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Eating habits and nutritional status of patients with affective disorders and schizophrenia

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Summary

Aim. The aim of the study was to assess the nutritional value of the food intake in the group of men and women suffering from recurrent affective disorders and schizophrenia, and also to determine the relation between selected nutritional parameters with anthropometric indices defining the nutritional status of the subjects.

Method. 219 persons participated in the study (61 patients with recurrent depressive disorders, 60 patients with schizophrenia and 98 healthy volunteers). A 24-hour dietary recall was used in the quantitative assessment of the diet. Anthropometric and biochemical measurements as well as body composition analysis were used to assess the nutritional status.

Results. It was shown that women with depression and schizophrenia had a significantly higher content of both visceral adipose tissue and subcutaneous adipose tissue as compared with the control group. A diet with a higher content of energy from protein, a higher supply of calcium promoted a lower fat content in the bodies of women suffering from depression (no such relationship was observed in the group of men). In the group of patients with schizophrenia, a diet with a lower supply of energy promoted a lower BMI value, waist circumference, lower waist-hip ratio and a lower fat content in the body.

Conclusions. An improper energy structure and an improper content of nutrients can, in the future, contribute to the development of many somatic diseases, thus leading to deterioration of life quality of subjects and preventing the maintenance of mental health.

Key words: depression, schizophrenia, eating habits

Introduction

The results of monitoring of the health status both in Poland and in the world indicate an increase in the frequency of the occurrence of mental diseases over the past years [1]. The results of cohort epidemiological research imply that nutritional deficiencies are related to an increase in the incidence of some mental diseases, in-

cluding schizophrenia and depression [2, 3]. Among factors related to the creation of susceptibility to mental disorders, researchers mention, among other things, deficiencies of exogenous polyunsaturated fatty acids, vitamin D and iron [4–6]. It was shown that the consumption of high-caloric food, rich in saturated fatty acids and simple sugars causes deterioration of the nervous system function by increasing the oxidation stress and decreasing the synaptic plasticity. The nutritional status of the body is a state of health resulting from daily consumption of food, absorbing and using nutrients it contains and the action of pathological factors influencing these processes. Excessive body weight contributes to lower self-esteem and the formation of a negative image of oneself, which, in turn, promotes depression and mood disorders. Obesity, through inflammatory processes and dysregulation of the neuroendocrine system, causes various metabolic disorders (including insulin resistance, dyslipidemia, hypercortisolemia) [7, 8]. Many studies have shown that depression proved to be a predictor of cardiovascular disease, promoted an increase in body weight and an increase in percentage of overweight and obese persons, especially with abdominal obesity and collection of metabolically active visceral adipose tissue [9]. The use of antipsychotic drugs can generate body mass increase, there also exist reports according to which patients, despite antipsychotic treatment, keep the right body weight, however, they have an incorrect body composition with a higher content of visceral adipose tissue [10].

The aim of the study was to assess the nutritional value of the food intake in the group of men and women suffering from recurrent affective disorders and schizophrenia and also to determine the relation between selected nutritional parameters with anthropometric indices defining the nutritional status of the subjects.

Material

The research, conducted between October 2015 and April 2016 involved 61 patients (33 women and 28 men aged 18–67 years) with diagnosed recurrent depressive disorders and 60 patients (32 women and 28 men aged 18–67 years) with schizophrenia (according to the ICD-10 criteria) [11]. Both patients with the first depressive episode (F32.0–F32.2) and patients with subsequent episodes in recurrent depressive disorder (F33) were included in the study. The severity of depressive disorders during the current episode was assessed using the Hamilton Rating Scale for Depression (17-item version) [12]. Current antidepressant treatment consisted of one antidepressant (selective serotonin reuptake inhibitors – SSRI) and one sedative used on an as-needed basis. Patients from the schizophrenia group had received atypical or typical antipsychotic drugs for at least a year before their inclusion in the study and they were psychiatrically stable.

Patients taking psychoactive substances, suffering from other mental disorders, suffering from diseases which might influence changes in metabolic parameters, using pharmacological and/or dietary treatment reducing lipid concentrations, were excluded from the study. The control group consisted of 98 healthy volunteers (60 women and 38 men aged 18–69 years) without any mental disorders, nutritional disorders and chronic diseases related to metabolism of nutrients.

