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The effect of giving black garlic on decreasing blood pressure and cholesterol in postpartum mothers

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Abstract
Background: Black garlic is obtained from fresh garlic (Allium sativum L.) that has been fermented for 80-90 daysthe best period of time and the fermentation compound chemical in garlic changes to new chemicals, such as S-allyl cysteine (SAC), S-allylmercapto-cysteine, and arginine.It is such a pharmacological activity which contains antioxidant, anti-cancer, hepatoprotective, can improve the immune system, reduce hyperglycemia, dyslipidemia, and anti-allergic.
Objective: To determine the results of a review of the effect of giving black garlic on decreasing blood pressure and cholesterol in postpartum mothers with hypertension.
Method: Systematic Literature Review look for previous research studies on electronic data bases (Pubmed, Cochrance Library, Crossreff, Science Direct, Emerald, Nature, Medline, Hindawi, John Wiley, Microsoft Academic, Garuda, Scopus, WoS (Web of Science) Clarivate, dan Google Scholar) with criteria research Randomized controlled trial, experiment, dan quasy experiment has been published in 2015-2021 and internationally indexed by Scopus Q1, Q2, Q3 and Q4. Data analysis used PRISMA protocol with population were 50 and sample were 6 articles.
Results: Analysis of black garlic data can reduce blood pressure and cholesterol in post-partum mothers compared to placebo. This was evidenced by the more effect size value on black garlic (black garlic) compared to placebo. Data from 28 articles from the international journal Scopus ranked Q1 was 1 articles, Q2 was 1 articles, Q3 were 2 articles, and 2 articles not indexed by Scopus with discussion the effect of black garlic on blood pressure and cholesterol in post-partum mothers with hypertension with dose of 12.3-2.400 mg per day for 2-24 weeks reduced the mean systolic blood pressure of 23.21 mmHg and diastolic 7.22 mmHg and reduced total serum cholesterol by 17 +/- 6 mg/dL and lipoprotein cholesterol. low density (LDL) of 9 +/- 6 mg/dL.
Conclusion: Black garlic can reduce blood pressure and cholesterol post-partum motherswith hypertension.

Keywords: black garlic, blood pressure, cholesterol, post-partum mothers, hypertension

Introduction

Maternal mortality is one of the health problems that must be a concern for the world community. The three main causes of maternal death are still dominated by hypertension, bleeding, and infection. Hypertension or high blood pressure is a systolic pressure of more than 140 mmHg and a diastolic blood pressure of more than 90 mmHg [1]. Hypertension is a multifactorial disease that arises due to the interaction of various factors. Hypertension is one of the most dangerous causes of bleeding and infection [2].

Post-partum hypertension plays a major role in perinatal morbidity and mortality. Mothers who develop hypertension in the postpartum after up to two thirds are diagnosed with preeclampsia and eclampsia. Postpartum hypertension is a rare condition that occurs when a mother has high blood pressure and excess protein in the urine immediately after giving birth [4].

World Health Organization (WHO) in 2015, explained that mothers died due to complications of pregnancy, childbirth and postpartum throughout the world [5]. The 99% ratio occurs in developing countries with 450 maternal deaths per 100,000 live births. The maternal mortality rate in developing countries is caused by hypertension 16%, this figure is higher than 13% bleeding, 8% abortion, and 2% infection [5].

Based on the Indonesian Demographic and Health Survey (IDHS) in 2015, the maternal mortality rate was still high at 305 per 100,000 [1] global MDGs (Millennium Development Goals) is to reduce the Maternal Mortality Rate (MMR) to 102 per 100,000 in 2017. This figure is still quite high when compared to neighboring countries. The slow process of reducing the MMR is due to the high level of poverty so that it is very influential in the health sector [6].

Reports received by the public health Office of Central Java Province from the City Health Office in 2015 were 619 (MMR of 111.16 per 100,000 live births), while in 2016 the number of maternal deaths decreased again although slightly, namely 602 cases (MMR of 109.65 per 100,000 live births) [7].

