**INTRODUCTION**

Metabolic syndrome is an important worldwide public health concern, and its prevalence is increasing (1). Metabolic syndrome is a chronic multi-factorial disease characterized by impaired glucose tolerance/diabetes, obesity, high triglyceride levels, low high-density lipoprotein (HDL) cholesterol levels, and hypertension and is associated with high mortality and cardiovascular disease (2). Metabolic syndrome affects more than 30% of the population over the age of 50 years, and women have three times a greater risk of mortality and morbidity due to cardiovascular disease (3). Previous studies have indicated that the prevalence of metabolic syndrome has increased in postmenopausal women, and it has been reported that its prevalence is between 16% and 69% in different societies (4). Abdominal obesity and low HDL levels are considered to be the main factors increasing metabolic syndrome prevalence in postmenopausal women (5,6). Obesity is very widespread among postmenopausal women, and studies have shown that approximately 50% of postmenopausal women are obese (7). A remodeling of body fat distribution is seen in women with the occurrence of progressive and permanent estrogen deficiency, while glutefemoral fat accumulation decreases and metabolically active fat accumulation increases (8). It has been suggested that abdominal obesity contributes to insulin resistance and causes dyslipidemia, glucose intolerance, and hypertension (9). This study aimed to measure the prevalence of metabolic syndrome and its components among postmenopausal women and its relationship with the hormonal status.

**METHODS**

The medical records of 138 postmenopausal patients were retrospectively reviewed between January 2013 and March 2014. Patients with surgical menopause and those who underwent hormone replacement therapy, chemotherapy, and radiotherapy were excluded. Metabolic syndrome was defined according to the National Cholesterol Education Program Adult Treatment Panel III criteria. Patients’ demographic data, menopausal status, medical history, and physical examination and clinical laboratory data were analyzed. Data were evaluated statistically.

**Results:** In total, 128 patients were included in this study. The menopausal age of patients in the metabolic syndrome group was 50.06±2.93 and that in the non-metabolic syndrome group was 45.16±4.4 years. The prevalence of metabolic syndrome was observed in 43.4% patients in this study. A statistically significant negative high correlation (p<0.05) was observed between waist circumference and the number of metabolic components with FSH-LH levels.

**Conclusion:** The prevalence of metabolic syndrome among postmenopausal women is high, and abdominal obesity and low HDL levels are strong predictors. These components can lead to an increase in cardiovascular diseases. Thus, it is encouraging to adopt lifestyle changes that reduce the prevalence of metabolic syndrome.
3. Having triglyceride levels of ≥150 mg/dL.
4. Low HDL (<50 mg/dL in women).
5. Hypertension (blood pressure of ≥130/85 mmHg or receiving antihypertensive treatment).

The height (cm), weight (kg), waist circumference (cm), and body mass index (BMI) [body weight (kg)/height (m)^2] of the patients were recorded. Blood was drawn from the patients after 8–12 hours fasting, and the glucose, lipid panel [low-density lipoprotein (LDL), HDL, triglyceride], estradiol, follicle-stimulating hormone (FSH), luteinizing hormone (LH), and prolactin levels were studied. Glucose and lipid panel were studied using an enzymatic colorimetric method. FSH, LH, estradiol, and prolactin levels were determined using the ELISA method.

**Statistical Analysis**

Analysis of the data was performed by the Statistical Package for the Social Sciences for Windows 16 (SPSS Inc.; Chicago, IL, USA) package program. Continuous variables were displayed as the mean±standard deviation or median (minimum–maximum), while categorical variables were displayed as the number of cases or (%). Continuous variables were evaluated by Student’s t-test or Mann–Whitney U test, while categorical variables were evaluated by the chi-square test. Whether there was any significant correlation between the continuous variables was examined by Spearman’s correlation test. p<0.05 was considered statistically significant.

**RESULTS**

One hundred and twenty-eight patients were included in the study. The clinical and biochemical parameters are presented in Table 1. The mean ages of the patients without and with metabolic syndrome were calculated as 50.83±6.53 and 59.66±9.46, respectively. The mean menopause age was 50.06±2.93 in the patients with metabolic syndrome and 45.16±4.4 in the patients without metabolic syndrome. Metabolic syndrome frequency was calculated as 43.4% in our study. Waist circumference, BMI, HDL, glucose, triglyceride, and menopause age were detected to be noticeably significant statistically in the postmenopausal patients with metabolic syndrome (p<0.05). Hypertension frequency was found to be higher in the patients with metabolic syndrome, while FSH, LH, estradiol, and prolactin levels were detected to be lower in the postmenopausal patients with metabolic syndrome; however, no statistical difference was observed. The prevalence of metabolic syndrome components are presented in Table 2.

