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Antidiabetic Effect of *Pluchea Indica Less* Tea as a Functional Beverage in Diabetic Patients

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Abstract - Hyperglycemia in diabetes mellitus can lead to a variety of acute and chronic complications. It induces oxidative stress and increases formation of free radicals and decreases the antioxidant capacity. This study was conducted to prove the antidiabetic effect of *Pluchea indica Less* tea as a functional beverage in diabetic patients. Mixed method design was used and the participants were 21 diabetic patients. Data were collected by physiological measurements, observation sheets and structured interviews. Result showed that the antidiabetic effect *Pluchea indica Less* tea as a functional beverage in diabetic patients was 0.001 by paired t-test. There were subjective complaints, such as reduced tingling in extremities and improvement in physical fatigue. The potency of antidiabetic effect of *Pluchea indica Less* tea, when consumed regularly, was proved because of its antioxidant ingredients.

Keywords: Antidiabetic Effect, Pluchea indica Less, Antioxidants.

1. Introduction

Diabetes is a complex chronic illness requiring continuous medical care with multifactorial risk-reduction strategies beyond glycemic control.[1] The most common complications of diabetes mellitus are microvascular complications such as diabetic nephropathy, neuropathy, and retinopathy, whereas the frequent macrovascular complications are peripheral vascular disease, coronary artery disease, stroke and heart failure. Long-term suffering can damage and cause failure of various organ systems.[2, 3, 4, 5] There were 382 million diabetic patients as of 2013 and the number is predicted to increase to 592 million by 2035. Of the 382 million estimated, 175 million of them have not been diagnosed, threatening to progressively develop into complications without prevention.[6]There were 12 million diabetic patients in Indonesia. In East Java there were approximately 28 million diabetic patients, with 600,000 who have been positively diagnosed with DM by a physician.[7] Uncontrolled blood glucose may increase the risk of complications. Hyperglycemia induces oxidative stress, increases formation of free radicals and decreases antioxidant capacity, leading to oxidative damage of cell components.[8] Free radicals are formed by glucose oxidation and non-enzymatic protein glycation.[9] This can increase mitochondrial superoxide overproduction in endothelial cells of vessels and lead to endothelial cellapoptosis.[10,11] Oxidative stress is a pathological condition triggered by the damaging action on cells and tissues of the body.[9] Domination of oxidative stress leads to an enhanced weak defense system of the body.[11] Management of diabetes needs to be done to prevent complications and death. Lifesytle modification is an important treatment of diabetes. Different types of therapy have been widely tried by diabetic patients, but the current paradigm in society regarding diabetes treatment has a tendency towards traditional medicine. The development of traditional health services using herbs is now growing rapidly. Today, preferred use of medicinal plants is as much as 72.51% in the form of herbal powder, stew, capsule, pill or tablet.[7] *Pluchea indica Less* is a herb which contains an antidiabetic compound. Providing of *Pluchea indica less* extract can reduce the blood glucose levels of winstars rats and can prevent necrosis of β-pancreatic cells.[12] This study was conducted to prove the antidiabetic effect of *Pluchea*

indica Less tea as a functional beverage in diabetic patients.

2. Methods

This was mixed method design. The population was diabetic patients in the working area of Gotong Royong Hospital Surabaya. There were 21 participants, selected by purposive sampling based on inclusive criteria. The instruments were physiological measurements and observation sheets. The *Pluchea indica Less* tea has passed ethical clearance. After informed consent was obtained, participants were checked for random blood glucose levels. After that they were given intervention of 2g of tea of *Pluchea indica Less* with added 100cc hot water without sugar, drunk twice a day regularly for two months. To control the adherence of tea drinking, a recording of a weekly tea schedule was evaluated. After completing the intervention, participants were checked for random blood glucose levels and interviewed about their subjective complaints as qualitative data. Homogeneity test of quantitative data by Levene test, normality test by Kolmogorov-Smirnov z test were performed and data analyzed by paired t-test $\alpha < 0.05$.

