

THE EFFECT OF DURIAN (*DURIO SPP.*) CONSUMPTION ON THE BLOOD HIGH-DENSITY LIPOPROTEIN LEVEL

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Durian merupakan buah tropis yang umum ditemukan di Asia Tenggara. Durian berasal dari keluarga *Malvaceae* dan genus *Durio*. High-density lipoprotein atau HDL adalah zat yang tidak larut dalam air dan memiliki fungsi untuk membawa kolesterol ester dan kolesterol dari jaringan kembali ke hati. Diyakini bahwa konsumsi durian berlebihan dapat menyebabkan status kesehatan yang buruk karena dapat meningkatkan tingkat kolesterol. Dalam penelitian ini, kami ingin mencoba untuk mengetahui apakah rumor ini benar atau tidak. Kami melakukan penelitian dengan rancangan penelitian eksperimental. Kami menggunakan tikus, dikelompokkan, dan kami memberi durian dalam periode tertentu. Pada setiap akhir periode, kami mengorbankan tikus dan mengambil darah untuk pemeriksaan. Kami menggunakan kit untuk mengukur tingkat HDL dan membandingkannya dengan kelompok kontrol yang tidak mengkonsumsi durian. Hasil penelitian menunjukkan konsentrasi HDL lebih rendah pada kelompok intervensi dibandingkan dengan kelompok kontrol di ketiga perbandingan. Namun, nilai p ditemukan tidak signifikan. Bentuk penelitian lain telah menemukan bahwa durian mengandung fenol dan flavonoid yang memiliki sifat antioksidan. Antioksidan dapat mengurangi risiko memiliki penyakit kardiovaskular dengan mencegah proses oksidasi LDL khusus oleh radikal bebas, spesies oksigen reaktif, dan spesies nitrogen reaktif. Rendahnya tingkat HDL adalah faktor risiko untuk aterosklerosis. Tapi, kita harus melihat dari pendekatan yang komprehensif mengenai konsumsi durian. Kita harus mengeksplorasi parameter lain seperti kolesterol total, LDL, dan trigliserida. Tingkat kolesterol total dalam penelitian ini mengalami penurunan. Jadi, kita tidak bisa menilai bahwa durian adalah buruk bagi kesehatan. Penyelidikan lebih lanjut mengenai profil lipid dan risiko memiliki penyakit kardiovaskular perlu dilakukan.

Kata kunci: Durian, HDL, Antioxidant, Cardiovascular diseases

Durian is a tropical fruit commonly found in South East Asia. It comes from the family of *Malvaceae* and the genus of *Durio*. High-density lipoprotein or HDL is a substance that is insoluble in water and has the function to carry cholesterol and cholesterol esters from the tissues back into the liver. It is believed that durian consumption moreover if excessive can lead to bad health status due to the increase of cholesterol level. In this research, we want to try to learn if this rumor is true or not. We done the research with experimental research design. We used rats, grouped them, and we give them durian in a certain period of time. In the end of each period, we sacrificed the rats and took their blood for examination. We use kit to measured the HDL level and compare it to a control group who does not consume durian. The results showed lower HDL concentration in the intervention group compare to the control group in all three comparison. However, the p value is not significant for two comparisons. Form other studies, we had found that durian contains phenols and flavonoids which has antioxidant properties. Antioxidant can reduce the risk of having cardiovascular diseases by preventing the oxidation process specifically LDL by the free radicals, reactive oxygen species, and reactive nitrogen species. Low level of HDL is risk factors for atherosclerosis. But, we have to look from comprehensive approach regarding this durian consumption. We have to explore other parameters such as the total cholesterol, LDL, and Triglycerides. The total cholesterol level in this research is decreasing. So, we cannot judge that durian is bad for the health. Further investigations regarding the lipid profile and the risk of having cardiovascular disease is need to be done.

Keywords: Durian, HDL, Antioxidant, Cardiovascular diseases

1. Introduction

Cardiovascular diseases is the leading cause of death worldwide. Both coronary heart disease and stroke accounts for 17,3 million deaths in 2008. The underlying mechanism of cardiovascular diaseases is atherosclerosis, it is a condition where the blood vessels is thicken and prone to occlusion. This happens because of the plaque that builds in the inner layer of the blood vessels.

