The Effects of Exercise Therapy on CVD Risk Factors in Women

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Abstract. [Purpose] The purpose of this study was to search for the association of Type D personality and CVD risk factors through comparison of the association of exercise participation with CVD risk factors in women. [Subjects] The research subjects were randomly assigned to four groups: Type D+Exercise (n=12), Type D+non-exercise (n=12), non-Type D+Exercise (n=12), and non-Type D+non-exercise (n=10). The study consisted of 46 participants. [Methods] An aerobic exercise program and meditation were conducted in parallel for 10 months. Stretching was performed for 10 min as a warm-up, and then walking and running on a treadmill at 60 to 70% of HRmax were performed for 40 min three times a week. Blood samples were processed according to standard laboratory procedures. The concentrations of TG and HDL cholesterol were determined enzymatically using a clinical chemistry analyzer (Hitachi High-Technologies Corporation, Tokyo, Japan). [Results] The weight, percentage of body fat, waist circumference, triglyceride concentration, HDL cholesterol concentration, systolic blood pressure, and diastolic blood pressure showed a significant difference between measurement times in the exercise groups. [Conclusion] In conclusion, there were significant differences between groups in terms of cardiovascular disease risk factors.

Key words: Exercise, CVD, Risk factor

INTRODUCTION

The traditional risk factors of cardiovascular disease (CVD) are age, smoking, hypertension, hypercholesterolemia, family history, and obesity. But these factors can explain the morbidity of CVD in only 50% of cases, and it is not known for certain how well any factor can accounts for the morbidity of CVD. In recognition of this, studies of relationships between CVD and psychosocial risk factors have increased.

Type D personality is characterized by both normal and stable personality traits, negative affectivity (NA, tendency experience negative emotions), and social inhibition (SI, tendency to inhibit self-expression in social interaction). With reference to Type D personality, it has been reported that the health conditions of people with a Type D personality are not six times better than those of people with a non-Type D personality based on a study intended for chronic cardiac disease patients. The results of studies intended for heart attack patients revealed that Type D personality was highly related to the onset of CVD prognosis and death rate and caused a falling off in the quality of life. Regular aerobic exercise reduces CVD risk factors and levels of oxidative stress and has a positive influence on lipoprotein metabolism. Also, it is reported that meditation increases the level of a strong vasodilator, nitrogen oxide, in the body improves cardiovascular functioning, and reduces arteriosclerosis.

The results of previous studies have been difficult to apply because the main subjects in the studies were patients with the disease. Also, previous studies in patients with the disease investigated the relation between Type D personality and risk factors of CVD, and no previous study has shown Type D personality to be associated with increased CVD risk in healthy populations. Therefore, the aim of this study was to search for the association of Type D personality and CVD risk factors through comparison of the association of exercise participation with CVD risk factors in women.

SUBJECTS AND METHODS

All subjects participated voluntarily and gave written informed consent. The 48 participants were classified into one of the following four groups: Type D+Exercise (n=12), Type D+non-exercise (n=12), non-Type D+Exercise (n=12), and non-Type D+non-exercise (n=10). Two subjects refused to participate, and so the final sample consisted of 46 participants. Characteristics of the participants are shown in Table 1. The 46 women participating were middle aged. All participants completed a 14-item Type D Scale (DS14) to whether they had a Type D personality. The DS14 consists
of two subscales, negative affectivity (NA) and social inhibition (SI), both of which comprise 7 items. A standardized cutoff score ≥ 10 on both subscales is used to classify a person as having a Type D personality. In this study, a Korean version of the DS14 developed by Lim et al. was used\(^{11}\). The Cronbach’s alpha was 0.82 for the NA subscale and 0.80 for the SI subscale, respectively. Subjects who reported going through menopause, drinking, smoking, and getting regular exercise in the past 6 months were excluded from this study. The sample size of this study was estimated prior to data collection by using a power analysis method as previously suggested\(^{12}\). Assuming a medium effect size of 0.25 and an alpha level of 0.05, G*Power 3.1 estimated that at least 8 participants would be necessary. All experiments were reviewed and approved by the Committee of the Kangwon National University. Blood samples were obtained following a 12-hour overnight fast. Samples were processed according to standard laboratory procedures. They were processed under the same conditions before exercise and 10 months after exercise. The concentrations of triglyceride (TG) and high-density lipoprotein (HDL) cholesterol were determined enzymatically using a clinical chemistry analyzer (Hitachi High-Technologies Corporation, Tokyo, Japan). Blood glucose was measured by the hexokinase method\(^{13}\). An aerobic exercise program and meditation were conducted in parallel for 10 months. Stretching was performed for 10 min as a warm-up, and then walking and running on a treadmill at 60 to 70% of HRmax\(^{7,14}\) were performed for 40 min three times a week. In order to accurately check whether the exercise was conducted within the set range of exercise intensity, we monitored the exercise intensity by having the subjects wear an automatic portable heart rate meter (Polar Electro, Kempele, Finland). Data are given as means±standard deviation (SD). Two-way repeated ANOVA was performed to examine differences between Type D personality and non-type D personality for 10 months. When a significant interaction effect was found between main effects, the paired t-test was applied to compare the effect between groups by time; for comparison between groups by time, one-way ANOVA and Duncan’s post hoc test were performed. SPSS for Windows version 20.0 was used for statistical analysis, and p<0.05 was considered statistically significant.

