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Original Research Article

The Influence of Consumption Pattern 'Kapurung' Against Conditions of Fasting Blood Glucose, 2 Hours of Post Prandial Blood Glucose, and Physical Activity in Ages 35-55 Years in North Luwu District.

Nur Fauzia Asmi[1], Burhanuddin Bahar[2], Suryani As'ad[3]

[1]Graduate Student, [2,3]Lecturer, [1,2]Department of Nutrion, Department of Medical and Public Health, Hasanuddin University, Jalan Perintis Kemerdekaan Km.10, PO Box 90245, Makassar, Indonesia

Corresponding Author: Nur Fauzia Asmi

ABSTRACT

Background: Kapurung is a typical food of North Luwu which is consumed everyday and made from sago. Sago is a high carbohydrate source food, high fiber and low glycemic index.
Objectives: This study aims to determine the effect of consumption pattern kapurung on fasting blood glucose (GDP), 2 hours of post prandial blood glucose (GD2JPP) and female physical activity in ages 35-55 years in the majority group to consume sago and minority groups to consume sago.
Materials and Methods: This study used an observational research design with cross-sectional method in the majority population consuming sago and minority consuming sago based on several inclusion criteria. The inclusion criteria in this study were healthy (not / undiagnosed by doctors suffering from DM), aged 35-55 years and living in North Luwu, settled in Luwu Utara for at least 10 years. Data were analyzed using the Mann Whitney test.
Result: The results showed that there was no significant difference in GDP between kapurung consuming and minority consuming kapurung (p = 0.519) and significant difference of GD2JPP between the majority of kapurung consumption and minority of kapurung consumption (p = 0.000). The majority of people consuming kapurung with physical activity having a lower GD2JPP score of 81.44 mg / dl compared with low physical activity was 116.03 mg / dl (p = 0.020). Whereas minority societies consuming kapurung have no significant relationship between physical activity to GDP (p = 0.527) and GD2JPP (p = 0.453). There is a difference in fat intake, KH, v it. C and zinc significant between the majority and minority kapurung group of 0.020; 0.000; 0.009; 0.000
Conclusion: The pattern of kapurung consumption can help to control sugar while 2 hours of post prandial if it can be done with moderate physical activity.
Key words: kapurung, sago, GDP, GD2JPP, physical activity.

INTRODUCTION

Diabetes mellitus (DM) is a collection of symptoms that arise in a person caused by an increase in blood glucose levels due to a decrease in progressive insulin secretion. [1] The World Health Organization (WHO) predicts an increase in the number of people with DM who become one of the global health threats. WHO predicts an increase in the number of people with DM in Indonesia from 8.4 million in 2000 to about 21.3 million by 2030. WHO predicts an increase in the number of people with DM in Indonesia from 8.4 million in 2000 to about 21.3 million years 2030. [2] While the International Diabetes Federation (IDF) predicts an increase in the number of people with DM in Indonesia from 9.1 million in 2014 to 14.1 million in 2035. [3] Indonesia is

ranked 7th with the highest DM and it is estimated that by 2040 it will increase to the rank of the 6th biggest DM patient in the world.

DM disease if it is not managed properly will result in various chronic diseases, such as cerebrovascular disease, coronary heart disease, leg blood vessel disease, eye disorders, kidney and nerves. People with diabetes mellitus have a 2 times greater risk of developing coronary heart disease and cerebrovascular disease, 5 times more likely to develop ulcers / gangrene, 7 times more susceptible to terminal renal failure, and 25 times more likely to get blind due to retinal damage than patients non diabetes. [4]

Therefore, it is necessary prevention efforts to avoid the occurrence of various things that are not profitable. One way to prevent or control DM disease is through diet. Epidemiological evidence suggests that people who regularly eat fruits and vegetables have a lower risk of developing type 2 diabetes. [5] Numerous studies have shown that high fruit intake has a negative correlation with the risk of cardiovascular diseases. [6] Other studies have shown that low GI and GL diets are relevant to the prevention and treatment of diabetes and coronary heart disease, and obesity. [7] According to research Wahjunengsih explained that sago has a low GI Index (GI) of 40.7. [8] South Sulawesi is one of the provinces in Indonesia where has high sago production.

