

Nutritional Profile and Effects of Chayote-Based Food Supplements on Total Cholesterol Levels in Hyperlipidemic Rats

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ABSTRACT: Hyperlipidemia is a key risk factor for cardiovascular disease. This study evaluated the nutritional profile and cholesterol-lowering effects of chayote-jasmine herbal tea in hyperlipidemic rats. Three formulations (70%, 80%, 90% chayote) were tested over 21 days. The 90% formulation showed the highest nutrient content and produced the greatest cholesterol reduction (27.1%). All formulations significantly lowered cholesterol ($p < 0.05$), with a clear dose-dependent effect, indicating higher chayote content leads to stronger hypocholesterolemic benefits.

KEYWORDS: Nutrition, Cholesterol, Chayote, Jasmine, Herbal Tea

INTRODUCTION

Hyperlipidemia is widely recognized as a major risk factor for cardiovascular diseases, and dietary intervention has become an essential component in maintaining health and preventing metabolic complications. Numerous studies emphasize that nutrient-rich meals and functional beverages play an important role in regulating blood cholesterol and improving lipid metabolism (Cena & Calder, 2020; Tamura et al., 2020). The increasing prevalence of cardiovascular disorders has further driven the need for safe, accessible, and food-based strategies to support cholesterol management. Functional foods enriched with bioactive compounds have received growing attention due to their potential to reduce saturated fat intake, modulate lipid absorption, and promote overall cardiovascular health (Zhou & Martirosyan, 2024; Aguilar-Pérez et al., 2023; Papagianni et al., 2021).

Chayote (*Sechium edule*) is a vegetable increasingly utilized in functional food development due to its rich nutritional composition and bioactive properties. The fruit contains dietary fiber, vitamins, and minerals essential for metabolic regulation (Mashine et al., 2023; Pu et al., 2021). In addition, chayote is known to possess antioxidant compounds such as flavonoids, saponins, and alkaloids, which contribute to lipid-lowering activity, attenuation of oxidative stress, and anti-inflammatory effects (Aguñiga-Sánchez et al., 2020; Madrigal-Santillán et al., 2024a; Madrigal-Santillán et al., 2024b; Siahaan et al., 2021). Findings from previous studies indicate that chayote-based food products may improve metabolic outcomes through the inhibition of lipid peroxidation and modulation of glucose and lipid homeostasis (Gbenga-Fabusiwa et al., 2018; Sakung et al., 2020; Sakung et al., 2022). These characteristics highlight chayote as a promising raw material for the development of lipid-modulating functional beverages.

Jasmine flowers, commonly incorporated into herbal teas, also contribute beneficial bioactive compounds. They contain phenolic substances and antioxidant components that support metabolic balance and help suppress inflammation, which is closely associated with dyslipidemia (Yoon et al., 2022). When combined with chayote flour, jasmine may enhance both the functional properties and sensory acceptability of the beverage. Although individually these ingredients demonstrate biological potential, scientific investigations evaluating their combined effects—particularly in the form of herbal tea—remain limited. The possibility of synergistic interactions between chayote-derived flavonoids and jasmine phenolics warrants further examination, especially within the context of managing hypercholesterolemia.

Despite the promising evidence, few studies have simultaneously characterized the nutritional composition of chayote herbal tea and assessed its physiological effects in vivo. Moreover, the hypocholesterolemic potential of chayote-jasmine formulations in hyperlipidemic animal models is not yet well established. Therefore, this study aimed to evaluate the nutritional profile of chayote herbal tea prepared in three formulations and to investigate its effects on total cholesterol levels in hyperlipidemic rats. Understanding these effects may contribute valuable insight into the development of plant-based functional beverages for cholesterol management.

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MATERIALS AND METHODS

Fresh chayote and dried jasmine were used to produce herbal tea, with analytical-grade reagents for nutrient and phytochemical analyses. Chayote was washed, sliced, dried, milled, and sieved into flour. Three formulations were prepared: F1 (70% chayote), F2 (80%), and F3 (90%), combined with dried jasmine and packed into tea bags. Nutritional analyses included fat (Soxhlet), protein (biuret), moisture (oven), ash (furnace), carbohydrates (by difference), flavonoids (AlCl₃ method), and alkaloids (spectrophotometry).

Twenty-four male rats were acclimatized and induced with hyperlipidemia using a high-fat diet. They were divided into three groups and given the tea daily for 21 days. Cholesterol levels were measured before and after treatment. Data were analyzed using Shapiro–Wilk, paired t-tests, ANOVA, or Kruskal–Wallis tests with $p < 0.05$.

