

# The effects of horseback riding on body mass index and gait in obese women

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**Abstract.** [Purpose] The aim of this study was to examine the effect of horseback riding on body mass index (BMI) and gait in obese women. [Subjects and Methods] Twenty-four obese women residing in Seoul and Gyeonggi-do were randomly divided into a horseback riding group and a walking group and conducted their respective exercises 3 times a week for 8 weeks. [Results] Step length increased significantly and BMI and width of the base of support significantly decreased in both groups. A comparison of BMI and width of the base of support after the intervention between the two groups revealed that the horseback riding group showed larger decreases than the walking group. [Conclusion] The result of this study indicated that the horseback riding may improve gait ability and obesity.

**Key words:** Obesity, Body mass index, Horseback riding

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## INTRODUCTION

Obesity, an intermediate risk factor, increases the risk of coronary artery disease, hypertension, type II diabetes mellitus, obstructive lung disease, osteoarthritis, and cancer. It is a serious health problem that reduces average life expectancy<sup>1)</sup>. As the obese population has increased, it has become important to resolve obesity in individuals from a social-health point of view<sup>2)</sup>.

Evaluation of body composition is an important factor that decides nutritional condition towards health and diseases. Regular aerobic exercise provides good results on body composition. If it is done continuously for a long term, obese people can reduce their body fat and weight and their risk of cardiovascular diseases. It also improves liver function, strengthens skeletal muscles, and improves the effect of insulin on fatty tissues, improving the body's ability to use blood sugar<sup>3)</sup>.

Body mass index (BMI) and waist measurement are considered important factors in measuring obesity in China, both for males and females<sup>4)</sup>. Compared with use of expensive and complicated facilities, BMI and waist measurement have been confirmed to be more accurate methods in estimating disabilities caused by obesity<sup>5)</sup>. It is reported that increased body fat, BMI, and waist measurement, as well as activities of daily living, are highly related to physical

disability<sup>1)</sup>.

As a treatment for obesity, which has become a social and economic problem, walking exercise appears to be the most effective exercise from a physiological point of view, and it is desirable to perform it for long periods at low intensity<sup>6)</sup>.

The chance of getting gonarthrosis for an obese or overweight person is considerably high<sup>7)</sup>. Incorrect gait habits and posture caused by weight gain increases the load on the lower limb joints and cause injuries in the lower limb joints and arthritis<sup>8)</sup>.

Horseback riding is a whole body exercise that uses muscles and joints. It stimulates nerves in various parts of the body, improving function recovery, balancing ability, adaptability to speed changes, and flexibility. In addition, the higher body temperature of the horses reduces the rider's tension and anxiety and stimulates blood circulation<sup>9-11)</sup>.

This study investigated the effect of aerobic exercise and gravity-eliminated active-assistive pelvis exercise using horses on BMI and blood lipids when the exercises were applied to various functional problems caused by obesity such as decreased balancing ability and the secondary lower limb diseases caused by incorrect gait. It also observed the changes in balancing ability and gait ability between before and after horseback riding.

## SUBJECTS AND METHODS

The experiments were conducted 3 times a week for 8 weeks in Seoul and the Gyeonggi-do area. The study subjects were 24 obese women who were willing to participate in the study and had a BMI of 25 kg/m<sup>2</sup> or over. They were randomly divided into a horseback riding group of 12 subjects and a walking group of 12 subjects. The experiment group, the horseback riding group, and the control group,

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**Table 1.** General characteristics of subjects

	HRG	WG
Age (years)	36.3±6.2	37.7±4.3
Height (cm)	161.5±4.9	162.2±5.4
Weight (kg)	72.3±6.8	71.4±4.7

Mean±SD. HRG: horseback riding group; WG: walking group

the walking group, performed appropriate exercise programs suitable for the purpose of this study.

The study subjects satisfied the following conditions: 1) obese woman between the ages of 30 and 45, 2) no history of central nervous system diseases such as stroke, Parkinson's disease, or spinal cord injury, 3) no orthopedic diseases in the spine or lower limb within the last 6 months, 4) able to walk independently without any assisting equipment or help, 5) no history of vision or vestibular system diseases, 6) no abnormality in blood pressure (systolic blood pressure over 160 mmHg or diastolic pressure less than 110 mmHg) when stable, 7) does not have diabetes, 8) 10 or fewer previous experiences of horseback riding before participating in this study, 9) no psychological fear or resistance towards horseback riding, 10) no metal inserted into the lower back or thighs, and 11) not taking obesity-related medications such as an appetite suppressant. All the subjects understood the purpose of this study and provided written informed consent prior to participation in the study in accordance with the ethical standards of the Declaration of Helsinki (Table 1).

The horseback riding program used in this study was applied properly according to the individual's ability and physical condition. Considering the length of the study, horseback riding was performed at a walk and at a trot. The specific composition of the horseback riding program was as follows; warm-up (5 min) and cool down (5 min) consisting of leg stretching, neck and trunk stretching, and shoulder stretching and horseback riding consisting of riding at a walk (5 min), at a trot (10 min), and then again at a walk (5 min). The walking program included a warm-up (5 min) and cooldown (5 min) consisting of leg stretching, neck and trunk stretching, and shoulder stretching and walking exercise (30 min) consisting of normal walking and fast walking.

