Dietary Intake in Body Mass Index Differences in Community-Based Japanese Patients with Schizophrenia

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Abstract

Background: Patients with schizophrenia reportedly have a high prevalence of obesity. One of the reasons is a poor choice of diet. The goal of this study was to clarify characteristics of the dietary intake across the strata of the body mass index (BMI) and to compare the general population and patients with schizophrenia in Japan.
Methods: This is a cross-sectional study of 51 patients with schizophrenia residing in rural areas in 2011. Anthropometric indices (of height, weight, body mass index) were measured at the commencement of the survey. Intakes of energy, protein, fat, carbohydrate, calcium, phosphorus, vitamins, total fiber, and salt were noted through a 3-day dietary recording. The nutrient intake was estimated using Excel add-in software (Excel Eiyou-kun Ver. 6.0, Kenpakusha Co., Ltd.). Patients were divided into two groups: those with a BMI ≥25 kg/m² and with a BMI <25 kg/m², and the differences in their nutrition intake were analyzed. To compare these patients with the general population, the results of the National Health and Nutrition Survey, 2010 (NHNS) were used (the NHNS group). For statistical analysis, an unpaired t-test was performed with $P < 0.05$.
Results: Patients with a BMI ≥25 kg/m² had the higher intakes than those with a BMI <25 kg/m² of energy, fat and phosphorus and salt. Patients with schizophrenia showed higher intakes of energy, carbohydrate, fat, calcium, phosphorus and salt than the NHNS group.
Conclusion: The characteristics of the dietary intake in patients with schizophrenia were suggested the food constitution that is likely to increase the body weight.

Keywords: Body mass index, Nutrition survey, Obesity, Schizophrenia

Introduction

An increase in overweight and obesity is an important problem to be addressed in public health. In particular, patients with schizophrenia are well known to be prone to be overweight (1-3). Conventional and atypical antipsychotics are associated with weight gain (4). Obesity and being overweight increase the risks of dyslipidemia, hypertension, cardiovascular disease, insulin-resistant diabetes, and type 2 diabetes mellitus (5, 6). Furthermore, the psychological effect of obesity in patients with schizophrenia have been suggested,

particularly its association with depressive symptoms (7). Previous studies have indicated that one of the causes of obesity in patients with schizophrenia is a poor choice of diet. According to surveys in the U.K., patients with schizophrenia showed a higher fat intake and lower intakes of fiber and vitamins than the general population and reference population (8, 9). In a survey in Iran, patients with schizophrenia showed higher intakes of hydrogenated fats, full-fat cream, and carbonated drinks than individuals without mental

disorder (10). It has been reported that patients with schizophrenia are likely to die early due to cardiovascular disease, which may be related to the low intake of fruit and vegetables (11). These findings suggest that a poor dietary intake has a major effect on obesity and physical health in patients with schizophrenia.

Obesity and overweight are generally known to result from nutritional excess and decreased physical activities, and the body mass index (BMI) is mainly used as an indicator of overweight and obesity. In a nutrition survey in the general population, the BMI closely related with the dietary intake and individuals with protein, fat, carbohydrate and fiber (12). Therefore, even in patients with schizophrenia, the intake of individual nutrient may differ depending on their BMIs. In previous nutrition surveys in patients with schizophrenia, differences in gender and races and comparison with the general population have been mainly studied, (10, 11, 13) and no surveys have clarified or discussed the characteristics of their dietary intake focusing on the BMI.

In this study, we investigated the characteristics of the dietary intake in patients with schizophrenia in Japan, comparing them between BMI strata. There is shortage of nutrition surveys in Japan where patients with schizophrenia. This study aimed to obtain helpful suggestions for supporting their dietary life from the comparison between patients with schizophrenia and the general population.

Materials and Methods

Study Area and Subjects

Subjects were chosen diagnosed with schizophrenia by psychiatrists and correspond to criteria from the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV). It was a cross-sectional study carried out from October to December 2011. This survey was conducted at the hospital daycare and workshops in Aomori, Japan. Subjects of age 20 years and above who had Schizophrenia of at least one year living in the community were included in the study. We obtained informed consent before the survey

from 60 community-based Japanese patients with schizophrenia who received the explanation about the survey verbally and in writing before consent. Among them, 51 subjects (25 men and 26 women) for whom there were no flaws in the questionnaire and photography for the nutrition survey were included in the analysis. This study was approved by the Ethical Review Board of Aomori University of Health and Welfare before implementation (Approval No. 08078).

