

NUTRITIONAL VALUES OF DIETS CONSUMED BY WOMEN SUFFERING UNIPOLAR DEPRESSION

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ABSTRACT

Background. Previous studies have shown that patients suffering from depression are more likely to adversely change their eating habits (eg. through increases in appetite, comfort eating and compulsive eating), which may result in an abnormal nutritional status.

Objectives. To evaluate selected dietary habits, such as the number and type of meals consumed during a normal day and comparing dietary calorific values and nutritional content between women suffering unipolar depression to those without this condition.

Material and methods. Subjects were a group of 110 women aged 18-65 years consisting of a test group of 55 women undergoing treatment for unipolar depression at the Department of Psychiatry, Medical University of Białystok and a control group of 55 women, without depression, attending an Obesity and Diet Related Treatment Centre. A study questionnaire was used to determine their eating habits along with other relevant data. The 24-hour diet recall method was used to obtain quantitative data collected on 3 weekdays and 1 weekend day; results being averaged. The calorific values and nutrient content of selected components, according to mealtimes, were evaluated using the Diet 5.0 computer programme.

Results. Those patients with depression showed that the 3 meals/day model dominated whilst the 4 meals/day model was predominant in the control group. The most frequently missed meals for both groups were afternoon tea and the mid-morning meal. Abnormalities in the calorific intake and nutritional contents from various meals were observed in women suffering depression.

Conclusions. It seems appropriate to recommend that those women especially suffering from depression should consult with dietitians about their changing dietary habits, particularly for achieving the proper calorific and nutritional values/balance from their meals.

Key words: women, depression, nutritional value of meals

STRESZCZENIE

Wprowadzenie. Jak wykazały badania u pacjentów chorujących na depresję częściej występują zmiany zachowań żywieniowych (m. in. wzrost apetytu, pocieszanie się jedzeniem, kompulsywne jedzenie), które mogą być przyczyną ich nieprawidłowego stanu odżywienia.

Cel. Celem pracy była ocena wybranych nawyków żywieniowych, w tym liczby i rodzaju zwyczajowo spożywanych posiłków w ciągu dnia oraz porównanie wartości energetycznej i odżywczej posiłków w jadłospisach kobiet z depresją jednobiegunową oraz kobiet nie chorujących na depresję.

Material i metody. Badania przeprowadzono w grupie 110 kobiet w wieku 18-65 lat. Grupę badaną stanowiło 55 kobiet leczonych z powodu depresji jednobiegunowej w Klinice Psychiatrii Uniwersytetu Medycznego w Białymstoku. Grupa kontrolna obejmowała 55 kobiet, u których nie rozpoznano depresji. W badaniach wykorzystano kwestionariusz ankiety zawierający m.in. pytania dotyczące nawyków żywieniowych. Ocenę ilościową dziennych racji pokarmowych dokonano przy użyciu 24-godz. wywiadu żywieniowego zebranego z 3 dni powszednich i 1 dnia weekendowego (wyniki uśredniono). Ocenie poddano (z uwzględnieniem podziału na posiłki) wartość energetyczną oraz zawartość wybranych składników odżywczych wykorzystując program komputerowy Dieta 5.0.

Wyniki. Wykazano, iż w grupie pacjentek z depresją dominował model 3 posiłkowy, a w grupie kontrolnej 4 posiłkowy. Najczęściej opuszczanym posiłkiem w obu grupach był podwieczerek i II śniadanie. Wykazano zaburzenia proporcji w dostarczaniu energii z poszczególnych posiłków jak i nieprawidłowości w zakresie ich wartości odżywczej, zwłaszcza w grupie kobiet z depresją.

Wnioski. Wydaje się słusznym zalecenie badanym kobietom, zwłaszcza chorującym na depresję konsultacje z dietetykiem nad zmianą nawyków żywieniowych, a w szczególności nad prawidłowym komponowaniem pod względem wartości energetycznej i odżywczej wybranych posiłków.

Słowa kluczowe: kobiety, depresja, wartość odżywcza posiłków

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INTRODUCTION

In recent years the incidence of depression has been increasing, leading to many health complications and thus constituting a serious public health problem [17]. According to World Health Organisation (WHO), unipolar depression was the leading cause of mental illness in the nineties of the previous century and perhaps, together with cardiovascular diseases (CVDs), they may become the most common illnesses in the world by 2020 [6].

