Received: 22 Mei 2026	**Revised:** 27 Mei 2026	**Accepted:** 1 Juni 2026
Published: October 2026	**DOI:** 10.14421/znsrhb68	**Article Type:** Research

Effect Of Pineapple Core Juice (*Anannas comosus* (L.) Merr.) On Blood Cholesterol Levels Of Hypercholesterolemic Mice (*Mus musculus* L.)

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ABSTRACT

Background: Hypercholesterolemia is one of the main risk factors for cardiovascular disease which is characterized by increased blood cholesterol levels. Pineapple tubers (Ananas comosus (L.) Merr.) contain bromelain, flavonoids, saponins, vitamin C and fiber which have the potential to reduce cholesterol levels. **Purpose**: To determine the effect of pineapple tuber juice on reducing blood cholesterol levels in hypercholesterolemic mice and determine the most effective dose. **Method**: A total of 30 male mice were divided into five treatments, namely negative control (K-), positive control simvastatin (K+), juice treatment namely 1.5mL/gBW (P1), 3mL/gBW (P2), and 4.5mL/gBW (P3). Mice were made hypercholesterolemic by being given a diet of chicken egg yolks for 14 days, then treated with weevil juice for 14 days. Data were analyzed using ANOVA and continued with the Tukey HSD test ($p<0.05$). **Findings**: The results of the study showed that giving pineapple tuber juice had a significant effect ($p<0.05$) on reducing blood cholesterol levels in mice. The highest percentage reduction in cholesterol levels was obtained at a dose of 4.5 mL/gBW (P3) of 25.75%, compared to simvastatin (K+) of 51%. **Limitations and Recommendations**: The average decrease in blood cholesterol with increasing the dose of pineapple tuber juice. This shows that pineapple tuber juice has the potential to be

Keywords : *Ananas comosus*; hypercholesterolemia; cholesterol; *Mus musculus*

ABSTRAK

Hiperkolesterolemia merupakan salah satu faktor risiko utama penyakit kardiovaskular yang ditandai dengan peningkatan kadar kolesterol darah. Umbi nanas (Ananas comosus (L.) Merr.) mengandung bromelain, flavonoid, saponin, vitamin C, dan serat yang berpotensi menurunkan kadar kolesterol. Tujuan: Untuk mengetahui pengaruh jus umbi nanas dalam menurunkan kadar kolesterol darah pada tikus hiperkolesterolemik dan menentukan dosis yang paling efektif. Metode: Sebanyak 30 ekor tikus jantan dibagi menjadi lima kelompok perlakuan, yaitu kontrol negatif (K-), kontrol positif simvastatin (K+), dan perlakuan jus yaitu 1,5 mL/gBW (P1), 3 mL/gBW (P2), dan 4,5 mL/gBW (P3). Tikus dibuat hiperkolesterolemik dengan diberi diet kuning telur ayam selama 14 hari, kemudian diberi jus umbi nanas selama 14 hari. Data dianalisis menggunakan ANOVA dan dilanjutkan dengan uji Tukey HSD ($p<0,05$). Temuan: Hasil penelitian menunjukkan bahwa pemberian jus umbi nanas memiliki efek signifikan ($p<0,05$) dalam menurunkan kadar kolesterol darah pada tikus. Persentase penurunan kadar kolesterol tertinggi diperoleh pada dosis 4,5 mL/gBW (P3) sebesar 25,75%, dibandingkan dengan simvastatin (K+) sebesar 51%. Keterbatasan dan Rekomendasi: Penurunan rata-rata kolesterol darah dengan peningkatan dosis jus umbi nanas. Hal ini menunjukkan bahwa jus umbi nanas memiliki berpotensi

Katakunci : Ananas comosus; hypercholesterolemia; cholesterol; Mus musculus

INTRODUCTION

Hypercholesterolemia is a serious medical condition characterized by elevated blood cholesterol levels (Civeira et al., 2022), especially LDL (Low-Density Lipoprotein) which is one of the main risk factors for cardiovascular disease such as atherosclerosis and heart attacks (Eid et al., 2020). Data from the WHO shows that ischemic heart disease due to high cholesterol is still the leading cause of death globally(Pirillo & Danilo, 2023). Although statin treatment is quite effective, long-term use can cause side effects such as muscle and liver disorders (Li et al., 2020). The search for safer natural therapeutic alternatives continues to be the focus of research.

Islam, as a perfect religion, teaches health for individuals and society. Indeed, Allah grows plants that are beautiful, green, and provide many health benefits and enjoyment to humans (Mohidem & Hashim, 2023). Allah says in QS. Yunnus: 57:

يٰٓاَيُّهَا النَّاسُ قَدْ جَاۤءَتْكُمْ مَّوْعِظَةٌ مِّنْ رَّبِّكُمْ وَشِفَاۤءٌ لِّمَا فِى الصُّدُوْرِۙ وَهُدًى وَّرَحْمَةٌ لِّلْمُؤْمِنِيْنَ

Meaning: "O people! Indeed, there has come to you a lesson (the Qur'an) from your Lord, a cure for diseases in the chest, and guidance and mercy for those who believe".

