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Original Research

Assessment of sleep quality, depression and nutrition habits of adults with insulin resistance

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Abstract

Background and aims: The aim of this study was to evaluate sleep quality, depression status, and nutrition habits of adults with insulin resistance. **Material and method:** The study was completed with 121 insulin resistance patients, 74 women and 47 men, aged between 18 and 65 years. The researcher applied to the participants a questionnaire including the Pittsburgh Sleep Quality Index (PSQI), CES Depression Scale (CES-D), Night Eating Questionnaire (NEQ) and 24-Hour Food Consumption Registration Form. **Results:** The mean age of the insulin resistance patients was found to be 38.64±12.71 years and 2.47±2.82 years. It has been determined that 50.7% of the participants follow a low-carb diet. About 54.5% of individuals had poor sleep quality and 52.9% had high depression levels. It was determined that 11.5% of them had night eating syndrome. **Conclusions:** This study shows that individuals with insulin resistance should be monitored in terms of sleep quality, depression and night eating behavior. These results should be supported with new studies.

Keywords: insulin resistance, sleep quality, depression, nutrition habits.

Background and aims

Insulin resistance is defined as the failure to generate the normal biological response to insulin secreted above a certain level in the human body or impairment of the expected effect and inadequate response to insulin [1]. The incidence of insulin resistance in our country is 26.2% [2]. Some studies have reported that the incidence of insulin resistance is 46.5% [3] in Venezuela and 51.8% [4] in Brazil. The rapid increase in insulin resistance and related complications in our country and the world in recent years has been reported to be associated with a sedentary lifestyle and changes in eating habits [5].

The leading known techniques for evaluating insulin sensitivity are the costly hyperinsulinemic-euglycemic clamp (EGC) and the frequently sampled intravenous glucose tolerance test (FSIVGTT) [6]. Although the gold standard among diagnostic methods for determining insulin resistance is recognized as the EGC test, it is not used in practice because it is difficult and takes a long time to get results [7]. Apart from these tests, homeostasis model assessment insulin resistance (HOMA-IR) and quantitative insulin sensitivity check index (QUICKI) are used in routine clinical studies as more suitable alternatives for fasting glucose and insulin measurements due to their cost-efficiency, fast

result yielding aspect, and effective reference methods [6].

The presence of abdominal obesity is considered to be the most important indicator of insulin resistance. Insulin resistance associated with obesity occurs due to pre-receptor, receptor, and/or post-receptor impairments secondary to elevated free fatty acids, hyperinsulinemia, and increased cytokines [6]. According to the report of TURDEP-II (Turkey Diabetes Prevalence Study), 34.0% of people aged 20 or older present abdominal obesity [8].

Among modifiable lifestyle factors, smoking and alcohol use and low-fiber and/or high-sugar diet consumption increase susceptibility to insulin resistance. Especially some types of carbohydrates have an important effect on the development of insulin resistance due to their high glycemic index among other nutrients. On the other hand, ethnicity and low-impact polymorphisms, which are among unchangeable risk factors, can be listed as genetic predisposition factors. Also, advancing age may affect the development of insulin resistance [9].

It is known that a decrease in sleep time affects glucose metabolism and impairs glucose tolerance. Although sleep deprivation leads to increased glucose production by indicating hepatic insulin resistance, short night sleep has been found to be associated with increased plasma levels of highly non-esterified fatty acids [10]. The deterioration of sleep quality due to depression can cause late-hour food consumption. It is thought that depression, sleep quality, and body mass index are a mediator that leads to night eating syndrome [11].

In light of these data, this study was carried out to evaluate the sleep quality, depression status, nutritional habits, and anthropometric measurements of individuals with insulin resistance.

Material and method

This study used a descriptive design and was conducted between February 2019 and April 2019 with 121 patients, including 74 females and 47 males, who had insulin resistance, who were aged between 18 and 65, who presented to Baskent University Ankara Hospital Department of Internal Diseases – Endocrinology and Metabolic Diseases Outpatient Clinic, and who voluntarily accepted to participate in the study. Individuals diagnosed with sleep apnea, diabetes, reflux, gastritis, morbid obesity, and major depression were not included in the study to prevent bias. Individuals who signed the voluntary consent form were included in the study. The study was approved by the Başkent University Clinical Research Ethics Committee (Date: 20/02/2019 and issue: KA19 / 35).

Data collection and analysis

A questionnaire form with multiple choice and/or open-ended questions was administered to determine the socio-demographic characteristics and general eating habits of the participants. Apart from general characteristics and eating habits, the questionnaire form involved the Pittsburgh Sleep Quality Index (PSQI), the Center for Epidemiologic Studies Depression Scale (CES-D), Night Eating Questionnaire (NEQ), and the 24-Hour Dietary Recall Form. The researcher filled out the questionnaire form by interviewing each patient in person. Participants' body weight was measured with a portable digital scale, their height was measured with a height scale, and waist and hip circumference were measured with a non-stretch tape measure. As a result of the measurements, the body mass index (BMI) value was calculated and recorded in the related form. The results obtained were evaluated according to the classification of the World Health Organization [12, 13].

