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Effects of Young Coconut Water Intake on Serum Total Cholesterol among Adults with Central Obesity: A Pre–Post Intervention Study

Sumarni[1], Junjun Fitriani[2], Nur Syamsi[3]

[1,2,3]Faculty of Medicine, Tadulako University, Palu, Indonesia

ABSTRACT: Central obesity is a core component of metabolic syndrome and a major contributor to dyslipidemia and cardiovascular risk, particularly in Asian populations. Young coconut water is a natural beverage rich in potassium, L-arginine, and antioxidant compounds that may favourably influence lipid metabolism.

This study aimed to examine the effect of young coconut water consumption on serum total cholesterol levels among adults with central obesity. A one-group pre–post intervention study was conducted involving 33 adults with central obesity, defined by Asian-specific waist circumference criteria (>90 cm in men and >80 cm in women). Participants consumed 200 mL of fresh young coconut water daily for 20 consecutive days. Serum total cholesterol levels were measured at baseline and after the intervention. Pre–post differences were analyzed using a paired t-test.

Mean serum total cholesterol decreased significantly from 209.33 ± 36.09 mg/dL at baseline to 183.39 ± 30.03 mg/dL post-intervention (mean difference: 25.94 mg/dL; 95% CI: 20.12–31.76; $p < 0.001$). The proportion of participants with abnormal cholesterol levels (≥200 mg/dL) declined from 54.5% to 33.3% following the intervention, indicating a clinically meaningful improvement.

Conclusion: Short-term consumption of young coconut water was associated with a significant reduction in serum total cholesterol among individuals with central obesity. These findings suggest that young coconut water may serve as a feasible, locally available adjunct nutritional strategy for dyslipidemia management. Further randomized controlled trials are warranted to confirm causality and long-term effects

KEYWORDS: Young coconut water, central obesity, serum cholesterol, metabolic syndrome

I. INTRODUCTION

Metabolic syndrome represents a major global public health challenge and is characterized by a constellation of interrelated metabolic abnormalities, including central obesity, dyslipidemia, hypertension, and impaired glucose metabolism. Collectively, these conditions substantially increase the risk of cardiovascular disease and type 2 diabetes mellitus[1]. Among these components, dyslipidemia and hypertension are well-recognized modifiable risk factors for cardiovascular morbidity and mortality[2]. Effective management of these abnormalities is therefore essential for reducing the long-term cardiovascular burden associated with metabolic syndrome.

Central obesity plays a pivotal role in the pathogenesis and diagnosis of metabolic syndrome, particularly in Asian populations, where excess visceral adiposity occurs at lower body mass indices compared with Western populations. Central obesity is closely linked to insulin resistance, chronic low-grade inflammation, and the development of an atherogenic lipid profile characterized by elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides, along with reduced high-density lipoprotein cholesterol (HDL-C)[3]. These metabolic disturbances directly contribute to atherosclerotic processes and underscore the importance of targeting central obesity in cardiometabolic risk reduction strategies.

Over the past two decades, Indonesia has experienced a marked epidemiological transition, accompanied by a rising prevalence of obesity and metabolic disorders. National data from the Indonesian Health Research indicate a consistent increase in adult obesity and cardiovascular risk factors across multiple provinces, including Central Sulawesi. Urban environments such as Palu City have been particularly affected, where shifts toward energy-dense diets and sedentary lifestyles have contributed to the growing burden of central obesity and dyslipidemia[4]. In this context, the utilization of locally available food-based interventions is of particular importance, as such approaches may enhance accessibility, cultural acceptability, and long-term adherence within the community.

Dyslipidemia associated with central obesity is a primary therapeutic target due to its direct involvement in atherosclerosis and cardiovascular disease progression[5,6]. Although pharmacological therapies, particularly statins, are effective in lowering cholesterol levels, long-term use may be limited by adverse effects, contraindications, and suboptimal patient adherence[7,8]. Consequently, non-

pharmacological strategies, including dietary modification and functional food interventions, remain a critical area of investigation for the prevention and management of dyslipidemia.

