

## The effect of tiwai (*Eleutherine americana* Merr.) coffee consumption on lipid profile in subjects aged between 40 and 67 years old

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### Abstract

Tiwai (*Eleutherine americana* Merr.) contains alkaloids, saponins, triterpenoids, steroids, glycosides, tannins, phenols, flavonoids, and polyphenols. Flavonoids, as antioxidants, play an important role in preventing and treating various degenerative diseases such as coronary heart disease, cholesterol, diabetes, and cancer. This study aimed to determine the effect of tiwai coffee consumption on lipid profiles (total cholesterol, Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), and triglycerides) and to determine the relationship between dietary intake and lipid profile. The study design uses a pre-and post-test design. The tiwai coffee intervention was given for 15 days, twice a day, once in the morning and once in the evening. The blood sample was collected before and after the intervention. Data were analyzed by a paired t-test to determine differences in the tiwai coffee consumption before and after intervention on lipid profiles. The correlation test was used to determine the degree of closeness of the relationship between food intake and lipid profile. The results showed that tiwai coffee consumption had a significant effect on triglyceride levels but had no significant effect on total cholesterol, LDL, and HDL levels. The pre-test average was 221.18±112.06 mg/dL, and the post-test average was 167.63±152.34 mg/dL. Triglyceride levels decreased by 53.55 mg/dL. The Decrease in total cholesterol, LDL, and HDL levels had no significant effect. However, the mean values showed a decrease in total cholesterol levels by 3.22 mg/dL, 0.82 mg/dL for LDL, and 0.18 mg/dL for HDL. From the results of this study, it can be concluded that cholesterol levels are influenced by food intake, diet, and physical activity. Tiwai coffee consumption can reduce triglyceride levels in the studied subjects.

### 1. Introduction

Plants rich in polyphenols have an important effect on disease prevention in patients with cancer, diabetes, cardiovascular disease, and degenerative diseases (Quero *et al.*, 2020). Hypercholesterolemia can be a major causative factor for coronary heart disease (Saragih *et al.*, 2014). According to the 2018 Riskesdas data, there are 13,977 diabetes mellitus patients in East Kalimantan Province, which is dominated by patients aged 45 to 54 years, reaching 124,652 people. Recently, the problem of multiple nutrition has become the center of attention of nutrition and health experts (Saragih, 2019). Associated with diet and daily habits in consuming food will affect

the unbalanced lipid profile, such as total cholesterol, LDL, HDL, and triglycerides. Lipid profile is the state of blood lipids in terms of total cholesterol, LDL, HDL, and triglycerides (Ercho *et al.*, 2013).

Lately, we can find coffee shops on almost every side of the road. This is due to the high demand for coffee and the lifestyle of the people, especially those in big cities, where they often work late at night. With the high demand for coffee and people's lifestyles, there is a need for innovation in making coffee by adding local ingredients from East Kalimantan, such as tiwai onions. Tiwai onion or native Dayak tribes onion plants contain almost all phytochemical compounds, including

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alkaloids, glycosides, flavonoids, phenolics, and steroids (Saragih *et al.*, 2021).

The Dayak people of Kalimantan often use Tiwai as a traditional medicine for curing high cholesterol levels, diabetes, and cancer. It is believed that consuming tiwai onion twice a day can lower cholesterol levels by 5.33 mg/dL in women with hypercholesterolemia (Saragih *et al.*, 2014). Tiwai onions have been produced for the manufacture of several products starting in 2008 by Saragih *et al.* (2019), such as candy, food coloring, effervescent tablets and herbal drinks—combined with other ingredients such as ginger and lemongrass.

