Jurnal Info Kesehatan
Vol. 20, No. 2, December 2022, pp. 240-250
P-ISSN 0216-504X, E-ISSN 2620-536X
DOI: *10.31965/infokes.Vol20Iss2.875*
Journal homepage:*http://jurnal.poltekeskupang.ac.id/index.php/infokes*

RESEARCH **Open Access**

The Administration of Dutch Teak Leaf Tea Extract (*Guazama Ulmifolia lamk*) in Reducing Cholesterol Levels in Depo Acceptors

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Received: 11 August 2022 Revised: 26 December 2022 Accepted: 29 December 2022

Abstract
Depo hormonal contraceptives are significantly effective contraceptives with a low failure rate. Women who apply this contraceptive may experience several side effects on fat metabolism, which is an increase and decrease in total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C). The objective of this study was to identify the influence of Dutch teak leaves (*Guazuma Ulmifolia Lamk*) on the cholesterol levels in the Depo acceptors. Quasi-experiment research design with one group pretest posttest design model. The pretest was completed first by the total number of samples which is 60 respondents. Furthermore, 250 ml of Dutch teak tea is consumed every morning and evening after eating. The intervention lasted two weeks, followed by a retest (posttest). Dutch tea pre and post results were analyzed employing t-test statistics on variable body weight (p = 0.706), systolic blood pressure (p = 0.322), and cholesterol (p = 0.001), and the Wilcoxon test on diastolic pressure variables (p = 0.043) and triglycerides (p = 0.417). With a p-value of 0.001, it demonstrates that there is a significant difference in cholesterol levels after being treated with Dutch teak tea. With a p-value greater than 0.05, there was no difference in triglycerides, weight, or blood pressure after receiving Dutch teak tea treatment. An increase in cholesterol levels is one of the side effects of DMPA acceptors. Therefore, consuming Dutch teak leaves is an alternative treatment option.

Keywords: Dutch Teak Leaf Tea, Cholesterol, Injection Acceptor.

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1. INTRODUCTION

Hormonal contraceptives are highly effective contraceptives with a very low failure rate. However, women applying this contraceptive may experience several side effects. Depo Medroxyprogesterone Acetate (DMPA) is a weak androgenic progestin provided as a single 150 mg intramuscular injection contraceptive every 3 months. This contraceptive is a potent inhibitor of gonadotropins. Several studies unveiled the debate about the side effects of DMPA injections on fat metabolism, which is an increase and decrease in total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) in DMPA users. Numerous studies have also revealed a reduction in high-density HDL cholesterol (HDL-C) levels in long- and short-term DMPA users. DMPA can cause serious cardiovascular side effects in women who administer this contraceptive (Affandi et al., 2014; Yadav, 2011).

The primary cause of weight gain after DMPA use is an increase in fat deposits. After a 30-month follow-up, medroxyprogesterone users gained 6.1 kg, which was due to an increase in fat mass. The use of DMPA, a glucocorticoid-like activity which affects fat gain, incorporating visceral fat, as well as injection-induced hypoestrogenism, which may be another factor responsible for the increase in body weight and body fat, is one possible mechanism that could explain weight gain. Body weight and leptin levels fluctuations can contribute to the development of several chronic complications, encompassing obesity, insulin resistance, and diabetes mellitus (Innas, Nurmainah, & Wahdaningsih, 2019).

Increased levels of lipids in the blood, triglycerides and cholesterol are signs of hyperlipidemia (Aman et al., 2019). Hyperlipidemia is managed through lifestyle changes, such as implementing a low-fat diet or healthy food patterns, as well as exercising or participating in appropriate activities. If non-pharmacological treatment fails, patients with hyperlipidemia should be provided anti-dyslipidemic or anti-hyperlipidemic drugs to return lipid levels to normal. Aside from conventional medicine, there is a growing number of medical applications for herbal plants or natural ingredients, as well as traditional medicines, to treat hyperlipidemia (Resti, 2022).

