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Original article

The evaluation on metabolic syndrome and nutrition in patients with schizophrenia

Nevin Şanlıer[1], Feride Ayyıldız[2], Murat Urhan[3], Onur Toka[4]

[1]Lokman Hekim University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara/Turkey - E-mail: nevintekgul@gmail.com; [2]Gazi University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara/Turkey; [3]Ege University, Faculty of Health Sciences, Department of Nutrition and Dietetics,İzmir/Turkey; [4]Hacettepe Uuniversity, Faculty of Science, Department of Statistics, Ankara/Turkey

Summary. The prevalence of metabolic syndrome (MetS) in patients with schizophrenia is increasing as is most diseases. It was aimed to assess eating habits, dietary intake, physical activity status and body composition which are important risk factors for MetS among patients with schizophrenia and compare with a healthy control group in this study. 32 patients with schizophrenia and 32 healthy controls aged 18-60 years were participated between September 2014-May 2015 in Turkey. The classification of MetS was examined by using three different methods. There wasn't any individuals in healthy control group who was diagnosed as MetS according to different MetS criterias. However the rate of MetS in patients with schizophrenia was high (43.8-46.9%). Their body weight, body mass index (BMI), fat mass, waist circumference, waist-hip ratios were also higher than the healthy control group ($p<0.05$). While their daily energy, protein, carbonhydrate and fat intake in these cases were higher ($p<0.001$), their physical activity levels were lower than the control group ($p<0.001$). Our findings suggest that MetS in schizophrenia patients is very prevalent. Further studies are still needed to research nutrition and anthropometric measurement in patients with schizophrenia.

Key words: Schizophrenia, metabolic syndrome, nutrition, anthropometric measurement, physical activity

Introduction

Metabolic syndrome (MetS), whose prevalance is increasing in recent years, has a negative effect on health both in healthy people and patients with psychiatric disorders. Metabolic syndrome (MetS) is an inflammatory state with a cluster of risk factors: abdominal obesity, dyslipidemia, elevated fasting glucose and blood pressure. This syndrome increases the risk of cardiovascular diseases (CVD), Type II diabetes mellitus (T2DM) and all-cause mortality (1). There are various definitions of metabolic syndrome made by organizations such as National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII), The World Health Organization (WHO) and The International Diabetes Federation (IDF). These definitions include elevated waist circumference, triglycerides, fasting glucose levels, blood pressure and decreased HDL-C levels. The most known and most preferred criteria was defined by the National Cholesterol Education Program Third Adult Treatment Panel (NCEP - ATP III) (2,3). In 2009, IDF, American Heart Association (AHA), the National Heart, Lung, and Blood Institute (NHLBI), World Heart Federation (WHF), International Association for the Study of Obesity (IASO), and International Atherosclerosis Society (IAS) made a consensus on a new harmonized definition (1).

Some studies show that the prevalence of metabolic syndrome (MetS) among the patients with schizophrenia is higher compared to the general population (4). Mackine et al (5), indicate a 2 to 3 fold higher

prevalence of MetS in patients with schizophrenia compared with the general population and it is also reported that women are more at risk for MetS. People with schizophrenia have a shorter life expectancy than the general population partly due to the effects of MetS's components (obesity, dislipidemia, hypertension and hyperglicemia) and cardiovascular morbidity (4-6). The risk of mortality from CVD in schizophrenia is 50.0-75.0% because of some risk factors such as smoking, sedentary lifestyle, antipsychotic drug treatment, obesity, dislipidemia (6). MetS includes these risk factors, too. The studies show that 2 fold greater prevalence of obesity (7) and 2-5 fold greater prevalence of T2DM (8) is found in patients with schizophrenia compared with the general population. These patients also have an increased risk for dyslipidemia (HR: 1.82) and hypertension (HR: 1.67) (9). Furthermore, MetS is associated with increased risk for T2DM (4 fold), CVD and stroke (2 fold) (10). When these risks are considered, the threat created by MetS will be understood better. Because of all these negative reasons, patients with schizophrenia may live approximately 15-20 years less than the general population (11).