Lipoproteins is a water soluble substance that is used to carry water insoluble substance such as triacylglycerol and phospholipids through the blood. As the name implies, it consist of combination between lipid and protein. There are some types of lipoproteins, they are high-density lipoprotein (HDL), low-density lipoprotein (LDL), intermediate-density ipoprotein (IDL), very-low-density lipoprotein (VLDL), and also chylomicrons. Here, we will discuss more about the HDL. HDL is consider as the good cholesterol, the reason is because of its reverse cholesterol transport properties. The HDL can carry the cholesterol in the endothelium of the blood vessel and deliver it to the liver that is why it is the good “cholesterol”. This process is contradicted with the other lipoproteins this is why it is called “reverse transport”. This specific properties of HDL is very important to prevent cardiovascular diseases because it lower the possibilities of atherosclerotic plaque formation in the vessel wall.²

Lipid profile is highly associated with diet. The diet taken by a person would be reflected in their lipid profile. Lipid profile that most commonly studied are cholesterol, triglyceride, HDL, and LDL. High HDL level is considered to be a good reflection of fine health status. Hyperliidiemia is one of the risk factors for atherosclerosis thus cardiovascular diseases.

Durian is commonly found in the South East Asian region of the world. The fruit comes from the genus *Durio* and the family of *Malvaceae*.¹ Durian is very unique due to its appearance and smell. The smell is very strong and the looks is very distinct with the thorn covering the fruit.

It is widely believe in the community that consuming durian moreover in large quantity is not a good diet by means of increasing the cholesterol level. This is even more important for those who has hypertension and pregnant woman. The chance to have cardiovascular disease is increase when the total cholesterol level is increasing whereas the HDL is decreasing. Knowing that this believes is still strongly accepted by the community, a research about the HDL level and durian consumption should be

done. It is important to understand if there is any changes happen to the HDL level related to durian consumption.

2. Literature Review

2.1.1. Cardiovascular Diseases

2.1.1.1. Atherosclerosis

Atherosclerosis is the condition where the blood vessels is thicken and the elasticity is decreasing. This can happen due to the plaque in the inner layer of the blood vessels, these plaque is created from cholesterol and lipid material. Atherosclerosis is still consider as one of the leading cause of death worldwide. Its manifestation depends on the place where it occurs. For example, if it happens in the vessels of the brain it can manifest into transient ischemic attack or even stroke. If it happens in the heart then it can leads to angina pectoris and even myocardial infarct.⁹

2.1.1.2. Epidemiology

Cardiovascular diseases is the leading cause of death in the world. 30% of global deaths in 2008 is cause by cardiovascular diseases. It represents around 17,3 million deaths, from that number, 7,3 million were caused by coronary heartd disease and 6,2 million were caused by stroke. It is also found that mroe than 80% these deaths happened in the developing country. Comparison between male and female showed that it is almost equal.¹⁰ In Indonesia, from the Riskesdas, it is found that the prevalence of cardiovascular diseases and stroke is also high in 2007, 31,9% and 15,4% respectively.¹¹

2.1.1.3. Etiology & Risk Factors

There are no specific etiology for cardiovascular diseases. The occurrence of these diseases is highly related with the risk factors. There are several risk factors for cardiovascular diseases, we can group them into modifiable and non-modifiable risk factors.¹²

Modifiable risk factors:

- Hyperlipidemia: lipid profile is related to atherosclerosis. People with hypertriglyceridemia, hypercholesterolemia, low level of HDL have higher risk of getting atherosclerosis.
- Hypertension: 14% of men and 12% of women cardiovascular diseases is due to increase blood pressure

- Smoking: 20% of men and 17% of women who has cardiovascular diseases is due to smoking
- Diabetes mellitus: it is found that people with DM type 2 has two to four fold more chance to get cardiovascular diseases in men and three to five fold in women
- Obesity: 5% of men and 6% of women cardiovascular diseases is due to the obesity