The verse above teaches humans that health is a right of the body. It is Allah who grows olive plants, dates, grapes, and other fruits with water sent down from the sky as sustenance and staple food for humans. In this case, humans are given ample opportunities to take more benefits from the universe by thinking and trying to increase the added value of His creation into knowledge (Jash, 2025). One natural ingredient that has potential for human health is pineapple (Ananas comossus (L.) Merr.). Pineapples contain active compounds with hypocholesterolemic effects, which can reduce cholesterol levels in people with hypercholesterolemia (Seenak et al., 2021).

Pineapple fruit (*Ananas comossus* (L.) Merr.) has been used traditionally to treat various health problems because it contains high levels of bromelain (Yulastri et al., 2024), flavonoids, saponins, and vitamin C (Sharma, 2024). Flavonoid compounds can inhibit the activity of the enzyme HMG-CoA reductase, which is the main enzyme in cholesterol biosynthesis in the liver (Bayu et al., 2024). The saponins in pineapple work by binding bile acids in the intestine and increasing their excretion, thereby reducing total cholesterol in the blood (Rahman et al., 2020). The content of soluble fiber and vitamin C also plays a role in reducing LDL (Low-Density Lipoprotein) levels by preventing oxidation and increasing lipid metabolism (Khairunnisa et al., 2025).

The pineapple tuber is the middle part of the pineapple fruit, which is cylindrical in shape, yellowish white in color, and has a harder texture than the flesh of the fruit (Hikal et al., 2021). So far, pineapple tubers are often considered an underutilized waste, even though phytochemically, this part has advantages because it contains a higher bromelain enzyme than the flesh of the fruit (Kamusoko & Mukumba, 2025). Bromelain is a protease enzyme that has fibrinolytic activity which biochemically plays a role in lipid metabolism by inhibiting cholesterol accumulation and increasing the breakdown of cholesterol plaque in blood vessels (Hu et al., 2022). Apart from bromelain, pineapple tubers also contain calcium oxalate, fiber, and flavonoid compounds which act as antioxidants to inhibit LDL oxidation, thereby providing a protective effect against hypercholesterolemia (Torres-le et al., 2023).

LITERATURE REVIEW

Previous research by Sasmithae et al., *(*2023), including observational clinical studies in humans and trials in animals (rats), reported a significant reduction in total cholesterol and LDL (Low-Density Lipoprotein) cholesterol levels after regular consumption of pineapple or pineapple juice. In one study, giving pineapple juice for 6 days to hypercholesterolemic research subjects showed an average reduction in LDL levels from 118.7 mg/dl to 102.53 mg/dl. Pineapple juice, as a natural form of consumption, needs to be tested further on mice to determine its effectiveness directly. This is important to support the use of pineapple as a herbal product based on scientific evidence. The method of administering juice is closer to people's daily consumption habits than extracts or tablets (Tokiman & Basri, 2024).

METHODS

This type of research is experimental. The research population and sample consisted of 30 mice (*Mus musculus* L.) weighing 20 grams and 2 months old. Mice were divided into 5 treatments, each consisting of 6 replications, namely: K+ (Simvastatin 0.0013mg/gBW), K- (egg yolk 2mg/gBW), P1 (Juice 0.25 mL/gBW), P2 (juice 0.5mL/gBW), and P3 (juice 0.75mL/gBW). Pineapple fruit tubers (*Ananas comosus* Merr.) were blended without adding water to produce homogeneous juice. Mice were acclimated for 7 days to obtain uniform physiological conditions. After acclimation, initial blood cholesterol levels were measured, then hypercholesterolemia levels were measured after being given high cholesterol feed (chicken egg yolk) for 14 days. Pineapple tuber juice was given according to the treatment for 14 days, and then the final cholesterol levels were measured. The observation variables consist of blood cholesterol levels (initial cholesterol, hypercholesterolemia, and final cholesterol) and the percentage of cholesterol reduction.

The percentage reduction in cholesterol is calculated using the following formula (Sampson & Wolska, 2021):

$$Decline\ Percentage = \frac{Initial\ Cholesterol\ Levels - Final\ Cholesterol\ Levels}{Initial\ Cholesterol\ Levels} \times 100\ \%$$

The measurement data were analyzed using Analysis of Variance (ANOVA) and the Turkey HSD α=0.05 further test.

RESULTS

1. Blood Cholesterol Levels of Mice (Mus musculus L.)

The results of the average total blood cholesterol levels of mice between treatments can be seen in Table 1.

Table 1. Mean Cholesterol Levels of Mice Between Treatments

Treatment	Baseline Blood Cholesterol (mg/dl)	Hypercholesterolemia (mg/dl)	Final Blood Cholesterol (mg/dl)
K+	76.7±4.32	167±4.20	81.83±2.56[a]
K-	77.0±5.80	166.7±3.56	164.83±3.54[b]
P1	86.3±11.81	140.5±8,22	131.2±2.93[c]
P2	86.5±8.48	143.7±11.08	121.3±5.35[d]
P3	86.0±8.88	144.7±9.24	107.2±3.60[e]

Note: Numbers followed by different letters indicate significant differences based on the LSD test (α=0.05)

2. Percentage Reduction in Blood Cholesterol in Mice (*Mus musculus* L.)

The mean percentage reduction in total blood cholesterol levels of the mice between treatments is presented in Table 2.

