Abstract

**Purpose:** The purpose of this study is to compare and analyze the differences in adult disease related indicators according to the presence or absence of obesity for a healthy life and prevention of the adult diseases for the middle aged women.

**Method:** In this study, the raw data of the 8th 1st year of the 2019 Korea National Health and Nutrition Examination Survey (KNHANES 2019) was downloaded and reprocessed for use according to the purpose of study. A total of 8110 males and females participated in the 2019 Korea National Health and Nutrition Examination Survey, of which 4381 females were extracted. From the data of 4381 women, 658 people in their 40s (ages 40-49) were extracted, of which 598 people were selected as the study subjects, excluding 26 underweight and 34 missing people. For the statistical processing, the mean and standard deviation of all questions were calculated by using SPSS 27.0 package. In order to compare the differences among the adult disease related indicators for the women according to obesity, t-test was conducted to compare the differences for each measurement question according to the presence or absence of obesity. The statistical significance level was based on p<.05, respectively.

**Results:** In terms of the differences in the blood lipids related variables according to obesity, TC, TG, and LDL-C turned out to be significantly higher in the obese group than in the normal group (TC; p<.01, TC; p<0.001, LDL-C; p<0.5). and HDL-C turned out to be significantly (p<.001) higher in the normal group than in the obese group. In terms of the hypertension related variables, the systolic and diastolic blood pressures turned out to be significantly higher in the obese group than in the normal group (systolic: p<.001, diastolic: p<.01), respectively. The diabetes related variables turned out to be significantly (p<.001) higher in the obese group than in the normal group in fasting blood sugar, glycated hemoglobin, and insulin concentration, respectively.

**Conclusion:** Gathering the results above, it was evident that obesity among women in their 40s are more likely to contract adult diseases such as blood lipids, high blood pressure, and diabetes. In the future studies, it is considered that additional analysis of age, gender and related variables are necessary.

**Keywords** Obesity Women, Adult Disease, Blood Lipids, Subjective Recognition of Body Type, Korea National Health and Nutrition Examination Survey

1. Introduction

Obesity is a very prevalent disease across the globe, and it not only imposes a huge health and economic burden on any society, but is also closely related to the metabolic syndrome [1][2]. Obesity is known to be the largest cause of changes in diet and decrease in physical activities, and also has a phenomenon that increases along with metabolic syndrome [3]. In a study on the prevalence of metabolic syndrome, it was reported to be higher in women than in men [4], and obesity has been reported to increase the risk of vascular and neurological complications such
as atherosclerotic cardiovascular disease, insulin resistance, diabetes, and cerebrovascular accidents, respectively[5][6].

Obesity causes high blood pressure, and weight loss is a common way for its improvement, yet it is difficult to address obesity because overweight and obese people consume more calories to maintain their weight. Furthermore, an additional food intake triggers a higher sodium intake, leading to a high prevalence of obesity[7].

Obesity is closely related with dyslipidemia, and drug dyslipidemia among the obese patients is characterized by high triglycerides and low high density lipoprotein cholesterol (HDL-C), while the high low density lipoprotein cholesterol (LDL-C) causes arteriosclerosis as the factor of inducement[8]. Numerous studies have demonstrated that those with higher levels of LDL-C have a higher risk of myocardial infarction and more abdominal fat accumulation. It has also been reported that the increased total cholesterol and LDL cholesterol are common yet primarily associated with the saturated fat consumption and not so much with weight gain and obesity[9]. Furthermore, obesity is primarily caused by insulin resistance and pro-inflammatory adipokines, and vitamin D deficiency has been reported to affect adipose tissue function and lipid status in obesity. However, it has been reported that metabolically healthy obesity has a low correlation with dyslipidemia[10][11].

