Nessa Nessa *et al*, International Journal of Pharmaceutical Sciences & Medicine (IJPSM), Vol.8 Issue. 10, October- 2023, pg. 148-156

ISSN: 2519-9889
Impact Factor: 5.9

ANTIHYPERLIPIDEMIC EFFECT OF CORN SILK ETHANOL EXTRACT (*Stigma maydis*) ON HIGH FAT DIET INDUCED WHITE RATS

Nessa Nessa; Ifmaily Ifmaily; Nessa Andriani Amyus; Ridho Asra
Faculty of Pharmacy, Universitas Perintis Indonesia, West Sumatera 25586, Indonesia
Email: nessa91nessa@gmail.com

DOI: 10.47760/ijpsm.2023.v08i10.011

ABSTRACT:
Hyperlipidemia is a state when there is an elevation in total cholesterol, triglycerides, Low Density Lipoprotein (LDL) and a reduction in High Density Lipoprotein (HDL) levels. The aim of this research is to investigate the antihyperlipidaemic effects of corn silk and determine the effective dosage of corn silk for reducing cholesterol, triglycerides, LDL and increasing HDL levels in male rats induced by a high-fat diet and PTU. This experiment utilized 24 male Wistar rats divided into six groups, each consisting of individuals aged 2-3 months and weighing between 200 and 250 grams. The groups were labelled as follows: negative control (Na CMC0.5%), positive control, comparison (simvastatin), and treatment I, II, III (with extract doses of 50 mg/KgBW, 100 mg/KgBW, and 150 mg/KgBW). The rats were administered a high-fat diet and propylthiouracil for a period of seven days to induce an increase in cholesterol levels. For the subsequent seven days, the extract was administered. The study results demonstrate that corn silk extract can significantly decrease cholesterol by 46%, 49% and 51%, and LDL by 57%, 61% and 67%, and that corn hair extract can decrease triglycerides by 60%, 65% and 67%, and increase HDL by 21%, 24% and 28%. Thus, it can be concluded that corn silk extract possesses antihyperlipidemic activity with significant value ($p<0.005$), and the most effective dose for lipid reduction is 150 mg/Kg BB.

Keywords: antihyperlipidemia, corn hair, cholesterol, triglycerides, LDL, HDL

INTRODUCTION

Hyperlipidemia is a medical condition in which total cholesterol, triglycerides, and Low Density Lipoprotein (LDL) levels increase, while High Density Lipoprotein (HDL) levels decrease.[1] This condition is a contributing factor to the thickening of the blood vessel walls, leading to arterial narrowing and hardening, which is commonly known as atherosclerosis.[2]

Atherosclerosis results from the enlargement of muscular arteries and manifests as endothelial dysfunction, vascular inflammation, and accumulation of lipids, cholesterol, calcium, and cellular debris in the intima of blood vessels. These accumulations lead to plaque formation, vascular remodeling, acute and chronic luminal obstruction, blood flow abnormalities, and reduced oxygen supply to organs.[3] Hyperlipidemia is a chief cause of atherosclerosis. There are two types of hyperlipidemia therapy drugs: chemical and natural. One instance of a natural drug that can decrease total cholesterol, triglycerides, LDL, and increase HDL levels is derived from corn hair waste.

ISSN: 2519-9889
Impact Factor: 5.9

Research demonstrates that corn silk contains beneficial chemical compounds, including beta sitosterol, which can reduce blood cholesterol levels. Intestinal mucosal cells absorb beta sitosterol and transport it through lipoproteins. When dietary cholesterol consumption increases, cholesterol biosynthesis from acetyl CoA in the liver decreases. The reduction in cholesterol biosynthesis occurs due to the inhibition of the enzyme HMG CoA reductase by cholesterol that enters the chylomicrons or LDL. Furthermore, the absorption and transportation of beta-sitosterol through lipoproteins can also decrease cholesterol biosynthesis in the liver. Consequently, this leads to lower levels of total cholesterol, triglycerides, and LDL cholesterol while elevating HDL cholesterol.[4] Corn silk also possesses several medicinal properties, such as antioxidant, anti-depressant activity, diuretic, antifatique and antiinflammation activity[5], hepatoprotector[6] and nefroprotector effect.[7]