All patients who took part in the study were informed about the purpose and methodology of the research. Each patient expressed written consent to participate in the study. This research was approved by the Bioethical Committee at the Medical University of Bialystok, number of permission R-I-002/370/2014.

Method

Assessment of eating habits

A 24-hour dietary recall from 3 weekdays was used for quantitative assessment of the diet and next the results were averaged in accordance with the existing recommendations [13]. The computer software Diet 5.0 developed by the Food and Nutrition Institute in Warsaw was used to evaluate the nutritional value of daily food rations. Nutrition standards for the Polish population were used for the assessment of compliance of nutrient consumption with recommendations [13]. The following percentages of energy from the consumption of basic nutrients were adopted: 12% from protein, 30% from fats (including 10% from saturated fatty acids (SFA), 10–14% from monounsaturated fatty acids (MUFA), 6–10% of the daily supply of energy from polyunsaturated fatty acids (PUFA)), 58% from carbohydrates. Moreover, the supply of dietary fibre of 30 g/day was adopted as compliant with the recommendations, while the corrected value of dietary cholesterol was 300 mg/day [13].

Assessment of the nutritional status

To assess the nutritional status of the subjects, body mass and height measurements were used and the BMI was calculated on this basis according to the following formula: body mass (kg)/height^2 (m^2). The measurements of the waist and hip circumferences were also performed, the WHR ratio was calculated in accordance with the following formula: waist circumference (cm)/hip circumference (cm). Body composition analysis was performed using bioelectric impedance using the Maltron BioScan 920-2 by Maltron International LTD. The body composition measurements were conducted using recommended measurement conditions. The percentage of fat tissue in the body, the depth of the subcutaneous fat (SAT), the depth of the visceral fat (VAT) at navel height and the value of the Resting Metabolic Rate (RMR, kcal/day) were assessed. Also, the concentrations of total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides in the blood serum were determined. The laboratory tests were performed at the Laboratory of the University Clinical Hospital in Bialystok and generally adopted standard ranges of reference values were regarded as the normal limits.

Statistics

Statistical analysis of the obtained results was performed using the Statistica 12.0 software by StatSoft to calculate the mean values, standard deviation and percentage values. The χ^2 and Mann-Whitney *U* tests were used to calculate the significance of

differences. The Spearman's correlation coefficient was also used to test relationships between selected features. Results with $p < 0.05$ were considered significant.

Results

In the group of women with recurrent depressive disorders, the current depressive episode was the first one in 30% of women and 47% of men, 36% of women and 21% of men had suffered from 2 to 4 episodes of depression and 34% of women and 32% of men had suffered from more than 4 episodes of depression. In the group of studied women, 36% received sertraline, 27% paroxetine, 24% escitalopram, 12% citalopram. In the group of male subjects 32% received escitalopram, another 32% paroxetine, 25% sertraline and 11% citalopram. In the group of female schizophrenia patients, 47% received 1 neuroleptic drug, 53% –2 or 3 neuroleptic drugs at the same time. In the group of men, 36% received 1 neuroleptic drug, 64% – 2 or 3 neuroleptic drugs at the same time. Olanzapine, risperidone, haloperidol, and clozapine were used the most often. Table 1 presents demographic variables and information on the illness of the studied patients.

Table 1. **Study groups characteristics**

Variables	Women			Men		
	Depression n = 33	Schizophrenia n = 32	Controls n = 60	Depression n = 28	Schizophrenia n = 28	Controls n = 38
	X±SD	X±SD	X±SD	X±SD	X±SD	X±SD
Age (years)	46.4±12.7	41.3±11.2	43.0±13.4	38.0±12.8	34.1±9.7	33.0±10.8
Place of residence n (%)						
Urban area	25(76)	27(84)	49(82)	21(75)	19(68)	29(76)
Rural area	8(24)	5(16)	11(18)	7(25)	9(32)	9(24)
Marital status n (%)						
Married	15(45)	7(22)	31(52)	20(71)[a]	9(32)[ac]	18(48)[c]
Single	18(55)	25(78)	29(48)	8(29)	19(68)	20(52)
Education n (%)						
Primary/vocational	9(27)[b]	10(31)[c]	1(2)[bc]	13(46)[b]	11(40)[c]	3(8)[bc]
Secondary	16(49)	14(44)	22(37)	11(40)	13(46)	13(34)
Higher	8(24)	8(25)	37(61)	4(14)	4(14)	22(58)
HAMD-17	19.0±6.1			14.9±5.9		
Age at onset (years)	35.5±11.5	30.1±8.7		29.2±8.6	23.3±7.0	
Illness duration (years)	10.2±9.5	10.4±8.1		8.4±6.6	9.5±7.9	