**DISCUSSION**

Metabolic syndrome has been defined as a risk factor cluster for diabetes mellitus and cardiovascular diseases and it comes first among the causes of death in postmenopausal women (10). The risk of cardiovascular disease significantly increases with the fall of estrogen levels in the postmenopausal period. Konukoglu et al. (11) reported that the cardiovascular disease incidence and mortality rise significantly after menopause and that it is four times higher in postmenopausal women. The gradual decrease of estrogen in the postmenopausal period causes many metabolic changes, such as metabolic active abdominal fat accumulation leading to central obesity, dyslipidemia, and insulin resis-

### Table 1. Clinical and biochemical parameters of the patients with and without metabolic syndrome

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Patients without metabolic syndrome</th>
<th>Patients with metabolic syndrome</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>50.83±6.53</td>
<td>59.66±9.46</td>
<td>0.01</td>
</tr>
<tr>
<td>Height</td>
<td>164.5±4.46</td>
<td>160.06±6.51</td>
<td>0.04</td>
</tr>
<tr>
<td>Weight</td>
<td>70.83±9.16</td>
<td>80.2±12.31</td>
<td>0.05</td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>92.08±7.25</td>
<td>108.03±10.35</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI</td>
<td>26.24±3.33</td>
<td>31.39±4.39</td>
<td>0.004</td>
</tr>
<tr>
<td>Hypertension</td>
<td>26(35%)</td>
<td>30(54%)</td>
<td>0.23</td>
</tr>
<tr>
<td>Menopause age</td>
<td>45.16±4.4</td>
<td>50.06±2.93</td>
<td>0.004</td>
</tr>
<tr>
<td>Fasting blood glucose</td>
<td>87.16±10.52</td>
<td>117.4±22.81</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>121±30.83</td>
<td>208±62.34</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HDL</td>
<td>60.16±11.77</td>
<td>49.53±10.48</td>
<td>0.03</td>
</tr>
<tr>
<td>LDL</td>
<td>118.4±30.17</td>
<td>120.46±20.28</td>
<td>0.54</td>
</tr>
<tr>
<td>FSH</td>
<td>45.59±15.89</td>
<td>38.18±19.01</td>
<td>0.36</td>
</tr>
<tr>
<td>LH</td>
<td>31.19±11.72</td>
<td>25.38±8.6</td>
<td>0.26</td>
</tr>
<tr>
<td>Prolactin</td>
<td>11.34±7.41</td>
<td>10.33±5.25</td>
<td>0.92</td>
</tr>
<tr>
<td>Estradiol</td>
<td>13.09±6.4</td>
<td>18.4±7.65</td>
<td>0.08</td>
</tr>
</tbody>
</table>

BMI: body mass index, FSH: follicle-stimulating hormone, HDL: high-density lipoprotein, LDL: low-density lipoprotein, LH: luteinizing hormone

### Table 2. Metabolic syndrome and the prevalence of its components

<table>
<thead>
<tr>
<th>Metabolic Syndrome Component</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist circumference ≥88 cm</td>
<td>68.2%</td>
</tr>
<tr>
<td>Triglyceride ≥150 mg/dL</td>
<td>39.6%</td>
</tr>
<tr>
<td>HDL-cholesterol &lt;50 mg/dL</td>
<td>45.6%</td>
</tr>
<tr>
<td>Systolic blood pressure ≥130 mm Hg</td>
<td>43.7%</td>
</tr>
<tr>
<td>Diastolic blood pressure ≥85 mm Hg</td>
<td>29.6%</td>
</tr>
</tbody>
</table>

HDL: high-density lipoprotein
was also reported in studies conducted in Iran (22) and Argentina (23) as the most common component of metabolic syndrome, with 68.2% frequency. It was also reported in studies conducted in Iran (22) and Argentina (23) as the most common component of metabolic syndrome, with 68.2% frequency. It was also reported in studies conducted in Iran (22) and Argentina (23) as the most common component of metabolic syndrome, with 68.2% frequency. It was also reported in studies conducted in Iran (22) and Argentina (23) as the most common component of metabolic syndrome, with 68.2% frequency. It was also reported in studies conducted in Iran (22) and Argentina (23) as the most common component of metabolic syndrome, with 68.2% frequency. It was also reported in studies conducted in Iran (22) and Argentina (23) as the most common component of metabolic syndrome, with 68.2% frequency.