Previous studies have found that a high-fat diet can cause high levels of total cholesterol, LDL, triglycerides, and low levels of HDL. The theory suggests that high-fat diets can lead to oxidative stress on the vascular endothelium, resulting in dyslipidemia conditions such as high levels of total cholesterol, LDL, VLDL, TG, and low levels of HDL in circulation. Oxidative stress can lead to endothelial dysfunction and the overproduction of Reactive Oxygen Species (ROS) which can promote the oxidation of extracellular LDL, leading to the formation of oxidized LDL. Macrophages phagocytose oxidized LDL through scavenger receptors, forming foam cells and initiating the lesion of atherosclerosis.[8]

Based on the lack of scientific research proving the antihyperlipidemic effect of *Stigma maydis* (corn hair), the authors aim to conduct an effect test of Stigma Maydis on rats induced with a high-fat diet. This study involves evaluating the levels of total cholesterol, triglyceride, LDL, and HDL.

RESEARCH METHODOLOGY

Corn Hair Ethanol Extract Preparation

This study utilized a cold extraction method known as maceration using 96% ethanol solvent to prepare the extractant from corn hair. The corn hair was weighed, chopped, and placed in a glass jar to undergo extraction via immersion in the ethanol solvent. The mixture was left to sit for three days before being filtered using filter paper. The resulting filtrate was then concentrated using a rotary evaporator.

Evaluation of Corn Silk Ethanol Extract

Extract evaluation included: organoleptic examination, determination of yield, determination of ash content, determination of drying shrinkage, and phytochemical tests for flavonoids, tannins, saponins, alkaloids, terpenoids and steroids.

Experimental Animals Preparation

For this study, 24 male White Wistar rats aged between 2-3 months and weighing between 200-250 grams were utilized. The rats were divided into 6 groups, with each group comprising 4 rats.

ISSN: 2519-9889
Impact Factor: 5.9

High Fat Diet Preparation

The high-fat diet given to the test animals used a composition of 80 grams of egg yolk, 15 grams of sucrose, and 5 grams of animal fat made in the form of an emulsion, all ingredients were mixed, then shaken until homogeneous and made new every day and given orally to the test animals with a volume according to body weight, which was given in the morning. And also given food enhancers such as 60 grams of standard feed, 30 grams of yellow eggs, and 10 grams of animal fat given at noon in the form of pellets, and also given PTU which has been mashed and then added as much as 0.27 grams dissolved in 100 ml of distilled water which is given orally in the afternoon

Na CMC 0.5% Solution Preparation

Prepare the Na CMC solution by weighing 0.5 grams of Na CMC and adding it to 10 milliliters of distilled water. Heat the mixture at 60^0 C for 30 minutes and then homogenize it. Add enough distilled water to make the volume of the solution up to 100 milliliters and homogenize it again.

Simvastatin Solution Preparation

This experiment uses a dose of 10 milligrams of simvastatin/day. To calculate the rat dose, multiply the human dose by the conversion factor of 0.018. This gives a rat dose of 0.18/200gBW/day.

Propylthiouracil (PTU) Solution Preparation

The starting amount of PTU for humans is 100-150 mg/day. This experiment uses PTU dosage 100 mg daily. To obtain the dosage for rats, multiply the human-to-rat conversion factor of 0.018 by the pharmacokinetic factor of 10. The dose for rats is 100 mg x 0.018 = 1.8 mg/200gb per day.