n – number of respondents; X±SD – arithmetic mean±standard deviation; statistically significant differences between: a – patients with depression and schizophrenia within the groups including

patients of the respective sexes; b – patients with depression and the control group within the groups including patients of the respective sexes; c – patients with schizophrenia and the control group within the groups including patients of the respective sexes.

It was shown that both in the compared groups of women and men, significantly more patients with depression and schizophrenia had primary/vocational education as compared with the control group. Moreover, in the compared groups of men, significantly more patients with depression were married as compared with men with schizophrenia (with the lowest percentage of person in a relationship). There were no significant differences between other variables presented in Table 1.

Table 2 presents selected anthropometric parameters as well as data concerning the body composition of the studied patients. Anthropometric data, such as body mass, height, BMI value, did not differ statistically in the compared groups. Over a half of the patients were characterized by BMI higher than 25 kg/m^2. Women with depression and schizophrenia had a significantly higher waist circumference as compared to the control group. In addition, in the group of women with schizophrenia, a significantly higher WHR value was observed as compared to the control group. No statistically significant differences were observed in the percentage of total body fat content in the bodies of patients form the compared groups. However, it was shown that women suffering from depression and schizophrenia had a significantly higher content of both visceral fat and subcutaneous fat as compared to the control group. Moreover, a significantly higher VAT/SAT ratio was observed in women with schizophrenia than in those with depression. No differences in the value of the resting metabolic rate were observed in the compared groups of women, while in the case of men, this value was the highest in the group of men with schizophrenia (this difference was statistically significant as compared to the group of men with depression).

Table 2. **Selected anthropometric parameters of the study participants**

Variables	Women			Men		
	Depression n = 33	Schizophrenia n = 32	Controls n = 60	Depression n = 28	Schizophrenia n = 28	Controls n = 38
	X±SD	X±SD	X±SD	X±SD	X±SD	X±SD
Body weight (kg)	72.6±16.3	73.0±17,8	67.1±12.3	83.5±13.5	91.3±20.2	88.4±18.3
Height (cm)	164.7±6.2	163.4±5.2	165.2±5.3	179.1±4.3	180.4±6.3	179.9±6.5
BMI (kg/m^2)	26.7±5.2	27.2±5.7	25.8±5.2	26.1±4.2	27.6±5.9	27.3±5.7
BMI < 25.0	12 (36%)	15 (47%)	24 (40%)	10 (35%)	12 (43%)	14 (37%)
BMI ≥ 25.0	21 (64%)	17 (53%)	36 (60%)	18 (65%)	16 (57%)	24 (63%)
Waist circumference (cm)	95.8^b±14.5	97.8^c±14.8	86.1^{b,c}±14.3	99.1±10.9	102.9±17.2	97.6±13.9
WHR	0.8±0.1	0.9^c±0.1	0.8^c±0.1	0.9±0.0	0.9±0.1	1.1±0.6
Total fat mass (%)	33.2±8.4	32.1±9.7	29.6±8.8	21.6±7.5	23.2±9.0	22.6±8.7

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Resting Metabolic Rate (kcal/day)	1,488.1±166.6	1,501.8±113.7	1,496.6±101.4	1,992.7[a]±166.7	2,105.2[a]±6.5	2,076.6±225.8
Visceral Fat (VAT) (cm^2)	331.0[b]±250.3	450.7[c]±366.4	207.7[bc]±217.2	314.8±288.1	503.1[c]±439.2	252.5[c]±231.4
Subcutaneous Fat (SAT) (cm^2)	125.0[b]±51.2	125.4[c]±38.9	102.0[bc]±53.3	113.4±59.7	121.4±52.1	134.7±57.7
VAT/SAT ratio	2.7[a]±1.6	4.3[ac]±2.7	1.9[c]±1.7	2.8±1.8	4.4[c]±3.6	2.1[c]±1.7

n – number of respondents; X±SD – arithmetic mean±standard deviation; WHR – waist/hip ratio; BMI – body mass index; statistically significant differences between: a – patients with depression and schizophrenia within the groups including patients of the respective sexes; b – patients with depression and the control group within the groups including patients of the respective sexes; c – patients with schizophrenia and the control group within the groups including patients of the respective sexes.

