Effectiveness of Consumption *Sechium Edule* on Decreasing Blood Pressure in Elderly with Hypertension in Coastal Area

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Abstract. *Sechium edule* contains flavonoids and potassium to reducing small blood pressure in the elderly with hypertension. The serving of chayote for consumption can be juiced, steamed, and squeezed. However, no research proves from three serving is more effective in reducing the pressure of elderly hypertension. The aims of the study compared from three presentations which is more useful to make blood pressure decrease in elderly with hypertension in coastal area. This study used Pre-Experimental Design with the three-group pre-post-test design. Samples were 51 elderly obtained from purposive sampling. The independent variable was the consumption of *Sechium edule* with the various presentation. The dependent variable was the blood pressure. Based on analysis data used paired t-test with significance p-value ≤ 0.05. The mean of blood pressure in the juiced group before intervention was 156.28 mmHg and after intervention 152.48 mmHg (decrease 3.8 mmHg). The mean of systolic pressure in steamed group before intervention was 154.46 mmHg and after intervention 151.43 mmHg (decrease 3.03 mmHg). The mean of systolic pressure in squeezed group before intervention 152.51 mmHg and after intervention 152.14 mmHg (decrease 0.37 mmHg). The juiced *Sechium edule* was most effective to decrease blood pressure in elderly with hypertension. The nurse can promote to the elderly in the coastal area to make juiced *Sechium edule* as a non-pharmacological intervention for patient with Hypertension.

1. Introduction

Hypertension or high blood pressure is one of the deadliest diseases in the world. In Indonesia hypertension is a disease that affects many Indonesians, especially in the elderly. In 2013, data collected by the Republic of Indonesia Basic Health Research showed that the prevalence of hypertension in Indonesia was 26.5% [1]. High blood pressure can improve cardiovascular disease and have an effect on especially heart health, cerebrovascular disease, kidney failure, retinopathy and neuropathy [2]–[4]. The global cardiovascular disease accounts for around 17 million deaths per year, almost one-third of the total. Of these, 9.4 million deaths per year are a complication of hypertension. Hypertension is responsible for at least 45% of deaths from heart disease and 51% of deaths from stroke [4].

In 2008, around 40% of adults over the age of 25 were diagnosed with hypertension; this number increased from 600 million in 1980 to 1 billion in 2008. Countries which contribute to the highest
prevalence of hypertension are countries with lower income countries, like Africa [4]. In Indonesia, patients with hypertension at age 65-74 years are 57.6% compared to other diseases [5]. Indonesia has a prevalence of hypertensive patients around 26%, the prevalence in East Java province is 26.2% in 2013 and the prevalence in the city of Surabaya reaches 22% [1]. From the a preliminary study conducted by researchers on April 20, 2017, in one district in Surabaya, there were 28 out of 48 elderly people with a mean age of 65 years experiencing hypertension with systolic blood pressure > 160 mmHg and diastolic > 90 mmHg.

The causes of increasing hypertension prevalence are population growth, aging and unhealthy lifestyles such as being overweight, a diet in high fat and salt, lack of activity and alcohol consumption [3], [4]. Some of these causes are modified and non-modified risk factors. One risk factor that can be changed is Diet. Several studies have been conduct on diet modification in hypertensive patients, although until now the results are still controversial. Nutrients in fruits and vegetables are hypothesized to be associated with low blood pressure including the content of them are fiber, potassium, magnesium, folate, vitamin C, and flavonoids. However, the interaction of food content can give different results in blood pressure. In addition, cooking methods or adding fat and seasonings can affect the beneficial effects of vegetables. The one of vegetable fiber sources that can reduce blood pressure is chayote [6], [7].

Hypertension can be caused due to loss of elasticity of the blood vessels which can cause peripheral vascular resistance to increase in blood vessels [8]. Changes that occur in the blood vessels of the elderly cause hypertension. Changes that occur are changes in the structure and function of blood vessels, namely the nature of elasticity of the blood vessels to be reduced and the occurrence of stiffness in the walls of blood vessels so that the dilatation process is disrupted. This shows that blood pressure will increase with age [9], [10]. Hypertension is characterized by a systolic pressure of more than 140 mmHg and diastolic more than or equal to 90 mmHg [11].

