Effects of brisk walking and green tea extract ingestion on lipid profile, aerobic capacity and physical fitness function in overweight and obese men

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（肥満、過体重者における血中脂質、有酸素能力および体力に対する速歩と緑茶抽出物摂取の影響）

区　　分　：　甲

論　文　内　容　の　要　旨

The prevalence of overweight and obesity has increased dramatically over the last four decades. Excess weight is a well-recognized risk factor for several common chronic conditions including type 2 diabetes, metabolic syndrome, cardiovascular disease,　and other health problems. Increased physical activity is an essential component of lifestyle intervention for obesity management and health improvement. Studies suggest the beneficial effects of green tea extract (GTE) for chronic diseases and obesity prevention. In addition, studies in animal models reported that green tea catechins have a potential effect on endurance capacity. The effects of green tea combined with exercise on overweight and obesity may be a more effective means for the improvement of chronic diseases. However, the effect of GTE combined with aerobic exercise on lipid profile, liver function and physical fitness function is not clear. Therefore, I hypothesized that GTE combined with brisk walking might improve the lipid profile, liver function, aerobic capacity, and physical fitness function in overweight and obese men, especially those with under uncontrolled dietary condition.

This study investigated the effects of GTE combined with brisk walking in inactivity overweight and obese men. Twenty-four overweight or obese, non-smoking, males (39.8±8.8 years) volunteered for this study. None were regular consumers of green tea, exercise training. All subjects in the GTE group (n=12) or placebo group (n=12) took part in the 12-week intervention program, and were followed for 4 weeks post-intervention. In the intervention period, all participants were asked to consume two GTE (300mg EGCG) or placebo tablets daily. The exercise program involved 12 weeks of brisk walking at an intensity of 65%-80% of the maximum heart rate, which was supervised by heart rate belt. The brisk walking program consisted of four 60-min sessions per week, 12 weeks, each including a 5 min warm-up and 5 min cool-down. The intention-to-treat (ITT) efficacy analysis was used in this study. If data were not normality distributed, a Wilcoxon test was used within groups. To examine changes within and between groups after the intervention, we used analysis of co-variance (ANCOVA) to analyze the changes in outcomes between groups, and repeated measure analysis of variance was used to analyze the three times (baseline, after 12-week and 16-week) data.

In the first study (chapter 2), after 12 weeks intervention, GTE group resulted in a significant reduce in the low-density lipoprotein cholesterol (LDL-C) and total cholesterol (TC) levels when compared to placebo group ($P < 0.01$). There was no significant change in the triglyceride (TG) and high-density

lipoprotein cholesterol (HDL-C) levels in the placebo group, but a significant reduction was noted in the HDL-C levels in the GTE group ($P < 0.05$). There was also a significant reduction in the aspartate aminotransferase (AST) levels ($P < 0.05$) in the GTE group, but no change in the placebo group ($P = 0.162$). After 4 weeks follow-up period, there was a negative trend in most parameters in both groups.

After 12-week intervention, the second study (chapter 3) showed that the combination effects of GTE and brisk walking has no significantly change in body weight, BMI, systolic blood pressure, and diastolic blood pressure in overweight and obese men. There was a significant reduce in waist circumference for the GTE group, no change in the placebo group. However, contrast to our hypothesis, we found a significant increase in fasting glucose levels in both groups after intervention.

In the third study (chapter 4), we found a significant increase in the aerobic capacity (6 min walking test) in both groups ($P<0.05$), and a significant increase in handgrip strength in the GTE group ($P<0.05$). After intervention, we found a significant decrease in time of the 8-foot up-and-go in both groups, and a significant increase in the length of sit and reach in both groups ($P<0.05$). While there was no significant change in the one-leg standing with eyes closed results of both groups. A down-ward trend was observed in the aerobic capacity and physical fitness function parameters after 4 weeks of follow-up.

In summary, GTE combined with brisk walking exhibited significant LDL-C and TC levels lowering properties in the overweight and obese men and also showed more effective improvement the liver function than brisk walking alone. This study provides data to support the main mechanism of action for the improvement of lipid profile by GTE. The mechanism underlying the reduction in plasma cholesterol levels by GTE might involve EGCG preventing the absorption of lipids and inhibiting digestive enzymes, with additional effects on the intestinal microbiota. Previous studies reported that exercise was able to improve the HDL-C and TG levels in human. However, we found a negative result in HDL-C levels in the GTE group and no significant change in the TG levels in both groups, which might be due to EGCG was able to increase the number of *Bifidobacteria* in the gut and reduced the serum cholesterol level. We found a significant increase in the handgrip strength in the GTE group, but no significant change in the placebo group. The results agree with a recent study, which showed that GTE combined with exercise was able to increase fatty acid oxidation in skeletal muscle and improve endurance capacity. The present doctoral thesis provides data to support the positive effects of green tea combined with brisk walking on lipid profile, liver function, aerobic capacity and physical fitness in overweight and obese men with under uncontrolled dietary.

Further studies on the effects of exercise intensity, dietary modification and the daily-dose of GTE are needed to clarify the effects of GTE combined with brisk walking in overweight and obese adults. Furthermore, an increased number of physiological parameters (maximal oxygen consumption, bone mineral density, body fat, muscle strength etc.) should be used in a future study to confirm the effects on physical fitness function.