Young coconut water is a natural beverage widely consumed in tropical regions and readily available in Indonesia. It contains essential electrolytes, vitamins, and amino acids—most notably potassium and L-arginine—as well as a range of bioactive compounds with demonstrated antioxidant and metabolic properties[9,10,11,12]. Emerging evidence suggests that these components may influence lipid metabolism through multiple mechanisms, including modulation of cholesterol synthesis and catabolism, improvement of endothelial function, and attenuation of oxidative stress and inflammation[13].

Preclinical studies have demonstrated that coconut water administration can reduce total cholesterol, LDL-C, and triglyceride levels while increasing HDL-C in animal models of hyperlipidemia[14,15]. However, clinical evidence in human populations remains limited. Existing human studies have predominantly focused on virgin coconut oil as a dietary intervention for metabolic syndrome, with reported improvements in lipid profiles[16]. Despite these findings, virgin coconut oil is not commonly incorporated into daily dietary practices by the general population, in contrast to young coconut water, which is widely consumed and culturally accepted.

Given the limited clinical data on the effects of young coconut water consumption on lipid profiles in humans—particularly among individuals with central obesity—this study aimed to evaluate changes in serum total cholesterol levels following a short-term intervention of young coconut water consumption in adults with central obesity in Palu City, Central Sulawesi, Indonesia.

II. RESEARCH METHODS

A. Research Design

This study employed a one-group pre–post intervention design to evaluate changes in serum total cholesterol levels following young coconut water consumption. The study was conducted in Palu City, Central Sulawesi Province, Indonesia, between September and October 2025.

B. Participants and Eligibility Criteria

Participants were adults aged 20–59 years who met the criteria for central obesity, defined as a waist circumference ≥90 cm for men and ≥80 cm for women, in accordance with the World Health Organization (WHO) and International Diabetes Federation (IDF) recommendations for Asian populations.

The inclusion criteria were as follows: (1) presence of central obesity based on waist circumference measurement; (2) relatively stable body weight, defined as a change of ≤2 kg during the preceding three months; (3) no current use of lipid-lowering medications or dietary supplements known to affect lipid metabolism; and (4) willingness to participate in the study and provide written informed consent. The exclusion criteria included: (1) a history of cardiovascular disease, diabetes mellitus, chronic kidney disease, or liver disease; (2) pregnancy or lactation; (3) regular consumption of other functional beverages or nutraceutical products during the study period; and (4) presence of acute infection or illness at the time of baseline assessment.

C. Sampling Technique and Sample Size

Participants were recruited from the community using purposive sampling. The sample size was determined based on feasibility considerations and reference to previous pre–post intervention studies evaluating changes in serum total cholesterol levels. A total of 33 participants who fulfilled the eligibility criteria and completed the entire intervention protocol were included in the final analysis.

D. Intervention Protocol

The intervention consisted of daily consumption of young coconut water for 20 consecutive days. Each participant consumed 200 mL of fresh young coconut water once daily. The coconut water was obtained from locally sourced fresh young coconuts and was served without the addition of sugar, sweeteners, or other ingredients.

Participants were instructed to maintain their usual dietary intake and physical activity levels throughout the intervention period and to refrain from consuming other functional beverages or nutraceutical products. Adherence to the intervention was monitored through daily consumption records and regular communication between participants and the research team.

E. Data Collection and Measurements

Waist circumference was measured at baseline using a non-elastic measuring tape, positioned at the midpoint between the lowest rib and the iliac crest, following standardized WHO procedures. Measurements were recorded to the nearest 0.1 cm. Venous blood samples were collected in the morning after an overnight fast of 8–10 hours at two time points: before the intervention (baseline) and after completion of the intervention (post-intervention). Serum total cholesterol levels were measured using an enzymatic colorimetric method at an accredited clinical laboratory, following standardized quality control procedures. The primary outcome of the study was the change in serum total cholesterol levels from baseline to post-intervention.