Sechium edule (Jacq.) Sw. (Cucurbitaceae) is an endemic plant from Mexico known as chayote. It originated in southern Mexico (the states of Veracruz, Puebla, and Oaxaca) [12]. Chayote is also widely grown in Indonesia. This plant is widely processed by the Indonesian as a vegetable ingredient. In addition, the fruit of this plant is believed to be able to reduce the blood pressure of hypertension sufferers. Indonesian people use chayote into various preparations to help lower blood pressure. Diverse treatment processes can have different effects [13]–[15]. The processing of chayote which is commonly done in Indonesia is steamed, squeezed and taken from the juice and made into juice, but there is no research that shows how to produce the most effective results in lowering blood pressure. This study aims to determine the most effective method of processing squash in reducing blood pressure in elderly hypertensive patients in coastal area. In this study, researchers used three methods of processing chayote, namely juiced, steamed, and extracted / squeezed.

2. Methodology

2.1 Study Design
This study certified in ethical clearance by Faculty of Nursing, Universitas Airlangga with number 452-KEPK. The researcher used an experimental research design with three-group pre-post-test design. We divided sample into three groups, namely Group A, Group B and Group C. Every group received different intervention. Respondents in group A consumed steamed chayote, group B received juiced chayote and group C consumed squeezed chayote.

2.2 Study Population, sampling, and procedure
Population in this study were the elderly who lived in coastal area especially Surabaya, Indonesia. There were 51 respondents; 17 respondents in the group A, B and C. The inclusion criteria were as follows; had systolic above 130 mmHg and/or diastolic more than 80 mmHg, consumed the hypertension’s drugs, no consumed alcohol and no smoked since a year and without diabetic mellitus, renal failure, liver and heart disease. The data collection occurred over a two month period from June
July 2017. The dozes of chayote were 100 grams per once every day. The chayote consumed for 10
days, at least 1 hour after breakfast. On the 11th day, researchers measured the blood pressure of each
respondent.

2.3 Intervention and Measurement
The blood pressure was measured using sphygmomanometer and stethoscope which had been
calibrated. Blood pressure measured every day within 10 days giving chayote, which is 30 minutes
before consuming chayote and 2 hours after consuming chayote. The data will be calculated on
average before and after chayote administration.

The chayote is prepared and delivered by the researcher. The chayote processing method in this study
is based on previous research, namely Steamed Chayote, Juiced Chayote, and Squeezed Chayote [12],
[13], [15]. The following is the method of processing squash:
1. Steamed Chayote
The method for processing steamed Chayote is as follows: 1. Chayote is removed from the sap, peeled
and washed in the water; 2. Then cut and weighed 100 grams; 3. After cutting the Chayote is steamed
for 5 minutes with a temperature of 100°C; 4. Then cooled, after the cold is given to the respondent.

2. Juiced Chayote
The method of processing Juiced Chayote was as follows: 1. Chayote was removed from the sap,
peeled and washed in the water; 2. Then, It was cut and weighed 100 grams; 3. Chayote was blended
with a blender machine and 200 ccs of water are added; 4. Chayote that has been juiced is poured into
a glass and can be consumed directly by the respondent.

3. Squeezed Chayote
Squeezed Chayote processing is as follows: 1. Chayote is removed from the sap, peeled and washed in
the water; 2. Then, cut and weighed 100 grams; 3. Chayote shredded and added 200 ccs of water: 4.
Then squeezed using cloth. The juice collected in a glass and consumed directly by the respondent.

2.4 Data Analysis
Data obtained at pretest and post-test in each group, then the mean of systole and diastole pressure was
calculated before and after chayote consumption. The results are analyzed from the difference of
systole and diastole pressure before and after chayote consumption. The demographic data of
respondents was carried out by descriptive analysis using the distribution table.

3. Result and Discussion
Based on demographic data (table 1) most of the elderly have the age range between 60-69 years,
which is 41 respondents (80.4%). Respondents were mostly female, amounting to 43 respondents
(84.3%) and more than half of the elderly (52.9%) had suffered from hypertension in less than five
years.

| Characteristics          | f | %  |
|--------------------------|---|----|
| Age (years)              |   |    |
| 60-69                    | 41| 80,4|
| 70-79                    |  9| 17,6|
| 80-89                    |  1|  2,0|
| Gender                   |   |    |
| Male                     |  8| 15,7|
| Female                   | 43| 84,3|
| Duration of Hypertension (years) | |    |
| < 5                      | 27| 52,9|
| ≥ 5                      | 24| 47,1|

f = frequency

Based on the data in table 2 it is known that all respondents in the three groups experienced a decrease
in blood pressure both systole and diastole. The decreasing of blood pressure in the three groups was
different. The highest decreasing of blood pressure was in B group. B group was the respondent who consumed Juiced Chayote. The decreasing systole pressure in B Group is 3.81 mmHg. The decreasing diastole pressure is 1.97 mmHg.

