

EFFECT OF CONSUMPTION OF FLOUR OF PORANG KAMORPHOPALUS MUELERI BLUME) ON GLUCOSE ABSORPTION IN THE DIGESTIVE SYSTEM THROUGH MEAL TOLERANCE TEST (MTT) AND REVERSE INTESTINE TEST

Idiek donowarti^{1*}

¹*Agriculture Faculty, Wisnuwardhana University, Malang*

***Corresponding author:**

Abstract:-

Porang flour is known to contain high glucomannan so that it can be beneficial in health. The purpose of this study was to determine the effect of porang flour absorbing on decreasing sugar absorbent in the digestive system.

The study was conducted through two experimental studies, the first through the Meal Tolerance Test (MTT) and the second through the reverse intestinal test. Giving porang flour consists of 3 doses of 0,3 g, 0,4 g and 0,5 g / kg BW respectively and using Wistar strain white rat test animals.

The results of research through MTT found that increasing the consumption of porang flour consumption can significantly reduce rat blood glucose levels at the end of the observation time of 120 minutes.

While in the reverse bowel test, the results showed that an increase in the administration of porang flour in rat jejunum succeeded in reducing the absorption of reducing sugars in rat jejunum.

Keyword:- *Porang flour, glucose, MTT, reversed colon, rat*

INTRODUCTION

Porang (*A. muelleri* Blume) included in the Araceae family is a type of tuber plant that has the potential to be developed as a functional food ingredient because the tubers of this plant contain high enough glucomannan levels up to 67% (Wahyuni, et al., 2004). Porang can grow well in Indonesia and generally grow wild, but now it has begun to be widely cultivated (Mulyono et al, 2009).

Porang flour has high glucomannan levels ranging from 70-80% (Syaifulloh, 1990), but its oxalate levels are also high at 6.11% in porang chips (Faridah et al., 2012) which can harm kidney health. One of the flouring technologies using a stamp mill followed by multilevel maceration with ethanol can produce porang flour with oxalate content of 0.073% and glucomannan content of 80% (Faridah et al, 2012). However, this low oxalate level is feared can still cause kidney organ health problems. Therefore, research on the effects of consumption of macerated porang flour on kidney health in vivo is still needed

Glucomannan is a soluble fiber polysaccharide which is hydrocolloid, cannot be hydrolyzed by digestive enzymes in the human body so that it is known as food without calories and has functional properties in the health or functional food and in food processing as food additives or food additives (Bidlack et al, 2000; Li et al., 2006). The functional properties of glucomannan have been widely studied as beneficial for the prevention of obesity, joint trauma, anti-cancer, hypoglycemic and hypocholesterolemic effects improving digestive function and the immune system (Vuksan, et al., 2000; Ling Chen et al., 2003; Sood, Baker and Craig, 2008). Tensiska, (2008). said that glucomannan has benefits in the treatment of constipation in children. Glucomannan can also heal injuries in joints because it can capture free radicals (Drabikova, et al., 2009).

Porang (*A. muelleri* Blume) included in the Araceae family is a type of tuber plant that has the potential to be developed as a functional food ingredient because the tubers of this plant contain high enough glucomannan levels up to 67% (Wahyuni, et al., 2004). Porang can grow well in Indonesia and generally grow wild, but now it has begun to be widely cultivated (Mulyono et al, 2009).

Overall dietary fiber has a similar function that can prevent and even treat some diseases associated with the digestive tract, lowering cholesterol (Lupton and Turner, 2000) and cardiovascular disease, colon cancer (Rissanen et al., 2003) and diabetes (Freeman, 2000).

The water-soluble fiber in the digestive system can absorb water and expand that is not moving in the intestine, which can reduce the absorption of sugar and fat. This effect is related to the nature of the polymer to form an immovable water layer which can reduce the rate of emptying of the stomach and resist the effect of removing substances from intestinal contractions, reducing the absorption of sugar through the small intestine (Zhanget al., 2005). In vivo experiments using mice as experimental animals showed that soluble food fiber played a role in lowering blood cholesterol levels. Giving guar gum 5%, 10% and 20% in hypercholesterolemia rats for 28 days can reduce total cholesterol, LDL-c, and triglycerides in a meaningful manner, and there is no significant change in HDL-c levels (Reza et al., 2012).

RESEARCH METHODS

This research was conducted experimentally which was designed in a Completely Randomized Design in a unidirectional pattern with 4 (four) treatments and 6 (six) replications (Steel and Torrie, 1989) with the aim to determine resistance to increased blood sugar levels due to consumption of macerated porang flour.

