

## **Assessment of the diet and nutritional status in obese patients and patients with normal body weight hospitalised because of a depressive episode**

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### **ABSTRACT**

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**Purpose:** Depressive disorders and obesity belong to the most frequently occurring diseases. Improper nutritional behaviours are observed in patients suffering from recurring depressive disorders. We have undertaken research aimed at comparing the body weight composition and the content of selected nutrients in the food intake of patients with diagnosed depressive disorders.

**Materials and methods:** 131 patients (76 women and 55 men) suffering from depressive episode took part in the study. The patients had their body composition analysed using electrical bioimpedance measured by a MALTRON BioScan 920-2 device. The assessment of the diet was conducted using a 24-hour interview concerning the day preceding the examination.

**Results:** Male with diagnosed depression and obesity were more often married or had lower level

of education as compared to male with the normal body weight. Obese female with diagnosed depression had more episodes of the disease and were older as compared to female with the normal body weight. Both obese male and female were characterised by a higher percentage content of visceral adipose tissue, subcutaneous adipose tissue and a higher VAT (visceral adipose tissue)/SAT (subcutaneous adipose tissue) ratio as well as a lower content of fat-free body mass.

**Conclusions:** Patients with diagnosed depression, with the normal body weight and obesity, were characterised by an inappropriate supply of proteins, carbohydrates, total fats, saturated and unsaturated fatty acids and dietary fibre.

**Key words:** depression, nutritional status, body composition.

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## **INTRODUCTION**

Depressive disorders and obesity belong to the most frequently occurring diseases. According to a report by the World Health Organization (WHO), by 2020, depression will have become the second most important cause of disability following ischaemic heart disease [1]. The rank of depressive disorders is fully comparable to diseases of social importance, such as diseases of the circulatory system, tumours and HIV [2]. Similarly, obesity is becoming a more and more noticeable health problem. Depressive disorders and obesity often co-occur, despite the fact that these are two separate disease entities [3]. They are both characterised by a polygenic and heterogeneous type of pathogenesis. Both heritable and environmental factors take part in their formation. Improper nutritional behaviours are observed in patients suffering from recurring depressive disorders. These involve avoidance or excessive consumption of certain groups of products and dishes, which may result in the development of severe nutritional deficiencies or excess as regards proteins, fats and carbohydrates [3].

Dysfunctional eating habits may result from the disease, during which the patient stops taking care of himself/herself as a result of low mood. Loss of appetite, which is one of the symptoms of depression, also plays an important role together with motivation disorders, psychomotor slowing and anhedonia.

Some anti-depressants increase appetite, forcing the patient to consume larger food portions, but also products with a higher energy index [4]. Recently, more and more data have been appearing, which indicate that both depressive disorders and obesity are secondary to inflammatory conditions [5,6].

In researchers' opinion, eating disorders result in abdominal obesity and the related proinflammatory condition may take part in the pathogenesis of depressive disorders, just like low mood in obesity [7,8]. These issues still remain unresolved. There are paucity of scientific studies concerning the problem of the nutritional status and the method of feeding patients with mood disorders, which would show deficiency or excess of specific ingredients in their food intake. As a result, we have undertaken research aimed at comparing the body weight composition and the content of selected nutrients in the food intake of patients with diagnosed depressive disorders.

We also analysed differences in anthropometric and biochemical parameters dividing the patients into subgroups, depending on the body weight and the sex.

## **MATERIALS AND METHODS**

### *Survey participants:*

131 patients (76 women and 55 men) with a diagnosed depressive episode according to the classification (ICD-10) [9] took part in the study. The patients were hospitalised at the Psychiatry Clinic, Medical University of Białystok. The study was conducted from 2013 to March 2014.

### *Procedures*

Both patients with the first depressive episode (F32.0-F32.2) and patients with subsequent episodes with recurring depressive disorders (F33) were included in the study. The total duration of the disease was not longer than 5 years and the current depressive episode could not last longer than a month. Moreover, the treatment time of the current episode, in the form of monotherapy with one of the following antidepressants: venlafaxine, mirtazapine, escitalopram, sertraline, citalopram, paroxetine was not longer than 4 weeks. Persons with a diagnosed depressive episode secondary to bipolar affective disorder, organic disorders of the central nervous system, addiction to psychoactive substances as well as with severe somatic diseases which can have a negative effect on the mood, were excluded from the study.