Data Collection

A self-completed questionnaire was distributed to each subject. Demographic variables collected were age, gender, age of onset, and anthropometric indices including BMI, height, and weight. Height was assessed using a handle-type height meter. With shoes removed (in socks), back and buttocks were measured standing upright with the heel touching the pillars of the height gauge. With both arms hanging down at the sides, the head was measured by slightly pulling on the chin. Body weight was measured with subjects wearing light clothing on a digital scale that can measure in 50 g units. The BMI of each subject was calculated from his/her height (m^2) and weight (kg) as the index of build. The dietary survey was performed with a 3-day dietary recording in consecutive weekdays. Following the illustrated instructions, the subjects took the photographs of food that they ate with a camera and recorded the food in a dietary check sheet. They were instructed to take the photographs of all the food they ate, including snacks, using a disposable camera. They were instructed to take the photographs of food with chopsticks or a spoon so that the sizes could be compared. According to the National Health and Nutrition Examination Survey (14), the dietary check sheet had spaces to record the food and beverages that the subjects consumed and the weights of the food and beverages as well as spaces to check the cooking methods (baked, fried, boiled, or deep-fried). It also included spaces to record the seasoning used. We instructed the subjects to take photographs before and after eating food to calculate the accurate intake. The names and weights of food were determined from the

photographs and dietary check sheets collected. For the food consisting of several materials, the name and weight of each material were determined. If it was difficult to determine them, approximate weights were estimated based on food guidebooks. The weight of the food that changed after cooking was corrected to be the weight before change. Oil absorption of deep-fried food was calculated based on food guidebooks. The nutrient intake was estimated using Excel add-in software (Excel Eiyou-kun Ver. 6.0, Kenpakusha Co., Ltd.) with the Standard Tables of Food Composition in Japan Fifth Revised and Enlarged Edition. The mean daily intake was estimated from the total intake for 3 days. The nutrient intake was analyzed by a single national registered dietitian to avoid possible bias.

National Health and Nutrition Survey (NHNS)
In the comparison of nutritional data between patients with schizophrenia and the general population, the results of the National Health and Nutrition Survey, 2010 were used. The NHNS was a stratified random sampling survey on health and nutrition in Japan. The survey analyzed the conditions of the body, nutritional intake, and lifestyle by gender and age group. As the features of these survey items, the results are shown by age group and gender; due to the different number of subjects in each item, the anthropometric indices of those who underwent the nutrition intake survey are not shown.
The NHNS nutrition survey was performed with the food weighing method for 1 day (other than Sundays and national holidays) in each family. The nutritional data in the population aged 20 years and older were used as the general population for comparison in this study.

Statistical Analysis
Descriptive statistics were summarized for the characteristics and dietary intake of subjects. The subjects were classified into 2 groups on the basis of their BMI values: BMI <25 kg/m² as the normal weight group and BMI ≥25 kg/m² as the overweight and obesity group. Each nutrient was analyzed using unpaired student t-test to compare

the effects of BMI on the dietary intake. The dietary intake was also compared between the subject group (the schizophrenia group) and the general population (the NHNS group). Assuming the NHNS data to be normally distributed population, the data in this study were z-transformed using the NHNS data. The null hypothesis was that the sample of this study had the same normal distribution as the NHNS data, and we considered the difference significant when the null hypothesis was rejected at $P < 0.05$. The statistical analysis was performed with SPSS 19.0J for Windows.

Results

The analysis included 51 patients with schizophrenia. The age was 39.1 (SD = 8.9) years, and there were 25 men (49%) and 26 women (51%). The height was 169.9 (SD = 9.4) cm in men and 157.3 (SD = 6.43) cm in women. The weight was 70.5 (SD = 12.2) kg in men and 63.9 (SD = 9.4) kg in women (Table1).

Table1: Demographic characteristics of Subjects

Variables	Mean ± SD (n = 51)
Age (yr)	39.1 ± 8.9
Gender	
Male	25 (49.0)
Female	26 (51.0)
Height	
Male	169.9 (9.4)
Female	157.3 (6.3)
Weight	
Male	70.5 (12.2)
Female	63.9 (11.0)
BMI (kg/m²)	
All subjects	25.1 ± 4.4
BMI < 25	28 (54.9)
BMI ≥ 25	23 (45.1)
Marital status	
Single/cohabitating	47 (92.1)
Married	4 (7.9)
Age of onset (years)	23.7 ± 6.7

Values are mean ± SD or number (%)/ BMI: Body Mass Index

Table2: Nutrient intake comparison of BMI < 25 and BMI ≥ 25 in patients with schizophrenia using a three-day food record

