INDICATORS OF THE CONCENTRATION OF POLYUNSATURATED FATTY ACIDS IN PATIENTS WITH METABOLIC SYNDROME, DEPENDING ON THE TYPE OF EATING BEHAVIOUR

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ABSTRACT

The study aimed to assess the nature of changes in the concentration of polyunsaturated fatty acids in patients with metabolic syndrome with different types of eating behaviour. The diagnosis of "metabolic syndrome" was established based on diagnostic criteria of the All-Russian Scientific Society of Cardiology in 2009. The respondents’ eating behaviour was assessed based on the data interpretation from the Dutch Eating Behavior Questionnaire of 1986. Determination of the concentration of polyunsaturated fatty acids in the blood of the subjects was carried out using the gas chromatography-mass spectrometry technique. Compensation of the body's free-radical reactions to oxidative stress led to a decrease in the level of polyunsaturated fatty acids in patients with metabolic syndrome. The results showed a decrease in linoleic and arachidonic acid concentration in the blood, mainly in individuals without symptoms of eating disorders.

Keywords: metabolic syndrome, eating behaviour, polyunsaturated fatty acids, oxidative stress.

I. INTRODUCTION

The main pathogenetic mechanism of the development of metabolic syndrome (MS) is an increase in the proportion of visceral adipose tissue associated with insulin resistance. It potentiates lipolysis and the accumulation of lipids on the walls of the arteries. As a result, an inflammatory reaction develops, and oxidative stress occurs, which increases the risk of the early development of cardiovascular pathology in this category of patients [3, 4]. Ensuring the functioning of the body's antioxidant system and preventing the formation of oxygen radicals is carried out due to the trace elements in food, vitamin E, and polyunsaturated fatty acids (PUFAs), particular docosahexaenoic, linoleic, linolenic and arachidonic acids [1, 2].

The article aims to assess the nature of changes in the concentration of polyunsaturated fatty acids in patients with metabolic syndrome, depending on the eating behaviour.

MATERIALS AND METHODS

In accordance with the national clinical recommendations of the Russian Society of Cardiology, the Russian Scientific Medical Society of Therapists, the Antihypertensive League, the Organization for the Promotion of Pre-hospital Medicine "Outpatient Doctor" and the Association of Clinical Pharmacologists in 2017, patients who
were on outpatient and inpatient treatment in the cardiology and endocrinology departments of the multidisciplinary hospital of St. Petersburg State Medical Institution "Yelizavetinskaya Hospital" were examined.

The criteria for inclusion of patients in the study were considered: age over 18 years; written consent to participate in the study; the protocol of which was approved by the Local Ethics Committee of the St. Petersburg State Medical Institution "Yelizavetinskaya Hospital" on December 8 2017; the presence of MS established based on diagnostic criteria developed by specialists of the All-Russian Scientific Society of Cardiologists (ARSSC) in 2009: abdominal obesity, determined based on measuring the waist circumference: >94 cm in men and >80 cm in women; the presence of two additional criteria from the presented ones: arterial hypertension – blood pressure ≥ 130/85 mm Hg, for example, an increase in the concentration of triglycerides ≥ 1.7 mmol/l and low-density lipoproteins > 3.0 mmol/l, a decrease in the level of high-density lipoproteins < 1.0 mmol/l in men and < 1.2 mmol/l in women, the concentration of glucose in the fasting blood plasma ≥ 6.1 mmol/l, or a violation of glucose tolerance.

Persons with diagnosed Type 1 diabetes mellitus, decompensation or severe course of chronic cardiovascular, endocrine, gastroenterological, neurological and nephrological pathology, any acute pathological condition that makes it difficult to examine within the framework of the study, oncological diseases, pronounced intellectual-mnestic and mental disorders, alcohol and drug addiction, as well as those who refused to sign an informed consent, were not included in the study.

The nature of the respondents' eating behaviour was assessed based on the results of the interpretation of the data of the Dutch Eating Behavior Questionnaire (DEBQ) of 1986.

Determination of the concentration of polyunsaturated fatty acids (PUFAs) in the blood of the subjects was carried out using the gas chromatography-mass spectrometry technique on an Agilent 7890 gas chromatograph with a mass-selective detector (Agilent Technologies, USA). The reference values of docosahexaenoic and linolenic acid levels were in the range of 16.1-37 mcg/ml and 7.68-22.9 mcg/ml, and the concentrations of linoleic and arachidonic acids were in the range of 441.8 – 777.8 mcg/ml and 84.8-161 mcg/ml, respectively.

Statistical processing of the results was carried out in the program Statistical Product and Service Solutions (SPSS) 17.0, qualitative variables were presented in the form of "n (%)", quantitative—in the form of median and quartile values: «Me (Q1; Q3)». The statistical significance of p was determined at the level of <0.05. Comparative analysis of the selected study groups was carried out using the nonparametric Kruskal-Wallis test, followed by a posteriori pairwise comparison using the nonparametric Mann–Whitney U-test, taking into account the Bonferroni correction (p <0.017).