Experimental Animal Treatment

Group I : negative control
Group II : positive control
Group III : simvastatin (comparison control)
Group IV : extract dose 50 mg/KgBW
Group V : extract dose 100 mg / kg BW
Group VI : extract dose 150 mg / kgBW

Lipid Profile Examination

Lipid profile examination was carried out three times, namely on the 7th day to check normal conditions, the 14th day to see the reaction after being given a high-fat diet, and the 21st day after being treated for 1 week. Next, blood was taken from each group of rats. Blood collection was carried out through the rat orbital sinus. Rats were anesthetized first by inhalation using ether. In the rat eye, the microhematocrit is inserted into the base of the corner of the eyeball while gently rotating it towards the back of the eyeball until blood flows through the microhematocrit.

Testing Parameters

The study measured total cholesterol, triglyceride, LDL, and HDL levels.

ISSN: 2519-9889
Impact Factor: 5.9

Data Analysis

Before analyzing the data, we checked whether the results were normally distributed and had homogeneity of variance. If these conditions are met (P>0.05), we use Two-Way Analysis Of Variance (ANOVA) to conduct the test, followed by Duncan's test using SPSS Version 25 program.

RESULTS AND DISCUSSION

This study aims to determine the antihyperlipidemic activity of corn hair ethanol extract on male white rats which were divided into several groups with different dose levels. Corn silk is obtained from F1 Aina Sweet Corn located in Batu Hampar, 50 Kota Regency, West Sumatra.

The extract was subjected to a phytochemical test using appropriate reagents and positive results were obtained for flavonoids, alkaloids, steroids and tannins (Table 1). From organoleptic observations, the results showed that the extract had a thick texture with a brownish yellow color with a sweet taste and distinctive smell.

Table 1. Result of Phytochemical Test

No	Secondary Metabolites	Result
1	Flavonoid	+
2	Alkaloid	+
3	Steroid/ Terpenoid	+
4	Saponin	-
5	Tannin	+

The test animals were divided into 6 groups, each group consisting of 4 rats. Group 1 (negative control) was only given a control solution in the form of 0.5% Na CMC, group 2 (positive control) was given high-fat feed and PTU only. while the other group was given an induction feed high in fat and PTU and then continued with extract doses in sequence, namely 50 mg/kgBB, 100 mg/kgBB and 150 mg/kgBB.

Before the rats were induced, the initial levels of total cholesterol, triglycerides, HDL and LDL were measured to ensure that the test animals were in a normal condition and did not experience hyperlipidemia because the test animals used were test animals that were normal or in a healthy condition. In this study, a negative control group was also provided to determine the conditions of the experimental environment that met the requirements for adaptation of the test animals so that the test animals were not stressed. Because if the test animal is stressed it will affect the lipid levels in the blood and of course this will affect the results of the experiment. The negative control here is not a reference for determining the effect of reducing blood lipid levels but only as an environmental control. The reference group for determining the lipid lowering effect is the comparison group.

