Journal of Biochemistry and Cell Biology

Mini Review Open Access

Regular and Consistent Exercise Increases High-Density Lipoprotein (HDL) Quantity and Quality in Middle-Aged Women with Improvements in Lipid and Apolipoprotein

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Abstract

HDL-C (high-density lipoprotein cholesterol) levels in the blood can generally be improved with regular aerobic exercise, in particular. Exercise enhances HDL functionality, antioxidants, and cholesterol efflux in addition to raising HDL-C levels. However, middle-aged women must determine the ideal exercise intensity and frequency in order to increase HDL quantity and quality. The purpose of this study was to compare the effects of exercise intensity, frequency, and duration on HDL quantity and quality in middle-aged women; There were three groups of participants: a group that is sedentary (group 1), a group that is middle-intensity (group 2), and a group that is high-intensity (group 3). The only anthropometric parameters that did not differ between the groups were blood pressure, muscle mass, and handgrip strength. HDL-C and apolipoprotein (apo)A-I levels in the blood were noticeably elevated in group 3 to 17% and 12%, respectively, despite the lack of a difference in serum total cholesterol (TC). Depending on the intensity of the exercise, the exercise groups saw significant reductions in serum LDL-C, glucose, triglycerides, and the apo-B/apoA-I ratio; Group 3 had lower levels of LDL-C, glucose, and triglycerides (TG) by 13%, 10%, and 45% than group 1. Aspartate aminotransferase (AST) levels in the hepatic and muscle damage parameters were significantly lower in the exercise groups. However, the three groups had comparable levels of high-sensitivity C-reactive protein (CRP), alanine aminotransferase (ALT), and -glutamyl transferase (-GTP). LDL showed the slowest electromobility and a distinct band intensity when compared to the sedentary group (group 1) in the exercise groups (groups 2 and 3), while the TG content in group 3 was 23% lower than in group 1, and the particle size in LDL increased by 1.5 times (p 0.001). The HDL2 exercise group (group 3) had 2.1 times more particles and 1.5 times more TC than group 1 (p 0.001). The exercise group also had significantly higher antioxidant capacity, paraoxonase (PON) activity, and ferric ion reduction capacity (FRA). Group 3's HDL3 particle size was 1.2 times larger than that of group 1, and the TG was 45 percent lower than that of group 1. HDL2 and HDL3 apoA-I expression, PON activity, and FRA were all elevated with increasing exercise intensity (p 0.001). Final outcomes show that middle-aged women who exercise regularly have higher levels of HDL-C and apoA-I in their blood, as well as higher levels of HDL quality and functionality, TC content, particle size, and antioxidant capacity. Regular, intensity-dependent exercise may enhance the anti-atherogenic properties of lipoproteins by reducing TG and oxidized products in LDL and HDL.

Keywords: High-Density Lipoproteins; Apolipoprotein A-I; Exercise; Paraoxonase; Low-Density lipoproteins

Introduction

Sedentary lifestyles are a major risk factor for cardiovascular disease and metabolic syndrome. Insulin resistance, abdominal obesity, low HDL-C, and high triglyceride (TG) levels are frequently linked to sedentary living. Exercise is linked to a lower risk of cardiovascular disease and overall mortality, dose-dependently. Regular exercise boosts HDL-C by increasing antioxidant, anti-inflammatory, and cholesterol efflux activity. However, poor diet, sedentary behavior, alcohol consumption, and smoking can all reduce HDL-C quantity and quality. Dysfunctional HDL production is intimately linked to a high incidence of metabolic syndrome because impaired HDL qualities, such as decreased oxidation and glycation properties, are frequently found in patients with obesity, diabetes, and hypertension [**1-3**]. Consequently, it is generally accepted that maintaining HDL's healthy and protective effects is linked to controlling hypertension, diabetes, and dementia. Policosanol, a nutrient supplement, has been shown in numerous human studies to increase HDL-C quantity, quality, and functionality in healthy subjects. In a number of human studies, apoA-I and paraoxonase activity were found to have a strong correlation with HDL function in prehypertension. Lifestyle and nonpharmacological interventions like exercise and nutrition can also improve HDL-C quantity and quality. Aerobic sports athletes like runners and wrestlers have the highest HDL-C, largest particle size, HDL content of apoA-I, and paraoxonase (PON) activity among the national Olympic representatives. Regardless of the type of exercise, these findings suggest that regular exercise may increase HDL-C quantity and HDL functionality [**4-7**].

In contrast, there are no studies that compare middle-aged, nonsmoking women's HDL quality and functionality in sedentary and exercise groups. As evidenced by decreases in LDL-C and TG and increases in HDL-CO, numerous studies have demonstrated that exercise transformed the pro-atherogenic lipid profile into an anti-atherogenic profile. Middle-aged, healthy, and normolipidemic women who had exercised regularly for at least a year prior to the study were compared to see how exercise intensity affected HDL and LDL properties like particle shape and size, oxidation and glycation extent, and lipid and apolipoprotein compositions [**8**].

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Received: 07-Jan-2023, Manuscript No: jbcb-23-85994, **Editor assigned:** 10-Jan-2023, PreQC No: jbcb-23-85994 (PQ), **Reviewed:** 24-Jan-2023, QC No jbcb-23-85994, **Revised:** 27-Jan-2023, Manuscript No: jbcb-23-85994 (R), **Published:** 31-Jan-2023, DOI: 10.4172/jbcb.1000173

Citation: Murphy A (2023) Regular and Consistent Exercise Increases High-Density Lipoprotein (HDL) Quantity and Quality in Middle-Aged Women with Improvements in Lipid and Apolipoprotein. J Biochem Cell Biol, 6: 173.

Lipoproteins' Electromobility

The agarose electrophoresis migration of each lipoprotein (LDL, HDL2, and HDL3) was used to compare the electromobility of the participant samples. The three-dimensional structure of HDL and its intact charge determine the relative electrophoretic mobility [**9**]. As a outcome, agarose gel electrophoresis with HDL2 and HDL3 in the nondenatured state was carried out for each group. After the gels were dried and stained with 0.125 percent Coomassie Brilliant Blue, band scanning using Gel Doc® XR (Bio-Rad) and Quantity One software was used to compare the relative band intensities [**10**].

Discussion

The number of large HDL particles increased despite the differences in exercise regimens, according to a meta-analysis of ten interventions. There is insufficient information regarding HDL particle shape, composition, and the extent of oxidation and glycation, despite widespread agreement that exercise improves HDL quality, including HDL particle size. Serum HDL-C apoA-I levels and cholesterol efflux activity are linked to regular exercise. Additionally, there are no studies that have compared the quantity and quality of HDL-C produced by regular exercise in the general population to those produced by sedentary individuals over the course of at least one year. This is because many studies have focused on the exercise's short-term physiological effect, which typically lasts between 8 and 24 weeks and was forced on random volunteers. The goal of this study was to find out if women in their middle years had an effect on their HDL quality and functionality.

A number of physiological parameters, including lipids, lipoproteins, apolipoproteins, hepatic functions, and inflammatory profiles, were found in healthy middle-aged women who exercised frequently. They were divided into three groups based on their individual responses to a questionnaire: In the exercise groups, particularly group 3, serum HDL-C and the percentage of HDL-C/TC increased significantly, while TG, TG/HDL-C, LDL-C/HDL-C, and apo-B/apoA-I decreased significantly. The other three groups were sedentary (group 1), low-intensity exercise (group 2), and high-intensity exercise.

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