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The Effect of Durian (*Durio zibethinus*) Seeds and Albedos Extract on Reducing Cholesterol Levels

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Abstract: This research aims to determine the potential of durian to reduce cholesterol levels. This research used a completely randomised design as the basis for determining the sample size. There were 5 treatment groups, including durian seed extract (T1), durian albedo extract (T2), a combination of seed and albedo extract (T3) and those 3 treatment groups were given at a dose of 0.28 mg/head/day, quail eggs at a dose of 0.5 mL/head/day, and cholesterol reducing medication at 50 mg/head/day. The data were analyzed using the One Way ANOVA Test, which showed that p (0.004) < 0.05, leading to the conclusion that there was a real differences between all treatment groups. The seed extract group experienced the largest average decrease, namely 49.15 mg/dL, while the average decrease in the combination seed-albedo extract group and cholesterol reducing medication was 43.0 mg/dL, 33.4 mg/dL, and 28.7 mg/dL, respectively. The conclusion of this research is durian seed extract and albedo are effective in reducing cholesterol levels in the blood.
Keywords: Albedo; cholesterol; durian seed

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INTRODUCTION

The development of fast food variations is directly proportional to the number of fast food outlets that are easy to find and have halal certification so they are loved by Indonesian people (Mariana et al., 2020). Tasty, practical and easy to find makes fast food popular with the public. On the other hand, consuming fast food has the potential to cause many diseases. One of these diseases is high levels of cholesterol in the blood (Martony, 2020). Fast food contains nutrients that are bad for health (Smith et al., 2022). According to Madan et al., 2021 and Malmir et al., 2023, fast food is unhealthy food that has high in calories and low in nutrients. Therefore, cholesterol sufferers in Indonesia can reach 28% with a death rate of 7.9% (Kemenkes, 2022).

The various types of medicines are available to treat excess cholesterol levels. One thing that attracts public interest is traditional medicine. Based on the results of the analysis conducted by (Zakiyah & Febriati, 2022), as many as 58.6% of people of various ages and backgrounds have moderate interest, 26% of people have high interest, and 15.5% of people have low interest in traditional medicinal plants. This can happen because currently there are many drinks in the form of traditional herbal medicine whose raw materials come from natural ingredients such as fruit which has the potential to contain beneficial ingredients.

Current research on cholesterol-lowering agents has focused extensively on synthetic drugs such as statins, which are widely prescribed for hypercholesterolimia management. However, long-term use of statins is associated with adverse effects such as muscle pain, liver damage, and increased risk of diabetes (Ruscica et al., 2022). Consequently, there has been a shift toward exploring natural sources with

cholesterol-lowering properties, including plant-based compounds rich in flavonoids and saponins. Various studies have investigated the cholesterol-lowering potential of fruits such as citrus (Agosto et al., 2024), dragon fruit (Agatha et al., 2024), and berries (Liu et al., 2021), but research on durian, specifically its seeds and albedo, remains limited.

Durian seeds and albedos, which are often overlooked by people, also has the potential to act as natural anti-cholesterol agents. The mechanism behind this cholesterol-lowering potential is attributed to its rich bioactive compounds. Based on research of (Maharani & Zuhro, 2017), durian albedo contains flavonoids and saponins, while the seeds contain a total of 29.74 μg/mL flavonoids (Hunna, 2020). Flavonoids are known to reduce cholesterol due to their antioxidant and anti-inflammatory properties (Ayoub, 2022), which can prevent the oxidation of LDL cholesterol. Meanwhile, saponins contribute by reducing cholesterol absorption in the intestine, possibly by forming insoluble complexes with cholesterol (Chávez-Santoscoy et al., 2016). Although these previous studies have demonstrated the presence of active compounds such as flavonoid and saponin and shown promising preliminary results on cholesterol-lowering efficacy, comprehensive research focusing on durian seeds and albedos remains scarce.

Therefore, this study aims to further investigate this gap by evaluating the effectiveness of durian seeds and albedo in reducing cholesterol levels. Durian seeds and albedo cannot be eaten directly, therefore alternatives are needed to be able to consume it. This research aims to determine the potential of durian to reduce cholesterol levels, so research was carried out on the effectiveness of antioxidants found in durian seeds and albedo.

METHOD

The materials used in this study were durian albedo, durian seeds, *Mus musculus* L. (mice), quail egg yolk, chick pellets, and the cholesterol-lowering drug simvastatin 10 mg, and cholesterol levels checked by Easytouch® GCU. This research used a completely randomized plan (CRD) with 5 treatments and 4 replications on 20 *Mus musculus* samples. Chopped the durian seeds and albedos then dried for 3x24 hours at a temperature of 80º. Grind the dried durian seeds and albedo until it becomes a dry powdery extract (Maharani & Zuhro, 2017). Added the aquadest as a solvent of each durian seeds and albedos extracts with an extract:solvent ratio of 1:3. Centrifuge extracts for 4 minutes (Dewi et al., 2018).

