

# Effects of Lower Body Muscle Exercise on Blood Lipids and Homocystein

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## Abstract

**Background/Objectives:** The purpose of this study was to investigate the effect of lower body center strength exercise on blood lipid and homocysteine in middle-aged men. For this purpose, 20 middle-aged men in their 40s were divided into 10 lower body muscle exercise group and 10 control group. The subjects were selected for those who have not participated in regular exercise and weight loss programs in recent years.

**Method/Statistical Analysis:** The LBMG's treatment program was followed by muscle exercise around the lower body for 60 minutes, 3 times a week for 12 weeks. CG was to maintain a normal life without any treatment during the 12 weeks of the experiment. Mean and standard deviation of each group and treatment time were calculated and 2-way ANOVA was performed to analyze the treatment effect. The significance level was verified at .05 level

**Findings:** 12 weeks of lower body muscle exercise showed significant differences in blood lipid variables such as triglyceride, high density lipoprotein, low density lipoprotein, total cholesterol and homocysteine.

**Improvements/Applications:** The purpose of this study was to investigate the effect of 12 weeks of lower body muscle exercise on blood lipid and homocysteine change. Lipoprotein, total cholesterol, and homocysteine showed positive improvement. In this respect, strength training of the large muscle center of the lower body is considered to be effective in improving blood lipid.

**Keywords:** Lower Body Muscle Exercise, Blood Lipid, Homocysteine, Middle Aged Men.

## Introduction

Korea has already entered the aging society in August 2018, with 12.95 million people (24.5%) in 2030 and 18.85 million people (41%) are expected in 2060<sup>[1]</sup>. This implies that people living in this society now will have to live their long middle age than any other

previous generation. In order to live a long middle age, economic ability must be followed even after retirement. However, career and jobs, which are the basis of people's economic ability - are now in such an instable state due to low lifelong employment rate, collapses of the social structure and de-hiring<sup>[2]</sup>. In particular, Korean men, now in their 40s, have experienced the rise and fall of the Korean economy since entering the job market during the 1997-1998 financial crisis. Moreover, middle-aged men are known to be vulnerable in various health conditions<sup>[3]</sup>.

Inactive and sedentary lifestyle is the primary risk factor for coronary artery disease. However, middle-aged men had shown that they have higher risk factors than women, including sedentary life style, smoking,

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hypertension, and hyperlipidemia. Middle-aged men could increase the incidence of type 2 diabetes, hyperlipidemia, hypertension, and atherosclerotic cardiovascular disease with complication of obesity- and they were four times more likely to develop cardiovascular disease than men in their 20s-30s, and also the mortality rates have been reported to be three times higher<sup>[4]</sup>.

Several risk factors for coronary heart disease (CHD) have been found out by studies examining various properties such as genetic markers, lifestyle and health status<sup>[5-6]</sup>. In addition, most chronic diseases are associated with a number of unhealthy lifestyle factors, including smoking, unhealthy foods, sedentary activities and excessive alcohol consumption<sup>[7]</sup>. The long-term health effects of several different unhealthy lifestyle patterns tend to interact to each other rather than simply being added, and changing life styles have been considered as effective intervention strategies for the management of various chronic diseases<sup>[8]</sup>.

Physical activity and regular exercise not only can prevent metabolic syndrome and also can lower the occurrence rate of various degenerative diseases, but also can prevent disease, reduce premature mortality and extend lifespan. In addition, higher fitness levels have a positive effect on the prevention and treatment of metabolic diseases such as obesity and diabetes, and the importance of exercise<sup>[9-10]</sup>.

Muscle strengthening program is one of the exercising method which can effectively improve muscle function. It enables various types of exercise by using various magnetic weight and exercise method using gravity or weight device. It is a representative method of

resistance exercise with excellent activity and relatively easy activity<sup>[11]</sup>.

It is widely known that muscular strength, cardiovascular endurance, and balancing tend to decrease when people get older<sup>[12-14]</sup>. Physical strength reduces cardiovascular risk by up to 50% in the middle age, prevents the development of triglyceride (TG), total cholesterol and low density lipoprotein (LDL) risk factors, and increases high density lipoprotein (HDL) levels<sup>[15-17]</sup>. In addition, homocysteine blood concentrations are known as independent cardiovascular risk factors<sup>[18]</sup>, and the increase of homocysteine is known to be associated with increasing the risk of cardiovascular disease, cognitive disorders, cancer, chronic renal failure and other chronic diseases<sup>[19]</sup>. Therefore, this study was conducted to build up the basic data for effective exercise prescription program for prevention of chronic and cardiovascular diseases by comparing and analyzing the effects on blood lipid and homocysteine after 12 weeks of lower body muscle exercise in middle-aged men.