The assessment of the course of depressive disorders up to date was performed on the basis of data from the medical history and available medical documentation. The severity of depressive symptoms during the current episode was assessed using the Beck Scale and the Hamilton Rating Scale for Depression (17-item version) [10, 11]. The Beck Scale consists of 21 questions, to which patients responds on his/her own. They correspond to higher intensity of symptoms, thus points from 0 to 3 are assigned to individual questions. The Hamilton Rating Scale for Depression, on the other hand, was completed by a psychiatrist with 20 years of experience with diagnosing persons suffering from mood disorders, who did not have access to the results obtained from the Beck Scale.

### *Methods*

In all patients, the body weight, height, waist and hip circumference were measured. At the next stage, the patients had their body composition analysed using electrical bioimpedance measured by a MALTRON BioScan 920-2 device (manufactured by Maltron International TLD). Biochemical blood parameters were also determined, i.e. the lipid profile (total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides), glucose and haemoglobin. The laboratory tests were performed at the Laboratory of the University Clinical Hospital in Białystok and generally adopted standard ranges of reference values were regarded as the normal limits.

**Assessment of the diet:**

The diet was assessed using a questionnaire developed at the Department of Dietetics and Clinical Nutrition, Medical University of Białystok. A 24-hour interview from the day preceding the examination was used in the quantitative assessment of the diet. The assessment of the value of the whole day food intake was conducted using the Dieta 5.0 software developed by the Food and Nutrition Institute in Warsaw, (licence agreement no. HBBxtpINI). The sizes of portions of products and dishes were assessed using the “Album of photographs of products and dishes” prepared by the Food and Nutrition Institute in Warsaw [12]. Nutritional standards for the Polish population established at the level of Recommended Dietary Allowances were used for the assessment of compliance of the consumption of selected nutrients with the recommended values [13]. The consumption of nutrients at a level of 90-110% of the nutritional standards was regarded as appropriate. The average demand for energy and basic nutrients was determined individually with reference to the ideal body weight (IBC). The consumption of proteins at a level of 10%, total fats 25% and carbohydrates at 65% of the whole-day energy demand was regarded as the norm. The demand for saturated, mono- and polyunsaturated fatty acids was also determined at the level of 7%, 10%, 8% of the demand for energy, respectively. 30

g was adopted as the norm for dietary fibre and 300mg per day was considered to be the norm for food cholesterol.

This research was approved by the local Bioethical Committee (Approval No. R-I-002/325/2011). All patients gave their written consent to take part in the study after receiving exhaustive information about its objectives and procedures.

**Statistical analysis:**

The final results were presented in the form of the arithmetic mean, standard deviation and percentage calculations. The statistical assessment of the results obtained was conducted using the STATISTICA 10.0 software by StatSoft.  $p < 0.05$  was adopted as the significance level in all the calculations.

**RESULTS**

The subjects were divided into subgroups of men and women (Table 1). In the group of women, 30 patients had a normal body weight (BMI ranging from 18.5-24.9 kg/m<sup>2</sup>), while 46 were obese (BMI value  $\geq 30$  kg/m<sup>2</sup>). In the group of men, only 15 patients were characterised by the body weight within normal limits and obesity was found in as many as forty male patients.

**Table 1** Characteristics of patients with depression.

Variables	Women (n=76)		Men (n=55)	
	Normal weight n=30	Obese n=46	Normal weight n=15	Obese n=40
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Age (years)	42.9±12.7*	49.3±10.3*	50.0±13.6	46.4±11.5
Marital status (%)				
Single	26.7	13.0	23.8**	0.0**
Married	50.0	69.6	66.78**	100.0**
Divorced	23.3	6.5	9.5**	0.0**
Widow	0.0	10.9	0.0	0.0
Education (%)				
Primary	20.0	45.6	0.0*	52.4*
Secondary	63.3	41.3	60.0*	31.7*
University	16.7	13.1	40.0*	15.9*
Number of previous episodes				
1 episode	43.3*	23.9*	40.0	60.4
2-4 episodes	26.7*	15.2*	60.0	11.3
>4 episodes	30.0*	60.9*	0.0	28.3
HAM-D score	10.4±6.1	12.6±6.7	10.0±1.5	13.7±6.2
Beck score	20.2±12.4	22.2±12.2	13.1±3.2	20.0±12.8

