

Keywords: Metabolic syndrome (MS), diabetes mellitus (DM), arterial hypertension (AH), reproductive age, obesity, glycemic index (GI), insulin, magnesium, vitamin D.

Worldwide, in recent years, there has been a steady increase in the prevalence of obesity, diabetes mellitus (DM) and arterial hypertension (AH) - risk factors, closely related to each other and combined within the framework of metabolic syndrome (MS) [1].
According to WHO, 1.7 billion people on the planet are overweight, and by 2025 the number of people with obesity in the world will reach 300 million people [2].
The high prevalence of MS at the beginning of the XXI century is considered a side effect of urbanization, since an important factor contributing to the development of MS are excessive consumption of food containing trans fats, simple carbohydrates and low physical activity.
The problems of the modern diet are excess caloric content, excess of light carbohydrates, deficiency of fiber and living plant foods in general, excess saturated, trans-, omega-6 and oxidized fats, deficiency of macro- and micronutrients, excess salt, food intolerance, malnutrition, deficiency of macro-, micronutrients in the prenatal period and at an early age.
In addition, the lifestyle of a modern citizen is the cause of chronic emotional stress and intellectual overstrain, leading to a disorder of neurohormonal regulation of autonomic functions [3].
Metabolic syndrome (MS) is one of the most common causes of anovulatory infertility, early pregnancy loss in women of reproductive age. The frequency of this pathology is about 30-35% in the structure of reproductive dysfunction and reaches 70% among patients with recurrent endometrial hyperplastic processes. Thus, MS is one of the most common diseases of young women [4]. Excessive content of adipose tissue in the body is accompanied by metabolic,

hormonal, vascular and pro-inflammatory disorders [5], as a result of which it seems appropriate to consider the existing ideas about the interactions between MS, obesity and the reproductive system of women.

It has been established that the onset of pregnancy with a BMI of more than 30 kg / m2 takes significantly longer than with normal body weight, and obesity becomes a risk factor for gestational diabetes, preclampsia, premature rupture of the membranes, fetal growth retardation, asphyxia, cesarean section [6] In addition, it has been proven that obesity before and during pregnancy contributes to maternal mortality. In more than 50% of all maternal deaths in the UK, patients were overweight or obese [7].

Therefore, obese women of reproductive age should actively modify their lifestyle before conception or in the early stages of pregnancy [8].

In the treatment of MS, measures aimed at modifying lifestyle are paramount, including normalizing body weight, quitting smoking, increasing the degree of physical activity.

Among the components of the diet that provide correction of the main manifestations of MS, the most important are the energy value of the diet, the amount and qualitative composition of fat, protein, carbohydrates, dietary fiber, vitamins, macro- and microelements, minor components of food [9].

Metabolic syndrome has more to do with the type of proteins, fats, and carbohydrates than with their absolute amount. Different diets with different protein, fat and carbohydrate content were studied. One study involved more than 750 overweight subjects from eight European countries. Initially, 938 subjects were on a very low-calorie diet (800 to 100 kcal per day) for 8 weeks. Subjects who managed to achieve an 8% weight loss were then randomly assigned one of five diets to help maintain their weight, and followed for another 26 weeks. None of the dietary recommendations included caloric restriction, as part of the goal was to determine whether macronutrient and glycemic index recommendations had an effect on calorie intake and satiety. As a result of the study, they came to the conclusion that a diet with a high protein content and a reduced content of products with a high glycemic index favorably affects the concentration of insulin in the blood [10].