**Method**

**1. Subject of Study:** The purpose of this study was to investigate the effect of lower body center strength exercise on blood lipid and homocysteine in middle-aged men. For this purpose, 20 middle-aged men in their 40s were divided into 10 lower body muscle exercise group (LBMG) and 10 control group (CG). The subjects were selected for those who have not participated in regular exercise and weight loss programs in recent years. The physical characteristics of the study subjects are shown in Table 1.

**Table1: Physical Characteristic of Subjects (M±SD)**

Group	N	Age (Yr)	Height (cm)	Weight (kg)	Fat (%)
LBMG	10	41.35±2.55	175.60±1.24	87.02±5.62	28.56±1.48
CG	10	42.38±2.23	172.82±1.80	85.60±4.94	29.36±2.40

**2. Exercise Program:** The LBMG’s treatment program was followed by muscle exercise around the lower body for 60 minutes, 3 times a week for 12 weeks. CG was to maintain a normal life without any treatment during the 12 weeks of the experiment. The exercise intensity of the LBMG was set by the researcher by setting the intensity and duration of

the program in consideration of the exercise ability of each subject. Prolonged rest and sugar intake during exercise were limited. The environmental homogeneity of LBMG and CG was secured. The main program of LBMG was 10 minutes each for warm-up and cool-down. Warm-up and cool-down were performed with stretching around the

upper body and lower body. The main exercise was maintained at 65-75% based on 1RM. Exercise events consisted of programs for strengthening lower body muscle exercise. Lower body exercise programs are shown in <Table 2>.

**Table 2: Lower body exercise Program**

Variable	Treatment program	Time/intensity
Warm-up/cool-down	Upper/lower stretching	Each 10min
Main exercise	Squat, plank, crunch, leg raise, leg press, leg extension, lunge, stiff legged deadlift	40min/1RM<75%, 10times, 2-3set, 2-3min rest

**3. Measurement method and equipment:** The body composition was performed using Inbody 770 Bio Space (Korea). Blood lipid variables such as triglyceride, high density lipoprotein, low density lipoprotein, total cholesterol and homocysteine were

analyzed before and after 12 weeks of experiment. 24 hours fasting time was maintained before blood test, and blood was collected by nurse and referred to medical center for analysis.

**4. Data Analysis:** Mean and standard deviation of each group and treatment time were calculated and 2-way ANOVA was performed to analyze the treatment effect. The significance level was verified at .05 levels.

**Result and Discussion**

**1. Blood Lipid:** According to <Table 3>, there was an interaction effect on TG (p = .016), TC (p = .001), HDL-C (p = .001) and LDL-C (p = .001) in the lower body muscle exercise group (LBMG) compared to the control group (CG). This suggests that lower body muscle exercise has a significant effect on blood lipid change.

**Table 3: Blood Lipid ANOVA**

Factor	Group	Pre	Post	P
TG (mg/dl)	LBMG	137.42±26.22	120.21±24.85	Group*period: .016 Group: .563 Period: .012
	CG	120.77±37.68	120.34±33.96	
TC (mg/dl)	LBMG	198.40±27.38	174.49±31.68	Group*period: .001 Group: .590 Period: .001
	CG	176.45±34.89	182.74±44.32	
HDL-C (mg/dl)	LBMG	53.62±9.90	61.32±6.94	Group*period: .001 Group: .038 Period: .004
	CG	51.48±7.63	50.80±7.67	
LDL-C(mg/dl)	LBMG	122.00±20.43	103.04±23.27	Group*period: .001 Group: .156 Period: .005
	CG	116.94±26.91	119.31±28.86	

**2. Homocysteine:** According to <Table 4>, there was an interaction effect in homocysteine (p = .001) in the lower body muscle exercise group

(LBMG) compared to the control group (CG). This suggests that high-intensity combined exercise has a significant effect on homocysteine.

