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Diagnostics at Alimentary Prevention of Non-Specific Diseases

ABSTRACT

In order to identify risk factors of nutrition-related diseases using a system Nutritest IP-3 the nutritional status of 3500 patients (mean age 48.4 ± 0.3 years), living in the Moscow region, has been examined. In the analysis of dietary intake on the average increased ration calorie due to excess intake of the total and saturated fat has been shown. Patients were overweight and obese. Osteopenia and osteoporosis were detected. Analysis of the results of biochemical studies revealed in patients increased levels of cholesterol, LDL cholesterol, triglycerides and glucose. These experiments allow developing a system of prevention of noncommunicable diseases, to carry out a personalized alimentary correction of violations of nutritional status taking into account gender and age features.

Keywords: actual nutrition, nutritional status, hypercholesterolemia, hyperglycemia, bone density.

Healthy diet is an essential component of healthy lifestyle and implies the need for food intake and biologically active substances, ensuring optimal implementation of physiological and biochemical processes enshrined in the human genotype [2,4].

Nutritional structural disturbance leads to changes in nutritional status that promotes the development of non-infectious diseases, which account for more than half of mortality causes in our country. It is proved that the contribution of nutrition to the development of cardiovascular diseases, diabetes, osteoporosis, obesity, some forms of malignancy ranges from 30 to 50%.

Currently, as a part of the nutritional prevention and correction of non-infectious diseases in FSBSI "Research Centre of Nutrition" to create a consultative and diagnostic center "Healthy Nutrition", whose main task is to provide highly consultative and diagnostic assistance for optimal nutrition.

The aim of the present study was to assess dietary intake, nutritional status and identifying risk factors nutrition-related diseases in patients who were examined, comprising modern genomic and post-genomic approaches analysis, consultative and diagnostic center "Healthy Nutrition".

Materials and methods

On the basis of the "Nutritest SP-3" 3,500 people were surveyed (average age 48.4 ± 0.3 years) living in the Moscow region [1, 3, 5, 6].

Determination of body composition (water content, absolute and relative weight of adipose tissue and muscle) was performed using the bioimpedansmetra «InBody 720» ("MEDASS", Russia).

The study of energy expenditure at rest by indirect calorimetry was performed using a portable metabolografa VO2000 («MedGraphics», USA).

Determining the degree of mineralization of bone tissue to detect the risk of osteoporosis is performed using ultrasound densitometer «Sunlight Omnisense 7000» («BeamMed», Israel) on the basis of studies of 4 areas of the skeleton (radius, tibia, thumb phalanx III, V metatarsal bone).

Biochemical parameters that characterize the state of the lipid, protein, carbohydrate and mineral metabolism were determined using the analyzer c «ABX PENTRA 400» («HORIBA ABX SAS», France), in the automatic mode.

Determination of serum levels of insulin, C-peptide, testosterone, estradiol, thyroid stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), parathyroid hormone, homocysteine, vitamin B12 and folic acid was carried out using an automated analyzer immunochemiluminometric «Immulite 2000 XPI» («Siemens Healthcare Diagnostics Inc», USA).

Statistical processing of the results was performed with the use of PASW Statistics 20. Tests for compliance with Hardy-Weinberg equilibrium and the identification of associations by Pearson χ^2 performed using DeFinetti at the Institute of Human Genetics (Munich, Germany).

Results

In the analysis of the actual food in the majority of the surveyed excessive intake of cholesterol, saturated fat was found out. Along with it, 16-80% of the patients had insufficient content in the diet of polyunsaturated fatty acids (PUFAs), omega-3 family, dietary fiber, vitamins A, B1, B2, PP, calcium, and magnesium.

As it can be seen from Table. 1, patients have increased caloric intake due to excess consumption of the total (44.2% in calories) and saturated fat (13.6%). Energy value of the diet was significantly higher in men than women ($p < 0.05$). Along with this, men are significantly more protein consumed in the diet ($p < 0.05$). There was no significant age differences in the chemical composition of the diet of persons of different ages.

Based on the results of the survey we revealed that 30.0% of patients were overweight and 34.1% obese. According bioimpedansmetry 67.0% of patients had an increase in body fat, mainly due to visceral fat, from 21.4% - excess fluid and 34.0% - low skeletal muscle mass.

As it is shown on the Table. 2, women and people with overweight had significantly higher levels of body fat and the visceral fat area, and lower - skeletal muscle mass ($p < 0.001$). The content of total fluid was significantly lower in women than men and significantly higher in individuals with overweight and obesity ($p < 0.001$).