Research has shown that patients suffering from depression are more likely to alter their eating behaviour with changes in appetite and food preferences, including avoiding certain foodstuffs and food groups, eating too rarely or by eating high-calorie snacks in between main meals [9, 16, 21, 22, 23]. Monitoring the diet of patients suffering from depression can help to indicate irregularities, which would thereby permit an appropriate adjustment to be made through the development of both healthy eating habits and educational programs. Currently there are no published studies on assessing the nutritional values of foodstuffs consumed by people suffering from unipolar depression.

The study was therefore aimed at evaluating and comparing selected dietary habits in women with or without unipolar depression. These included the number and type of meals normally consumed during the day and their dietary calorific and nutritional values.

MATERIALS AND METHODS

The survey group consisted of 110 women aged 18-65 years. Of these, the test group was 55 women treated for depression at the Department of Psychiatry, Medical University of Białystok, whilst the control group were 55 women patients who were first reported at the Obesity Treatment Centre and Diet-Related Diseases and were not on a reducing diet. The study took place between September and November 2012. The test group included patients diagnosed with recurrent major depressive disorder (according to ICD-10), lasting up to 5 years, where their current episode of depression did not last longer than a month [24]. Furthermore, their current treatment for depression consisted of one antidepressant from the following; paroxetine, sertraline, venlafaxine, citalopram, mirtazapine, escitalopram and a sedative drug used as needed.

The current course of the disease was assessed based on data from interviews and available documentation. Depressive symptoms were measured using the Hamilton Depression Rating Scale (version 17-point), and Beck's self-esteem scale [3, 10]. Patients participating

in the study were informed of its purpose and methodology. Each patient expressed written consent for such consultations. The study was approved by the Bioethics Committee of UMB No. RI-002/325/2011. A dietary questionnaire developed in-house at the Department of Dietetics and Clinical Nutrition, Medical University of Białystok was used to collect data. The questionnaire contained, amongst others, questions about dietary habits, including the number of commonly consumed meals and any eating in-between.

The daily diets were quantitatively analysed using the 24-hour diet recall, including 3 weekdays and 1 weekend day; results being averaged. Patients did not take any additional vitamin and mineral supplements. The daily diet (including mealtimes) were evaluated by their calorific value and nutritional content of selected nutrients, where in the latter case this was performed using the Diet 5.0 computer programme as developed by the Institute of Food and Nutrition in Warsaw, taking into account nutrient losses during the cooking process (*Diet 5.0 package for planning and current assessment of individual nutrition, Institute of Food and Nutrition - license contract no. HBBxtpINI*). In assessing the intake of the selected nutrients, recommended nutrition standards for the Polish population were used as reference [14]. The proportion of calories derived from each meal were thence related to the recommended total calorific intake according to *Hasik and Gawęcki* [11].

Statistical analysis consisted of calculating averages, standard deviations and percentages with results being evaluated using StatSoft STATISTICA 10.0, by the χ^2 and t-test for independent variables. Significance was adopted at the $p < 0.05$ level.

RESULTS

The subjects groups' characteristics are presented Table 1. There were no significant differences between the average age (45.8 years in women with depression vs. 41.1 years in the control group), nor correspondingly body height (162.8 cm vs. 162.1 cm), body weight (70.7 kg vs. 69.2 kg) and the average body mass index (26.8 kg/m² vs. 27.0 kg/m²). The average points score on the Hamilton depression scale for the depressed subjects was 14.0 and 25.4 on the Beck scale. Mean disease duration for 50% of the women was 4 years, for 17% 2-3 years, and for 33% it was less than 1 year. In this group, episodes of depression were on average 2.7. A single episode for depression was reported in 33% of women, 2-4 episodes in 39%, more than 4 episodes occurred in 28% of patients. The average points score on the Hamilton depression scale for the control group was 3.0 and 6.5 on the Beck scale. In the group of depressed women 11% received paroxetine, 26% sertraline

