ABSTRACT

Aim: To investigate the relationship between sleep disorders and depression in patients with metabolic syndrome.

Methods: This descriptive and cross-sectional study included 63 patients with metabolic syndrome. Participants were assessed with Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale and Beck Depression Index. Mann-Whitney U and Spearman Correlation tests were used for data analysis.

Results: Mean ages were 40.6±10.2. Sleep quality was poor in 38.7% (n=24), excessive daytime sleepiness was reported by 55.7% (n=34), and depression scores were high (>17 points) in 12.7% (n=8) of the patients. There was no significant correlation between sleep quality, daytime sleepiness, average sleep duration and metabolic parameters. PSQI (p=0.027) and depression scores (p=0.031) were higher in female patients compared to male patients. Depression scores were positively correlated with PSQI scores (r=0.538, p<0.001) and negatively correlated with average sleep duration in our study population (r=0.293, p=0.013).

Conclusion: Sleep quality was negatively correlated with depression scores and worse in female patients. Assessing and treating sleep problems and depression associated diseases particularly in female patients may improve the quality of life.

Keywords: metabolic syndrome, sleep disorders, depression

ÖZET

Amaç: Metabolik sendromlu hastalarda uyku bozuklukları, uykululuk ve depresyon ilişkisinin araştırılması amaçlanmıştır.


Bulgular: Olguların yaş ortalaması, 40,6±10,2 yıl olarak bulundu. Uyku kalitesi kötü olanların (Global Uyku Kalitesi Puanı (PUKİ) >5) sayısı %38,7 (n=24), gündüz aşırı uykululuk sıfırlı ise %55,7 (n=34) idi. Beck Depresyon puanı yüksek (BDP>17) olanların sıfırlı %12,7 (n=8) olarak bulundu. Uyku kalitesi, Gündüz Uyku Kalitesi, ortalama uyku süresi ve metabolik parametreler arasında anlamlı bir ilişki saptanmadı. Uyku kalitesi ve depresyon puanları, erkeklerde göre kadın hastalarda anlamlı yüksek bulundu (sirsaysyla p=0,027, p=0,031). BDP ile PUKİ arasında pozitif (r=0,538, p<0,001), ortalama uyku süresi ile BDP arasında negatif yönde ilişki bulundu ( r=-0,293, p=0,013). 

Sonuç: Uyku kalitesi depresyonla ilişkili ve erkeklerde göre kadın hastalarda uyku kalitesi daha kötü bulundu. Özellikle kadın hastalarda olmak üzere, uyku sorunları ve depresyonla ilişkili hastalıklara yönelik taraflar ve koruyucu yaklaşımların yaşam kalitesini arttırabileceği öngörülebilir.

Anahtar kelimeler: metabolik sendrom, uyku bozuklukları, depresyon

Introduction

Sleep disorders and depression are common clinical problems that generally correlate with poor quality of life (1-3). The prevalence of metabolic syndrome is also increasing worldwide as obesity and there are possible associations between sleep difficulties, metabolic syndrome and depression (4). According to a trial by
metabolic syndrome in Turkey, about one third of the adult population has metabolic syndrome, with the prevalence as 36.6% according to ATP III and 44.0% according to IDF (5). The increasing prevalence of metabolic syndrome is thought to be related with genetic and environmental factors; mostly with lifestyle, being overweight and inactive (6). The studies have shown associations between sleep disorders and leptin and/or ghrelin-related appetite increase and growth hormone and cortisol (7,8).

The link between metabolism and sleep problems may be the result of a new era. Today we are independent from the solar time as the case in the old times. By the artificial enlightenment, we have longer work days and shift works, we use more media such as television, radio and computers which may disrupt our sleep routine, all affecting both metabolism and sleep hygiene (9).

In this study, we aimed to search for the relationship between sleep disorders and depression in patients with metabolic syndrome.

