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Utilization of Alkaline Water as An Alternative Complementary Therapy on Triglyceride Levels among Patients with Grade I Hypertension

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Abstract. Cardiovascular disease a non-communicable disease with a high incidence in Indonesia. Non-communicable diseases are increasing every year, especially in Indonesia. An alternative treatment for hypertension with complementary therapy is alkaline water, which can improve triglyceride levels. This study aimed to examine alkaline water's effect as an alternative, complementary medicine on triglyceride levels among patients with hypertension grade I. This research quasi-experimental with a design using pre-test-test and post-test control group design. Data collection involved 40 respondents of phase I hypertension patients, selected through non-probability sampling with a purposive sampling method divided into two groups. The intervention group received therapy, captopril drug, and simvastatin, with the consumption of alkaline water 8.5 doses 1.5 liters per day for 21 days. In contrast, the control group was only assigned medication according to the doctor's prescription and mineral water consumption with normal power of hydrogen (pH). Independent t-test results showed significant differences with the average triglyceride levels p-value 0.000 (<0.05). The intervention group is better at lowering triglyceride levels than the control group seen from the higher difference values. Conclusion in utilizing alkaline water with a pH of 8.5 doses 1.5 liters per day for 21 days effectively reduces triglyceride levels in grade I hypertension patients.

Keyword: Alkaline water, complementary therapy, triglyceride levels, hypertension.

INTRODUCTION

Non-communicable diseases are the diseases that we encounter most often. The World Health Organization says in Southeast Asia reported that five non-communicable conditions with the highest morbidity and mortality rates, namely cardiovascular, cancer, chronic respiratory diseases, diabetes mellitus, and injuries (1-2). The proportion of death causes of non-communicable diseases at the age of fewer than 70 years, with cardiovascular disease by 39% (3-4). Cardiovascular disease is a non-communicable disease with a high incidence in Indonesia. Heart disease (cardiovascular), namely psychological disorders of the working system of the heart and blood vessels, SNH (non-hemorrhagic stroke), congenital heart disease, and heart disease with other conditions (5). Non-communicable diseases that are increasing, especially in Indonesia, are hypertension. Dyslipidemia and hypertension are the main factors of heart and blood vessel disease. Hypertension is the most significant cause of mortality (6-9).

Cholesterol levels and triglyceride levels that continue to increase for a long time can cause thickening of the arteries and risk of narrowing of the arteries (10). The blood vessels work to carry blood to the body's organs when the heart pumps blood. The pressure needed is under the body's process when expressive but will increase when there is a blockage (11). Arterial muscle cells accumulate fat, resulting in lost or reduced elasticity when regulating blood pressure. Narrowing blood vessels causes more challenging heart work to meet the blood supply to all tissues, high blood pressure, or hypertension. Excess cholesterol and fat levels would react to other substances and accumulate in arteries to form plaques and blockages, commonly called atherosclerosis (12).

The prevalence of hyperlipidemia every year is increasing. According to the AHA (American Heart Association), the total cholesterol level ≥of 240 mg/dl in patients with hyperlipidemia is estimated at 13.8 percent of the population of around 31.9 million (13). Data on biomedical risk in 2012, the prevalence of high total cholesterol in Indonesia was 44.9 percent, LDL levels increased by 73.1 percent, and HDL levels decreased by 35 percent (14).

Hypertension and cholesterol usually occur together. The fat accumulated in the blood can cause thickening in artery walls and decreased blood vessels' flexibility. The resulting in blood flow requiring intense pressure so that blood can pass through small blood vessels, in these circumstances resulting in blood circulation barriers and rising blood pressure (15).

Hypertension is systolic blood pressure ≥140 mmHg, and diastolic blood pressure ≥90 mmHg(16). Patients with hypertension who have high pressure for a long time and continuously can cause complications including urological (kidney), cardiovascular disease (heart and blood vessels), neurological disorders (nerve and brain) if they do not get treatment immediately. Patients with hypertension who do not return to the nearest hospital or public health center with a prevalence of 63.8% and non-compliance routinely consume drugs 77.4% (17-18). Controlling hypertension is a significant role of the closest people (family), health workers (doctors, nurses), government, private, and public (19).