The risk factors of MetS in schizophrenia include inadequate and unbalanced nutrition habits side effects of antipsychotic drugs which are used for the treatment of schizophrenia, increased prevalence of obesity, smoking, drinking alcohol, ethnicity, decreased physical activity due to negative semptoms of the disease and the deficiency of healthcare (11,12). Antipsychotics for treating schizophrenia may cause changes in appetite, weight, blood glucose levels, as well as insulin response (13). In addition, schizophrenic patients' diet and sedentary lifestyle have effects on weight gain. In addition, they have poorer nutrition habits than general population, while they consume fat, sugary foods and caffeine more, they consume fresh vegetables and fruits (fiber) less (14).

The aim of this study is to compare the risk factors for MetS including nutrition and physical activity status, body composition and some biochemical parameters in patients with schizophrenia compared to healthy control group.

METHODS

Subjects

Thirty-two patients with schizophrenia who were diagnosed according to DSM-V critera at Psychiatry Polyclinic of Manisa Mental Health and Diseases Hospital in Turkey and 32 healthy controls aged 18-60 years were participated in this study. The patients who use antipsychotic medication for at least six months and the participants in both groups whose nutrition status was stable for last six months were included in this study. Subjects who have a psychoactive substance addiction except cigarette and alcohol were excluded.

Ethical Considerations

The study was conducted after the approval of Istanbul Medipol University Non-interventional Clinical Researches Ethics Board, Istanbul, Turkey (21.03.2014/10840098-62). Clear explanations were provided for the individuals regarding the purpose of the study, then a written consent was obtained from all the subjects in accordance with the Declaration of Helsinki (World Medical Association).

Study Plan

The data were collected between September 2014 – May 2015. Demographical data and general information (age, gender, educational status, eating habits and physical activity status) were gathered from self-report questionnaires. Daily record of food intake, physical activity record, anthropometric measurements and body composition of individuals were evaluated. All datas were collected using face to face interview by trained dieticians.

A pilot study was conducted on 10 participants at the beginning of the study and minor changes were made to the confusing questions. The individuals that agreed to participate in the study answered the questionnaire in 25 minutes while sitting in a comfortable place.

Anthropometric Measurements

Anthropometric measurements and body composition of individuals were obtained by trained dieti-

cians. Anthropometric measurements taken were weight, height, waist and hip circumferences. Body composition was evaluated by bioelectrical impedance analysis (BİA) (TANITA BC 418) All measurements were taken appropriately. The square of the height was taken in meters and divided by body mass in order to calculate the BMI value (kg/m^2). The BMI values of the participants were grouped into three categories: normal/healthy weight (18.5-24.9 kg/m^2), overweight (25.0- 29.9 kg/m^2) and obese (≥30 kg/m^2) (15) Waist-hip ratio was classified, representing high risk for chronic diseases (CVD,T2DM etc.) when ≥0.90 in male and ≥0.85 in female (16).

Assesment of Nutrition Status

The present study analyzed dietary intake data using a 24-hour dietary recall. A questionnaire was administered to patients' relatives who were unable to answer questions about their dietary intake.

Daily total energy, macronutrients and micronutrients intake were calculated through a software program. The eating habits of individuals were investigated by a questionnaire, too.

Assesment of Physical Activity

Physical Activities (PA) done in a day were recorded with five minutes intervals to evaluate the individuals physical activity status. PAL was calculated (duration of activity*physical activity ratio (PAR))/24). Physical activity level (PAL) was defined as sedantery for 1.40-1.69, moderate exercise for 1.70-1.99 and vigorous exercise for 2.0-2.4 (17).

Biochemical Parameters

Biochemical parameters (fasting blood glucose (FBG), total cholesterol, high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), triglycerides (TG) were taken in the morning after an overnight fast. The analyses were conducted at Laboratory of Manisa Mental Health and Diseases Hospital. Blood samples were collected using 10-mL venipuncture tubes and they were evaluated using standard analytical techniques. After 5 minutes of supine rest, blood pressure was taken while participants were sitting. Raised BP was defined as greater than or equal to135/85 mm Hg.