Variable	BMI <25 kg/m² (n = 28) Mean (SD)	BMI ≥25 kg/m² (n = 23) Mean (SD)	t	P
Energy (kcal)	1933.1 (362.3)	2250.3 (455.1)	-2.77	0.008**
Protein (g)	69.2 (16.4)	76.3 (18.4)	-1.45	0.153
Calories from protein (%)	14.3	13.6	-	-
Fat (g)	55.9 (16.6)	69.7 (19.7)	-2.71	0.009**
Calories from fat (%)	26.0	27.7	-	-
Carbohydrate (g)	279.8 (46.9)	310.3 (98.2)	-1.45	0.151
Calories from Carbohydrate (%)	57.9	55.3		-
Calcium (mg)	526.7 (175.9)	637.2 (306.1)	-1.86	0.069†
Phosphorus (mg)	1045.5 (228.6)	1206.0 (212.9)	-2.12	0.039*
Retinol (µg)	486.5 (212.9)	523.4 (307.1)	-0.56	0.615
Vitamin D (µg)	9.167 (8.19)	7.93 (7.23)	0.54	0.588
Vitamin B$_{12}$ (µg)	5.67 (6.17)	4.45 (4.91)	0.76	0.449
Vitamin C (mg)	73.0 (30.4)	108.9 (101.2)	-1.78	0.081†
Total Fiber (g)	12.0 (3.2)	14.2 (6.1)	-1.57	0.122
Salt (g)	12.4 (5.5)	15.6 (7.5)	-1.71	0.094†

BMI: Body Mass Index / **$P < 0.01$, *$P < 0.05$, †$P < 0.10$

The BMI in all subjects was 25.1 (SD = 4.4) kg/m² (range: 18.6 to 35.1), and 28 subjects (54.9%) had a BMI <25 kg/m² and 23 subjects (45.1%) had a BMI ≥25 kg/m². The marital status was "single/cohabiting" in 47 subjects (92.1%) and "married" in 4 subjects (7.9%). The age of onset of schizophrenia was 23.7 (SD = 6.7) years (Table1).

Table 3: Nutrient intake comparison patients with schizophrenia using a three-day food record and NHNS controls using a one-day food weighing method

Variable	Schizophrenia Group (n = 51) Mean (SD)	NHNS Group (n = 7229) Mean (SD)	P
Energy (kcal)	2076.1 (433)	1859 (555)	0.005**
Protein (g)	72.4 (17.5)	68.1 (22.6)	0.18
Calories from protein (%)	13.9	14.7	-
Fat (g)	62.1 (19.1)	52.7 (23.3)	0.004**
Calories from fat (%)	26.9	25.2	-
Carbohydrate (g)	293.6 (75.3)	259.8 (80.6)	0.003**
Calories from Carbohydrate (%)	56.6	60.0	-
Calcium (mg)	576.5 (216.0)	502 (265)	0.047*
Phosphorus (mg)	1111.7 (273.7)	963 (327)	0.001**
Retinol (µg)	503.1 (257.5)	534 (617)	0.726
Vitamin D (µg)	8.6 (7.7)	7.7 (8.7)	0.465
Vitamin B$_{12}$ (µg)	5.1 (5.6)	6.3 (6.5)	0.193
Vitamin C (mg)	89.2 (73.0)	115 (167)	0.275
Total Fiber (g)	13.0 (4.8)	14.6 (6.6)	0.087†
Salt (g)	13.8 (6.6)	10.6 (4.3)	0.000**

BMI: Body Mass Index, NHNS: National Health and Nutrition Survey in Japan, 2010 /Results 20 years old or over/**$P< 0.01$, *$P < 0.05$, †$P < 0.10$

The results of the comparison of each nutrient intake between the BMI groups in patients with schizophrenia are shown in Table 2. Compared with subjects with a BMI <25 kg/m^2, subjects with a BMI ≥25 kg/m^2 had significantly higher intakes of energy (t = −2.77, P = 0.008), fat (t = −2.71, P = 0.009), and phosphorus (t = −2.12, P = 0.039). The intakes of calcium (t = −1.86, P = 0.069), vitamin C (t = −1.78, P = 0.081), and salt (t = −1.71, P = 0.094) tended to be higher in subjects with a BMI ≥25 kg/m^2 (P < 0.10). There were no significant differences in other nutrients. The results of the comparison of each nutrient intake between the schizophrenia group and the NHNS group are shown in Table 3. The schizophrenia group showed significantly higher intakes of energy, fat, carbohydrate, calcium, phosphorus, and salt than the NHNS group (P < 0.01 or P < 0.05). The intake of total fiber tended to be higher in the NHNS group (P < 0.10). There were no significant differences in other nutrients.