The city of Semarang, which is the capital of Central Java Province, has a MMR which tends to increase. In 2014 AKI again increased by 33 cases and until the end of 2015 the increase in AKI was recorded at 35 cases [7]. Temporary data on maternal mortality until the end of 2017 there was a decline in MMR in the city of Semarang, namely 23 cases. The maternal mortality rate in Pati district in 2017 was 15 MMR and 8 of them (53.3%) were caused by PEB and post-partum eclampsia. In 2018 there were 11 MMR and 6 of them (54.6%) were caused by PEB and post-partum eclampsia. In 2019 there were 8 AKI and 4 of them (50%) were caused by PEB and postpartum eclampsia**.** In 2020 until June there were 7 MMR and 6 (86.2%) of them were caused by PEB and postpartum eclampsia**.** Based on the calculation of the number of cases of AKI is still relatively high, Pati Regency is ranked 5th of the maternal mortality ranking based on temporary data on maternal mortality in Central Java Province until the end of 2017 [8]. The prevalence of maternal mortality in Pati Regency is 60% caused by preeclampsia or hypertension. in postpartum mothers. The determinants that affect maternal mortality in postpartum are preeclampsia or eclampsia and complications of maternal labor with hypertension.

Postpartum or the postpartum period is a critical transition period experienced by mothers, babies, and their families. Postpartum begins after the birth of the placenta and ends when the uterine organs return to their pre-pregnancy state [9]. Postpartum lasts for 40 days after delivery. During postpartum, mothers will experience physiological, psychological, and social adaptations, but not all postpartum mothers can pass postpartum adaptation smoothly.

Theoretical cause of hypertension in postpartum mothers is not known, hypertension in postpartum mothers is still the subject of many studies to understand its etiology and improve detection of its management. Cases of maternal death in Pati Regency caused by hypertension during pregnancy, childbirth and postpartum are supported by several factors, namely the referral system, SpOG response time (<30 minutes), and high risk of hypertension [7]. Maternal and Perinatal Audit Data (AMP) in Pati Regency in 2015 from 35 cases of maternal death, 57.4% could be prevented by standardized management and continuous sub-optimal care [1]. Efforts to reduce maternal mortality have been carried out by the Semarang City government in reducing maternal mortality, namely optimizing the COC (Continue of Care) program through pregnant women classes, mentoring mothers with high risk by health surveillance officers (Gasurkes) [10-11].

Complications of hypertension in postpartum mothers include cerebral hemorrhage, stroke, retinal injury, eye disorders, heart problems, pulmonary oedema, liver necrosis. Researchers also stated that complications of hypertension in postpartum mothers include kidney, kidney failure, and blood vessel damage [12]. To reduce morbidity and mortality in postpartum mothers with hypertension, it is necessary to provide treatment according to government programs and also complementary developments. Handling hypertension in postpartum mothers aims to prevent complications through pharmacological and non-pharmacological treatment [2].

Pharmacological treatment that is often used by health workers is the administration of nifedipine with a target dose of 20 mg in RCTs. Nifedipine is a non-cardio selective antihypertensive drug that has a more dominant beta-blocking action than alpha antagonists. Through the use of nifedipine, blood pressure can be lowered by reducing systemic vascular resistance without significant changes in cardiac output or heart rate, so that the hypotension that occurs is less accompanied by tachycardia effects, but postpartum mothers can experience side effects when taking nifedipine, namely flatulence, constipation, nausea, cough and headache [13]. Administration of nifedipine is well absorbed about 92-98% bound to plasma proteins and the antihypertensive effect will occur in a very rapid onset ranging from 15-30 minutes and can last for approximately 6-12 hours. This drug is excreted by 80% within 24 hours in the form of urine metabolism**.**

The use of alternative drugs needs to be considered considering the side effects that can be caused by consuming nifedipine, one of which is non-pharmacological treatment using black garlic [15]. One of the preventive measures to lower blood pressure is to consume black garlic. The results of Saila's research prove that black garlic has a daily intake of 1,400-1,600 mg of allicin compounds. The average allicin content in one black garlic is about 500 mg, so black garlic has a high allicin content to help reduce and lower blood pressure. The allicin content in black garlic can dilate blood vessels and inhibit rennin secretion. Allicin is also needed to normalize the heart rhythm and help circulate oxygen to the brain so that metabolism in the body is not disturbed.