Research conducted by Saragih *et al.* (2011) found that tiwai coffee was preferred by panelists with a sugar:coffee:tiwai ratio of 80:15:5 (%). Moreover, a test conducted using a spectrophotometer with DPPH showed a value of 0.10-0.15 mg/mL, which indicates a moderate antioxidant category. Tiwai coffee has a black color and a good dissolution rate (16 s) with a distinctive aroma and taste. Saragih *et al.* (2021) research found that the antioxidant activity of green and ground coffee was classified as a strong antioxidant, while tiwai powder – a mixture of ground coffee and tiwai powder and a mixture of ground coffee and instant tiwai – was in the moderate antioxidant category. The coffee plant has been cultivated for a long time and has become an important commodity in agriculture and one of Indonesia's main export products. Indonesian specialities include Arabica coffee varieties, mainly produced in South Sulawesi, especially in Tana Toraja and Enrekang Regencies.

Arabica coffee is known to have a good taste with low acidity, smooth texture, and slightly oval shape (Assa *et al.*, 2021). On the other hand, Arabica coffee is known for its mild, slightly sour taste and finer texture. Phytochemical studies on the non-volatile compounds of Arabica coffee beans showed the presence of carbohydrates, fiber, amino acids, lipids, minerals, organic acids, chlorogenic acid, trigonelline, and caffeine. The volatile compounds are released differently in coffee depending on coffee type and degree of roasting (Dippong *et al.*, 2022). Furthermore, a study has found that coffee ripening is essential for good volatile compound composition. Based on this explanation, the researchers made an innovation by adding tiwai onions with a mixture of Arabica coffee powder, which hopefully could be an added value to the product and further increase the economic value of tiwai onions. This study aimed to determine the effect of tiwai coffee consumption on lipid profiles (total cholesterol, LDL, HDL, and triglycerides) and to determine the relationship between nutritional intake and lipid profile.

## 2. Materials and methods

### 2.1 Tiwai coffee-producing method

#### 2.1.1 Preparation of tiwai powder

Tiwai onions were washed using running water. After that, the onion was cut to 1 mm. Tiwai onions that had been cut were then dried in the air for 2 days. Tiwai onions that had been dried were roasted for 15 min, mashed using a blender and then sieved using an 80 mesh sieve.

#### 2.1.2 Coffee powder production

Arabica coffee beans that had been dried were roasted for 15 min, mashed using a grinder and then sieved using an 80-mesh sieve.

#### 2.1.3 Mixing and packaging

The tiwai powder and ground coffee were mixed using a 3:1 ratio; 3 kg of tiwai powder and 1 kg of coffee powder. This mixing was carried out in a closed container and then stirred until the two ingredients were homogeneous. Then, 5 g of tiwai coffee was weighed, packed into a paper bag, sealed, and stored in a vacuum package.

### 2.2 Tiwai coffee intervention

Subjects who met the inclusive criteria were aged between 40 and 67 years, had cholesterol levels above 200 mg/dL, were not taking cholesterol-lowering drugs, and were willing to participate in the study. The exclusion criteria included subjects who had no history of hypercholesterolemia.

First, subjects must complete a personal data form and sign an informed consent letter. This research is in accordance with the protocol of the ethical commission from the Faculty of Medicine with the code of ethics: No.167/KEPK-FK/X/2022. Subjects were invited to have their blood samples collected before the intervention at Prodia Samarinda Clinical Laboratory. The blood analysis includes a lipid profile examination, consisting of total cholesterol, HDL, LDL, and triglycerides. After blood samples were collected, one pack of tiwai coffee containing 30 sachets, 5 g each, was distributed to the subjects. Preparation for consumption was by putting 5 g of Tiwai coffee into a glass, then adding 150 mL of freshly boiled hot water and then stirring it with a spoon and after it is cold enough to drink it. After the first week of intervention, the subjects were interviewed using two 24-hour food recall methods, and the food recall was repeated on the 14th day after the tiwai coffee intervention. On the 16th day, the subject was invited back to the Prodia Samarinda Clinical Laboratory to perform another blood analysis after

consuming tiwai coffee. Then the subjects were interviewed for testimonials while consuming tiwai coffee.

