

## THE ASSESSMENT OF THE NUTRITIONAL VALUE OF MEALS CONSUMED BY PATIENTS WITH RECOGNIZED SCHIZOPHRENIA

Ewa Stefańska<sup>1</sup>, Agnieszka Wendolowicz<sup>1</sup>, Magdalena Lech<sup>1</sup>, Karolina Wilczyńska<sup>2</sup>, Beata Konarzewska<sup>2</sup>, Joanna Zapolska<sup>1</sup>, Lucyna Ostrowska<sup>1</sup>

<sup>1</sup>Department of Dietetics and Clinical Nutrition, Medical University of Białystok, Poland

<sup>2</sup>Department of Psychiatry, Medical University of Białystok, Poland

### ABSTRACT

**Background.** As studies show, changes in diet - so important in the therapy of psychiatric disorders and related to changes in appetite and nutritional preferences, including avoiding of the consumption of specific groups of products and dishes - are much more frequent among patients affected by schizophrenia.

**Objective.** The aim of the study was to assess the chosen nutritional habits, including the number and type of meals usually consumed during a day, snacking between meals and the energy value and content of the chosen nutrients in the diets of persons with recognized schizophrenia.

**Material and methods.** The study was carried out in a group of 85 patients with recognized schizophrenia, and 70 healthy volunteers ranging in age from 18-65 years without mental or nutritional disorders. For the purpose of the study, we used a questionnaire containing questions on nutritional habits. A 24-hour diet recall was used in the quantitative nutritional assessment with the use of the computer program Dieta 5.0.

**Results.** Female patients with recognized schizophrenia were having 3 meals a day significantly more frequently as compared to healthy women. They were also having an afternoon snack much more frequently as compared to the control group. The food rations of female patients were characterized by a significantly higher energy value and the content of most of the assessed nutrients as compared to the food rations of healthy women. The food rations of men with recognized schizophrenia were characterized by a much lower energy intake and the content of the majority of assessed nutrients as compared to the food rations of healthy men. In all compared groups, we observed an energetic structure of food rations with the breakdown by specific meals that was inconsistent with the applicable recommendations.

**Conclusions.** Despite of differences between the nutritional value of the meals of patients with recognized schizophrenia and those of healthy subjects, it seems advisable to involve patients with recognized schizophrenia in the education of forming appropriate nutritional habits.

**Key words:** *schizophrenia, nutritional value of meals, nutritional habit*

### STRESZCZENIE

**Wprowadzenie.** Jak wykazały badania u pacjentów chorujących na schizofrenię częściej występują zmiany sposobu żywienia, tak istotnego w terapii zaburzeń psychiatrycznych, związane ze zmianą łaknienia, preferencji żywieniowych, w tym unikanie spożywania określonych grup produktów i potraw.

**Cel.** Celem pracy była ocena wybranych nawyków żywieniowych, w tym liczby i rodzaju zwyczajowo spożywanych posiłków w ciągu dnia, pojadania między nimi oraz wartości energetycznej i zawartości wybranych składników odżywczych w jadłospisach osób z rozpoznaniem schizofrenii.

**Material i metody.** Badania przeprowadzono w grupie 85 pacjentów z rozpoznaniem schizofrenii oraz 70 zdrowych ochotników w wieku 18-65 lat bez zaburzeń psychicznych i zaburzeń odżywiania. W badaniach wykorzystano kwestionariusz ankiety zawierający pytania dotyczące nawyków żywieniowych. Ocenę ilościową dziennych racji pokarmowych dokonano przy użyciu 24-god. wywiadu żywieniowego wykorzystując program komputerowy Dieta 5.0.

**Wyniki.** Pacjentki z rozpoznaniem schizofrenii istotnie częściej spożywały 3 posiłki w ciągu dnia, istotnie częściej też uwzględniały w swoich jadłospisach podwieczorki w porównaniu z kobietami zdrowymi. Racje pokarmowe kobiet chorych charakteryzowały się istotnie wyższą wartością energetyczną oraz zawartością większości ocenianych składników odżywczych w porównaniu z racjami kobiet zdrowych. Racje pokarmowe mężczyzn z rozpoznaniem schizofrenii cechowała istotnie niższa podaż energii oraz zawartość większości ocenianych składników odżywczych w porównaniu z racjami pokarmowymi mężczyzn zdrowych. We wszystkich porównywanych grupach odnotowano niezgodną z zaleceniami strukturę energetyczną racji pokarmowych z uwzględnieniem podziału na posiłki.

**Wnioski.** Pomimo wykazanych różnic w wartości odżywczej posiłków pacjentów z rozpoznaniem schizofrenii jak i zdrowych, zasadnym wydaje się, objęcie pacjentów z rozpoznaniem schizofrenii edukacją kształtującą właściwe nawyki żywieniowe.