The Pittsburgh Sleep Quality Index (PSQI): The PSQI was developed by Buysse et al. [14], and its validity and reliability study was carried out by Ağargün et al. [15]. The scale assesses sleep quality with questions under seven main topics. The questions are answered by considering the sleeping habits in the last month, and the answers are scored between 0 and 3. The sum of the scores obtained from seven components gives the PSQI score. The lowest and highest scores that can be obtained from the scale range between 0 and 21. A score of 5 or greater shows poor sleep quality.

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The Night Eating Questionnaire (NEQ): This questionnaire was developed by Allison et al. [16] to determine the presence of night eating syndrome, and its Turkish validity and reliability study was conducted by Atasoy et al. [17]. The questionnaire consists of 14 questions in total, and the lowest and highest scores range between 0 and 52. A score of 25 or greater indicates the presence of night eating behavior [17].

The CES Depression Scale (CES-D): This scale was developed by Radloff [18] to measure the depression symptoms, and its Turkish validity and reliability study was conducted by Tatar and Saltukoğlu [19]. Getting a score of 16 or greater from the scale, which consists of 10 items, indicates increased depression levels.

The 24-Hour Dietary Recall Form: A 24-hour dietary recall data were collected from the participants. The Computer-Aided Dietary Program, Dietary Information Systems Software Package (BEBIS), which was designed for Turkey, was employed to determine and assess participants' daily dietary intake of energy and nutrients. The calculated energy and nutrient data were assessed according to "Dietary Reference Intake: DRI" classified by age and gender [20].

The Visual Analogue Scale (VAS): This scale is used to convert values that cannot be measured numerically into numerical values. Two end definitions of the parameters to be evaluated are written on both ends of a 10 cm line, and the patient is asked to indicate the point that their condition matches on this line. This line may be straight or it may be evenly divided [21]. In this study, the scale was administered to the participants to let them assess their appetite before and after they had been diagnosed with insulin resistance.

Statistical analysis of the data

The SPSS 17.0 software package was used to evaluate the data. Descriptive statistics included numbers (S) and percentages (%) for categorical variables and arithmetic mean (X), standard deviation (SS), and lower and upper values for continuous variables. Fisher's exact test, Yates Chi-square test, and Pearson's Chi-square test were used in the comparison of categorical variables. T-test and Mann-Whitney U-test were used to compare the differences in independent groups. The correlation analysis was employed to reveal the relationship between two quantitative variables. The statistical significance level was accepted as $p<0.05$ in the analysis of all hypothesis tests.

Results

A total of 121 people, 74 of whom were female (61.2%), participated in the study. The mean age of the participants was 38.6±12.71 years, and 65.3% of the participants, who had insulin resistance for an average of 2.4±2.82 years, did not have any other diseases. Also, 39.7% of them were found to regularly use drugs for the treatment of insulin resistance (Table 1).

Table 1: The distribution of data regarding the general characteristics and health status of the participants.

	Participants (n=121)	
	n	%
Gender		
Female	74	61.2
Male	47	38.8
Age (year), XSD	38.6±12.71	
Chronic diseases		
Yes	42	34.7
No	79	65.3
Type of disease*		
Obesity	10	8.3
High cholesterol	12	9.9
Hypertension	10	8.3
Hypothyroidism	10	8.3
Insulin resistance (year), XSS	2.4*2.82*	
Regularly use drugs		
Yes	48	39.7
No	73	60.3

*Percentages are based on multiple responses.

Table 2 shows data on the eating habits of the participants. Accordingly, 59.5% were found to consume three main meals, 34.7% consumed two snacks, and 88.4% skipped meals. The most frequently skipped meals were snacks (93.5%) and lunch (43.9%). It was determined that the participants mostly preferred fresh/dried fruits (43.2%), coffee/tea (22.7%), and milk/yogurt/yogurt shake (18.2%) for snacks.

It was determined that 62.0% of the participants received dietary recommendations, and 69.3% of them followed these recommendations. Of the diet types followed, 50.7% were low carbohydrate, 22.7% were weight loss, and 21.3% were low-fat diet. Also, 66.7% of the participants were found to receive these dietary recommendations from a dietician. When the mean hours of snacks were calculated, it was found that the participants had mid-morning, late afternoon, and night snacks at 10:46 am, 15:39 pm, and 21:03 pm, respectively. The mean daily water consumption of the participants was 1880.9±836.09 ml (Table 2).