Values are mean (SD) or percentages of subjects for categorical variables

\*: $p < 0.05$ , \*\*: $p < 0.01$ , \*\*\*: $p < 0.001$

There were significant differences between women in terms of age. Obese women were older

as compared to women with the normal body weight, while no differences were found as regards

their marital status or the level of education. Scores on the Beck and Hamilton scales were similar in both groups. However, in obese women, the number of depressive episodes was significantly higher than in women with the normal weight. More than 4 episodes occurred only in 30.0% patients with the normal weight and in as many as 60.9% obese patients (Table 1). Among obese women, during the current episode: 36.8% were taking venlafaxine, 23.7% mirtazapine, 2.6% escitalopram, 23.7% sertraline, 2.6% citalopram and 10.6% paroxetine. Women with the normal body weight were usually administered venlafaxine (40.8%). The same percentage of women (22.2%) was treated with sertraline and escitalopram. In the group of women with the normal body weight, paroxetine (7.4%) and mirtazapine (7.4%) proved to be the most rarely used.

The body composition analysis of obese women revealed a significantly higher value of the WHR (waist-hip ratio) and the percentage content of fatty tissue and a lower content of fat-free body mass as compared to women with the normal body weight. Furthermore, they were characterised by a higher content of visceral adipose tissue (VAT), subcutaneous adipose tissue (SAT) and a higher VAT/SAT ratio. The content of extracellular water was higher in the group of women with the normal body weight, while the intracellular water content was higher in the obese women. The extracellular-to-intracellular water ratio was lower in the obese women. Laboratory blood tests revealed a similar content of total cholesterol, LDL cholesterol, triglycerides and haemoglobin in the group of obese women and women with the normal body weight (Table 2).

**Table 2.** Selected parameters for assessing the nutritional status of patients with depression.

Variables	Women (n=76)		Men (n=55)	
	Normal weight n=30	Obese n=46	Normal weight n=15	Obese n=40
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Body height (cm)	166.0±5.7***	165.2±5.9***	175.2±4.3	176.6±6.8
Body weight (kg)	56.9±6.8***	82.7±9.7***	66.0±8.2***	98.5±11.1***
Body mass index (kg/m <sup>2</sup> )	20.7±2.1	30.1±3.4	21.4±1.5	31.8±3.1
Waist circumference (cm)	81.4±8.2	102.9±10.1	88.0±5.4	103.2±7.8
WHR (waist-hip ratio)	0.83±0.07**	0.91±0.17**	0.87±0.03	103.2±7.8
Fat mass (%)	25.4±7.1***	39.4±5.6***	20.1±5.1***	29.9±5.9***
Fat mass (kg)	15.0±5.7***	31.9±7.5***	13.6±5.1***	26.8±6.6***
Fat free mass (%)	74.6±7.0***	60.4±5.5***	79.8±5.1***	70.1±5.9***
Fat free mass (kg)	42.8±4.2	47.7±4.5	52.4±3.0**	62.2±9.1**
VAT (cm <sup>2</sup> )	155.3±125.7***	332.2±229.8***	99.0±65.7	410.2±370.2
SAT (cm <sup>2</sup> )	93.4±33.6***	229.5±38.2***	74.4±11.5	302.0±270.0
VAT/SAT	1.671±1.25***	2.627±1.678***	1.2±0.6*	1.35±2.9*
Total body water (%)	54.4±4.7	47.6±4.3	56.9±2.5***	52.5±3.4***
ECW (%)	46.8±4.3**	43.7±5.1**	40.7±0.3	42.9±1.7
ICW (%)	51.1±4.3**	53.5±1.8**	56.2±0.3	57.0±1.8
ECW/ICW	0.915±0.227***	0.816±0.06***	0.724±0.010	0.754±0.056
Total cholesterol (mg/dl)	202.9±9	220.3±40.5	213.2±17.5	216.8±40.0
HDL (mg/dl)	58.7±12.2	50.1±11.6	47.8±9.3	43.4±8.9
LDL (mg/dl)	114.5±39.8	137.2±28.6	140.2±17.5	138.7±42.9
Triglycerides (mg/dl)	116.2±69.0	148.9±108.7	125.4±43.3	169.9±87.1
Glucose (mg/dl)	102.7±13.8	107.1±11.8	99.6±19.7	103.3±13.4
Hemoglobin (g/dl)	12.9±1.3	12.5±0.9	13.7±0.8	14.7±1.0

Table 3 shows the men energy value and the mean content of selected nutrients in daily food

rations of depressed patients, depending on the nutritional status. The average energy value of the

food intake of women with the normal body weight was slightly lower than in obese women; however, these differences were not statistically significant. In the food intake of women, the protein supply was

too high as compared to the demand, both among slim (115.2% of the daily demand) and obese women (121.5% of the daily demand).