The Evaluation of Metabolic Syndrome

The participants were evaluated according to three different MetS criteria. The diagnosis of metabolic syndrome was defined according to ATP III, IDF and consensus criterias were shown in Table 1.

Table 1. The diagnosis of metabolic syndrome according to ATP III, IDF and Harmonized criterias

	ATP-III-A NCEP (2) (min 3 criterias)	**IDF (3) (WC plus min 2 criterias)**	**Harmonized (2) (min 3 criterias)**
WC(cm)	Male≥102	Male≥94	Male≥94
Female≥88	Female≥80	Female≥80	
BP (mmHg)	≥130/≥85 or taking antihypertensive drug	≥130/≥85 or taking antihypertensive drug	≥130/≥85 or taking antihypertensive drug
HDL-C (mg/dL)	Male <40	Male <40	Male <40
	Female <50	Female <50	Female <50
TG (mg/dL)	≥150	≥150	≥150
FBG (mg/dL)	≥100 or taking antidiabetic drug	≥100 or taking antidiabetic drug	≥100 or taking antidiabetic drug

ATP-III-A: Adapted Adult Treatment Protocol,2004
IDF: International Diabetes Federation, 2005
Consensus: IDF and AHA/NHLBI, 2009
** WC*:Waist circumference *BP: Blood pressure, HDL-K-C: High density lipoprotein- cholesterol, TG: Trygliceride, FBG: Fasting blood glucose*

Statistical Evaluation of the Data

All statistical analyses were performed using SPSS (The Statistical Package for Social Sciences) Version 20.0 (SPSS Inc., Chicago, IL, USA). Counts, percentage (%) and mean ± standard deviation (SD) values were taken for the evaluation of the data. The comparisons between healthy and schizophrenic individuals made by Man Whitney U test. The differences were examined by using the results of Pearson probability and Fisher exact test chi-square. $p<0.05$ and $p<0.001$ was determined as the level of significance for all of the analyses.

Results

Sixty-four participants (32 cases, 32 controls) were included in the study. 53.1 % (n = 17) of patients with schizophrenia and 59.4 % (n = 19) of the control group were males. When educational status of the patients with schizophrenia was investigated it was seen that most of them were graduated from primary school, which is much lower than healthy individuals' educational status (p=0.00). There was not any individual diagnosed with MetS in the control group. MeTS was determined to be 43.8% according to ATP-III-A and IDF, also 46.9% according to Harmonized criterias in patients with schizophrenia. 75.0 % of the patients with schizophrenia were overweight or obese according to BMI classification but there were no healthy individuals in these classifications. In females, patients with schizophrenia had a significantly higher risk than controls according to waist-hip ratio risk classification (p = 0.002). No statistically significant difference was found between cases and controls in males in this classification.

The evaluation of some biochemical parameters in patients with schizophrenia and healthy controls were presented in Table 2. The ratio of individuals who have high blood pressure (p=0.001), high waist circumference (p=0.000), hypercholesterolemia (p=0.001), hypertriglyceridemia (p=0.000), high LDL-C (p=0.000) and high fast blood glucose (p=0.00) levels was higher in schizophrenic patients.

The evaluation of some anthropometric measurements and body compositions in patients with schizophrenia and healthy controls according to gender were illustrated in Table 3. The mean body weight, fat mass, waist and hip circumferences and BMI in patients with schizophrenia were significantly higher than healthy individuals of both genders ($p<0.05$). In females, fat free mass and waist-hip ratio were significantly higher than healthy individuals ($p<0.05$).