Non-modifiable risk factors:

- Age: older age means more risk to get cardiovascular diseases
- Sex: it is found that men is more susceptible compare to women
- Genetic: mutation in the angiotensin-converting enzyme (ACE) gene is linked with cardiovascular diseases
- Family history: people who their family member have cardiovascular diseases has increase chance to get the disease, this is related with the lifestyle of the family

2.1.1.4. Pathophysiology of Atherosclerosis

Atherosclerosis formation is following these process:

- Fatty streak formation
- Leukocyte recruitment
- Foam cell formation

Fatty streak is the condition where there is an accumulation of lipoproteins in the inner layer of the blood vessel. Those lipoproteins will bind with the extracellular matrix thus causing it to be hard to remove from the blood vessel and prolonged the time in the blood vessels. If the lipoproteins is not removed, it will undergo chemical modifications and forms atherosclerosis. The most studied chemical reaction are lipoprotein oxidation and nonenzymatic glycation.

The next step is leukocyte recruitment. The most common leukocyte in this process is the monocytes and lymphocytes. The leukocytes will be attracted due to the adhesion molecules in the blood vessels. The leukocytes will go inside the vessels, convert into macrophage and transform into foam cells which has lipid inside it.

The lesion then will become a plaque that impeding the blood flow. When it gets bigger, less blood will be able to go through and this is a problem. Organs and tissues

will have less blood and thus less nutrition and oxygen. The lesion can also rupture and cause embolism. The debris can be carried by the blood flow, blocking smaller blood vessels thus causing another problem.

2.1.2. Durian

2.1.2.1. Definition

Durian is a tropical fruit especially common in South East Asia. It comes from the genus of *Durio* and the family of *Malvaceae*. The appearance of the fruit is very eye catching due to its thorny skin. Inside the fruit, we can find the pulp and the seed.³

Previous research believed that tropical fruit has great antioxidant activity. Other research has tried to find the substance that might be related with this ability and the result is the finding of phenolics.⁴ This substance effect is also believe related to the stages of ripening of the durian. It is also stated that cultivars paly role on this ability, and the one that has the most significance is the *Mon-thong*.⁵

2.1.2.2. Phenolic

Phenolic or phenols is a substance that could be found in vegetables or fruits naturally. This substance can also be made with biochemical techniques. It can be found in many form such as phenolic acids, simple phenols, flavonoids, and hydroxycinnamic acid derivates.^{6,7} Structurally it is an aromatic hydrocarbon group which has one or more hydroxyl groups attached to it.

2.1.2.3. Antioxidant

The body use reactive oxygen species (ROS) and reactive nitrogen species (RNS) for many important body functions everyday. For example, it is use for immune function, energy supply, and chemical signalling. Oxidative damages can occur when there is too much production of these species or if there are oxidant substances from outside the body. That is why it is important to consume antioxidant because it is believed that it can prevent chronic diseases by reducing the oxidative damages.⁸

2.1.3. High-Density Lipoprotein

2.1.3.1. Definition

Lipoproteins works like a vehicle in the blood stream. It can carry other substance usually insoluble one such as triacylglycerols and phospholipids in its core and move it through the blood. There are some types of lipoproteins, HDL is the smallest one compare to the other lipoproteins. Eventhough it is small, it is the

densest lipoproteins. This possible because the amount of protein is very high in comparison to the amount of cholesterol. In HDL, the biggest number of apolipoprotein is apoAI and apoAII.

2.1.3.2. High-Density Lipoprotein Synthesis

The synthesis of HDL can happen in three ways. First, it can be created from the accumulated apoproteins from VLDL and chylomicrons with the help of lipoprotein lipase enzyme. Second is by free apoAI come from other types of lipoproteins in the blood. Third, it can be synthesized from the nascent HDL. Nascent or young HDL will mature due to the accumulation of phospholipids and cholesterol from the endothelium of the blood vessels. The process is mediated by the HDL-bound enzyme, named lecithin-cholesterol acyl transferase (LCAT). The activation of this enzyme required transfer of apoAI from the chylomicrons. The core of the nascent HDL will be filled by cholesterol esters and this process will change the shape of the HDL into more globular form thus creating the mature HDL.