Table 1. General characteristics of subject groups

Variables	Depressed subjects (n=55)	Control group (n=55)
Age (years)	45.8 (12.2)	41.1 (13.1)
Body height (cm)	162.8 (5.4)	162.1 (5.2)
Body weight (kg)	70.7 (14.5)	69.2 (10.6)
Body mass index (kg/m ²)	26.8 (5.3)	27.0 (5.3)
Underweight (%)	3.6	0.0
Normal weight (%)	45.4	47.3
Overweight (%)	32.7	40.0
Obese (%)	18.3	12.7
Waist circumference (cm)	89.4 (9.0)**	83.7 (9.8)
Marital status (%)		
Married	63.6***	40.0
Single	36.4	60.0
Education (%)		
Primary	14.5	12.7
Vocational	22.0	12.7
Secondary	54.5	38.2
University	9.0	36.4
Number of previous depression episodes	2.7(1.7)	-
HAM-D score	14.0 (7.3)	3.0 (1.7)
Beck score	25.4 (12.8)	6.5 (3.2)

Values for categorical variables are mean, (SD) or percentages of subjects. For continuous variables, the independent t test was used; for categorical variables, chi-square test was used

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

and venlafaxine, 9% citalopram, 12% mirtazapine and 16% escitalopram.

Waist circumference (WC) was however statistically higher in the depressed women's group than controls (89.4 vs. 83.7 cm) and likewise there were significantly more married women in the depressed group than controls. No significant differences in levels of education were observed between groups, however the test group tended to have more women with primary, vocational and secondary education but less with higher education as compared with controls.

The number of meals, mealtimes and meal types in both study groups are shown in Table 2, where there were no significant differences in the aforementioned between the test and control groups. Nevertheless, more depressed women (36.4%) preferred eating the usual 3 meals a day whereas those without depression preferred to eat 4 meals daily (43.6%). It was also noted that about 7% of the test women 4% of controls consumed only 2 or fewer meals per day. Eating an optimal 5 meals a day was observed in 31% of women for both compared groups. Nearly 90% of all the women studied consumed three main meals, ie. breakfast, lunch and dinner. The least frequent consumed meals in the two treatment groups were: afternoon tea (consumed by 56% of women with depression and 45% of women in the control group) and the mid-morning meal (consumed by 56% of women with depression and 69% of women

Table 2. Details of subjects' dietary habits selected for assessment

Variables	Depressed subjects n=55		Control group n=55	
	n	%	n	%
Number of meals				
≤2	4	7.3	2	3.6
3	20	36.4	12	21.8
4	14	25.4	24	43.6
≥5	17	30.9	17	31.0
Type of meals				
Breakfast	51	92.7	49	89.0
Mid-morning meal	31	56.3	38	69.0
Lunch	55	100.0	50	90.9
Afternoon tea	31	56.4	25	45.4
Dinner	50	90.9	49	89.0
Additional eating in-between meals	48	87.3	41	74.5
Type of additional snacks				
Sweets	28	58.3	17	41.4
Fast food	1	2.0	2	4.9
Sandwiches	11	23.0	10	24.4
Fruit	8	16.7	12	29.3
Vegetables	0	0.0	0	0.0

without depression). Another detrimental aspect of the observed eating behaviour was the custom of snacking in-between meals as declared by 87% of women with depression and 74% of women in the control group (differences not significant); the main foodstuffs being eaten were mostly sweets.

The average calorific values and content of selected nutrients in the daily diets are reported in Table 3. The diets of the depressed had both higher calorific values and nutritional content. Statistically significant differences were observed between respectively the test group and controls for the total daily calorie intakes (1660.1 kcal/day vs. 1431.6 kcal/day), total fat (59.6 g/day vs. 42.7 g/day), saturated fatty acids (SFA) (25.2 g/day vs. 16.9 g/day) and monounsaturated fatty acids (MUFA) (22.8 g/day vs. 15.7 g/day). Moreover, higher dietary contents were respectively seen in women with depression compared to controls of total protein (65.7 g/day vs. 65.2 g/day), polyunsaturated fatty acids (6.3 g/day vs. 5.9 g/day), cholesterol (248.7 mg/day vs. 216.1 mg/day) and total carbohydrates (230.8 g/day and 212.5 g/day), although these differences were not statistically significant. The average daily intakes of dietary fibre were too low from normal in both groups of 16.7g/day (test) and 22.7g/day (controls), however these differences were insignificant. The percentage of total calories from dietary protein in women with depression was lower at 15.8% than the 18.2% in the controls; differences being significant. In contrast, the percentage of dietary calories derived from total fat, saturated fatty acids and monounsaturates was significantly higher in women with depression compared with women in the