The World Health Organization (WHO) states that around 17.5 million deaths are caused by disease heart and blood vessels (cardiovascular). It also said that in 2030 there were approximately 23.3 million people died due to heart and blood vessel disease. The prevalence of hypertension in the world is estimated to occur about 1 billion people and increase every year, along with the dense population growth (5). Increasing the systolic blood pressure from 130 to 140 mmHg is twice the risk of sudden cardiac arrest than people who have normal systolic blood pressure (20).

Basic Health Research in 2018 organized by the Ministry of Health shows the prevalence of hypertension in Indonesia at the age of >18 years (based on blood pressure measurement) is very high, namely 34.71 percent of the total adult population increased rapidly from the basic health research data in 2013 namely, 25.8 percent. The highest prevalence of hypertension in South Kalimantan province is 44.1 percent, while the lowest majority in Papua province is 22.2 percent and Central Java prevalence is 36 percent (21).

Health data from the region of Central Java in 2015, the prevalence of the population at risk of hypertension was 11.03% or 2,807,407 people. The highest incidence of hypertension was in Salatiga District, which was 41.52%, and the lowest was in Banjarnegara District, which was 0.83%. While in the city of Semarang, there were 29,335 cases of hypertension in 2015 (22). While in the working area of the Srondol Public Health Center, visits of hypertensive patients in 2019 amounted to 3,109 cases.

Degenerative diseases occur due to the aging process. There is an essential role in oxidative stress, which can inhibit antioxidants' protection and cause gaps in free radicals or oxidants and antioxidants. Oxidative stress causes tissue damage when a pathogenesis reaction occurs due to ROS exposure (Reactive Oxygen Species). Tissues that can be damaged by ROS are DNA, lipids, and proteins. Antioxidants can maintain tissue from exposure to ROS, thereby avoiding oxidative damage. According to its origin, antioxidants consist of endogenous antioxidants and exogenous antioxidants. Exogenous antioxidants come from outside the body, found in foods and drinks that we usually consume (23-26).

Pharmacological therapy that is often done in hypertensive patients is the use of antihypertensive. A captopril dose of 12.5 mg-100 mg per day is a drug from the group Angiotensin-Converting Enzyme Inhibitor (ACEI). And the class of drug Calcium Canal Bloker (CCB) is amlodipine at a dose of 2.5-10 mg per day. The impact of the use of these drugs is dizziness, headache, cough, diarrhea, tachycardia, increased blood potassium levels (hyperkalemia), and an increase in SGOT / SGPT (19, 27). Drug simvastatin at a dose of 10-20 mg per day has side effects on headaches, muscle/joint pain, constipation, nausea, and insomnia.

Control of non-pharmacological therapy of hypertension sufferers, namely lifestyle changes, therapies including relaxation of breath (28), SEFT (29), Gymnastics (30-32), classical music therapy (33), complementary or herbal medicine and applying the diet DASH (*Dietary Approach to Stop Hypertension*) rich will be potassium, calcium and a low-salt diet (27, 34-35). Non-pharmacological therapy is highly recommended because it minimizes the side effects or effects of drug use. It was also easily found in foods or drinks that we usually consume, easy to do, and makes the body healthier and maintains its resistance (36).

