



## Effect of purple sweet potato extract supplement on hypertensive pregnant women

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### ABSTRACT

Hypertension in pregnancy is a cause of maternal morbidity and mortality. Pregnant women with hypertension are given the antihypertensive drug nifedipine but it has side effects on the mother and fetus, so it is necessary to research the supplementation of purple sweet potato extract as a companion to nifedipine. Purple sweet potatoes contain anthocyanins, which act as antioxidants and antihypertensives. The study aimed was to determine the effect of purple sweet potato extract supplement on blood pressure in pregnant women with hypertension. The research design is a quasi-experiment with pre and post-test with control group design. The intervention group (15 respondents) was given supplements of purple sweet potato extract 960 mg per day and 10 mg nifedipine, the control group (15 respondents) was given 10 mg nifedipine. Blood pressure measurements were carried out before and after 14 days of treatment. The sampling technique was randomized sampling. Data analysis used paired sample t-test, independent t-test, Wilcoxon, and Mann Whitney. The results of this study are the average decrease in systolic and diastolic blood pressure in the intervention group was 19.20 mmHg and 13.60 mmHg, the control group was 13.07 mmHg and 6.73 mmHg. There was a significant difference in the mean difference in systolic and diastolic blood pressure between the intervention and control groups (p-value 0.031 and 0.001). Supplements of purple sweet potato extract 960 mg per day and nifedipine 10 mg were effective in reducing the blood pressure of pregnant women with hypertension.

**Keywords:** Hypertension, purple sweet potato, pregnancy

### INTRODUCTION

Hypertension during pregnancy can be classified as systolic blood pressure 140 mmHg and/or diastolic blood pressure 90 mmHg measured twice 4 hours apart on the same arm.<sup>1</sup> Hypertension in pregnancy can be classified into chronic hypertension, gestational hypertension, and pre-eclampsia. Chronic hypertension is hypertension that appears before 20 weeks of gestation. Gestational hypertension is hypertension that appears at gestational age above 20 weeks and is not

accompanied by urine protein. Preeclampsia is hypertension that occurs after 20 weeks of gestation and is accompanied by protein in the urine.<sup>2,3</sup>

In 2016 maternal death became the second cause after HIV/AIDS as a contributor to mortality in women of reproductive age.<sup>4</sup> The main cause of maternal death is bleeding, which is 27.1%, the second is hypertension with 14% and sepsis is 10%.<sup>5</sup> Hypertension during pregnancy affects 5-10% of pregnancies and is a major cause of maternal morbidity and fetal and neonatal mortality. In addition, hypertension in pregnancy is the

most common medical complication in obstetrics.<sup>1</sup> Maternal mortality occurred in pregnant women with gestational age at term with eclampsia by 23.9% and in premature pregnancies by 8.9%.<sup>6</sup>

Hypertension during pregnancy can have an impact on pregnant women and the fetus they contain. Placental abruption, preeclampsia, intracerebral hemorrhage, and hospitalization in health facilities are risks that may be experienced by pregnant women with hypertension, while for the fetus the risks that may be experienced are stunted fetal growth, prematurity, and intrauterine death.<sup>7</sup>

Trophoblast invasion of the uterus is a unique differentiation, but it does not proceed normally. These abnormalities are related to nitric oxide which has a major effect on blood vessels. Arterial resistance in the uterus may increase sensitivity to vasoconstriction and chronic placental ischemia and oxidative stress. In parallel, oxidative stress can increase free radicals, lipid oxidation, cytokines, and vascular endothelial growth factor 1. This abnormality can cause endothelial dysfunction through vascular hyperpermeability, thrombophilia, and hypertension.<sup>8</sup>

Nifedipine is an L-type calcium channel blocker antihypertensive. The administration of nifedipine will reduce the entry of calcium into blood vessel cells due to the blocking of dihydropyridine calcium channels. Calcium channel blockers have antioxidant effects and nifedipine can reduce intracellular ROS production by activating AMPK.<sup>9</sup> Non-pharmacologic therapy is considered safer and more comfortable to do and has minimal side effects so that non-pharmacological treatment can support pharmacological therapy.<sup>10</sup> Non-pharmacological therapy is increased to lower blood pressure.<sup>11</sup>