3. Results

Table 1. Demographic Characteristic of Participants

Data	Category	Frequency (people)	Percentage (%)
Sex	Female	15	71.5
	Male	6	28.5
Age (years old)	40-50	5	23.9
	51-60	12	57.1
	>60	4	19
Length of suffering of DM	< 1 year	4	19
	1-5 years	13	62
	6-10 years	2	9.5
	>10 years	2	9.5

Table 2. Test of Homogeneity of Variances

Levene Statistic	Df 1	Df2	Sig
1.371	1	40	.249

Table 3. Non Parametric Test One Sample Kolmogorov-Smirnov z Test

Mean	SD	Kolmogorov-Smirnov z	Asymp. Sig (2-tailed)
192.07	82.97	.836	.487

Table 3. The Level of Random Blood Glucose Pre- and Post- Intervention of Consuming *Pluchea indica Less* Tea

Data	Category	Mean	± SD
Random Blood Glucose (mg/dl)	Pre-Intervention	210	74.5
	Post-Intervention	175.8	59.8

Table 4. Antidiabetic Effect of *Pluchea indica Less* Tea to Reduce Random Blood Glucose Level

Data	Mean	+SD	T	Sig. (2-Tailed)
Pre-Intervention – Post-Intervention	34.28571	41.3293	3.802	.001

Table 5. Subjective Complaints of Participants after Consuming *Pluchea indica Less* Tea

Data	Category	Frequency (people)	Percentage (%)
Subjective Complaints	Improvement of physical fatigue	7	33.4
	Reduced tingling in extremities	9	42.8
	Combination of both	5	23.8

4. Discussion

Chronic hyperglycemia causes damage to the endothelial cells and renders them unable glucose transport well; this is referred to as the toxic effects of hyperglycemia and macrovascular and microvascular complications will occur.[11] Microvascular complications cause particularly higher risk of accelerated atherosclerosis, which ultimately culminates in cerebrovascular and cardiovascular events. Diabetes Mellitus induces changes in the microvasculature, affecting the capillary basement membrane, including arterioles.[13] The oxidative stress is implicated in several chronic diseases, such as atherosclerosis, cancer, diabetes, arthritis, neurodegenerative diseases, inflammatory diseases and aging.[14] Hyperglycemia conditions stimulate oxidative stress and may be harmful to biomolecules.[15] Catalase is an antioxidative enzyme to protect against oxidative stress. Catalase protects pancreatic β-cells from damage by hydrogen peroxide.[10] Antioxidants are chemical or biological agents able to neutralize the potentially damaging action of free radicals.[9] The statistical test by paired T-test $\alpha = 0.001$. This means that the antidiabetic effect of *Pluchea indica Less* tea can reduce the random blood glucose in diabetic patients. *Pluchea indica Less* tea has an attractive modern packaging and is easy to consume by diabetic patients. Regularly consuming it can reduce the random blood

glucose because of its ingredients. *Pluchea indica Less* has an antioxidant substance and contains phytochemical compounds such as saponin, tanin, fenol hidrokuinon and flavonoids. It has potential as an antioxidant,[16] Previous research on winstars rats showed that *Pluchea indica Less* leaf water extract possessed anti-diabetic activity based on blood glucose reducing capability. Its ability was 56.37%, which was the higher than glibenclamide (49.59%).[12] The hot water extract of *Pluchea indica Less* contains a source of antioxidants and inhibitors of Nitric Oxide and Prostaglandin E2 production. It can be used as dietary supplements containing a good health promoting effect.[17] Oxidative damage and inflammation can be prevented by foods rich in antioxidants and the properties of some herbal teas have recently been shown to include reactive species suppression.[18] After consuming *Pluchea indica Less* for two months all of the participants stated that there were reductions in the subjective complaints, namely, reduced tingling in extremities, improvement in physical fatigue and a combination of both. Chronic hyperglycemia leads to diabetic neuropathy and can damage neuronal cells and affect pain perception and sensation changes such as tingling.[19] One of the substances found in *Pluchea indica Less* is flavonoids as antioxidant compounds. Flavonoids can protect against diabetic neuronal cell death and dysfunction.[20] Antioxidants may act at different levels, inhibiting the formation of reactive oxygen species or scavenge free radicals, or increase the antioxidants defense enzyme capabilities. *Pluchea indica Less* possesses antioxidants which may potentially improve endothelial dysfunction and mitochondrial function, as well as decreasing vascular oxidase activity.[21] Antioxidant supplementation reduces the oxidative stress and improves the insulin sensitivity.[22] Antioxidants can prevent oxidative membrane damage and restore mitochondrial and other cellular membrane functions via delivery of undamaged replacement lipids to cellular organelles. Antioxidants restore mitochondrial electron transport function and reduce moderate to severe chronic fatigue in chronic diseases. [23]

5. Conclusion

Consuming *Pluchea indica Less* tea twice a day regularly for two months can reduce random blood glucose levels and eliminate subjective complaints of patients, such as tingling in the extremities, and bring improvement in physical fatigue.

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