In the assessment of lipid metabolism (Table 3), no statistically significant differences were found between the compared groups with the exception of the concentrations of the HDL-cholesterol fraction which was significantly lower in the group of men suffering from schizophrenia as compared to the control group. Moreover, increased levels of total cholesterol (≥ 190 mg/dl) in 50% of women and 40% of men from the experimental groups and 60% of women and 40% of men from the control group. Lower HDL-cholesterol levels (≤ 50 mg/dl) were observed in 24% of women with depression and 37% of men with schizophrenia as well as in 60% of women from the control group. HDL-cholesterol concentrations below 40 mg/dl were observed in 30% of men from both experimental groups and 17% of men from the control group. Elevated LDL-cholesterol levels (>115 mg/dl) were observed in approx. 40% of women from the experimental groups and 50% of women from the control group. In men, elevated LDL-cholesterol concentrations were observed in 23% of patients with depression and 46% patients with schizophrenia as well as in 33% of men from the control group. Elevated triglyceride values in blood serum occurred in 15% of women from the experimental groups and 30% of women from the control group. For men with depression and schizophrenia, this value applied to approx. 40% of patients (25% of men from the control group).

Table 3. **Selected biochemical parameters of the study participants**

Variables	Women			Men		
	Depression n = 33	Schizophrenia n = 32	Controls n = 60	Depression n = 28	Schizophrenia n = 28	Controls n = 38
	X±SD	X±SD	X±SD	X±SD	X±SD	X±SD
Total cholesterol (mg/dl)	196.3±43.2	199.7±41.7	197.5±29.4	184.6±49.0	193.0±46.9	177.6±38.7
HDL-cholesterol (mg/dl)	56.6±15.4	55.4±17.6	55.4±17.6	48.4±16.8	40.9[c]±9.5	54.9[c]±12.9
LDL-cholesterol (mg/dl)	117.5±40.6	118.2±38.4	113.7±28.8	108.0±41.9	119.5±43.1	100.5±27.6
Triglycerides (mg/dl)	111.2±58.1	134.3±78.4	151.8±88.6	154.5±65.0	163.5±97.8	120.2±67.3

n – number of respondents; X±SD – arithmetic mean±standard deviation; statistically significant differences between a – patients with depression and schizophrenia within the groups including

patients of the respective sexes; b – patients with depression and the control group within the groups including patients of the respective sexes; c – patients with schizophrenia and the control group within the groups including patients of the respective sexes.

Table 4 presents the average energy value of daily food rations and the average consumptions of selected nutrients. The food intake of women with depression and schizophrenia covered 90% of the daily energy demand (85% in the control group of women). In the case of men, it was observed that the average supply of energy covered the recommendations in 81% in the group with depression and in the control group and in 86% in the group with schizophrenia. Attention should be paid to the incorrect structure of consumption of basic nutrients, regardless of the compared group (too low a percentage of energy from the consumption of carbohydrates and polyunsaturated fatty acids, which are important in the diet therapy of mental disorders, and too high a percentage of energy from total protein and fat consumption, especially saturated fatty acids).