RESULTS AND DISCUSSION

Nutrition Profile of Chayote Herbal Tea

Nutritional profile of chayote herbal tea was analyzed, and the results indicated that the highest nutritional profile was for formula 3's carbohydrate content (77.82 g/100 g), 1's fat content (1.59 g/100 g), 1's protein content (6.70 g/100 g), 1's water content (11.77%/100 g), 1's ash content (5.75 g/100 g), 3's flavonoids (0.84 gQE/100 g), and 3's alkaloids (0.209 g/100 g) (Table 1). A 90% cyan pumpkin raw material increased the amount of carbs, flavonoids, and alkaloids, according to data from Formula 3. The carbohydrate, fat, and protein content of herbal tea products could supply energy, which enabled the body's organs to perform their functions and engage in activities (Ahmed, Bakhtiar, Ali, Ghostlaw, & Nguyen, 2022; de Carvalho Silvello et al., 2022).

The high carbohydrate content suggested that chayote herbal tea products could be used as an energy supplement or as a staple food (Singh, Rasane, Kaur, & Nanda, 2022). Fat aided in the absorption of fat-soluble vitamins (Stacchiotti, Rezzi, Eggersdorfer, & Galli, 2021), making this product better suited to controlling fat intake. Protein in chayote herbal tea helped increase protein intake in food, particularly for individuals who required more protein, such as athletes, or for recuperation after illness (Papadopoulou, 2020). Flavonoids provided several health advantages, such as strengthening the immune system and preventing chronic illnesses like cancer and heart disease. In addition, flavonoids were known to have neuroprotective and anti-inflammatory properties. Potential pharmacological effects of alkaloids in chayote herbal tea products included antibacterial, analgesic, and central nervous system stimulation (Shyaula & Manandhar, 2021).

Table 1. Nutritional profile of chayote herbal tea various formulas

Nutrition Profile Intervention group (% chayote)	F1 (70%) Mean $\pm$ SD	F2 (80%) Mean $\pm$ SD	F3 (90%) Mean $\pm$ SD
Fat Content (g/100 g)	1.59 $\pm$ 0.133	1.25 $\pm$ 0.04	1.14 $\pm$ 0.02
Carbohydrate (g/100 g)	74.19 $\pm$ 0.36	76.24 $\pm$ 0.150	77.82 $\pm$ 0.007
Protein (g/100 g)	6.70 $\pm$ 0.136	6.03 $\pm$ 0.07	5.11 $\pm$ 0.07
Water (g/100 g)	11.77 $\pm$ 0.124	11.09 $\pm$ 0.09	10.72 $\pm$ 0.105
Ash (g/100 g)	5.75 $\pm$ 0.03	5.38 $\pm$ 0.02	5.19 $\pm$ 0.02
Flavonoids (g/100 g)	0.130 $\pm$ 0.012	0.110 $\pm$ 0.005	0.840 $\pm$ 0.004
Alkaloids (g/100 g)	0.148 $\pm$ 0.005	0.163 $\pm$ 0.004	.209 $\pm$ 0.008

Source: Primary Data 2023

Chayote herbal tea's flavonoid content helped lower the body's levels of LDL (low-density lipoprotein) to boost lipoprotein lipase activity, which in turn controlled blood triglyceride levels. Flavonoids could inhibit cholesterol synthesis enzymes, thereby increasing the activity of LDL cholesterol receptor formation in the liver, it showed that chayote herbal tea containing flavonoids had a role in lowering LDL cholesterol levels in the blood. Alkaloids reduced blood cholesterol levels by inhibiting the activity of HMG-KoA reductase enzyme (Wresdiyati et al., 2023), which played a significant role in cholesterol synthesis in the body, HMG-KoA reductase enzyme suppressed cholesterol production. In addition, alkaloids could increase bile secretion, which was a liquid that played a role in fat digestion, increased bile secretion increased the process of removing cholesterol from the body (Ibrahim et al., 2020; Lee & Kim, 2023; Patel, 2023).

The Intervention of Chayote Herbal Tea

Cholesterol levels were then examined before and after the study's results on chayote supplement samples, specifically chayote herbal tea, was administered to test animals (white rats). The test animals' cholesterol data in this study included their cholesterol levels before and after the intervention, as well as any changes in their cholesterol levels. Before the sample received treatment at the start of the trial, cholesterol levels were measured, and after the trial, on day 21, after the sample had received therapy, cholesterol value following intervention was measured. Cholesterol value following the intervention was less than cholesterol value before the intervention, which represented the change in knowledge value.

