



Original paper

# Diet composition and energy intake in obese subjects with depression

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## Abstract

**Objective:** Depression is frequently associated with obesity; however, it is unknown whether obesity is its cause or consequence. Depression per se may change the diet composition and increase the consumption of simple carbohydrates. The aim of the present study was to assess the energy intake and diet composition in obese subjects with various intensification of depression symptoms.

**Material and methods:** Forty-five obese subjects starting a 3-month complex group weight loss program were enrolled. The subjects were asked to fill in the standard 3-day nutritional questionnaire. Depression levels were scored based on the full 21-item version of the Beck Depression Inventory (BDI). Studied subjects were allocated to subgroups: without depression symptoms (0-9 pts), with mild depression symptoms (10-15 pts) or severe depression symptoms (16 pts or more).

**Results:** The mean energy consumption was similar in subjects with a severe depression ( $n = 16$ ;  $1822 \pm 1285$  kcal/day) and mild depression level ( $n = 8$ ;  $1802 \pm 378$  kcal/day) and in those without depression symptoms ( $n = 21$ ;  $2017 \pm 846$  kcal/day). Furthermore, there were no significant differences in diet composition between study groups (carbohydrates:  $44.9 \pm 10.8\%$ ,  $40.3 \pm 9.6\%$  and  $42.9 \pm 9.5\%$ ; proteins:  $19.6 \pm 3.0\%$ ,  $16.1 \pm 2.2\%$  and  $19.5 \pm 4.5\%$ ; fat:  $35.5 \pm 10.5\%$ ,  $43.6 \pm 10.1\%$  and  $37.6 \pm 8.6\%$ , respectively). In addition, we observed a similar frequency and levels of depression in subgroups with lower and higher consumption of carbohydrates and fat.

**Conclusions:** It seems that the depression level does not change the energy consumption and diet composition in obese subjects.

**Key words:** obesity, depression, diet composition.

## Introduction

Our recent study showed a higher prevalence of mild and severe depression symptoms among the obese as well as a higher depression level in morbidly obese subjects [1] in line with previous findings of other authors [2,3]. However, these studies did not answer the question whether obesity is a cause or consequence of depression.

McElroy *et al.* [4] proposed three hypotheses which can explain the relation between obesity and depression. According to the first one, depression and obesity are unrelated conditions with different pathogenesis. On the contrary, the second hypothesis stated that both conditions

have exactly the same underlying etiology. While, the third one supposed that depression and obesity have different pathogenesis which are convergent in some aspects.

Studies performed in children and adolescents showed that depression may be a cause of obesity. The key links between these two entities probably are reduced interest and enjoyment of physical activity and a tendency to choose some particular foods [5-7]. On the other hand, numerous studies revealed that obesity may be a reason for depression development [8,9]. The supposed causes of depression in obese subjects are body image dissatisfaction [10], discrimination and stigmatization by other people [11], and lower socioeconomic status [12-14].



It was also suggested that in obese subjects, depression symptoms may have created the disease vicious circle – obesity is a cause of depression, and in turn depression decreases physical activity and stimulates food intake, finally enhancing obesity. This hypothesis is supported by a theoretical model of Reward Based Stress Eating proposed by Adam and Epel [15]. In this model, stress activates the hypothalamic–pituitary–adrenal axis. Then the increased circulating cortisol level stimulates in the brain a pathway enhancing food intake, especially intake of carbohydrates. In turn, the food consumption stimulates release of endogenous opioids and serotonin. Recent population-based studies support this hypothesis, providing good prospective evidence that obesity is associated with increased depression symptoms [16].

Having in mind the above-described observations, we hypothesized that subjects with depression symptoms may consume more energy, especially from simple carbohydrates. Therefore, the aim of the present study was to assess the energy intake and diet composition in obese subjects with different levels of depression.

## Material and methods

Forty-five obese subjects (38 women, 7 men) starting a 3-month complex group weight loss program were enrolled. The mean age was  $43.3 \pm 14.9$  years, and mean body mass index (BMI) was  $39.5 \pm 6.6$  kg/m<sup>2</sup>.

The weight of the obese subjects was stable at the enrollment. Subjects with both the weight loss or gain of more than 2 kg during the last 3 months were excluded from the observation. Their case histories of obesity have lasted for at least some years. The study was approved by

the local Bioethics Committee, and all subjects gave their informed consent to the participation.

The body mass and height were measured and BMI was calculated. The subjects were asked to fill in the standard 3-day nutritional questionnaire, including all consumed foods and drinks, as well as its weight, as recommended by Basiotis *et al.* [17].

The depression level was assessed using the self-reported Polish adaptation [18] of a full 21-item version of the Beck Depression Inventory (BDI) [19]. The total BDI scores were calculated. On that basis the studied subjects were allocated to subgroups: without depression symptoms (0-9 pts), with mild depression symptoms (10-15 pts) or severe depression symptoms (16 pts or more).