Diabetes has been associated with the increased risk of atherosclerosis, coronary heart disease (CHD) and peripheral arterial disease, and even for those without diabetes, fasting blood glucose concentration and glycated hemoglobin (HbA1c) are associated with the risk of vascular disease[12][13]. Obesity and diabetes are both associated with the increased risk of cancer, and this is a worrisome trend for cancer rates given the increasing prevalence of obesity and diabetest across the globe. The relationship between hyperinsulinemia, chronic inflammation, and antihyperglycemic drugs has been identified as a basic mechanism, and the most common obesity and diabetes related cancers are reported as endometrial cancer, colorectal cancer, and postmenopausal breast cancer[14]. Examining the studies related to overweight and obese women, the Gestational Diabetes Mellitus (GDM:) is increasing with obesity[15], and drug treatment and diet are primarily used[16]. In the early stage of GDM, treatment is started with diet and exercise, and if such measures do not reach the blood sugar target, insulin therapy is implemented[17].

In general, the obese patients are known to have a much stronger muscular strength than the normal or underweight patients, and it has been reported that the obese patients with sarcopenia have weakened their muscular strength[18][19]. Furthermore, a study evaluating the effects of resistance training on muscular strength, abdominal obesity metabolic risk, and inflammatory markers among the postmenopausal women reported an improvement in their muscular strength and a decrease in fat after high intensity resistance training[20]. In particular, the sarcopenic obesity is characterized by a low skeletal muscle mass, and is often seen among the middle aged and older women. For the prevention and treatment of obesity and hypothyroidism, it has been reported that the resistance exercise improves muscle mass and strength and decreases fat mass[21]. In 2013, 19.9% of the European women aged 50 or older were affected by obesity, and it was reported that the highest prevalence rate was 21.6% for those aged 70 or older[22].

In the study of subjective recognition of body type related to obesity, the self-perceived body image of the Korean women is garnering much attention due to the unhealthy weight control behavior. It has been reported that the younger and the higher the underweight ratio, the more likely they perceived their body size as being normal or overweight, and that the incorrect body image recognition and unhealthy weight control behavior caused various problems[23].
As for the obesity related adult diseases, the prevalence of various diseases such as metabolic syndrome, dyslipidemia, hypertension, and diabetes are present together. Hence, the purpose of this study is to compare and analyze the differences among the adult disease related indicators according to the presence or absence of obesity for a healthy life and prevention of adult diseases among the middle aged women.

2. Research Method

2.1. Research subject

This study is a secondary analytical study using the raw data of the 8th 1st Korea National Health and Nutrition Examination Survey (KNHANES 2019) conducted by the Ministry of Health and Welfare and the Korea Centers for Disease Control and Prevention. When downloading the data, a consent was made for the collection and use of personal information for the Korea Centers for Disease Control and Prevention, and the agreement to comply with the statistical data users was reached. A total of 8110 males and females participated in the 2019 Korea National Health and Nutrition Examination Survey, and among which, 4381 females were extracted with priority.

From the data of 4381 women, 658 people in their 40s (ages 40-49) were extracted, and 598 people were selected as the study subjects, excluding 26 underweight and 34 missing people. The physical characteristics of the study subjects are as illustrated in <Table 1>.

Table 1. Physical characteristics of the study subjects.

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>BMI (kg/m²)</th>
<th>Waist (cm)</th>
<th>Neck (cm)</th>
<th>People (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>44.86 ±2.93</td>
<td>159.26 ±5.54</td>
<td>67.41 ±9.35</td>
<td>26.57 ±3.37</td>
<td>86.71 ±8.46</td>
<td>31.60 ±1.28</td>
</tr>
<tr>
<td>Normal</td>
<td>44.47 ±2.89</td>
<td>160.70 ±5.21</td>
<td>54.30 ±4.54</td>
<td>21.01 ±1.24</td>
<td>73.70 ±4.78</td>
<td>34.20 ±1.98</td>
</tr>
</tbody>
</table>

Note: Mean and standard deviation, ***p<.001.

