Effective Consumption of Garlic (Allium Sativum Linn) on Decreasing Blood Cholesterol Levels

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Abstract. Many people in Babat Jerawat village suffer from cholesterol disease. The treatment carried out by the community in Babat Jerawat village is more familiar with medical treatment than herbal medicine. This study aims to analyze the effect of consumption of garlic (Allium sativum linn) on reducing cholesterol levels in blood in hypercholesterolemia patients in Babat Jerawat village, Benowo Surabaya. This study uses a Pre Experimental design, with a population of 20 people, a sample of 14 people. Independent variable is garlic which is consumed raw with a dose of @ ± 4gram (2x1 a day), the dependent variable is a decrease in cholesterol levels in the blood. The sampling technique used is Purposive sampling. The results of this study indicate that of the 14 respondents, all experienced a decrease in cholesterol levels in the blood after consuming garlic @ ± 4gram (2x1 a day). Results that can be used using the Wilcoxon Signed Ranks Test are ρ <α (0.001 <0.05). There is an effect of garlic consumption because there is a significant decrease in cholesterol levels in the blood. Nurses can recommend the preparation of consumption of garlic which has been dried @ ± 4gram (2x1 a day) as a complementary therapy in patients with hypercholesterolemia. It is expected that further research can better control the behavior and lifestyle of respondents.

1 Introduction
Cholesterol disease can affect almost all groups of people throughout the world. The number of sufferers from year to year continues to increase due to changes in lifestyle that tend to consume foods that contain a lot of fat, including people in the Village of Acne Friends, many of whom suffer from cholesterol disease (usually the examination is done by taking peripheral blood at random). Treatment carried out by the community in Babat Jerawat village is more familiar with medical treatment than herbal medicine as a controller of cholesterol levels in the blood. Using herbal remedies such as consumption of garlic that has not been believed by the people in Babat Jerawat village can reduce cholesterol levels, but consumption of garlic will give a reaction with a long time compared to modern medicine, but it will be safer if consumed in the long term. There are still a few people in Babat Jerawat village who consume garlic and many still have high cholesterol. The most recent survey in 8 Asian countries reported that 50% of the Asian population failed to lower high cholesterol levels according to the targets recommended in the treatment guidelines. In Indonesia, this failure even reaches 70% of the people who cannot reduce high cholesterol levels, a very large number. So that there are still many people who are attacked by serious diseases such as coronary heart disease and...
stroke which is still one of the biggest factors in the occurrence of death in Indonesia caused by cholesterol in the blood (Mumpuni, Yekti, 2011).

Cholesterol incidence rates in community Health centers of Pakal in July-September 2016 based on the initial data collection, were 97 cases of cholesterol. The prevalence in Babat Jerawat Village according to the integrated data of the Assistant Health Center (PUSTU) of the Babat Jerawat in October 2016 was 20 people who experienced cholesterol (usually the examination was done by randomizing peripheral blood). A total of 16 (78%) people had high cholesterol levels (random) ≥240mg / dL, while 4 (22%) people had high cholesterol levels (random) ≥200-239mg / dL. Factors that cause an increase in cholesterol are genetic disorders in genes that regulate fat metabolism, food, excess weight (obesity), lack of physical activity or exercise, excessive alcohol consumption, excessive coffee drinking habits, smoking, stress, age and type sex. From the causes and unhealthy lifestyle habits can be a trigger for more serious diseases such as hypertension, coronary heart disease, and strokes that are still the number one cause of death in Indonesia (Rusilanti, 2014). Garlic can be chosen as an alternative to reduce cholesterol levels in the blood. The majority of the sulfur compounds in garlic that are still intact are \( \gamma \)-glutamyl-S-allyl-L-cysteines and S-allyl-L-cysteine sulfoxides (alliin). Both are present in large quantities as sulfur compounds in garlic. The active elements in garlic that are useful for lowering cholesterol levels are ajoene, dialyl disulfide, S-allyl cysteine (Liu, 2006). Garlic which is consumed directly or raw contains the active ingredient S-allyl cysteine, a component of thioallyl which has the property of reducing blood fat levels (hypolipidemic) and antithrombotic (Dalimartha, Setiawan & Felix Adrian, 2013).

