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The effect of African leaf herbal tea on fast blood glucose on centration of prediabetes teachers in Makassar city☆

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Abstract
Objective: The aims of this study was to determine the effect of giving 14 days of African leaf herbal tea to FBG levels of prediabetes teachers.
Method: A quasi-experimental study using the non-randomized pretest posttest method. There were 30 samples. Levels of FBG, Anthropometry and Recall 24-hours collected had been divided into 3 study groups are dose of 2 grams (group I), 4 g (group II) and controls.
Result: 5.3% decreases in FBG levels of group I, 5.6% in group II, and 0.5% increase in FBG levels of control group. There was no significant difference in FBG levels before and after intervention in group I ($p = 0.057$), group II ($p = 0.252$), and control group ($p = 0.928$).
Conclusion: Consumption of 4 g of African leaf herbal tea for 14 days reduces FBG best. It is recommended to consume African leaf herbal tea to reduce blood glucose levels in patients with prediabetes.

Introduction

Prediabetes is now recognized as a reversible condition that increases a person's risk for developing diabetes. Prediabetes is a condition in which individuals have blood glucose levels higher than normal but not high enough to be classified as diabetes. More than 100 million Americans suffer from prediabetes or diabetes.[1] In Indonesia, 26.3% of the

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population aged ≥15 years sustain Interrupted Fasting Blood Sugar (GDP > 100–125 mg/dL).[2]

Lifestyle interventions can reduce the percentage of prediabetes patients whose diabetes develops to 20%.[1] One method that can help change the behavior of people with prediabetes in order to change their lifestyle (food intake and physical activity) is better by providing education. Health education regarding diabetes mellitus has an effect on opportunities for public behavior as indicated by a decrease in blood glucose levels after 3 months of education.[3] In addition to education, reducing blood sugar levels can be done by consuming tea. One of the plants that can be used as medicine and served is the Papua Tea plant (*Vernonia amygdalina*).[4]

Santoso research showed that African leaf extract with its active ingredients such as saponins, tannins, flavonoids, alkaloids and polyphenols can be used to reduce post prandial blood glucose.[5] These active substances are able to inhibit -amilase in the villi of the small intestine thereby interfering with the absorption of glucose in the intestine.[6] These active substances are also able to reduce blood glucose levels by increasing GLUT 4 expression so that it increases muscle glucose absorption which increases muscle glycogen synthesis.[7]

The antioxidants of polyphenols and vitamin C contained in African leaves can reduce oxidative stress by preventing the occurrence of chain reactions to convert superoxide to hydrogen superoxide by donating hydrogen atoms from the aromatic hydroxyl (–OH) group to bind free radicals and remove them from the body through the excretion system so that prevent excessive oxidation and prevent damage to pancreatic β cells and maintain insulin content in them.[8]

This study aims to determine the effect of giving African leaf herbal tea to the fasting blood glucose concentration of predibetes teacher in Makassar city.

Method

Location and design of research

This research was conducted in 18 Public Elementary Schools in Tamalanrea and Biringkanaya subdistricts for 14 days of educational intervention and African leaf herbal tea. This study was a quasi-experimental design with non-randomized pretest posttest with control group.

Population and samples

The population were Prediabetes Primary School Teachers in the Makassar city area. The study sample was prediabetes elementary school teachers in the Makassar city area who appropriate the inclusion and exclusion criteria totaling 30 people. The sample was divided into 3 study groups, namely intervention group I (2 g dose of herbal tea), intervention group II (4 g dose of herbal tea) and control group (education without herbal tea). With a total sample of 10 people per group. The inclusion criteria of this study were those aged 30–65 years, had a FBG level of 100–125 mg/dL and were willing to consume African leaf herbal tea every day for 14 days. While the exclusion criteria for this study are BMI <17 kg/m^2, taking herbal medicines or from a doctor which can control blood glucose levels, taking on study assignments/study permits, pregnant/breastfeeding women, and in sickness or in doctor's care.

Method of collecting data

Primary data were obtained directly from interviews, questionnaires and laboratory results in the form of respondents' characteristics data, fasting blood glucose level data and respondent's food intake. Secondary data is obtained from the family and from other reference sources that support research.

Data analysis

Data processing is done using the SPSS computer program. Univariate tests were carried out on each variable to see a general description of the distribution and frequency. Whereas bivariate tests were carried out by comparing the results of fasting blood glucose examination before and after the intervention using paired *t* test/Wilcoxon and ANOVA to test the treatment between groups. Furthermore, the data obtained will be presented in the form of tables and graphs accompanied by narration.

Research ethics

This research was conducted after obtaining recommendations for approval from the Ethics Committee of the Faculty of Public Health, Hasanuddin University with the number of letter: 4827/UN4.14.8/TP.02.02/2019 dated June 18, 2019 and protocol number: 20519042108.

Result

Table 1 shows that the most of respondents were in the age group of the early elderly (46–55 years) (56.7%). Most of the respondents were female (80%) and almost all of the respondents were academically/college educated (93.3%). In addition, almost all respondents were married (93.3%) and had abnormal abdominal circumference (90%). Table 1 also shows that most respondents have a family history of diabetes mellitus (70%) and obese (53.3%).

Table 2 shows a decrease in the average GDP concentration of respondents before and after intervention in the intervention group I and intervention group II where in the intervention group I there was a decrease in difference of -5.9 ± 8.54 mg/dL and in the intervention group II was -6.5 ± 16.8 mg/dL. Whereas in the control group there was an increase in GDP concentration before and after the intervention with a difference was 0.6 ± 20.4 mg/dL. The same results for the difference in mean FBG concentration before and after the intervention showed there is no significant difference between the three groups ($p = 0.554$).