F. Statistical Analysis

Statistical analyses were performed using statistical software. The normality of data distribution was assessed using the Shapiro–Wilk test. Continuous variables were expressed as mean ± standard deviation for normally distributed data or as median (interquartile range) for non-normally distributed data. Differences in serum total cholesterol levels before and after the intervention were analyzed using a paired t-test for normally distributed data. A two-tailed p-value of <0.05 was considered statistically significant.

G. Ethical Considerations

The study protocol was reviewed and approved by the Ethics Committee of the Faculty of Medicine, Tadulako University (Approval No. 9410/UN28.10/KL/2025). All participants provided written informed consent prior to study enrolment. Participant confidentiality was maintained throughout the study in accordance with the principles of the Declaration of Helsinki.

III. RESULT

A total of 33 adults with central obesity completed the study and were included in the final analysis. Of these participants, 18 (54.5%) were female and 15 (45.5%) were male, with an age range of 22–55 years. The relatively balanced sex distribution indicates that the study sample adequately represents both sexes. Baseline demographic characteristics of the participants are summarized in Table 1.

Table I. Baseline Characteristics of Study Participants

Participant Characteristics	Frequency (n)	Percentage (%)
Male	15	45.5
Female	18	54.5
Total	33	100

At baseline, 18 participants (54.5%) presented with abnormal serum total cholesterol levels (≥200 mg/dL), while 15 participants (45.5%) had levels within the normal range (<200 mg/dL). Following the 20-day intervention of young coconut water consumption, the proportion of participants with normal serum total cholesterol levels increased to 22 (66.7%), whereas those with abnormal levels decreased to 11 (33.3%). This shift reflects an overall improvement in the distribution of serum total cholesterol levels after the intervention (Table 2)

Table 2. Distribution of Serum Total Cholesterol Levels at Baseline

Serum Total Cholesterol Category	Frequency (n)	Percentage (%)
Normal (<200 mg/dL)	15	45.5
Abnormal (≥200 mg/dL)	18	54.5
Total	33	100

Descriptive analysis showed that the mean serum total cholesterol concentration at baseline was 209.33 ± 36.09 mg/dL. After completion of the intervention, the mean serum total cholesterol level decreased to 183.39 ± 30.03 mg/dL. The observed reduction indicates an improvement in serum total cholesterol levels following young coconut water consumption (Table 3).

Table 3. Descriptive Statistics of Serum Total Cholesterol Levels (Mg/Dl)

Time Point	Mean (mg/dL)	SD	N
Pre Intervention	209.33	36.09	33
Post Intervention	183.39	30.03	33

A paired t-test was performed to evaluate the difference in serum total cholesterol levels before and after the intervention. The analysis revealed a mean reduction of 25.94 mg/dL in serum total cholesterol levels, with a 95% confidence interval ranging from 20.12 to 31.76 mg/dL. The test yielded a t-value of 9.075 with 32 degrees of freedom, and the difference was statistically significant ($p < 0.001$). These results indicate a significant decrease in serum total cholesterol levels following the intervention (Table 4).

Table 4. Paired T-Test Analysis of Serum Total Cholesterol Levels (Mg/Dl)

Comparison (Pre – Post)	Mean Difference	95% CI (lower-upper)	t	df	p-value
Total cholesterol	25.94	20.12-31.76	9.08	32	<0.001

IV. DISCUSSION

The present study demonstrates that short-term consumption of young coconut water is associated with a statistically and clinically significant reduction in serum total cholesterol levels among adults with central obesity. Following a 20-day intervention, mean serum total cholesterol decreased by approximately 26 mg/dL, accompanied by a substantial reduction in the proportion of participants with abnormal cholesterol levels. These findings suggest that young coconut water may exert a favorable effect on lipid metabolism in individuals with central obesity.