**Słowa kluczowe:** *schizofrenia, wartość odżywcza posiłków, zwyczaje żywieniowe*

**Corresponding author:** Ewa Stefańska, Department of Dietetics and Clinical Nutrition, Medical University, Mieszka I 4 b, 15-054 Białystok, Poland, tel./fax: +48 857328244, e-mail: estef@umb.edu.pl

## INTRODUCTION

As the studies showed, changes in nutritional behaviors related to changes in appetite, nutritional preferences, including avoiding specific products and dishes, too rare consumption of meals or too frequent snacking of convenience food between main meals are significantly more frequent among patients with recognized schizophrenia [5, 16]. It is reflected by an incorrect nutritional value of the meals consumed by these patients. Some authors noted that patients with recognized schizophrenia are characterized, among others, by the consumption of products that are rich in fats and simple carbohydrates and poor in dietary fiber as compared to the population of healthy people [4, 5, 15]. Other authors showed that patients with recognized schizophrenia are characterized by the intake of basic nutrients with practically no different content of these nutrients in the general energy value of daily intake as compared to the control group [4]. There is also research in which any significant differences in terms of nutritional habits between people affected by schizophrenia and healthy people were not stated [8]. It was also noted that patients with recognized schizophrenia are characterized by a more frequent occurrence of many somatic disorders, the development of which is related to the nutritional factors [3]. An inappropriate diet, right next to low physical activity, smoking as well as a lack of interest in physical health may worsen the health condition of these patients [5]. Monitoring of the diets of patients affected by schizophrenia may help in indicating abnormalities that would allow to ensure adequate correction through both the formation of appropriate nutritional habits in this group and the creation of educational programs. In the available literature, there are no studies concerning the assessment of the nutritional value of specific meals consumed by people with recognized schizophrenia.

The aim of the study was to assess the chosen nutritional habits, including the number and type of meals consumed usually during a day, snacking between meals and the energy value and content of the chosen nutrients in the diets of people with recognized schizophrenia.

## MATERIALS AND METHODS

The research carried out from September 2016 to June 2017 covered 85 patients with recognized schizophrenia (according to the ICD-10 criteria) [21], that is to say, 45 women and 40 men ranging in age from 18-65 years (ambulatory patients under the care of the Outpatient Mental Clinic) and 70 healthy volunteers (40 women and 30 men) ranging in age from 18-65 years without any mental or nutritional disorders. Patients

with schizophrenia have been receiving atypical or typical antipsychotics for at least 1 year before being included in the study and they were mentally stable. Persons taking psychoactive substances, affected by other mental, cognitive or nutritional disorders were excluded from the study. In the group of patients with schizophrenia, 39% have been receiving 1 antipsychotic, 61% - 2 or 3 antipsychotics at the same time. In the case of men, 45% have been receiving 1 antipsychotic, 55% - 2 or 3 antipsychotics at the same time. Olanzapine, risperidone, haloperidol and clozapine were applied the most frequently. The patients taking part in the study were informed about the aim and methods of the research. Each patient gave a written consent to conduct them. The study obtained permission number R-I-002/355/2016 issued by the Bioethics Committee of the Medical University of Białystok. We used a survey questionnaire containing, among others, questions on nutritional habits, including those concerning the number and type of typically consumed meals and snacking between them. In the quantitative assessment of the daily food rations, we used a 24-hour diet recall covering 3 weekdays and one day of the weekend. In order to elaborate the nutritional value of daily food rations, we used the Diet 5.0 computer program elaborated by the Institute of Food and Nutrition in Warsaw. In order to assess the compliance of nutrient consumption with the recommendations, we used the nutritional standards for Polish people [6]. The following values were adopted as the proper content of energy derived from basic nutrients: 12% from protein, 30% from fats, 58% from carbohydrates. Furthermore, the intake of dietary fiber at the level of 25g/day, of dietary cholesterol at the level of 300 mg/day, the intake of saturated fatty acids (SFA), monounsaturated fatty acids (MUFAs), polyunsaturated fatty acids (PUFAs) respectively as 10%, 12%, 8% of the daily energy intake were considered as consistent with the recommendations [6]. In the assessment of the percentage of energy derived from each meal consumed during a day as compared to the total energy intake, we used the nutritional recommendations according to *Jaros* [6]. The statistical analysis of the obtained results was carried out with the use of the computer program STATISTICA 12.0, made by StatSoft, using the  $\chi^2$  test and t-test for independent variables and adopting the results with  $p < 0.05$  as significant.

## RESULTS

Table 1 presents the socio-demographic characteristics of the patients. It was observed that the number of single women and men and those with a primary/vocational education was significantly higher in the group of patients with recognized schizophrenia as compared to the control group.

Table 1. General characteristics of subject groups

| Variables                            | Women                 |                  | Men                   |                  |
|--------------------------------------|-----------------------|------------------|-----------------------|------------------|
|                                      | Schizophrenia<br>n=45 | Controls<br>n=40 | Schizophrenia<br>n=40 | Controls<br>n=30 |
| Age (years)                          | 39.0(6.7)             | 38.2(12.5)       | 37.8(11.6)            | 35.9(8.6)        |
| Body height (cm)                     | 163.5 (5.4)           | 166.0(4.4)       | 177.8(6.8)            | 180.9(5.2)       |
| Body weight (kg)                     | 68.1(16.3)            | 65.0(11.8)       | 80.3(17.3)            | 85.1(12.9)       |
| Body mass index (kg/m <sup>2</sup> ) | 25.1(5.3)             | 24.4(5.0)        | 25.0(4.6)             | 25.9(4.2)        |
| <25.0 (%)                            | 64                    | 67               | 30                    | 34               |
| ≥25.0 (%)                            | 36                    | 33               | 70                    | 66               |
| Waist circumference (cm)             | 93.3 (14.0) **        | 85.5(13.3)       | 96.2(12.8)            | 92.9(10.2)       |
| Marital status (%)                   |                       |                  |                       |                  |
| Married                              | 18                    | 62               | 25                    | 56               |
| Single                               | 82*                   | 38               | 75*                   | 44               |
| Education (%)                        |                       |                  |                       |                  |
| Primary                              | 4***                  | 0                | 29***                 | 0                |
| Vocational                           | 13                    | 0                | 25                    | 0                |
| Secondary                            | 53                    | 25               | 33                    | 35               |
| University                           | 30                    | 75               | 13                    | 65               |
| Age of onset (years)                 | 27.3(7.1)             | -                | 26.7(9.0)             | -                |
| Disease duration (years)             | 12.3(7.2)             | -                | 10.0(6.7)             | -                |