2.2. Research tools and variables

The 2019 8th 1st Korea National Health and Nutrition Examination Survey is consisted of basic variables, health survey, screening survey, and nutrition survey. In this study, 658 women aged 40-49 years were extracted based on the number of years of age since their conception as the basic variable. Furthermore, the obesity prevalence variables were recoded to exclude underweight (26 patients) and missing values (34 patients), while 330 normal and 268 obese patients were used in line with the purpose of this study.

In the health survey and screening survey, the factors related to the adult diseases were classified into 5 categories and were consisted of blood lipids, high blood pressure, diabetes, muscular strength, and subjective perception. The specific definitions of the variables used in the study are as follows.

2.2.1. Blood lipids variables

Blood lipids variables: TC (total-cholesterol), HDL-C (high-density lipoprotein), TG (triglycerides) were used without processing the raw data, while LDL-C (low-density lipoprotein) is the formula according to the Friedewald equation Calculated LDL-C was calculated using the formula (LDLc=TC-(TG/5+HDLc)).
2.2.2. Hypertension and diabetes variables

Hypertension-related variables: Systolic blood pressure (SBP), diastolic blood pressure (DBP), and 60-second pulse rate (60s HR) were used as the raw data.

Diabetes-related variables: FBS (Fasting Blood Sugar), HbA1c, and Insulin were used as raw data.

2.2.3. Muscular strength and the subjective awareness variables

As for the grip strength, the average value was derived and used by adding the results of the first, second, and third measurements. The subjective health perception was 1 = very good, 2 = good, 3 = average, 4 = bad, 5 = very bad, and the subjective recognition of body type was 1 = very bad, 2 = slightly skinny, 3 = average, 4 = slightly obese, and 5 = very obese used the raw data for the 5-point Likert scale.

2.3. Data processing

This study used the data published in the 2019 Korea National Health and Nutrition Examination Survey, and as for the statistical processing, the mean and standard deviation of all questions were calculated by using the SPSS 27.0 package. In order to examine and understand the difference in the adult disease-related indicators of women according to obesity, the t-test was conducted to determine the difference in each measurement question according to the presence or absence of obesity. The statistical significance level was based on p<.05, respectively.

3. Results

The results of analyzing the indicators related to adult diseases according to obesity are as follows.

3.1. Blood lipids related variables

The results of analyzing the differences in the lipid components according to obesity are as illustrated in <Table 2>.

<table>
<thead>
<tr>
<th></th>
<th>TC (mg/dL)</th>
<th>HDL-C (mg/dL)</th>
<th>TG (mg/dL)</th>
<th>LDL-C (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>201.37 ±33.46</td>
<td>54.33 ±11.28</td>
<td>125.25 ±86.05</td>
<td>121.72 ±32.24</td>
</tr>
<tr>
<td>Normal</td>
<td>194.28 ±30.56</td>
<td>61.07 ±11.96</td>
<td>87.33 ±55.57</td>
<td>115.66 ±27.01</td>
</tr>
<tr>
<td>t-value</td>
<td>-2.677**</td>
<td>6.950***</td>
<td>-6.383***</td>
<td>-2.451*</td>
</tr>
</tbody>
</table>

Note: Mean and standard deviation.

The differences in the lipid-related components according to obesity are as illustrated in <Table 2>. TC, TG, and LDL-C turned out to be significantly higher for the obese group than for the normal group (TC; p<.01, TG; p<0.001, LDL-C; 0.5), while HDL-C turned out to be significantly higher in the normal group than in the obese group (p<.001), respectively.

3.2. Hypertension and diabetes-related variables

The results of comparing the differences in the diabetes-related variables according to the presence or absence of obesity are as illustrated in <Table 3>. 
Table 3. Comparison of the hypertension and diabetes-related variables according to obesity.