The magnitude of cholesterol reduction observed in this study is noteworthy and exceeds what would typically be expected from random biological variation. The paired t-test results, supported by a narrow 95% confidence interval, indicate a consistent response across participants. Importantly, the improvement was evident not only in mean values but also in the categorical distribution of cholesterol levels, underscoring the potential clinical relevance of the intervention.

Several biological mechanisms may explain the observed lipid-lowering effect of young coconut water. Young coconut water is rich in potassium, an essential electrolyte known to play a role in metabolic regulation and insulin sensitivity. Improved insulin sensitivity may indirectly influence lipid metabolism by reducing hepatic cholesterol synthesis and enhancing lipid clearance. In addition, young coconut water contains amino acids such as L-arginine, which serves as a precursor for nitric oxide synthesis. Nitric oxide has been shown to improve endothelial function, modulate lipid metabolism, and reduce inflammatory processes that contribute to dyslipidemia in central obesity.

Furthermore, the presence of natural antioxidant compounds in young coconut water may contribute to reduced oxidative stress and lipid peroxidation. Oxidative modification of lipoproteins is a key mechanism underlying atherogenesis, particularly in individuals with central obesity who experience chronic low-grade inflammation. By mitigating oxidative stress, antioxidants in young coconut water may help preserve lipid homeostasis and attenuate the progression of dyslipidemia.

The findings of this study are consistent with previous preclinical research demonstrating hypolipidemic effects of coconut water in animal models of hyperlipidemia, including reductions in total cholesterol, LDL-C, and triglycerides, along with increases in HDL-C. Although human clinical data remain limited, the present study extends existing evidence by focusing specifically on adults with central obesity using Asian-specific diagnostic criteria. This is particularly relevant, as Asian populations tend to develop metabolic complications at lower levels of adiposity compared with Western populations.

In contrast to most human studies that have examined virgin coconut oil as a dietary intervention for metabolic syndrome, this study evaluated young coconut water as a more practical and culturally acceptable alternative. While virgin coconut oil has demonstrated lipid-modifying effects, its high caloric density and limited acceptance as a daily dietary component may restrict its long-term applicability. Young coconut water, on the other hand, is widely consumed, low in calories, and readily available in tropical regions, making it a potentially sustainable dietary adjunct for metabolic health.

Despite these promising findings, several limitations should be acknowledged. The use of a one-group pre–post design without a control group limits the ability to establish causality. External factors such as unmeasured dietary intake or physical activity changes may have influenced the observed outcomes, although participants were instructed to maintain their usual lifestyle habits throughout the study. Additionally, the relatively small sample size and short intervention duration limit the generalizability of the findings and preclude assessment of long-term effects.

Nevertheless, the study has notable strengths, including standardized biochemical measurements, high participant compliance, and a focus on a locally available, minimally processed nutritional intervention. Taken together, the results provide preliminary evidence supporting the potential role of young coconut water in improving lipid profiles among individuals with central obesity.

Future studies employing randomized controlled designs with larger sample sizes, longer follow-up periods, and comprehensive lipid profiling—including LDL-C, HDL-C, and triglycerides—are warranted to confirm these findings and elucidate underlying mechanisms. Exploration of dose–response relationships and long-term safety profiles would further strengthen the evidence base.

V. CONCLUSIONS

In conclusion, short-term consumption of young coconut water was associated with a significant reduction in serum total cholesterol levels among adults with central obesity based on Asian-specific criteria. The observed decrease of approximately 26 mg/dL, along with a reduced proportion of individuals with abnormal cholesterol levels, indicates a consistent and clinically meaningful improvement in lipid profiles.

These effects may be attributed to the combined action of potassium, L-arginine, and antioxidant compounds present in young coconut water, which may collectively modulate lipid metabolism and reduce oxidative stress. Although the absence of a control group limits causal inference, the findings provide preliminary support for young coconut water as a feasible, locally available adjunct nutritional strategy for dyslipidemia management in individuals with central obesity. Further randomized controlled trials are necessary to confirm causality and evaluate long-term efficacy.

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