**Table 3.** Mean energy value and the content of selected nutrients in food rations of the patients with depression.

Variables	Women (n=76)		Men (n=55)	
	Normal weight n=30	Obese n=46	Normal weight n=15	Obese n=40
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Energy (kcal/day)	1501.4±473.8	1680.8±640.0	1677.9±668.0	1875.9±635.3
Total protein (g/day)	60.5±22.7	63.8±24.5	68.2±19.2	67.9±21.4
Animal protein (g/day)	36.3±18.8	40.1±17.1	45.6±9.4	43.6±18.9
Total fat (g/day)	53.2±24.7	60.2±28.8	55.0±20.5	77.3±34.8
SFA (g/day)	22.1±10.1	25.9±14.3	23.7±11.7	34.7±16.8
MUFA (g/day)	21.5±11.7	22.8±11.3	22.6±6.0	30.1±13.9
PUFA (g/day)	5.5±4.2	6.4±4.1	4.6±1.6	6.7±3.5
Cholesterol (mg/day)	185.9±128.7	269.2±201	188.7±56.8	269.2±161.1
Carbohydrates (g/day)	210.8±63.3	236.7±91.3	239.3±105.6	240.7±84.0
Fiber (g/day)	15.5±6.0	17.8±7.6	14.6±4.9	16.3±6.9
Protein (% E)	16.1±2.9	15.7±3.1	17.0±2.0	14.5±4.0
Total Fat (% E)	30.5±8.0	30.9±7.8	29.3±0.6	35.5±7.9
Carbohydrates (% E)	53.5±7.9	53.3±6.8	53.7±2.7	49.0±7.4

SD –standard deviation; % E- percentage of energy; \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

#### Women

Moreover, a high consumption of saturated fatty acids, as compared to the norms, was found both in the group of women with the ideal body weight and with obesity. The content of the MUFA fatty acids, on the other hand, was too low in the food intake of both slim and obese women. In the assessment of carbohydrate consumption, too low a supply of carbohydrates was found in the food intake of both women with the proper body weight (61.8% of the daily demand) and in obese women (70.4% of the daily demand). Apart from the low carbohydrate consumption, also too low a consumption of dietary fibre was found as compared to the recommended amounts (51.6% of the recommended daily allowance among women with the normal body weight and 59.3% of the recommended daily allowance among obese women).

#### Men

Men did not differ in terms of the age. In the compared groups of men, obese patients had a lower level of education and were more often married than men with the normal body weight. In both groups of men, the average number of depression episodes and scores on the Beck and Hamilton depression scales were similar (Table1). During the treatment of the current episode in the group of obese men, 32.8% were administered venlafaxine, 11.5% mirtazapine, 18.0% escitalopram, 27.9% sertraline, 4.9% citalopram and 4.9% paroxetine. Men with the normal weight were

treated with venlafaxine (60.0%) and mirtazapine (40%).

The body composition analysis of obese men suffering from depression revealed a significantly higher percentage content of adipose tissue and a higher VAT/SAT ratio as compared to men with the proper body weight. The fat-free body mass content was significantly lower in the same group. A comparison of the total water content in the groups of men showed that the water content in the bodies of obese men was significantly lower than in men with the normal body weight. Laboratory blood tests revealed a similar content of total cholesterol, LDL cholesterol, triglycerides and haemoglobin in the blood in the group of obese men and men with the normal body weight (Table 2).

