

Comparison of the Effects of Exercise Participation on Psychosocial Risk Factors and Cardiovascular Disease in Women

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Abstract. [Purpose] The aim of this study was to research the association of Type D personality with CVD risk factors and psychology through comparison of the association of exercise participation with CVD risk factors and psychological risk factors in women with Type D. [Subjects] This study included 416 middle-aged women. All participants completed the 14-item Type D Scale (DS14) to assess Type D personality. The DS14 consists of two subscales, NA and SI, both of which comprise 7 items. 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), 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 were performed on a treadmill at the HRmax 60–70% level for 40 min; this was done three times a week. Blood samples were processed according to standard laboratory procedures. The concentrations of TG and HDL-cholesterol were determined enzymatically on a clinical chemistry analyzer. Blood glucose was measured by the hexokinase method. [Results] Weight, percent fat, social support, and waist circumference showed a significant difference between times in the Exercise groups, and the values were significantly lower than those of the non-Exercise groups. Anxiety and depression showed a significant interaction effect between groups. The average number of CVD risk factors in subjects showed a significant difference between groups. [Conclusion] In conclusion, there were significant differences between groups in terms of CVD risk factors and psychological risk factors in women with Type D personality.

Key words: Psychological, Personality, Exercise

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INTRODUCTION

Type D personality is characterized by both normal and stable personality traits, negative affectivity (NA, tendency to experience negative emotions), and social inhibition (SI, tendency to inhibit self-expression in social interaction)^{1, 2)}. With reference to Type D personality, the health condition of Type D personality people is not six times better than that of non-Type D personality people through the study intended for chronic cardiac disease patients³⁾, through the results of studies intended for heart attack patients, reported that Type D personality was highly related to the onset of cardiovascular disease (CVD) prognosis, death rate and caused a falling-off in quality of life⁴⁾.

Negative emotions are associated with increased pro-

duction of pro-inflammatory cytokines including tumor necrosis factor-alpha (TNF- α) and interleukin-6 (IL-6)^{5, 6)}. Episodic psychological risk factors such as depression have been associated with poor prognosis in CVD^{7, 8)}. Chronic psychological risk factors may also affect clinical manifestations of heart disease⁹⁾, but individual difference variables like personality traits have received little attention to date in behavioral immunology research¹⁰⁾.

Regular aerobic exercise reduces CVD risk factors and levels of oxidative stress and, has a positive influence on lipoprotein metabolism¹¹⁾. Personality type, unlike other psychological factors, is slowly and stably formed from childhood through adulthood and is not easily changed, so psychological factors of Type D personality people are likely formed repeatedly over a comparatively long period of time. They think that it is needed to apply the long-term exercise program over 12 weeks. Also, it was difficult that the results of studies was applied because the main subjects of previous studies was patients with disease. Furthermore, a previous study in patients with disease has investigated the relation between Type D personality and risk factors of CVD, but no previous study has shown Type D personality

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to be associated with increased CVD risk in healthy populations¹²).

Therefore, the aim of this study was to research the association of Type D personality with CVD risk factors and psychology through comparison of the association of exercise participation with CVD risk factors and psychological risk factors in women with Type D personality.

SUBJECTS AND METHODS

This study included 416 middle-aged women. All participants completed the 14-item Type D Scale (DS14) to assess Type D personality. The DS14 consists of two subscales, NA and SI, both of which comprise 7 items. A standardized cut-off score ≥ 10 on both subscales is used to classify Type D personality¹³. In this study, a Korean version of the DS14 was used¹³. The Cronbach's α was 0.82 for the NA subscale and 0.80 for the SI subscale. Based on self-reporting, subjects who had gone through menopause, drank alcohol, smoked, or had been performing regular exercise for more than 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 suggested¹⁴. Assuming a medium effect of 0.25 and an alpha level of 0.05, G*Power 3.1 estimated that at least 8 participants were required. All subjects participated voluntarily and gave written informed consent. The 48 participants were classified into one out of four subgroups: Type D+Exercise (n=12), Type D+non-Exercise (n=12), non-Type D+Exercise (n=12), 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.

Social support, anxiety, depression, NA, and SI were chosen as psychosocial risk factors of CVD^{15, 16}. In the Korean version of the social support scale, each item is scored on a 4-point Likert scale ranging from 0 to 3¹⁷. The Cronbach's alpha of the social support scale was 0.85. We investigated anxiety using the Korean version of the Spielberger State and Trait Anxiety Inventory (STAI-S). The items of this scale are answered on a 4-point Likert scale from 1 to 4. The Cronbach's α of the STAI-S was 0.83. The self-rating depression scale¹² is a short self-report scale designed to measure depressive symptoms. The questionnaire contains 20 items, and each item is scored on a 4-point scale ranging from 0 to 3. The Cronbach's α of the self-rating depression scale was 0.87.