Research Preparation

A total of 24 Wistar white rats were divided into 4 treatment groups, each group consisting of 6 rats then adapted for 1 week by being fed and drinking ad libitum. The acclimatization process was carried out at the Nutrition and Food Laboratory of Gajah Mada University in Yogyakarta, experimental animals and AIN-93M standard feed were obtained from the Nutrition and Food Laboratory of Gajah Mada University in Yogyakarta with the composition of feed referred to the American Institute of Nutrition 1993 formula (AIN 1993) as explained. in table 8.

Research Implementation

Before the treatment of rats fasted for 16 hours, then each group was treated with macerated porang flour at a dose of 0,3 g / kgBB; day; 0,4 g / kg / day; 0,5 g / kg / day. The determination of this dose is based on the calculation of the use of pure glucomannan for humans 3-5 g / day (Alonso et al, 2009, Sood et al, 2010)

Table 1. Composition of Test Mouse Feed in 1000 grams of AIN-93M Standard Feed

Component	Composition(%)
Corn Flour	620,692
Casein	140
Sucrose	100
Soybean oil	40
Fibers	50
Mineral Mixture	35
Vitamin Mixture	10
L-Cystine	1,8
Bitartrate Choline	2,5
TBHQ	0,008
Total	1000

Sumber: Reeves, 1993.

Based on the opinion of Reagan, Minakshi Nihal and Nihal Ahmad (2007), the conversion to rats obtained calculation $(3g / 60) \times 37/6 = 0.308$ g, while the glucomannan content in porang flour was 78%, then obtained $100 / 78 \times 0.306 = 0,393$ g, from this figure a dose of 0,3; 0,4; 0,5 g / kg / day. Then obtained the following treatment:

T0: fed AIN-93M standard

T1: given standard feed + maceration flour 300 mg / kgBB

T2: given standard feed + maceration flour 400 mg / kg BW

T3: given standard feed + maceration flour 500 mg / kg BW

Procedure for porang administration, macerated porang flour is dissolved in distilled water, then the rat is taken and strangled at the back of the neck until the mouth is open, then the syringe is inserted (sonde method).

Data retrieval

Blood serum collection was performed after 1 hour of feeding ie at 1 mL, 0, 15, 30, 45 and 60 minutes in retro orbital plexus. blood samples obtained were then centrifuged at 4000 rpm at room temperature for 15 minutes. The supernatant (blood serum) is taken 10 μ L then added glucose kit as much as 1 mL, then the absorbance value is measured at 500 nm so that blood glucose levels can be measured.

Glucose Absorption Test

In vitro testing was conducted to determine the absorption of glucose in the small intestine due to the influence of macerated porang flour. This test was carried out using the modified Cranes and Wilson (1958) modified intestinal bag method (Yuwono, 1987). This research is an experimental design in a completely randomized design with 4 (four) treatments and 2 (two) replications (Steel and Torrie, 1989)

Research Preparation

A total of 8 white Wistar rats were divided into 4 treatment groups, each group consisting of 2 rats then adapted for 1 week by being fed and drinking ad libitum. The acclimatization process was carried out at the Laboratory of Nutrition and Food of the University of Gajah Mada Yogyakarta, experimental animals and AIN-93M standard feed obtained from the Laboratory of Nutrition and Food of the University of Gajah Mada Yogyakarta with feed composition based on the American Institute of Nutrition 1993 formula (AIN 1993) (Reeves et al., 1993)

Research Implementation

8 rats were fasted for 16 hours and were still given a drink, then the rats were terminated, dissected the jejunal intestine as long as 10 cm. Furthermore, the intestine is reversed, so the villi are outside. Both ends of the tied small intestine that were previously filled with 0.9% NaCl solution are called serous fluid (every 5 cm of the intestine is filled in 1 mL). Then the small intestine is put into a tube containing macerated porang flour with a dose of 0,3 each; 0,4 ; 0,5 mg / kgBB in 0.9% NaCl solution with a reducing sugar content of 1.4% called mucosal fluid. During the experiment all parts of the intestine must be submerged in mucosal fluid and must be filled with oxygen (100 bubbles/minute), the temperature must always remain at 37oC and stirred continuously every 15 minutes for 90 minutes. The overall treatment obtained is as follows:

G0: NaCl 0.9% + reducing sugar 1.4%

G1: NaCl 0.9% + reducing sugar 1.4% + maceration flour 300 mg / kgBB

G2: NaCl 0.9% + reducing sugar 1.4% + maceration flour 400 mg / kg BW

G3: NaCl 0.9% + reducing sugar 1.4% + maceration flour 500 mg / kg BW

Results and Discussion

Research in phase III was conducted a Meal Tolerance Test (MTT) or tolerance test for an increase in blood sugar levels due to consuming substances containing carbohydrates and cholesterol. Tests for glucose and cholesterol absorption are carried out using the intestine (jejunum) ex vivo with the aim to find out the trapping mechanism by porang glucomannan against glucose and cholesterol in the small intestine so that it inhibits/reduces its absorption.