One of the traditional medicines which have been extensively consumed by Indonesian people is the Dutch teak plant. Research conducted by (Ulfah & Iskandar, 2020), revealed that the aqueous extract of Dutch teak leaves at a dose of 50 mg/Kg BW was able to significantly inhibit the increase in total and LDL cholesterol levels in the control group. Quercetin in Dutch teak leaf extract owns a fairly high level and is efficacious in lowering cholesterol levels (Batubara et al., 2017). Supriani's research et al. (2019), uncovered a change in cholesterol levels after administering Dutch teak leaf tea in Kedungsari Hamlet, Balongsari Megaluh Village. Changes in cholesterol levels are affected by sterols which are also discovered in Dutch teak leaves. Sterols bind to cholesterol in the food consumed by humans.

The variables evaluated in this study encompassing age, duration of being a DMPA acceptor body weight, systolic and diastolic blood pressure, cholesterol and triglycerides. The normality test was examined by employing the Kolmogorov Smirnov. The results revealed that weight, systolic blood pressure and cholesterol were normally distributed, hence, the different tests administered the t test, while the diastolic pressure and triglycerides were not normally distributed, thus, the Wilcoxon test was utilized. The objective of this study was to identify the influence of Dutch teak leaves (*Guazuma Ulmifolia Lamk*) on the cholesterol levels in the DMPA acceptors.

2. RESEARCH METHOD

This research is a quasi-experiment study with a one group pretest posttest design model in which the experiment was performed only in one group. The experimental group in this

study encompassing DMPA family planning acceptors treated with Dutch teak leaves (*Guazuma Ulmifolia Lamk*). Before the acceptors consumed the leaves of Dutch teak (*Guazuma Ulmifolia Lamk*), a pretest was administered, which is the measurement of total cholesterol levels. Measurements were conducted by administering blood serum employing an analyzer. Respondents were intervened by providing 250 ml of Dutch teak leaves (*Guazuma Ulmifolia Lamk*) to be drunk every morning and evening after eating, for 2 weeks. Then, it was performed an evaluation test (posttest), the same as during the pretest, to determine the effect of providing Dutch teak leaves (*Guazuma Ulmifolia Lamk*) on cholesterol levels in DMPA family planning acceptors.

Most people in general consume Dutch teak leaves by boiling them until they are dry boiling and brewing. This kind of treatment possesses a negative impact on the nutritious substances embodied in the Dutch teak leaves. Not numerous people understand that boiling or brewing tea at a temperature >90^{o}C is able to eliminate the efficacy of Dutch teak leaves (Hidayat, et al., 2014). Thus, it will be far more beneficial if it is manufactured into teak kombucha tea and utilized as a health drink to lower blood triglyceride levels in humans.

The research was conducted in the area of Patebon 02 Kendal Public Health Center. The total population encompasses 399 people and the sample was selected in accordance with purposive sampling, hence, a total sample of 60 people was obtained with the criteria for DMPA acceptors of more than 2 years, ages 20 to 35 years. The measuring instruments of this research comprise of the tread scales, cholesterol checking tools and observation sheets.

Age, duration of family planning injection, body weight, systolic and diastolic blood pressure, cholesterol, and triglycerides were the variables examined in this study. The normality test was administered by employing Kolmogorov Smirnov. The results discovered that weight, systolic blood pressure, and cholesterol were normally distributed, thus, the different tests performed the t test, but diastolic pressure and triglycerides were not, hence, the Wilcoxon test was conducted. This research has obtained ethical eligibility from the ethics committee Sultan Agung Semarang Islamic University No.348/X/2021/ Commission on Bioethics.

3. RESULTS AND DISCUSSION

In accordance with the results of the observation sheet on 60 DMPA family planning acceptors with age criteria between 20-35 years and having been DMPA family planning acceptors for at least 2 years, the following data were obtained.

Table 1. Distribution of Respondent Characteristics.

Variable	Average (SB)	Median	Minimum	Maximum
Age (years)	35.8 (7.90)	35	20	57
Injection duration (months)	67.92 (56.26)	45	1	204

Table 1 illustrates that the average age of the respondents was 35 years and the duration of injection was 68 months (5.6 years).

Table 2. Distribution of Body Weight, Blood Pressure, Cholesterol, Pre and Post Triglycerides Treatment.