Table 3. Average calorific values and content of selected nutrients in subjects' daily diets

Variables	Depressed subjects (n=55)		Control group (n=55)	
	Mean (SD)	% of Standard	Mean (SD)	% of Standard
Calories (kcal/day)	1660.1 (611.5)*	79.0	1431.6 (410.6)	68.2
Total protein (g/day)	65.7 (26.2)	109.5	65.2 (21.9)	108.7
Animal protein (g/day)	41.1 (19.6)	137.0	43.5 (20.8)	145.0
Total fat (g/day)	59.6 (27.2)***	85.0	42.7 (18.1)	61.0
SFA (g/day)	25.2 (12.9)***	108.1	16.9 (9.6)	72.5
MUFA (g/day)	22.8 (11.5)***	81.4	15.7 (7.4)	56.1
PUFA (g/day)	6.3 (4.3)	35.3	5.9 (3.4)	31.5
Cholesterol (mg/day)	248.7 (196.2)	82.9	216.1 (156.1)	72.0
Carbohydrates (g/day)	230.8 (88.5)	75.8	212.5 (68.9)	69.8
Fibre (g/day)	16.7 (7.4)	55.7	22.7 (27.7)	75.7
Protein (% E)	15.8 (3.0)***	-	18.2 (5.2)	-
Total Fat (% E)	31.3 (7.8)***	-	26.8 (7.2)	-
SFA (% E)	13.7 (2.0)***	-	10.6 (3.0)	-
MUFA (% E)	12.4 (2.4)***	-	10.0 (2.0)	-
PUFA (% E)	3.4 (1.4)	-	3.7 (1.4)	-
Carbohydrates (% E)	52.9 (7.7)	-	55.0 (8.1)	-

SD-standard deviation

%E -percentage of calories

For continuous variables the independent t-test was used

*: <0.05, **: <0.01, ***: <0.001

control group and respectively amounted to 31.3%, 13.7%, 12.4% vs. 26.8%, 10.6%, 10.0%.

The percentage of calories derived from dietary polyunsaturated fatty acids was however similar in both groups; being 3.4% in women with depression and 3.7% in the control group. Likewise, there was no significant differences between the test and control groups in the percentage of calories derived from carbohydrate intake; respectively 52.9% vs. 55%.

A breakdown of the calorific content for each meal declared to be consumed by both subject groups, along with recommended reference values are presented in Figure 1. This demonstrated that in the depressed women, the calorific content of breakfast and afternoon teas is too low but too high for lunch when compared to recommendations. A significant proportion of calories however derived from snacking in between meals for

both the depressed women (11%) and controls (7%). In fact in the former group, these additional calories exceeded those derived from the mid-morning meal and afternoon tea and were mainly provided by carbohydrates and dietary cholesterol (Table 4).

The nutritional values of breakfast eaten by both subject groups was similar, however in the depressed women's group, the intake derived from of total fat and saturated fatty acids was higher than controls. In the former group, the daily diet had significantly less fibre than controls. Significantly lower dietary calorific values and the intakes of total protein and carbohydrates were also seen for the mid-morning meal in women with