Table 4. **The average energy intake and contents of selected nutrients in the daily food rations of the study participants**

Variables	Women			Men		
	Depression n = 33	Schizophrenia n = 32	Controls n = 60	Depression n = 28	Schizophrenia n = 28	Controls n = 38
	X±SD	X±SD	X±SD	X±SD	X±SD	X±SD
Energy (kcal)	1,872.8±483.2	1,923.8±573.9	1,777.7±562.0	2,186.7±562.0	2,323.7±568.7	2,179.0±710.6
Protein (g)	65.7±15.3	63.6±16.8	62.4±25.1	86.7±20.8	76.7^{c}±22.3	103.3^{c}±38.2
Energy from protein (%)	14.5^{b}±3.0	13.7^{c}±3.0	18.3^{bc}±5.4	16.4^{a}±3.3	13.5^{ac}±3.2	19.7^{c}±5.8
Carbohydrates (g)	248.4^{b}±87.1	266.7^{c}±109.7	191.6^{bc}±84.5	272.4±71.5	295.2±96.9	280.1±114.0
Energy from carbohydrates (%)	49.8^{a}±10.1	55.3^{ac}±9.1	49.7^{c}±10.7	47.5±8.4	49.0±11.7	47.9±11.4
Dietary fiber (g)	17.8±7.7	20.6±8.8	19.3±8.3	19.1±5.2	17.3±5.2	20.7±10.6
Fat (g)	74.9^{b}±32.3	64.0±25.9	52.1^{b}±28.4	84.7±34.7	100.0±42.3	78.2±44.4
Energy from fat (%)	35.5±10.1	30.8±9.3	31.6±10.3	34.8±8.4	37.4^{c}±10.5	31.3^{c}±10.6
Cholesterol (mg)	278.4±182.6	233.4±140.4	236.9±200.5	337.6±186.9	439.1±286.6	398.7±310.0
Saturated Fatty Acids (SFA) (g)	29.3^{b}±12.4	28.1±12.7	22.8^{b}±14.8	39.4^{b}±15.1	49.3^{c}±22.7	32.1^{bc}±15.4
Energy from SFA (%)	14.0±5.9	13.0±5.9	11.5±7.4	16.2±6.2	19.0±8.8	13.2±6.4
Monounsaturated Fatty Acids (MUFA) (g)	31.2^{b}±14.8	25.6±10.4	24.4^{b}±10.9	34.4±14.2	39.5±16.7	33.4±16.2
Energy from MUFA (%)	15.0±7.1	12.0±4.8	12.3±5.5	14.1±5.8	15.3±6.5	13.8±6.7

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Polyunsaturated Fatty Acids (PUFA) (g)	8.8±4.9	8.9±6.2	8.8±4.7	10.9±7.5	10.7±4.5	10.4±6.2
Energy from PUFA (%)	4.2±2.3	4.2±2.9	4.4±2.3	4.5±3.0	4.1±1.7	4.3±2.6
Eicosapentaenoic acid (EPA) (C20:5) (g)	0.04±0.16	0.01±0.03	0.05±0.01	0.01[a]±0.02	0.003[a]±0.001	0.05±0.04
Docosahexaenoic acid (DHA) (C22:6) (g)	0.09[a]±0.02	0.02[a]±0.03	0.13±0.4	0.04±0.08	0.03±0.05	0.21±0.08
EPA + DHA (g)	0.11±0.38	0.02±0.03	0.18±0.01	0.05±0.09	0.03±0.05	0.06±0.1
Calcium (mg)	526.8±302.3	567.4±298.2	566.3±351.7	871.2±714.2	582.5±422.0	689.7±476.6
Vitamin D (µg)	2.6±1.5	2.4±1.8	2.4±1.3	2.6±1.4	3.0±1.9	3.7±3.2

n – number of respondents; X±SD – arithmetic mean±standard deviation; statistically significant differences between: a – patients with depression and schizophrenia within the groups including patients of the respective sexes; b – patients with depression and the control group within the groups including patients of the respective sexes; c – patients with schizophrenia and the control group within the groups including patients of the respective sexes.

The food intake of women with depression showed a significantly higher percentage of energy from carbohydrate consumption as compared with the food intake of women with schizophrenia. Moreover, in the food intake of women with depressive disorders, a significantly lower value of energy from the consumption of proteins and a significantly higher supply of carbohydrates, total fat, including saturated and unsaturated fatty acids were observed as compared to the control group. Moreover, the food intake of women with depression provided significantly more docosahexaenoic acid as compared to the food intake of women with schizophrenia. In the food intake of women suffering from schizophrenia, a significantly lower value of energy from the consumption of proteins and a significantly higher supply of carbohydrates, as well as a higher percentage of energy from carbohydrates were shown as compared to the control group.