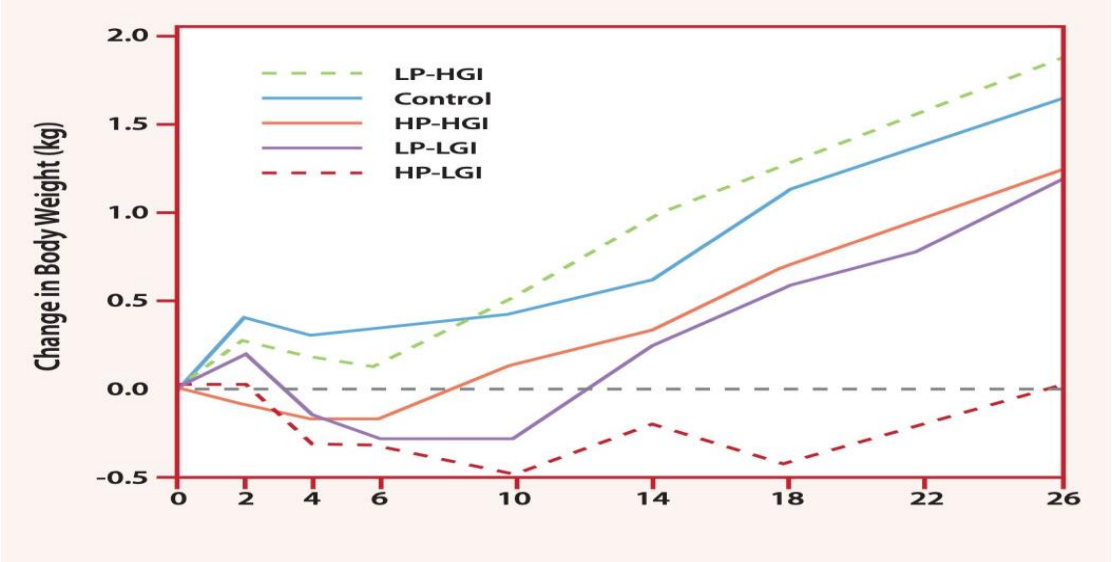

Fig. 1. The change in body weight after a decrease in body weight by 8%, depending on macronutrients and instructions for the glycemic index.

The pathophysiology of MS is quite complex. The formation of insulin resistance and MS are influenced by both exogenous and endogenous factors. Exogenous factors include: a decrease in physical activity, a high-carbohydrate nature of nutrition and the consumption of excessive amounts of animal fats, a lack of biologically active substances in food (in particular, magnesium, B vitamins, vitamin D). Endogenous factors include hormonal disorders (increased cortisol, increased testosterone in women, decreased progesterone, decreased somatotropic hormone, catecholamine balance disorders), aseptic inflammation of the hypothalamus and impaired metabolism of visceral adipose tissue (abnormal changes in the intensity of lipolysis and liponeogenesis, changes in the endocrine functions of the adipose tissue itself, which secretes leptin, adiponectin and tumor-α necrosis factor into the bloodstream) [11].

The results of fundamental and clinical studies have shown that MS is associated with deficiencies of various micronutrients: magnesium, zinc, vitamin D [12]. Deficiencies of these micronutrients, especially combined, stimulate the development of such components of MS as impaired glucose tolerance, dyslipidemia and obesity.

According to the PubMed search system, from 1990 to 2020, 649 summaries and full-text articles were published on the problem of MS in vitamin D deficiency.

Currently, a sufficient number of clinical studies have been accumulated on the various biological effects of vitamin D and its beneficial effects on human health [13]. Studies in recent years have shown an important role of normal levels of vitamin D in maintaining human health [14]. Vitamin D is involved in the regulation of the synthesis of sex hormones - progesterone, testosterone and estrogen, which ensure the proper maturation of follicles and the successful course of pregnancy.

To date, the relationship between serum concentrations of 25 hydroxyvitamin D (25(OH)D) and MS (Maroufi N.F. et al., 2020; Weldegiorgis T.Z. et al., 2020). Thus, the results of a 20-year prospective CARDIA study, which initially included young people at risk of developing CVD, showed that the normalization of the level of 25 (OH) D is associated with a reduced risk of developing AO, carbohydrate metabolism disorders and lipid metabolism disorders (a decrease in high-density lipoprotein cholesterol (HDL cholesterol)) regardless of age, sex, race[15] In addition, in a one-time study conducted in China, it was found that individuals with severe vitamin D deficiency (25(OH)D less than 10 ng/mL) had a 1.5-fold higher risk of developing MS compared to individuals whose 25(OH)D level was greater than 10 ng/mL [16].