Table 2. The evaluation of some biochemical parameters in patients with schizophrenia and healthy controls

	Schizophrenia (n:32)	**Control (n:32)**		
	n (%)	**n (%)**	$\chi 2$	**P value**
High BP	17 (53.1)	4 (12.5)	11.978	0.001*
High waist circumference	25 (78.1)	3 (9.4)	30.730	0.000**
Hypercholesterolemia	14 (43.8)	2 (6.3)	12.000	0.001*
Hypertriglyceridemia	13 (40.6)	- (-)	16.314	0.000**
High LDL-C	25 (78.1)	11 (34.4)	12.444	0.000**
Low HDL-C	6 (18.8)	6 (18.8)	0.000	1.000
High FBG	13 (40.6)	3 (9.4)	8.333	0.004*

High blood pressure (BP): ≥130/≥85 mmHg
High waist circumference: Male ≥94 cm, Female≥80 cm
Hypercholesterolemia: T. Cholesterol >200 mg/dL
Hypertriglyceridemia: Triglyceride >150 mg/dL High LDL-C: LDL-C>100 mg/dL
Low HDL-C: Male <40 mg/dL, Female<50 mg/dL High FBG: FBG >100 mg/dL
**p<0.05; ***p<0.001*

Table 3. The evaluation of some anthropometric measurements and body compositions in patients with schizophrenia and healthy controls according to gender (SD)

		Schizophrenia (n:32) X□± SD	Control (n:32) X□± SD	MWU	P value
Height (cm)	Male	175.00±6.21	176.42±5.37	-.812	0.433
	Female	164.20±7.60	165.38±3.94	-1.157	0.254
Body weight (kg)	Male	80.74±12.92	70.38±6.09	-2.456	0.013*
	Female	89.92±20.04	59.18±4.11	-3.893	0.000**
Fat mass (kg)	Male	19.04±7.73	12.04±3.70	-2.899	0.003*
	Female	35.51±14.00	16.17±3.06	-3.846	0.000**
Fat mass (%)	Male	23.01±6.72	16.91±4.23	-2.837	0.004*
	Female	38.18±9.53	27.15±3.66	-3.318	0.000**
Fat free mass (kg)	Male	58.79±7.69	55.66±4.04	-1.870	0.061
	Female	51.33±9.52	42.01±4.30	-2.926	0.003*
Waist circumference (cm)	Male	96.70±14.44	85.44±4.66	-3.176	0.001*
	Female	108.26±18.94	74.07±4.64	-3.943	0.000**
Hip circumference (cm)	Male	107.11±9.88	97.15±4.76	-3.855	0.000**
	Female	117.20±14.28	93.55±5.02	-3.992	0.000**
Waist-hip ratio	Male	0.89±0.07	0.87±0.22	-.364	0.731
	Female	0.92±0.11	0.79±0.04	-3.248	0.001*
BMI (kg/m^2)	Male	26.42±4.63	22.59±1.40	-3.121	0.001*
	Female	33.36±7.54	21.62±1.02	-3.985	0.000**

** p<0.05; **p<0.001*

The assessment of some biochemical parameters and physical activity status in patients with schizophrenia and healthy controls was exhibited in Table 4. The average fasting blood glucose, T. cholesterol, TG, LDL-C levels, systolic and diastolic blood pressure values in patients with schizophrenia were significantly higher compared with controls (p<0.05). Besides PAL which is used to evaluate physical activity level was higher in healthy control group were significantly higher than the patients with schizophrenia (p<0.05).

Table 4. The assessment of some biochemical parameters and physical activity status in patients with schizophrenia and healthy controls

	Schizophrenia (n:32) X□± SD	Control (n:32) X□± SD	MWU	P value
FBG (mg/dL)	105.66±20.65	89.16 ±8.30	-3.293	0.001*
T.Cholesterol (mg/dL)	202.28 ±46.57	173.53±57.46	-3.210	0.001*
HDL-C (mg/dL)	51.66±8.15	54.38±9.17	-1.736	0.083
TG (mg/dL)	146.03±61.98	84.59±27.02	-4.466	0.001*
LDL-C (mg/dL)	123.56±36.32	92.84±21.06	-3.384	0.001*
Systolic BP (mmHg)	125.31±12.70	111.56±7.23	-4.697	0.001*
Diastolic BP (mmHg)	82.19±9.06	74.69±9.50	-2.964	0.003*
PAL	1.46±0.26	1.94 ±0.12	-6.153	0.001**