The food intake of men with depression differed significantly as compared to the food intake of patients with schizophrenia as it was characterized by a higher percentage of energy from protein consumption and a higher content of eicosapentaenoic acid. In addition, men with depression consumed significantly more saturated fatty acids as compared to the control group. The food intake of men with schizophrenia was, in turn, characterized by a significantly lower supply of total protein and the percentage of energy from protein consumption as well as higher fat consumption and a significantly higher supply of saturated fatty acids as compared to the control group. Moreover, it was also shown that the average supply of dietary fibre in the analyzed groups was similar and it provided only approx. 60–70% of the recommended amount.

While assessing the supply of cholesterol, the average daily consumption of this ingredient in the amounts exceeding recommendations (> 300 mg) was observed.

Moreover, the average consumption of calcium from the diet was consistent with the recommendations only in approx. 60% of the subjects in the compared groups, except for the group of men with depression where the average calcium consumption was the highest and it allowed the fulfillment of recommendations in 87%. Vitamin D was provided in the diet in amounts fulfilling the nutritional recommendations in approx. 50% in the groups of women and in approx. 60% in the groups of men.

In addition the relationship between the selected anthropometric parameters and parameters characterizing the nutrition in the groups of women and men were also assessed in this study. In the group of women with depression, the percentage of energy from protein consumption correlated with BMI ($r = – 0.45$; $p < 0.05$), the waist circumference ($r = – 0.34$; $p < 0.05$), the total fat tissue content (%) ($r = – 0.41$; $p < 0.05$). Moreover, the daily calcium intake was significantly negatively correlated with the percentage of total fat mass in this group ($r = – 0.34$; $p < 0.05$). In the case of women from the control group, the average daily energy consumption was positively correlated with VAT ($r = – 0.39$; $p < 0.05$), also the percentage of energy from the consumption of saturated fatty acids was significantly positively correlated with the content of adipose tissue in the body (%) ($r = 0.32$; $p < 0.05$). In the case of women with schizophrenia no statistically significant correlation was found between compared parameters.

In the case of men with schizophrenia, a statistically significant positive correlation was found between the value of the average daily energy consumption and the BMI ($r = 0.45$; $p < 0.05$), the waist circumference ($r = 0.55$; $p < 0.05$), the WHR ($r = 0.50$; $p < 0.05$), the percentage of adipose tissue in the body ($r =0.40$; $p < 0.05$). In the control group of men, a statistically significant correlation occurred between the daily supply of energy in the diet and the percentage of the adipose tissue in the body ($r = 0.36$; $p < 0.05$).

Discussion

Many studies show the co-occurrence of positive correlations between the occurrence of excessive weight and obesity and severity of mental disorders [7, 14]. There are also studies which show that depressive symptoms increased in patients who were undernourished and those with morbid obesity, while in patients with normal body weight and in overweight patients, the severity of symptoms was significantly lower [15]. In the own research, a positive but insignificant correlation was observed between the severity of depressive symptoms with the BMI. Research by other authors showed that depressive symptoms were significantly positively correlated with the total adipose tissue content in the body (%), while no statistically significant correlation was observed between the severity of symptoms with the visceral adipose tissue content, the BMI, the waist circumference and the WHR [7].

In the research conducted among schizophrenia patients by Wysokiński and Kołaszewska [8], it was observed that the content of adipose tissue was positively correlated with the body mass, the BMI, the visceral adipose tissue content and the waist circumference. Despite the fact that the visceral adipose tissue content in the

research by these authors did not differ in a statistically significant manner between sexes (98.2 cm^2 in women and 101.1 cm^2 in men), a much more frequent occurrence of abdominal obesity was observed in women, as compared to men, thus contributing to a higher risk of the occurrence of insulin resistance, atherosclerosis, hypertension and diabetes in this group [8].