Table 4. Calorific and nutritional values of meals consumed by subjects

Variables	Depressed subjects (n=55)	Control group (n=55)
	Mean (SD)	Mean (SD)
Breakfast		
Calories (kcal)	321.6 (158.3)	291.8 (126.4)
Total protein (g)	11.9 (7.1)	13.1 (6.5)
Animal protein (g)	8.1 (6.0)	8.3 (5.0)
Total fat (g)	14.1 (10.4)**	10.4 (6.2)
SFA (g)	7.2 (5.0)***	4.4 (3.4)
MUFA (g)	5.0 (4.3)	3.9 (2.4)
PUFA (g)	1.2 (0.9)	1.3 (0.9)
Cholesterol (mg)	45.1 (47.8)	48.0 (86.7)
Carbohydrates (g)	38.3 (17.3)	40.8 (19.0)
Fibre (g)	2.4 (1.8)***	3.9 (2.4)
Mid-morning meal		
Calories (kcal)	137.2 (179.9)**	211.1 (203.9)
Total protein (g)	5.0 (7.2)*	8.5 (10.3)
Animal protein (g)	3.3 (5.4)	5.9 (8.3)
Total fat (g)	5.2 (8.4)	6.4 (6.9)
SFA (g)	2.5 (4.3)	2.8 (3.3)
MUFA (g)	1.9 (3.2)	2.3 (2.9)
PUFA (g)	0.4 (0.7)	0.8 (1.9)
Cholesterol (mg)	15.7 (24.1)	17.2 (18.6)
Carbohydrates (g)	18.6 (24.1)*	31.6 (34.3)
Fibre (g)	1.4 (2.4)	2.2 (3.0)
Lunch		
Calories (kcal)	577.1 (184.8)***	427.8 (186.2)
Total protein (g)	25.5 (8.9)	26.6 (13.1)
Animal protein (g)	15.6 (7.7)	18.9 (12.1)
Total fat (g)	14.7 (9.3)**	10.0 (8.7)
SFA (g)	5.0 (3.4)***	3.2 (2.8)
MUFA (g)	6.7 (4.7)**	4.1 (4.2)
PUFA (g)	1.8 (1.7)	1.6 (1.7)
Cholesterol (mg)	71.9 (33.1)	88.4 (100.9)
Carbohydrates (g)	91.6 (34.5)***	62.9 (34.2)
Fibre (g)	7.7 (3.1)	6.9 (4.0)
Afternoon tea		
Calories (kcal)	109.5 (159.7)	132.0 (154.3)
Total protein (g)	3.6 (6.3)	3.0 (4.9)
Animal protein (g)	1.6 (3.9)	1.6 (3.9)
Total fat (g)	2.9 (5.6)	3.3 (6.4)
SFA (g)	0.9 (2.0)	1.7 (3.4)
MUFA (g)	0.9 (1.8)	1.2 (2.5)
PUFA (g)	0.4 (0.6)	0.4 (0.7)
Cholesterol (mg)	9.9 (7.7)	8.2 (7.2)
Carbohydrates (g)	18.5 (28.0)	22.2 (24.9)
Fibre (g)	1.5 (1.8)	1.3 (1.5)

Dinner		
Calories (kcal)	339.3 (203.8)*	264.5 (184.3)
Total protein (g)	13.8 (9.6)	11.9 (10.0)
Animal protein (g)	9.7 (8.4)	7.9 (8.8)
Total fat (g)	14.7 (12.6)**	8.2 (9.0)
SFA (g)	6.5 (6.0)	3.5 (4.0)
MUFA (g)	4.9 (4.2)**	2.8 (3.4)
PUFA(g)	2.0 (0.2)	1.4 (1.3)
Cholesterol (mg)	85.5 (38.4)	47.4 (37.5)
Carbohydrates (g)	40.4 (25.8)	38.3(27.6)
Fibre (g)	2.5 (1.7)	3.3 (2.8)
Snacks in-between meals		
Calories (kcal)	177.2 (201.0)*	104.4 (108.5)
Total protein (g)	4.8 (7.2)*	2.2 (3.6)
Animal protein (g)	2.8 (5.9)*	0.9 (2.2)
Total fat (g)	7.8 (10.7)*	3.5 (1.1)
SFA (g)	2.9 (1.1)	1.6 (1.7)
MUFA (g)	3.1 (4.8)*	1.3 (2.6)
PUFA (g)	0.9 (1.9)	0.4 (0.9)
Cholesterol (mg)	20.6 (13.4)*	6.9 (7.8)
Carbohydrates (g)	22.8 (16.3)	16.7 (15.0)
Fibre (g)	1.3 (1.9)	1.0 (1.6)

SD-standard deviation

For continuous variables the independent t-test was used

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

depression compared to controls. In contrast, significantly higher dietary calories at lunchtime, in the depressed women’s group, were observed to be derived from total fat, saturated fatty acids, monounsaturated fatty acids or total carbohydrates compared to the controls. There were no significant differences between the two subject groups in dietary calorific intake nor nutritional content for the afternoon tea. At dinnertime, the women with depression demonstrated had significantly higher dietary calorific values and intakes of total fat and monounsaturated fatty acids compared to controls. Furthermore, the depressed women’s group more frequently adopted the adverse habit of snacking between meals, which provided significantly more calories, total protein, (including animal protein), total fat, monounsaturated fat and dietary cholesterol in their diets compared to the women without depression.