Methods

This descriptive, cross-sectional study included 63 patients diagnosed with metabolic syndrome who attended the outpatient clinics at Baskent University Istanbul Hospital. All participants were assessed with sociodemographic questionnaires, anthropometric measures, biochemical parameters. The individuals who were noncooperated or non agreed to be volunteers, diagnosed with psychiatric diseases, with organ failure or chronic illness or mentally or physically disabled, using medications that affect sleep, mood and metabolism and aged under 18 and over 70 years were excluded from the study. Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with the ethical principles stated in the “Declaration of Helsinki” and approved by the institutional ethics committee of Baskent University Faculty of Medicine (KA12/41).

Metabolic syndrome was defined according to presence of three or more of the following criteria based on the definition released by World Health Organization for the Diagnostic Criteria of Metabolic Syndrome: 1) high blood pressure; systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg, 2) dyslipidemia; triglyceride ≥150 mg/dl 3) HDL-C <40-50 mg/dL for men and women, respectively 4) glucose intolerance; fasting plasma glucose >100mg/dl 5) abdominal obesity with waist circumference >94 cm for men or >80 cm for women.

BMI was calculated as weight (kg) divided by squared height (m2). Waist circumference were measured at the midpoint between the anterior superior iliac crest and the lowest rib. BMI was calculated as weight (kg) divided by squared height (m2).

Evaluation with scales

Epworth Sleepiness Scale: A questionnaire for assessing daytime sleepiness (EPSS) EPSS scores ≥10 were considered to show excessive daytime sleepiness (EDS). Izci B et al have demonstrated that EPSS is reliable and valid for Turkish population samples (10).

The Pittsburgh Sleep Quality Index (PSQI): This scale was used in all of study participants to evaluate the sleep quality and sleep disturbances measuring as self-reported information tool to assess the sleep disturbance, such as insomnia, sleep apnea and restless legs. The PSQI is a questionnaire for evaluating subjective sleep quality over the previous month with a global score ranging from 0-21, with higher scores (>5) indicating poor sleep quality. The clinical and psychometric properties of the PSQI have been formally evaluated by several research groups (11,12). The PSQI has a sensitivity of 89.6% and specificity of 86.5% for identifying patients with sleep disorder. Agargun MY et al have shown PSQI to be valid in Turkish population samples (13).

Beck Depression Inventory (BDI): It was used to establish an underlying depressive illness as a contributing factor in sleep disorders. Beck Depresyon Index were assessed as the scores 0-9: no depression, 10-17: mild depression, >17: moderate or severe depression (14). Aalto AM, 2012). The Beck Depression Inventory, a 21 item screening questionnaire comprising 13 cognitive and 8 somatic questions was used to assess the affective, motivational, cognitive and somatic symptoms of depression. Each item of the inventory scores 0-3
points with the high total scores showing severe depression. Studies have demonstrated that BDI is reliable and valid for Turkish population samples (15).

Statistical analysis

Statistical analysis was conducted using the SPSS statistical software package version 16.0 (SPSS Inc.). Data are expressed as mean and standard deviation or as number and percentage. Mann-Whitney U and Spearman Correlation tests were used for the comparison of nonparametric variables. Statistically significance was considered as p value of less than 0.05.

Results

The mean ages were 40.6±10.2 years, 54% (n=34) of the patients were female, 64.1% were highly-educated (graduates of high school and college) and 79.6% were married (Table 1). There was no significant association between sleep quality, daytime sleepiness, sleep duration and education levels and/or marital status. The mean BMI were 31.1±4.9 kg/m² (range 24.2-45.9). The mean waist circumferences were 101.9±11.6 cm. (range 85-129) in female patients and 106.9±8.9 cm (range 93-131) in male patients, respectively (Table 1).

