THE EFFECT OF TEMPE FLOUR ON BLOOD SUGAR IN ELDERLY

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Abstract.
Diabetes is an increasingly serious disease of modern civilization. The most common diabetes is type II, which is acquired diabetes. It is confirmed that aglycone can help the regulation of blood sugar. Tempe has more aglycone than other soybeans product. This study observes changes in blood sugar in elderly by fed tempe flour. Tempe flour that has been analyzed aglycone isoflavones (genistein, daidzein, glycetein), then made a formulation of tempe beverage with isoflavones content of 50 milli grams/day (35 grams of tempe flour). Respondents were given tempe twice a day at 06.00 and 18.00. The study was divided into two groups: the groups were given tempe flour (n=15) and the other group was given 17,5 grams casein (n=15). Measurement of fasting blood sugar gout using EasyTouch GCU by taking blood from the fingertips. The analysis between treatment groups used two mean difference test with an independent group T-test. The analysis between before and after treatment of each group using the T dependent test.
The results of the analysis using the Independent T-test that the fasting blood sugar did not differ significantly between the Tempe flour and casein groups. The two mean different test analysis with the dependent T-test for the analysis of each group before and after the intervention the fasting blood sugar in tempe flour group tend decrease than casein group, although that was not different significantly. The conclusion that fasting blood sugar tends to decrease after intervention in the tempe group. Further research is needed on the elderly with longer time intervention.

Keywords: tempe, elderly, blood sugar

1.INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease that arise in a person due to an increase in blood glucose levels above normal. This disease is caused by impaired glucose metabolism due to insulin deficiency both in absolute and relative terms [1].

Based on Global data on the status report on non communicable diseases in 2014, the prevalence of DM worldwide is estimated at 9%. The proportion of deaths from DM disease from all deaths from non-communicable diseases is 4%. Deaths due to DM occur in low and middle income countries with a proportion of 80%. In 2030 it is estimated that DM ranks 7th in the world [2]. An abnormality which is the underlying cause of diabetes mellitus is the relative or absolute deficiency of the hormone insulin. Insulin is the only hurmon that can reduce glucose levels in the blood [3].

According to data from the World Health Organization (WHO), it is predicted that cases of diabetes mellitus in the world will double by 2030 with 366 million people with diabetes mellitus. The prevalence of diabetes mellitus in the world population is calculated annually to reach 125 million and predictions multiply to 250 million in the next 10 years. The prevalence of diabetes mellitus cases will increase in developing countries compared to developed countries [4].

The results of the 2018 basic health research (Riskesdas) show that the prevalence of diabetes mellitus in Indonesia reaches 2.0% while the results of basic health research in 2013

reached 2.1%, meaning that in 2018 the prevalence of diabetes mellitus has decreased by 0, 1%, but according to the Indonesian endorinology association the prevalence of diabetes mellitus in 2013 reached 6.9% while in 2018 the prevalence of diabetes mellitus reached 8.5%, this proves that the prevalence of diabetes mellitus is increasing every year. The prevalence of diabetes mellitus in Yogyakarta reaches 3.1%, while in East Kalimantan the prevalence reaches 3.1%, Central Sulawesi 3.0%. The lowest prevalence of diabetes mellitus cases is in East Nusa Tenggara, which is 0.9% while the highest prevalence of diabetes mellitus is in DKI Jakarta Province as much as 3.4%, when viewed from the age characteristics the highest prevalence of diabetes mellitus patients at the age of 55- 64 years the prevalence is 6.29% while in the age of 65-74 years the prevalence reaches 6.03% if you look at the basic health research data in 2018 it turns out that most people with diabetes mellitus are in the elderly [5].

Complications of diabetes mellitus can affect almost all body systems such as the cardiovascular system: myocardial infarction, hypertension, in the eyes such as diabetic retinopathy, cataracts, kidney parts such as pyelonephritis, glumeruloskelrosis, while in the gangrene, ulcer, furunkes. With the complications of diabetes mellitus this automatically affects the quality of life of the elderly Research in various populations in many countries shows that soy protein lowers plasma cholesterol, triacylglycerol, and blood glucose, and acts as a potential antioxidant and improves coronary endothelial function. [6,7]. Over the past 60 years, it has been known that replacing animal consumption with peanut protein -main can improve lipid profile and prevent atherosclerosis. In the last 10-12 years research on increasing and profound legume protein has proven that protein consumption improves several health aspects including diabetes mellitus and heart health. A meta-analysis from 1966 to 2005 explained that soy protein supplementation had a significant effect on decreasing total cholesterol, LDL and triglycerides and increasing K-HDL [8]. The role of improving lipid profiles and blood glucose appeared to be more beneficial in the consumption of soy protein or soy protein matrices intact rather than protein concentrates or non-nutritional concentrates in soybeans. [9]. Although the role of individual soybean components on fat is not fully understood, soy protein is thought to affect hepatic metabolism of cholesterol or lipoprotein or regulation of LDL receptors [10]. one of the soy products widely consumed in Indonesia is tempe.