One of the factors that trigger hypertension is atherosclerosis which causes arterial damage. Atherosclerosis occurs due to oxidative stress and can be prevented by antioxidants. Antioxidants can be obtained from black garlic (Black Garlic). Black garlic is a natural alternative treatment for hypertension. Black garlic is garlic (Allium sativum) which is fermented into black garlic, contains levels of organosulfur compounds and antioxidants, but the unpleasant smell of black garlic makes people reluctant to consume it [17-19]. Andrianti's research has proven that postpartum maternal hypertension sufferers who consume 1 capsule of black garlic daily experience a decrease in blood pressure of up to 10% in one week. This can happen because the very high allicin content in black garlic will increase the concentration in the intracellular so that it draws fluid from the extracellular part and sodium. In intracellular fluid retention occurs which results in increased excretion of sodium in the urine and can cause blood pressure [16]. The antioxidant activity for the polyphenol content of black garlic extract was 7 times higher than that of fresh garlic extract [21].

The most important thing in black garlic related to blood pressure is allicin which is contained in high amounts. When breastfeeding a baby, it is expected that more fluids are needed to produce milk every day. This increase in fluid requirements is followed by an increase in the need for allicin to help maintain fluid balance in the body. In addition, allicin also plays a role in the work of the nervous system and muscle contraction [22]. Nurul's research proved that by consuming allicin, the average arterial blood pressure in albino rats decreased. So that a

lot of allicin will increase its concentration in the intracellular fluid, tend to attract fluid from the extracellular part and can lower blood pressure [23]. Allicin is a chemical compound that plays a role in maintaining the normal function of the muscles, heart, and nervous system. Allicin is a major regulator of blood vessels.

Black garlic can lower cholesterol levels [24-30]. Black garlic contains the compound allicin which can also lower cholesterol levels. Cholesterol levels in the blood is a serious problem because it is one of the risk factors for various non-communicable diseases such as coronary heart disease, diabetes mellitus, atherosclerosis (narrowing of blood vessels), stroke, and high blood pressure or hypertension [32, 33]. Cholesterol is a modifiable risk factor for hypertension. Higher the total cholesterol level, the higher the possibility of hypertension [35]. Irhamna's research has proven that the allicin content in black garlic can reduce systolic pressure up to 18.44 mmHg and diastolic pressure by 14.23 mmHg. The mechanism is that allicin will break down fat and will reduce the amount of fat attached to the arteries thereby reducing the development of plaque which can cause the arteries to become hard and clogged, thus allowing blood flow to be smoother when passing through the arteries and increasing the elasticity of the arteries [36].

In Indonesia, black garlic is very easy to find. It doesn't taste bitter, doesn't have a pungent smell, is reasonably priced, and has many health benefits, making black garlic one of the most popular therapies for all people compared to garlic [37]. Black garlic is widely circulated in the community, it is claimed to reduce blood pressure and cholesterol levels, but there has been no scientific research on postpartum mothers with hypertension, therefore researchers want to prove this to the public. So that people understand more about the benefits of black garlic.

Achievements in reducing hypertension in postpartum mothers are still not as expected. Therefore, innovation in reducing hypertension in postpartum mothers is necessary to improve service quality. It is necessary to conduct a systematic study of literature reviewing the results of research on the use of black garlic in lowering blood pressure and cholesterol levels in postpartum mothers, so this research needs to be carried out as additional knowledge and new findings to the community that the content contained in black garlic plays an active role in the process of increasing allicin and can keep the walls of the arteries to remain elastic and optimize their function so that they are not easily damaged due to high blood pressure. Researchers hope that the results of this study can contribute to efforts to improve the quality of health services in Indonesia and in developing countries, especially in the COC (Continue of Care) program [38].