According to Silalahi (2006) thyoallyl compound, which is an oxygenated compound from garlic, is anti-coagulant in animal experiments, and is able to imbibe gastric lipase thereby reducing fat absorption. Garlic is thought to have the effect of lowering cholesterol by inhibiting its synthesis. The possible inhibiting mechanism is in two ways, namely: (i) inhibition of the enzyme reaction hydroxymethylglutaryl-CoA reductase (a rate limiting enzyme) and (ii) the recovery of other enzyme reactions, such as squalene mono-oxygenase and lanosterol-14-demethylase (Gupta & Porter in Khoir, Ahmad Kanzul, 2015).

The research by Rosalina Silvia Dewi (2011), showed that the administration of Garlic Ethanol Extract could improve lipid profile in male dyslipedemia rats, this study used dyslipidemic male rats. Giving ethanol extract of garlic can reduce total cholesterol, triglycerides, LDL, and increase HDL levels of blood serum in dyslipidemia male rats significantly, which shows an increase in effectiveness if the dose of garlic ethanol extract is increased. Further research is needed to determine the optimal dose of garlic ethanol extract on blood lipid profiles and it is recommended to consume garlic appropriately to improve blood lipid profiles for people with dyslipidemia. Research by Alicajic F (2009) on 30 mild and moderate hypertensive patients to assess the efficiency of garlic as a management of mild and moderate hypertension. 30 patients, aged 41-64 years, 17 men and 13 women received 3 cloves of garlic per day (about 10 grams) for 1 month. Subjects are not allowed to take antihypertensive drugs. There was an average reduction of systolic blood pressure of 9.52%, and for an average diastolic blood pressure of 10.42%. That garlic does not have a significant decrease in blood pressure, but can be used as part of a diet as a strategy for managing hypertension. For comparison, fresh garlic cloves (2 grams) contain 5-9 grams of allicin. The difference in garlic preparations has different effects of lowering blood pressure, namely those that contain little allicin as in boiled garlic or garlic extract, the effect of lowering blood pressure is more minimal. Based on the description above, the author is interested in conducting research on the effect of consumption of garlic (Allium Sativum Linn) on reducing cholesterol levels in the blood in hypercholesterolemia patients in Babat Jerawat Village, Pakal Benowo Surabaya.
2 Research Methods

This study uses a Pre-Experimental design with One group pre post test design approach. The population in this study were all hypercholesterolemia patients in Babat Jerawat Village as many as 20 sufferers. Sampling in this study uses Nonprobability sampling by Purposive sampling.

a. Inclusion criteria
   1. More than 40 years old.
   2. Have cholesterol > 200mg / dL

b. Exclusion criteria
   1. Take anti-cholesterol drugs
   2. Pain related to cholesterol: SH, Hepatoma

c. Drop out criteria
   Respondents who forgot to consume garlic.

Sample: Some patients with hypercholesterolemia in Kampung Babat Jerawat fit the inclusion criteria as many as 14 patients.

Data Processing Stage

a. Editing: The activities of the researcher in editing include checking the correctness of the data obtained.

b. Coding: Classifying observations into categories by giving numeric marks or codes to each result to facilitate data processing.

1) The code for the variable consumption of garlic is:
   Code 1: Do not regularly consume garlic if you do not consume garlic 2x1 in the morning and evening for 14 days.
Code 2: Regularly consume garlic if you consume garlic 2x1 in the morning and evening for 14 days.

2) Giving code on the variable of decreasing cholesterol level in blood is:
   Code 1: Stay and there is an increase in cholesterol levels in the blood.
   Code 2: No decrease in cholesterol levels in the blood.
   Code 3: There is a decrease in cholesterol levels in the blood.

c. Processing: After all are observed and obtain valid data, the next step is to process the data so that it can be analyzed. Data processing is then carried out by entering data from the observation sheet to the computer data package. The computer program package used for data entry is the SPSS 20 for Windows program.

d. Cleaning: Researcher's activities in Cleaning include re-checking the data that has been entered whether there is an error or not.

e. Tabulation: the process of compiling data into a table. At this stage the data that has been considered has been processed so that it must be immediately arranged into the place that has been designed.

3 Result and Discussion

3.1 General Data

3.1.1 Characteristics of respondents based on age

Table 1. Frequency distribution of respondents by age on the subject of consumption of garlic in Babat Jerawat Village, Pakal Benowo Surabaya.

| No | Age (Years) | Frequency (n) | Percentage (%) |
|----|-------------|---------------|----------------|
| 1  | 36-45       | 3             | 21.4           |
| 2  | 46-55       | 5             | 35.7           |
| 3  | 56-65       | 6             | 42.9           |
| total |          | 14           | 100            |

Source: Primary data, February 2017

Table 1 shows that of the 14 respondents almost half (42.9%) of respondents were at the age of 56-65 years.