### 2.3 Data analysis

#### 2.3.1 Blood sampling

Blood samples were obtained via intravenous (IV) blood collection before and after the intervention. First, the blood samples were collected from the arm vein into a tube containing EDTA. Then, plasma samples were analyzed enzymatically for total cholesterol (CHOD PAP), LDL (Homogeneous enzymatic), HDL (Homogeneous enzymatic), and triglyceride enzymatic colorimetry with Glycerol-3-phosphate-oxidase (GPO) performed by Prodia Samarinda Clinical Laboratory.

#### 2.3.2 Food intake

Data analysis regarding nutritional intake was used to determine the subject's nutritional intake (calories, protein, fat, carbohydrates, fiber, and cholesterol). First, the subjects were interviewed using a 2×24-hour food recall during the first and the second week after tiwai coffee was distributed. Then, the food recall data were analyzed by computerization using the NutrisurveyTM software program, and the results were then compared to the Indonesian Nutrition Adequacy Rate (RDA) table.

#### 2.3.3 Statistical analysis

Paired t-tests were conducted to assess the differences between pre- and post-test results of tiwai coffee consumption.

## 3. Results and discussion

### 3.1 Characteristics of the subject

These study subjects met the inclusion and exclusion criteria and were willing to participate during the intervention according to the research ethics protocol. The subject has a cholesterol level of 220 mg/dL, with

13 subjects aged between 40-49 years (59.1%), eight subjects aged 50-64 years (36.4%), and one subject aged 67 (4.5%). The subject's gender consists of 10 women (45.5%) and 12 men (54.5%). In addition, subjects with normal body mass index (BMI) on the pre-test were two people (18.2%) and five people (22.7%) on the post-test. Subjects with overweight BMI on the pre-test were seven (31.8%) and six (27.3%) on the post-test. Subjects with obesity category I were seven (31.8%) on the pre-test and 8 (36.4%) on the post-test. Finally, subjects with obesity category II were four (18.2%) on the pre-test and three (13.6%) on the post-test.

### 3.2 Food intake

The average nutritional intake is presented in Table 1. The calorie intake on day-7 (D-7) of tiwai coffee consumption was 2150.5±447.8 Cal, and on day-14 (D-14) was 2150.9±468.5 Cal. The t-test results showed no significant effect ( $p=0.997$ ) on caloric intake (Cal). This result indicates that the subject's calorie consumption was in accordance with the 2019 RDA. In addition, the protein intake on D-7 of tiwai coffee consumption showed 76.5±29.5 g, and on D-14, 85.4±24.2 g. However, the t-test showed no significant results ( $p=0.323$ ) for protein intake (g). It was also known that the average fat intake on D-7 of tiwai coffee consumption was 42.5±23.5 g, and 40.9±25.8 g on D-14. The t-test showed no significant result ( $p=0.791$ ) on fat intake (g). Moreover, the average carbohydrate intake on D-7 and D-14 of the tiwai coffee intervention was 294.6±148.4 g and 345.9±109.7 g. Also, the t-test showed no significant result ( $p=0.177$ ) on carbohydrate intake (g). The average fiber intake on D-7 of intervention was 18.5±7.32 g, and 21.5±6.98 g on D-14. The t-test showed no significant effect ( $p=0.149$ ) on fiber intake (g). The average cholesterol intake decreased on D-7 of intervention by 127.9±74.01 mg and 107.2±85.51 mg on D-14. These results indicate a decrease in cholesterol intake by 20.7 mg. However, based on the t-test results, there was no significant effect ( $p=0.379$ ) on

Table 1. Food intake.