Based on the description above, it is so important to lower blood pressure because allicin is lacking. Researchers are interested in conducting research on "The Effect of Giving Black Garlic (Black Garlic) to Lowering Blood Pressure and Cholesterol in Post-partum Mothers (A Systematic Literature Review)".

Material and Methods

Design

Method used in this study is the Systematic Literature Review method. The steps in implementing a systematic review are very well planned and structured so that this method is very different from the method which is just to convey literature studies.

Database

The data used to search the literature is through selection based on research criteria regarding the effect of giving black garlic (black garlic) to reducing blood pressure and cholesterol in postpartum mothers. Next, apply a review of the literature related to black garlic (black garlic), blood pressure, cholesterol and postpartum mothers. Articles were searched by collecting and analyzing 50 journals from various database sources such as Garuda, Scopus, WoS (Web of Science) Clarivate, and Google Scholar. This literature search was determined within the last five years, from 2015 to 2020.

Keywords

The criteria and keywords used for the literature search were black garlic, black garlic, hypertension, hypertension, blood pressure, blood pressure, cholesterol, cholesterol, mother. Postpartum, and postpartum mothers were added to the search data to examine current articles related to black garlic, blood pressure, hypertension, cholesterol, and postpartum mothers.

Inclusion and Exclusion Criteria

Table 1: List of criteria in literature review articles

No	Inclusion	Exclusion
1	Research reports, journal articles, conference articles, and proceedings	Duplicate journal articles
2	*In vivo* studies in	foreign languages (other than English)
3	Qualitative studies	Incomplete journal articles
4	Quantitative	
5	studies Cross-sectional, case controls, cohorts, Randomized Control Trials(RCTs), clinical trials, or other intervention designs	