Management of hypertension and the use of antihypertensive drugs are the consumption of Alkaline water. Alkaline water or what we are familiar with alkaline water is alkaline water and usually has a pH ranging from 7-9.5. Alkaline water can also be called ionized water with high redox potential (which is a good antioxidant because the value of Oxidation Reduction Potential is very negative) and has smaller molecules than normal water. Water with a PH of less than seven or acid is not suitable for humans' consumption but can be used for hygiene and caring for the body. In contrast, alkaline water is recommended for consumption and is beneficial for health, including digestive diseases (gastro-intestinal), endocrine (diabetes), cancer, and high blood pressure (hypertension) (37). Another advantage of alkaline water has been recognized in developed countries, namely Japan and Korea. A previous study found that ionized water has benefits such as removing reactive oxygen species, preventing constipation, blocking fat formation in the blood, preventing the body's skin from UV and infrared light, increasing immunity, and improving blood sugar levels (38).

Another study also explained that alkaline water with pH 7-8.1 was 1.5-2 Liters per day for 4-8 weeks could impact expected blood pressure results. For the total cholesterol results, HDL and LDL showed changes at week 4, while at week eight, there were no significant changes. The results obtained have not demonstrated clinically significant effects, but the results were within normal limits (39).

Alkaline water (alkaline water), which has a high pH, proved to change blood viscosity, systolic blood viscosity, and diastolic blood viscosity. This study involved 100 respondents and is divided into two groups. The treatment group received alkaline water with high pH, while the control group received mineral water with normal pH. Significant results were obtained with a p-value of 0.02 (40).

Non-pharmacological therapy that has been carried out with alkaline water (PH), given to white male rats strain Sprague Dawleyat a dose of 0.0284 mg / g BW given for seven days. On the 8th day, an examination showed the effectiveness of reducing cholesterol levels in blood with an average cholesterol level of 157.50 mg/dl. But this research has never been done on humans (41).

OBJECTIVE

This study aims to examine alkaline water's effect as an alternative, complementary therapy on triglyceride levels among patients with hypertension grade I.

METHODS

Quasi-experimental research, pre-test, and post-test with a non-equivalent control group design was applied in this study. Researchers arranged two groups. The intervention group received therapy, captopril drug, and simvastatin with the consumption of alkaline water. In contrast, the control group was only given medication according to the doctor's prescription and mineral water consumption with normal power of hydrogen (pH). Giving complementary therapy alkaline water pH 8.5 is provided for 21 days at a dose of 1.5 liters per day.

Measurement of triglyceride levels by taking vein cubiti blood samples by the health analyst, and then measurements are carried out in the laboratory. Examination of the triglyceride levels of respondents who have hypertension is before (pre-test-test) and after the therapeutic action (post-test).

The population in this research were all grade I hypertension patients in the Srondol Public Health Center Semarang. Determination of the minimum sample size using techniques non-probability sampling with the method of purposive sampling and based on inclusion and exclusion criteria, as many as 40 respondents divided into two groups with 20 respondents. Patients in the intervention group received the therapy captopril drug and simvastatin with alkaline water consumption. Whereas, patients in the control group received the therapy medication according to the doctor's prescription and mineral water consumption with normal power of hydrogen (pH)).

In this study, researchers conducted data collection through observation, identification, interviews, and filling in the observation sheets. The data were analyzed through the IBM SPSS program version 24.0 and continued with different tests, namely parametric and non-parametric tests (Paired t-test and independent t-test). The processed data is used as a basis for discussing statement matters, which are then presented in tabular form so that conclusions can be drawn.

RESULTS

Characteristic of respondents

Table 1 described the characteristic of respondents. The results showed that most of the respondents in both the experimental group (85%) and control group (80%) were more than 50 years. More than half of the experimental group (65%) and control group (60%) were female. Regarding the BMI level, 45% of the experimental group respondents was 18.5 – 24.9, and the control group (60%). Most respondents have cholesterol for less than five years. Whereas respondents in both groups developed hypertension less than ten years