The total potential of developed land for sago in South Sulawesi is 4,102 Ha, located in Luwu Regency covering 1,462 Ha around 35.6% and North Luwu with 1,590 Ha around 38.8%, so the two of districts are producing the largest sago areas in South Sulawesi. Sago in North Luwu society is consumed as daily food in some form of traditional food such as kapurung, dange and bagea cake. Based on the description, the researcher wanted to see the effect of kapurung consumption which is one of staple food in North Luwu District on pre-prandial blood glucose and 2 hours of post prandial blood glucose in women about 35-55 years of Luwu Utara District.

MATERIALS AND METHODS

Location and Research Design

This research is an observational research with cross-sectional method in April until September 2017. The location of the research held in Buangin, Masamba and Kaluku areas of North Luwu District.

Method of Collecting Data

The population in this study was all the female aged around 35-55 years in North Luwu. The sample was calculated by using Lemeshow's formula and obtained as many as 33 groups, so the total sample are at least 66 people. The groups in this study were the majority group of Kapurung consumption and the minority of Kapurung consumption. The majority of Kapurung consumption is the respondents who consume kapurung at least 1 time a day and Kapurung minority are the respondents who do not routinely consume kapurung. The numbers of samples are obtained during the field down as much as 42 groups.

This research has used a sampling technique based on cluster random's sampling that is at Buangin village location, Kaluku village and Masamba city.

Data Analysis

Data collection consisted of primary data and secondary data. Primary data were obtained from the results of laboratory tests and interviewed by using FFQ questionnaires and recall on 24 hours. The data were collected by measuring GDP, GD2JPP and physical activity in the majority group of sago consumption as well as minority of sago consumption. The examination of GDP and GD2JPP was done by UTD officer Andi Djema Masamba Hospital. As for the examination of GDP respondents who are required for fasting (no food consumed except drinking water) for 8-12 hours before the test. While the next day (morning after fasting (eg at 8 am)) will be blood sampling in the vein part of 3-5 ml and collected in red cap tube (without anticoagulant). On examination, GD2JPP

done for 2 hours after fasting blood glucose's test. The patients were given the same food and contained 80 grams of carbohydrate before the test was performed. Furthermore, patients should not perform heavy activity and 2 hours later is done for taking of venous blood as much as 3-5 ml. Physical Activity is measured by using Physical Activity Level. While the food intakes by using validated FFQ questionnaires and recall on 24 hours. The secondary data were obtained from The Public Health Office of North Luwu District which is covering area, population and total sago production every year.

The analysis used univariate and bivariate analysis. The univariate analysis describes the characteristics of all variables in the form of frequency distribution tables and the bivariate analysis using independent T-Test if the data is distributed to normal and Man Whitney which is not normally distributed. Presentation of data in table form and accompanied by narration.

RESULT

Characteristics of Sample

The total of 84 respondents who is participated in this study which was divided into 42 people every each group. Research location of the majority group kapurung most in Buangin village that is equal to 45.2% whereas for kapurung minority group at most in Kaluku village equal to 59.5%. The distribution of age in majority group of kapurung consumption at most in age group 35 - 45 year equal to 66.7% and kapurung consumption minority group in age group 46 - 55 year that is equal to 54.8%. The level of education of respondents in the majority group kapurung most at the SMP level of 42.9% while the minority group kapurung at the elementary level of 42.9%. The highest number of IRT respondents was 81.1% in the majority group of kapurung consumption and 73.8% in kapurung minority group. Physical activity of respondents in both groups was mostly in light activity around 78, 6%.