Discussion

To our knowledge, this study is the first to investigate the relationship between the dietary intake and BMI in patients with schizophrenia in Japan. Previous studies have demonstrated that the excess body weight and high fat intake in patients with schizophrenia are related to significant health risks. A high fat intake is the most important factor for obesity (15). The European Prospective Investigation into Cancer and Nutrition (EPIC) Potsdam cohort found that dietary patterns that are high-fiber and low-fat food choices that can help to maintain body weight or at least prevent excess body weight gain (16). Fat is the most energy-dense macronutrient, and it is well known that obesity is caused by the imbalance between the intake and consumption of energy due to the excess energy intake and reduced physical activities. In particular, patients with schizophrenia are known to be sedentary, and side effects and increased BMI have been reported to be associated with anti-psychotropic drugs (17).

Although their physical activities were not measured in this study, it was suggested that the higher energy intake, particularly the higher fat intake, in addition to the decreased daily activities was a cause of the increased body weight in patients with a BMI ≥25 kg/m^2. Based on the photograph data, many patients with a BMI ≥25 kg/m^2 in this study often consumed fuss-free food such as fast food, instant noodles, and prepared food (data not shown). In particular, instant noodles were often eaten because they are widely consumed in Asian countries (18) and are inexpensive and easy to cook. Fast food, including instant noodles, has high contents of fat, salt, and phosphorus. Moreover, fast food consumption tends to be associated with a higher intake of undesirable nutrients such as sugar, salt, saturated fats and a lower intake of desirable nutrients such as vitamins, minerals and fiber (19). The high intakes of phosphorus and salt in patients with a BMI ≥25 kg/m^2 may reflect the fact that they often eat fast food in the daily diet. The reasons for eating fast food so often are probably the low cooking skill and lack of knowledge about food in patients with schizophrenia as well as the convenience and low prices. Therefore, it will be important to investigate the dietary intake in consideration of their economic backgrounds and knowledge levels on food in further studies.

Although the schizophrenia group showed significantly higher energy intake than the NHNS group in this study, the relative calorie intakes from major nutrients (protein, fat, and carbohydrate) were considered similar between the 2 groups. This indicates that the dietary intake in patients with schizophrenia is generally similar to that in the general population. The results in this study are similar to those in the survey by Strassnig et al. (13) in which the schizophrenia group and the general population group were compared. However, our results were different from the finding by McCreadie et al. (8) and Henderson et al. (20) that the schizophrenia group had a lower dietary intake than the National Health and Nutrition Examination Survey (NHANES) group and normal controls. One important difference is that those

studies used different survey methods. There are various methods to investigate the dietary intake, and each method has advantages and disadvantages depending on the sizes and targets of surveys. Therefore, the differences in the survey results may result from the difference in survey methods. While the target of the survey by Henderson et al. (20) was the patients who slept for 10 hours or longer due to the sedative effect of psychotropic medications, the target of this study was the patients who attended ambulatory rehabilitation in the daytime and participated in simple employment training and recreational activities. In both the schizophrenia group and the NHNS group, the intakes of calcium and fiber were lower and the salt intake was higher than the dietary reference intakes in Japan. The schizophrenia group showed a lower fiber intake and higher salt intake than the NHNS group. Previous studies have suggested that dietary fiber suppresses energy intake, and high fiber intake correlates with lower weight (21). It is also reported that individuals with a higher calcium intake tend to have a lower body weight (22). According to dietary reference intakes for Japanese, 2010 the recommended dietary allowance of calcium is 600 mg more than less of the age groups of men and women 20 years of age or older (23). The characteristics of the dietary intake in patients with schizophrenia were lower intakes of nutrients related to the prevention of obesity, such as fiber and calcium, and a higher fat intake than the dietary reference intakes, which suggested the food constitution that is likely to increase the body weight. Therefore, in addition to the nutritional intake, the quality of food and individual food products should be investigated in further studies.

Limitation

This study has several limitations. First, the cross-sectional design does not allow the establishment of a cause-effect relationship, although it provides evidence about dietary intake and overweight and obesity. Second, several potential confounding factors, such as physical activity levels, socioeco-

nomic status, and antipsychotic medications, were not assessed in our study. Third, because all of the participants were volunteers who were interested in their health, they may not be representative of typical subjects with schizophrenia.

Conclusion

It was suggested that higher intake of energy, phosphorus, salt, and, particularly, higher fat intake occurred in patients with a BMI > 25 kg/cm². The high intakes of phosphorus and salt may reflect the fact that they often used fast food products. Patients with schizophrenia tended to have a lower fiber intake and higher salt intake than the NHNS group. The characteristics of the dietary intake in patients with schizophrenia were lower intakes of calcium and fiber and a higher intake of fat than the dietary reference intakes in Japan, which suggested the food constitution that is likely to increase body weight.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

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