Table 1 Characteristic of respondents

Characteristic of respondents	Intervention group (n=20)		Control group (n=20)		P-value
	N	%	N	%	
Age					
31 – 40 years	1	5	1	5	0.520
41 – 50 years	2	10	3	15	
>50 years	17	85	16	80	
Sex					
Male	7	35	8	40	0.534
Female	13	65	12	60	
Education					
Elementary school	8	40	8	40	0.188
Middle School	8	40	8	40	
High school	4	20	4	20	
BMI					
<18.4	9	45	7	35	0.621
18.5 – 24.9	9	45	12	60	
25 – 29.9	2	10	1	5	
Duration of cholesterolemia					
<5 years	15	75	12	60	0.062
>5 years	5	25	8	40	
Duration of hypertension					
<10 years	15	75	16	80	0.463
>10 years	5	25	4	20	
Physical activity					
Yes	9	45	10	50	0.664
No	11	55	10	50	
Stress					
Yes	9	45	8	40	0.555
No	11	55	12	60	
Smoking					
Yes	7	35	8	40	0.534
No	13	65	12	60	
Total	20	100	20	100	

**Homogeneity Test*

Mean difference of triglyceride levels before and after treatment among the intervention group and control group

Table 2 described the mean difference of triglyceride levels before and after treatment among the intervention and control groups. The results explained a significant mean difference in triglycerides level before (152.65±43.329) and after (123.10±34.224) receiving the treatment among interventions. Whereas the control group before receiving the intervention was 153.95±44.850 and after receiving the intervention was 153.60±38.755.

Table 2. Mean difference of triglyceride levels before and after treatment among the intervention group and control group

Group	Pre-testPre-test Mean ± SD	Post-test Mean ± SD	t	P-value
Intervention	152.65±43.329	123.10±34.224	7.263	0.000
Control	153.95±44.850	153.60±38.755	0.112	0.000

**Paired t-test*

Mean difference of triglyceride levels between the intervention group and control group

Table 3 showed significant differences in triglycerides levels between the intervention group and the control group with a p-value was 0.000 (<0.05). It was indicated that there is a positive effect of the intervention for the intervention group than the control group.

Table 3. Mean difference of triglyceride levels between the intervention group and control group

Variable	Intervention Group	Control Group	Mean Difference	t	P-value
	Mean ± SD	Mean ± SD			
Triglyceride levels	123.10±34.224	153.60±38.755	-30.500	-2.638	0.012
Delta triglyceride levels	-29.55±18.196	-0.35±13.929	-29.200	-5.699	0.000

**Independent t test*

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DISCUSSION

The administration of alkaline water (pH 8.5) as much as 1.5 liters for 21 days for changes in triglyceride levels, observations were made twice, namely at the pre (day 1), and post (day 21)

Results Statistical tests using the Independent T-Test are proven to reduce triglyceride levels. Measuring the value of triglyceride levels between the intervention group and the control group, there was a significant difference (p=0.012) in which the intervention group received drugs with the consumption of alkaline water (pH 8.5) as much as 1.5 liters and the control group received therapy in the form of simvastatin.

The observations results of triglyceride levels for 21 days showed that the mean before treatment was 152.65 mg/dl, and after intervention decreased to be 123.10 mg/dl with a p-value >0.005. While the control group showed, the mean difference was 0.35 mg/dl. Delta reduced triglyceride levels in the intervention group at pre 29.550±18.196 while in the control group 0.350±13.929

. It was indicated that alkaline water (pH water) 8.5 and simvastatin therapy effectively reduced triglyceride levels. In the control group, the treatment received the captopril and simvastatin. In contrast, the intervention group also received an additional pH of 8.5 alkaline water, about 1.5 liters, for 21 days. The results of the examination of triglyceride levels of the average value of respondents in the intervention group were at a lower point than the control group with the average value of final triglyceride levels of 123.10 mg/dl. This study proves that the consumption of simvastatin drugs with a combination of alkaline water decreases triglyceride levels.

In contrast to the study conducted by Kajiyama et al., administering 900 ml/day of hydrogen water pH of 900 ml/day on lipid profiles in patients with impaired glucose tolerance (IGT) (n=36) did not experience a significant decrease in total cholesterol and triglycerides in the week all eight gifts. But it only affects the level of low-density lipoprotein (LDL) cholesterol with a p-value <0.01 [(42).]