Global sleep quality was poor (PSQI>5) in 38.7% (n=24), excessive daytime sleepiness was reported by 55.7% (n=34), and depression scores were high (>17 points) in 12.7% (n=8) of the patients.

| Table 1. Sociodemographic characteristics and anthropometric measures of the study group. |
|-----------------|-----------------|-----------------|
| **Gender**      | **Female n (%)**| **Male n (%)**  |
| Age (years)     | Mean (range)    | Mean (range)    |
| Education       | Low (%)         | High (%)        |
| Marital status  | Married         | Single          |
| BMI (kg/m²)     | Mean (range)    | Mean (range)    |
| Waist circumference (cm) | Female Mean (range) | Male Mean (range) |

The average sleep duration were higher in male patients compared to female patients (p=0.094) while Global Sleep scores (p=0.027) and Beck Depression scores (p=0.031) were higher in women compared to men (Table 2). Depression scores were positively correlated with Global Sleep scores (r=0.724, p<0.001) and negatively correlated with average sleep duration in the study population (r=0.534, p<0.001). The correlations between sleep quality, daytime sleepiness, average sleep duration and metabolic parameters are shown in Table 3.

| Table 2. The results of the scales in female and male patients. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Global Sleep Quality Score** | Female Mean (range) (min-max) | Male Mean (range) (min-max) | 5.8±3.8 (0-16) | 37.8±2.1 (1-11) | 27 |
| **Daytime Sleepiness Score** | Female Mean (range) (min-max) | Male Mean (range) (min-max) | 5.6±3.3 (0-10) | 6.0±3.8 (0-16) | 814 |
| **Average Sleep Duration** | Female Mean (range) (min-max) | Male Mean (range) (min-max) | 6.1±2.4 (0-10) | 7.2±1.0 (5-9) | 94 |
| **Beck Depression Score** | Female Mean (range) (min-max) | Male Mean (range) (min-max) | 11.1±8.7 (0-35) | 6.4±4.5 (0-17) | 31 |
Sleep is one of the main necessities for humans to maintain life. Sleep disorders are among the most common clinical problems and are likely to be prevalent. Many studies were performed to assess the association between sleep problems and insulin resistance in metabolic syndrome and related disorders (9,16). It was demonstrated that sleep problems might affect energy homeostasis through increasing the body weight by increased appetite and hence food intake and decreased energy expenditure (8). The suggested mechanisms for the effect of sleep problems on development of insulin resistance are increased sympathetic neuronal activity, decreased cerebral utilisation of glucose, increase in evening cortisol levels and growth hormone and disorder of neuroendocrine control of appetite which increases the risk for obesity (7,8). Besides, increase in inflammatory mediators during sleep deprivation may cause the development of impaired vascular function and increased inflammation resulting in insulin resistance. Plantinga et al have found that more than 90% of the diabetic patients have reported any kind of sleep problem and 10% to 40% reported any given problem in the United States (17).

Stress and depression were shown to be associated with subjective sleep complaints (18). Epidemiological studies have showed that insomnia is an independent risk factor for depression and patients with depression were shown to have disturbances in sleep continuity (19,20). Depression is associated with central obesity (chronic inflammation and insulin resistance, neuroendocrine effects) and depressive people were found to have poor lifestyle and sleep difficulties resulting in insulin resistance (21).

Gender difference in metabolic syndrome was investigated and its prevalence was found more common in women in many of the studies (22,23). Female population was found to be more prone to metabolic syndrome than male population in a large study in Turkey (5) as 41.1% compared to 28.8% in women and men, respectively. Metabolic syndrome risk was 1.62-fold higher in females compared to males. In our study, female population were found to be more prone to depression as consistent with the literature. The increased prevalence of poor sleep quality in women compared to men was also consistent with the studies showing increased PSQI