Values for categorical variables are arithmetic mean (standard deviation) or percentages of subjects. For continuous variables the independent t test was used; for categorical variables, chi-square test was used; \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Statistically significant differences concerning the anthropometric parameters of the patients taking part in the study were not stated, except for the waist circumference that was significantly larger in the case of women affected by schizophrenia as compared to healthy women. While assessing the number and type of meals consumed by patients taking part in the study, it was stated that women with recognized schizophrenia were having three meals a day much more frequently as compared to healthy women (Table 2). At the same time, the largest group of healthy women declared a rational nutritional model that assumes 5 meals

a day. The consumption of 3-4 meals a day was preferred in both groups of men. While assessing the type of consumed meals, it was stated that more than 90% of women from both groups were having three main meals, that is to say breakfast, lunch and dinner. It was stated at the same time that additional snacking between meals was significantly more frequent in the group of women with recognized schizophrenia as compared to healthy women (sweets were chosen the most often in the group of women with schizophrenia, while fruits - in the group of healthy women).

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

| Variables                       | Women                 |     |                  |    | Men                   |    |                  |    |
|---------------------------------|-----------------------|-----|------------------|----|-----------------------|----|------------------|----|
|                                 | Schizophrenia<br>n=45 |     | Controls<br>n=40 |    | Schizophrenia<br>n=40 |    | Controls<br>n=30 |    |
|                                 | n                     | %   | n                | %  | n                     | %  | n                | %  |
| Number of meals                 |                       |     |                  |    |                       |    |                  |    |
| ≤2                              | 1                     | 2   | 0                | 0  | 5                     | 12 | 0                | 0  |
| 3                               | 21                    | 47* | 5                | 12 | 14                    | 36 | 8                | 27 |
| 4                               | 10                    | 22  | 15               | 38 | 12                    | 30 | 12               | 40 |
| ≥5                              | 13                    | 29  | 20               | 50 | 9                     | 22 | 10               | 33 |
| Type of meals                   |                       |     |                  |    |                       |    |                  |    |
| Breakfast                       | 43                    | 95  | 37               | 93 | 28                    | 70 | 24               | 80 |
| Mid-morning meal                | 19                    | 42  | 25               | 62 | 11                    | 27 | 10               | 33 |
| Lunch                           | 43                    | 95  | 39               | 97 | 33                    | 82 | 25               | 85 |
| Afternoon tea                   | 17                    | 38  | 12               | 30 | 10                    | 25 | 5                | 16 |
| Dinner                          | 41                    | 91  | 38               | 95 | 33                    | 82 | 18               | 60 |
| Additional eating between meals | 29                    | 64* | 15               | 37 | 18                    | 45 | 9                | 30 |
| Type of additional snacks       |                       |     |                  |    |                       |    |                  |    |
| Sweets                          | 14                    | 48  | 5                | 33 | 7                     | 36 | 4                | 44 |
| Sandwiches                      | 6                     | 21  | 3                | 20 | 8                     | 46 | 2                | 21 |
| Fruit                           | 9                     | 31  | 10               | 67 | 3                     | 18 | 3                | 35 |

\*p&lt;0.05

A more frequent consumption of afternoon and evening meals (more than 80% of the subjects) was stated in the group of men with schizophrenia, whereas in the group of healthy men, an opposite tendency was stated. Snacking between meals in the case of men was also more frequent in the group of patients with schizophrenia who were choosing sandwiches more often as opposed to healthy men who were eating sweets more frequently. Table 3 presents the average energy value and average content of the chosen nutrients in the daily food rations of the patients taking part in the study (Table 3). It was noted that the daily food rations of women with recognized schizophrenia were characterized by a higher energy value and content of the majority of assessed nutrients. Statistically significant differences were noted in the case of the all-

day energy intake and total fat and saturated fatty acids (SFA) content, the percentage of energy derived from saturated fatty acids and total carbohydrate content and the percentage of energy derived from carbohydrates. Furthermore, the food rations of women with schizophrenia were characterized by a statistically significantly lower percentage of energy derived from proteins. It was stated at the same time that despite a higher content of the majority of assessed nutrients in the diets of women with schizophrenia, these diets were providing polyunsaturated fatty acids and dietary fiber at a level that is below the recommendations, whereas saturated fatty acids were being consumed in excess. The diets of healthy women were not satisfying the recommendations in terms of all assessed nutrients, except for total protein intake.