Food Intake	Treatment	Minimum	Maximum	Average	T-test
Calorie (Cal)	D-7	2279	2626.6	2150.5±447.8	0.997
	D-14	2151	2537.2	2150.9±468.5	
Protein (g)	D-7	73	104.9	76.5±29.5	0.323
	D-14	76	124.7	85.4±24.2	
Fat (g)	D-7	45	101.2	42.5±23.5	0.791
	D-14	34	79.9	40.9±25.8	
Carbohydrate (g)	D-7	297	426.2	294.6±148.4	0.177
	D-14	342	473.4	345.9±109.7	
Fiber (g)	D-7	25	30.9	18.5±7.32	0.149
	D-14	14	35.4	21.5±6.98	
Cholesterol (mg)	D-7	32	2025	127.9±74.01	0.379
	D-14	92	2548	107.2±85.51	

cholesterol intake (mg). The 2×24-hour food recall analysis data showed no effect on cholesterol intake. Therefore, it can be concluded that the subject's fiber intake increased, indicating that the fiber intake meets the 2019 RDA for tiwai coffee consumption on D-14.

### 3.3 Lipid profile

#### 3.3.1 Effect of tiwai coffee consumption on total cholesterol

The t-test on tiwai coffee consumption for 14 days showed no significant effect ( $p=0.425$ ) on total cholesterol levels, as show in Table 2. The average pre-test value was  $222.90\pm 32.51$  mg/dL, and the post-test value was  $219.68\pm 32.90$  mg/dL. There was a decrease in total cholesterol levels by 3.22 mg/dL. This study result was different from research conducted by Saragih et al. (2014), which found that consuming a tiwai herbal drink (THD) for seven days could reduce total cholesterol levels by 5.33 mg/dL in hypercholesterolemic patients. Tiwai onion contains alkaloids, glycosides, flavonoids, phenolics, saponins, and steroids (Saragih et al., 2014; Wathoni et al., 2018; Tran et al., 2020). Alkaloids act as antimicrobials, so the body is not easily infected by bacteria (Yanti et al., 2022). Meanwhile, flavonoids are natural coloring compounds that give red, purple, blue, and some yellow colors (Khoo et al., 2011; Tran et al., 2020). Usually, foods containing flavonoids are anti-carcinogenic or anti-cancer.

This study showed that the subjects had normal cholesterol levels; six (27.3%) on the pre-test and nine (40.9%) on the post-test. Moreover, from a total of 22 subjects, there were 16 people (72.7%) on the pre-test and 13 people (59.1%) on the post-test who had high cholesterol levels. Based on this study's results, three subjects had an increase in cholesterol levels from normal to high category. Consequently, the high category based on the original data decreased by three people. This means there was a decrease in cholesterol levels during the tiwai coffee intervention. This result was reinforced by Saragih et al. (2014), that the consumption of tiwai herbal drink (THD) could reduce total cholesterol levels by 5.33 mg/dL in hypercholesterolemic patients. Therefore, Tiwai has the potential to lower cholesterol levels. But based on statistical data, the effect was not significant. Several factors, such as food intake, diet, and lack of activity, may influence the findings. In this study, there was no restriction on the daily food intake of the subjects. So, a

poor daily intake can result in high cholesterol levels (Centonze et al., 2022).

Cholesterol intake before tiwai coffee consumption (pre-test) was  $127.9\pm 74.01$  mg and decreased to  $107.2\pm 85.51$  mg in the post-test. However, this had no significant effect on the statistical test. Cholesterol acts as an important lipid molecule in cell membranes and lipoproteins, a precursor to the steroid hormone, bile acid, and vitamin D (Tajoda et al., 2013; Li et al., 2019). The mechanism of action of cholesterol is through exogenous pathways with HDL and endogenous pathways with LDL and cholesterol return pathways associated with HDL metabolism (Kontush et al., 2020; Behl et al., 2020; Sandesara et al., 2021; Bhattarai et al., 2021; Patel and Kashfi, 2021).