## Statistical analysis

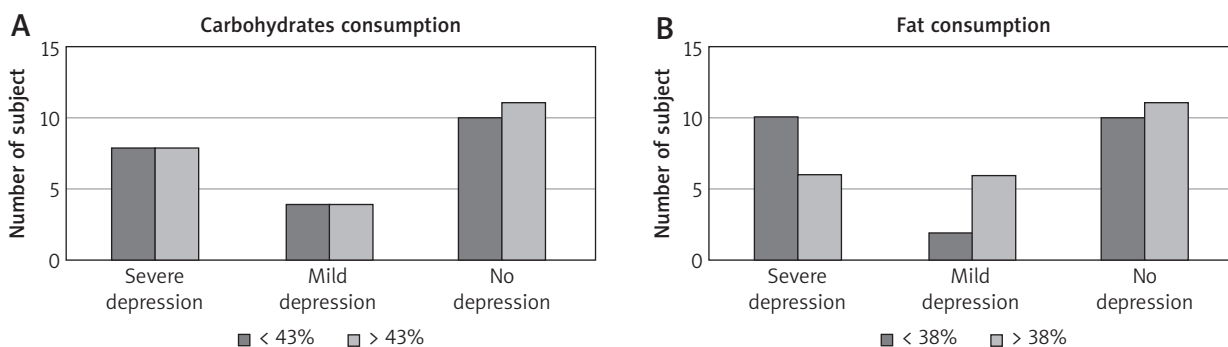
Statistical analysis was performed using the STATISTICA 12.0 PL software package. Values of variables were presented as percentages; median values with an interquartile range, or mean values  $\pm$  standard deviation, as appropriate. For comparison of quality variables, the  $\chi^2$  test and  $\chi^2$  test for trend were used. Subsequently quantitative data were compared using the analysis of variance test (ANOVA-test) or U-Mann-Whitney test. The results were considered as statistically significant with a *p*-value of less than 0.05.

## Results

In the analysed group, 24 subjects (53.3%) had depression symptoms: 16 subjects severe ( $21.7 \pm 3.7$  pts) and 8 mild ( $12.6 \pm 1.8$  pts). The age, body mass, and BMI were similar in these groups and subjects without depression symptoms (Table 1).

**Table 1.** The characteristics of the studied groups (median values and interquartile range)

	Depression		Without depression ( <i>n</i> = 21)
	Severe ( <i>n</i> = 16)	Mild ( <i>n</i> = 8)	
Age [yrs]	46.5 (36.0-60.5)	51 (29.5-55.0)	36 (27.0-51.0)
Body mass [kg]	99.9 (89.4-115.1)	94.6 (87.5-112.0)	106 (92.8-129.4)
BMI [kg/m <sup>2</sup> ]	38.6 (34.5-43.3)	39.9 (34.7-44.1)	37.8 (33.8-45.5)
Total energy intake [kcal/day]	1537.7 (1157.9-2015.4)	1703.5 (1539.9-2024.8)	1864.4 (1590.6-2438.0)
Diet composition			
Carbohydrates [%]	42.0 (38.6-49.7)	42.8 (29.8-47.0)	42.8 (35.8-46.8)
Proteins [%]	19.0 (18.3-21.1)	16.0 (14.7-17.9)	19.3 (16.9-21.1)
Fat [%]	37.3 (30.8-41.6)	40.0 (36.8-53.9)	37.8 (33.0-43.5)



**Figure 1.** Consumption of carbohydrates lower and higher than median (A) and fat (B) consumption in relation to severity of depression symptoms in obese subjects

The mean energy intake was slightly, however not significantly lower ( $p = 0.17$ ) in both groups with depression (Table 1). The diet composition was similar in all examined groups (Table 1).

Moreover, when the study subjects were divided into groups according to the median value of content of carbohydrate (< 43% and > 43%), content of fat (< 38% and > 38%) in diet, the frequency of mild and severe depression symptoms as well as BDI score were similar (Figure 1).

## Discussion

The present study is one of the few studies that assessed the association between depression symptoms and eating behavior in obese subjects. The energy consumption was similar in groups with and without depression symptoms. It should be emphasized that in all study subgroups the energy consumption was relatively low. A cause of this may be the fact that despite that they were asked not to change their previous food intake, the subjects restricted their own consumption after taking a decision to participate in the weight loss program. Moreover, as was shown in last studies, obese subjects generally underreported own food intake [20-22], especially carbohydrates and fats [21,22]. It was also suggested that this behavior of obese subjects is aimed at presenting oneself in a favorable light. This phenomenon is commonly known as 'social desirability biases' [23,24].

We also did not observe any differences in diet composition between subgroups with and without depression symptoms. Furthermore, the frequency of depression symptoms was similar when study subjects were divided into subgroups according to lower and higher carbohydrates and fat consumption. These results are contrary to results published previously. Jeffery *et al.* [25] observed that depressive symptoms were associated with higher sweet food consumption and lower non-sweet food intake. Kontinen *et al.* [26] also showed increased consumption of sweet foods and lower fruit and vegetable intake in subjects with depressive symptoms and emotional

eating. While Wallis *et al.* [27] revealed increased intake of high fat snacks in subjects with emotional eating. The differences between our and these studies may be results of assessment of obese subjects as well as other estimation methods of food consumption. Regardless of negative results of our study, the problem of depressive symptoms in obese subjects and eating behavior should be a topic of further studies because clarification of these connections may be useful in the most effective obesity management.

The limitation of the study is a small study group and enrolment of only subjects who come forward to obesity treatment. Moreover, in our study, to assess depression symptoms only the Beck Depression Inventory was used. The BDI determines only the level of depression symptoms, and does not diagnose depression according to nine criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) [28]. Therefore, it seems that further studies should be focused on obese subjects who did not take a decision about weight loss. Moreover, for better assessment of general diet composition and energy consumption, the Nutrition Questionnaire or nutritional history should be used rather than self-reported food consumption.

## Conclusions

It seems that the depression level does not have an effect on energy consumption and diet composition in obese subjects.

## Ethical approval

The study protocol has been approved by the Local Bioethical Committee and thus meets the standards of the Declaration of Helsinki in its revised version of 1975 and its amendments of 1983, 1989, and 1996.

## Disclosure

The authors report no conflict of interest.

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