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COMPARISON OF THE QUALITY MACRONUTRIENT COMPOUND OF RECOMMENDED DAILY INTAKES AND THE SECOND TYPE DIABETES PATIENTS' DIET

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Annotation The article states that the development of insulin resistance is influenced by many parameters, however, one of the first of it is the increased weight. The main parameter that characterizes the degree of obesity is the body mass index. There is a direct correlation between body mass index and the probability of diabetes developing. Diabetes is a part of symptoms called the metabolic syndrome. The comparative analysis of macronutrient composition of diabetes patient's diets and healthy individuals recommended daily intakes were made. Thus, for patients with diabetes it is necessary to reduce overall caloric intakes by fat and carbohydrates. It is recommended to reduce total fats by reducing saturated fatty acids at the same time to increase the content of omega-3-fatty acids. It is shown that the consumption of foods with dietary fiber (40 – 50 grams per day), reduces the immediate response of insulin up to 25 – 50 %, and has a positive effect on blood glucose and lipids in the blood.

Key words: the second type diabetes, the insulin resistance, the metabolic syndrome, the body mass index, the glycaemic load, diets.

ПОРІВНЯННЯ ЯКІСНОГО МАКРОНУТРИЄНТНОГО СКЛАДУ РЕКОМЕНДОВАНИХ ДОБОВИХ НОРМ З РЕЖИМАМИ ХАРЧУВАННЯ ХВОРИХ НА ЦУКРОВИЙ ДІАБЕТ II ТИПУ

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Анотація У статті зазначено, що профілактику і лікування діабету II типу необхідно здійснювати, в тому числі, за рахунок регулювання режимів харчування. На розвиток резистентності до інсуліну впливають багато чинників, однак, одним з перших є підвищена маса тіла. Основним показником, який характеризує ступінь ожиріння, є індекс маси тіла. Існує пряма кореляція між показником маси тіла та ймовірністю розвитку цукрового діабету. Цукровий діабет входить до симптомокомплексу, метаболічного синдрому. Проведений порівняльний аналіз макронутрієнтного складу рекомендованих добових норм з режимами харчування хворих на цукровий діабет II типу. Так, для хворих на цукровий діабет необхідно знижувати загальну добову калорійність за рахунок жирів та вуглеводів. Рекомендовано у режимі харчування знизити масову частку жирів з насиченими жирними кислотами та жирів у транс конфігурації, водночас підвищити вміст омега-3-жирних кислот. Показано, що вживання вуглеводних продуктів з харчовою клітковиною (40 – 50 г на добу, переважно розчинною), знижує миттєву відповідь інсуліну на 25 – 50 %, позитивно впливає на рівень глюкози та ліпідів у крові.

Ключові слова: цукровий діабет другого типу, інсулінорезистентність, метаболічний синдром, індекс маси тіла, глікемічне навантаження, режим харчування.

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Introduction

20 years ago there were only 30 million people with diagnosis «diabetes». Nowadays, according to the WHO, their amount increased up to 347 million. Experts predict that in 2030 diabetes will be the seventh leading cause of death in the world. Over the next 10 years the number of deaths from diabetes will

increase by the half. The second type diabetes is 85 – 90 % of all types of diabetes.

The second type diabetes is also called insulin-dependent diabetes, or elderly person's diabetes. Now, however, every year the disease damages people in more young age, so the scope of the disease were developed from 35 years [1].

The second type diabetes is the metabolic disease, which characterized by chronic hyperglycemia

that occurs by a lack of insulin action in tissues. This is called insulin resistance. It's a state when in the blood there is a normal or increased amount of insulin, but the cells are insensitive to it. In this case, as in the case of insulin lack, the glucose flow into the cell is reduces, and, accordingly, blood glucose increases [2].

Analysis of recent research and publications

There are many factors that influence on the insulin resistance development, but scientists tied for the first place the increased body weight. The main indicator that characterizes the obesity degree is the body mass index.

The body mass index is the indicator, which allows to estimate the degree of correspondence between the weight and the height, and, thus, indirectly estimate is there lack of weight, is there normal weight or is there overweight (obesity). There were shown a correlation between the body mass index (BMI) and the probability of the second type diabetes development [3].