Several factors might interfere during the intervention of tiwai coffee consumption, so the findings were not significantly different regarding total cholesterol levels before (pre-test) and after (post-test) tiwai coffee consumption. The first factor was that the subject did not maintain a good diet. The second factor was the lack of physical activity. Finally, the third factor was influenced by increasing age. Therefore, several factors that affect increased cholesterol levels include age, food intake or unhealthy eating habits, lack of physical activity, excess body weight (obesity), and smoking habits (Dumont et al., 2017; Zhou et al., 2019; Hsu et al., 2019; Park and Kang, 2019; Nassef et al., 2020; Nindita et al., 2023). Based on age, 13 people (59.1%) who joined this study were 40-49 years old, eight people (36.4%) were 50-64 years old, and one person (4.5%) was 67 years. The study subjects comprised ten women (45.5%) and 12 men (54.5%).

Based on the testimony, the subject testified that during the consumption of tiwai coffee, some of the subjects felt that their body was being detoxified. Detoxification is the natural removal of toxins from the body and provides many health benefits. In addition, some of the subjects also felt better because the cramp or tingling they once felt was no longer felt after consuming tiwai coffee, and even the symptoms were no longer felt. Therefore, in this study, it can be concluded that tiwai coffee is said to be safe for consumption by subjects and has no side effects.

Table 2. Blood lipid profile on pre-test and post-test of tiwai coffee consumption for 14 days.

Intervention	Total cholesterol (mg/dL)	LDL cholesterol (mg/dL)	HDL cholesterol (mg/dL)	Triglyceride* (mg/dL)
Pre-test	$222.90\pm 32.51$	$132.50\pm 29.48$	$47.18\pm 9.58$	$221.18\pm 11.20$
Post-test	$219.68\pm 32.90$	$131.68\pm 28.15$	$47.00\pm 10.16$	$167.63\pm 15.23$

\*statistically significantly different based on the t-test results at 5% confidence level.

### 3.3.2 Effect of tiwai coffee consumption on low-density lipoprotein cholesterol levels

The t-test result of tiwai coffee consumption for 14 days had no significant effect ( $p=0.493$ ) on the subject's LDL cholesterol, as shown in Table 2. The average pre-test value was  $132.50\pm 29.48$  mg/dL, and the post-test value was  $131.68\pm 28.15$  mg/dL, there was a decrease of 0.82 mg/dL in the subject's LDL cholesterol levels. LDL is a single molecule consisting of about 50% lipid acids, such as polyunsaturated fatty acids (PUFA), and is very susceptible to oxidation; LDL oxidation induces cardiovascular disease (Fitrotin *et al.*, 2021). The phenolic compounds and antioxidant content are indicated to protect against oxidative stress, which acts as a major contributor. Tiwai onion contains phenolic compounds, which are part of the flavonoid compounds acting as antioxidants or anthocyanins, potentially reducing hypercholesterolemia (Olas, 2020; Saragih *et al.*, 2021; Dhama *et al.*, 2021).

Sliced cuts and drying using ovens, sunlight, and roasting in the research of Saragih *et al.* (2019), have their weaknesses. Therefore, it is recommended to use roasting methods for coffee powder and tiwai powder, which have strong antioxidant activity, and tiwai coffee as a supplement in a coffee product. Furthermore, the highest antioxidant activity was produced in roast drying (185.24 ppm) compared to the oven and sunlight.

Sensory variation in coffee is related to the types of varieties, agronomic conditions, and processing methods. The sensory characteristics of brewed coffee are associated with non-volatile compounds such as pyrazine and pyridine compounds formed during the growing, fermenting, roasting, and processing. Chlorogenic acids, such as feruloyl quinic and caffeoylquinic acids in Arabica coffee contribute to the bitter, sour, and astringent taste of coffee when brewed. In addition, chlorogenic acid acts as a precursor for the formation of phenols and catechols (Seninde and Chambers, 2020). The result of previous studies showed that mice induced by Hyper-Low Density Lipoproteinemia (Hyper-LDL) were able to increase the risk of atherosclerosis. Oxidative stress on the endothelium due to hyper-LDL causes the increased production of free radicals and induces endothelial dysfunction. Oxidative stress occurs due to an imbalance between free radicals and antioxidants (Garcia-Sanchez *et al.*, 2020).