Variable (n=60)	Pre	Post
Weight (kg)		
Average (SB)	58.2 (9.46)	58.35 (8.75)
Median	58	59
Minimum	39	39
Maximum	79	79
Systolic Blood Pressure (mmHg)		
Average (SB)	125.7 (12.82)	124.2 (13.61)
Median	125	122.5

Minimum	90	91
Maximum	160	162
Diastolic Blood Pressure (mmHg)		
Average (SB)	81.6 (7.62)	79.27 (8.84)
Median	82	80
Minimum	60	57
Maximum	100	100
Cholesterol (ml/dl)		
Average (SB)	157.5 (32.73)	175.8 (41.04)
Median	157	171
Minimum	90	105
Maximum	230	280
Triglycerides (ml/dl)		
Average (SB)	134.8 (73.1)	142.6 (94.20)
Median	119.5	113.5
Minimum	48	37
Maximum	363	600

Table 2 illustrates that the average body weight before treatment was 58.2 kg and after treatment 58.35 kg, systolic blood pressure before and after treatment was 125.7 mmHg, diastolic pressure before 81.6 mmHg and afterward was 79.27 mmHg. It was revealed an increase in cholesterol from before treatment, which is 157.5 mg/dl to 175.8 mg dl, triglycerides also increased from 134.8 mg/dl to 142.6 mg dl.

The data was examined for normality first by utilizing the Kolmogorov Smirnov method and then statistically examined employing the t test. The results of the normality test demonstrated that the variables that were normally distributed encompass weight, systolic blood pressure and cholesterol with p-value >0.05, hence, utilizing paired t-test, while data which were not normally distributed were diastolic pressure and triglycerides with p-value. <0.05, hence, employing the Wilcoxon test.

Table 3. Distribution of average levels of cholesterol, triglycerides, body weight and blood pressure pre and post treatment.

Variable (n=60)	**Mean**	**SD**	**SE**	***p-value***
Cholesterol (mg/dl)				
Pre treatment	157.52	32.73	4.23	0.001
Post treatment	175.83	41.04	5.29	
Triglycerides (mg/dl)				
Pre treatment	134.8	73.1	9.43	0.417
Post treatment	142.6	94.20	12.16	
Body weight (kg)				
Pre treatment	58.18	9.46	1.22	0.706
Post treatment	58.35	8.75	1.13	
Systolic BP (mmHg)				
Pre treatment	125.72	12.82	1.65	0.322
Post treatment	124.18	13.61	1.76	
Diastolic BP (mmHg)				
Pre treatment	81.6	7.62	0.984	0.043
Post treatment	79.27	8.84	1.14	

Table 3 presents that there is a significant difference in cholesterol levels after being treated with Dutch teak leaf tea with a p-value of 0.001. However, there was no difference in

triglycerides, body weight and blood pressure after being treated with Dutch teak leaf tea with *p-value* > 0.05.

This study determined the difference in cholesterol and triglyceride levels after being treated with traditional Dutch teak tea provided for 2 weeks/14 days in a row. Dutch teak leaf tea decoction was provided with a frequency of 500 ml, consumed 2 times in 1 day (250 ml in the morning and 250 ml in the evening) after meals with a total of 60 respondents.

Age, injection duration, body weight, and blood pressure were also evaluated in the depo acceptors. The respondents in this study had an average age of 35 years, a duration of injection of 68 months (5.6 years), a body weight of 58 kg, and blood pressure that was still within normal limits. This acceptor's age is in the phase of spacing out pregnancies, so an effective contraceptive method is required to prevent pregnancy, but fertility can return quickly. Furthermore, it was discovered that DMPA acceptors utilized contraception for an average of 5.6 years. In several studies, it is elaborated that the implementation of depo provena injectable contraception in the long term will possess an impact on the increasing BMI to class I obesity classification (on use >12 months) and can also affect a decrease in libido at use >2 years. Therefore, DMPA injection family planning acceptors require to be provided counseling about the side effects of DMPA injection family planning and are advised not to employ it for a long time. After it is experienced to interfere with health, you can immediately change to another contraceptive (non-hormonal) (Innas, Nurmainah, & Wahdaningsih, 2019; Ningsih & Zainiyah, 2020).