In this study, abdominal obesity was found to be the most common component of metabolic syndrome in postmenopausal women (5, 6, 21). Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21). Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21). Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21). Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21). Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21). Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21). Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21).

Metabolic syndrome prevalence varies significantly around the world. The reason for this difference in metabolic syndrome prevalence may be linked to the use of different diagnosis criteria in the studies conducted, socioeconomic and environmental differences, genetic factors, and lifestyle. The prevalence was found to be 43.4% in postmenopausal women. Metabolic syndrome prevalence in other studies has been reported to be similar to the results in our study. In studies conducted in Iran (13), India (14), and Ecuador (15), prevalence was reported to be 69%, 55%, and 41.5%, respectively. There are also other studies in which the results are different from this one. The prevalence in the studies carried out in Austria (16), Germany (17), and Canada (18) was 32.6%, 36.1%, and 29.6%, respectively.

Body weight and composition are a result of a complex balance between energy intake and expenditure. Weight gain can be related to lifestyle, nutrition, and behavioral factors as well as life events such as pregnancy and menopause. Estrogen regulates the reproduction function and body weight by its receptors. In studies conducted on female mice, it was found that estrogen receptor deletion in the brain caused hyperphagia and abdominal obesity. Furthermore, it is well known that estrogen in the brain has a key role in body weight gain (19, 20). Metabolic status and the fat accumulation pattern in different tissues change with going through the menopause. It has been reported that with the decrease of estrogen, fat tissue accumulation shifts from lower extremities to the abdominal region, causing changes in lipid metabolism. Abdominal obesity and a low HDL cholesterol level are considered to be the main factors increasing the prevalence of metabolic syndrome in postmenopausal women (5, 6, 21).

The fall of estradiol and a rise above the normal limits in FSH and LH are observed with the depletion of follicle reserves in the postmenopausal period. There are not many studies examining the relationship between metabolic syndrome and hormonal status, but some researchers have observed a negative correlation between FSH concentration and BMI (25-27). Bjørnerem et al. (26) reported that the mean FSH concentration in diabetic postmenopausal patients is lower than in healthy postmenopausal patients. Velasco et al. (28) found the FSH concentration of obese postmenopausal women was below 30 mL IU/mL. The fall of FSH value in obese postmenopausal women has been explained by the turning of the increased adrenal steroid in fat tissue into estrogen. Malacara et al. (27) reported that the fall in FSH takes place with a mechanism not associated with insulin resistance. A statistically insignificant correlation was detected between the FSH level and BMI (p>0.05) and a negative (p<0.05) statistically significant correlation was detected between central obesity and the number of metabolic components. Malacara et al. (27) and Stefanska et al. (29) have reported similar findings to those of our study.

Menopause is associated with increased metabolic syndrome and the prevalence of cardiovascular disease. The purpose of metabolic syndrome administration is to treat the risk factors, such as hypertension and dyslipidemia, and to decrease the underlying causes, such as obesity and physical inactivity. Diet and lifestyle changes are the main factors and they decrease cardiovascular risk (30). The treatment should include weight loss programs, regular physical exercise, and diet changes. There are studies indicating a 58% decrease in metabolic syndrome and diabetes incidence by losing 5% weight through regular exercise (31-33). Although a therapeutic lifestyle change is the first line of treatment for metabolic syndrome, it may be necessary to add antihypertensive and antilipidemic agents for the purpose of individual cardiac risk factor administration (34).

### CONCLUSION

The prevalence of metabolic syndrome and cardiovascular disease increase in postmenopausal women. Abdominal obesity, low HDL levels, and hypertension are strong predictive factors for metabolic syndrome. Metabolic syndrome frequency can be decreased by encouraging lifestyle changes and by cardiac risk factor administration.

**Ethics Committee Approval:** Ethics committee approval was not obtained due to the retrospective nature of this study.

**Informed Consent:** Due to the retrospective design of the study, informed consent was not taken.
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