

NUTRITION ANALYSIS OF CIPLUKAN FRUIT AS NUTRITIONAL THERAPY FOR HYPERTENSION

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ABSTRACT

The prevalence of hypertension in the world increases every year. Hypertension is a non-communicable disease that occurs when systolic blood pressure exceeds 140 mm/Hg and diastolic blood pressure exceeds 90 mm/Hg. Oxidative stress is involved in the hypertension pathogenesis Objective: Ciplukan fruit (*Physalis angulata* L.) has beneficial health effect for hypertension patients. Ciplukan fruit has high mineral content and antioxidants, so it can help lower blood pressure. Therefore, the aim of this study was to analyze the nutritional contents of ciplukan fruit (CF). CF was obtained from Bandung West Java. Method: Minerals including potassium (K), calcium (Ca) and magnesium (Mg) levels were determined using the SSA-flame methods, whereas flavonoid and antioxidant activity were determined using spectrophotometry and DPPH. The evaluation was conducted at the Universitas Gadjah Mada (UGM) integrated research and testing laboratory (LPPT). Results: 100 g of CF contained 585 mg of potassium, 13 mg of calcium, 24 mg of Mg, 1,2% b/b of flavonoids, and 19,06 mg/ml antioxidant activity. Conclusions: CF is a good source of minerals and high antioxidant activity, which can be used as nutritional therapy for hypertension.

Keywords: antioxidant activity; calcium; ciplukan fruit; hypertension; magnesium; potassium

INTRODUCTION

Hypertension is an epidemic disease that continues to increase every year. Hypertension is often referred to as the silent killer which has symptoms such as headaches, chest pain, difficulty breathing, blurred vision, dizziness and anxiety. Hypertension is also called the "silent killer" because its symptoms are not always detected (Kumanan, 2018). Many symptoms or signs (asymptomatic) especially in the early and later stages result in life-threatening conditions which are directly related to cardiovascular and cerebrovascular diseases (Darroudi et al., 2019). According to The World Health Organization (WHO) 2023, the percentage of the Indonesian population with hypertension is 40% (WHO, 2023). The prevalence of hypertension in Indonesia according to Riskesdas (2018) is 34.1% attacking adults over the age of 18 years. The risk factors of hypertension in Indonesia are age, obesity, gender and physical activity (Khasanah, 2022) High consumption of dietary salt, red meat, dietary fat, junk food, and alcohol are also risk factors (Batubo et al., 2023).

High blood pressure is risk factor atherosclerosis, Stiff blood vessels are become narrow and develops increased plaque which inhibits peripheral blood circulation. Stiffness of the blood vessels and slow blood flow causes an increase in the burden on the heart, balanced by the heart's pumping efforts resulting in an increase in blood pressure in the circulatory system (Kim, 2023). Hypertension management is divided into 2, there are pharmacological and non-pharmacological therapies. Pharmacological therapy is therapy that uses drugs like β -blockers, calcium channel blockers and renin angiotensin system inhibitors either alone or in combination for both initial and maintenance therapy. Non-pharmacological interventions involving lifestyle modifications, such as weight management, sodium intake reduction, increased potassium consumption, regular physical exercise, limited alcohol consumption, and smoking cessation, are also recommended for

all hypertensive patients (Mancia et al., 2023). The recommended minerals intake according to the DASH diet. Nutraceuticals, such as minerals, have been studied extensively for their efficacy in lower blood pressure and may be of benefit to the general (Behers et al., 2023). Recently, people have chosen natural (herbal) treatments. A medicinal plant that is widely used, but not widely cultivated, is the ciplukan plant (*Physalis angulata* L.) (Kusumaningtyas et al., 2015)

Ciplukan fruit (CF) can found in bushes and the has been widely used as traditional medicine in several countries and various regions in Indonesia (Fadhli et al., 2023). CF is beneficial for hypertension patients (Ambarwati & Pujiati, 2024). CF is known as superfruit because it is a plant that is beneficial for health (Mazova et al., 2020). Previous research has shown that CF can lower the cholesterol total in patients with hypercholesterolemia (Reyes-Beltrán et al., 2015). Studies have shown that ciplukan may have antihypertensive effects, meaning that it may help to lower blood pressure in people with hypertension. In one study, ciplukan was found to significantly lower blood pressure in pregnant women with hypertension (Munthe & Sembiring, 2023). Therefore, in this study, we aim to determine the mineral, flavonoid, and antioxidant activity of CF which can be used in the nutritional therapy of hypertension.

METHOD

This research is in the form of an experimental laboratory study. The CF was obtained from Bandung West Java. Mineral (potassium, calcium and magnesium (Mg)) levels were determined using the SSA-flame methods, whereas flavonoids and antioxidant activity were determined using spectrophotometry and DPPH. The evaluation was conducted at the Universitas Gajah Mada (UGM) integrated research and testing laboratory (LPPT).