Table 3. Nutrient intake comparison between patients with schizophrenia and controls.

| Variables                   | Women              |               |                |               | Men                |               |                |               |
|-----------------------------|--------------------|---------------|----------------|---------------|--------------------|---------------|----------------|---------------|
|                             | Schizophrenia n=45 |               | Controls n=40  |               | Schizophrenia n=40 |               | Controls n=30  |               |
|                             | Mean (SD)          | % of standard | Mean (SD)      | % of standard | Mean (SD)          | % of standard | Mean (SD)      | % of standard |
| Energy (kcal/day)           | 1785.0 (558.3)**   | 91            | 1478.5 (446.3) | 75.8          | 2052.4 (639.9)*    | 84            | 2464.9 (800.8) | 101           |
| Total protein (g/day)       | 63.4 (16.6)        | 109           | 65.7 (20.4)    | 113           | 72.7 (20.0)**      | 99            | 111.7 (30.4)   | 153           |
| Total fat (g/day)           | 60.0 (23.0)*       | 95            | 49.3 (25.6)    | 76            | 86.7 (40.0)        | 106           | 91.4 (37.1)    | 111           |
| SFA (g/day)                 | 27.6 (15.5)**      | 125           | 17.8 (12.0)    | 81            | 38.6 (20.9)        | 143           | 37.6 (16.3)    | 139           |
| MUFA (g/day)                | 24.5 (15.5)        | 94            | 19.2 (12.0)    | 74            | 33.9 (17.5)        | 103           | 37.3 (15.8)    | 113           |
| PUFA (g/day)                | 8.0 (7.0)          | 47            | 8.4 (5.0)      | 49            | 8.0 (4.2)*         | 36            | 12.3 (5.1)     | 56            |
| Cholesterol (g/day)         | 226.0 (128.3)      | 75            | 265.0 (224.2)  | 88            | 379.5 (261.9)      | 126           | 465.8 (331.6)  | 155           |
| Total Carbohydrates (g/day) | 248.9 (100.4)**    | 90            | 193.0 (78.2)   | 68            | 259.7 (90.8)*      | 73            | 319.7 (135.4)  | 90            |
| Fibre (g/day)               | 18.2 (7.0)         | 73            | 19.9 (7.9)     | 80            | 15.9 (5.0)*        | 64            | 23.3 (9.7)     | 93            |
| Protein (%E)                | 14.3 (2.3)***      | -             | 19.4 (5.4)     | -             | 14.6 (3.0)*        | -             | 18.8 (4.9)     | -             |
| Fat (%E)                    | 31.0 (7.9)         | -             | 30.3 (10.1)    | -             | 36.5 (9.0)         | -             | 33.4 (9.9)     | -             |
| SFA (% E)                   | 13.4 (4.1)*        | -             | 10.8 (4.7)     | -             | 16.9(3.9)          | -             | 13.7(3.1)      | -             |
| MUFA (%E)                   | 12 (3.8)           | -             | 14.9 (5.2)     | -             | 14.7 (4.1)         | -             | 13.6 (3.0)     | -             |
| PUFA (%E)                   | 3.9 (2.1)          | -             | 4.8 (2.3)      | -             | 3.5 (1.7)          | -             | 4.5(2.0)       | -             |
| Carbohydrates (%E)          | 54.8 (7.9)*        | -             | 50.8 (11.0)    | -             | 48.7 (10.5)        | -             | 47.7 (9.7)     | -             |

SD-standard deviation, SFA- saturated fatty acids, MUFA-monounsaturated fatty acids, PUFA-polyunsaturated fatty acids, %E-percentage of energy, for continuous variables the independent t-test was used, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

An opposite tendency was stated in the compared groups of men: the nutritional rations of men with schizophrenia were characterized by a lower content of the majority of assessed nutrients. A statistically significant lower energy intake and a lower content of total protein, polyunsaturated fatty acids, carbohydrates, dietary fiber as well as the percentage of energy derived from protein was stated in this group as compared to the group of healthy men. At the same time, while comparing the food rations of men affected by schizophrenia with the recommendations for the Polish population, we stated a too low intake of energy, polyunsaturated fatty acids, total carbohydrates and dietary fiber and a too high intake of saturated fatty acids and dietary cholesterol. In the case of the nutritional rations of healthy men, we stated a too low polyunsaturated fatty acid content and a too high total protein, saturated fatty acids and dietary cholesterol content.

Figure 1 presents an energetic structure of the nutritional rations of women with a breakdown by meals (Figure 1). In the group of women affected by schizophrenia, we stated a too low energy value of the breakfast as compared to the recommendations; the other meals were characterized by an energy value that is compliant with the recommendations. In the case of healthy women, an improper distribution of energy value (too low as compared to the recommendations) concerned lunches, afternoon tea and dinners. At the same time, a contribution of snacking in providing energy in the diet was stated (in both groups of women, it amounted to 8%). In the case of men with recognized schizophrenia, we observed a too low energy value of the lunches and afternoon tea and a too high energy value of dinners as compared to the recommendations, whereas in the control group, we stated a too low energy value of the breakfasts and mid-morning meals and lunches and a too high energy value of the dinners. Snacking between meals in this group was providing 5% of the total energy intake (Figure 2).

