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Original Article

Effect of Combination Decaffeinated Green Tea and Green Coffee in Reducing Cholesterol Levels in Patients with Metabolic Syndrome

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ABSTRACT

Background: Green tea and green coffee are natural ingredients that improve cholesterol levels. Combining the two in experimental animal studies provides more significant benefits when compared to single administration in reducing cholesterol levels.
Objective: This study aimed to determine the effect of decaffeinated green tea and green coffee as adjuvant treatments in reducing blood cholesterol levels.
Methods: This randomized controlled trial included 90 metabolic syndrome patients determined according to the IDF criteria for Asian people aged 50–70. All subjects received atorvastatin 20 mg and were divided into three groups. Participants in Group 1 received decaffeinated green tea and green coffee 2.5 grams twice daily, Group 2 received 5 grams daily, and Group 3 received a placebo. The total cholesterol, low-density lipoprotein cholesterol (LDL), high-density lipoprotein cholesterol (HDL), and triglyceride levels were measured at the beginning and the end of the study.
Result: At 90 days, after administration of the extract of decaffeinated green tea and green coffee, we found that the concentration of total cholesterol in Group 1 and Group 2 was significantly reduced compared to the placebo (-50 ± 6.1 vs. -62.8 ± 5.9 vs. -22.5 ± 5.8 mg/dL; p= <0.05). But there was no significant difference in reduction of total cholesterol levels between the first and second groups. The other parameters also decreased, but not significantly compared to the placebo group.
Conclusion: Administration of a combination of decaffeinated green tea extract and green coffee as an adjunctive therapy can reduce the average total cholesterol, LDL, HDL, and triglyceride levels more than placebo, but only total cholesterol has a significant difference compared to other cholesterol components.

1. Introduction

According to National Cholesterol Education (NCE), the prevalence of metabolic syndrome (MS) varies between 20 and 25% worldwide; however, it is 23.3% in Indonesia, with more males (26.2%) than females (21.4%) having the condition. The components of the metabolic syndrome include hypertension, hyperglycemia, and dyslipidemia. Statins are the go-to treatment for dyslipidemia. The primary phenolic element in green tea and green coffee, chlorogenic acid (CGA), has been shown to help people with metabolic syndrome by inhibiting adipocyte development and lowering cholesterol levels.[3,4]

A previous study showed that combining green tea and green coffee extracts improved lipid profiles and blood pressure in SM conditions compared to giving green coffee extract and green tea alone. In this study, a clinical trial will be carried out by providing a combination of green tea extract and decaffeinated green coffee as a powder drink, which will be given to sufferers of metabolic syndrome with conversion doses from experimental animals from previous studies.[5]

2. Materials and Methods

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2.1. Combination of decaffeinated green tea and green coffee extract components

In this study, we used a combination extract of green tea and green coffee that had been decaffeinated with the blanching and carbon absorption methods to eliminate the effect of sympathetic activity stimulation on the cardiovascular system. Then packaged as a powder sachet drink at 2.5 grams that has passed the animal testing process, is safe for humans, and has a distribution permit with the P-IRT number 5103573010736-27.

2.2. Study design

This study was approved by the Research Ethics Committee of Saiful Anwar Hospital Malang with an ethical clearance number of 400/274/K3/102.7/2022. The study participants were patients with metabolic syndrome who had received atorvastatin 20 mg daily as the primary disease therapy. The subjects were randomly divided into three groups: Group 1 received 2.5 mg of decaffeinated green tea and green coffee extract twice daily (n = 30), Group 2 received 5 mg of decaffeinated green tea and green coffee extract once daily (n = 30), and Group 3 received Placebo (n = 30). Subjects were educated about low-cholesterol diets and moderate-intensity training activities. We checked cholesterol panel levels, including total cholesterol, low-density lipoprotein cholesterol (LDL), high-density lipoprotein cholesterol (HDL), and triglycerides before and after 90 days after receiving treatment or placebo.

2.3. Study participants

People who were 50 to 70 years old and had been diagnosed with metabolic syndrome according to the IDF Asian criteria (waist circumference > 90 cm for males and > 85 cm for women, triglycerides > 150 mg/dl, HDL-C > 40 mg/dl, and blood pressure > 130/85 mmHg) in The Cardiology Out Patient Department of The Saiful Anwar General Hospital were included. Participants were not permitted to participate in this study if they had allergy to an extract component, acute heart failure, or acute coronary syndrome. All participants agreed after receiving all information.

2.4. Sample size

Sampling was carried out for this experiment using a straightforward random sample procedure. At least 30 patients per group were needed for the appropriate sample size, estimated with a power of 95% and a confidence interval (CI) of 95%. The sample size was raised to 30 patients in each group to accommodate a 10% dropout rate:

$$n = [(Z/2 + Z)\ 2 \times \{(p1\ (1\text{-}p1) + (p2\ (1\text{-}p2))\}] / (p1 - p2)^2$$

2.5. Laboratory test

A homogenous approach was used to measure triglycerides, total cholesterol, LDL, and HDL levels. The Daichi reagent and Cobas Mira apparatus were used to analyze each 0.2 ml serum. Examining triglycerides with a colorimetric enzymatic test Using Randox reagent and the Cobas Mira instrument, the Glycerol-3-phosphate-oxydase (GPO) PAP technique evaluated 0.2 ml of the blood sample. Using the Shirakawa method, DNA visualization is examined.