The research shows that in people with schizophrenia, as compared to the population of healthy persons, visceral obesity is found more often (40–60%), which results 2.5 times higher incidence of the metabolic syndrome in women and 1.5 times higher incidence in men [16]. As shown by research conducted on patients with schizophrenia (also ones with normal body weight according to the WHO criteria), the visceral deposit of adipose tissue can be even 5 times higher in men and 2 times higher in women than in patients in the control group, thus confirming an increased cardiovascular risk in this group of patients [10]. In a study by Vogelzangs et al. [9], a statistically significant relationship was found between the occurrence of depression and visceral obesity in men. These data are also confirmed by the results of the own research which showed that content of the visceral adipose tissue both in the group of patients with depression and schizophrenia was higher as compared to the control group (in women with depression nearly 1.5 times higher, in men with depression 1.2 times higher, in female and male schizophrenia patients more than 2 times higher than in the control groups). The percentage of patients with BMI > 25 kg/m^2 in comparable groups was similar and exceeded 50%.

In research by Everson-Rose et al. [17] conducted in a group of female patients with depressions, a lower average visceral adipose tissue content (94.6cm^2) was revealed and a higher content of subcutaneous adipose tissue (389.5cm^2) than that obtained in the own research. Moreover, as shown in research by these authors, women with a content of visceral adipose tissue higher than 163cm^2 were 4 to 5 times more exposed to the reversed lipid profile (low concentrations of HDL-cholesterol, hypertriglyceridemia, high LDL-cholesterol to HDL-cholesterol ratio). It was shown in the own research that the visceral adipose tissue content was positively correlated with total cholesterol in the blood of women with depression and negatively correlated with HDL-cholesterol fraction concentrations in women with schizophrenia. In women from the control group, the content of visceral adipose tissue was positively correlated both with the total cholesterol concentrations in the blood and the LDL-cholesterol fraction concentration. There were no such relationships in men.

In research by Konarzewska et al. [10], it was shown that the energy-content of the diet of patients with schizophrenia is not a factor which has a significant influence on the amount of the visceral adipose fat deposit. The accumulation of visceral adipose tissue may be caused by an incorrect composition of the diet rather than the excessive supply of energy. In other research it was shown that the development of obesity depends, to a higher extent, on a higher fat to carbohydrates ratio in the diet than on excessive consumption [18]. In the own research, however, it was revealed that there was a higher correlation between the supply of energy and selected anthropometric parameters (BMI, waist circumference, WHR, total fat mass (%)) only in the group of men with schizophrenia. Moreover, no significant correlations were observed between

the percentage of energy from the consumption of basic nutrients and the percentage of the adipose tissue in the bodies of subjects with schizophrenia. Such a relationship was observed only in the group of women with depression – the percentage of protein in the energy value of the daily consumption was negatively correlated with the BMI value and also with the waist circumference as well as with the percentage of adipose tissue in the body and the content of visceral adipose tissue. According to research, protein consumption may induce the thermal effect and increase energy expenditure [18], which could account for significant negative correlations between the percentage of the protein in the energy value of daily intake with the BMI, the percentage of adipose tissue and visceral adipose tissue.

It was shown in the research that the consumption of high-calories nutrition, rich in saturated fatty acids and simple sugars causes deterioration of the nervous system function by increasing the oxidative stress and decreasing the synaptic plasticity. Moreover, the popular model of nutrition of societies in developed countries is characterized by consumption of large amounts of foods which are especially poor in nutrients conditioning proper brain function, e.g., polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) or vitamins from group B and minerals (Mg, Zn) [6, 10]. The content of EPA and DHA is particularly important in the diet, as these acids can be produced from α-linolenic (ALA), however, this conversion occurs in the human body very slowly, as a result of which only 2–10% of ALA is converted to EPA and DHA. This process is significantly less effective in men than in women and it is influenced by the environment – it is further impaired in stress and the related hypercortisolemia, a higher content of saturated fatty acids in the diet, zinc deficiencies and during viral infections [6, 19]. As shown in the research, 1–2 grams of omega 3 fatty acids supplied in the diet are a sufficient amount for healthy persons, however, this demand increases to 9.6 g/a day for patients with depression [19].

