

Can Purple Sweet Potato Yoghurt Control Weight Gain?

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Abstract—We investigated the effect of purple sweet potato yoghurt to obesity parameters. Thirty male Wistar rats were randomly divided into 5 groups: normal control, negative control and three intervention groups with purple sweet potato yoghurt (200, 300, and 400 mL/day) for thirty days. The body weight of rats was weighed and weight gain, Lee Index were calculated afterwards. In the end of experiment, the rats were sacrificed to measure the distribution of visceral fat. The results were analysed using ANOVA test, and showed no significant difference between intervention group and normal control in mean body weight, weight gain, Lee Index, and mean total visceral fat. As conclusion, consumption of high fat diet together with purple sweet potato yoghurt in dose 200 mL/day tends to control stabilization body weight and accumulation of visceral fat compare to normal control.

Keywords: purple sweet potato, Lee index, weight gain, visceral fat, yoghurt

I. INTRODUCTION

Prevalence of obesity in Indonesia has increased from 1.4% to 7.3% by 2007, at the age of 16-18 years old. Obesity is a condition that caused by the accumulation of fat in adipose tissue [1]. Accumulation of adipose tissue is caused by imbalance food intake that high in calories but lack of physical activity [2]. Obesity and overweight are closely related to the risk of insulin resistance, metabolic disorder, and dyslipidemia.

These conditions become risk factors for the occurrence of degenerative diseases such as coronary heart disease (CHD), stroke, diabetes mellitus, and other metabolic diseases [3,4]. Furthermore, it is necessary to conduct precautionary measures to prevent obesity and overweight. One of the solutions is consuming functional food, like yogurt. Yogurt is a modification of symbiotic food derived from probiotic fermentation [5]. Yoghurt can be made by mixing natural ingredients as a source of glucose, with prebiotics as the initiator of the fermentation process [6].

Ingredients commonly used for making yoghurt include powdered milk, skim milk, non-fat milk powder, milk that is partially removed, or a mixture of several milk types. High protein and glucose content, abundant availability, become reasons for choosing milk as a raw material in the process of yoghurt manufacturing. However, since 2016, many people began to look for alternative ingredients to substitute the needs for milk in yoghurt processing. Some alternative raw materials that used widely include coconut milk, nuts, seeds, and also rice [7]. In the process of raw material selection, we need to consider its compound, protein and glucose levels contained as a substitution.

As a tropical country, tubers are a large number of plants in Indonesia. One of the tuber plants which is widely known for its high anthocyanin content is the purple sweet potato. Purple sweet potato has a lot of nutrients such as carbohydrates, proteins, fats, fibre, vitamin C, vitamin A, beta-carotene, and phenol compounds. Purple sweet potato has the highest anthocyanin content compared to other types [8]. Anthocyanin is flavonoid compounds that have many benefits. Anthocyanin has a capability to lowering blood sugar level. Several studies have shown that foods rich in anthocyanin have antioxidant activity in the in vivo test [9]. Anthocyanin has powerful antioxidant and good bioavailability so it can be easily absorbed into the blood [10]. Other studies have suggested that anthocyanin has an effect in reducing body fat and anti-obesity effect that will reduce fat storage in the body tissue [11]. From that reason, we want to investigate the effect of purple sweet potato yoghurt on obesity parameters.

II. METHODS

This research is an experimental study using rats Wistar strains as experimental animals from the Laboratory of Pharmacology, Faculty of Medicine, Universitas Padjajaran, Bandung, West Java. Wistar male rats handling procedures issued by Faculty of Medicine, Bandung Islamic University Ethics Committee. Ethical approval number of this research is 371/Komite Etik.FK/III/2018.

A. Purple Sweet Potato Yoghurt Making Process

The procedure used for making homemade purple sweet potato yoghurt referred to previous research with some modification [12]. Sweet potatoes with the brand of Murasaki imo were used in this research. It washed first and boiled until tender. The tuber then weighed and mashed. Water was added in a ratio of 1:4 from the weight of sweet potatoes. Then it filtered until become puree. After that, 60% of full-cream milk added to the puree. The inoculum starter was added by 10% w/v. Incubation held in room temperature for 48 hours.

B. Purple Sweet Potato Intervention

Twenty-five Wistar male rats were adapted at the Laboratory of Medical Biology, Faculty of Medicine, Bandung Islamic University, regarded to the cycle of day and night, humidity, and privacy. Before the intervention, body weight of rats measured with digital scale. Rats were divided into five groups: normal control (normal diet), negative control (high-fat diet), the intervention group given high fat diet with variation amount of yoghurt 200 mL/day, 300 mL/day, and 400 mL/day purple sweet potato yoghurt for 30 days. The amount of yoghurt variation given was adjusted with recommendation of fermented drinks consumption daily [13].

C. Obesity Parameters Measurement

After 30 days intervention, obesity parameters were measured. Body weight and total visceral fat were measured with digital scale. Naso-anal length measured with measuring tape. Lee index was calculated. Weight gain was calculated by alleviated rats body weight in the end stage of the research referred to body weight before the intervention. After measuring body weight, rats were sacrificed and dissected. Fat from gonadal, abdominal, and retroperitoneal were measured.