*PAL=Physical activity level, * p<0.05; **p<0.001*

The evaluation of energy and some nutrient intakes in patients with schizophrenia and healthy controls according to gender were shown in Table 5. In both genders, the mean intakes of energy, protein, carbohydrate, sucrose, fat, saturated fat, n-3 in patients with schizophrenia were significantly higher than the healthy control group ($p<0.05$). The mean intakes of fiber, monounsaturated fatty acid (MUFA) and vitamin E in the diets of females with schizophrenia were higher compared with controls ($p<0.05$). While tea, dried fruit, pizza and diet biscuits were the most consumed foods or drinks in the control group ($p<0.05$), carbonated beverages and sugar were the most consumed foods or drinks in patients with schizophrenia ($p<0.05$). In addition, consumption of milk and yoghurt was lower in patients with schizophrenia ($p>0.05$)

Discussion

MetS, whose prevalence increases rapidly, may vary from country to country. It was reported that patients with schizophrenia had a higher risk regarding the development of MetS compared with the general population. While Kozan et al. (18), found that the prevalence of MetS according to ATP-III was 33.9 %, it varies from 21.0% to 43.0% according to MetS cri-

Table 5. The evaluation of energy and some nutrient intakes in patients with schizophrenia and healthy controls according to gender

		Schizophrenia (n:32) $X \pm$ SD	**Control (n:32)** $X \pm$ SD	**MWU**	**P value**
Energy (kcal)	Male	3131.17±969.11	2225.57±534.42	-3.470	0.000**
	Female	3240.33±999.56	1735.61±340.65	-3.708	0.000**
Protein (g)	Male	99.11±32.54	72.10±17.39	-3.233	0.001*
	Female	91.40±33.47	62.69±19.21	-2.190	0.029*
Carbohydrate (g)	Male	394.00±132.39	280.47±80.14	-2.678	0.007*
	Female	407.33±139.89	206.30±77.68	-3.616	0.000**
Fiber (g)	Male	37.00±20.46	31.26±7.36	-.269	0.802
	Female	32.73±8.28	20.46±6.35	-3461	0.000**
Sucrose (mg)	Male	83.35±60.11	39.10±26.19	-2.330	0.019*
	Female	87.26±46.42	46.38±44.94	-2.651	0.007*
Fat (g)	Male	119.23±49.10	85.94±28.40	-2.964	0.002*
	Female	130.13±52.33	68.23±15.29	-2.99	0.002*
Saturated fat (g)	Male	36.67±15.29	24.45±14.64	-2.804	0.004*
	Female	42.40±15.46	23.13±5.56	-3.063	0.002*
Mono unsaturated fatty acid (MUFA) (g)	Male	39.44±19.09	28.95±10.50	-1.822	0.071
	Female	46.08±18.47	22.96±7.87	-3.294	0.001*
Polyunsaturated fatty acid (PUFA) (g)	Male	35.37±19.21	26.97±9.27	-.808	0.433
	Female	33.72±24.17	18.15±7.27	-1.958	0.052
Omega- 3 fatty acid (n-3) (g)	Male	2.01±0.93	1.30±0.39	-2.519	0.011*
	Female	2.16±1.02	1.40±0.84	-2.603	0.008*
Vitamin A (mcg)	Male	1642.05±1969.10	2110.57±4214.27	-.111	0.925
	Female	1696.20±1182.46	2189.00±4650.55	-1.543	0.130
Vitamin C (mg)	Male	178.52±215.96	207.26±134.58	-1.933	0.052
	Female	178.53±142.35	178.30±123.17	-.253	0.821
Vitamin E (mg)	Male	34.41±19.95	26.31±8.98	-1.095	0.285
	Female	33.80±25.99	17.15±6.92	-2.078	0.037*

** p<0.05; **p<0.001*

terias of ATP-III, ATP-III A, IDF in patients with schizophrenia in Turkey. In this study, it was determined to be 43.8% according to ATP-III-A and IDF, also 46.9% according to Harmonized criterias. As it is seen, the prevelance of MetS, which affects their lives negatively, is high among schizophrenic patients.