The Description of the Effect of Sago Consumption on GDP and GD2JPP

There was an average difference in blood glucose in both groups. The mean fasting blood glucose between the majority and minority groups were 74.31 mg / dl and 79.45 mg / dl. Table 1 showed that there is an average difference in GDP between majority group and kapurung minority, but statistically, the difference is not significant where the value p = 0.519. On 2-post blood prandial blood glucose test showed the average post prandial blood sugar in the majority group of kapurung consumption of 1119.92 and kapurung minority group was 138.45, with p value = 0.000. This shows that there is a significant difference between the majority group kapurung and kapurung minority.

Table1.Differences in GDP and GD2JPP in majority and minority groups of kapurung consumption.

Blood Glucose	Mean ± SD		The value of P
	Kapurung's Mayority	Kapurung's Minority	
GDP	74.30±47.84	79.45 ± 65.59	0.519
GD2JPP	111.92 ± 68.77	138.45 ± 88.46	0.000

This data is the mean ± SD of GDP and GD2JPP
The value of p is significant from Man Whitney test

The Existence of Physical Activity Relation to GDP and GD2JPP for Majority Groups and Minorities of Kapurung

The Table 2 shows that majority group kapurung with physical activity is having lower GDP and GD2JPP value that is 74.31 and 81.44 compared to light activity 76.88 and 116.03 with p = 0.48 value on GDP and p = 0.02 for GD2JPP. This illustrates the pattern that the higher the physical activity the lower the fasting blood glucose and blood glucose 2 hours after eating. In the minority group kapurung associated with GDP shows that the physical activity is having a GDP of 84.59 while in light activity of 73.77. While for medium activity to GD2JPP have value 164.97 higher than mild activity that is 155.22 and there is no significant relation between physical activity to GDP and GD2JPP in kapurung minority group with p value respectively 0.527 and 0453. This

illustrates the pattern that despite moderate physical activity, the GD2JPP values remain high compared with mild activity as well as the GDP values in the minorities of different kapurung in moderate and light activity.

Table2. Relation of Physical Activity to GDP and GD2JPP in majority group and minority kapurung

Group	Physical Activity	n (%)	GDP		GD2JPP	
			Mean ± SD	p value	Mean ± SD	p value
Majority	Easy	33 (78,6)	76.88±53.62	0.302	116.03±77.45	0.020
	Moderate	9 (21,4)	74.31±10.24		81.44±31.61	
Minority	Easy	27 (64,3)	73.77±26.68	0.527	155.22±72.04	0.453
	Moderate	15 (35,7)	84.59±103.17		164.97±112.98	

p value ; significant from spearman test

The Existence of Nutrition Intake between Kapurung Majority Groups and Kapurung Minorities

The result of measurement of food intake of respondent through food recall on 24 hours was analyzed with nutrisurvey. So, the results of analysis include macro nutrients and micronutrients in the majority groups kapurung consumption and minority kapurung consumption.

Table3. Comparison of Nutritions between Sago Majority Groups and Sago Minorities

Nutrients	Majority Group	Minority Group	pvalue
Supply	mean ± SD	mean ± SD	
Energi (kkal)	1882.97 ± 117.6	1863.79 ± 125.6	0.472
Protein (g)	52.85 ± 9.4	58.06 ± 14.30	0.052*
Lemak (g)	35.25 ± 11.69	41.82 ± 15.42	0.023*
KH (g)	335.07 ± 24.2	310.44 ± 43.39	0.002
Serat (g)	8.18 ± 4.8	7.94 ± 3.26	0.943
Vit. A (µg)	528.43 ± 337.22	519.23 ± 619.7	0.125
Vit. B1 (mg)	0.55 ± 0.15	0.550 ± 0.12	0.842
Vit. B2 (mg)	0.57 ± 0.16	0.574 ± 0.18	0.690
Vit. B6 (mg)	1.19 ± 0.29	1.20 ± 0.39	0.454
Vit. B12 (µg)	2.51 ± 1.40	2.60 ± 3.25	0.096
Vit. C (mg)	27.71 ± 14.88	21.04 ± 21.71	0.009
Kalsium (mg)	233.73 ±134.32	289.44 ± 409.94	0.050
Fosfor (mg)	750.68 ± 133.29	846.91 ± 282.31	0.206
Iron (mg)	6.90 ± 3.68	6.27 ± 2.68	0.142
Zink (mg)	5.30 ± 1.28	6.71 ± 1.58	0.000