3.1.2 Characteristics of respondents by sex.

Table 2. Frequency distribution of respondents based on sex on the subject of consumption of garlic in Babat Jerawat Village, Pakal Benowo Surabaya.

| No | Gender | Frequency (n) | Subject | Percentage (%) |
|----|--------|---------------|---------|----------------|
| 1  | Man    | 7             | 50,0    |
| 2  | Woman  | 7             | 50,0    |
| total |       | 14           | 100     |

Source: Primary data, February 2017

Based on table 2 shows that of the 14 respondents 7 people (50%) were male and of 7 people (50%) were female.
3.1.3 Characteristics of respondents based on education level

Table 3. Frequency distribution of respondents based on the level of education on the subject of consumption of garlic in Babat Jerawat Village, Pakal Benowo Surabaya.

| No. | level of education          | Subject Frequency (n) | Percentage (%) |
|-----|----------------------------|-----------------------|----------------|
| 1.  | Haven't Graduated          | 9                     | 64.3           |
| 2.  | Basic Education            | 4                     | 28.6           |
| 3.  | Middle Education           | 1                     | 7.1            |
| 4.  | Higher Education           | 0                     | 0              |
| Total|                            | 14                    | 100            |

Source: Primary data, February 2017

Table 3 shows that of the 14 respondents most (64.3%) of the respondents had not finished elementary school.

3.1.4 Characteristics of respondents based on family history of cholesterol

Table 4. Frequency distribution of respondents based on family history of cholesterol in the subject of consumption of garlic in Babat Jerawat Village, Pakal Benowo Surabaya.

| No. | Family history of cholesterol | Subject Frequency (n) | Percentage (%) |
|-----|--------------------------------|-----------------------|----------------|
| 1   | Yes                            | 2                     | 14.3           |
| 2   | No                             | 12                    | 85.7           |
| Total|                               | 14                    | 100            |

Source: Primary data, February 2017

Table 4 shows that of the 14 respondents almost all (85.7%) there was no family history of cholesterol.

3.1.5 Characteristics of respondents based on smoking habits

Table 5. Frequency distribution of respondents based on smoking habits on the subject of consumption of garlic in Babat Jerawat Village, Pakal Benowo Surabaya.

| No. | Smoking habit | Subject Frequency (n) | Percentage (%) |
|-----|---------------|-----------------------|----------------|
| 1   | Yes           | 6                     | 42.9           |
| 2   | no            | 8                     | 57.1           |
| Total|               | 14                    | 100            |

Source: Primary data, February 2017

In table 5 shows that of the 14 respondents most (57.1%) respondents did not have a smoking habit.

3.2 Special Data

3.2.1 Cholesterol levels in the blood of random respondents with hypercholesterolemia before consuming garlic.

Table 6 Results of examination of cholesterol levels before consumption of garlic in Babat Jerawat Village, Pakal Benowo Surabaya.

| No. | Cholesterol levels before consuming garlic | Subject Frequency (n) | Percentage (%) |
|-----|--------------------------------------------|-----------------------|----------------|
| 1   | <200 mg/dL (Which are expected)            | 0                     | 0              |
| 2   | >200-239 mg/dL (High Limit)                | 7                     | 50.0           |
| 3   | >240 mg/dL (High)                          | 14                    | 100            |

Source: Primary Data, February 2017
In table 6 shows that the average results of examination of cholesterol levels in random blood 14 sufferers (respondents) hiperkolesterol in Babat Jerawat Villag, Benowo Surabaya before consuming garlic setangah (50%) are in the high limit category >200-239 mg / dL and half (50%) are in the high category ≥240 mg / dL.

3.2.2 Cholesterol levels in random blood of respondents with hypercholesterol cholesterol after consuming garlic.

Table 7. Results of examination of cholesterol levels after consumption of garlic in Babat Jerawat Village Pakal Benowo Surabaya

| No. | Cholesterol levels After consuming garlic | Frequency (n) | Percentage (%) |
|-----|------------------------------------------|---------------|----------------|
| 1.  | <200 mg/dL (Which are expected)          | 7             | 50.0           |
| 2.  | >200-239 mg/dL (High Limit)              | 3             | 21.4           |
| 3.  | >240 mg/dL (High)                        | 4             | 28.6           |
| 4.  | Jumlah                                   | 14            | 100            |

Source: Primary Data, February 2017

In table 7 shows that the average results of examination of cholesterol levels in random blood 14 patients (respondents) hiperkolesterol in Kampung Babat Jeral Pakal Benowo Surabaya, after consumption of half garlic (50%) are in the expected category ≤ 200mg / dL.