ISSN: 2519-9889
Impact Factor: 5.9

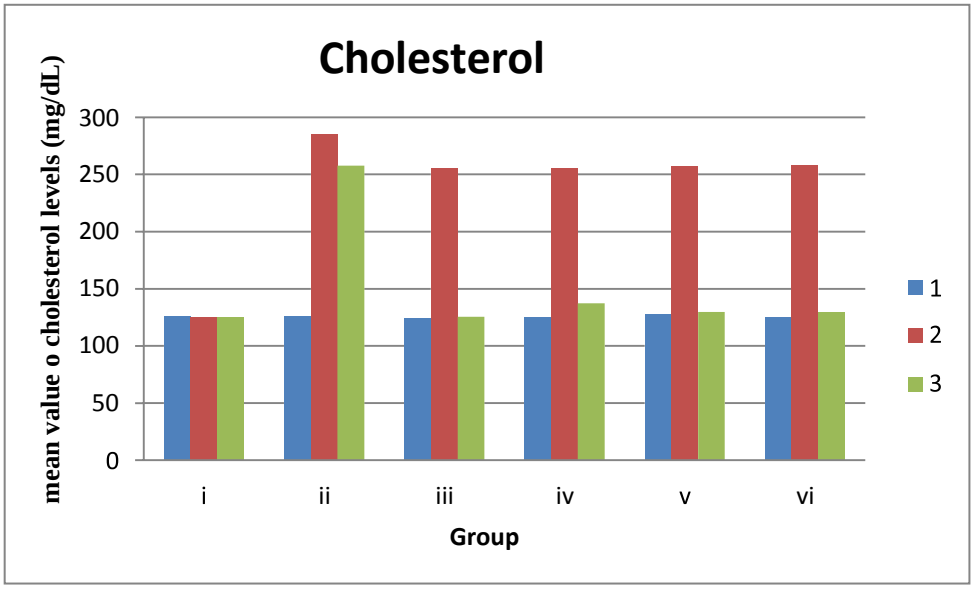

Figure 1. Average cholesterol level of each group

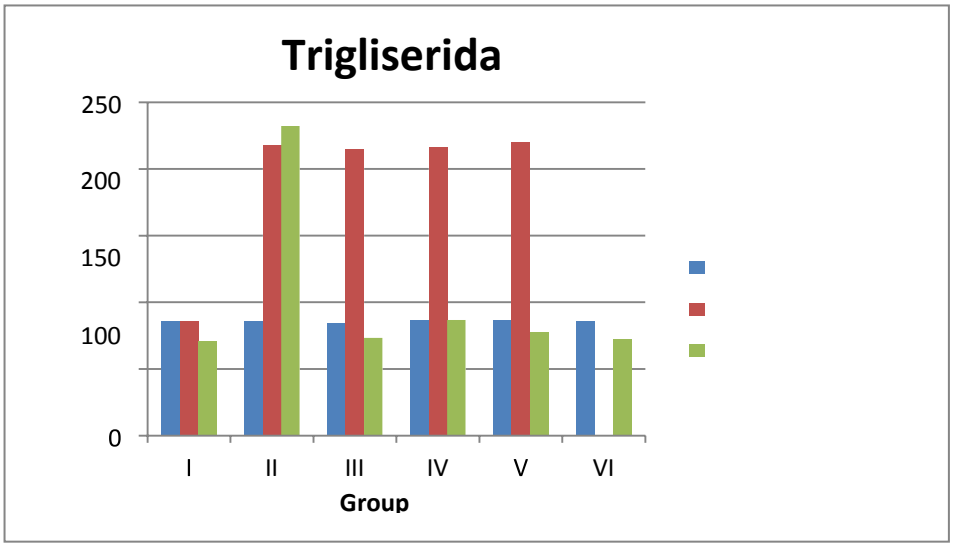

Figure 2. The average triglyceride levels of each group

ISSN: 2519-9889
Impact Factor: 5.9

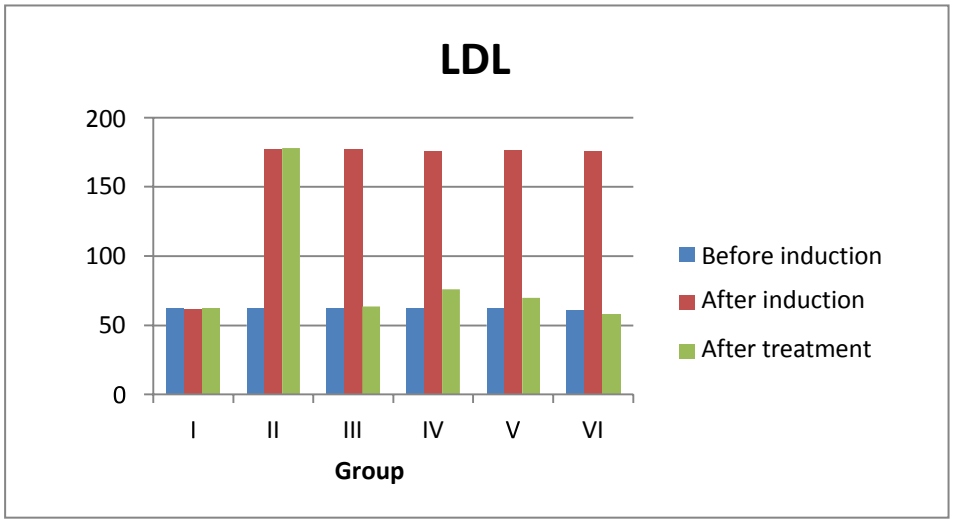

Figure 3. The average LDL level of each group

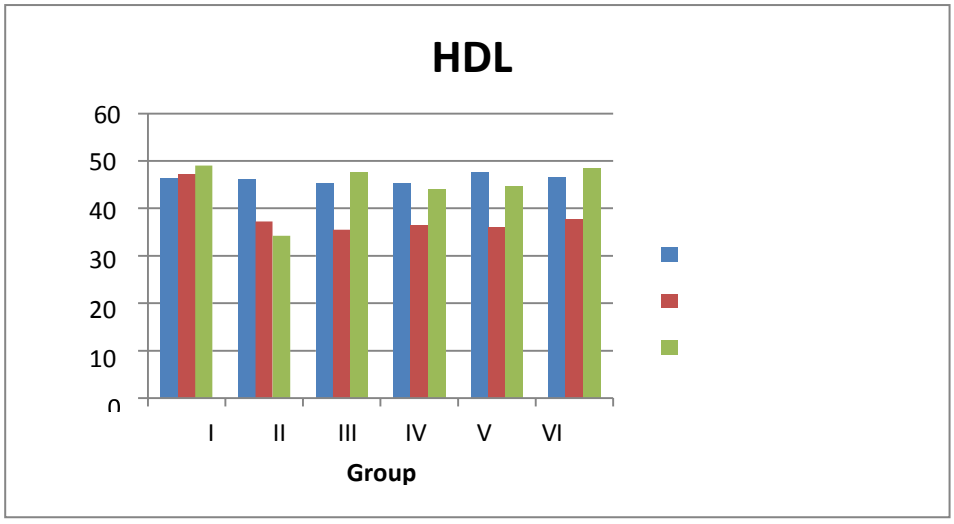

Figure 4. The average HDL level of each group

In this study, rats were induced with high-fat feed and PTU. High fat feed is made from a mixture of 80 grams of egg yolk, 15 grams of sucrose and 5 grams of animal fat which is given in the morning. And supplementary feed is also given which is made from 60 grams of regular feed mixed with 30 grams of egg yolk and beef tallow. 10 grams heated and given during the day. Giving PTU results in decreased thyroid hormone activity, so that there is no reuptake of HDL and secretion of lipoprotein cholesterol by liver cells. This results in increased levels of

ISSN: 2519-9889
Impact Factor: 5.9

total cholesterol, triglycerides, LDL and decreased levels of HDL in the blood. High fat feed is given 2 times a day, namely morning and afternoon, and PTU is given in the afternoon for 7 days. High fat and PTU feed was given to determine the effect of corn silk extract as a medium for treating diseases mediated by hyperlipidemia.[9]