RESULTS

The changes in body composition and risk factors for CVD after 10 months of exercise are shown in Table 2. The percentage of body fat (p=0.025) showed a significant difference between measurement times, and the values groups were significantly lower than those of the non-exercise group. Waist circumference (p<0.001) showed a significant difference between groups, and the values of the Exercise group were significantly decreased compared with those of the non-exercise group; the value of the non-Type D+Exercise group (87.34±14.87 cm) was significantly smaller than that of the Type D+Exercise group (90.94±5.67 cm). The triglyceride concentration showed significant interaction effect between groups (p=0.004), and group×time (p=0.049), and in the post-exercise results, the triglyceride concentrations of the Exercise groups were decreased compared with the non-exercise group; that of the non-Type D+Exercise group (146.08±11.12 mg/dl) was lower than that of the Type D+Exercise group (157.75±10.25 mg/dl). The HDL cholesterol concentration showed significant differences between groups (p=0.030) and times (p=0.012), and it was significantly increased in the Type D+Exercise group (50.42±5.62 mg/dl) and non-Type D+Exercise group (52.33±4.79 mg/dl) compared with in the non-exercise groups. Systolic blood pressure showed a significant difference between groups (p=0.010) and was significantly higher in the Type D groups than in the non-type D groups. Diastolic blood pressure showed a significant difference between groups (p=0.005) and was lowest in the non-type D+non-exercise group compared with the other three groups. It was found that the participants with a Type D personality had two or more CVD risk factors before exercise, such as obesity, high blood pressure, or diabetes. The number of CVD risk factors showed a significant difference between groups (p<0.001) and times (p=0.007), and it was significantly decreased in the Type D+Exercise group (1.67±0.65 n) compared with in the non-type D+Exercise groups (1.08±0.90 n).

### Table 1. Characteristics of the subjects

| Variables          | Groups                  | S±M  |
|--------------------|-------------------------|------|
| Age (years)        | Exercise                | 47.8±1.8 |
|                    | Non-exercise            | 47.6±2.5 |
|                    | Type D                  | 46.6±2.4 |
|                    | Non-type D              | 46.7±1.9 |
| Height (cm)        | Exercise                | 156.6±4.9 |
|                    | Non-exercise            | 157.2±4.7 |
|                    | Type D                  | 157.3±6.2 |
|                    | Non-type D              | 157.9±5.5 |
| Weight (kg)        | Exercise                | 69.2±10.0 |
|                    | Non-exercise            | 66.8±8.0 |
|                    | Type D                  | 66.4±4.0 |
|                    | Non-type D              | 66.9±3.7 |

DISCUSSION

The prevalence rate of chronic diseases such as high blood pressure, diabetes, increases from the age of 40 onwards\(^{15}\), and considering that the onset and progression of most diseases that are the leading causes of death in domestic women can be prevented through early screening and the practice of a healthy lifestyle, such as cancer and cerebrovascular diseases\(^{16}\), it can be said that the role of exercise is important. Studies have shown that regular walking and running for 10 months are significantly effective in improving obesity indicators including weight, body mass index (BMI), and waist circumference.

It has been reported that as excessive accumulation of body fat causes the imbalance symptoms of insulin sensi-
tivity and insulin resistance cytokine expression, it plays a role in inducing the inflammatory response. Therefore, in this respect, the results of this study indicate that reduction of abdominal obesity and CVD risk factors through walking and running exercise is significantly effective in reducing serum levels of insulin resistance.

The blood pressure and heart rate of Type D personality subjects increase by more than those of the non-Type D personality subjects when under stress17), and secretion of the precursor of the inflammatory response cytokine is increased5). In this respect, the results of this study indicate that the phenomenon of reduction blood levels after exercise may be a secondary outcome due to the decrease in body fat and waist circumference resulting from exercise, and it is judged that the phenomenon of reduction of insulin resistance cytokine expression improves insulin sensitivity and contributes a decrease in CVD risk factors.