This study also discovered that family planning acceptors possessed normal blood pressure. It is probably due to the fact that most of the respondents are still relatively young, which is 20-35 years old, hence, their blood pressure is still within normal limits along with the high fertility rate. Women who have not gone through menopause are protected by the hormone estrogen, which plays a pivotal role in increasing HDL levels (HDL). High levels of HDL cholesterol are a protective factor in the prevention of atherosclerosis. The presence of premenopausal female immunity is understood to be explained by estrogen's protective effect. During premenopause, women gradually lose the hormone estrogen, which has been protecting blood vessels from damage.

However, Mukaromah, (2018) explained that the risk of high blood pressure will escalate with increasing age, length of utilization of contraception and weight gain. This change in body weight is caused by the hormone progesterone, which facilitates the conversion of carbohydrates and sugar into fat, so that a lot of fat accumulates under the skin and is not due to retention (accumulation) of body fluids. Furthermore, depo provera stimulates the appetite control center in the hypothalamus, which can cause acceptors to eat more than usual, thus, people with excess fat (hyperlipidemia) possess the potential to experience blood clots. Hence, this narrowing and blockage by fat causes the heart to pump blood more vigorously in order to supply the tissues with the blood they require. As a result, blood pressure escalataes, then there is high blood pressure. Therefore, it is identified that the utilization of depo provera contraception is one of the supporting factors for the emergence of high blood pressure if this contraceptive is implemented in the long term.

Cholesterol is frequently understood to as blood fat, which is one of the fatty tissues in the body that is naturally produced by the liver. Cholesterol is a component of fatty acids discovered in the blood. This substance is required by the body for certain processes for survival. Among them to generate hormones, cells and treat nerve cells (Manganti, 2017). Generally, cholesterol is tremendously beneficial ffor the body as it aids in the formation of healthy cells, the production of body hormones, and the production of vitamin D. Total cholesterol (LDL and HDL) levels should be less than 200 mg/dl in general. The habits and types of food consumed on a daily basis possess a significant impact on blood cholesterol

levels. Definitely, the better the pattern and quality of daily food, the better the cholesterol balance and overall health (Munarsih & Rini, 2019). On research results (Supriani et al., 2019),

The research revealed that the research subjects experienced a significant reduction in LDL cholesterol levels. This could be due to the diet of the research subjects, who did not eat much or purposefully avoided foods high in saturated fat in order to maximize LDL reduction.

The effect of depo provera on the cardiovascular system causes a slight increase in insulin levels and a decrease in HDL-cholesterol. Cholesterol is not soluble in water or blood. Lipoproteins, which are composed of fats and proteins, transport cholesterol to various tissues in the body (Affandi et al., 2014).

LDL cholesterol (low density lipoprotein) is predominantly reported in arteries. It is a bad situation because if LDL cholesterol levels are greater than >130 mg/dl while HDL levels are lower, suggest <40 mg/dl, there is a risk of an increase in blood pressure (Aman et al., 2019).

This study's findings indicate that there is a difference in average cholesterol levels before and after treatment, with a p value of 0.001. However, this difference indicates that there is an increase in cholesterol levels following administration of Dutch teak leaf tea. This contradicts the findings of several previous studies, which discovered that a water extract of Dutch teak leaves at a dose of 50 mg/kg BW could significantly reduce the increase in total and LDL cholesterol levels compared to the control (Ulfah & Iskandar, 2020). Likewise, research by Supriani et al., (2019) elaborated that there was a change in cholesterol levels after providing Dutch teak leaf tea in *Kedungsari* Hamlet, *Balongsari Megaluh* Village. Sterols, which are also discovered in Dutch teak leaves, cause changes in cholesterol levels. The administration of ethanol extract of Dutch teak leaves reduced plasma LDL cholesterol levels, but the doses of 25 and 50 mg/kgBW/day and vitamin C 1.14 mg/day were thought to be insufficient. One of the reasons that the decrease has not been maximized is that the induction dose of ethanol extract of Dutch teak leaves is only 14 days, which is not enough time, so the induction time must be extended. The longer an ethanol extract of Dutch teak leaves was provided to hypercholesterolemic rats as an induction dose, the more likely the extract's active ingredient was to reduce LDL and increase HDL levels (Na'im et al., 2017).