High waist circumference, high blood pressure and fasting blood glucose levels, which are one of the components of MetS, are remarkable in patients with schizophrenia. As is known, waist circumference is an important measurement which is correlated with visceral fat storage (19). Some studies reported that BMI, waist circumference and waist – hip ratio correlated with total body fat mass. However waist circumference and waist - hip ratio are better indicators than BMI for body fat distribution, intra-abdominal adiposity and risk for MetS (20). In this study, while 75.0% of patients with schizophrenia were obese or overweight according to the BMI classification, there were no individuals in these classes in the control group. In addition, the risk according to waist-hip ratio was higher in women who were diagnosed as schizophrenia. This case may be associated with the increase in the frequency of abdominal obesity in women, which is a great risk for MetS. Abdominal adiposity raises important metabolic risks. Increased blood pressure, insulin resistance and dyslipidemia which are important health problems are associated with pro-inflammatory cytokines secreted by visceral tissue (21). In this present study, the ratio of individuals with high waist circumference was greater in patients with schizophrenia (p=0.000) (Table 2). Morever, the rate of high blood pressure, hypercholesterolemia, hypertriglyceridemia, high LDL-C and elevated blood glucose levels were higher in the patients with schizophrenia (Table 2). The pro-inflammatory cytokines which increase by the presence of abdominal obesity may be associated with these parameters.

Several studies show that the prevalence of obesity is 2-5 times higher in patients with schizophrenia than general population (5,7,8). In this study, the ratio of obesity and mean BMI in patients with schizophrenia were significantly higher than control group (p = 0.001) (Table 3). Besides the view of the effect of antipsychotic medication on weight gain, it was shown that there was an increase in body weight independent of such drugs (22). The factors such as inadequate and unbalanced eating habits, sedentary lifestyle and genetic predisposition contribute to the increased prevalence of obesity in these patients (23). It is important to have healthier eating habits in patients with schizophrenia, who have higher body weight as well as body fat mass and waist circumference (Table 3). In addition to these, the consumption of high fiber and foods which have less fat content (fruits, vegetables etc.) is important in the maintenance of healthy body weight and the prevention of excessive-weight gain.

Energy imbalance which occurs as a result of increased energy intake and decreased physical activity leads to an increase in body weight. In this study, patients have lower physical activity level (PAL) (Table 4) (p <0.001), and higher energy intake (p = 0.000) (Table 5) compared to the control group. Regular physical activity is quite important in the prevention and treatment of hypertension, obesity, diabetes, impaired glucose tolerance and dyslipidemia (14,17,23) However, in this study, 69% of the patients with schizophrenia do not work in any establishment and they sleep an average of 11 hours a day and spend about 10 hours sitting and lying down. Similarly, Henderson et al (24), found that patients with schizophrenia had been sleeping about 10 hours. Faulkner et al (25), showed that 77% of patients with schizophrenia didin't work in any establishment. The sedation caused by antipsychotic drugs may be a cause of a decrease in physical activity of patients with schizophrenia (26). With the increase in physical activity, it is possible that there is a decrease in the prevalence of diseases, which are accompanying schizophrenia and associated with obesity such as cardiovascular diseases, diabetes and MetS.

Increased energy and fat intake in patients with schizophrenia are risk factors for cardiovascular diseases and diabetes mellitus. The prevalence of diabetes in patients with schizophrenia is 2-5 times more than the general population (8). In this study, energy, fat, saturated fat intake of both male and female individuals diagnosed with schizophrenia were higher than the control group (p = 0.000) (Table 5). In addition FBG, T. Cholesterol, TG, LDL-C levels and blood pressure were higher in schizophrenic patients (Table 4). Main reasons for this finding is thought to be genetic predisposition, neuroendocrine disorders, antipsychotic

drugs, poor eating habits and sedentary lifestyle (27). It is thought that reducing these values which are risk parameters of cardiovascular diseases, diabetes mellitus and MetS in normal levels will affect the life expectancy of patients with schizophrenia.