### 3.3.3 Effect of tiwai coffee consumption on high-density lipoprotein cholesterol levels

The t-test results showed that tiwai coffee consumption for 14 days had no significant effect ( $p=0.889$ ) on the increase in the subject's HDL

cholesterol level (Table 3). The average pre-test value was  $47.18\pm 9.58$  mg/dL, and the post-test was  $47.00\pm 10.16$  mg/dL. High-density lipoprotein (HDL) participates in the transfer of excess cholesterol from peripheral sites to the liver. The cholesterol is carried via this lipoprotein, making HDL often referred to as good cholesterol (Chiesa and Charakida, 2019). Flavonoids will inhibit the activity of the key enzyme in the lipogenesis process, namely the HMG-CoA reductase enzyme. This enzyme will stop or inhibit cholesterol formation, so cholesterol synthesis decreases (Mateos *et al.*, 2013). Flavonoids have also been shown to increase good cholesterol, namely HDL cholesterol, by increasing the production of apo A1 protein. Therefore, tiwai coffee consumption was expected to increase HDL cholesterol levels.

Table 3. The difference in average pre-and-post-test lipid profile of tiwai coffee consumption for 14 days.

Cholesterol Lipid	Intervention	T	Df	p-value
Cholesterol Total	Before and After	0.81	21	0.425
LDL	Before and After	0.30	21	0.765
HDL	Before and After	0.14	21	0.889
Triglyceride*	Before and After	2.27	21	0.034

\*statistically significantly different based on the t-test results at 5% confidence level.

There were 13 subjects (59.1%) with 40-49 years, eight subjects (36.4%) aged 50-64 years, and one subject (4.5%) aged 67 years. In total, there were 22 subjects, consisting of 10 women (45.5%) and 12 men (54.5%). In addition, subjects with normal BMI on the pre-test were two people (18.2%) and five people (22.7%) on the post-test. Moreover, subjects with an overweight BMI on the pre-test were seven (31.8%) and six (27.3%) on the post-test. Subjects with obesity category I were seven (31.8%) on the pre-test and 8 (36.4%) on the post-test. Finally, subjects with obesity category II were four (18.2%) on the pre-test and three (13.6%) on the post-test. Suppose HDL cholesterol levels are higher than LDL. In that case, it means that HDL levels are highly recommended for higher LDL (bad cholesterol) and triglyceride (fat) levels in the blood, and cholesterol levels will increase with age (Gawlik *et al.*, 2017).

This study showed that the subjects with a low HDL ratio of 1-2.5 in the pre-test were 11 people (50%), and subjects with a normal HDL ratio of 3.5 in the post-test were 11 people (50%). The result of this study indicated that tiwai coffee consumption had no significant effect on increasing the subject's HDL level. Although these results did not have a significant effect, tiwai coffee consumption for 14 days was testified by the subjects to have a lowering triglyceride level effect. Based on the interview result regarding the subject's testimony, the subject had high triglyceride levels before tiwai coffee

consumption. Still, after consuming tiwai coffee, the subject had decreased triglyceride levels, which were believed to be due to the effect of tiwai coffee consumption. One subject initially had high triglycerides and had been checked at a clinic before. The effect of tiwai coffee consumption is expected to increase high HDL levels, so that it can reduce LDL levels, which can inhibit lipid oxidation or bad fats.

Based on the 2×24-hour food recall results, the study subjects performed several physical activities during the tiwai coffee intervention, such as aerobics and badminton. In addition, Nassef *et al.* (2020) have found that aerobic exercise and badminton could improve HDL levels, which carry the lipoprotein lipase (LPL) genotype. Therefore, aerobic exercise and regular badminton might significantly increase HDL.