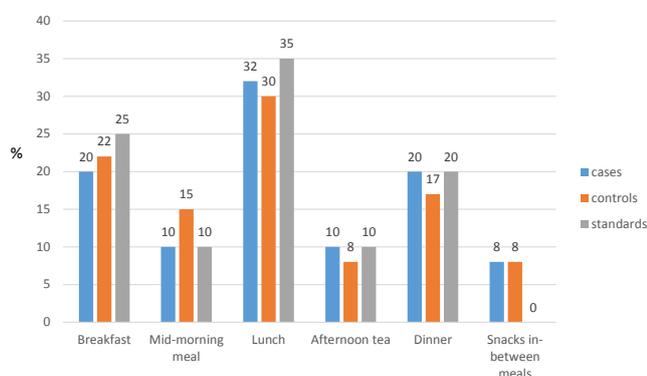


Figure 1. Energy content (%) breakdown per meal determined in both subject groups (women) along with recommended reference values

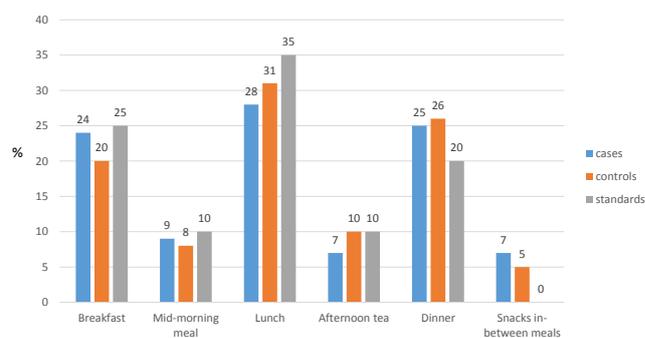


Figure 2. Energy content (%) breakdown per meal determined in both subject groups (men) along with recommended reference values

While assessing the energy value and nutritional value of specific meals consumed by female subjects, it was stated that, in the case of breakfasts, their nutritional value was similar in both compared groups, except for the intake of total fat, saturated and monounsaturated fatty acids, the intake of which was significantly higher in the group of women with recognized schizophrenia (Table 4). In the case of mid-morning meals, the diets of women with recognized schizophrenia were characterized by a significantly lower intake of total protein and dietary fiber as compared to the diets of healthy women. On the other hand, the lunches consumed by women affected by schizophrenia were characterized by a significantly higher energy value and total carbohydrate and dietary fiber content as compared to the lunches of women from the control group. In the case of afternoon tea, both the energy value and intake of specific nutrients were very similar in the food rations of both compared groups and did not show any statistically significant differences. The study also showed that both the energy value of the dinners and the intake of total fat, saturated, monounsaturated and polyunsaturated fatty acids and total carbohydrates was significantly higher in the food rations of women with schizophrenia as compared to the food rations consumed by the control group. While assessing a negative habit, i.e. snacking between meals, it was stated that the food rations of women from both compared groups were characterized by a similar nutritional value (providing mainly carbohydrates and dietary cholesterol) without any statistically significant differences in the intake of specific nutrients. The breakfasts of men with schizophrenia were characterized by a significantly lower content of carbohydrates and dietary fiber as compared to the control group. A significantly lower dietary fiber intake in the food rations of patients was also observed in the case of mid-morning meal. The lunches of the male patients were characterized by a lower intake of energy, total protein, total fat and saturated fatty acids as compared to this kind of meals among healthy people.

Table 4. Nutritional values of meals consumed by subjects.