Table 2. Average Glucose Levels at Various Observations Due To Provision Of Porang Flour According To Treatment

Porang Flour (mg/kgBB)	Glucose (mg / dL) in Min				
	0	30	60	90	120
0	74.95 a	101.98 c	116.26 c	127.07 d	135.31 d
300	78.17 b	101.85 c	112.85 c	118.22 c	120.54 c
400	77.38 ab	95.29 b	98.65 b	101.16 b	103.54 b
500	77.89 b	81.14 a	85.58 a	87.82 a	90.37 a

Note: Numbers that are accompanied by the same letters in the same column are not significantly different in the 0.05 BNJ Test.

In the MTT experiment, the rats were given feed and porang flour according to treatment, then blood glucose levels were measured several minutes later. After a certain time can be seen an increase in glucose levels compared between those without porang flour and those treated with porang flour.



Figure 1. Increased Rat Blood Glucose Levels in Minutes Observations due to Provision of Porang Flour according to Treatment

Figure 2. shows a comparison of increases in blood sugar levels between treatments. In the treatment of porang flour with various doses significantly affect the increase in blood sugar levels significantly. The increase occurred in the direction of increasing doses of porang flour. The lowest blood sugar level is achieved when giving porang flour 500 mg/kg BW.

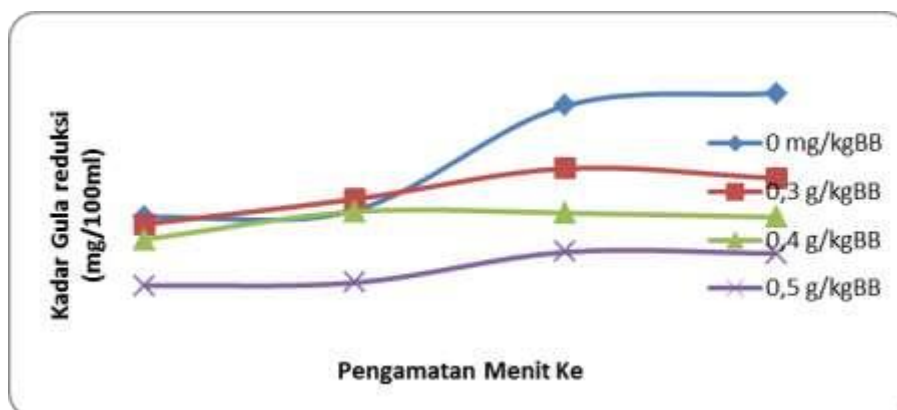


Figure 2 Average Absorption of Reducing Sugar in Ratunum in Minutes of Observation due to Porang Flour Granting according to Treatment

The results of the absorption of reducing sugars in reverse intestine are presented in Figure 2. In the administration of porang flour, all doses significantly affect the absorption of reducing sugars in the small intestine. Increasing the dose of

porang flour significantly reduces the absorption of reducing sugar in the small intestine (jejunum). The lowest absorption is obtained if porang flour is given at a dose of 500 mg/kg BW. Glucomannan can undergo crystallization and can form the structure of fine fibers because the polymer has properties between cellulose and galactomannan (Frey and Peston, 1967). Glucomannan dissolves in cold water and forms a thick mass (Sarko and Marchessault, 1967), Glucomannan is insoluble in 20% NaOH solution. The heating treatment until the gel is formed will cause glucomannan to not dissolve again in water. Glucomannan thick solution with the addition of lime water can form a gel that is not easily broken (Sugiyama et al., 1971). The results of the thermographic analysis show the glucomannan decomposition temperature is 280 oC.

The power of developing glucomannan in water is quite large at around 138-200%. Glucomannan solution can be precipitated by recrystallization by ethanol and the formed crystals are dissolved again with dilute hydrochloric acid (Syaifullah, 1990). Glucomannan can be used as a microbial growth medium because of its liquor properties such as agar (Boelhasrin and Budiman, 1970).