RESULTS AND DISCUSSION

One hundred seventeen patients were examined, with an average age of 51.0 (44.0; 57.0). The number of men and women selected for the study was 46 (39.3%) and 71 (60.7%), respectively. Based on the data of the Dutch Eating Behavior Questionnaire (DEBQ), four representative groups were identified, depending on the variant of eating behaviour, comparable in gender and age composition:

1. 30 respondents who did not show signs of abnormal eating behaviour were included in the group "rational type of nutrition";
2. 28 patients who tend to limit the amount of food consumed, ignoring the natural needs of the body, were designated as a study group with a "restrictive type of diet";
3. 29 people with a hyperphagic reaction to stress and negative emotions formed the group "emotionogenic type of nutrition";
4. Thirty subjects with food motivation caused by external factors were considered as representatives of the group "external type of nutrition".

Table 1 presents data on the nature of patients' distribution in the formed groups by gender and age. The results of the comparative analysis, which did not reveal statistically significant differences in these indicators, confirm the validity of dividing the sample of subjects into the described groups.

Table 1
The nature of the gender and age composition of respondents in the selected groups

<table>
<thead>
<tr>
<th>Indicator</th>
<th>&quot;Type of eating behaviour&quot; group</th>
<th>Level p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rational</td>
<td>restrictive</td>
</tr>
<tr>
<td>Me (Q1;Q3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, years</td>
<td>53,5 (29,0; 58,0)</td>
<td>49,0 (44,0; 61,0)</td>
</tr>
<tr>
<td>N (%)</td>
<td>Men</td>
<td>13 (43,3)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>17 (56,7)</td>
</tr>
</tbody>
</table>

* – p <0,05 the differences are statistically significant

The results of the comparative analysis of certain concentrations of docosahexaenoic, linolenic, linoleic, and arachidonic acids in the blood by performing gas chromatography-mass spectrometry are shown in Table 2.

Table 2

Indicators of polyunsaturated fatty acids in the blood serum of patients in the formed groups

<table>
<thead>
<tr>
<th>Indicator</th>
<th>&quot;Type of eating behaviour&quot; group</th>
<th>Level p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rational</td>
<td>restrictive</td>
</tr>
<tr>
<td>Docosahexaenoic acid mcg/ml</td>
<td>12,2 (8,3; 14,4)</td>
<td>14,7 (10,4; 27,7)</td>
</tr>
<tr>
<td>Linolenic acid, mcg/ml</td>
<td>8,7 (8,2; 14,3)</td>
<td>9,6 (7,7; 14,4)</td>
</tr>
<tr>
<td>Linoleic acid, mcg/ml</td>
<td>367,2 (270,5;405,7)</td>
<td>454,8 (324,6;566,8)</td>
</tr>
<tr>
<td>Arachidonic acid, mcg/ml</td>
<td>16,8 (15,4; 42,8)</td>
<td>44,0 (25,3; 53,2)</td>
</tr>
</tbody>
</table>

* – p <0,05 the differences are statistically significant
** – p <0,01 the differences are observed at a high level of statistical significance

The median values of the level of docosahexaenoic acid in the blood serum were reduced compared to the respondents' reference values in all the study groups – on average, 13.3 (8.7; 30.1) mcg/ml, while there were no statistically significant differences in this indicator.

The concentrations of linolenic acid in the blood of all the examined patients were within the normal range-on average, 9.7 (7.8; 14.6) micrograms/ml.

The level of linoleic acid on average corresponded to the lower limit of the reference values – 468.7 (341.9; 605.7) mcg/ml, but in patients with a rational type of nutrition, its concentrations were slightly reduced compared to the corresponding indicators of respondents with signs of eating disorders (p=0.002).

At the same time, in all the studied groups, there was a decrease in the concentration of arachidonic acid in the blood serum – an average of 31.9 (17.6; 50.9) mcg/ml, while a comparative analysis showed the presence of more pronounced changes in individuals with no symptoms of pathological eating behaviour.

II. CONCLUSION

The obtained results showed a regular change in the balance of PUFAs in the blood serum in the direction of decreased concentration. It is regarded as a consequence of depletion of the reserves of ω-3 and ω-6unsaturated fatty acids to compensate for free-radical reactions of the body against the background of oxidative stress in patients with Metabolic syndrome (MS). The revealed changes in the examined patients' blood suggest the
presence relationship between the nutrition type and the diet characteristics and the possibility of prescribing drugs containing both ω-3 and ω-6 PUFAs, based on the data on the absence of eating disorders in the patient. While for patients with pathological eating behaviour, it is more advisable to use drugs containing ω-3 unsaturated fatty acids.

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