Table 3 presents the participants' mean daily energy and macronutrient consumption, standard deviations, and lower and upper values. Accordingly, the mean daily energy consumption of the participants was 1487.2±392.04 kcal. The share of energy from carbohydrates in total energy was 40.7±8.58%; it was 18.4±4.67% from protein and 40.6±8.46% from fat. The daily fiber consumption was found to be 23.2±9.16 g (Table 3).

Table 4 shows the distribution of the participants' scores from PSQI, CES-D, and NEQ scales by gender.

In Table 4, it was determined that 56.8% of the females and 51.1% of the males had poor sleep quality (≥5 points). In addition, 54.1% of the females and 51.1% of the males had high depression levels (≥16 points). Moreover, 9.5% of the females and 14.9% of the males had night-eating syndrome (≥25 points).

In Table 5, the scores of the participants regarding their appetite before and after insulin resistance were evaluated according to gender. Accordingly, it was determined that the mean appetite score in females was 3.4±1.02 before insulin resistance and that it decreased to 3.2±1.07 after the diagnosis of insulin resistance.

Table 2: The distribution of data regarding the eating habits of the participants.

	Participants (n=121)	
	N	%
Main meal		
1	2	1.7
2	47	38.8
3	72	59.5
Snacks		
0	23	19.0
1	30	24.8
2	42	34.7
3	26	21.5
Meal skipping		
Yes	107	88.4
No	14	11.6
Skipped meal*		
Breakfast	16	15.0
Lunch	47	43.9
Dinner	10	9.3
Snacks	100	93.5
Mostly preferred*		
Fresh/dried fruits	19	43.2
Milk/yogurt/yogurt shake	8	18.2
Crackers, biscuits	5	11.4
Chocolate, wafer	3	6.8
Nuts	6	13.6
Diet product, grissini	3	6.8
Coffee/tea	10	22.7
Dietary recommendations		
Yes	75	62.0
No	46	38.0
Followed recommendations		
Yes	52	70.3
No	22	29.7
Diet types		
Weight loss diet	17	22.9
Low carbohydrate diet	38	51.3
Low fat diet	16	21.6
High proteins diet	1	1.4
Mediterranean diet	2	2.8

(continues)

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Table 2: Continued

	Participants (n=121)	
	N	%
Dietary recommendations from		
Dieticians	50	66.7
Doctors	22	29.4
Trainers	1	1.3
Themselves	1	1.3
Hours of snacks, X̄		
Mid-morning	10.46	
Late afternoon	15.39	
Night snacks	21.03	
Water consumption (ml), X̄SD	1880.9±836.09	

*Percentages are based on multiple responses.

In males, on the other hand, the mean appetite score, which was 3.6±0.68 before insulin resistance, increased to 3.8±0.89 after the diagnosis of insulin resistance.

Discussion

The incidence of insulin resistance in our country is 26.2% (2). It is estimated that 33% of adult individuals in the US will have insulin resistance in 2050 [22].

A nutritional plan should be created to include 45–60% of energy from carbohydrates, 10–20% from proteins, and 20–35% from fat in individuals with insulin resistance as in healthy adults [23]. In this study, 40.7% of the mean daily energy intake of the participants was found to come from carbohydrates, 18.4% from proteins, and 40.6% from fats. Accordingly, it was determined that the proportion of total energy coming from carbohydrates was low, but that the proportion from fat was high. With this respect, the findings of the present study were consistent with those of Öçal [24]. Also, 70.3% of the participants in this study stated that they followed a low carbohydrate diet. This suggested that the participants were most probably following popular diets, not healthy diets. Besides, the daily fiber consumption of the females in this study was below the recommendations [23]. Deer et al. [25] found that insulin resistance developed in individuals who got 9–67% of their daily energy intake from saturated fat. In the current study, the proportion of the mean daily energy consumption of the participants from saturated fat was 14.0±3.97%. Fasching et al. [26] compared diets rich in saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, and carbohydrates, and they found no difference

Table 3: Participants' energy and macronutrient consumption, and minimum, maximum, mean (X), and standard deviation (SD) values.

Energy and nutrients	Participants (n=121)		
	Min	Max	XSS
Energy (kcal)	631.49	3074.43	1487.2±392.04
Carbohydrate (g)	43.62	285.15	147.9±49.80
Carbohydrate (TE%)	13.00	65.00	40.7±8.58
Protein (g)	18.54	141.76	66.6±23.33
Protein (TE%)	10.00	34.00	18.4±4.67
Fat (g)	15.41	164.43	67.9±22.22
Fat (TE%)	21.00	73.00	40.6±8.46
Monounsaturated fatty acid (%)	23.00	251.00	17.3±4.61
Polyunsaturated fatty acid (%)	7.60	32.50	6.7±3.74
Saturated fatty acid (%)	2.36	20.05	14.0±3.97
Fiber (g)	4.49	29.26	23.2±9.16

Table 4: Distribution of the participants' scores from PSQI, CES-D, and NEQ scales by gender.