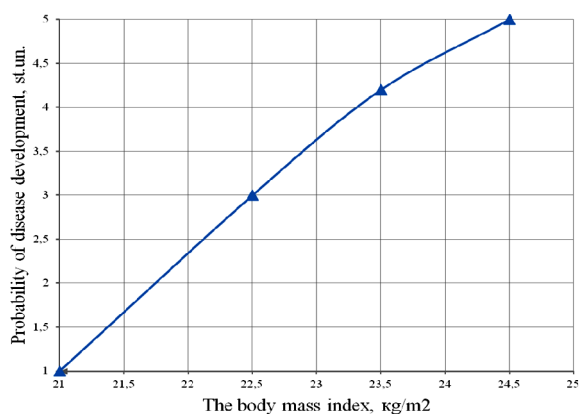


Fig. 1. The correlation between the body mass index (BMI) and the probability of the second type diabetes development [3]

Now begins to spread, so-called Western world disease – the metabolic syndrome (MS). This syndrome includes several diseases (Fig. 2). Thus, in 2005 at the International Congress of diabetes and MS in Berlin and at the 75 Congress of the European Society of Atherosclerosis in Prague they were offered the following criteria for the MS diagnostic:

1. The waist circumference for adult women more than 80 cm, for men – more than 94 cm.
2. The lipoproteids less than 0,9 mmol/dm³ and 1,1 mmol/dm³ respectively for women and men.
3. The serum triglycerides lower than 1,7 mmol/dm³.
4. Blood pressure more than 130/85 mm.m.
5. The glucose in the blood plasma more than 5,6 mmol/dm³.

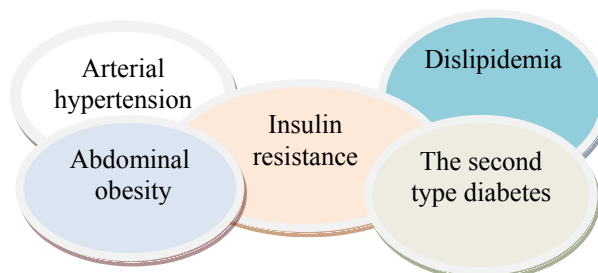


Fig. 2. Components of the metabolic syndrome

The purpose of the article

Therefore the second type diabetes is the part of the metabolic syndrome and depends on the body weight. According to the opinion of Enfeldt and others [4], the global increase in the body weight and the MS spreading in the world are particularly active since the majority of scientific community proclaimed the need to reduce the fat amount in the diet, simultaneously called them as the main factor for cardiovascular disease. This, consequently, increases the number of carbohydrates in a diet as a result of daily calorie content compensation. Food industry quickly adaptes to current dietary recommendations: to provide new lowfat products with the pleasant taste in their recipes they add sugars, flavors enhancers and other artificial ingredients. So now we are seeing a significant imbalance in diet towards increasing mass fraction of sugar and flour, which correspondingly increase the level of glucose in the blood. As a result, insulin level increases and contributes to the high rate of appetite and increasing of the body fat. The diet with a big amount of carbohydrates is a risk area for people who genetically predisposed to diabetes. At first scientists do not correlate clinical signs with the diet, then, recently, more researchers say that diabetes (as a part of the MS) is the result of the nutrient imbalance [5].

The purpose of the article is to determine changes (in makronutrient composition) which should be made in the risk category people's diet for the prevention and treatment of the second type diabetes.

The analysis of nutrient deficient factors in the second type diabetes' prevention and treatment

The term "Recommended Daily Intakes" was introduced in 1968 in America, as a basis for the diet developing for relatively healthy people. The diet is the qualitative and quantitative characteristic of the nutrition, which includes the number and time of meals and division it due to calorie and chemical composition [5].

Elaboration of the scientifically based diet for the treatment and prevention of the second type diabetes is the important task, because the disease prevalence in the world has a constant tendency to increase, and also it has complex flow. It is recommended for the patients to take meal according to the ninth regime. In the regime describing there is a list of permitted and

prohibited products, methods of thermal processing of it and day menu examples divided on partitive meal. Diabetes is a disease that requires periodic sanatorium visits. In sanatorium they make a generalized diet, according to the ninth regime, which defers by the mass fraction of main makronutrien from the RDA of healthy persons. This diet usually is general and does not take into account individual physiological characteristics of the patient.

It is known [7] that the greater the dehydration of the organism is, the lower its ability to make insulin. So in addition to overiewing patient's diet, it is necessary to make recommendations for the drinking regime as well.

In Table 1 there are the nutrients recommended for healthy persons' daily intakes and diet for persons who are suffering from diabetes due to the latest achievements in nutrition science. The numerical values are given for people with similar physiological data to make the comparison easier.