**Table 4: Homocysteine ANOVA**

Factor	Group	Pre	Post	P
Homocysteine (umol/L)	LBMG	14.41±2.78	12.56±2.54	Group*period: .001 Group: .005 Period: .001
	CG	13.27±2.35	13.07±1.99	

## Discussion

This study was conducted to build up the basic data for effective exercise prescription program to prevent chronic and cardiovascular diseases. 12 weeks exercise program was designed, and the following explains the results by comparing and analyzing the effects on blood lipid and homocysteine after 12 weeks of lower body muscle exercise in middle-aged men.

Physical fitness reduces the cardiovascular risk by up to 50% in middle age, prevents the development of triglyceride (TG), cholesterol (TC), and low density lipoprotein (LDL) risk factors and increases high-density lipoprotein (HDL) levels<sup>[20]</sup>. High levels of homocysteine in the blood are also emerging as a new risk factor for health as an independent factor inducing arteriosclerosis along with blood lipids<sup>[21]</sup>. In addition, a decrease in homocysteine concentration is associated with a reduced risk of cardiovascular disease, and plasma homocysteine concentration increases with age<sup>[22]</sup>. Physical exercise reduced the risk of cardiovascular disease<sup>[23-24]</sup> and is now reported that exercise appears to alter blood homocysteine levels<sup>[25]</sup>.

When delving into previous studies on changes in blood lipids through muscle exercise in middle-aged men, Shim<sup>[26]</sup>, has shown that the improvement of blood lipids was reported in obese middle-aged men who performed pilates exercise three times a week for 12 weeks (with mid-level intensity) for 65 minutes each time. Additionally, Boo<sup>[27]</sup> also reported positive effects of blood lipids through the results of effective resistance exercise to strengthen upper and lower body strength with an exercise program, which was carried out 4 sets per week for 8 weeks, 3 sets (12 times in each set) of using 60~80% intensity of 1~RM. In the study of Eem, Cho & Lee<sup>[28]</sup>, circuit exercise with 50~60% intensity of HRR for 40 minutes was carried out for 8 weeks, three times a week, 40 minutes each - and did show an improvement in blood lipids. In addition, the study by Shim & Kim<sup>[29]</sup> also reported the effect of resistance movements with 50-80% intensity of HRR, twice a week, every 50 minutes, for 15 weeks.

When reviewing the previous studies which dealt with changes in homocysteine through muscle exercise in middle-aged men, Steenge et al<sup>[30]</sup> reported that blood homocysteine levels were significantly reduced after 8 weeks of resistance training in adult men. Furthermore, several studies dealt with exercise programs which

had effects on decreasing homocysteine levels<sup>[31]</sup>. Previous studies have also suggested that homocysteine concentrations decrease after resistance training<sup>[32]</sup>, but aerobic exercise training has been shown to be less or no effective in reducing homocysteine levels<sup>[33]</sup>.

In this study, the lower body muscle exercise of 1RM 65-75% was performed for 12 weeks - three times a week, 60 minutes each for middle-aged men, and the results showed a significant difference in blood lipid and homocysteine. These results suggest that it could reduce the concentration of homocysteine in the blood, because the resistance exercise requires more protein metabolism, increases the protein synthesis for skeletal muscle contractile activity and it also increases protein retention in muscle<sup>[32]</sup>.

This decrease in homocysteine levels in blood which was demonstrated by resistance training studies seems to be related to exercise, intensity, and exercise performance rather than walking and stair climbing activities<sup>[34]</sup>. In addition, one of the mechanisms associated with homocysteine function in cardiovascular disease is due to a decrease in HDL levels. Homocysteine reduces HDL concentration in plasma by inhibiting liver synthesis of apoprotein A, which presents in HDL. Reduced HDL concentrations and increased homocysteine levels may increase the risk of cardiovascular disease<sup>[22]</sup>.

As described above, the lower body muscle exercise conducted in this study is considered as an effective exercise program, which can prevent cardiovascular diseases by improving blood lipids and homocysteine - by strengthening the thigh muscles of human body. In addition, it is considered that further research is needed to develop realistic and diverse exercise programs and to verify the effects of the results of applying these findings to the field.

## Conclusion

The purpose of this study was to investigate the effect of 12 weeks of lower body muscle exercise on blood lipid and homocysteine change. Lipoprotein, total cholesterol, and homocysteine showed positive improvement. In this respect, strength training of the large muscle center of the lower body is considered to be effective in improving blood lipid. Based on this program, various weight loss and metabolic syndrome improvement programs are needed.

**Ethical Clearance:** Not required

**Source of Funding:** Self

**Conflict of Interest:** Nil

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