2.6. Statistical Analysis

SPSS 22 for Windows, a statistical package for social sciences, was used for the analysis. Using the Kolmogorov-Smirnov test, we determined if the data were evenly distributed when the p-value was more than 0.05. One-way ANOVA was used to compare the average delta LDL, HDL, total cholesterol, and triglyceride levels between the pre-and post-extract administration groups. A p-value of less than 0.05 was deemed statistically significant. The differences between the post-administration outcomes of each group are determined using a posthoc test to determine whether the difference is statistically significant.

3. Result

3.1. Baseline Characteristic

Of the 96 patients who met the inclusion criteria, three asked to stop, and three were lost follow-ups. Finally, 90 patients were included in the data analysis. From the baseline characteristics (table 1), we found the mean total cholesterol level in the placebo group was 191.6 ± 4.2 mg/dL; group 1 was 193.3 ± 4.4 mg/dL, and group 2 was 191.1 ± 4.0 mg/dL. The mean triglyceride level in the placebo group was 157 ± 4.5 mg/dL; group 1 was 158.1 ± 4.8 mg/dL, and group 2 was 165.5 ± 2.6 mg/dL. The mean LDL level in the placebo group was 117.9 ± 2.9 mg/dL, group 1 was 117.4 ± 2.3 mg/dL, and group 2 was 121.7 ± 3.3 mg/dL. The mean HDL level in the placebo group was 33.3 ± 0.6 mg/dL, group 1 was 33.7 ± 0.6 mg/dL, and group 2 was 33.3 ± 0.4 mg/dL.

Table 1. Baseline characteristics for each group.

Baseline characteristics	Group 1 (2.5 g twice daily) (n = 30)	Group 2 (5 g once daily) (n = 30)	Group 3 (Placebo) (n = 30)
Age	63.7 ± 2.0	59.8 ± 1.4	65.2 ± 1.7
HbA1C	9.2 ± 3.0	9.0 ± 0.4	11.25 ± 3.7
Total cholesterol	193.3 ± 4.4	191.1 ± 4.0	191.6 ± 4.2
Triglyceride	158.1 ± 4.8	165.5 ± 2.6	157 ± 4.5
HDL	33.7 ± 0.6	33.3 ± 0.4	33.3 ± 0.6
LDL	117.4 ± 2.3	121.7 ± 3.3	117,9 ± 2.9
Urea	31.6 ± 3.0	30.0 ± 1.7	56.7 ± 8.8
Creatinine	1.0 ± 0.1	0.9 ± 0.0	0.8 ± 0.0
BW	71.3 ± 2.0	76.9 ± 3.0	74,4 ± 2.8
BMI	29.1 ± 0.7	29.7 ± 0.9	39.4 ± 9.5
Waist circumference	97.4 ± 2.5	98.7 ± 2.1	94.7 ± 2.3
BP systolic	129 ± 3.0	136 ± 3.0	136 ± 3.0
BP diastolic	89 ± 7.0	85 ± 2.0	86 ± 2.0

*note: ASD:Atrial Septal Defect; HR: heart rate; mPAP: mean Pulmonary Arterial Pressure; PDA:Patent Ductus Arteriousus; PVR: pulmonary vascular resistance; TVG: transvalvular gradient; TVR: Tricuspid Regurgitant Velocity; VSD:Ventricular Septal Defect.

3.2. Cholesterol level parameters

After administering the green tea and green coffee extract therapy for 90 days, a mean comparison was attained among the placebo, group 1, and group 2. Changes in mean total cholesterol were assessed and found to be significant, but not in triglycerides, LDL, or HDL.

Table 2. Mean differences in lipid profile changes among treatment groups.

Baseline characteristics	Group 1 (2.5g twice daily) (n = 30)	Group 2 (5g once daily) (n = 30)	Group 3 (Placebo) (n = 30)	p-value
Δ Total cholesterol	-50 ± 6.1	-62.8 ± 5.9	-22.5 ± 5.8	0.030
Δ Triglyceride	-20.3 ± 6.3	-23.3 ± 6.2	-14.2 ± 6.2	0.059
Δ HDL	2.05 ± 1.9	2.39 ± 1.3	1.36 ± 1.01	0.063
Δ LDL	-26.1 ± 4.7	-28.5 ± 4.5	-11.6 ± 4.2	0.221

*note: ESWT: Endurance Shuttle Walk Test; ISWT: Incremental Shuttle Walk Test; 6MWT: Six Minute Walk Test

3.3. Total cholesterol

It was determined through the various ANOVA tests that there was a significant difference in cholesterol reduction among the three groups, -22.5 ± 8 vs. -50 ± 6.1 vs. -62.8 ± 5.9 mg/dL ($p < 0.05$) (Table 2). From post-hoc analysis, it was found that total cholesterol reduction in Group 1 ($p < 0.05$) and Group 2 ($p < 0.05$) were greater than in Group 3. Still, groups 1 and 2 had no significant difference in reducing total cholesterol ($p = 0.390$).