PICO Process

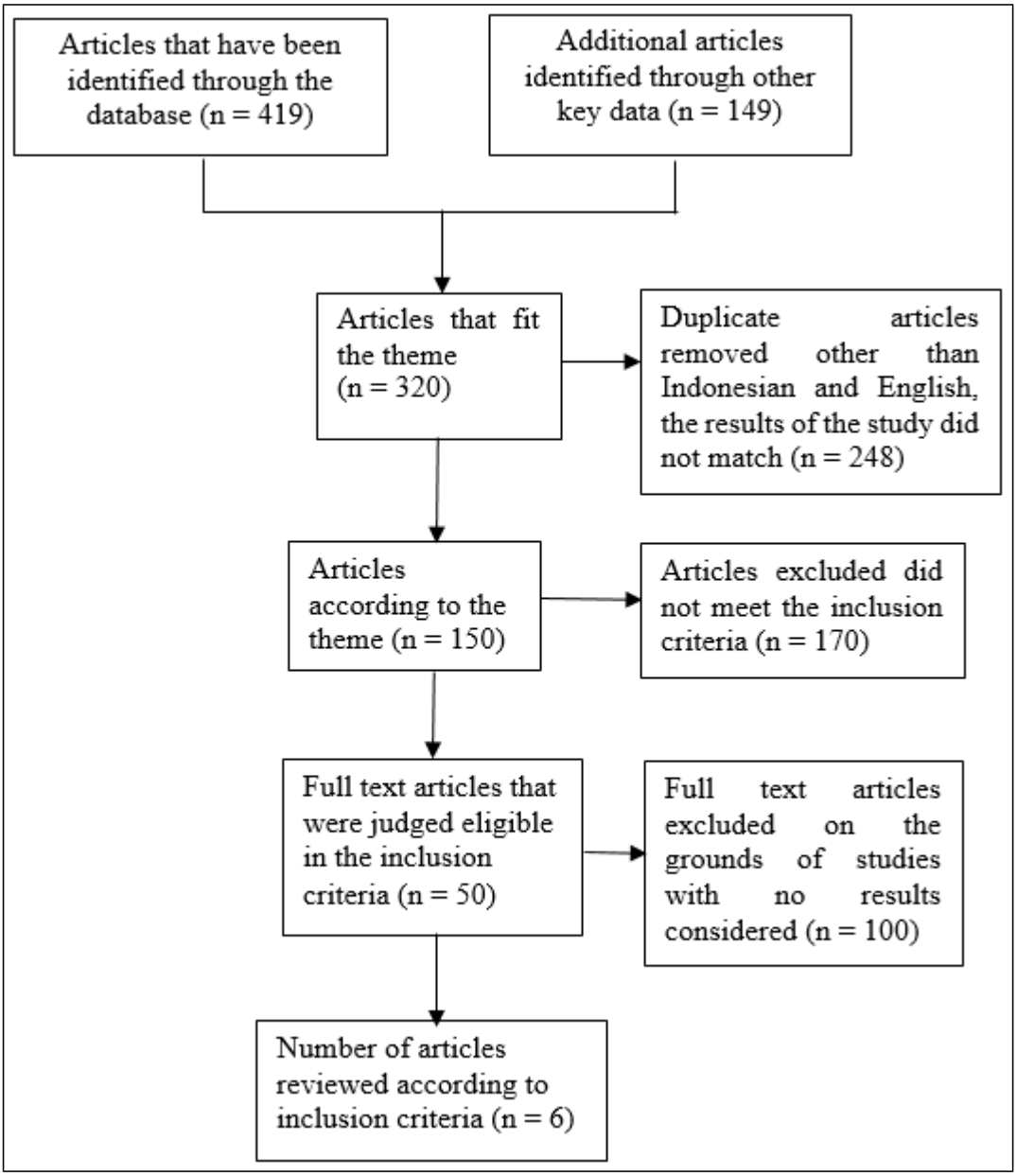

Fig 1: Literature search flowchart

Results

From 6 studies that met the criteria for this systematic literature review, the results obtained are 5 studies using a randomized controlled trial and 1 study using a quasi-experimental. The results of the study were grouped according to the specified variable, namely the black garlic intervention.

A total of 6 studies involved postpartum mothers with black garlic. There are 2 studies (33.3%) in Iran, 1 study (16.7%) in Indonesia, 1 study (16.7%) conducted in China, 1 study (16.7%) conducted in Turkey, and 1 study (16.7%) were conducted in Pakistan. There are 1 Quartile 1 journal, 1 Quartile 2 journal, 2 Quartile 3 journals, and 2 international journals. Respondents in this study are multi-regional. All respondents are postpartum mothers and pregnant women with hypertension. Based on 6 research studies of hypertension and high blood pressure, and similar interventions.

Discussion

Black Garlic (Black Garlic) as an Alternative Medicine for Lowering Blood Pressure in Postpartum Mothers with Hypertension

Several results of a systematic review of articles on black garlic show that there is an effect of black garlic on reducing blood pressure in postpartum mothers with hypertension. There was a significant difference between the two groups (P = 0.029). The prevalence of preeclampsia was 1 (1%) in the intervention group and 5 (5.2%) in the control group [39]. The black garlic extract pills caused a decrease in diastolic blood pressure at 4 and 8 weeks after the intervention (P = 0.041), compared to the control group. The results showed that black garlic

pills could lower diastolic blood pressure [40]. The deviation of blood pressure from the mean pre-post intervention scores of the 2 groups indicated the first systolic measurement and the third diastolic measurement. Systolic and diastolic blood pressure showed a p value of 0.000. The mean total blood pressure in the systolic group was 23.21 mmHg with a p value of 0.000. His diastolic was 7.22 mmHg with a p-value of 0.016. Conclusions and recommendations there is an effect of black garlic extract on blood pressure [41].

The results showed that all supplements significantly ($p < 0.05$) had a significant effect on the patient's systolic blood pressure. Among the supplements, black garlic powder had the highest effect on patients' blood pressure, which increased with the consumption of black garlic powder supplements [42].