Discussion

In Table 2 there was no significant difference in changes in fasting blood glucose levels before and after intervention in all three groups. Table 2 also shows that despite the absence

Table 1 Characteristics of prediabetes teachers in Makassar city, 2019.

Characteristic	Group						Total	
	I		II		Control			
	n	%	*n*	%	*n*	%	*n*	%
Age group								
Early adult	1	3.3	1	3.3	2	6.7	4	13.3
Late adults	1	3.3	1	3.3	2	6.7	4	13.3
Early elderly	7	23.3	7	23.3	3	10.0	17	56.7
Late elderly	1	3.3	1	3.3	3	10.0	5	16.7
Gender								
Man	2	6.7	1	3.3	3	10	6	20
Woman	8	26.7	9	30	7	23.3	24	80
Education								
Senior high school	1	3.3	1	3.3	0	0	2	6.7
Academy/college	9	30.0	9	30.0	10	33.3	28	93.3
Marriage status								
Single	0	0	1	3.3	0	0	1	3.3
Married	10	33.3	9	30.0	9	30.0	28	93.3
Death divorce	0	0	0	0	1	3.3	1	3.3
DM family history								
Yes	8	26.7	6	20	7	23.3	21	70
No	2	6.7	4	13.3	3	10	9	30
Abdominal circumferences								
Normal	0	0	1	3.3	2	6.7	3	10
Abnormal	10	33.3	10	30	8	26.7	27	90
BMI								
Normal	2	6.7	2	6.7	2	6.7	6	20
Overweight	1	3.3	3	10.0	4	13.3	8	26.7
Obesity	7	23.3	5	16.7	4	13.3	16	53.3

of a significant difference, the administration of African leaf herbal tea has the effect of decreasing fasting blood glucose concentration in patients with prediabetes.

The percentage changes in FBG concentrations before and after the intervention are calculated using the formula $(V_2 - V_1)/V_1 \times 100\%$, which $(V_2 - V_1)$ is the difference between the mean FBG and V_1 is mean of FBG concentration before intervention. Then the results are 5.3% decreases of FBG concentration in the group I and 5.6% decreases of FBG concentration in group II. Whereas in the control group there was 0.5% increases of FBG concentration.

In the study of Ibegbu that the African leaf extract given to Wistar rats with different doses of 40 mg/kg, 80 mg/kg and 120 mg/kg BW showed the most effective decreases at dose of 80 mg/kg after 14 days of intervention.[9] While the Ekpo in rats showed that African leaf extract significantly reduced glucose levels by 15.6, 23.4, 19.5 and 11.7% at doses of 100, 250, 500 and 1000 mg/kg, respectively and the biggest decrease is at a dose of 250 mg/kg BB.[10] In the study of Ong et al. showed that in the oral glucose tolerance test, dose of 400 mg/kg African leaves showed a significant increase in glucose tolerance from diabetic rats

Table 2 Fast blood glucose concentration analysis of prediabetes teacher in Makassar city, 2019.

FBG concentration	Group			*p* value
	I	II	Control	
Pre-intervention Mean ± SD mg/dL	111.2 ± 7.23	115.3 ± 8.09	109.2 ± 10.26	0.290*
Post-intervention Mean ± SD mg/dL	105.3 ± 12.56	108.8 ± 21.48	109.8 ± 28.06	0.888*
p value	0.057**	0.252**	0.928**	
Δ FBG concentrationMean ± SD mg/dL	−5.9 ± 8.54	−6.5 ± 16.8	0.6 ± 20.4	0.554*

* $p \leq 0.05$.
** $p \leq 0.01$.

induced by *Streptozotocin* compared to doses of 200 mg/kg and 600 mg/kg BW.[7]

African leaf extract was able to reduce blood glucose levels in hyperglycemic rats without causing hypoglycemic effects in fasting normoglycemic rats. In addition, mice appeared normal and no deaths were observed in acute toxicity studies after treatment with extracts of up to 5000 mg/kg.[9] Decreasing effects occur because African leaves contain antioxidant and phytochemical substances.

Ong revealed that the ethanol extract of African leaves contains high levels of polyphenols, especially 1.5-dicaffeoyl-quinic acid, dicaffeoylquinic acid, chlorogenic acid and luteolin-7-O-glucoside.[8] African leaves show a protective effect on pancreatic cells against damage induced by *Streptozotocin*, causing a slight increase in insulin levels compared to diabetes control. African leaves were found to increase GLUT4 expression (24%) in rat skeletal muscles. Further tissue fractionation revealed that African leaves can increase GLUT4 (35.7%) translocation to the plasma membrane also indicating that African leaves can stimulate skeletal muscle glucose uptake.

The effect of decreasing of blood glucose is because African leaves can suppress liver gluconeogensis. African leaves cause a significant increase in glucose tolerance and insulin resistance (HOMA-IR) in Streptozotocin-induced mice. African leaves inhibit the increase in expression of key enzymes of gluconeogenesis (PEPCK and G6Pase) and increase AMPK activity in the liver. In palmitic acid (PA) HepG2 cells, African leaves reduce glucose production and expression of PEPCK and G6Pase proteins, also activate the AMPK pathway.[11]

Conclusion

Based on the results of this study there was 5.3% decreases of FBG concentration in group I and 5.6% decreases of FBG concentration in group II. Whereas in the control group there was 0.5% increases of FBG concentration.

Conflict of interest

The authors declare no conflict of interest.

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