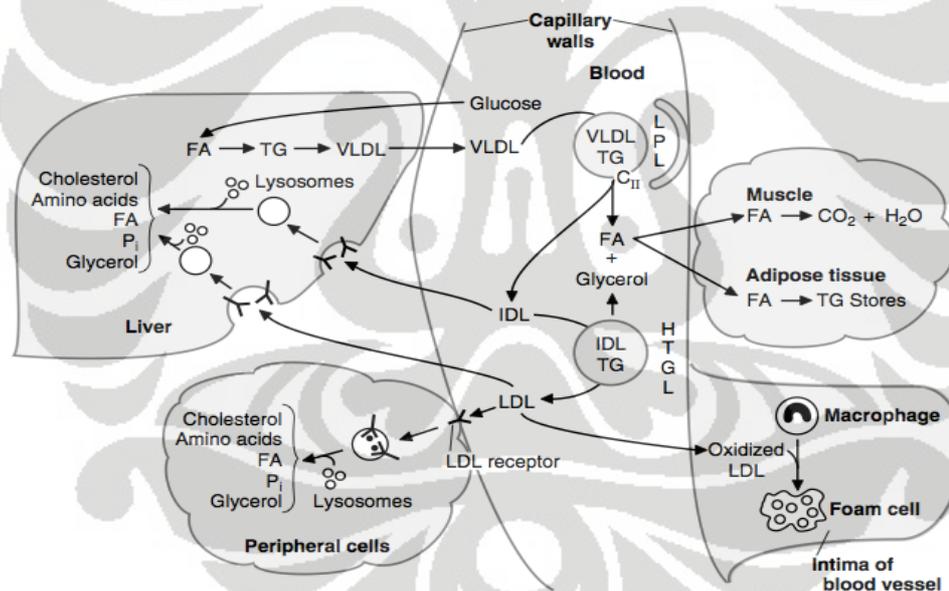


Figure 1. Metabolism of HDL

2.1.3.3. High-Density Lipoprotein Metabolism

The metabolism of HDL is done by a scavenger receptor called the SRB-1. The receptor can be found in many kinds of cells. Other than this, it can also be done by a specific receptor on the hepatocytes. When HDL attaches with the receptor, it will transfer the cholesterol and the esters in the core of the HDL. After that, the HDL will be detached from the receptors and goes back to the circulation. Some cells that need

cholesterol for biosynthesis of other substance can increase the number of receptor to fulfill it needs.

2.1.3.4. High-Density Lipoprotein Normal Level

Based on The American Heart Association, National Cholesterol Education Program, and National Institute of Health, here are the normal level of fasting HDL:

Table 1. Normal Level of Fasting HDL

As it has been explain before, the important function of HDL is the reverse cholesterol transport from the vessels to the liver. This is why people with high level of HDL is consider to have less risk of cardiovascular disease. In the other hand, if the HDL level is low then the person is consider as having increase risk of cardiovascular disease.

Level (mg/dL)	Level (mmol/L)	Interpretation
<40 for men <50 for women	<1.03	Low HDL Increase risk of cardiovascular disease
40-59	1.03-1.55	Medium HDL
>60	>1.55	High HDL Less risk of cardiovascular disease

3. Methods

This research used an experimental research design to measure the effect of durian consumption to the level of high-density lipoprotein. The research was conducted for 10 months from July 2012 until April 2013. It takes place in Faculty of Medicine Universitas Indonesia, Jakarta, Indonesia. The sample used is male Sprague Dawley rats with the weight between 100 to 150 grams. The Sprague Dawley rats were divided into 4 groups:

1. Group of rats that does not consume durian
2. Group of rats that consume durian for 1 week
3. Group of rats that consume durian for 2 weeks
4. Group of rats that consume durian for 3 weeks

The second and third groups were fed with standard diet and excessive amount of soften durian two times everyday. This is done for 1 week for the second group,

2 weeks for the third group, and 3 weeks for the last group. All the rats received normal diet and ad libitum daily. After each week ends, the rats were sacrificed in deep anesthetized ether. The blood was taken from the heart and collected in heparinized tube. The blood then centrifuged so that the plasma can be separated from the blood cells. The plasma was used to analyze the level of HDL using kits from ST. Reagensia, Indonesia, AKD 10101200008.