Based on the diagrams above, dose groups I, II, III have lower total cholesterol, triglyceride and LDL levels compared to the positive control. Diagram above also shows that dose groups I, II, III have higher HDL levels compared to the positive control. The statistical test with two-way ANOVA on day to 21 obtained from the normally distributed normality test were significant (0.00), then continued with the homogeny test with significant (0.00), then the Anova test was normally distributed with significant (0.00), then continued the Duncan test to get a dose of 150. mg/Kg BW is not significantly different from simvatatin but is significantly different from a dose of 100 mg/Kg BW, significantly different from a dose of 50 mg/Kg BW, as well as negative control and positive control. Simvastatin was not significantly different from the dose of 150 mg/Kg BW, but was significantly different from the dose of 100 mg/Kg BW, significantly different from the dose of 50 mg/Kg BW, significantly different from the negative control and positive control. The dose of 100 mg/Kg BW is significantly different from the dose of 50 mg/Kg BW, significantly different from the dose of 150 mg/Kg BW, significantly different from simvastatin and significantly different from the negative control and positive control. This means that on day 21 the test and comparison preparations of simvastatin were able to reduce total blood cholesterol levels. This is because the mechanism of action of simvastatin has been seen and is standardized in reducing cholesterol levels, namely by inhibiting the action of the HMG-CoA reductase enzyme so that the process of reducing HMG-CoA to mevalonate which is a sterol precursor of cholesterol does not occur, so that cholesterol production is hampered and there is a significant decrease in total cholesterol and LDL cholesterol levels.[3]

Corn silk contains chemical compounds that are useful for health. One of the substances contained in corn silk is flavonoids, alkaloids, steroids and phenols. Alkaloids work as antioxidants by donating hydrogen ions like flavonoids. This compound can also inhibit the activity of the pancreatic lipase enzyme, thereby increasing fat secretion through feces, as a result, fat absorption by the liver is hampered so that it cannot be converted into cholesterol. Reduced activity of the pancreatic lipase enzyme can reduce triglyceride deposits entering the small intestine because the enzyme converts triglycerides into two monoglycerides and two free fatty acids so that they can enter the blood vessels.[10]

Phenolic compounds are reported to be able to reduce total cholesterol levels and to inhibit the formation of atherosclerosis. Steroid compounds are phytosterols. Phytosterols in the body function to reduce cholesterol levels by inhibiting cholesterol absorption in the intestine by competing with cholesterol in the absorption process in the intestine, thereby helping to reduce the amount of cholesterol entering the bloodstream and speeding up cholesterol excretion. Flavonoid compounds can reduce hepatic cholesterol and plasma lipoprotein cholesterol levels in rats fed a high-fat diet, significantly reducing the activity of the HMG-CoA enzyme synthesis and increasing the activity of cholesterol 7-α hydroxylase.[11]

Apart from that, corn silk contains chemical compounds such as beta sitosterol. The beta sitosterol substance is thought to have an effect on reducing blood cholesterol levels. Beta-

ISSN: 2519-9889
Impact Factor: 5.9

sitosterol in the liver will accelerate the breakdown of enzymes specifically what the liver needs to produce cholesterol or indirectly inhibit cholesterol formation in the liver. Beta-sitosterol has a chemical structure that is almost the same as cholesterol so it can inhibit the absorption of cholesterol by the blood. Cholesterol that is not absorbed by the blood will then be excreted out of the body. The mechanism of action of beta-sitosterol in lowering cholesterol in the blood is to reduce the absorption of cholesterol including triglycerides and other dietary fats in the digestive system. Reducing cholesterol absorption is carried out by locking or binding fat molecules from food and blocking these fat molecules from being absorbed by intestinal mucosal cells. Inhibition of cholesterol and triglyceride absorption will cause chylomicron anabolism to be reduced, which will cause serum treiglyceride levels to be reduced and intake of dietary cholesterol and triglycerides to the liver will also be reduced. This will result in low serum LDL cholesterol levels anabolism. The small amount of LDL anabolism causes low serum triglyceride levels. Cholesterol, triglycerides and other dietary fats that are not absorbed by intestinal mucosal cells due to the presence of beta sitosterol will be excreted in the feces along with bile salts. Beta-sitosterol is a plant sterol compound that is difficult to absorb by intestinal mucosal cells. Beta-sitosterol that is not absorbed by intestinal mucosal cells will also be excreted in the feces.[4]