Table 2. Blood Pressure Before and After Treatment

| Chayote Serving         | Pre test | Post test | δ          |
|-------------------------|----------|-----------|------------|
|                         | Systolic (mmHg) | Diastolic (mmHg) | Systolic (mmHg) | Diastolic (mmHg) |
| Steamed Chayote (Group A) | 154,46   | 82,12     | 151,43     | 81,63         | -3,04 | -0,49 |
| Juiced Chayote (Group B)  | 156,28   | 83,28     | 152,48     | 81,31         | -3,81 | -1,97 |
| Squeezed Chayote (Group C) | 152,51   | 87,04     | 152,14     | 86,33         | -0,37 | -0,71 |

These results prove that consumption of juiced chayote is the most optimal for lowering blood pressure in elderly hypertension. This is because in the process of serving the juiced chayote it does not reduction in substances or ingredients. Researchers argue that the presentation of juiced chayote is a modification of the cooking process that does not change the composition of the chayote. The juiced chayote is only the process of changing the shape from solid to liquid. Unlike the other serving such as steamed and squeezed chayote. In both types of serving, there is a reduction in substances and ingredients in chayote. The reduction has an effect on optimizing the content of chayote to decrease blood pressure in elderly people with hypertension.

The squeezed chayote experienced a process of material reduction. During the process of serving, 100 grams of chayote grated and then squeezed, will produce two kinds of products namely the essence of chayote which will be consumed by the respondent and the grout discarded. This process causes decreasing the composition of potassium and fiber in chayote, compared to juiced chayote. In a study conducted by Beretta, M.V et al. (2018) note that there is a relationship between increased consumption of fiber and a decrease in blood pressure in diabetics. This type of soluble and insoluble fiber is not related to blood pressure reduction. In this study, one of the fiber sources studied was chayote [16].

The presentation of chayote by steaming can reduce the composition of potassium in chayote. Lewu M.N et al (2010) stated that there was a significant decrease in the content of potassium Colocasia esculenta (L.) schott after the steaming process [17]. These results are also supported by the study of Bethke P.C et al (2008) which states steamed white potatoes (Solanum tuberosum L.) can reduce potassium levels [18]. So, the content of potassium in chayote is not optimal in reducing blood pressure in elderly people with hypertension.

Chayote plants are a type of food, with potential pharmacological activity associated with phytochemical composition. All chayote plants are nutritionally important for the human diet. Although the fruit of S. edule is relatively low in protein, vitamins, fatty acids, and sodium content compared to other vegetables. Unripe fruit has important levels of vitamins such as folic acid, and vitamin C and E. The macronutrient content of the fruit is sufficient, although micronutrients show a low level compared to other cucurbit fruits. This food is a good source of potassium and phosphorus. In addition, chayote has a high calorie and carbohydrate content. However, it contains more crude fibre than sugar. The content of dietary fibre in chayote fruit is similar to other vegetables, but without high-calorie content [6], [7]. In addition, chayote fruit also shows several health benefits as a diuretic, anti-inflammatory and antihypertensive [7]. The mechanism of antihypertensive effects on chayote plants has been identified in a study conducted by Lombardo-Earl, Galia et al. (2014) in rats using chayote root extract. S. edule extract may have Angiotensin II antagonist activity [12].

Limitation of this study was that the researchers did not test the content on every kind chayote serving. It can make the researcher not understand what changes in content were in it. In addition, researchers also did not limit the type and kind of food respondents for 10 days so it will affect the results of blood pressure measurements.

4. Conclusion
This study can conclude that consuming regular juiced chayote is very good for reducing blood pressure without side effects. The nurses and elderly can use this juiced chayote as an alternative food that can help lower blood pressure. In addition, the results of this study can used as a reference to develop other research on the types of foods that can affect the blood pressure.

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