PUKİ	Kadın (n=74)		Erkek (n=47)		Toplam (n=121)		p-Value
	S	%	S	%	S	%	
<5	32	43.2	23	48.9	55	45.5	0.670[a]
≥5	42	56.8	24	51.1	66	54.5	
CES-D							0.893[a]
<16	34	45.9	23	48.9	57	47.1	
≥16	40	54.1	24	51.1	64	52.9	
GYA							0.536[a]
≥25	7	9.5	7	14.9	14	11.5	
<25	67	90.5	40	85.1	107	88.5	

[a]*Pearson correlation.*

Table 5: Distribution of the participants' mean VAS scores by gender.

Appetite score, XSD	Women (n=74)	Men (n=47)
Before insulin resistance	3.4±1.02	3.6±0.68
After insulin resistance	3.2±1.07	3.8±0.89

in insulin resistance caused by the type of the diet.

The habit of not consuming regular meals and skipping meals affects the preferred foods and the total amount of food consumption during the day and causes the consumption of foods rich in fat and carbohydrates, especially, to suppress the feeling of hunger. It has been reported that the habit of skipping meals is more common, especially among individuals with slightly overweight and overweight [27]. In a study on obese and insulin-resistant women, Ayata [28] found that 32.0% of the participants skipped meals. In another study, individuals consuming ≥4 meals and those consuming ≤3 meals a day were compared, and it was found that the risk of obesity was 45% lower in the first group [29]. In this study, 88.4 of the participants were found to skip meals.

One of the basic physiological needs of human beings that ensures the continuity of health is sleep. Irregular sleep negatively affects glucose metabolism by causing the development of meal skipping behaviors and plays a role in the development of obesity and type 2 diabetes. In the deep phase of non-REM sleep during normal sleep, sympathetic nerve activity decreases, but when the individual does not sleep on time and has adequate sleep, the increase in norepinephrine level contributes to the development of insulin resistance as it increases glycogenolysis and gluconeogenesis [30].

Depression, which occurs along with a series of mental and physical symptoms, including mental depression and/or loss of desire/interest, is another condition that has an impact on general health [31]. Generally, blood sugar imbalances directly affect the brain and mental functions. Likewise, blood sugar is also affected by mental and emotional changes [32]. Also, serotonin hormone, which is highly associated with mood, affects food selection, leptin, corticosterone inflammatory mechanisms, plasma glucose exchange, and the development of insulin resistance [31, 33]. In the study of Asghar et al. [34], 20 Pakistani women, who were newly diagnosed with depression, were administered euglycemic insulin clamp to measure insulin sensitivity, and a significant improvement in insulin sensitivity was observed after treatment for depression. In another study by Adriaanse [35], the CES-D score was found to be ≥16 in 15% of females and 9% of males with insulin resistance. In the present study, 52.9% of the participants had high levels of depression.

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Night-eating syndrome is another common eating behavior disorder, especially common in individuals who cannot achieve glycemic control [11]. Poor sleep quality, developing especially due to depression, can cause night time food intake. Therefore, depression and sleep quality are thought to be effective in night eating syndrome [36]. In the present study, it was determined that 69.7% of the participants with poor sleep quality had higher depression levels and that 92.9% with night-eating syndrome had high depression levels ($p<0.05$).

In the present study, more than half of the individuals who had developed insulin resistance had poor sleep quality and high levels of depression (54.5% and 52.9%, respectively). Although these results were not statistically significant ($p>0.05$), they were remarkable when evaluated in terms of frequency. However, night-eating syndrome was found to be low (11.5%) in this population. It is thought that effective treatment of depression can improve insulin resistance and reduce depression symptoms. To prevent the development of insulin resistance, enough attention should be paid to lifestyle changes (eating habits, sleep patterns, body weight management, and exercise), which are some of the changeable risk factors. When individuals in slightly overweight or overweight groups can achieve weight loss with a healthy and balanced diet, this will help increase insulin sensitivity. Another situation that affects insulin sensitivity is the food choices in the daily diet. Substitution of high glycemic index foods with low-glycemic index foods, preferring whole-grain carbohydrates and high-fiber foods, reducing saturated fats to a minimum, and consuming mono and polyunsaturated fats in appropriate amounts are all important. In this context, the evaluation of these factors in the treatment of insulin resistance is very important in the treatment of patients.

Conclusions

These findings highlight the significance of depression, sleep quality, and night eating factors associated with insulin resistance.

In this study, the participants' physical activity status was not questioned, and detailed body analyses were not performed. This can be considered as a limitation of the current study. Therefore, we recommend that the results of the study should be supported with more comprehensive studies in larger samples to present clearer recommendations.

Conflict of interest

The authors declare no conflict of interest.

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