Apart from that, beta-sitosterol can also reduce the amount of cholesterol production in the liver. Beta-sitosterol has a ring structure identical to the ring structure cholesterol, but differ in the chain bonds of the attached ethyl groups. Beta-sitosterol that is absorbed by intestinal mucosal cells will be transported via lipoproteins. If dietary cholesterol consumption increases, cholesterol biosynthesis from acetyl CoA in the liver will decrease.[12]

The decrease in cholesterol biosynthesis is due to the limitation of the enzyme hydroxyl methyl glutaryl CoA reductase (HMG CoA reductase) by cholesterol entering the remaining chylomicrons or LDL.[13] So the presence of beta-sitosterol which is also absorbed and transported via lipoproteins can also reduce cholesterol biosynthesis in the liver. This results in a decrease in total cholesterol, triglycerides and LDL cholesterol levels and an increase in HDL cholesterol.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that:

1. Ethanol extract of corn hair at graded doses has an effect on reducing total cholesterol, triglyceride, LDL and increasing HDL levels in male white rats.
2. Ethanol extract of corn hair at a dose of 150 mg/kg BW is an effective dose to reduce total cholesterol, triglyceride, LDL and increase HDL levels.

REFERENCES

[1]. Katzung, BG. Basic and Clinical Pharmacology. Translator for the Pharmacology Department of the Faculty of Medicine UNAIR. 2008. Jakarta: Salemba Medika.

[2]. Guyton AC, Hall JE. Textbook of Medical Physiology. 11th ed. 2012. USA: Elsevier Saunders

[3]. Gilman. Goodman and Gilman: Pharmacological basis of therapy. Edition 10. Vol. 2. 2012. Jakarta : EGC. Hal. 943-968.

[4]. Wijayanti F, Muhammad RR. The effect of corn silk (Zea mays) on reducing blood cholesterol levels. *Majority. 2016; 5(3):91–5*

ISSN: 2519-9889
Impact Factor: 5.9

[5]. Hasanudin K., Hashim P. and Mustafa S. *Corn Silk (Stigma Maydis) in Healthcare*: A Phytochemical and Pharmacological Review. *Molecules*. 2012; 17. 9697-9715.

[6]. Nessa, Nessa, et al. Hepatoprotector Effect of Corn Silk Ethanol Extract (Stigma maydis) on Paracetamol-Induced White Male Rats. *Asian Journal of Pharmaceutical Research and Development*, 2021, 9.5: 10-16.

[7]. Nessa, Nessa, et al. Nefroprotector Effect Of Corn Silk (Stigma Maydis) Ethanol Extract On Gentamicin Induced In Wistar Rats. *IJPSM*. 2021.

[8]. Rusmini H, Putri, DF, Hidayat, H., & Risandy, D. The Effect of Ceiba Pentandra Honey on LDL Levels of Rattus Norvegicus Rats Fed a High-Fat Diet. *Jurnal Ilmiah Kesehatan Sandi Husada.* 2020:*9* (1), 479-489.

[9]. Heryani R. Effect of Red Dragon Fruit Extract on the Blood Lipid Profile of Hyperlipidemic White Rats. *Research of Applied Science and Education V10.i1 (8- 17*)

[10]. Lajuck P. Bay leaf extract is more effective in reducing total and LDL cholesterol levels than statins in dyslipidemia sufferers [thesis]. 2012. Denpasar : Universitas Udayana.

[11]. Honda K., Saneyasu T, Hasegawa S, Tominaga, et al. Effect of Licorice Flavonoid Oil on Cholesterol Metabolism in High Fat Diet Rats in High Fat Diet Rats, 8451(May). https://doi.org/10.1271/bbb.130104

[12]. Anwar F. Phytosterol: Vegetable Cholesterol That Is Effective In Lowering Plasma Cholesterol. 2003 Available from: http://www.kcm.com.

[13]. Subhana M. Basics of Scientific Research. 2005. Jakarta: Erlangga