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Cholesterol levels after F1 significant value = 0.047 (p-value <0.05) indicated that cholesterol levels after F1 were not normally distributed, while the normality test (Shapiro-Wilk) revealed a significant value > 0.05 (normally distributed data), indicating that the analysis used parametric statistical tests, specifically paired t-test, and analysis of variance.

The mean cholesterol level in the 70% chayote herbal tea intervention group (F1) was 267.50 g/100 g before the intervention and 219.17 g/100 g after it. In addition, the paired t-test results indicated that the 70% chayote herbal tea intervention group exhibited a significant difference in cholesterol levels before and after the intervention, with a sig value of 0.004 (p-value <0.05) and an 18.1% decrease in cholesterol levels.

In this study, the mean cholesterol level in the 80% chayote herbal tea intervention group (F2) was 280.00 g/100 g before the intervention, and 207.17 g/100 g following it. According to the results of the paired t-test, the 80% chayote herbal tea intervention group's cholesterol levels decreased by 26.0% before and after the intervention, with a sig value of 0.000 (p-value <0.05).

The 90% chayote herbal tea intervention group (F3) had an average cholesterol level of 271.33 g/100 g before the intervention and 197.83 g/100 g following it. Based on the results of the paired t-test, the 80% chayote herbal tea intervention group's cholesterol levels decreased by 27.1% before and after the intervention, with a sig value of 0.002 (p-value <0.05). The group that received the most chayote herbal tea experienced the largest drop in cholesterol levels following the intervention, at 90%. This indicated that the sample intervention had an impact on cholesterol levels.

The intervention group's cholesterol levels decreased when compared to the 70% chayote (F1) intervention group, which reduced the lowest cholesterol levels (48.33 g/100 g) and the highest (73.50 g/100 g) with the intervention of chayote and jasmine herbal tea. This had the highest formulation of chayote (90%) in this study.

With a significant value = 0.000 (p-value <0.05), the one-way anova test findings demonstrated that the 3 intervention groups had a substantial impact on cholesterol levels before intervention. This indicated a genuine difference in the 3 groups pre-intervention cholesterol levels.

The results of the Games-Howell test for cholesterol levels before intervention showed statistically significant differences (p-value <0.05) in the groups of 70% chayote herbal tea (F1), 80% chayote herbal tea (F2), and feeding (F2) with 90% chayote herbal tea (F3). Post hoc tests were also performed to determine which intervention group differed among the 3 groups.

The Kruskal Wallis test had a significant value of 0.046 ($p < 0.05$), showing the intervention groups changed cholesterol levels after the intervention. This means the groups had real differences in cholesterol levels after it was done. The Mann-Whitney test also showed differences ($p < 0.05$) between the group with 70% chayote tea (F1) and the group with 90% chayote tea (F3). Post hoc tests were also done to find out which groups were different from the others.

The one-way ANOVA test had a significant value of 0.030 ($p < 0.05$), which showed the intervention groups changed cholesterol levels a lot. This means the groups weren't the same in how cholesterol levels changed. The Games-Howell test also showed differences ($p < 0.05$) between giving 80% chayote tea (F2) and 90% chayote tea (F3). Post hoc tests were done too, to see which groups were different from each other among the three groups.

The study observed cholesterol levels and found a 73.50 g/100 g reduction with 90% chayote and jasmine tea, which was the best combination. Therefore, using more chayote might work better than using less, such as in F1. Chayote was effective for lowering cholesterol naturally, and when there's more chayote in the mix, cholesterol reduction was more. Other studies revealed chayote helped lower cholesterol and that using more of it worked better for this purpose (Huerta-Reyes, Tavera-Hernández, Alvarado-Sansininea, & Jiménez-Estrada, 2022).

CONCLUSIONS

The average decrease in cholesterol levels of test animals after the intervention was highest after the intervention of chayote herbal tea and jasmine flowers with 90% formulation with a decrease of 73.50 g/100 g. Several differences in cholesterol levels were observed before and after the intervention of the 3 intervention groups with a p-value <0.05. In addition, there was an effect of giving chayote herbal tea and jasmine flowers in 3 groups after intervention with a significant value = 0.000 (p-value <0.05).

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