

Changes in oxidized low-density lipoprotein cholesterol are associated with changes in handgrip strength in Japanese community-dwelling persons

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Abstract Nordic walking (NW), characterized by the use of two walking poles, has positive effects on several muscle groups. Muscle strength and mass decrease with age, and recently, this decrease is defined as sarcopenia. Sarcopenia may be triggered by oxidative stress. We investigated whether changes in the oxidative stress marker, malondialdehyde-modified low-density lipoprotein (MDA-LDL)/LDL-cholesterol (LDL-C) ratio are associated with change in handgrip strength (HGS), which is a useful indicator of sarcopenia, by a 12-week NW exercise among Japanese

community-dwelling persons. The present study included 65 women aged 67 ± 7 years and 9 men aged 71 ± 8 years from a rural village. NW exercise of 120 min per week was performed for 12 weeks. Before and at the end of the 12-week intervention, various confounding factors and HGS were measured. 12-week changes in various factors were calculated by subtracting the baseline values from the 12-week values. Changes in HGS and follow-up HGS increased progressively with decreased changes in the MDA-LDL/LDL-C ratio after the 12-week walking exercise ($r = -0.32$, $P = 0.006$ and $r = -0.35$, $P = 0.002$, respectively). Multiple linear regression analysis showed that changes in HDL-C ($\beta = 0.26$, $P = 0.019$) and MDA-LDL/LDL-C ratio ($\beta = -0.32$, $P = 0.004$) were significantly and independently associated with changes in HGS. When the data were further stratified by gender, change in the MDA-LDL/LDL-C ratio was significantly and similarly associated with change in HGS in women only. These results suggest that change in MDA-LDL/LDL-C ratio may be a predictor for HGS after a 12-week NW exercise in community-dwelling persons.

Table 1 Baseline characteristics of participants by gender

Characteristic	Men N = 9	Women N = 65	P value*
Age (years)	71 ± 8	67 ± 7	0.132
Body mass index ^a (kg/m ²)	25.4 ± 3.0	24.0 ± 2.9	0.191
Waist circumference (cm)	90.6 ± 10.1	85.0 ± 8.5	0.072
Triglycerides (mg/dL)	95 (73–175)	92 (65–125)	0.267
HDL cholesterol (mg/dL)	50 ± 18	69 ± 14	<0.001
LDL cholesterol (mg/dL)	106 ± 30	132 ± 29	0.012
MDA-LDL (U/L)	90 ± 56	73 ± 22	0.097
MDA-LDL/LDL cholesterol ratio (%)	80.2 ± 26.0	56.2 ± 15.7	<0.001
High sensitivity CRP (mg/dL)	0.11 (0.03–0.15)	0.05 (0.03–0.11)	0.179
Serum uric acid (mg/dL)	6.0 ± 1.0	4.8 ± 1.0	<0.001
Handgrip strength (kg)	37.2 ± 6.7	26.4 ± 4.2	<0.001

Bold values indicate statistical significance ($p < 0.05$)

Data are mean ± standard deviation

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Introduction

Nordic walking (NW) is characterized by walking with the assistance of poles to increase the use of the upper body muscles [1] and individuals can burn up to 67 % more calories than by regular walking [2]. Recent studies have shown that NW may lead to greater adaptations in the cardiovascular and respiratory systems as well as greater energy expenditure in both its acute and long-term effects.