***p value : significant for independent T-test**
p value : significant for Man Withney

Table 3 shows that the intake of macro nutrients does not show significant difference in energy, protein and fiber intake between majority group and kapurung minority group with p value respectively is 0.472; 0.052 and 0.943. Furthermore, there was a significant difference between fat intake and KH in both groups with p value = 0.023 and p = 0.002. Whereas in micronutrient intake showed that there were significant differences of vitamin C and zinc in both groups with p value = 0.00. In the majority groups kapurung describes high micronutrient intake in vit. A, vit C and iron

DISCUSSION

Kapurung is a typical food community in Luwu North made from sago. In making kapurung only by dissolving sago and a little of water. Furthermore sago that has been watered by using boiling water and stir until the sago-shaped chewy. After getting the desired shape, sago is served with a mixture of fish and vegetables. Kapurung gravy is made by using fish water mixed with various spices such as lime, nutmeg, tomato, lombok, salt and finely ground fish. Furthermore, it is served by using vegetables, fish, corn cakes, etc. One serving of kapurung contains 451.7 kcal of energy, 95.9 g of carbohydrate, 14.4 g protein, 0.7 g fat, 3.1 g fiber.

According to Wahjunengsih et al, sago has a low glycemic index so it is well consumed to control blood sugar. [8] Another study explains that sago noodles belong to a low glycemic index type of food with an IG value of 28 so it is well consumed for DM patients. [9] Research in the United States explains that low and high glycemic index foods have an effect on the speed of glucose absorption and the fructuation of blood glucose levels. Foods with a low glycemic index cause the digestive process in the stomach to be slow so that the rate of emptying the stomach becomes slow. This result in food suspensions that have been digested in the stomach more slowly reaching the small intestine, resulting in further carbohydrate digestion and absorption of blood glucose in

the small intestine is slow. Foods of low glycemic index most of the glucose absorption occurs in the small intestine (duodenum) and the middle (jejenum). In the end, fluctuations in blood glucose levels were relatively small. In contrast, high GI foods abdominal discharge rate, carbohydrate digestion and rapid glucose uptake. Most glucose absorption occurs only in the upper small intestine so that the glycemic response is characterized by high fluctuations in blood glucose levels. [10]

The same study was conducted by Turner-Mc Grievy et al. who stated that low IG and BG diets are indirectly associated with controlling blood glucose. This is because the low ID BG diet is associated with weight loss, which will indirectly predict a decrease in HbA1C. [11] Another study according to Shore states that foods with a glycemic index will show the rate of glucose absorption and suppress the secretion of pancreatic insulin hormone so there is no spike in blood glucose levels 2 hours post prandial. [12] Other results of different studies also show that high IG consumption can lead to elevated blood glucose levels, the risk of damage to vascular tissue and other organs. [13,14] Studies in Germany show that high IG consumption is significant with elevated blood glucose in adolescents. [15]

Some types of carbohydrates can increase blood glucose levels if consumed unbalanced. But not all types of carbohydrates increase hyperglycemia when consumed. According to some studies, there is a difference in the postprandial blood glucose response to various carbohydrate-containing foods. Sago starch contains 27% amylose and 73% amylopectin. Replacement rates of amylose and amylopectin composition will affect the properties of starch. The higher the amylose level then the patience is less dry, less adhesive and easy to absorb air. Amylose is a simple, un branched polymer (straight structure) to make amylose perfectly hydrolysed by an enzyme only α-amylase (easily digested). While amilopectin is a simple sugar polymer having branches and has a larger molecular size compared with amylose. Therefore, to hydrolyze amylopectin required 2 enzymes that is α-amylase and α1 Æ6 Glucosidase making it more difficult and longer digested. Based on this, then foods containing high amylopectin will have low digestibility. This also indicates that the Glycemic Index of the food (sago) is also low. Foods with high amylopectin and low glycemic index are much longer and the rate of gastric emptying is slower. It is suspended by a disease that has been affected by digestion (chyme) more slowly reaches the small intestine, resulting in more digestion and absorption of glucose in the intestine. Once the insulin work is not heavy and can defisiensi insulin deficiency that accumulated sugar in the blood. This suggests that there are differences in the carbohydrate component responsible for the variation of post prandial blood glucose response in both healthy and diabetic individuals. [16] Studies in humans show that RS can have strong health benefits such as increased insulin sensitivity in patients with type 2diabetes and a reduction in blood glucose levels. [17] Other studies have suggested that hospital consumption is associated with reduced blood glucose and insulin response (decreased fasting blood glucose concentration, reducing post prandial response). [18]