Research conducted by Nakao et al. Reported that the effectiveness of giving hydrogen-rich water to lipid profiles in patients with hypertension (n=20) experienced a significant decrease in total cholesterol and triglycerides in administration for four weeks with p values <0.05. The mean different value of total cholesterol in the 4th week of administration was 3.2±0.8. It decreased by -0.2 from the first day or before treatment, while the mean different value for triglycerides in the four weeks of administration was 1.5±0.9 reduced by -0,1 on the first day or before treatment [(39).]

Alkaline water is smooth and has an energy that is also macro that can be absorbed in the body adequately. An alkali also helps the process of filtering acid conditions in the body. Because of the number of electrons in it, alkaline water can make cells destroy free radicals that are harmful to the body (43).

Alkaline water overcomes free radical damage by neutralizing acids in the body. Obesity occurs due to acid levels in the body. Acid levels create fat cells. Fat molecules produced in the body make weight gain. The factor of the increase in cholesterol levels in the body is obesity. Drinking alkaline water can maintain the body's health, maintain ph in the body, and reduce fat storage and accumulation by releasing acids (44).

Oxidative stress is an imbalance between the number of free radicals and the number of antioxidants in the body. Free radicals are extremely reactive and can oxidize molecules such as lipids, proteins, and carbohydrates up to DNA. Antioxidants are very easily oxidized so that antioxidants can inhibit cell damage and protect molecules derived from cells due to reactive oxygen.

Potassium can prevent the release of renin by increasing the excretion of sodium and water. If renin is inhibited, angiotensin, I, and angiotensin II can be formed and will reduce vasoconstriction sensitivity. Potassium and magnesium are also very good in helping the heart's performance where the factor of heart disease is caused by increased cholesterol levels in the blood (45-46).

This study uses simvastatin as anti-hypercholesterolemia drugs. Simvastatin is a statin drug and can reduce blood pressure and is beneficial for cardiovascular disease (47-48).

Statins are a class of cholesterol drugs by inhibiting the enzyme HMG CoA reductase. The enzyme plays an essential role in mevalonate's production process, a component needed in cholesterol biosynthesis. The HMG CoA reductase enzyme's inhibition decreases cholesterol levels by an up-regulation mechanism in LDL receptors to increase plasma cholesterol (49-50).

Simvastatin is a widely used drug to reduce total cholesterol, triglyceride, LDL levels, and increase HDL. Simvastatin performance by inhibiting cholesterol-forming enzymes that cholesterol levels in the blood will be reduced. Also, simvastatin has other properties, namely decreasing coronary heart disease risk, improving blood sugar levels, and stroke risk (48).

Simvastatin has side effects such as indigestion, gastric mucosal irritation, muscle, joint pain, gallstones, and kidney damage if consumed long term (51). Many non-pharmacological treatments have been developed to reduce the side effect of alkaline water consumption (52). Alkaline water is an antioxidant that could fight cholesterol and prevent damage to cells and blood vessel tissue (53).

Consumption of simvastatin drugs and alkaline water does not cause side effects. However, it works side-by-side. Alkaline water is a high antioxidant that can fight cholesterol, prevent cell or tissue damage, and reduce the risk of side effects caused by simvastatin drugs.

CONCLUSION

Based on data processing and analysis of utilization alkaline water as an alternative, complementary therapy, it can be concluded that the average decrease in triglycerides levels in the intervention group with a difference of -29.55 mg/dl more than the average reduction in triglycerides levels in the control group with a difference of -0.35 mg/dl with a p-value 0.000 (<0.05). In conclusion, the intervention group was better at reducing triglycerides levels than the control group.

Provision of alkaline water pH 8.5 much as 1.5 liters can reduce triglyceride levels after being given for 21 days and captopril and simvastatin drugs administration in grade I hypertensive patients.

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