The energy value of the food intake of obese men was slightly higher as compared to men with the normal body weight; however, these differences were not statistically significant (Table 3). The amount of protein in the food intake of the men taking part in the study fell within the normal limits, however, it was characterised by too high a content of animal protein as compared to recommendations. The supply of fats was found to be too low as compared to the demand in the food intake of men with the normal body weight (73.3% of the daily demand). The consumption of saturated fatty acids was too high both in the group of men with the normal body weight and with obesity. The

consumption of monounsaturated fatty acids was too low only in the group of men suffering from depression with the normal weight. The content of the MUFA fatty acids was too low in the food intake of both slim and obese men. The average cholesterol content in the food intake of patients with depression did not exceed the recommended 300mg/day and it was similar in both groups of patients. In the assessment of carbohydrate consumption, too low a supply of carbohydrates was found in the food intake of both men with the normal body weight (61.8% of the daily demand) and in obese men (54.8% of the daily demand). Apart from the low carbohydrate consumption, also too low a consumption of dietary fibre was found as compared to the recommended amounts (only 48.6% of the recommended daily allowance among men with the normal body weight and 54.3% of the recommended daily allowance among obese men).

## **DISCUSSION**

There were a lot of obese patients among women and men hospitalised due to depressive episodes. Obese men were significantly more often married and less frequently had a higher level of education as compared to men with the normal body weight. Similar results were obtained previously by Akbaraly et al. [14]. Depressive disorders in his group of patients occurred more frequently in persons in relationships with a lower level of education and with obesity [4]. Similarly, in the general population, the problem of excess weight more often concerns unemployed persons with primary education [15,16]. Other researchers, on the other hand, indicate a strong relationship between obesity and depression among people with a higher socio-economic status [3]. These differences may result from differences between analysed populations. In highly developed countries, the level of education is inversely correlated with the body weight. It is connected with healthier eating habits and physical activity, but also with the pressure of society, which prefers slim persons. It is difficult to draw conclusions about the nature of the relationship between the aforementioned socio-cultural factors and depression on the basis of our results. At present, we know that a low social status, lack of education can be a source of chronic stress. Overeating is a known way of regulating the mood and reducing the tension among mentally ill patients. On the other hand, by providing larger amounts of food, the partner of a person with diagnosed depression can show his/her care and interest, but also compensate for other instinctive and emotional needs, which are not satisfied because of depression. This can account for the more frequent presence of married

men in the group of persons suffering from depression and obesity.

In our study, obese women were older and they were characterised by a larger number of depressive episodes, which are connected with a higher number of pharmacotherapy cycles used in the treatment. An increased appetite and body weight gain are frequent adverse effects of some antidepressants, in particular, TLPD and mirtazapine [16]. In this study, only 2.2% women with the proper body weight and 23.7% of obese women were administered mirtazapine. The reverse proportions were observed in men, where mirtazapine was the least frequently used drug. Research by Simon et al. revealed a relationship between the severity of depressive symptoms and a higher risk of obesity. An increase in the BMI, on the other hand, promoted the occurrence of depressive disorders [3]. Also, research by other authors reveals connections between obesity and depressive disorders [7,17]. This relationship was stronger for women in some studies [17-19]. In our study, the scores on both the Beck and Hamilton scales were similar in both groups of patients, both slim and obese, which is not consistent with data from studies by other authors [7,17-19].

### *Body composition*

Both obese men and obese women were characterised by a higher percentage content of visceral adipose tissue, subcutaneous adipose tissue and a higher VAT/SAT ratio as well as a lower content of fat-free body mass as compared to slim persons. In the body composition, particular significant differences were observed as regards to the visceral fat content, which was several times higher in obese persons than in persons with the normal body weight. First reports on an increased volume of the abdominal fatty tissue in persons suffering from depression appeared nearly 15 years ago [20]. In the study by Simon et al. [3], depression occurred more often in obese persons with a higher BMI value, a higher body fat content and a higher waist circumference.

There are many factors connected with depression, which may promote fat deposition in the intra-abdominal region. This disease, as a result of accompanying stress causes disorders on the hypothalamic-pituitary-adrenal (HPA) axis, mostly by an increased release of hypothalamic corticotiberin, which, in turn, increases the secretion of cortisol. Physiological activity of glyco-lcorticosteroids is neutralised by insulin and leptin, but during chronic stress, the balance of this system is tilted, which probably results in increased food consumption and abdominal deposition of adipose tissue [21]. In a study by Akbaraly et al. [14] the most frequent factors connected with depression

involve abdominal obesity, a high concentration of triglycerides and a low concentration of HDL cholesterol.