Magnesium is one of the most important bioelements that are of fundamental importance for maintaining metabolic functions in the body. The data of experimental, clinical and epidemiological studies indicate that sufficient intake of magnesium from food and magnesium preparations contributes to the normalization of the sensitivity of tissues and cells to insulin [17], reducing the severity of the manifestation of the components of MS [18].

Magnesium is an important mediator of both carbohydrate and lipid metabolism, so its reduced level in the blood plasma is associated with a more pronounced severity of the components of MS. For example, observations of a group of 117 overweight and obese patients showed that the lower the magnesium levels, the greater the number of MS components characterized the patient's condition [19]. Daily magnesium intake in the MS group (n=200) was inversely proportional to metabolic biomarkers of insulin resistance (fasting glucose levels, insulin levels,

HOMA-IR index). The risk of elevated HOMA-IR (>3.6) was 71% lower (RR 0.29, 95% CI 0.12–0.72, p<0.01) in participants with the highest magnesium intake (>300 mg/day) [20].

Table 1. Relationship between serum magnesium levels and some metabolic parameters (ARIC study, data at the start of the study) [21]

Параметр	Квинтиль магния (ммоль/л)						p
	<0,70	0,70–0,75	0,75–0,80	0,80–0,85	0,85–0,90	>0,95	
Число пациентов (%)	426 (16)	552 (21)	689 (26)	522 (20)	297 (11)	136 (5)	-
ИМТ, кг/м²	29,1±6,4	29,8±6,4	29,1±5,8	29,0±5,8	29,0±5,9	28,0±4,0	0,03
Окружность талии:окружность бедер	0,92±0,07	0,91±0,08	0,90±0,08	0,91±0,08	0,91±0,07	0,90±0,07	0,007
Прием диуретиков, %	30	24	22	22	19	22	0,02
Калий сыворотки, ммоль/л	4±0,5	4.1±0,4	4,2±0,4	4,2±0,4	4,3±0,5	4,3±0,4	0,001
Инсулин натощак, пкмоль/л	85±62	86±65	77±54	78±52	77±69	71±39	0,01

From a physiological point of view, magnesium is required for the implementation of energy metabolism - the processes of breaking down proteins, fats and carbohydrates and converting them into ATP. Among the 720 currently known magnesium-dependent human proteome proteins, more than 310 are involved in ATP metabolism. In particular, magnesium is necessary for signaling from insulin receptors and for efficient breakdown of glucose [22]. The present paper presents the results of a systematic analysis of the molecular mechanisms of the relationship between magnesium, pyridoxine and MS deficiency.

Based on the above, it can be concluded that, reducing or eliminating refined sugar and simple carbohydrates, increasing the consumption of complex carbohydrates and whole grain products (oatmeal, barley, wheat) 3-4 times a week other changes in diet and lifestyle that favorably affect the level of glucose and insulin can positively affect life expectancy and reduce the risk of developing chronic diseases in women of fertile age. In addition, regular (daily) 40-minute walking per day:

- burns about 100-120 kcal per day;
-has a vasodilating effect;
- promotes weight loss and reduced insulin resistance;
- has a positive effect on the brain and nervous system;
-contributes to the prevention of GB.

In addition, therapy with cholecalciferol at a dose of 4000 IU / day. within three months, it is associated with the normalization of glycemic control in women with MS. It is advisable for women with MS to determine the concentration of 25 (OH) D in the blood serum for the purpose of early diagnosis of vitamin D deficiency and deficiency.

And also, magnesium is one of the most important nutritional factors that determine the effectiveness of the metabolism of fats and carbohydrates, the normal physiological course of which is an essential component of the prevention of MS. According to clinical and epidemiological studies, adequate provision of the population with magnesium significantly

reduces the risk of developing MS. Clinical trials within the framework of evidence-based medicine show the prospects of using oral preparations of organic magnesium and its synergist pyridoxine, organic magnesium salts (lactate, magnesium citrate) in the treatment and prevention of overweight and MS and in women.

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