Table 1 - Recommended nutrient composition of the healthy persons' diet and the diet for patients with the diabetes [6]

The daily intakes, g	People suffering from the second type diabetes	Healthy persons
Protein	100 – 110	100
Fats	75 – 80	100
Carbohydrates	300 – 350	400 – 450
Salt	12	15
Free liquid, dm ³	1,5	1,5
Energy value, kcal	2400 – 2500	2900 – 3300

The protein amount in both diets is almost identical, the amount of fats and carbohydrates in the patients diet reduced on 20 – 25 g and 100 g respectively. The ninth diet gives only recommendation about the total amount of the makronutrients and doesn't explain their quality composition.

According to the latest scientific concepts, in the consumption of protein products, preference should be given to products with a complete amino acid composition, which have a limited number of limited amino acids. The certain amino acids have special importance in reducing the risk of diabetes. Thus, glycine stimulates pituitary function and glucagon synthesis, increases the glucose formation from glycogen in cells; valine and isoleucine activate glycogen synthesis and involved in insulin secretion. Insulin effect on metabolism has arginine. Tryptophan is a predecessor to the formation of serotonin, melatonin, hormones that are involved in the regulation of food behavior, carbohydrate and protein metabolism; synthesis and activity of insulin; also has antioxidant properties [8].

Diabetics are more often than healthy people suffering from atherosclerosis, heart attacks and

strokes (related components of the MS). The cholesterol profile of patients with diabetes is usually worse than average healthy people have in the same age. Consumption of saturated fat in big amount and relative deficiency of the essential fatty acids in the diet leads to an increased risk of diabetes and cardiovascular complications. This kind of diet reduces the mobility of the cell membrane, which in turn causes a contraction in binding of insulin with receptors on the membranes and/or weakening its action.

To reduce the risk of diabetes, it is necessary [8]:

- to reduce the intakes of saturated fatty acids;
- to minimize the fat intakes in trans configuration;

- to balance the intakes of essential fatty acids (linoleic and α -linolenic), by increasing the α -linolenic acid amount;

- to increase the intakes of omega-3-fatty acids (alpha-linolenic, eicosapentaenoic, dokozaheksayenic).

For persons with diabetes metabolic conversions of PUFAs have defects. With the increase of the omega-3-fatty acids in the membrane lipids composition increases the sensitivity of cell receptors to the insulin and consequently reduces hyperinsulinemia [9]. The recommended ratio of omega-3 and omega-6 fatty acids is 1:5. The daily intakes of omega-3-fatty acids are about 2 grams, of omega-6 acids – up to 10 grams [10].

For patients with diabetes the most attention should be paid to the carbohydrate composition of food products. Moreover, at almost all developed countries, carbohydrates are the main part of the population's diet.

Patients with diabetes are not recommended to consume refined carbohydrates in amount that exceeds 20 – 30 grams per day. To characterize carbohydrate food that breaks down to glucose there is an indicator which is called «glycemic index». The faster product breaks down to glucose, the higher its glycemic index is. For standard it is recommended to take glucose, glycemic index of which is equal to 100 units. All other nutrients are compared to the glucose glycemic index. There is a general recommendation for patients with diabetes: to eat foods with a low glycemic index.

A diet which contains foods with high glycemic index, slows food evacuation from the stomach, reduces the adsorption of glucose in the intestinal tract, stimulates the secretion of insulin, leptin and resistin, increases the cells tolerance to glucose and insulinresistance. Vice versa, using products with a low glycemic index is not accompanied with negative effects listed above [11]. It should be noted that the term «glycemic index» was introduced several decades ago and is regarded as a constant. However, recent scientific research at the Weizmann Institute [12] showed that the quantitative value of glycemic index can vary depending on the biological characteristics of the individual organism. In addition, the glycemic index takes into account only organism response to product's

simple carbohydrates and does not take into consideration the total amount of them. For this purpose there is an indicator which is called «glycemic load», it is calculated by multiplying the glycemic index and the total amount of carbohydrates (expressed in percents).

Conducted studies [3] establish the relationship between the second type diabetes development probability and the amount of consumed fiber and the glycemic load (Fig. 3).