Black garlic has an effect on maternal blood pressure postpartum hypertension caused by the dose and duration of administration. Aged black garlic, raw black garlic, garlic powder, aged black garlic extract, or black garlic oil all help lower blood pressure. The effective dose ranges from 12.3-2,400 mg per day for 2-24 weeks, depending on the form taken [43-46]. Most studies reporting blood pressure-lowering effects have provided the following recommended dosage and duration of administration [43-46]

a. 188 mg of black garlic powder containing egg yolk per day for 12 weeks.
b. 400 mg of raw black garlic per day for 6 months.
c. 240–2,400 mg of aged black garlic extract per day for 2–23 weeks

Allicin, the main active compound in black garlic, is thought to play a major role in lowering blood pressure in black garlic. Allicin can prevent the production of angiotensin II, the compound responsible for increasing blood pressure by causing blood vessels to stiffen or contract. By preventing the production of angiotensin II, the effect of allicin makes it easier for blood to flow freely, which in turn lowers blood pressure. hydrogen sulfide and nitric oxide, two compounds important for regulating blood pressure levels. In addition, the anti-inflammatory and antioxidant properties of black garlic can further contribute to reducing or preventing the rise in blood pressure levels [47-51].

Black garlic supplements are very safe. The most commonly reported side effects are garlic breath, taste, or body odor. Abdominal pain is common, gas, reflux, but symptoms are generally mild. Other side effects may include hypersensitivity, headache, dry mouth, cough, hot flushes, thrush, and drowsiness, but are considered rare. Side effects are rare when supplements of black garlic powder or aged black garlic extract are used [45].

Black Garlic (Black Garlic) as an Alternative Medicine for Lowering Cholesterol in Postpartum Mothers with Hypertension

Several results of a systematic review of articles on black garlic show that there is an effect of black garlic on reducing cholesterol in postpartum mothers with hypertension. The results showed that all supplements significantly ($p < 0.05$) had a significant effect on BMI, HDL, total cholesterol, triglycerides, and LDL. Among the supplements, black garlic powder had the highest effect on BMI, TC, LDL and HDL whereas the impact of GP-CSP and CSP was more pronounced on TGL. All parameters decreased with supplementation except HDL, which increased with consumption of black garlic powder supplementation [42].

Administration of black garlic compared with placebo resulted in a decrease in high serum C-reactive protein (hs-CRP) levels (-1425.90 vs 1360.50 ng/mL, $p = 0.01$) and an increase in plasma glutathione (GSH) (+98.10 vs -49.87 mol/l, $p = 0.03$). The conclusion is that consumption of black garlic for 9 weeks in pregnant and postpartum women who are at risk for preeclampsia causes a decrease in hs-CRP and an increase in GSH, but does not affect lipid profile, total antioxidant capacity (TAC) and pregnancy outcome.[52] Lactobacillus bulgaricus increased the ability of black garlic to reduce FBG, 1hBG and 2hBG levels, and the incidence of perinatal complications ($p<0.01$). Plasma MDA levels in the black garlic group were lower than those in the control group, while the levels of SOD, GSH-PX and T-AOC in the black garlic group were higher than those in the control group ($p<0.01$) [53].

The difference in the results of several systematic reviews of articles on black garlic shows that black garlic has an effect on maternal cholesterol in postpartum hypertension caused by the dose and duration of administration. Aged black garlic, raw black garlic, black garlic powder, aged black garlic extract, or black garlic oil all help lower cholesterol in postpartum hypertensive mothers. Black garlic is one of the most well-known supplements for reducing cholesterol. Previous research on black garlic yielded conflicting results, but other studies have shown that it can lower cholesterol. More recent research suggests there is evidence of cholesterol-lowering benefits. Aged black garlic extract reduces blood pressure to a degree comparable to pharmaceutical drugs. Black garlic supplements were effective in reducing total serum cholesterol by 17 +/- 6 mg/dL and Low Density Lipoprotein (LDL) cholesterol by 9 +/- 6 mg/dL in individuals with elevated cholesterol levels (> 200 mg/dL) when taken by mouth. for at least 2 months.

Conclusion

Based on a systematic literature review of 28 articles in journals that have been studied as a whole, it is concluded that black garlicas an alternative medicine reduces blood pressure and cholesterol in postpartum mothers with hypertension.

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