After exercise training in this study, although the Exercise groups showed a decrease in the degree of anxiety and depression, the non-exercise groups showed a significant increase. We found that aerobic exercise and meditation were effective in decreasing anxiety and depression. Depression and anxiety are more highly apparent in the CVD group than the healthy group, but it is ambiguous whether this is the result of illness or the result of the original personality traits. But, like this study, depression and anxiety of ordinary individuals, not those of CVD patients, can be interpreted as the results of personality maladjustment irrelevant to disease. Programs need to be developed that can raise the awareness associated with dietary habits, health-related behaviors, effort to improve health through the diet, etc., and to manage stress.

The limitations of this study include the fact that the number of subjects was small, and thus the results cannot be extrapolated to all women.

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| Table 2. The changes in body composition and risk factors of CVD |
|---------------------------------------------------------------|
| **Variables** | **Groups** | **Before** | **After** | **Difference** | **Duncan** |
|----------------|-----------|-----------|-----------|---------------|-----------|
| Percent fat (%) | Type D | Exercise | 38.0±5.0 | 33.4±5.7 | −4.6**<sup>***</sup> |
| | Type D | Non-exercise | 37.5±4.3 | 37.4±4.2 | −0.0 |
| | Non-type D | Exercise | 36.7±3.5 | 33.3±3.7 | −3.3**<sup>***</sup> |
| | Non-type D | Non-exercise | 37.1±3.0 | 37.1±3.3 | 0.1 |
| Waist circumference (cm) | Type D | Exercise | 95.1±7.1 | 90.9±5.7 | −4.2<sup>c</sup> |
| | Type D | Non-exercise | 96.8±6.6 | 97.3±6.8 | 0.5<sup>c</sup> |
| | Non-type D | Exercise | 90.4±6.6 | 87.3±4.9 | −3.1 |
| | Non-type D | Non-exercise | 95.5±7.7 | 95.7±8.0 | 0.2 |
| Triglyceride (mg/dl) | Type D | Exercise | 173.4±9.8 | 157.8±10.3 | −15.7**<sup>***</sup> |
| | Type D | Non-exercise | 176.8±11.5 | 176.2±11.0 | −0.7<sup>c</sup> |
| | Non-type D | Exercise | 161.3±13.3 | 146.1±11.1 | −15.3**<sup>***</sup> |
| | Non-type D | Non-exercise | 167.5±18.1 | 167.7±16.7 | 0.3 |
| HDL cholesterol (mg/dl) | Type D | Exercise | 44.0±5.8 | 50.4±5.6 | 6.4**<sup>***</sup> |
| | Type D | Non-exercise | 45.8±4.9 | 45.6±4.6 | 0.2<sup>b</sup> |
| | Non-type D | Exercise | 47.2±5.5 | 52.3±4.8 | 5.1**<sup>***</sup> |
| | Non-type D | Non-exercise | 45.8±5.6 | 45.6±5.3 | −0.2 |
| Systolic blood pressure (mmHg) | Type D | Exercise | 137.1±6.6 | 132.5±5.8 | −4.6 |
| | Type D | Non-exercise | 137.1±8.1 | 135.0±7.1 | −2.1<sup>c</sup> |
| | Non-type D | Exercise | 132.5±8.1 | 127.1±6.9 | −5.4<sup>c</sup> |
| | Non-type D | Non-exercise | 127.3±14.7 | 129.1±12.6 | 1.8 |
| Diastolic blood pressure (mmHg) | Type D | Exercise | 88.8±3.8 | 83.8±3.8 | −5.0 |
| | Type D | Non-exercise | 85.0±6.4 | 84.2±5.6 | −0.8<sup>c</sup> |
| | Non-type D | Exercise | 86.7±7.2 | 82.5±6.9 | −4.2<sup>d</sup> |
| | Non-type D | Non-exercise | 79.6±10.4 | 79.1±7.7 | −0.5 |
| Number of CVD risk factors (n) | Type D | Exercise | 2.7±1.0 | 1.7±0.7 | −37.5*<sup>c</sup> |
| | Type D | Non-exercise | 2.8±1.1 | 2.8±1.0 | 0.0<sup>c</sup> |
| | Non-type D | Exercise | 1.9±0.5 | 1.1±0.9 | −43.8**<sup>***</sup> |
| | Non-type D | Non-exercise | 2.45±0.7 | 2.4±0.8 | −3.7 |

Mean±SD. **<sup>p</sup><0.001; *<sup>p</sup><0.01; *<sup>p</sup><0.05 (by paired t-test). a, Type D+Exercise (n=12); b, Type D+non-exercise (n=12); c, non-Type D+Exercise (n=12); d, non-type D+non-exercise (n=10)
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