The results of meta-analyses of randomized research also show the possibility of using supplementation of schizophrenia patients' diets with eicosapentaenoic acid. According to Lakhan and Vieira [19], supplementation with docosahexaenoic acid inhibits the effects of EPA supplementation in these patients, thus it is recommended that patients should take EPA in the form of supplements which is converted in the body to the required amount of DHA. According to these authors, 2 g of EPA a day, as an addition to the existing treatment, effectively reduced symptoms in patients with schizophrenia. In recent years, the role of inflammation in pathogenesis of mental disorders has attracted a lot interest. The research suggest that the inflammatory process in the hypothalamus and mediators released at that time can also lead to the creation of a positive energy balance and development of obesity [20]. This data confirms an advantageous participation of EPA in the diet, which is of fundamental importance to keep the immune balance of the body. In the own research, very low consumption of both EPA and DHA was observed in all compared groups, however, the menus of women with depression were characterized by a significantly higher value of DHA as compared to the menus of women with schizophrenia, while a significantly higher EPA content was observed in the menus of men with depression as compared with the group of schizophrenia. The research shows that daily supplementation with as little as

4 g EPA + DHA is related to significant mood changes (more vigor, less anger, anxiety and tiredness) [6]. The own research showed that the lowest total supply of EPA and DHA occurred in patients with schizophrenia, it was lower than in patients with depression,, however, the supply was too low in all groups as compared to recommendations.

The daily energy supply shown in the own research was close to recommendations in the groups of women, however, in the groups of men it met the recommendations only in 80%. The patients' food intake examined by other researchers [2, 10] was characterized by even lower energy supply. In the own research, consumption of saturated fatty acids in excessive amounts was observed with too low supply of polyunsaturated fatty acids, dietary fibre, calcium and vitamin D. In research by Perez-Cornago [2], it was shown that together with an increase in depressive symptoms, patients' diets were characterized by decreased consumption of polyunsaturated omega 3 fatty acids, but also dietary fibre, vitamins $B_{1,}$ B_6, C, magnesium, selenium and tryptophan, components which are of particular importance in proper brain function [2]. In research by Konarzewska et al. [10], it was shown that the greatest deficiencies in the diet of schizophrenia patients were related to the consumption of total carbohydrates, mono – and polyunsaturated fatty acids, dietary fibre as well as selected vitamins: C, folic acid and minerals such as: calcium, magnesium, iron and zinc.

In the own research, attention was also paid to the supply of calcium and vitamin D. Calcium influences body weight modulation by influencing the adipocyte metabolism. There are reports, according to which the body's mineral homoeostasis system reduces the concentration of 1.25-dihydroxyvitamin D with an increased calcium supply, which reduces permeability of calcium channels, as a result of which there is a decrease in intracellular calcium concentrations, increase in adiponectin production as well as lipolysis intensification and lipogenesis reduction [4, 21]. Vitamin D, in turn, regulates gene expression related to calcium and phosphorus homoeostasis by means of an intracellular receptor. In the own research, too low content of calcium and vitamin D was observed in the food intake of patients, regardless of their sex, however, this content was higher than the content in the food intake of patients examined by other authors [10, 22].

As shown by research, vitamin D can play a protective role in the case of neurodegenerative and neuroimmune diseases. Research on the CNS function show that vitamin D deficiency in the first year of life can be treated as one of risk factors in the incidence of schizophrenia. The research on etiology of schizophrenia define it as a consequence of disturbed regulation of gene transcription during the period of brain development. Hormone-depended nuclear receptors for vitamin D participate in the development of nervous system and the regulation of gene expression [5, 21]. The conducted research indicate that the nutritional condition in patients did not only depend on nutrients supplied with the diet but also on mutual proportions of basic nutrients. Statistically significant correlations were observed between the supply of energy with food and anthropometric indices only in the group of men with schizophrenia, in the group of patients with depression only women show a statistically negative correlation between the anthropometric indices reflecting their nutritional condition and the energy from protein consumption in the diet.

Conclusions

1. The nutritional value of daily food intake of the examined patients, regardless of the assessed group, was characterized by an excessive supply of fat with predominance of saturated fatty acids and too low supply of polyunsaturated fatty acids, total carbohydrates and dietary fibre, calcium and vitamin D.
2. A diet with a higher content of energy from protein, a higher supply of calcium promoted a lower fat content in the bodies of women suffering from depression (no such relationship was observed in the group of men). In the group of patients with schizophrenia, a diet with a lower supply of energy promoted a lower BMI value, waist circumference, lower waist/hip ratio and a lower fat content in the body.
3. It seem justified that a dietary procedure for patients with affective disorders and schizophrenia should include not only the calorie content of food but also mutual proportions of the consumption of basic nutrients.

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