SPSS for Windows version 20.0 was used for statistical analysis, and $p < 0.05$ was considered statistically significant. One-way ANOVA was performed for verification of differences between groups with regard to variables measured before the interventions. Two-way repeated ANOVA was performed to examine differences between Type D personality and non-Type D personality after 10 months. In the case of a significant interaction effect between the main effects, the paired t-test was applied between groups by time, and for comparison between groups by time, one-way ANOVA and Duncan's post hoc test were performed.

Table 1. Characteristics of the subjects

Variables	Groups		M \pm SD
Age (years)	Type D	Exercise	47.8 \pm 1.75
		Non-Exercise	47.5 \pm 2.50
	Non-Type D	Exercise	46.5 \pm 2.43
		Non-Exercise	46.7 \pm 1.90
Height (cm)	Type D	Exercise	156.5 \pm 4.93
		Non-Exercise	157.1 \pm 4.74
	Non-Type D	Exercise	157.2 \pm 6.16
		Non-Exercise	157.8 \pm 5.31
Weight (kg)	Type D	Exercise	69.2 \pm 9.99
		Non-Exercise	66.8 \pm 8.00
	Non-Type D	Exercise	66.4 \pm 4.00
		Non-Exercise	66.8 \pm 3.73

RESULTS

The changes in body composition and psychosocial risk factors after exercise for 10 months are shown in Table 2. Weight ($p=0.026$) and percent body fat ($p=0.025$) showed a significant difference between times, and those of the Exercise groups were significantly lower than those of the non-Exercise groups. Social support showed a significant difference between groups ($p < 0.001$), and social support in the Type D groups were lower than that in the non-Type D groups; the levels of social support in the Type D+Exercise (44.42 \pm 8.59 score) and non-Type D+Exercise (51.50 \pm 8.63 score) groups were significantly increased. Waist circumference ($p < 0.001$) showed a significant difference between groups, and those of the Exercise groups were significantly decreased compared with those of the non-Exercise groups; that of the non-Type D+Exercise group (87.34 \pm 4.87 cm) was significantly smaller than that of the Type D+Exercise group (90.94 \pm 5.67 cm).

Anxiety and depression showed a significant interaction effect between groups ($p < 0.001$) and for group \times time ($p=0.023$, $p=0.010$ respectively), and the scores for the Type D groups were significantly higher than those of the non-Type D group in the post-test results; those for the Exercise groups were significantly decreased compared with those of the non-Exercise groups. NA and SI showed a significant difference between groups ($p < 0.001$) and were significantly decreased in the Type D+Exercise group (11.42 \pm 2.07 and 11.33 \pm 2.35, respectively). The average number of CVD risk factors in subjects showed a significant difference between groups ($p < 0.001$) and times ($p=0.007$), and the numbers of CVD risk factors were significantly decreased in the Type D+Exercise (1.67 \pm 0.65) and non-Type D+Exercise (1.08 \pm 0.90) groups.

DISCUSSION

People with a Type D personality have a temperament featuring a lack of positive emotions and so have high self-esteem and high stress responses under certain circumstances¹⁸. It is easier for them to feel more depressed than