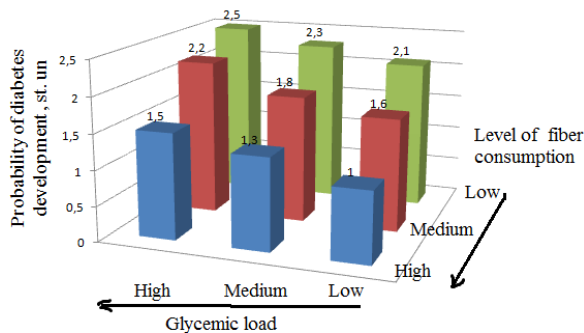


Fig. 3. The impact of glycemic load and the consumed fiber level on the probability of second type diabetes development

For basic point for all indicators it was set the level «one». It was shown that the best therapeutic effects were achieved by increasing the amount of fiber in the food regime and by the consumption of food with a low glycemic load [13]. Daily consumption of foods with dietary fiber (40 – 50 grams per day) reduces the immediate response of insulin up to 25 – 50 % and has positive effect on blood glucose and lipids in the blood. Soluble dietary fiber prevent the development of hyperglycemia. At the basis of inhibiting the absorption of mono- and disaccharides in digestive tract there is a formation by soluble dietary fiber, the gelatinous solution, that complicates the assimilation of those carbohydrates. There is also hypothesis about the competitive relationship between the water-soluble dietary fiber and simple carbohydrates for the transport proteins and enzymes that are involved in metabolism of food carbohydrate-contain

substrates [14]. The most pronounced hypoglycemic effect has guar gum. We also know that amylopectin improves cells' insulin sensitivity much more than the pectin does [8].

Conclusions

Based on the analysis and synthesis of the scientific literature it was shown the relevance of rational nutrition for the prevention and treatment of the second type diabetes. The concept of food systems properties' targeted regulation is based on a clear balance of diet's compounds. A comparative analysis of the RDA diet and the diet of patients with the second type diabetes' makronutrient compound were held. Thus, for patients with diabetes it is necessary to reduce the total diet calorie intakes by fat and carbohydrates. The recommended rate of protein should be followed. Regarding to the protein quality compound were shown that preference should be given to products with a complete amino acid composition, which have a limited number of limited amino acids. It is recommended to reduce fat with saturated fatty acids and fats in trans configurations simultaneously increase the content of omega-3-fatty acids (alpha-linolenic, eicosapentaenoic, dokozaheksayenic). The total amount of carbohydrates should be reduced by decreasing the reducing sugars mass fraction. In addition, it is necessary to monitor the presence in menu of sick and risk group person's the products with dietary fiber (40 – 50 grams per day, preferably soluble one), which reduce the immediate response of insulin by 25 – 50 % and have a positive effect on blood glucose and lipids in the blood. Therefore, further tasks should be to select the products assortment for providing recommendations for the rational and adequate diet for people who are in the second type diabetes risk group. In a process of diet components selection much attention should be paid to using of the different raw materials, that characterized by rational combination of ingredients, to develop and improve the technology of manufacturing variety of high quality food products.

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СОПОСТАВЛЕНИЕ КАЧЕСТВЕННОГО МАКРОНУТРИЕНТНОГО СОСТАВА РЕКОМЕНДОВАННЫХ ДНЕВНЫХ НОРМ С РЕЖИМАМИ ПИТАНИЯ БОЛЬНЫХ САХАРНЫМ ДИАБЕТОМ II ТИПА

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Аннотация. В статье показано, что профилактику и лечение диабета II типа необходимо осуществлять, в том числе, за счет регулирования режимов питания. На развитие резистентности к инсулину влияют многие показатели, однако, одним из первых является повышенная масса тела. Основным показателем, характеризующим степень ожирения, является индекс массы тела. Существует прямая корреляция между показателем массы тела и вероятностью развития сахарного диабета. Сахарный диабет входит в симптомокомплекс, метаболический синдром. Проведенный сравнительный анализ макронутриентного состава рекомендованных суточных норм питания с режимами питания больных сахарным диабетом II типа. Так, для больных сахарным диабетом необходимо снижать общую калорийность за счет жиров и углеводов. Рекомендуется в режиме питания снизить массовую долю жиров с насыщенными жирными кислотами и жиров в транс конфигурации, в то же время повысить содержание омега-3-жирных кислот. Показано, что употребление продуктов питания с пищевой клетчаткой (40 – 50 г в сутки, преимущественно растворимой), снижает мгновенный отклик инсулина на 25 – 50 %, положительно влияет на уровень глюкозы и липидов в крови.

Ключевые слова: сахарный диабет второго типа, инсулинорезистентность, метаболический синдром, индекс массы тела, гликемический нагрузка, режим питания.

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