D. Result Analysis

Data gained were groups into four categories, body weight, weight gain, lee index, and total visceral fat. Results from the intervention were analysed with ANOVA.

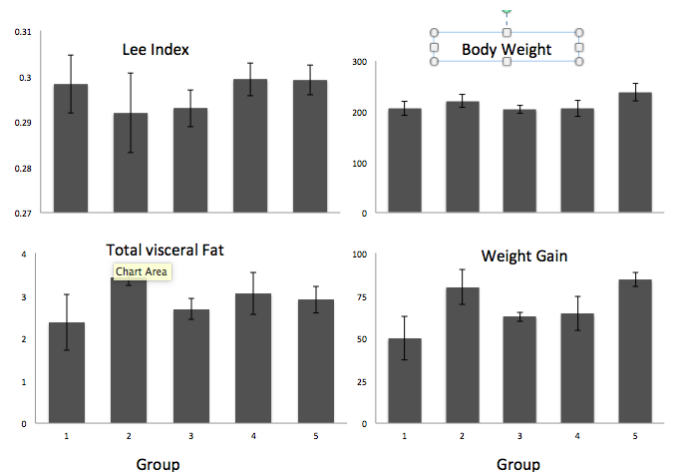
III. RESULTS AND DISCUSSION

This research conducted for 30 days with three types of diet: normal diet, high fat diet, and the high-fat diet supplemented with yoghurt. There is no difference between groups in the Lee index ($p=0,796$) (figure 1). According to Lee index, all of the group did not categorize as obesity with lee index less than 0,3. Obtained holistic information about obesity the research continued examination final body weight.

Excess energy from food will be stored in the body as body weight. Final body weight measured at the last stage of the research. From the data above, known that no significant difference between groups after intervention. Supplementation of 200 mL/day sweet potato yoghurt to rats with high-fat diet consumption showed similar characteristic with normal diet rats. However, increasing doses of yoghurt consumption increased body weight of rats with high-fat diet consumption. From this data, it was analyzed further information about weight gain changed after the intervention.

Weight gain could be calculated by a result of different body weight at the end of the study from weight before the intervention. Weight gain in the group given high-fat diet ($80\pm23,313$) showed higher levels than the group given the normal diet ($50\pm28,609$). The different result is shown by the group of high-fat diet rats with 200 mL/day ($62,60\pm6,107$) and 300 mL/day ($64,40\pm22,098$) sweet potato yoghurt supplementation compare to normal diet group (figure 1). These shows consumption of sweet potato yoghurt have a controlling effect in stabilizing weight gain on the high-fat diet rats. However, increasing doses of yoghurt consumption increase weight gain on high-fat diet rats. Therefore, next step research was going to measure total visceral fat.

Total visceral fat is the amount of fat distribution in adipose tissue throughout the body. There was no difference of total visceral fat between groups. Total visceral fat in the group given high fat ($3,4244\pm0,428$) showed higher visceral fat levels than the group given the normal diet ($2,368\pm1,460$). The different result is shown by the group of high-fat diet rats with 200 mL/day ($2,682\pm0,541$) sweet potato yoghurt supplementation compare to normal diet group (figure 1).



ND: Normal Diet, HFD: High Fat Diet, Group 1: ND, Group 2: HFD Group 3: HFD+ yoghurt 2 mL/day, Group 4: HFD+ yoghurt 3mL/day, Group 5: HFD+ yoghurt 4 mL/day, Data in the form of mean± SE, N=5/group, ANOVA.

Fig. 1. Obesity parameter: Lee Index, Body Weight, Weight Gain, and Total Visceral Fat.

Yoghurt has been believed to be a functional food to help weight loss process [1]. It has been consumed by human since thousand years with milk as a basic ingredient for its manufacture [14]. In this study, we added purple sweet potato puree as an additional substrate for the fermentation process. Not only functions as a substrate for the fermentation process, but also have a role in weight loss with anthocyanin [15].

This test was carried out by supplementation purple sweet potato yoghurt with varied doses start from 200, 300, 400 mL/day on high-fat diet rats consumption for 30 days. Lee index measurement showed insignificant results of obesity marker between three groups intervention compared to normal diet rats. In body weight analysis 200 ml/day and 300ml/day of yoghurt consumption showed stabilize body weight level compare to a normal diet. The value of this result equal to weight gain measurement. However, the different result

showed in total visceral fat measurement. Total visceral fat on the group given 300 ml/day yogurt was higher than the group given 200 ml/day yoghurt and normal diet.

From all analysis above, the group that has given 200 ml yoghurt had a better performance in stabilizing obesity parameters in high-fat diet rats compared to other group intervention. Obesity marker achieved by this group have similar values with normal diet rats. From these data consumption, 200ml/day of yoghurt could control weight gain and accumulation visceral fat on high-fat diet rats.