### 3.3.4 Effect of tiwai coffee consumption on triglyceride level

The t-test results on tiwai coffee consumption for 14 days had a significant effect ( $p=0.034$ ) on the subject's triglyceride (Table 3). The average pre-test value was  $221.18 \pm 11.20$  mg/dL, and the post-test value was  $167.63 \pm 15.23$  mg/dL (Table 2). There was a decrease in triglyceride levels by 53.55 mg/dL. This finding was in line with Paramita and Rahmah's (2021) research, which found that fresh red dragon fruit consumption with the CHOD PAP and GPO intervention method for 21 days significantly reduced triglyceride (fat) levels in the blood. In that study, there was a 55.27 mg/dL decrease in triglyceride levels by giving dragon fruit 2.86 g/kg BW to the respondent. There was a significant decrease before and after consuming red dragon fruit.

Subjects with low triglyceride levels at the pre-test were six people (27.3%), and at the post-test were 12 people (54.5%). Subjects with the normal category at the pre-test were seven people (31.8%) and three people at the post-test (13.6%). Moreover, subjects with the high category on the pre-test were nine people (40.9%) and seven people (31.9%) on the post-test. Based on the results of this study, both original data and statistics showed that tiwai coffee consumption during the 14 days of intervention had reduced triglyceride levels. This is influenced by the presence of compounds contained in tiwai onion, including alkaloids, glycosides, flavonoids, phenolics, saponins, and steroids (Saragih *et al.*, 2014; Wathoni *et al.*, 2018; Tran *et al.*, 2020; Yanti *et al.*, 2022). Flavonoids are a type of antioxidant that acts as a compound that can reduce triglycerides (Fardoun *et al.*, 2020).

Based on the correlation test results for the relationship between food intake to determine the

subject's post-test cholesterol and post-test triglyceride, it was found that there was no significant relationship ( $p=0.403$ ) with to triglyceride level. Based on the results of the t-test that energy, protein, fat, carbohydrate, and fiber intake were also not related to a decrease in triglyceride (fat) levels in the blood. It was concluded that there was an effect of the tiwai coffee intervention. The daily diet is more directed at consuming less than 10% saturated fat in total calories, cholesterol consumption of less than 300 mg per day, and fat intake between 20-35% of total calories with a higher composition of polyunsaturated fat and monounsaturated fat (Saragih, 2011).

It has been shown that the triglyceride index predicts death in cardiovascular disease, and the triglycerides/HDL ratio predicts the severity of coronary artery disease (CAD) (Tolunay and Firtina, 2021). In this study, the triglyceride/HDL ratio ranged from 1.38-3.74 at the pre-test to 0.9 to 2.66 on the post-test (Table 4). The predictive power of metabolic syndrome is higher for the triglycerides to HDL cholesterol ratio compared to non-HDL cholesterol. The optimal cut-off value for the triglyceride to be the HDL-cholesterol ratio predicting the onset of the metabolic syndrome is 2.8. Therefore, the triglyceride to HDL cholesterol ratio is a simple and practical indicator of the risk of metabolic syndrome (Hong and Sin, 2018). This means that the triglyceride (fats) in the blood of 22 subjects were included in the normal category.

Table 4. The ratio of total cholesterol, HDL, and LDL levels before and after intervention.

Intervention	Total Cholesterol:HDL	Triglyceride*:HDL	HDL:LDL
Pre-test	1.50-3.04	1.38-3.74	1.57-3.64
Post-test	1.96-3.73	0.9-2.66	1.53-3.64

\*statistically significantly different based on the t-test results at 5% confidence level.

## 4. Conclusion

Based on the result of the study, tiwai coffee consumption for 14 days has a significant effect on triglyceride levels. Still, it did not significantly affect cholesterol, LDL, and HDL levels, considering that tiwai coffee has the potential as an alternative food that can lower cholesterol and reduce triglyceride levels in the blood, so that it can help prevent degenerative disease at a vulnerable age. The decrease in the subject's triglyceride levels was 53.55 mg/dL and was not correlated to cholesterol intake and lipid profile.

## Conflict of interest

The author declares no conflict of interest.

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