Dutch teak leaves are understood to contain alkaloids, flavonoids, sterols and phenolic acids. Sterols bind to cholesterol in the food consumed, hence, when teak leaf tea is consumed after eating, the sterols in Dutch teak leaves will bind to cholesterol, hence, the bound cholesterol will be conducted by leftovers and causes cholesterol in the body to change (Supriani et al., 2019). The chemical content of Dutch teak leaves, namely alkaloids, flavonoids, saponins, tannins, lendie and resin, the leaves of this plant are very effective for lowering cholesterol levels (Manganti, 2017). The results of quantitative analysis of alkaloid compounds in the acetone extract were greater, which is 1.925%, in the ethanol extract, only 1.91%, and in the aqueous extract, 0.82%, the saponin content in the ethanol extract was lower, that is 7.74% compared to the aqueous extract, that is 7.88%, the level of phenol as gallic acid in the ethanol extract is 3.9%, and the level of flavonoids as quercetin (Rivai et al., 2019).

Guazuma ulmifolia leaf extract is able to reduce plasma cholesterol concentrations, which is possible through the inhibition mechanism of HMG-CoA reductase. HMG-CoA is an essential enzyme in de novo cholesterol synthesis (Nurrahmanto, Nuri, & Sari, 2016). In the research by Rahmania et al. (2017) who compared the potency of the active compounds from Dutch Teak, Jabon and Mindi as HMG-CoA Reductase Inhibitors, the highest inhibition power of the methanol flavonoid extract was contained in Dutch teak extract (79.85-94.42%) compared to other plants. The maximum inhibition of the Dutch teak ethanol flavonoid extract was 82.8% at a concentration of 10 ppm, which was higher than the pravastatin control (73.91%), which has previously been identified as an HMGR inhibitor (Rahmania, Sulistiyani

& Lelono, 2017). Quercetin is abundant in Dutch teak leaf extract and has properties associated with cholesterol reduction; thus, quercetin may be a distinguishing feature of Dutch teak leaves. A high LDL cholesterol level in the control group is associated with a high cholesterol and saturated fatty acid diet. A high-cholesterol diet can raise blood cholesterol levels by inhibiting the synthesis of LDL receptors. Saturated fatty acids raise cholesterol levels by decreasing liver cholesterol synthesis, increasing free cholesterol transfer, and decreasing LDL affinity for LDL receptors (Na'im, Marianti & Susanti, 2017).

Foods with high levels of saturated fat when consumed continuously tend to escalate triglyceride levels in the blood (Lubis et al., 2021). Hyperlipidemia is defined as an increase in high levels of fat in the blood caused by excessive fat consumption, which can cause an imbalance in fat intake and reshuffling. Hyperlipidemia is defined by elevated blood cholesterol levels and TGD values that exceed normal limits. TGD levels in the blood are normal (<150 mg/dL). TGD has a numerical upper limit (150-200 mg/dL). Excessive triglyceride levels (>200 mg/dL). TGD is associated with an increased risk of atherosclerosis, coronary artery disease, and stroke (Wedro, 2018). Management of hyperlipidemia is performed by modifying lifestyle, incorporating by implementing a low-fat diet or a healthy diet and exercise or performing adequate activities, if non-pharmacological treatment is not successful, hyperlipidemic patients are required to be provided anti-dyslipidemic or anti-hyperlipidemic drugs which is able to decrease lipid levels to normal again (Ulfah & Iskandar, 2020).

In this study, there was no difference between triglyceride levels before and after being provided Dutch teak leaf tea. It indicates that the triglyceride levels in the respondents are the same. It is probably due to the influence of the type and amount of food consumed (containing a lot of fat) and lack of physical activity and exercise. Age factors can also affect the rise or fall of triglyceride levels in the blood. The normal function of body cells begins to decline with age is the cause (Jonathan et al., 2014). The findings of this study differ from previous research that reported that Dutch teak leaf extract reduced triglyceride levels in dyslipidemic people. It is possible due to the presence of alkaloids, tannins, mucilago, flavonoids, and resin in Dutch teak leaf extract. Tannins, which act as astringents, have been discovered to precipitate mucosal proteins on the surface of the small intestine, reducing absorption and cholesterol levels from these foods. Furthermore, alkaloids and flavonoids inhibit pancreatic lipase activity, resulting in decreased fat absorption in the intestine (Jonathan et al., 2014).