DISCUSSION

Studies have reported that the usual diets of persons suffering from depression may differ from the principles of rational nutrition [9, 23]. The presented study has shown no significant differences in both the number of meals normally eaten and their type between the two groups of subject women. However the test group ie. depressed women, tended to have more afternoon tea and snacks in-between meals. Whilst the presence of the former in a daily diet is beneficial, attention should be drawn to their doubtful nutritional value, in that these are mainly carbohydrate meals, with small amounts of protein. In addition, the diets of women with depression demonstrated that the nutritional value of in-between meal snacking exceeds that of nutritional foodstuffs consumed during afternoon tea and mid-morning meals, which is also not consistent with the principles of proper nutrition. The current study showed that the most popular snacks were sweets eaten by almost 50% of subjects from the two compared groups. *Jeffery et al.* [15] reported that depressive symptoms were significantly and positively correlated between the consumption of high-calorie sugary snacks with a high-calorie consumption but negatively correlated with non-sweet food.

Other studies have shown that the most common women’s meals skipped were the morning ones and that other mealtimes varied according to the afternoon, evening and night-time hours of one day [19]. *Friedrich* demonstrated that from the modelling of modern women’s lives, then this shows a lower consumption of breakfast before going to work. Reasons determined were a decreased appetite early in the morning and not enough time for preparing breakfast [7].

According to some research, having the total calorific intake from the daily diet spread over 5 meals is most appropriate for human body health. This 5-meal/day model should include: breakfast providing 25%,

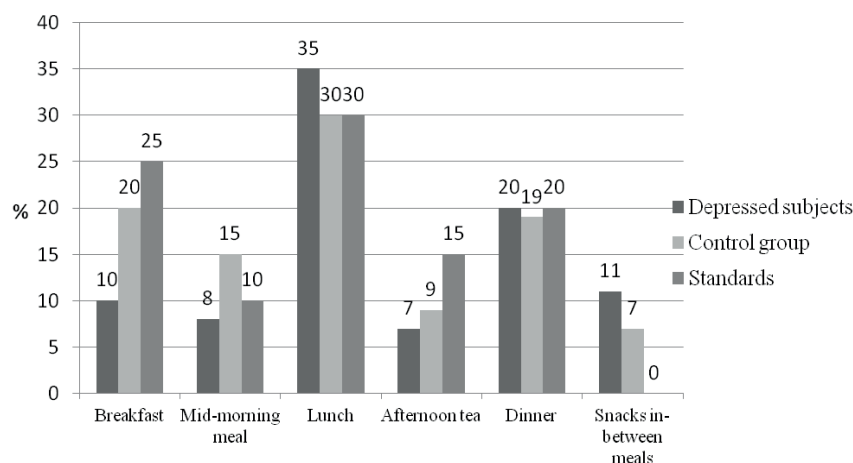


Figure 1. Energy content (%) breakdown per meal determined in both subject groups along with recommended reference values

mid-morning meal -10%, lunch -30%, afternoon tea -15% and dinner -20% of the total calorific daily food intake [11]. The presented results however differ from these cited recommendations and it should be stressed that the habit of snacking in-between meals provided 11% of the diet's total calorific daily intake for women with depression and 7% in the control group. An even greater amount of calories coming from in-between snacks, compared to the current study, was reported by *Carels et al.* and *Zizza et al.* [4, 25], which respectively gave 15% and 22% values of the total calorific intake of the daily diet. Moreover, these were mostly derived from carbohydrate-fat products, a finding also confirmed by the presented study.