Durian fruits were purchased from the local market. The part used is the pulp of the durian. The pulp were diluted in water. It is administered to the rats by using esophageal tube two times perday with 2 ml durian/administration. The analysis were done using SPSS

4. Results

After the experiment, the number of rats survived including the control group are 14 rats.

Table 4.1. Characteristics of Rats

Variable	n	%
Control	5	35,7%
Rats fed with durian for 1 week	4	28,6%
Rats fed with durian for 2 weeks	3	21,4%
Rats fed with durian for 3 weeks	2	14,2%

From table 4.1 we can see that the number of rats fed with durian is decreasing each week. The control group is fed with normal food for the three weeks.

Table 4.2. Comparison of HDL Mean Concentration Between Groups

Variable	Control	Rats 1 week	Rats 2 weeks	Rats 3 weeks
HDL	25,000 ± 4,603	22,480 ± 4,728	17,513 ± 3,152	8,452 ± 1,964

From table 4.2 we can compare the mean concentration from each group. The mean concentration from control to 1 week, 2 weeks, and 3 weeks intervention is decreasing.

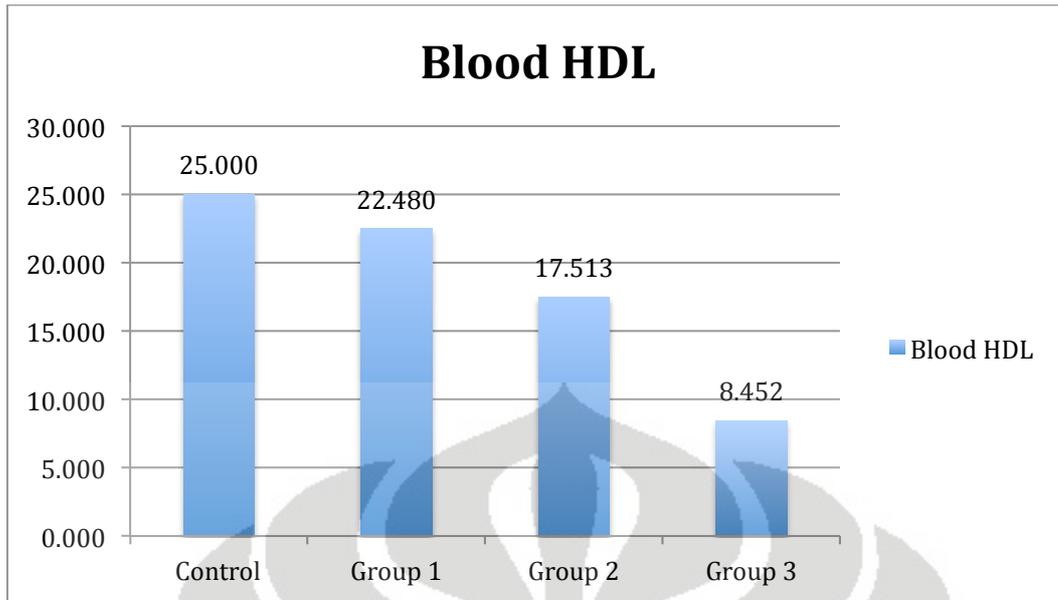


Figure 1. Mean Concentration of HDL Between Groups

We can see clearer from figure 1 the decreasing trend of mean concentration from the first group to the last group.