| Variables               | Women              |               | Men                |               |
|-------------------------|--------------------|---------------|--------------------|---------------|
|                         | Schizophrenia n=45 | Controls n=40 | Schizophrenia n=40 | Controls n=30 |
|                         | Mean (SD)          | Mean (SD)     | Mean (SD)          | Mean (SD)     |
| Breakfast               |                    |               |                    |               |
| Energy (kcal)           | 354.3±216.7        | 326.7±136.1   | 480.3±244.4        | 494.2±204.2   |
| Total protein (g)       | 12.0±6.9           | 13.5±6.7      | 16.2±9.5           | 17.1±8.8      |
| Total fat (g)           | 14.2±10.5**        | 9.7±6.8       | 24.2±16.8          | 19.8±11.8     |
| SFA (g)                 | 7.4±5.3*           | 4.4±4.1       | 12.2±8.3           | 8.8±5.9       |
| MUFA (g)                | 5.4±5.2**          | 3.6±4.1       | 9.0±6.8            | 7.9±5.3       |
| PUFA (g)                | 1.8±1.7            | 1.6±1.2       | 1.9±1.8            | 2.3±1.7       |
| Cholesterol (g)         | 60.3±70.2          | 56.3±62.7     | 150.7±236.9        | 109.0±182.7   |
| Carbohydrates (g)       | 50.4±44.4          | 45.1±23.5     | 52.0±28.4*         | 71.6±31.9     |
| Fibr                    | 3.2±3.6            | 4.3±3.1       | 2.5±1.6*           | 4.4±3.1       |
| Mid-morning meal        |                    |               |                    |               |
| Energy (kcal)           | 174.0±185.0        | 225.5±151.1   | 190.5±245.1        | 210.7±274.0   |
| Total protein (g)       | 4.0±4.3**          | 9.8±9.2       | 5.7±7.9            | 9.5±15.2      |
| Total fat (g)           | 5.6±8.6            | 7.4±7.0       | 8.0±13.1           | 7.5±10.4      |
| SFA (g)                 | 2.7±3.6            | 3.0±2.8       | 3.7±6.7            | 3.2±3.9       |
| MUFA (g)                | 2.1±3.1            | 2.9±3.4       | 3.0±4.9            | 2.7±5.2       |
| PUFA (g)                | 0.6±0.9            | 1.2±1.2       | 1.0±1.7            | 1.0±2.6       |
| Cholesterol (g)         | 12.3±19.2          | 26.7±16.67    | 22.3±48.0          | 40.0±24.0     |
| Carbohydrates (g)       | 26.5±29.2          | 30.2±22.3     | 24.7±31.1          | 35.0±40.3     |
| Fibre (g)               | 1.9±2.1**          | 3.9±3.3       | 1.0±1.3**          | 2.7±3.9       |
| Lunch                   |                    |               |                    |               |
| Energy (kcal)           | 574.3±251.9**      | 442.8±160.4   | 566.9±214.4**      | 757.0±379.1   |
| Total protein (g)       | 25.2±11.4          | 26.7±10.7     | 25.7±10.2***       | 44.2±17.8     |
| Total fat (g)           | 15.0±11.5          | 14.7±9.8      | 15.8±11.3***       | 30.7±21.9     |
| SFA (g)                 | 5.7±5.2            | 5.0±4.0       | 6.1±4.1***         | 11.3±6.9      |
| MUFA (g)                | 7.0±5.0            | 6.4±4.7       | 7.3±5.8            | 14.2±8.6      |
| PUFA (g)                | 2.5±2.1            | 3.0±2.0       | 1.3±0.9            | 3.4±1.3       |
| Cholesterol (g)         | 80.4±61.7          | 119.2±150.7   | 83.3±51.7          | 189.5±195.4   |
| Carbohydrates (g)       | 79.0±43.4***       | 52.7±31.8     | 86.2±39.8          | 82.5±64.9     |
| Fibre (g)               | 7.2±3.9**          | 5.8±3.5       | 7.2±3.1            | 6.8±4.4       |
| Afternoon tea           |                    |               |                    |               |
| Energy (kcal)           | 189.2±170.0        | 109.2±146.1   | 155.3±171.5        | 240.9±270.4   |
| Total protein (g)       | 5.9±12.1           | 3.8±6.9       | 4.3±8.2*           | 9.2±10.2      |
| Total fat (g)           | 7.0±11.0           | 3.3±7.1       | 6.4±10.0           | 13.2±15.9     |
| SFA (g)                 | 3.6±1.1            | 0.9±1.7       | 2.8±5.0            | 4.9±4.5       |
| MUFA (g)                | 2.4±3.7            | 1.8±2.6       | 2.5±4.7            | 4.3±7.5       |
| PUFA (g)                | 0.8±1.7            | 0.6±1.1       | 1.0±1.3            | 2.2±2.4       |
| Cholesterol (g)         | 14.1±12.6          | 8.7±11.1      | 38.1±35.6          | 25.8±39.5     |
| Carbohydrates (g)       | 48.6±51.6          | 21.2±20.1     | 20.8±30.9          | 33.4±34.8     |
| Fibre (g)               | 1.6±3.3            | 1.8±2.3       | 1.2±3.0*           | 3.1±3.0       |
| Dinner                  |                    |               |                    |               |
| Energy (kcal)           | 364.4±154.4***     | 247.8±172.5   | 517.9±278.1        | 650.5±641.0   |
| Total protein (g)       | 17.0±14.5          | 11.7±10.2     | 16.1±9.0***        | 28.4±19.7     |
| Total fat (g)           | 17.0±12.6*         | 9.7±10.7      | 26.3±20.6          | 16.6±13.1     |
| SFA (g)                 | 7.7±5.7***         | 3.4±4.4       | 12.4±9.6           | 7.0±5.6       |
| MUFA (g)                | 6.5±5.4**          | 3.2±4.2       | 10.2±6.9           | 7.0±5.8       |
| PUFA (g)                | 2.5±2.0*           | 1.7±3.2       | 2.9±1.9            | 2.3±4.2       |
| Cholesterol (g)         | 57.1±64.3          | 51.4±63.9     | 75.5±78.9          | 95.3±88.5     |
| Carbohydrates (g)       | 40.1±18.6***       | 27.1±20.5     | 59.5±41.7          | 71.7±54.7     |
| Fibre (g)               | 3.3±1.8            | 3.1±2.5       | 2.9±1.9*           | 4.1±3.0       |
| Snacks in-between meals |                    |               |                    |               |
| Energy (kcal)           | 134.2±197.2        | 125.9±168.9   | 142.7±180.9        | 113.0±113.3   |
| Total protein (g)       | 2.7±4.8            | 2.5±5.0       | 4.4±7.6            | 3.4±6.7       |
| Total fat (g)           | 4.9±7.9            | 5.0±6.8       | 6.6±5.3            | 3.7±6.2       |
| SFA (g)                 | 2.2±3.5            | 1.7±3.0       | 2.5±5.3            | 1.1±2.0       |
| MUFA (g)                | 1.6±2.1            | 2.0±3.8       | 3.0±6.2            | 1.2±0.6       |
| PUFA (g)                | 0.9±1.7            | 1.3±2.0       | 0.7±1.0            | 1.1±0.7       |
| Cholesterol (g)         | 7.6±12.0           | 8.5±7.2       | 8.4±8.1            | 6.9±3.9       |
| Carbohydrates (g)       | 20.4±16.1          | 19.2±18.4     | 16.4±13.5          | 26.6±12.6     |
| Fibre (g)               | 1.5±2.5            | 1.8±3.0       | 1.1±1.8            | 2.4±4.3       |

\*p&lt;0.05, \*\*p&lt;0.01, \*\*\*p&lt;0.001

The afternoon snacks and dinners of male patients were also characterized by a significantly lower protein intake as compared to the control group. We did not note statistically significant differences in the nutritional value of additional snacks consumed by men.