In addition for kapurung to GDP and GD2JPP, physical activity also has an important role to control blood glucose. According to Gibney, physical exercise improves insulin sensitivity and increases muscle glucose intake. In this way physical exercise has a beneficial effect on carbohydrate metabolism in people with diabetes and people who are not people with diabetes. Physical exercise also provides a beneficial effect on fat metabolism and plays a role in weight loss. [19] Physical activity affects blood glucose levels. When the activity of the body is high, the use of glucose by muscles will increase. The synthesis of endogenous glucose will be

enhanced to keep blood glucose levels in balance. Under normal circumstances, this homeostatic state can be achieved by various mechanisms of the hormonal, nervous, and glucose regulatory systems. [20] Several studies have shown a dose-response relationship between the amount of energy spent during exercise and its effects on glycemia. [21-23]

The Nutrition supply affects the blood glucose control. The majority of respondents consumed kapurung which had better macro and micro nutrient supply than kapurung minority. In the macro nutrient supply showed that there was not significant difference in energy, protein and fiber supply between majority group and kapurung minority group with p value respectively 0.472; 0.052 and 0.943. In addition, there was a significant difference between fat intake and KH in both groups with p = 0.023 and p = 0.002. While on micronutrient supply showed that there are significant differences of vitamin C and zinc in both groups with p value = 0.00. In the majority kapurung group describes high micronutrient intake in vit. A, vit C and iron. Research conducted by Wulandari mentions that a person with diabetes mellitus has decreased levels of vitamin C. Vitamin C is structurally similar to glucose and can replace glucose in various chemical reactions. Vitamin C plays an important role in protecting cell damage caused by free radicals such as auto oxidation of glucose, glycosylation of proteins involved in the formation of oxidative stress and the etiology of DM. Vitamin C reduces the glucose toxicity that contributes to preventing the decrease in pancreatic β cell mass and insulin levels. [24] Communities consuming kapurung have a good intake of micronutrients such as vitamins that play an important role in the production of insulin in the body and vitamin C that serves as an antioxidant and protects blood vessels from susceptible damage occurs in diabetics.

CONCLUSION

This study can be concluded that there is no significant difference in GDP between kapurung consuming and minority consuming kapurung (p = 0.519) and significant difference of GD2JPP between majority group of kapurung consumption and minority of kapurung consumption (p = 0.000). The majority of people consuming kapurung with physical activity having a lower GD2JPP score of 81.44 mg / dl than compared with low physical activity was 116.03 mg / dl (p = 0.020). There is a difference in fat supply, KH, vit. C and zinc significant between majority and minority kapurung group with p value of 0.020; 0.000; 0.009; 0.000 The majority group of kapurung consumption has lower fat supply than minority kapurung group, and KH, Vit C and zinc are higher than kapurung minority. Therefore, the pattern of kapurung consumption with moderate physical activity could control their blood glucose for 2 hours of post prandial.

The suggestion for the next research is needed deeper research about sago consumption pattern to blood glucose with different parameter like HbA1C or adiponectin to get more accurate conclusion. This is needed to increase promotion and preventive effort related to blood glucose control for considering impact of uncontrolled blood glucose dangerous.

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