### Table 3. The correlations between scales and age, waist circumference and BMI (kg/m²).

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Spearman's rho</th>
<th>Age (year)</th>
<th>BMI (kg/m²)</th>
<th>Waist circumference (cm)</th>
<th>Global Sleep Score</th>
<th>Daytime Sleepiness</th>
<th>Average Sleep Duration</th>
<th>Beck Depression Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>r</td>
<td>0.093</td>
<td>0.012</td>
<td>-0.050</td>
<td>0.146</td>
<td>-0.148</td>
<td>-0.107</td>
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<tr>
<td></td>
<td>p</td>
<td>0.295</td>
<td>0.897</td>
<td>0.700</td>
<td>0.253</td>
<td>0.291</td>
<td>0.418</td>
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</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>r</td>
<td>-0.093</td>
<td>0.538**</td>
<td>-0.039</td>
<td>0.047</td>
<td>-0.104</td>
<td>0.155</td>
<td></td>
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<tr>
<td></td>
<td>p</td>
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<td>0.714</td>
<td>0.460</td>
<td>0.242</td>
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<tr>
<td>Waist circumference (cm)</td>
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<td>-0.016</td>
<td>0.038</td>
<td>0.104</td>
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<tr>
<td></td>
<td>p</td>
<td>0.409</td>
<td>0.900</td>
<td>0.788</td>
<td>0.434</td>
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<td></td>
<td></td>
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<tr>
<td>Global Sleep Score</td>
<td>r</td>
<td>0.145</td>
<td>-0.516**</td>
<td>0.724**</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>p</td>
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<td>0.000</td>
<td>0.000</td>
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<td></td>
</tr>
<tr>
<td>Daytime Sleepiness</td>
<td>r</td>
<td>-0.098</td>
<td>-0.534**</td>
<td></td>
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<tr>
<td></td>
<td>p</td>
<td>0.484</td>
<td>0.153</td>
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<td></td>
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<tr>
<td>Average Sleep Duration</td>
<td>r</td>
<td></td>
<td>-0.534**</td>
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</tbody>
</table>

BMI: Body Mass Index

### Discussion

Sleep is one of the main necessities for humans to maintain life. Sleep disorders are among the most common clinical problems and are likely to be prevalent.

Many studies were performed to assess the association between sleep problems and insulin resistance in metabolic syndrome and related disorders (9,16). It was demonstrated that sleep problems might affect energy homeostasis through increasing the body weight by increased appetite and hence food intake and decreased energy expenditure (8). The suggested mechanisms for the effect of sleep problems on development of insulin resistance are increased sympathetic neuronal activity, decreased cerebral utilisation of glucose, increase in evening cortisol levels and growth hormone and disorder of neuroendocrine control of appetite which increases the risk for obesity (7,8). Besides, increase in inflammatory mediators during sleep deprivation may cause the development of impaired vascular function and increased inflammation resulting in insulin resistance. Plantinga et al have found that more than 90% of the diabetic patients have reported any kind of sleep problem and 10% to 40% reported any given problem in the United States (17).

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scores in women. The actual mechanism of this difference might be associated with high depression incidence in women (16,24).

Sleep quality was associated with metabolic syndrome in the literature (25). The reasons of this association remains unknown. Hypothalamic-pituitary-adrenal (HPA) hyperactivity plays a role in the pathogenesis of the metabolic syndrome (26). Poor sleepers were more prevalent among subjects with metabolic syndrome than those without metabolic syndrome (27). But in our study, there was not significant correlation possibly because; 1) The Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale all are self reported scales, 2) the subjects may not be aware of sleep problems that relate to metabolic disturbances, 3) there may be a problem in the individuals' perceptions of their sleep and/or they are not used to reflect their real complaints about their sleeping rituals during the physicians’ visits.

The weakness of our study was, we used self reported scales such as PSQI, Epworth Sleepiness Scale and Beck Depression Index for assessing sleep problems and depression, depending on patients’ feedback and not objective as polysomnography and face to face interview methods. Another weakness of our study is the lack of control study subjects. In the beginning of the study, we planned to compare obese healthy control subjects as obesity is a contributing factor for sleep problems but we had difficulty to find enough obese/overweight people with normal metabolic parameters. This may be the reflection of growing incidence of metabolic syndrome in our population. There is also some strengths of our study as we screened all of the subjects for depression since it might cause directly sleep problems.

Assessing or screening for sleep difficulties resulting in metabolic disturbances or vice versa may be integrated to daily practice and may be helpful in treatment of underlying diseases and hence the quality of life. It may be also recommended to the physicians to assess the sleep quality and depression in clinic practice and during periodical health examinations as well as for metabolic parameters. Sleep problems may be directed to advanced objective measures of sleep techniques such as polysomnography in a sleep laboratory when needed. All these preventive measures may provide additional economic benefits from improved daytime functioning and increased productivity. More studies are needed to unravel the patophysiological relation of sleep problems, depression and metabolic syndrome.

References


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