3.2.3 Differences in cholesterol levels in the blood of respondents before and after consuming garlic.

Table 8 Analyze the results of cholesterol level examination before and after consumption of garlic in Babat Jerawat Village, Pakal Benowo Surabaya

| No. | Difference decreases cholesterol levels before and after (mg/dL) | Frequency (n) | Percentage (%) |
|-----|-----------------------------------------------------------------|---------------|----------------|
| 1.  | 3-10 mg/dL (Low)                                                | 3             | 21.4           |
| 2.  | 11-50 mg/dL (standart)                                          | 8             | 57.1           |
| 3.  | >50 mg/dL (High)                                                | 3             | 21.4           |
|     | Total                                                           | 14            | 100            |

Source: Primary Data, February 2017

Table 8 shows that of the 14 sufferers (respondents) most (57.1%) experienced a decrease in cholesterol levels in the blood after consuming garlic. Results that can be used using the Wilcoxon Signed Ranks Test have a probability value = 0.001. Therefore \( p < \alpha (0.001 < 0.05) \) then \( H_0 \) is rejected and \( H_1 \) is accepted, which means that there is an influence of consumption of garlic (Allium sativum linn) on cholesterol levels in blood in hypercholesterol patients in Babat Jerawat Village, Pakal Surabaya. This means that cholesterol levels in the blood of 14 respondents before and after consumption of garlic are different (post test is lower than pre test) which means that consumption of garlic has significantly reduced blood cholesterol levels significantly.

3.3 Cholesterol levels before (pre test) consumption of garlic.

The results of the study in table 4.6 show that of the 14 respondents before consumption of garlic half (50%) of respondents cholesterol levels in random blood are in the high category ≥240 mg / dL. High cholesterol levels can cause more serious complications or diseases, the increase in cholesterol levels in the blood can be caused by several factors. One factor that can cause an increase in high cholesterol levels is food and a lack of maximum physical activity (exercise). Excessive food intake and not balanced with balanced physical activity will cause fat deposits in the blood so that it can inhibit the
metabolism of cholesterol breakdown in fat cells which releases fatty acids and glycerol into the bloodstream which accumulates which results in high cholesterol levels in the process of making cholesterol, because of the inhibitory process in cholesterol synthesis. This is in accordance with the theory of Manan, El (2011) excessive cholesterol levels in the blood (hypercholesterolemia) can cause deposits of fat that attach to the walls of blood vessels, form clots and plaques that clog arteries, and ultimately break the blood flow to the heart can cause a heart attack, or even inhibit blood circulation to the brain (arteriosclerosis) which will trigger a stroke.

Based on Table 5.1 shows that of the 14 respondents nearly half (42.9%) of respondents aged 56-65 years (final elderly), this is due to the age of 56-65 years (late elderly) are very at risk of developing high cholesterol, because the body is unable to produce hormones to the maximum and because of the aging process that occurs so that the body's metabolism is no longer able to break down cholesterol properly. Based on table 5.2 shows that of the 14 half respondents (50%) were female. From the observations of each respondent when asked, the 7 respondents who were female were more likely to experience stress because they tended to overestimate a problem. According to Rusilanti (2014) stress will increase cholesterol levels in the blood. Therefore, the ability to control stress is needed. While from 14 respondents almost half (42.9%) had smoking habits based on the results of the questionnaire characteristics of respondents, this is shown in table 5.5. Smoking can damage the walls of the blood vessels so that damaged walls can facilitate directional fat sticking to HDL cholesterol which helps reduce the accumulation of LDL cholesterol in the blood vessels levels will decrease if someone smokes, consequently the chance of LDL cholesterol accumulation in the blood vessels increasingly big. The accumulation that continues to occur forms plaque on the blood cavity ducts that are getting bigger so that the risk to body health is getting higher. According to Rusilanti (2014) smoking can increase LDL cholesterol levels and suppress HDL cholesterol. High levels of nicotine in the blood can also lead to abnormalities in blood vessels that affect health problems. The analysis of this researcher is only by observing and analyzing based on the questions to each respondent and the results of the questionnaire characteristics of the respondents, but does not relate the stress factors and smoking in the statistical test.