Tempe is a processed soybean product through a fermentation process with the addition of Rhizopus oligosporus. Tempe protein is easier for the body to digest, while amino acid arginine, which increases almost twice in tempeh, is very high in health benefits, especially in improving lipid profile and diabetes mellitus [11].

Studies in rats with diatetes showed that tempe flour significantly lowered the rate of fasting blood glucose better than soybean and the control group ($p < 0.01$). Although both groups showed an increase in serum insulin level after intervention but did not differ significantly in both. A significant decrease in fasting blood glucose in the soymilk group compared to the control group ($p < 0.01$). Tempe flour shows better antidiabetic activity than soymilk [12]. This study observes changes in fasting blood sugar in the elderly by fed tempe flour.

2.MATERIALS AND METHODS

2.1. Preparation of Tempe Flour Making

Tempe flour is made using fresh tempeh produced by Rumah Tempe Indonesia. The fresh tempe is then made flour with the frezze dryed method so that there is not much nutrient content in the tempe. Tempe flour was analyzed using HPLC to see isoflavone content.

2.1 Intervention in the Elderly

Experimental studies with samples of elderly aged 60+ were divided into two groups, namely the group given tempe flour (n = 15) and the group given casein (n = 15). Inclusion criteria for Age 60+, not dementia, are willing to follow the intervention according to the rules, do not consume soybeans and processed products during the study. Exclusion criteria: vegetarian and undergoing estrogen therapy. Tempe flour is given in packs of 2 sachets @ 35 grams for drinking at 6:00 and 18:00. The control group was given casein 17.5 grams. Intervention during one day given in 06.00 am and 16.00 pm for analyzed the quick response tempe flour for blood sugar in elderly. Samples of tempe flour and casein group on one day before intervention measured fasting blood sugar levels. One day after the intervention measured fasting blood sugar levels, 24-hour food recall. When taking blood sugar samples when the respondent is fasting, a blood sample is taken through a finger and measured using a glucometer.

3.RESULTS AND DISCUSSIONS

This study measured fasting blood sugar before and after intervention. Table 1 shows the data obtained before the intervention were samples of elderly with an average age of 71.8 years for the tempe flour group and 68.73 years for the casein group. Age of the two groups did not differ significantly (p> 0.05). The average body mass index for the tempe flour group 25.35 (kg / m2) and casein group 27,699 (kg / m2) were not significantly different (p> 0.05). Fasting blood sugar in the tempe flour group averaged 97.13 (mg / dl) higher than the casein group 87.13 (mg / dl) but the two groups did not differ significantly (p> 0.05).

Table 1. Mean ±SD(95%CI) Age, BMI, and Fasting Blood Sugar before in the intervention

NO	VARIABEL	TEMPE GROUP	CASEIN GROUP	P VALUE
1	Age (years)	71.80 ± 4.16	68.73 ± 5.133	0.858
2	BMI (kg/m^2)	25.35 ± 4.0745	27.699 ± 11.834	0.473
3	Fasting Blood Sugar (mg/dl)	97.13 ± 14.372	87.13 ± 14.555	0.069

Fasting blood sugar after intervention in table 2 shows that the tempe flour group decreased from 97.13 (mg / dl) to 93.20 (mg / dl) even though it was not significant (p> 0.05). But the casein group experienced an increase in fasting blood sugar from 87.13 (mg / dl) to 95.47(mg/dl) even though it was not significant (p> 0.05). Fasting Blood Sugar The Tempe group did not differ significantly from the casein group after intervention (Table 3).