Mus musculus total cholesterol levels were checked before and after treatment using the Easytouch®. The measurement of cholesterol levels by cutting the tip of the tail of *Mus musculus* . Drop the *Mus musculus* blood sample on the test strip until it beeps and a digital number comes out.

Mus musculus was acclimatized for 12 days in a plastic cage measuring 30x20x17 cm containing wooden husks as a base for the cage and a wire cover. *Mus musculus* was fed chicken feed during the acclimatization period. *Mus musculus* is also given drinking water using a plastic bottle through a pipe.

Quail egg yolk induction was given for 44 days at a dose of 0,5 ml/day. Each treatment was given to a group of *Mus musculus* , each consisting of 4 individuals. The determination of 4 animals for each group was carried out randomly. Then these groups were given different treatments. Treatment follows the Table 1 below.

Table 1. Treatment and time allocation

Code	Treatments	Time Allocation
T1	Durian seed extract 28mg/20g *Mus musculus* BW	14 days
T2	Durian albedo extract 28mg/20g *Mus musculus* BW	
T3	Durian seed and albedo combination extract 28mg/20g *Mus musculus* BW	
T4 control (-)	No treatment	
T5 control (+)	Cholesterol reduce medication	

The data analysis was carried out by comparing total cholesterol levels before and after treatment. Statistical tests used the Statistical Program for Social Science (SPSS) version 25 with the one way ANOVA test method and Duncan's advanced test to determine differences between treatment groups with a significance level of α=5% or 0.05. The data normality test uses the Shapiro Wilk test because the research sample is less than 50 samples and the homogeneity test uses the Levene test.

RESULTS AND DISCUSSION

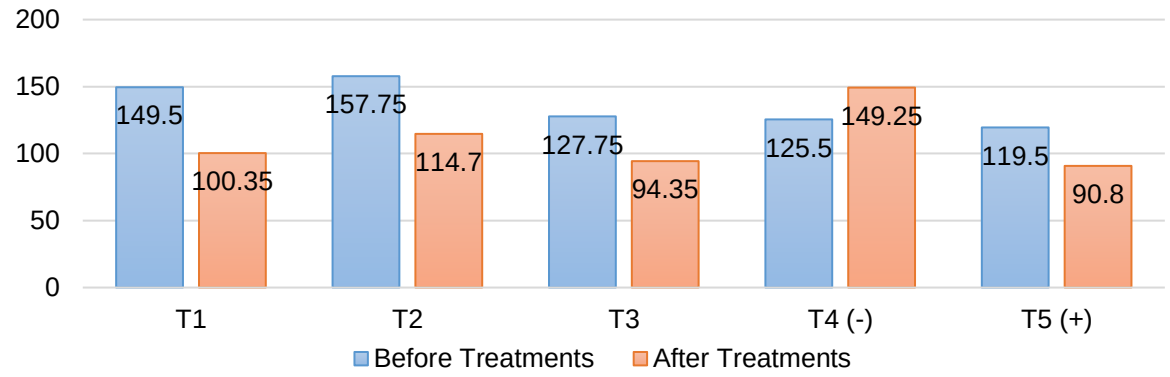
The results of statistical data analysis used Statistical Program for Social Science (SPSS) version 25, the first stage was a normality test using the Shapiro Wilk Test method with a significance value of 0.32>0.05, the data from the Shapiro Wilk test shows a significance value of >0.05 so it can be concluded that the data is normally distributed.

Table 2. The average number of cholesterol levels by 5 treatments

Treatments	Averages	P-*value* ANOVA
T1 (Durian Seed Extract)	124.92 ± 40.10^{ab}	
T2 (Durian Albedo Extract)	136.22 ± 31.65^{b}	
T3 (Durian Seed & Albedo Extract)	111.05 ± 19.23^{ab}	0.004
T4 (No Treatment)	137.37 ± 22.10^{b}	
T5 (Cholesterol Medication)	105.15 ± 17.89^{a}	

The average normality test for all treatments is normally distributed and the homogeneity test results also show that the data is homogeneous. The P-value in the One Way ANOVA test is 0.004, indicating that there are significant differences between all treatment groups (P<0.05). The treatment group given durian seed extract (T1) and the group without treatment (P4) showed a significant reduction in cholesterol levels and there was a real difference between the two groups.However, the best value for reducing cholesterol levels is found in administering cholesterol medication with the lowest average value (105.15±17.89a).

This research was conducted with the aim of testing the effectiveness of the flavonoid content contained in durian seed extract and albedo on cholesterol levels. There was a reduce in total cholesterol levels of *Mus musculus* after being given durian seed extract and albedo. The decrease in cholesterol levels can be seen in the following Figure 1.



