



# The Relationship between the Prevalence of Diabetes and Grip Strength and Obesity Levels in Middle-Aged Post-Menopausal Korean Women

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## Dear Editor-in Chief

Sudden hormonal changes due to aging lead to menopause in middle-aged women, unlike that in other age groups. These changes are associated with negative changes in body composition, such as increased obesity and decreased muscle, bone density, and physical strength, which subsequently increase the risk of various chronic diseases, including diabetes (1). Therefore, to prevent the effects of menopause in middle-aged women, increasing their muscle strength through regular physical activity is essential. In particular, grip strength is an easy and accurate parameter to analyze the muscular strength of the upper extremi-

ties and is the most commonly used body indicators for various diseases such as sarcopenia.

The data used in this study were acquired from the Korean National Health and Nutrition Examination Survey (KNHANES), a nationwide cross-sectional survey conducted by the Centers for Disease Control and Prevention of the Ministry of Health and Welfare to understand the health status and behavior of the public. A total of 3,945 middle-aged post-menopausal women in their 50s to mid-60s who participated in the National Health Survey from 2014 to 2019 were enrolled in this study (Table 1).

**Table 1:** Physical characteristics of the subjects

Variable	50~59 yr (n=2,486)	60~64 yr (n=1,459)	P-value
Age (yr)	55.29±2.65	61.94±1.42	<0.001
Height (cm)	156.89±5.22	155.28±5.08	<0.001
Weight (kg)	58.41±8.71	58.81±8.53	0.161
BMI (kg/m <sup>2</sup> )	23.72±3.32	24.38±3.31	<0.001
RHS (%)	42.82±8.32	40.93±8.29	<0.001
Glucose (mg/dl)	100.39±23.90	103.52±23.65	<0.001
HbA1c (%)	5.78±0.73	5.97±0.85	<0.001

Values are Mean±SD, BMI: Body mass index, RHS: Relative Handgrip Strength, HbA1c: Hemoglobin A1c



The grip strength was measured using a digital dynamometer (TTK 5401, Takei Scientific Instruments Co. Ltd, Japan). After six measurements, the highest value was divided by the weight (kg) to calculate the relative grip strength (RHS) (2). Diabetes was diagnosed as suggested by the American Diabetes Association: fasting blood glucose level >126 mg/dL or glycosylated hemoglobin >6.5% (3). In addition, patients who were diagnosed by a doctor or under treatment for diabetes in the KNHANES data were also considered to have diabetes mellitus.

SPSS/Window 26.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. An independent *t*-test was conducted to compare and analyze the mean values of variables between the groups according to age. In addition, muscular strength (grip strength) and obesity were divided into upper and lower groups to classify the participants into four groups of ① Low body mass index (BMI) & High RHS, ② Low BMI & Low RHS, ③ High BMI & High RHS, and ④ High BMI & Low RHS. A logistic regression analysis was conducted after controlling for age, smoking, and drinking to calculate the odds ratios (ORs) and the 95% confidence interval. A *P* value < .05 was considered as statistically significant.

In this study, the participants were divided into four groups based on the values of their grip strength and obesity (high and low groups). In a logistic regression analysis controlled for age, smoking, and drinking, the Low BMI & Low RHS, High BMI & High RHS, and High BMI & Low RHS groups had a 1.34 [OR: 1.34 (95% CI: 1.03~1.75)], 2.20 [OR: 2.20 (95% CI: 1.58~3.05)], and 3.25 [OR: 3.25 (95% CI: 2.58~4.09)] times greater risk of diabetes, respectively, than the Low BMI & High RHS group (Reference, OR: 1).

The results demonstrated that grip strength and obesity were related to a risk of diabetes in mid-

dle-aged post-menopausal women. Menopause due to aging in middle-aged women decreases physical activity and increases the incidence of obesity, thereby reducing muscle loss, bone density, and physical fitness and negatively affecting the risk factors for metabolic diseases (1). As a result, the incidence of chronic diseases, such as diabetes, increases. Thus, based on these findings, increased muscular strength through regular physical activity in middle-aged post-menopausal women has positive effects on muscle loss and obesity. It would be an important strategy for a healthy life.

In conclusion, improving the muscle strength by controlling obesity and increasing physical activity would be an effective way to lower the risk of diabetes in middle-aged post-menopausal women. Follow-up studies must further investigate the most effective types of physical activity for middle-aged post-menopausal women.

### Conflict of interest

The author declares that there is no conflict of interest.

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