The issue of back to nature and reducing the use of chemicals has led to an increase in the use of natural ingredients for medicines. Toxic effects and minimal side effects are the reasons for using drugs and herbal formulations.<sup>12</sup> One of the plants that can be used is purple sweet potato. In the 16th century, sweet potatoes began to spread throughout the world, especially in countries with tropical climates. The sweet potato was spread to Asia, especially the Philippines, Japan, and Indonesia by the Spanish.<sup>13</sup> Flavonoid compounds contained in various plants can improve endothelial vascular function. Purple sweet potato tubers contain high anthocyanins which are flavonoids and function as antioxidants both in vivo and in vitro.<sup>14</sup> The purple color of the skin and flesh of purple sweet potatoes is due to the presence of anthocyanin compounds. Sweet potatoes contain a fairly high anthocyanin, which is 110.15 per 100 grams.<sup>15</sup> Anthocyanins are found in various plants and are water-soluble pigments. Anthocyanins are a sub-type of organic compounds from the flavonoid family and are members of polyphenols, a larger group of compounds.<sup>16</sup> Anthocyanins are included in the type of flavonoid that is proven to have benefits as antioxidants, hepatoprotective and antihypertensive. Flavonoids have been shown to reduce blood pressure by increasing the production of NO (Nitric Oxide). NO will decrease when under oxidative stress. How to

increase the NO content is to provide antioxidants so that they can reduce free radicals and avoid oxidative stress. Flavonoids are one of the antioxidants that can increase NO levels.<sup>17</sup>

Based on this background, research on purple sweet potato extract supplementation in pregnant women with hypertension has never been done, therefore researchers are interested in examining the effect of purple sweet potato extract supplementation on blood pressure in pregnant women with hypertension.

## METHODS

This type of research is an experimental quasi-experimental design with a pre-post test design. This research was conducted at the Puskesmas in the Semarang City area in April-May 2021. The population in this study were pregnant women with hypertension in the working area of the Semarang City Health Center. The sample in this study was 15 respondents in the intervention group and 15 respondents in the control group. Sampling using a simple random sampling technique. Inclusion criteria in this study were pregnant women with gestational age  $\geq 20$  weeks, blood pressure  $\geq 140/90$  mmHg -  $\leq 160/110$  mmHg, taking nifedipine, and willing to be respondents. The exclusion criteria were twin pregnancy, hypersensitivity to purple sweet potato, and a history of heart disease, kidney disease, and diabetes mellitus.

The intervention group was given 960 mg purple sweet potato extract and nifedipine for 14 days, while the control group was given nifedipine for 14 days. The process of making purple sweet potato extract is to clean the purple sweet potato, cut the purple sweet potato into thin slices. Then dry the purple sweet potato at a temperature of 50<sup>0</sup> C until dry, then the pollination process is carried out. After that, purple sweet potato powder was put into a simple macerator and 96% ethanol was added as a solvent, then stirred until evenly distributed. The maceration process was carried out for 3 days and was stirred occasionally. After that, a filtration process is carried out to separate the macerate from the filtrate. Then the results of the macerate are carried out by an evaporation process using low temperatures with the help of air flowing over the surface to obtain a thick extract. After that proceed to the process of crystallization and pollination. The last process is to enter the purple sweet potato extract into the capsule.

The measuring instrument used in this study is a digital sphygmomanometer. Blood pressure measurements were carried out before being given the intervention and 14 days after being given the intervention, in the intervention and control groups. The analysis used in univariate analysis in the form of frequency distribution and bivariate analysis using paired sample t-test, Wilcoxon, independent t-test, and Mann Whitney.

Ethical approval in this study was obtained from the Ethics Commission of the Sultan Agung Islamic University Faculty of Medicine with no. 57/III/2021/Commission on Bioethics on March 15,

## RESULTS

**Table 1: Differences in systolic blood pressure before and after treatment in the intervention and control groups**

Variable	Group		P-value
	Intervention	Control	
	Mean±SD	Mean±SD	
Pre	146,87±4,172	148,27±5,431	0,435 <sup>b</sup>
Post	127,67±7,007	135,20±7,370	0,008 <sup>b</sup>
P-value	0,000 <sup>a</sup>	0,000 <sup>a</sup>	
Difference	19,20±7,063	13,07±7,695	0,031 <sup>b</sup>

<sup>a</sup> paired sampel t-test, <sup>b</sup>Independent t-test

Tabel 1. The results showed that there were differences in systolic blood pressure in the intervention and control groups after being given treatment (p-value = 0,000). The decrease in systolic blood pressure in the

intervention group was greater than the control group. Its means there was a significant difference between the difference in systolic blood pressure before and after being given treatment for two weeks (p-value = 0.031).