Research result (Ulfah & Iskandar, 2020) demonstrated that the Dutch teak leaves are able to reduce triglyceride fat levels. The most effective infusion dose was infusion with a dose of 1250 mg/kgBW with a decrease in triglyceride levels of 41.30% from the quasi-negative control. Another study calculated LDL and triglyceride levels in male Wistar rats by employing the Cholesterol Oxidase-p-aminophenazone (CHOD-PAP) method with the principle of enzymatic colorimetric testing. Dutch teak ethanol extract 30 mg can significantly decrease LDL and triglyceride levels (Prahastuti et al., 2016).

Medicinal plants possess numerous uses and are expected to possess minimal side effects compared to chemical drugs (Supriani et al., 2019). Currently, traditional medicine is quite extensively implemented by the community and is still extensively processed in the form of extracts or powders and still rarely consumes traditional medicine in the preparation of kombucha tea which is a fermented beverage in maintaining health. In addition to conventional medicine, drugs containing herbal plants or natural ingredients, as well as traditional medicine, are increasingly being employed to treat hyperlipidemia (Resti, 2022). Tea is the drink most people understand and most frequently consumed by Indonesians (Krisnawati, 2014). Several processed herbal teas have been marketed in the category of traditional herbal medicine and are claimed to lower cholesterol levels, according to the Decree of the Head of BPOM RI concerning the Basic Provisions for Grouping and Marking Indonesian Natural Medicines.

Traditional medicine, on the other hand, is classified as herbal medicine, with efficacy claims in accordance with empirical data based on experience.

Kombucha tea is one of the well-known functional drinks that provides health benefits. Kombucha tea contains antioxidants that aid in the prevention of oxidation, the inhibition of cancer cell growth, the reduction of cholesterol accumulation in the blood, and the acceleration of cholesterol elimination through feces. Kombucha's microbes convert the tea and sugar solution into various organic acids that are beneficial to the body's metabolism, giving it the potential to act as a natural antibiotic. Furthermore, kombucha can eliminate toxins from the body and acts as an immunomodulator, boosting the immune system (Khamidah & Antarlina, 2020). Kombucha tea is one of the most intriguing traditional drinks as it is the result of fermentation conducted by a symbiotic culture. Kombucha is generally made with black tea leaves, green tea, or oolong tea, but it can also be made with infused water containing fruits, mint leaves, jasmine flowers, and Dutch teak leaves. Wulandari (2018) elaborates that, With increasing fermentation time, the brightness level of kombucha with teak leaf base material changes, as well as a decrease in the average tannin content. Tannins in teak leaf tea kombucha are degraded during the brewing and processing processes.

Dutch teak leaves are effective cholesterol-lowering agents. Caffeine, sterols, and phenolic acids are also discovered in the leaves of the Dutch teak plant. The tannins and mucilage in Dutch teak precipitate the protein mucosa on the small intestine's surface, reducing food absorption. As a result, the Dutch teak plant can be utilized in traditional medicine to lower cholesterol levels (Supriani et al., 2019). The chemical content of alkaloids, flavonoids, saponins, tannins, mucilage, carotenoids, phenolic acids, and resins in Dutch teak leaves is believed to be able to degrade fat and lower blood cholesterol levels. These chemical compounds have been demonstrated to connect to cholesterol and fat molecules contained in food, causing a decrease in the amount of fat and cholesterol absorption in the intestine and, as a result, a decrease in blood cholesterol levels (Permana et al., 2016). The alkaloid content of Dutch teak leaves is chemically similar to Orlistat, a synthetic drug that can suppress appetite by inhibiting the performance of the lipase enzyme, reducing fat absorption in the body. The mucilage compound present in Dutch teak leaves acts by depositing protein on the surface of the small intestine, reducing food absorption and thus inhibiting the absorption process (Ulfah & Iskandar, 2019). The mucilage content also connects bile salts which can reduce the fat emulsification process, thereby decreasing the process of fat absorption in the digestive tract (Amalia et al., 2018).