3.4. Triglyceride

Based on the d ANOVA test, there was no significant difference among the three groups in reducing triglyceride value, -14.2 ± 6.2 vs. -20.3 ± 6.3 vs. - 23.3 ± 6.2 mg/dL ($p = 0.058$) (Table 2).

3.5. HDL

A significant difference was not found from the ANOVA test among the three groups in the increase in HDL value, 1.36 ± 1.01 vs. 2.05 ± 1.9 vs. 2.39 ± 1.3 mg/dL ($p = 0.063$) (Table 2).

3.6. LDL

The ANOVA did not significantly differ among the three groups in reducing LDL value, -11.6 ± 4.2 vs. -26.1 ± 4.7 vs. -28.5 ± 4.5 ($p = 0.221$) (Table 2).

4. Discussion

Our study revealed that a combination of decaffeinated green tea and green coffee administration effectively decreased total cholesterol, triglyceride, and LDL levels compared to the placebo. We also found that combining decaffeinated green tea and green coffee increased HDL levels. This result was in line with the animal study by Lukitasari et al.[5] Because total cholesterol in this study was a composite of many blood lipids, including LDL, triglycerides, VLDL, and HDL, it was simple to assess and show statistically significant improvements. This makes changes in total cholesterol noticeable and effective compared to its constituent parts.[5–7]

Tea extract can reduce lipid accumulation during adipogenesis in 3T3-L1 preadipocytes. Green tea extract was also able to reduce the mRNA and protein expression of transcription factors CCAAT/enhancer-binding protein (C/EBP) and peroxisome proliferator-activated receptor (PPAR) in 3T3-L1 cells by reducing Akt phosphorylation.[8] Another study showed that catechin compounds in green tea could inhibit glycerol-3-phosphatase activity as a differentiation marker. These catechins inhibit the expression of PPAR and C/EBP, both of which are major transcription factors in early cell differentiation, followed by the expression of glucose transporter (GLUT) 4 in the early stages of cell differentiation.[2,9–11]

Our results were different from the prior meta-analysis in which green tea significantly reduced the total cholesterol and LDL levels. This was related to the eating habits and exercise levels that were not strictly monitored in our study. However, investigators attempted to educate subjects on the kinds of low-cholesterol meals that must be consumed and the necessity of moderate physical exercise. However, the implementation was not well-monitored. A prior study showed that moderate or vigorous-intensity physical activity (>150 minutes per week divided 2-3 times) could increase HDL by 1.71 mg/dL and reduce Triglycerides by 98 mg/dL after three weeks. Physical activity was thought to increase the activity of lipoprotein lipase and lecithin cholesterol acyltransferase and decrease the activity of hepatic lipase and cholesterol esterified transfer protein, the reverse cholesterol transport component, thereby lowering cholesterol, especially triglycerides and increasing HDL.[6,12]

The insignificant difference between the treatment and placebo groups could also be due to the duration of statin consumption and its type. In this study, all subjects homogeneously consumed Atorvastatin 20mg, but the drug duration was not distinguished before being given treatment. Regular consumption of statins within 6-8 weeks can reduce total cholesterol by 25% from baseline, so if the subject has previously taken statins for longer, the effect of lowering cholesterol will be more significant compared to those who have just taken statins.[13,14]

4.1. Limitation

The researchers only attempted to educate subjects on the kinds of low-cholesterol foods that must be consumed and the necessity of engaging in moderate-intensity physical activity, but the implementation was not closely monitored. This study's limitation was the lack of well-controlled diet patterns and physical activity.

5. Conclusion

Administration of green tea extract and decaffeinated green coffee as an adjunctive therapy can reduce the average total cholesterol, LDL, HDL, and triglyceride levels more than placebo. Still, only total cholesterol significantly differs from other cholesterol components.

6. Declarations

6.1 Ethics Approval and Consent to participate

This study was approved by the Research Ethics Committee of Saiful Anwar Hospital Malang with an ethical clearance number of 400/274/K3/102.7/2022.

6.2. Consent for publication

Not applicable.

6.3 Availibility of data and materials

Data used in our study were presented in the main text.

6.4 Competing interests
Not applicable.

6.5 Funding Source
Not applicable.

6.6 Authors contributions
Idea/concept: FHA, MSR. Design: FHA, MSR. Control/supervision: MSR, TA, CTT, HM. Data collection/processing: FHA, MSR, TA. Analysis/interpretation: FHA, MSR, TA. Literature review: FHA, MSR, HM. Writing the article: FHA, MSR. Critical review: MSR, CTT, TA, HM. All authors have critically reviewed and approved the final draft and are possible for the content and similarity index of the manuscript.

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