According anthropometry in patients over 30 years showed an increase in body mass index (25.0 ± 0.28 kg / m² and 30.1 ± 0.20 kg / m², $p < 0.001$), waist circumference (70.8 ± 1.36 cm and 80.7 ± 1.02 , $p < 0.001$), the hips (91.1 ± 1.36 cm and 96.3 ± 1.13 , $p < 0.01$).

Patients over 60 years old there was a significant decline in the relative value of fat mass ($22.2 \pm 0.70\%$ and 25.7 ± 0.57 31.2%, $p < 0.05$), the visceral fat area (79.3 ± 2.52 cm² and 120.3 ± 1.94 cm², $p < 0.05$), and reduced - the content of total liquid (37.9 ± 0.48 kg and 35.5 ± 0.36 , $p < 0.001$), and the mass of skeletal muscle (28.4 ± 0.39 kg and 26.4 ± 0.29 , $p < 0.001$). Research resting energy expenditure by indirect calorimetry revealed their significant decrease in patients older age group (1794.2 ± 32.4 kcal and 1738.2 ± 29.36 , $p < 0.05$).

Blood pressure was significantly higher in men and individuals with overweight and obesity ($p < 0.001$). Systolic (114.0 ± 0.96 mmHg and 139.5 ± 1.41 mmHg, $p < 0.001$) and diastolic blood pressure (74.5 ± 0.68 mm Hg and 86.6 ± 0.81 mm Hg, $p < 0.001$) was significantly increased in patients older age group.

According to the ultrasonic osteodensitometry osteopenia was found in 31.0% of men and 25.0% women, and osteoporosis - respectively, 20.9% and 30.3%. At the same time women's group average risk of osteoporosis was significantly higher than in men ($p < 0.05$). In patients older than 60 years were revealed a significant decrease in the T-test, which characterizes bone mineral density (-1.14 ± 0.08 and 0.09 ± 1.23 , $p < 0.001$).

Analysis of the results of biochemical studies characterizing the state of nutritional status, revealed the presence of hypercholesterolemia in 68.7% of patients. Reduced levels of HDL cholesterol in the blood serum was

observed in 5.8% of patients, the increased concentration of LDL cholesterol - at 63.9%, triglycerides - at 22.5%, glucose - at 29.4%. In individuals with overweight were found significantly higher levels of total cholesterol ($p < 0.01$) and lower - HDL cholesterol ($p < 0.001$). At the same time in men ($p < 0.01$) and obese ($p < 0.001$) had significantly higher levels of triglycerides and uric acid in the blood serum.

The excess of normal levels of homocysteine in the blood serum was observed in 7.6% of men. The level of homocysteine in men was significantly higher ($p < 0.05$) than in women. At the same time decrease in providing patients with folic acid, involved in the metabolism of homocysteine, it was detected in 12% of patients. The contents of the serum vitamin B12 were within normal range in all groups surveyed.

It had higher cholesterol levels (4.88 ± 0.10 mmol / L and 5.67 ± 0.05 mmol / L, $p < 0.05$) and glucose (5.28 ± 0.07 mmol / l and $6, 16 \pm 0.08$ mmol / L, $p < 0.01$) in the serum of patients older than 30 years and triglyceride levels - over 60 years (1.13 ± 0.11 mmol / l and 1.92 ± 0.40 mmol / l, $p < 0.05$). The content of cholesterol and serum glucose associated with body mass index surveyed.

In patients older than 30 years had significantly higher levels of uric acid in the blood serum (274.3 ± 7.09 mmol / L and 305.6 ± 4.39 mmol / L, $p < 0.001$) and older than 60 years - the concentration of urea (4.76 ± 0.12 mmol / l and 7.90 ± 1.98 mmol / L, $p < 0.01$).

There was a significant decrease after 60 years of iron levels in the blood serum (16.5 ± 0.62 mmol / L and 16.1 ± 0.41 mmol / L, $p < 0.001$) and a significant increase in the calcium concentration ($2.45 \pm 0, 01$ mmol / l and 3.14 ± 0.60 mmol / l, $p < 0.02$).

The study of vitamin provision revealed a significant decrease in people older than 60 years the level of folic acid in the serum (6.94 ± 0.96 ng / ml and 4.98 ± 0.62 ng / ml, $p < 0.05$). The content of vitamin B12 and homocysteine in the blood serum with age tended to decrease.