Tabel 2. Mean ±SD(95%CI) Fasting Blood Sugar Before and After Intervention

Fasting Blood Sugar (mg/dl)	Tempe Group	P Value Tempe Group	Casein Group	P Value Casein Group
Before	97.13 ± 14.372	0.103	87.13 ± 14.555	0.215
After	93.20± 10.930		95.47 ± 29.705	

Table 3. Mean ±SD(95%CI) Fasting Blood Sugar After intervention Tempe Flour and Casein Group

VARIABEL	TEMPE GROUP	CASEIN GROUP	P VALUE
Fasting Blood Sugar (mg/dl)	93.20 ± 10.930	95.47 ± 29.705	0.784

This study was conducted on elderly people aged 60+ divided into two groups, namely the tempe flour group and casein group. According to the Indonesian Endocrinology Society, the age group of more than 45 years is an age group that is at high risk of developing diabetes mellitus. Age has a very close relationship with type 2 diabetes mellitus because the more age increases the risk of developing type2 diabetes mellitus increases and the aging process can result in changes in the anatomical and physiological and biochemical systems of the body, one of which is decreased pancreatic function in producing insulin and the impact of this can lead to insulin resistance [13].

Approximately 80% of type 2 diabetics are proven to be obese or overweight, and the risk of diabetes increases progressively as indicated by body mass index (BMI), which is weight gain in height divided by height in m2. If BMI of more than 35 kg / m2 the risk of type 2 diabetes will increase by 10 years by 80 times compared to the BMI value of less than 22 kg / m2. The latest data from the NHANES survey in the United States shows the risk of type 2 diabetes over a period of up to 6-10 times in individuals aged 18 years with BMI of more than 35 kg / m2 compared to individuals with BMI 18.5 kg / m2 (mean difference governance 6-7 years of all life expectancies). Obesity is also important to determine if central fat reserves are more at high risk of developing type 2 diabetes than gluteofemoral fat reserves. In health facilities, central obesity can be assessed by measuring the ratio of weight and hip circumference, but the advantages over examination of arm circumference are still unclear [3]. The nutritional status measurement by body mass index. Avarage body mass index before intervention for the tempe flour group 25.35 (kg / m2) and casein group 27,699 (kg / m2) were not significantly different (p> 0.05). This research did not compare nutritional status for the tempe and casein groups after intervention because the intervention was only given for one day.

At the time of checking fasting blood sugar before and after the intervention there was no indication that diabetes was above 180 mg / dl. Giving tempe flour has the effect of reducing blood sugar. This occurs because soy isoflavones can increase glucose and lipid metabolism through the antidiabetic mechanism of PPAR (Peroxisome Proliferator-Activated Receptor), a receptor that regulates gene transcription that plays a role in metabolizing glucose and lipid homeostasis in cells. Isoflavones may increase insulin secretion without changing blood sugar levels and possibly reduce plasma adiponectin concentrations in type 1 DM patients [14]. Soy isoflavone extract can

protect beta pancreatic cells from apoptosis such as regeneation and proliferation [15]. During the fermentation process, the beta glucosidase enzyme hydrolyzes isoflavone glycosides to form isoflavone aglycones, in a more active form [16].

Tempe is an authentic Indonesian food produced from soybean fermentation using the Rhizopus mushroom. In a healthy body insulin secretion regulates blood sugar by the pancreas. Through the action of insulin so glucose Metabolism of the body occurs through the action of glucose insulin in the transport of blood into the cell to provide the energy needed by the cell. When insulin levels are not enough or inefficient use insulin to reduce blood sugar in the body, high blood sugar problems will occur. The most common diabetes is type II. Aglycone can help regulate blood sugar. Tempe has more aglycone than other soy products [17].

Estrogen receptors and androgen receptors (AR) regulate energy homeostasis in mice and humans. In women, estrogen maintains energy homeostasis through ERα, and ERβ by suppressing energy intake and lipogenesis, increasing energy expenditure and improving insulin secretion and sensitivity. In men, testosterone is converted to estrogen and maintains fuel homeostasis through ER and AR, which shares related functions to suppress adipose tissue accumulation and improve insulin sensitivity. ER and AR are targets for preventing age-related metabolic disorders. Tempe can increase serum estrogen in studies in old mice [18], so tempe is good for diabetics [19].

4. CONCLUSION

Tempe flour can reduce blood sugar in the elderly. Consumption of casein can increase blood sugar. Future studies to be carried out with a longer time and in the pre-elderly and elderly groups.

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