RESULT AND DISCUSSION

Table 1.
Testing the content of Ciplukan Fruit (CF)

Kinds of Analysis	Analysis Method	Results Analysis
Potassium	SSA-flame	585 mg/100 g
Calcium	SSA-flame	13 mg/100 g
Magnesium	SSA-flame	24 mg/100 g
Flavonoid	Spectrophotometry	1,2 % b/b
Antioxidant Activity	DPPH	19,06 mg/ml

Tabel 1 describes the content of CF. Content test results show that CF has high potassium and strong antioxidant activity. As the, DASH diet recommendations for potassium consumption are 4700 mg/d, ciplukan fruit can increase the potassium intake of hypertension sufferers in lowering blood pressure . The increase in grams of potassium excretion per day results in a decrease in systolic blood pressure of 1.08 mmHg (excretion of 1 g of sodium produces an increase of 2.11 mmHg) (Staruschenko, 2018). Based on the results, 100 g of CF contains 585 mg of potassium. If compared to celery and cucumber, the potassium content of ciplukan fruit is higher than celery (400 mg) and cucumber (147 mg) (Simamora et al., 2021; USDA, 2024). Among the possible positive effects of potassium on hypertension and its, related mechanisms, the function of potassium as a antihypertensive are as follows : (1) natriuresis by inhibiting sodium reabsorption in the proximal renal tubules and suppressing renin secretion, (2) normalizing the plasma level of digitalis like substances, (3) increased urinary volume excretion, (4) smooth muscle relaxation by increasing nitric oxide production and/or by stimulating the rectifier K(+) channels resulting in potential membrane hyperpolarization and subsequently vasodilation, (5) suppression of free

radical formation, and (6) protection against vascular injury in salt sensitive hypertension (Nguyen et al., 2013).

Based on the results, CF contains 13 mg/100 g of calcium. Calcium can help reduce blood pressure by increasing intracellular calcium levels in the vascular. The daily recommended calcium intake is 1500-2000 mg/day. In short-term trials in humans, calcium supplements can modestly lower systolic blood pressure (-1.43 mmHg) and diastolic blood pressure, (-0.98 mmHg) (Cormick et al., 2015). The mechanism of calcium intake on blood pressure reduction is (1) calcium can inhibit the activity of the renin-angiotensin-aldosterone system (RAAS) and (2) regulate the activity of sodium-potassium ATPase (Na⁺/K⁺-ATPase), which is an enzyme that helps maintain proper sodium and potassium levels in the body (Villa-Etchegoyen et al., 2019). Calcium helps to regulate calcitonin production, which is a hormone that can help lower blood pressure. Calcitonin inhibits the release of vasoconstrictors, such as angiotensin II, and promotes vasodilation (Cormick & Belizán, 2019). Magnesium (Mg), an essential element in the human body, may have beneficial health effects for the primary prevention of hypertension. This study, shows that 100 g of CF contains 24 mg of magnesium. The consumption of magnesium and improving dietary patterns can reduce blood pressure (Bateman SW, 2017). Magnesium can reduce blood pressure by (1) relaxing blood vessels, (2) reducing muscle tension, (3) inhibiting vasoconstriction, and (4) reducing inflammation (Zhang et al., 2016).

Regarding flavonoid levels, the content test results show 100 g of CF contains 1,2% b/b of flavonoid. This may help to prevent damage to blood vessels and improve blood flow, which can contribute to lower blood pressure (Ciumărnean et al., 2020). According to a study flavonoids were able to modulate blood pressure by restoring endothelial function directly, by affecting nitric oxide (NO) levels (Mozaffarian & Wu, 2018). Flavonoids have been shown to inhibit the activity of calcium channels, which can help to reduce blood pressure by reducing the amount of calcium that enters the cells and reduces the contraction of blood vessels (Clark et al., 2015). Flavonoids has antihypertensive effects as it increases nitric oxide (NO) bioavailability, reduce endothelial cell oxidative stress and modulating vascular ion channel activity (Maaliki et al., 2019). Antioxidants are compounds that work to block the oxidation process by capturing free radicals or highly responsive molecules. Antioxidant activity is the ability of a compound or substance to protect body cells from damage caused by free radicals (Janciauskiene, 2020). The result of the study shows, strong antioxidant activity in CF, namely 19,06 mg/ml. CF is a natural source of antioxidants that can help protect the body from free radicals and excessive oxidation (Putra & Astuti, 2023). Antioxidants have an important role in lowering blood pressure because they can inhibit oxidation and inflammation processes which can cause an increase in blood pressure. (Amponsah-Offeh et al., 2023). CF also has the effect of diuretic activity (Sharma et al., 2015). CF exhibits low Angiotensin-I converting enzyme (ACE) inhibitor (Andriani et al., 2022). Inhibition of ACE is a major target for controlling hypertension (Das S and De B, 2013).

CONCLUSION

Ciplukan fruit is a good source of mineral and higher antioxidant activity, which can be as nutritional therapy for hypertension.

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