Table 4.3. HDL Concentration Between Groups

No	Control	Group 1 (1 week intervention)	Group 2 (2 week intervention)	Group 3 (3 week intervention)
1	29.048	21.349	16.190	9.841
2	21.270	28.651	15.238	7.063
3	29.841	17.222	21.111	
4	25.397	22.698		
5	19.444			
\bar{x}	25.000	22.480	17.513	8.452
SD	4.603	4.728	3.152	1.964
Statistical Analysis				p = 0,038*
Correlation				- 0,764

From table 4.3 we can see the concentration of HDL from each subject in each group. From the statistical analysis the p value is 0,038. In the correlation, we get negative correlation.

5. Discussion

High-density lipoprotein is a substance created from lipids and proteins molecule binds together. They are known as the good cholesterol due to their function of moving triacylglycerol and phospholipids from the tissues back to the liver. In the other hand, there is also LDL which has the opposite function to HDL. Because of that, LDL is famous as the bad cholesterol. HDL is a part of a total cholesterol count. Total cholesterol level in a person consists of HDL, LDL, and Triglyceride.

Durian is said to be harmful because it can increase the cholesterol level in a persons body. In the contrary, a journal from Leontowicz et al. in 2008 stated that durian contains phenols and flavonoids. Flavonoids is believed to have an antioxidant capacity which is beneficial for the body. Another study from Haruenkit R et al.¹ and Arancibia et al. stated that the bioactivity of phenols in durian is related with the stage of ripening. Total polyphenols, flavonols, flavonoids is the highest in the ripe stage.

Based on USDA, the nutrition content of durian actually does not contain any cholesterol. Most of what we can find is actually carbohydrate and also fats. So, now we have to know how does carbohydrates and fats contributes to the cholesterol transport and the body metabolism. Excess of carbohydrates in the body will be converted to fatty acid and triacylglycerol. From the other experiment, the tryglyceride level is decreasing. But, in the third week it would increase. The body might still adapt in the beginning, but, the body compensation eventually depleted and it will increase.

Plaque formation can happen when there is oxidation of LDL in the blood vessels. Oxidation of the LDL is induced by metal ions, reactive oxygen species, reactive nitrogen species, and other free radical agent. This process then will produce oxidized LDL (Ox-LDL). The immune system by means of the macrophage will recognize and engulf the Ox-LDL. Thus, it will lead to formation of atherosclerotic plaque and increase the chance of cardiovascular diseases. Antioxidant in durian might help here by preventing the oxidative damages, this is in accordance with the research from Dimitrios² in 2006.

In the experiment, after analyzing using statistical method we acquire the p value of 0,038 which means there is significant difference between those groups of experiment. From the correlation, we get -0,764 which means there is negative relation between the duration of durian consumption with the concentration of HDL.

The longer the duration of durian consumption will cause the concentration of HDL to decrease.

Low level of HDL is a risk factors for having atherosclerosis. It means that triacylglycerols and phospholipids will be deposited in the tissue with only a small number of HDL that can remove it from there. But, we also have to see the bigger picture, to have a better understanding we need the other parameters such as the cholesterol, LDL, and triglycerides. Fortunately the other member of this research group is observing the cholesterol level. The total cholesterol level is decreasing in this experiment. Low total cholesterol level is good because it reduces the risk to get cardiovascular diseases. If the total cholesterol and HDL is low, it is actually okay as long as we can maintain those level.

If durian does not contain cholesterol and also have antioxidant properties then it is very good for the health. We don't have to be worried anymore to the rumour that accuse durian as bad for the health and can cause diseases. On the contrary we can suggest people to consume durian because their phenols and flavonoids substance that has the antioxidant abilities.

In the end, we need to explore and continue to search for new knowledge regarding the lipid profile and cardiovascular diseases. Cardiovascular diseases is still the most lethal killer in the world. If we can acquire new understanding, it would be very beneficial for everyone. This research has many limitations, that is why further research and learning need to be done.

6. Conclusion

The level of HDL in the durian group is lower compare to the control group. There is a decreasing trend of HDL concentration in relation to the duration of excessive durian consumption.

7. Recommendation

The knowledge regarding the ripening stage and the variant of the durian should be taken into account. Increasing the number of samples as a precaution of death rats. The rats can be given time to get used to the durian. Taking the blood samples each week, so we can see the changes more clearly.

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