Table 2. Average Percentage Reduction in Cholesterol Levels

Treatment	Average Decrease in Blood Cholesterol (mg/dl)
K +	51±1,73[a]
K -	1.10±0,44[bC]
P1	6.43±4,77[bc]
P2	15,09±7,34[d]
P3	25,75±3,71[e]

Note: Numbers followed by different letters indicate significant differences based on the LSD test (α=0.05)

DISCUSSION

Based on the data in Table 1, it shows that the initial blood cholesterol levels in mice that had just been acclimated to all treatments showed a normal range, namely 76-86 mg/dl. Normal

blood cholesterol levels in mice ranged from 40-120 mg/dl (Hassaan et al., 2026). Simvastatin (K+) induction caused hypercholesteolemia in the blood of mice, namely 167 mg/dL, whereas those treated with high-cholesterol feed, namely chicken egg yolk, also experienced hypercholesterolemia with a range of 140.5 mg/dl (P1) to 166.7 mg/dl in K-. After giving pineapple tuber juice for 14 days, a decrease in final cholesterol was seen.

The highest reduction in cholesterol was seen in treatment P3, namely 107.2 mg/dl, followed by P2, namely 121.3 mg/dl, and P1, namely 131.2 mg/dl. Based on the Turkey HSD further test α=0.05, the final cholesterol level value in all pineapple weevil juice treatments was significantly different when compared to the negative control (K+), which was only given egg yolk. This reduction in cholesterol is still classified as hypercholesterolemia; normal blood cholesterol levels in mice range from 40-120 mg/dl. The K+ treatment given simvastatin showed the lowest final cholesterol level, namely 81.83 mg/dl, compared to the pineapple tuber juice treatment. This shows that the dose of pineapple tuber juice given is not very significant in lowering cholesterol when compared with simvastatin as a cholesterol lowering drug.

Based on the data in Table 2, it shows that the positive control treatment (K+) given simvastatin showed the highest percentage reduction in cholesterol levels of 51%. These results show that simvastatin is effective in reducing blood cholesterol levels because it works by inhibiting the HMG-CoA reductase enzyme, which plays a role in cholesterol biosynthesis in the liver (Pangestika et al., 2020). In contrast, the negative control (K) only showed a decrease of 1.10%, which indicates that without treatment, the blood cholesterol levels of mice tended to remain high and did not decrease significantly.

In the pineapple weevil juice treatment, the percentage reduction in cholesterol levels increased as the dose given increased. Treatment P1 showed a decrease of 6.43%, P2 of 15.09%, and treatment P3 of 25.75%. These results show that there is a dose-response relationship, namely that the higher the dose of pineapple weevil juice given, the greater the percentage reduction in mice's blood cholesterol levels. The ability of pineapple tuber juice to lower cholesterol levels is thought to be related to the content of bromelain, flavonoids, saponins, and soluble fiber found in pineapple tubers (Rahman et al., 2020). Bromelain plays a role in helping lipid metabolism and fat degradation in the blood, while fiber and saponin help bind bile acids, thereby increasing the excretion of cholesterol from the body (Ahmed et al., 2025). Thus, giving pineapple tuber juice has the potential to be a natural therapy in lowering blood cholesterol levels.

Turkey HSD follow-up test results α= 0.05, indicate that P3 treatment has higher effectiveness

in reducing cholesterol levels than P1 and P2 treatments. Treatment P1 showed a reduction in cholesterol levels by 6.43%, P2 by 15.09%, and P3 by 25.75%. These results indicate the existence of a dose-response relationship, namely the higher the dose of pineapple weevil juice given, the greater the effect in reducing blood cholesterol levels. This is because the higher the dose given, the greater the content of chemical compounds such as bromelain and fiber, which work in lipid metabolism by inhibiting cholesterol accumulation and increasing the breakdown of cholesterol plaque in blood vessels (Ajayi et al., 2021).

CONCLUSIONS

Pineapple tuber juice (*Ananas comosus* (L.) Merr.) has an effect on reducing blood cholesterol levels in hypercholesterolemic mice (*Mus musculus* L.), although it is not significant when compared with simvastatin (K+). The effective dose of pineapple weevil juice in reducing cholesterol percentage is at a dose of 4.5 mL/gBW (P3) with a reduction percentage of 25.75%.

LIMITATION AND RECOMMENDATION

Increasing the dose of pineapple weevil juice did not have a significant relationship when compared with administering simvastatin to reduce cholesterol levels. Based on the results of the research that has been carried out, research can be continued on the effect of giving pineapple tuber juice on triglyceride, LDL, and HDL levels. Research can also be continued with toxicity tests which, include acute, subchronic, and special toxicity.

ACKNOWLEDGMENT

We would like to express our thanks to the FMIPA UHO research team and the biology laboratory, as well as the students involved in this research.

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