In the analysis of indicators of hormonal status there was a significant reduction in serum levels of triiodothyronine (116.6 ± 14.6 ng / dl and 88.8 ± 5.60 ng / dl, $p < 0.05$) in patients older than 30 years and testosterone (182.2 ± 44.9 ng / dL and 114.8 ± 28.4 ng / dl, $p < 0.01$) - in the older age group surveyed.

These experiments allow based on high-tech methods to develop a system of prevention of noncommunicable diseases, to carry out a personalized alimentary correction of violations of nutritional status.

Table 1. Chemical composition and energy content of the diet of patients according to gender and body mass index ($M \pm m$)

Index	Gender	
	Men	women
Energyvalue, kcal	$2903,6 \pm 17,1$	$2429,5 \pm 5,59^*$
Protein, g	$99,6 \pm 5,88$	$86,0 \pm 1,98^*$
Protein,% bycaloric	$13,4 \pm 0,37$	$13,7 \pm 0,17$
Totalfat, g	$136,8 \pm 7,36$	$125,5 \pm 3,31$
Fat% oncaloric	$42,0 \pm 1,26$	$44,6 \pm 1,11$
NLC% oncaloric	$14,0 \pm 0,44$	$13,8 \pm 0,16$
Totalcarbohydrates	$318,5 \pm 18,6$	$238,9 \pm 6,10^{***}$
Carbohydrates% oncaloric	$43,3 \pm 1,56$	$37,3 \pm 0,51$
Sugaradded,% ofcaloric	$10,1 \pm 1,03$	$9,27 \pm 0,33$

Note here and in Table. 2: * - significant differences ($p < 0.05$), the index of women against men, ** - significant differences ($p < 0.01$) *** - significant differences ($p < 0.001$).

Table 2. Clinical and metabolic characteristics of patients according to gender and body mass index (M ± m)

Index	Gender	
	Men	women
Age, Mr.	45,4 ± 0,71	49,2 ± 0,33
BMI, kg / m ²	28,0 ± 0,26	28,8 ± 0,16
Systolic blood pressure, mm Hg	131,9 ± 1,22	125,7 ± 0,72***
Pulsebeats. min.	72,9 ± 1,65	73,9 ± 1,02
T-score	-0,95 ± 0,09	-1,17 ± 0,05*
Fatmass,%	25,8 ± 0,72	31,4 ± 0,48***
Water, kg	47,7 ± 0,43	35,1 ± 0,15***
Skeletalmuscle mass, kg	36,3 ± 0,35	26,0 ± 0,14***
The area of the visceral fat,%	104,1 ± 2,85	114,5 ± 2,08***
Energy costs alone kcal	2122,4 ± 45,7	1719,2 ± 14,3***
Total cholesterol, mmol / l	5,52 ± 0,09	5,67 ± 0,05
HDL Cholesterol, mmol / l	1,35 ± 0,05	1,52 ± 0,01***
LDL Cholesterol, mmol / L	3,30 ± 0,10	3,34 ± 0,05
Triglycerides, mmol / l	2,08 ± 0,42	1,46 ± 0,03**
Glucose mol / l	5,85 ± 0,10	6,01 ± 0,07
Total protein, mol / l	75,3 ± 0,72	74,2 ± 0,39
Creatinine, mmol / l	88,5 ± 3,07	76,3 ± 3,29
Uric acid, mmol / l	337,7 ± 8,83	291,3 ± 3,51***
Urea, mmol / l	7,24 ± 1,84	4,99 ± 0,06*
Calcium, mmol / l	2,50 ± 0,02	2,62 ± 0,15
Iron mmol / l	19,1 ± 0,58	15,9 ± 0,27***
Thyroid-stimulating hormone (TSH) ng / dL	3,97 ± 2,28	2,48 ± 0,26
T4, ng / dL	1,07 ± 0,06	1,01 ± 0,03
T3, ng / dL	95,8 ± 9,38	93,6 ± 5,16
Testosterone, ng / dL	307,0 ± 30,6	94,7 ± 15,7***
Estrogen pg / ml	34,7 ± 4,41	85,5 ± 13,4
C-peptide, ng / ml	1,96 ± 0,19	2,08 ± 0,11
Homocysteine, begging / l	11,6 ± 1,15	9,43 ± 0,48*
Folic acid, ng / ml	6,09 ± 0,60	7,03 ± 0,56
Vitamin B12 pg / ml	512,1 ± 71,8	528,7 ± 58,1

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