Note:
T1 : Durian seed extract 28mg/20g *Mus musculus* BW
T2 : Durian albedo extract 28mg/20g *Mus musculus* BW
T3 : Durian seed and albedo combination extract 28mg/20g *Mus musculus* BW
T4 kontrol (-) : No treatment
T5 kontrol (+) : Cholesterol medication

Figure 1. Comparison of the reduction in cholesterol levels before and after administration of the extract in each treatment (mg/dL)

Before given by durian seed extract and albedo treatments, *Mus musculus* were induced using quail egg yolk to increase total cholesterol levels. Quail eggs have a triglyceride content of 65.50% (Wiradimadja et al., 2009), while triglycerides are the building blocks of cholesterol molecules in the body (Hesturini & Erlina, 2022). After giving treatment by durian seed and albedo extracts, it can be seen in Figure 1 that there was a reduction in cholesterol levels in treatment 1 from 149.5 mg/dL to 100.35 mg/dL or namely 32.88%. The second largest reduction in cholesterol levels was shown by treatments of albedo durian extract in T2, namely 43.05 mg/dL (27.29%). The lowest reduction in cholesterol levels was the treatments of a combination of durian seeds and albedo combination extract, which only reduced total cholesterol levels by 33.4 mg/dL (26.14%). The negative control in this study was T4, with an increase in cholesterol levels of 23.75 mg/dL (18.93%). The rate of reduction in total cholesterol levels in the treatment of giving seed, albedo, and giving a combination of durian seed and albedo extracts was higher than when giving cholesterol medication (T5) which were only able to reduce total cholesterol levels by 28.7 mg/dL (24.01%). The treatments of a cholesterol medication as a positive control is intended to compare the percentage of effectiveness of durian seed and albedo extract as a benchmark for its potential to become an alternative drug to lower natural cholesterol levels.

The reduction in cholesterol levels after treatment with durian seeds, albedo, and a combination of seeds and albedo occurred because durian extract contains a source of positive antioxidants, namely flavonoids. (Andriani & Anggraini, 2023; Maharani & Zuhro, 2017; Masturi et al., 2020; Sakaganta & Sukohar, 2021). Flavonoids can help prevent the deposition of bad cholesterol or LDL (Low-density lipoprotein) on blood vessel walls (Sakaganta & Sukohar, 2021). The deposition of LDL in the blood vessels is caused by high levels of LDL in the body, so that the excess LDL will go through an oxidation process and form clots which will get bigger and bigger over time until they block the blood vessels (Yoeantafara & Martini, 2017).

The procedure for reducing cholesterol levels caused by the presence of flavonoids starts from inhibiting HMG-CoA reductase (Utari et al., 2023), namely an enzyme that accelerates the formation of cholesterol. Inhibition of HMG-CoA has a direct impact on increasing acyl cholesterol lecithin activity, acyl cholesterol lecithin

functions as a converter of free cholesterol into cholesterol esters which are not easily soluble in water (Yunarto et al., 2019). Furthermore, these cholesterol esters bind to the lipoprotein core and form new HDL which has an impact on increasing the concentration of HDL in the blood (Manthei et al., 2020). In addition to inhibiting HMG-CoA, flavonoids help increase catalase and Superoxide Dismutase (SOD) which is accompanied by a decrease in lipid peroxidase levels, thereby reducing cholesterol levels (Adriana et al., 2019).

Besides of the presence of flavonoids, the content of saponins, tannins and triterpenoids is also found in durian skin (Maharani & Zuhro, 2017). Tannins can inhibit fat absorption by reacting with mucosal proteins and intestinal epithelial cells (Sakaganta & Sukohar, 2021). Meanwhile, triterpenoids and alkaloids play a role in preventing increases in total cholesterol and triglyceride levels (Mustofa et al., 2022). Artha et al., (2017) stated that alkaloids can work as antioxidants by adding hydrogen ions. According to Illing & Yusiranna, (2019) albedo durian also contains β-sitosterol which can prevent cholesterol from entering the intestines. Inhibition of cholesterol in the intestine is carried out by reducing the level of mRNA expression of the enzyme which is a key protein for the entry of cholesterol into intestinal epithelial cells, making it difficult for cholesterol to be absorbed by the intestine. However, only high concentrations of β-sitosterol can inhibit cholesterol reabsorption (Apriana et al., 2022; Chen et al., 2020).

CONCLUSION

Durian seed and albedo extracts are effective in reducing cholesterol levels. The best extract concentration in reducing cholesterol was obtained in T1, that is treatment of durian seeds extract with the highest reduction of 49.15 mg/dL (32.88%). Therefore, durian seed extract and albedo have potential as alternative traditional medicines for lowering cholesterol levels.

RECOMMENDATION

Recommendations for future research include conducting a stability test of this study, which should ideally be done during the durian season to provide a clearer measurement of the fruit's harvest age. The type of durian in this study is local durian, so it is hoped that future research will use different types of durians and include tests for flavonoid content with clear measurements.

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