In schizophrenic patients, energy, protein, carbohydrate, sucrose, fat (g), saturated fat, and n-3 intake were significantly higher than healthy people ($p < 0.05$) (Table 5). Similarly, Ito et al (28), found that patients with schizophrenia had higher energy, carbohydrate, fat, fiber, calcium and phosphorus intake than the control group. Strassing et al (29), found that PUFAs and saturated fatty acid intake is higher in patients with schizophrenia but there was no difference in n-3 intake. In this study, saturated fat intake in both genders was higher, whereas MUFA intake was higher in only women with schizophrenia ($p < 0.05$). As is seen, there isn't a certain conclusion about dietary intake. It was thought that long-term studies with large samples will be useful to observe the effect of dietary intake.

American Heart Association (AHA) reports that there should be a maximum 7% of energy from saturated fat in diet (30). In this study, the portion of energy from saturated fat in patients with schizophrenia was found 11%. It is known that while saturated fatty acid exacerbate the insulin resistance which are major components of MetS, PUFA and MUFA have adverse affects (31). It can be said that because of this effect, the intake of balanced unsaturated fatty acids may contribute to the treatment of MetS.

It was indicated that antioxidant vitamins have positive effects on the treatment of patients with schizophrenia. However in this study there was no difference in vitamin A and C intake between the patients and the controls. Besides, female patients had higher vitamin E intake than female controls but there was no difference in males (Table 5). Similarly, Strassing et al (29), showed that there was no difference in the intake of antioxidant vitamins (A, C, E) between the patients with schizophrenia and the controls. There is a need for further studies for more exact results.

Christen and Chrisen (32), reported that nutrition had significantly correlated with symptoms of schizophrenia. Countries where people who had Mediterranean-style diets, (higher seafood, fruit and vegetable consumption) had a lower rate in symptoms of schizophrenia compared to countries with a high proportion of saturated fat diet. Kilbourne et al (33), indicated that patients with schizophrenia had poorer nutrition than the general population. It is known that patients with schizophrenia make poor dietary choices and their tendency to have increased caloric intake including a higher total dietary fat consumption than healthy individuals has been indicated previously (34). This study shows that sugar and soft drinks consumption preferences have a higher rate in patients with schizophrenia. High energy intake which is not provided by an adequate and a balanced diet can increase the risk of chronic diseases. Unhealthy foods such as high energy food and drinks (fast food, beverages, dessert etc.) are more frequently consumed in the diet of patients with schizophrenia. European Society of Cardiology (ESC) and WHO suggest that refined sugar intake should not exceed 10% of the total energy in general nutrition for heart health protection (35). In this study, sugar consumption in patients with schizophrenia was found about 11% of daily energy. It is thought that high saturated fat and sugar intake may be effective in the etiology of schizophrenia as well as heart diseases. This mechanism may be related with brain-derived neurotrophic factor (BDNF) and it was found that hippocampal BDNF expression decreased in rats fed by a diet containing high refined sugar. Decreased BDNF expression was seen in the prefrontal cortex of patients with schizophrenia and in this case may be directly related with the etiology of schizophrenia (36).

Conclusion

MetS prevalence is increasing all over the world. It is a serious problem which is associated with diabetes mellitus and morbidity and mortality of cardiovascular diseases. People with schizophrenia have a predicted increased risk of both coronary heart diseases and stroke. Because MetS is common in patients with schizophrenia, it is associated with a shorter life expectancy of these patients.

Healthy nutrition programs to reduce the risks of disease and monitoring disease processes regularly are very important. A multidisciplinary approach provides

a benefit to patients. It is very useful to monitor patients by easy methods such as blood pressure, waist circumference and biochemical analysis. According to the course of treatment, it is also useful to change drugs causing patients to put on weight, to consider drug-nutrient interactions and to increase physical activity level.

Nutrition education is beneficial to ensure weight loss and protect optimal body weight because obesity is a major problem in patients with schizophrenia. In addition, this education might be useful for a long-term behavior change and increasing physical activity levels.

Limitations

A clear limitation is the relatively small sample size that resulted from unwillingness to complete the assessments or patients being unreachable.

It is believed that controlled observational studies with large samples will contribute to the literature.

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Correspondence:
Nevin Şanlıer
Lokman Hekim University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara/Turkey
E-mail: nevintekgul@gmail.com