Table 2. The changes in body composition and psychosocial risk factors of CVD

Variables	Groups		Before	After	Difference	Duncan
Weight (kg)	Type D	Exercise	69.21±9.99	63.09±9.62	-6.12***	
		Non-Exercise	66.81±8.00	66.69±8.22	-0.12	
	Non-Type D	Exercise	66.43±4.00	59.04±4.59	-7.39***	
		Non-Exercise	66.89±3.73	67.40±3.11	0.51	
Percent fat (%)	Type D	Exercise	38.02±5.00	33.41±5.69	-4.61***	
		Non-Exercise	37.47±4.31	37.43±4.21	-0.04	
	Non-Type D	Exercise	36.68±3.52	33.34±3.68	-3.34***	
		Non-Exercise	37.05±3.03	37.12±3.25	0.07	
Waist circumference (cm)	Type D	Exercise	95.14±7.07	90.94±5.67	-4.20	
		Non-Exercise	96.78±6.62	97.30±6.84	0.52	c<a<d, b
	Non-Type D	Exercise	90.43±6.58	87.34±4.87	-3.09	
		Non-Exercise	95.47±7.74	95.68±8.03	0.21	
Energy (kcal)	Type D	Exercise	1,947.10±270.32	1,921.38±251.80	-1.32	
		Non-Exercise	1,934.54±266.43	1,926.56±273.23	-0.41	
	Non-Type D	Exercise	1,927.43±252.00	1,918.44±317.12	-0.47	
		Non-Exercise	1,929.50±274.00	1,921.81±306.20	-0.40	
Social support (score)	Type D	Exercise	35.58±9.54	44.42±8.59	24.85	
		Non-Exercise	40.75±10.00	39.42±7.83	-3.26	a, b<d, c
	Non-Type D	Exercise	47.50±10.45	51.50±8.63	8.42	
		Non-Exercise	48.60±8.21	47.70±7.54	-1.85	
Anxiety (score)	Type D	Exercise	56.00±8.76	47.67±6.62	-14.88	
		Non-Exercise	56.08±12.49	61.75±13.29	10.11	c, d<a<b
	Non-Type D	Exercise	48.25±6.28	41.08±3.75	-14.86	
		Non-Exercise	46.10±5.53	45.60±7.29	-1.08	
Depression (score)	Type D	Exercise	56.25±8.23	46.17±7.93	-17.92	
		Non-Exercise	55.67±11.80	61.50±12.80	10.47	c<d, a<b
	Non-Type D	Exercise	46.83±7.65	39.08±6.11	-16.55	
		Non-Exercise	47.10±5.32	45.60±5.17	-3.18	
Negative affectivity (score)	Type D	Exercise	12.75±3.17	11.42±2.07	-10.43	
		Non-Exercise	16.33±4.48	16.42±4.25	0.55	c, d<a<b
	Non-Type D	Exercise	4.92±3.65	4.75±3.52	-3.46	
		Non-Exercise	5.40±3.27	5.60±3.53	3.70	
Social inhibition (score)	Type D	Exercise	12.75±3.11	11.33±2.35	-11.14	
		Non-Exercise	15.75±4.59	16.17±4.47	2.67	c, d<a<b
	Non-Type D	Exercise	4.50±3.45	4.33±3.26	-3.78	
		Non-Exercise	4.40±2.55	4.60±2.88	4.55	
CVD risk (n)	Type D	Exercise	2.67±0.98	1.67±0.65	-37.45*	
		Non-Exercise	2.75±1.06	2.75±0.97	0.00	c<a<d, b
	Non-Type D	Exercise	1.92±0.51	1.08±0.90	-43.75**	
		Non-Exercise	2.45±0.69	2.36±0.81	-3.67	

Mean±SD. ***p<0.001; **p<0.01; *p<0.05 (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)

people with non-Type D personality, and they tend to have a very low life satisfaction⁴). Apart from negative emotions, social inhibition may also impact the immune system¹⁹). In relation to health problems, Type D personality is a factor causing occurrence of CVD and poor prognosis^{4, 19}).

In a previous study, the heart rates of the heart rate recovery at one minute of rest (HRR-1)≤18 bpm group was significantly lower than that of the HRR-1>18 bpm group during exercise, and most of the subjects had a Type D per-

sonality; it was also particularly confirmed that they had high SI tendencies²⁰). But after a cardiac rehabilitation program for 12 weeks, maximum aerobic exercise capacity, left ventricular ejection fraction, exhaustion time, and Type D character variables did not show significant differences between groups²). Milani and Lavie reported that as CVD patients can have low cardiorespiratory function, the effect of exercise training for three months is insufficient²¹). CVD patients have various CVD risk factors, and they need more

long-term exercise training rather than a higher exercise intensity in order to reduce the CVD risk factors. Therefore, application of the long-term exercise program conducted in this study is effective in improving CVD risk factors²²⁾.

Through studies on Type D personality and the effects of exercise programs, the Type D personality score was found to decrease and quality of life was found to increase after a cardiac rehabilitation program²³⁾. Anxiety and depression scores in people with Type D personality decreased after a three-month cardiac rehabilitation program³⁾.

After long-term exercise training in this study, the Exercise groups showed decreased degrees of anxiety and depression, while the non-Exercise groups showed significant increases. Therefore, we found that aerobic exercise and meditation were effective for decreasing anxiety and depression. Depression and anxiety appear to be higher in individuals with CVD than on those that are healthy, but it is ambiguous whether this is the result of illness or the result of original personality traits. However, as in the present study, depression and anxiety in the general population can be interpreted as the results of personality maladjustment unrelated to disease.

Psychological factors may also promote immune dysregulation. It has been suggested that a dysregulated cytokine network is implicated in the pathophysiology of emotional distress in coronary artery disease^{24, 25)}. Programs need to be developed that can raise the awareness associated with dietary habits, care for health control behaviors, health-related behaviors, the effort for health in diet, etc., and to manage stress, motivators and opportunities should be diversified that can strongly take advantage of sound programs such as those incorporating various movements in daily life, singing classes, yoga, meditation, etc., which have already been developed and are widely available. The muscle output during simultaneous contraction was larger than that of each individual muscle, suggesting that it is easier to contract the LA when the TA is contracted from the standpoint of the kinetic chain²⁶⁾.

The limitations of the present study include its relatively small sample size. In addition, the findings from the study results were somewhat limited by the small sample sizes for the groups. However, the present study has extended the existing research on Type D personality in several respects, including intervention and social support.

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