**Table 2: Differences in Diastolic Blood Pressure Before and After Treatment in the Intervention and Control Group**

Variable	Group		P-value
	Intervention	Control	
	Mean±SD	Mean±SD	
Pre	96,47±3,833	98,87±4,291	0,161 <sup>b</sup>
Post	82,87±3,833	92,13±5,630	0,000 <sup>b</sup>
P-value	0,001 <sup>a</sup>	0,002 <sup>a</sup>	
Difference	13,60 ±5,343	6,73 ±5,189	0,001 <sup>c</sup>

<sup>a</sup> Wilcoxon, <sup>b</sup> Mann whitney, <sup>c</sup> Independent t-test

Tabel 2. The results showed that there were differences in diastolic blood pressure in the intervention and control groups after being given treatment (p-value = 0,001 and p-value = 0,002). The decrease in diastolic blood pressure in the intervention group was greater than the control group. Its means there was a significant difference between the difference in diastolic blood pressure before and after being given treatment for two weeks (p-value = 0.001).

will be maintained as a strong vasoconstrictor by accumulating anthocyanins in endothelial cells and protecting endothelial cells from free radicals.<sup>20</sup>

Consuming foods containing flavonoids regularly for 14 years, especially anthocyanins, flavan-3 flavones can prevent hypertension by up to 8% which is thought to be due to the vasodilating effect of flavonoids.<sup>21</sup> Anthocyanins will protect endothelial cells from the effects of free radicals and balance intracellular and extracellular fluids by accumulating them into endothelial cells with target cell membranes. Then, nitric oxide (NO) will be maintained as a potent vasodilator and endothelin-1 will be reduced. Decreased endothelin-1 will cause blood vessels to experience vasodilation and can lower blood pressure.<sup>22</sup>

Nifedipine is an L-type calcium channel blocker antihypertensive. The administration of nifedipine will reduce the entry of calcium into blood vessel cells due to the blocking of dihydropyridine calcium channels. Oxidative stress and intracellular ROS production are implicated in the pathogenesis of the cardiovascular disease, which causes smooth muscle proliferation. Calcium channel blockers have antioxidant effects and nifedipine can reduce intracellular ROS production by activating AMPK.<sup>9</sup>

Nifedipine can reduce systemic vascular resistance and can increase urine output by increasing renal blood flow and inhibiting the release of antidiuretic hormone, making nifedipine an appropriate drug for use in hypertension in pregnancy.<sup>23</sup>

Previous research conducted on hypertensive patients, namely, giving pomegranate juice containing anthocyanin compounds, obtained similar results,

## DISCUSSION

Based on the results of statistical tests, there is a significant difference between the difference in systolic and diastolic blood pressure between the intervention group and the control group (p-value = 0.031 and p-value = 0.001) which means that the hypothesis is accepted, so it can be concluded that the supplementation of purple sweet potato extract was 960 mg and nifedipine 10 mg can lower blood pressure in pregnant women with hypertension.

Purple sweet potato tubers contain high anthocyanins which are flavonoids and function as antioxidants both in vivo and in vitro. In addition, it can also function to lower blood pressure in people with hypertension.<sup>14</sup> Purple sweet potato extract has an IC50 value of 41.1±7.3 which means it has a strong antioxidant activity to ward off free radicals.<sup>18</sup>

Antioxidant activity, maintenance of endothelium with nitric oxide, and prevention of serum lipid oxide are associated with the administration of anthocyanins to lower blood pressure.<sup>19</sup> Nitric oxide synthase (NOS)

namely there was a difference in systolic and diastolic blood pressure between the intervention group and the control group with p-values of 0.002 and 0.0038, respectively.<sup>24</sup>

Research conducted on primigravida pregnant women showed that the combination of dark chocolate and Spiritual Emotional Freeform Technique (SEFT) can reduce anxiety and blood pressure. Flavanols found in dark chocolate can inhibit angiotensin-converting enzyme and steric acid which can lower diastolic blood pressure.<sup>25</sup>

Research conducted on pregnant women with hypertension by being given tomato juice containing lycopene and potassium can lower blood pressure. Lycopene functions as an antioxidant that can counteract free radicals to avoid oxidative stress, then it will increase NO production and improve vascular function so that blood pressure will decrease.<sup>26</sup>

The results of this study are different from the results of other studies giving roselle flowers to postpartum mothers with hypertension. The results obtained are that there is no significant difference in systolic and diastolic blood pressure between the

intervention group and the control group with p-values 0.178 and 0.066 with a decrease in systolic blood pressure before and after treatment in the intervention group is 39.67 mmHg and the control group is 34.67 mmHg, while the decrease in diastolic blood pressure in the intervention group was 22.33 mmHg and the control group was 17 mmHg. Two factors can explain these results, namely because in this study the length of the intervention given depends on the duration of healing of each respondent, and the post-test blood pressure value is taken from the last measurement after the respondent is declared cured.<sup>27</sup>

## CONCLUSION

Supplementation of purple sweet potato extract 960 mg and nifedipine 10 mg for 14 days in pregnant women with hypertension can reduce systolic and diastolic blood pressure. Future researchers are expected to be able to conduct further research by adding other variables such as nitric oxide and increasing the number of research samples.

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