BMI is an obesity measurement that estimates the amount of fat using height and weight. It is calculated by dividing weight by the square of height. In general, 18.5–24.9 kg/m<sup>2</sup> indicates normal weight, 25–29.9 kg/m<sup>2</sup> indicates overweight, 30.0–34.9 kg/m<sup>2</sup> indicates moderate obesity, and 35 kg/m<sup>2</sup> or higher indicates severe obesity. According to this classification, this study classified subjects with a BMI of less than 25 kg/m<sup>2</sup> as normal and those with a BMI over 25 as obese, as 25 kg/m<sup>2</sup> is the standard that divides normal weight and overweight<sup>12)</sup>.

For gait analysis, this study used an AP1105 (GAITRite EWPV), which is a gait analysis system developed by CIR in the U.S. It was used to measure step length and width of the base of support with normative data to measure the level of similarity with a normal gait.

Each subject walked back and forth on a sensor mat in her normal manner twice for a total of 4 consecutive times.

**Table 2.** Comparison of pre- and post-intervention measurement values

Variable	Group	Pre	Post
BMI (kg/m <sup>2</sup> )	HRG	28.7±2.9	23.7±1.6 <sup>a</sup>
	WG	27.5±1.3	24.8±3.4 <sup>a</sup>
Step length (cm)	HRG	35.7±6.5	41.1±5.6 <sup>a</sup>
	WG	36.8±7.1	39.9±7.4 <sup>a</sup>
Width of the base of support (cm/s)	HRG	12.8±8.6	11.0±3.8 <sup>ab</sup>
	WG	12.2±4.5	11.9±3.5 <sup>ab</sup>

<sup>a</sup>Significant difference between pre- and post-intervention values. <sup>b</sup>Significant difference in post-intervention values between HRG and WG

All the results of measurement are expressed as the mean±standard deviation.

PASW Statistics for Windows (version 18.0) was used for data analyses. The paired t-test was used to analyze the difference between before and after the intervention. The independent t-test was used to determine the differences in the results of each group. The statistical significance level was  $\alpha = 0.05$ .

## RESULTS

After the intervention, both groups showed a significant increase in step length ( $p < 0.05$ ). BMI and width of the base of support also significantly decreased in both groups ( $p < 0.05$ ). When the two groups were compared to each other, the horseback riding group showed a bigger decrease in BMI and width of the base of support compared with the walking group ( $p < 0.05$ ) (Table 2).

## DISCUSSION

This study implemented a horseback riding program, which provided aerobic exercise and exercise focusing on the pelvis, and a walking program for obese women for 8 weeks and examined their effects on BMI, blood lipids, static balancing ability, and gait ability. Then, it compared the active-assistive horseback riding program, which provided exercise focusing on the pelvis, and the active walking program to see their effects on the level of obesity and physical functions.

Generally, it is more effective to apply mid-to low-intensity exercise than high-intensity exercise for weight loss and to decrease the percentage of body fat, as exercise stimulates sympathetic nerves and increases the catecholamine concentration and glucagon, as well as the rate of blood flow into active muscles, following exercise, which cause a high fat oxygenation rate<sup>13)</sup>.

He et al.<sup>14)</sup> conducted an intervention consisting of aerobic exercise in obese women for 16 weeks and reported weight loss and a reduced percentage of body fat. This is in agreement with the results of the walking program, which consisted of aerobic exercise.

Since the horseback riding program also generated positive results, both groups experienced aerobic exercise effects. The reason for the more positive results in the horseback

riding group after 8 weeks is that the subjects needed time to adjust to the motion of the horse during horseback riding. It is considered that the group had better exercise results after the adjustment period.

Encheft<sup>15)</sup> reported that the horseback riding exercise treatment results in functional improvement of the four limbs, as it improves the posture controlling ability of the stomach muscles.

The common features of walking and horseback riding are that they both require pelvis movement and they both allow the trunk to be kept straight during movement. The differences between them include that walking allows the arms to move freely, while horseback riding requires more stability in the shoulders, as the hands should hold the reins. From this point of view, the walking program and the horseback riding program might have influenced the distance between the feet generated by exterior rotation of the hip joint after 8 weeks of the programs.

As time went on, the horseback riding group and the walking group both showed improved gait ability. The horseback riding group showed a more positive result than the walking group.

It is difficult to generalize the results of this study to all obese women because the number of study subjects was small and the intervention period was not long enough. In addition, this study could not examine periods of time in which the interventions were not being performed. Moreover, the individual subjects could not demonstrate their horseback riding ability, as there was a time limit in the program. Furthermore, this study did not utilize a concrete and dynamic approach in applying the horseback riding program. With respect to level of ability, the subjects were skilled at walking, while they were inexperienced at horseback riding. Therefore, hypothesis the testing of the effects is a bit questionable. Future studies should be performed without these limitations.

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