The body composition analysis of obese men and women in this study showed a significantly lower percentage content of fat-free tissue as compared with persons with the normal body weight. Fat-free tissue mostly consists of muscles and its deficiency results in incorrect basic metabolism. Lower activity of patients suffering from depression is responsible for this. Motor slowing, anhedonia, lower initiative is frequent symptoms of mood disorders. Research by Guedes et al. [22] revealed that persons with reduced fat-free mass are at a higher risk of developing depressive disorders.

#### *Diet of study participants*

During the assessment of the average energy value of the food intake of patients with depression, it was found that the energy value of the food intake of persons with the normal body weight was slightly lower than of those with obesity; however, those differences were not statistically significant. A higher energy value of food intake of patients with depression was found in research by Murakami et al. and Park et al. [23-25].

Also, results obtained by Simoni et al. [3] suggest that an increased caloric value is a potential mediator of the relationship between obesity and depression.

The protein supply was found to be too high in the food intake of women taking part in the study as compared to the demand, while the amount of protein in the food intake of men fell within the normal limits. In the research by Park et al., the average protein content in the food intake of patients with depression was slightly lower than the values presented in this study and it amounted to 59.2g /day [25]. In a study by Grossniklaus et al. [26] values similar to the ones obtained in this study were reported.

However, the fat supply was too low as compared to the demand in the food intake of men with the normal body weight, which may be the reason why this group of our patients keep the normal body weight. A high consumption of saturated fatty acids, as compared to the norms and a low consumption of unsaturated fatty acids both in the group of women with the normal body weight and with obesity can be regarded as particularly interesting findings.

Similar results were obtained by Sanhueza et al. [27]. It turned out that people suffering from depression are characterised by an enhanced response of the immune system to, amongst other things, increased secretion of pro-inflammatory cytokines and eicosanoids.

At present, we know that omega-3 EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) cause a decrease in the production of pro-inflammatory cytokines from arachidonic acid [28].

Considering the inflammatory background of depressive disorders, we can assume that the aforementioned unsaturated fatty acids may have a curative effect as regards depression, at the level independent of antidepressants. Thus they can constitute an important supplement in the diet and also an additional therapeutic component in periods of major depressive episodes and during remission.

The assessment of carbohydrate consumption revealed that the supply of carbohydrates was too low in the food intake of both women and men. Similarly, Aparicio et al. [29] obtained slightly lower values of carbohydrate consumption [29]. The results concerning carbohydrate consumption in the study by Park et al. are much below the values obtained in this study [25].

In persons with depression, lower levels of neurotransmitters, such as serotonin, dopamine and norepinephrine, are often found in the central nervous system. A diet rich in carbohydrates can contribute to changes in insulin and glucose levels in the blood, which stimulates the release of tryptophan from protein and its conversion into serotonin. As a result, this type of diet may play a role in preventing depression, while promoting obesity [29,30].

It turns out, that long-term use of antidepressants, such as selective serotonin re-uptake inhibitors (SSRI) cause a reduced consumption of carbohydrates and these drugs still improve the mood [29].

Nevertheless, we should not recommend that patients should give up carbohydrates in the diet due to their indirect influence on the mood.

Also, the consumption of dietary fibre was much too low in all tested groups of men and women. There is evidence that eating fruits and vegetables frequently, which are a source of dietary fibre, may contribute to a less frequent occurrence of depressive episodes [1,2]. This probably results from the probiotic mechanism of the influence of dietary fibre on the digestive tract and intestinal flora. Gut microbiota is one of the key elements of the gut-brain axis.

Numerous studies indicate the influence of intestinal flora on the mood and behaviour and on its potential anti-anxiety and antidepressant effect. It influences the central nervous system by modulation pro- and anti-inflammatory cytokine concentrations and by the influence on the tryptophan content - the precursor of serotonin and its metabolites, necessary ingredients responsible for the good mood [31].

## CONCLUSIONS

1. Men with diagnosed depression and obesity were more often married or had the lower levels of education as compared to men with the normal body weight. Obese women with diagnosed depression had more episodes of the disease and were older as compared to women with the proper body weight.
2. Both obese men and women were characterised by a higher percentage content of visceral adipose tissue, subcutaneous adipose tissue and a higher VAT/SAT ratio as well as a lower content of fat-free body mass.
3. Patients with diagnosed depression, with the normal body weight and obesity, were characterised by an inappropriate supply of proteins, carbohydrates, total fats, saturated and unsaturated fatty acids and dietary fibre.

## Conflicts of interest

The authors declared no potential conflicts of interest.

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