<table>
<thead>
<tr>
<th></th>
<th>SBP (mmHg)</th>
<th>DBP (mmHg)</th>
<th>60s HR</th>
<th>FBS (mg/dL)</th>
<th>HbA1c (%)</th>
<th>Insulin (μU/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>115.03 ±14.25</td>
<td>75.78</td>
<td>58.67</td>
<td>100.79</td>
<td>5.681</td>
<td>10.10 ±6.79</td>
</tr>
<tr>
<td>Normal</td>
<td>109.75 ±12.03</td>
<td>73.60</td>
<td>54.4</td>
<td>92.83</td>
<td>5.454</td>
<td>6.03 ±3.23</td>
</tr>
<tr>
<td>t-value</td>
<td>-4.817***</td>
<td>-2.995**</td>
<td>-.788</td>
<td>-4.964***</td>
<td>-4.781***</td>
<td>-9.504***</td>
</tr>
</tbody>
</table>

Note: Mean and standard deviation.

Table 3 illustrates the differences between hypertension and diabetes-related variables according to obesity. The hypertension-related variables, systolic and diastolic blood pressure, turned out to be significantly higher in the obese group than in the normal group (systolic: p<.001, diastolic: p<.01), yet there was no significant difference in terms of the heart rate at 60 seconds. Furthermore, the diabetes-related variables turned out to be significantly (p<.001) higher in the obese group than in the normal group in fasting blood sugar, glycated hemoglobin, and insulin concentration.

3.3. Muscular strength and subjective cognition related variables

Table 4 illustrates the differences in the muscular strength and subjective cognition-related variables according to obesity.

Table 4. Differences in muscular strength and subjective recognition-related variables.

<table>
<thead>
<tr>
<th></th>
<th>Grip(L)kg (kg)</th>
<th>Grip(R)kg (kg)</th>
<th>Subjective</th>
<th>Health awareness</th>
<th>Body type recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>52.57 ±10.78</td>
<td>54.80 ±11.45</td>
<td>2.87 ±0.77</td>
<td>4.18 ±0.59</td>
<td></td>
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<tr>
<td>Normal</td>
<td>51.70 ±8.77</td>
<td>53.66 ±9.65</td>
<td>2.68 ±0.74</td>
<td>3.10 ±0.57</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>-1.080</td>
<td>-1.297</td>
<td>-3.006**</td>
<td>-22.576***</td>
<td></td>
</tr>
</tbody>
</table>

Note: Mean and standard deviation.

The differences in terms of the muscular strength and subjective recognition-related variables according to obesity are as illustrated in Table 4. As for the muscular strength related variables, there was no significant difference demonstrated in terms of the grip strength (left, right), and subjective awareness turned out to be significantly higher in both the health and body type recognition (health: p<.01, body type: p<.001).

4. Discussion

4.1. Blood lipids

As a result of this study, TC, TG, and LDL-C among the lipid-related components according to obesity turned out to be significantly higher in the obese group than in the normal group (TC: p<.01, TC: p<.001, LDL-C: p<.5), while HDL-C turned out to be significantly (p<.001) higher in the normal group than in the obese group. Such results demonstrated that the obese group had a result value related to dyslipidemia, and on the contrary, the HDL-C turned out to be higher...
in the normal group. Examining the related studies, abnormal lipid metabolism is very commonly observed among obese patients, and approximately 60 to 70% of them are dyslipidemia. Among the obese patients with lipid abnormalities, TG, VLDL, and Apo B levels turned out to be high, while HDL-C and Apo AI levels turned out to be low[24]. Furthermore, while the level of LDL-C turned out to be within the normal range, an increase in the level of VLDL-C is a cause of arteriosclerosis, and hence, attention ought to be paid thereto[25].

4.2. Hypertension and diabetes-related variables

As a result of this study, the difference between hypertension and diabetes-related variables according to obesity turned out to be significantly higher in the obese group than in the normal group (systolic: p<.001, diastolic: p<.01), yet there was no significant difference in terms of the 60second heart rate. Furthermore, the fasting blood glucose, glyated hemoglobin, and insulin concentrations turned out to be significantly (p<.001) higher in the obese group than in the normal group. Such systolic and diastolic results suggest that the obese group has a higher risk of hypertension and cardiovascular disease than the normal group. Furthermore, the fact that the fasting blood glucose, glyated hemoglobin and insulin concentrations turned out to be high in the obese group confirmed the fact that obesity was closely related to diabetes.