The presence of soluble fiber can slow glucose absorption so that it can play a role in regulating blood sugar and slowing the rise in blood sugar (Vuksan, et al. 2000, Ling Chen et al, 2003, Sood, Baker and Craig, 2008 Tensiska, 2008). It was further explained that glucomannan can reduce blood sugar levels through its high viscosity and resistance to fermentation reactions in the digestive system causing "full" conditions in the stomach that affect the reduction in food intake. In addition, with its physical properties that are easy to absorb water can accelerate the passage of food in the intestine thereby reducing the amount to be absorbed by the body.

The same thing was conveyed by Restiani (2010), that the mechanism of fiber on healing diabetes, among others, by reducing the efficiency of carbohydrate absorption. This decrease will cause a decrease in the insulin response, with a decrease in the insulin response, the work of the pancreas will be lighter so that it can improve the function of the pancreas in producing insulin. Decreased blood glucose levels are strongly influenced by the absorption of carbohydrates in the intestine. The lower the absorption of carbohydrates, the lower the blood glucose level

This ability is expressed in the Glycaemic Index (GI), which ranges from 0 to 100. Foods that are quickly metabolized and absorbed quickly can increase blood sugar levels, have high GI numbers; whereas food that is slow to be metabolized and is slowly absorbed into the bloodstream has a low GI number (Marsono et al, 2007).

Conclusion

(1) From the test through the Meal Tolerance Test (MTT) it was found that consumption of porang flour at a dose of 0.3; 0.4 and 0.5 g / BW proved to be able to significantly reduce glucose absorption in the blood of white rats at 120 minutes compared to the treatment without porang flour. (2) Through the reverse intestinal test results obtained that the administration of porang flour at a dose of 0.3; 0.4 and 0.5 g / BW can reduce the absorption of reducing sugars in white mouse jejunum compared to treatment without porang flour.

Reference

- [1]. Boelhasrin, S., dan T. Budiman. 1970. Iles-iles dan Pengunannya dalam teknologi. Asta Pharmaceutica, 1: 1 – 5.
- [2]. Faridah, A., Widjanarko, S.B., Sutrisno, A., danSusilo, B. 2012.Optimasi produksi tepung porang dari chip porang secara mekanis dengan metode permukaan respons. Jurnal Teknik Industri, Vol.13, No. 2, Agustus 2012: 158-166
- [3]. Freeman, B.B. 2000.Dietary Fiber and Energy Regulation.Journal of Nutrition, 132(2); 272 S – 275 S.
- [4]. Frey, A. and W. Peston.1967. MicrofibrillarMorphology of Mannan. Advance in Carbohydrates, Volume 21. Academic Press, Inc. New York.
- [5]. Li, B., B.J. Xie, and J.F. Kennedy. 2006. Studies on the molecular chain morphology of konjac glucomannan. Carbohydrate Polymers 64: 510-515.
- [6]. Lupton, J.R., and Turner, D. 2000. Dietary Fiber, In Biochemical and Physiological Aspects of Human Nutrition. London: WB Saunders Company
- [7]. Marsono, Y., Wiyono, P., danUtama Z. 2007. Indekglikemikprodukolahanagarut (Marantaarundinata LINN).Prosiding Seminar Nasional PATPI, Bandung 17-18 Juli 2007
- [8]. Mulyono, E., Risfaheri, Misgiyarta, A.W. Permana, dan F. Kurniawan. 2009. Teknologi Produksi Tepung Mannan dari Umbi Iles-Iles (*Amorphophallus oncophillus*) yang Dapat Menghasilkan Rendemen 85% dan Derajat Putih 80%. Makalah pada seminar Hasil Penelitian SINTA TA.2009, 9 – 10 Oktober 2009.Badan Penelitian dan Pengembangan Pertanian, Jakarta
- [9]. Reza, H.M., Saeed, S., Sadaat, D.A., andMarziyeh, A. 2012. Comparison of the beneficial effects of guar gum on lipid profile in hyperlipidemic and normal rats.J. Med. Plants Res. 6(9): 1567-1575.
- [10]. Rissanen, T.H., Voutilainen, S., Virtanen, J.K., Venho, B., Vanharanta, M., Mursu, J., and Salonen, J.T. 2003. Low Intake of Fruits, Berries and Vegetables Is Associated with Excess Mortality in Men: the Kuopio Ischaemic Heart Disease Risk Factor (KIHD) Study. Journal of Nutrition, 133; 199-204.