It was found that, on average, the calorific value of diets in women with depression was significantly higher when derived from total fat, saturated fatty acids and monounsaturated fatty acids compared to controls. Other studies by *Grossniklaus et al.* and *Konttinen et al.* respectively however, demonstrated higher calorific values of 1899.8 kcal/day and 2224.0 kcal/day [9, 16], but lower values were found in studies by *Jacka et al.*, *Murakami et al.*, *Park et al.*, respectively; 1642.0 kcal/d; 1575.0 kcal/d; 1524.5 kcal/d [13, 20, 21].

The presented study found that dietary protein intake from depressed women were insignificantly different to controls and was similar to the values obtained in other studies [5, 9, 21]. However, our study demonstrated an abnormal ratio between the intakes of animal and vegetable derived protein, with a predominance of the former. Dietary fat contents were significantly higher in women with depression. Higher dietary fat intakes in depressed women of 72.0 g - 90.0 g/day than those obtained in the present study were observed in other studies [5, 9]. Further studies on depressed women found similar levels of dietary cholesterol to the current study as follows; 217.7 mg/day in *Grossniklaus et al.* [9] and 268.8 mg/day in *Parks et al.* [21]. Total dietary carbohydrate was found to be lower in the presented study compared to others [2, 5, 9], with generally low total carbohydrate intake in both groups together with low dietary fibre. Even lower fibre intakes (ie. than the <16 g/day of the current study), has been reported [9, 21]. Studies have demonstrated that this situation may arise from insufficient food intake in depressed patients from those foodstuffs rich in fibre such as raw fruit and vegetables, whole-grain cereals or dried leguminous seeds [1, 2, 5, 9, 15, 16, 23, 25]. Furthermore, a prospective cohort GAZEL study has shown that the intake of selected groups of foodstuffs such as fruit, vegetables and fish were associated with a reduced risk of subsequent episodes of depression [18].

Studies have shown that the diets of those suffering depression often have an inappropriately excessive composition of fatty acids, especially SFA [23]. How-

ever, a proper dietary intake of fatty acids, particularly unsaturated fatty acids of *omega-3*-acid, EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) may have beneficial effects for treating patients suffering from depression. A study by *Lakhan* found that a high consumption of fish, as a source of unsaturated fatty acids, correlates with fewer patients suffering from mental disorders within the population [17]. Here, it was suggested that a 1 – 2 g daily intake of omega-3 was sufficient for healthy people, whilst consuming 9.6 g appears to be safe and adequate for patients with mental disorders [17]. The antidepressant effect of EPA may be due to its conversion to prostaglandins, leukotrienes and other compounds required for normal brain function. Another theory suggests that EPA and DHA affect signal transduction in brain cells by activating peroxisomal proliferator-activated receptors (PPARs), inhibiting G-proteins and protein kinase C, as well as calcium, sodium, and potassium ion channels [17].

It has been demonstrated that depression caused by monoamine deficiency (acting as a pathophysiological substrate) leads to decreased levels of neurotransmitters serotonin, norepinephrine and dopamine in the central nervous system. Synthesis of serotonin or 5-hydroxytryptamine (5 HT) has been found to be dependent on the availability of the dietary precursor serotonin-tryptophan [12]. High-carbohydrate and low-protein meals may affect mood by increasing the synthesis of this 5-hydroxytryptamine as compared to low carbohydrate and high protein meals [8]. Much research has indicated that patients feel more calm, relaxed after a snack rich in carbohydrates compared to protein-rich and low-carbohydrate meals. This may therefore also explain why the studied subjects took frequent recourse to those foodstuffs providing carbohydrates [8].

CONCLUSIONS

1. There were statistically insignificant differences between the two groups of subjects in both the number and types of meals throughout the day, as well how many snacks were eaten in-between meals, although this unhealthy habit tended to be more common in the depressed women.
2. Despite both subject groups having afternoon tea, the doubtful nutritional value of this actual meal rendered it unhealthy, especially for the depressed women.
3. The composition of diets for those women suffering from depression was incompatible with dietary recommendations regarding calorific intakes.
4. Compared to controls, the diets of women with depression had significantly higher calorific values and contents of total fat, SFA and MUFA as well as

the percentage of calories derived from total fat, SFA and MUFA.

- It is recommended that women suffering from depression should consult with dietitians for improving their dietary habits, particularly for achieving the correct calorific and nutritional values/balance for their meals.

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Conflict of interest

The authors declare no conflict of interest.

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