As for the related studies, according to a study on the effect of abdominal obesity and drinking on high blood pressure in adults, it was reported that the risk of prevalence of hypertension increased rapidly during dangerous drinking accompanied by abdominal obesity[26].

According to a study that investigated the effects of physical activity, body mass index, and depression on health-related quality of life according to the presence or absence of hypertension in elderly women, age, education, physical activity, body mass index, and depression were significant predictors for health-related quality of life. In addition, it was reported that the higher the amount of physical activity and the lower the body mass index, the lower the depression, the higher the health-related quality of life[27]. In a study on hypertension and weight loss, arterial hypertension, overweight, and obesity are closely related. And, it was reported that weight loss has a positive effect on blood pressure, and obese patients with high blood pressure need weight management[28].

Furthermore, many studies on the relationship between obesity and diabetes are currently conducted. The co-morbidity of obesity and diabetes is high worldwide and is also primarily caused by the 2 factors of insulin resistance and insulin deficiency[29]. It has also been reported that obesity, diabetes, and metabolic syndrome are the factors which place an excessive burden on the heart in the studies of diabetes and cardiovascular disease, and it has been reported that if either one returns to normal, the prevalence of the cardiovascular disease is lowered[30].

4.3. Muscular strength and subjective recognition-related variables

There was no significant difference in terms of the difference as for the grip strength (left, right) according to obesity, and the subjective recognition turned out to be significantly higher in both health and body type recognition in the obese group (health: p<.01, body type: p<.001). The results of the subjective awareness and body shape recognition suggest that these women have poor health awareness and poor body shape recognition. Furthermore, while there was no significant difference in terms of grip strength, muscular strength training in obese female patients is important in the long term, suggesting that the strength training should be performed concurrently with the prevention of metabolic syndrome for old age. Examining the previous studies related thereto, a cohort study conducted in the UK reported that when the grip strength increased, and the waist circumference also increased, the sarcopenic obesity was reversed in the report on the obesity and muscular strength in men and women[31][32]. The studies on the health awareness targeting obese people are very inadequate, and in the studies on the mental health status and the health-related life related practice of the middle-aged
women, the women who participate in the regular exercise reported to have a higher health awareness[33]. In the research papers related to the body type recognition, it was reported that the body type recognition of the normal and obese people with obesity had different patterns and that the obese women performed more weight control than the normal women[34].

5. Conclusion

Gathering the results above, it was evident that the obesity in women in their 40s had a high correlation with the blood lipids, hypertension, and the diabetes-related values, and the management of related indicators was important to prevent the adult diseases. In the future studies, it is considered that the additional analysis of age, gender, and related variables in greater detail will be necessary.

6. References

6.1. Journal articles

[19] Ahn S. Eucommiae Cortex(Eucommia Ulmoides Oliver) Modulates M
## 7. Appendix

### 7.1. Authors contribution

<table>
<thead>
<tr>
<th>Initial name</th>
<th>Contribution</th>
</tr>
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<tbody>
<tr>
<td>WC</td>
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<tr>
<td></td>
<td>- Design ☑</td>
</tr>
<tr>
<td></td>
<td>- Getting results ☑</td>
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<td></td>
<td>- Analysis ☑</td>
</tr>
<tr>
<td></td>
<td>- Make a significant contribution to collection ☑</td>
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<tr>
<td></td>
<td>- Final approval of the paper ☑</td>
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<td></td>
<td>- Corresponding ☑</td>
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<td>- Play a decisive role in modification ☑</td>
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<tr>
<td></td>
<td>- Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑</td>
</tr>
<tr>
<td></td>
<td>- Participants in Drafting and Revising Papers ☑</td>
</tr>
<tr>
<td></td>
<td>- Someone who can explain all aspects of the paper ☑</td>
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