Guazuma ulmifolia water extract with a dose of 50 mg/kg BW managed to significantly reduce Low Density Lipid (LDL) and total cholesterol levels. Mucilage contained in Dutch teak can swell in the stomach, thus, it suppresses appetite (Ulfah & Iskandar, 2020). Dutch teak leaf extract incorporates higher levels of flavonoids, tannins, and antioxidant compounds than other plants, which make it more effective in lowering one's cholesterol levels. Dutch teak leaves in addition to lowering cholesterol, triglycerides, LDL also escalate HDL, by elevating the work of the lipoprotein lipase enzyme (Hidajat et al., 2019). The longer the induction dose of ethanol extract of Dutch teak leaves is provided to hypercholesterolemic patients, the more likely the extract's compounds are to work in significantly reducing LDL and increasing HDL levels (Naim et al., 2017).

The majority of people consume Dutch teak leaves by boiling them until they are dry boiling and brewing, resulting in a negative impact on the nutritious substances contained in the Dutch teak leaves. Few people are aware that boiling or brewing tea at temperatures above 90 degrees Celsius can render Dutch teak leaves ineffective (BPOM, 2014), thus, it will be much more beneficial if it is made in the form of teak kombucha tea as a health drink to lower blood triglyceride levels in humans.

Previous research demonstrated that Dutch teak leaf tea therapy had a significant effect on changing and stabilizing cholesterol levels. Respondents reacted positively to the provision of Dutch teak leaf tea therapy as it tastes the same as regular steeping tea. Teak leaf tea therapy has the potential to lower cholesterol levels while having fewer side effects than chemical drugs (Supriani et al., 2019).

Another study revealed that high-fat diet (HFD)-induced hyperlipidemia resulted in increased total cholesterol levels. *Guazuma ulmifolia aqueous* extract significantly reduced total cholesterol levels compared to the HFD group. Moreover, the ethanol extract of *Guazuma ulmifolia* fruit significantly inhibited lipase activity higher than orlistat (Ulfah & Iskandar, 2020). In Sholihah's 2016 study, The combination of Dutch teak leaf extract and rosella flower petals reduced total cholesterol, triglyceride, and LDL levels while increasing HDL levels in plasma. This is due to the high levels of flavonoids discovered in ethanol extracts of Dutch teak leaves and water extracts of rosella petals. Previous studies demonstrated that a 45 mg/kg body weight water extract of rosella petals had the highest lipase inhibitory activity of any Indonesian anti-cholesterol herb. Histopathological examination of the heart organ in the combination of Dutch teak leaves and rosella petals revealed no change in the structure of the heart organ, indicating that exposure to this combination had no effect on the heart organ (Hilma et al., 2018).

Previous research determined that the best dose of Dutch teak leaf kombucha tea (*Guazuma ulmifolia Lamk)* for lowering triglyceride levels was 200 ml/g BW orally, with a 37.68% reduction in triglycerides. Providing a dose of 200 ml/g BW of Dutch teak kombucha tea leaves is nearly the same as giving a dose of 20 mg simvastatin suspension with a percentage reduction of triglycerides obtained 35.20%. Thus, it can be indicated that providing Dutch teak kombucha tea leaves can reduce triglyceride levels in the blood. (Lubis et al., 2021).

It It is unidentified whether the findings of this study will differ from previous studies. Giving Dutch teak leaf tea increased cholesterol levels in DMPA acceptors, but there was no significant difference in triglycerides. Before being examined on respondents, treatment products should ideally go through a more thorough process (Lubis et al., 2021). The assumption of the researcher is that simplicia phytochemical screening from Dutch teak leaves is tremendously essential before being processed into medicinal products. It is also evident that there are alkaloids, flavonoids, saponins, tannins, glucosides and steroids in Dutch teak leaves selected in accordance with criteria, hence, strict phytochemical screening is able to produce quality care products. Dutch teak leaf tea can be discovered in pharmacies, supermarkets and online stores.

4. CONCLUSION

There was a significant difference in cholesterol levels after being treated with Dutch teak leaf tea with a p-value of 0.001. However, there was no difference in triglycerides, body weight and blood pressure after being treated with Dutch teak leaf tea with p-value >0.05. Thus, it can be concluded that the alternative hypothesis is acceptable, which indicates that there is a significant effect in consuming Dutch teak leaf tea with cholesterol levels in DMPA acceptors. The recommendation of this research is that further research is required on the effects of Dutch teak leaf tea by controlling the influencing factors.

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