## DISCUSSION

As the research shows, the diet of patients with recognized schizophrenia may deviate from the nutritional habits of healthy people [1, 4, 8]. The in-house study revealed a lack of statistically significant differences in terms of both number and type of usually consumed meals, except for the diets of women with schizophrenia who were consuming 3 meals a day more frequently and were having additional episodes of snacking much more frequently as compared to healthy women. We did not observe any statistically significant differences in the type of snacks consumed between the meals; however, in the group of female patients, sweets were chosen much more frequently, whereas in the group of male patients - these were mainly sandwiches and sweets. There was no statistically significant difference in the nutritional value of products eaten between the meals between the compared groups; however, these were mainly products providing carbohydrates, fats and dietary cholesterol with a little amount of protein. These results are compliant with the studies of *Kampov-Polevoy et al.*, which showed that women with mental disorders and more frequent mood changes were claiming lower self-control while consuming sweet snacks [7].

The in-house study revealed that regardless of the compared group, the afternoon tea and mid-morning meal were the meals that were skipped the most frequently. It was shown in the study of *Roick et al.* that a significantly lower number of patients with recognized schizophrenia was consuming the breakfast and mid-morning meal as compared to healthy people. Statistically significant differences were not stated in the case of the choice of other meals. The authors also revealed statistically significant differences in the more frequent consumption of evening snacks by patients with recognized schizophrenia and the less frequent consumption of products such as, among others, raw/cooked vegetables, whole-grain cereal products and the significantly more frequent consumption of low-calorie products and products belonging to the group of convenience food as compared to the control group [16]. It was shown in the study of *Kim et al.* that patients with recognized schizophrenia admittedly were characterized by a higher regularity in the consumption of meals; however, these meals were poorer in terms of nutritional value, in particular in terms of low intake of protein, polyunsaturated fatty

acids, niacin, folates and vitamin C as compared to the food rations of healthy people. This situation is due to a low consumption of products being a nutritional source of the above-mentioned nutrients [8].

As the research shows, what is most beneficial for the human body is to distribute the total energy value of the daily food ration into 5 meals. In the five-meal model, breakfast should provide 25%, mid-morning meal 10%, lunch 35%, afternoon tea 10%, whereas dinner 20% of the total amount of the all-day food ration [6]. The presented in-house study results are deviated from the quoted recommendations, in particular in the case of the breakfasts of women with schizophrenia and the lunches and dinners in the group of men affected by this disorder. An advantageous aspect was the fact that the snacking habit in the group of women was not providing more than 8% of the total energy intake (7% in the group of men). The previous in-house research conducted among patients with mental disorders revealed a higher energy intake provided by snacking. The products consumed the most frequently were carbohydrate-fat products, while the energy value of consumed snacks was exceeding the energy value of the mid-morning meals and afternoon snacks [18].

A popular nutritional model of societies living in developed countries is characterized by the consumption of a large amount of food that is poor, in particular, in nutrients that condition the proper functioning of the brain, such as e.g. polyunsaturated fatty acids, in particular those from the n-3 group or vitamins from the B group and minerals [4, 8, 14]. While assessing the average energy and nutritional value of the compared food rations of women, it was stated that the food rations of women with recognized schizophrenia were characterized by a significantly higher energy value and content of the majority of the assessed nutrients. Similar results were obtained by other authors [4, 8, 9]. In the case of the compared groups of men, an opposite tendency was observed - the diets of patients with recognized schizophrenia were characterized by a lower energy intake and intake of the majority of the assessed nutrients as compared to healthy people. Other results were obtained in the study of *Kim et al.* [8]. Not only is the total energy intake meaningful in the all-day ration, but also the mutual contribution of specific basic nutrients in providing this energy. The recommended values are applicable to 10-15% of energy derived from protein, 25-30% from fat and 55-65% of energy derived from carbohydrates in its all-day intake [6]. The results obtained in this study are close to the recommended values; however, we observed a higher percentage of energy derived from total fat, saturated fatty acids, total carbohydrates and a lower percentage in the case of proteins and polyunsaturated acids in the food rations