3.4 Cholesterol levels after (post test) consumption of garlic.
Based on table 4.7, it shows that of the 14 respondents who have high cholesterol (hypercholesterolemia) consumption of garlic in Surabaya Benowo Acne Claw Village, half (50%) of respondents cholesterol levels in random blood are in the expected category ≤200 mg / dL. At the time of giving garlic consumption the researcher made observations with 2 days to meet the respondent, namely on the second day, day 4, day 6, day 8, day 10, day 12, and day to day 14 but researchers did not check cholesterol levels, researchers only observed by measuring blood pressure, response, and checking the willingness of garlic provided by the researchers. One of the contents of garlic is the substance allicin and allin which will be broken down into many smaller substances to help bind compounds for cholesterol biosynthesis so that cholesterol levels decrease in the blood. This is in accordance with the theory of Handayani (2006) the mechanism of action of garlic is to inhibit the dependence of concentrations of cholesterol biosynthesis on several different stages of the enzyme (14-alpha-demethylase, HMG CoA reductase). The theory is supported by Sunarto & Susetyo (1995) in Priskilia, Maria (2008) which states that there are other compounds such as dialilil-disulfide (DADS) that have an allyl chain which will easily be reduced to a saturated propyl chain, thereby reducing NADH and NADPH which are important for the synthesis of triglycerides and cholesterol. Allicin also has a SH group binding characteristic, namely a functional part of Ko-A which is needed for cholesterol biosynthesis.

3.5 Analyzing the differences in cholesterol levels before (pre test) and after (post test) consumption of garlic.
Based on table 4.8 shows the difference in the pre and post test of 14 respondents consumption of garlic changes in half (50%) to 7 respondents cholesterol levels in random blood are in the expected category ≤200 mg / dL. Difference from the results of measuring cholesterol levels in the blood before and after consuming garlic. From the results of further analysis using the Wilcoxon Signed Ranks
Test, the probability value is 0.001 because \( \rho < \alpha (0.001 < 0.05) \), \( H_0 \) is rejected and \( H_1 \) is accepted, which means there is an influence of consumption of garlic (Allium sativum linn) in reducing cholesterol levels blood in the hypercholesterolemia sufferer in the Benowo Acne Pakal Village in Surabaya. The decline can be seen in table 5.9 which shows a small percentage (21.4%) of respondents who experienced a very extreme reduction in cholesterol levels of mg50 mg/dL, after observing these respondents states that they already have the habit of consuming garlic before doing research.

The content of garlic, which is the substance allicin and allin, is present in many garlic which is broken down into smaller substances to help bind compounds for cholesterol biosynthesis so that cholesterol levels decrease in the blood. The above is supported by Khoir's theory, Ahmad Kanzul (2015) which states that Allicin and thiosulfimates substances immediately break down into other compounds such as diallyl sulfide (DAS), diallyl disulfide (DADS), diallyl trisulfide (DAT), dithiins and ajoene. And supported by Sunarto & Susetyo (1995) in Priskilia, Maria (2008) which states that Allicin also has a binding character of SH group, which is a functional part of Ko-A needed for cholesterol biosynthesis.

4 Conclusion

a. Hyperkolesterol sufferers before consuming garlic in the Babat Jerawat Village, Pakal Benowo Surabaya in half (50%) are in the high category 40240 mg/dL.

b. Patients with hypercholesterol after consuming garlic lower than before consuming garlic in Babat Jerawat Village Pakal Benowo Surabaya after consuming half garlic (50%) are in the expected category ≤ 200mg/dL.

c. There is an influence of consumption of garlic (Allium sativum linn) on reducing cholesterol levels in blood in hypercholesterolemia patients in Babat Jerawat Village Benowo Surabaya.

Suggestion

a. For Nurses: Nurses can recommend the preparation of consumption of garlic with a dose of @ ± 4gram (2x1 a day) as a complementary therapy in patients with hypercholesterolemia.

b. For people with hypercholesterol. Hypercholesterol sufferers are expected to consume garlic as an anti-cholesterol treatment, maintain diet and behavior in maintaining health, and check blood cholesterol levels at least once a month.

c. For Further Researchers. It is expected that further research can better control the behavior and lifestyle of respondents.

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