of patients of both sexes as compared to the food rations of healthy subjects. A beneficial influence of the diet providing 46% of energy from carbohydrates, 24% from proteins and 30% from fats (including <8% from saturated fatty acids intake) not only in terms of body mass reduction, but also in connection with cognitive functions was revealed in the research of *Brinkworth et al.* [2]. The protein intake in the food rations of the compared groups of the women assessed in the in-house study did not show any statistically significant differences. Only the diets of male patients were characterized by a significantly lower content of this nutrient as compared to the control group. A protein intake that was similar to the one obtained in this study was observed in the studies of other authors [4, 9]. While assessing the fat intake, we observed a significantly higher content of those in the food rations of women with recognized schizophrenia. A lower content of fat in the food rations of patients with recognized schizophrenia (44.0g-50.0g/day) than the one obtained in this study was observed in the researches of other authors [8, 9, 19]. Not only does the total fat intake have a great importance in appropriately balanced diet, but also paying attention to the content of specific acid groups, in particular polyunsaturated acids, is so important in the functioning of the central nervous system. A very low intake (approx. 40-50% of the recommendations) of polyunsaturated acids was observed in all groups. This situation is disadvantageous because the *omega-6* and *omega-3* fatty acids, as the structural components of the nervous system, fulfil an important role in its functioning. In particular, the *omega-3* fatty acids fulfil an essential role in cerebral processes, having an impact on the liquidity of the cell membranes, function of the membrane's enzymes and synthesis of eicosanoids. Low levels of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in cerebral tissue are considered the main factors of neuropathology of schizophrenia [8]. These acids may prevent mood changes, improve the blood flow and provide better access of the nutrients to the brain [20]. The study of *Pawelczyk et al.* showed that a 6-month-long intervention with fish oil (2.2 g/day EPA + DHA) significantly decreased the psychotic symptoms among patients with schizophrenia [11]. The study revealed that the food rations of female patients were significantly different in terms of a higher saturated fatty acids content as compared to the healthy women. A disadvantageous aspect was a fact of too high consumption of those as compared to the recommendations in the group of women with schizophrenia and in both groups of men. A high consumption of these acids exceeding 7% that is recommended along with an insufficient intake of monounsaturated and polyunsaturated acids, so popular within the Polish population, may have an impact on the

development of cardiovascular diseases, amplifying the bad health condition of psychiatric patients [17]. The studies of other authors also revealed a higher content of saturated fatty acids in the food rations of patients with recognized schizophrenia as compared to healthy people [8, 9]. The in-house study also revealed a too high consumption of dietary cholesterol, but only in the groups of men. The dietary cholesterol intake revealed in other authors' studies was lower than the one obtained in this paper and oscillated between 190-209mg/d in the group of women and between 241-275mg/d in the group of men [8, 9]. While assessing the total carbohydrate content in the food rations of the patients, it was stated that the diets of women with recognized schizophrenia were providing significantly higher amounts of this nutrient as compared to healthy women, whereas among the male patients, an opposite tendency was observed. A value of these nutrients that is similar to the one obtained in this study was observed in the diets of people with schizophrenia examined by other authors [8, 9]. At the same time, the in-house study revealed that the diets of women with recognized schizophrenia were characterized by a percentage of energy derived from carbohydrates that was the closest to the recommendations as compared to the other groups. The in-house study in all the compared groups revealed also a low dietary fiber intake (the lowest intake – 15.9g/d on average in the group of men with recognized schizophrenia). An even lower intake of this nutrient (9-13g/d) than the one revealed in the in-house study was stated in the studies of other authors [4, 19]. As the studies showed, this situation may be due to an insufficient consumption of products being a source of this nutrient: that is to say, raw vegetables and fruits, whole-grain cereal products, pulses [13, 16, 19]. According to *Sugawara et al.*, the most desired nutritional model intended for patients with recognized schizophrenia allowing to maintain the appropriate nutritional state, including, among others, the prevention of excessive body mass, is a model taking into consideration an appropriate intake of protein, fats, in particular of polyunsaturated fatty acids from the n-3 and n-6 group, as well as the intake of dietary fiber, folates, riboflavin, pyridoxine, cobalamin and vitamin C [19].

The study of *Peet et al.* revealed that there is a relationship between the consumption of foodstuffs and an intensification of symptoms and frequency of schizophrenic relapses. These researchers observed that there is a negative correlation between consumption of such products as meat, dairy products or eggs and the prognosis of schizophrenia measured by a percentage of people with severe functional impairment. The multiple regression analysis revealed though that the consumption of monosaccharides was the most significant factor associated with the course of illness

[13]. The regression analysis conducted by *Roick et al.* revealed that, in the case of patients with recognized schizophrenia, the factors affecting their habits related to health are – among others – sex, educational level and age [16]. These researchers noted that women choose foodstuffs with a higher nutritional value more frequently than men; they drink less alcohol and smoke fewer cigarettes. Furthermore, patients with a higher education degree choose healthier foodstuffs more often and smoke fewer cigarettes during a day, just like the older patients [16]. According to *Kim et al.*, the standard recommendations related to the diet of patients with recognized schizophrenia should take into account a higher consumption of whole-grain cereal products, in particular brown rice, products with barley and rye grains, but also products rich in niacin such as eggs, poultry, dairy products. These authors point out that it is necessary to increase the consumption of products rich in polyunsaturated fatty acids such as mackerel, tuna, salmon, vegetable oils, nuts while maintaining, at the same time, the total intake of fats and saturated fatty acids respectively below the level of 30% and 7% of the energy value in the diet. According to these authors, it is necessary to consume vegetables and fruits at least 5 times a day, taking into account, in particular, dark green vegetables, mainly spinach, lettuce, broccoli and seasonal fruits being a source of vitamin C [8].

## CONCLUSIONS

Despite the differences between the nutritional value of meals of the patients with recognized schizophrenia and those of healthy people, it seems necessary to involve the patients with recognized schizophrenia in the education of forming proper nutritional habits that promote the principles of rational nutrition and increase the motivation for preparation one's own healthy meals.

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### Conflict of interest

*The authors declare no conflict of interest.*

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