Daily yoghurt consumption will help the digestive process. The content of probiotics in yoghurt will increase the amount of microflora in the digestive system [16]. Increased number of microflora can reduce the absorption of lipids and sugars in the intestinal, the main cause of obesity [16]. Consumption of 200ml/day of yoghurt proved to be able to maintain the stability of weight gain and the accumulation of body fat. This fact according to the research conducted by Park which states that the consumption of probiotics has an anti-obesity effect [1].

However, increasing yoghurt consumption shown weight gain effect. It was affected by milk nutritional content as a raw material in yoghurt manufacturing process. Lipid and sugar composition in certain milk types are not proportionate to the amount of intestinal microflora. These compounds will be stored as lipid accumulation in adipose tissue. It could become a new concern in raw material selection for yoghurt fermenting process.

This study used purple sweet potato as an additional substrate for yoghurt. Anthocyanin contented in purple sweet potato has many effects, one of the most trusted function is weight loss induction [17]. Anthocyanin inhibits adipogenesis [15]. However, anthocyanin can be an alternative substrate for fermentation process by bacteria because it has three benzene ring with glucosides structures [15]. It can be energy reservation in adipose tissue if it was not consumed. It was predicted as a caused of insignificant weight gain stability along the experiment of addition purple sweet potato based yoghurt coupled with high-fat diet.

IV. CONCLUSION

As conclusion, consumption of high fat diet together with purple sweet potato yoghurt in dose 200 mL/day tends to control stabilization body weight and accumulation of visceral fat compare to normal control. We also concluded that the amount of yoghurt consumption should be adjusted with individual needs. In purpose of increasing body weight, amount of yoghurt consumption should be higher with high lipid and sugar contented in milk as a raw material. Meanwhile, in the purpose of weight loss, types of yoghurt with low fat and sugar would be considered. For better understanding, this research needs further development. We suggest research with a longer time monitoring and a wider range of high-fat diets variations. We also suggest another marker to analysed obesity parameter such as: lipid profile, glucose level, and rat's metabolism."

REFERENCES

- [1] S.Y. Park, K.S. Seong, and S.D. Lim, "Anti-obesity effect of yogurt fermented by *Lactobacillus plantarum* Q180 in diet-induced obese rats," *Korean journal for food science of animal resources*, vol. 36, no. (1), p. 77, 2016.
- [2] D. Segula, "Complications of obesity in adults: a short review of the literature," *Malawi Medical Journal*, vol. 26, no. (1), pp. 20-24, 2014.
- [3] E. Huriyati, H.F. Luglio, P.D. Ratrikaningtyas, A.F. Tsani, A.H. Sadewa, and M. Juffrie, "Dyslipidemia, insulin resistance and dietary fat intake in obese and normal weight adolescents: the role of uncoupling protein 2-866G/A gene polymorphism," *International journal of molecular epidemiology and genetics*, vol. 7, no. (1), p. 67, 2016.
- [4] Y.J. Kang, H.W. Wang, S.Y. Cheon, H.J. Lee, K.M. Hwang, and H.S. Yoon, "Associations of obesity and dyslipidemia with intake of sodium, fat, and sugar among Koreans: a qualitative systematic review," *Clinical nutrition research*, vol. 5, no. (4), pp. 290-304, 2016.
- [5] A. Baroutkoub, R.Z. Mehdi, R. Beglarian, J. Hassan, S. Zahra, M.S. Mohammad, and E.M. Hadi, "Effects of probiotic yoghurt consumption on the serum cholesterol levels in hypercholesteremic cases in Shiraz, Southern Iran," *Scientific Research and Essays*, vol. 5, no. (16), pp. 2206-2209, 2010.
- [6] J.G.B. Januário, I.C.F. da Silva, A.S. De Oliveira, J.F. De Oliveira, J.N. Dionísio, S.J. Klososki, and T.C. Pimentel, "Probiotic yoghurt flavored with organic beet with carrot, cassava, sweet potato or corn juice: Physicochemical and texture evaluation, probiotic viability and acceptance," *International Food Research Journal*, vol. 24, no. (1), p. 359, 2017.
- [7] P. Sfakianakis and C. Tzia, "Conventional and innovative processing of milk for yogurt manufacture; development of texture and flavor: A review," *Foods*, vol. 3, no. (1), pp. 176-193, 2014.
- [8] E. Ginting, J.S. Utomo, R. Yulifianti, and M. Jusuf, "Potensi ubijalar ungu sebagai pangan fungsional," *Iptek Tanaman Pangan*, vol. 6, no. (1), 2015.
- [9] J.G. Zhao, Q.Q. Yan, L.Z. Lu, and Y.Q. Zhang, "In vivo antioxidant, hypoglycemic, and anti-tumor activities of anthocyanin extracts from purple sweet potato," *Nutrition research and practice*, vol. 7, no. (5), pp. 359-365, 2013.
- [10] X.L. He, X.L. Li, Y.P. Lv, and Q. He, "Composition and color stability of anthocyanin-based extract from purple sweet potato," *Food Science and Technology*, vol. 35, no. (3), pp. 468-473, 2015.
- [11] J.H. Ju, H.S. Yoon, H.J. Park, M.Y. Kim, H.K. Shin, K.Y. Park, ... and M.S. Do, "Anti-obesity and antioxidative effects of purple sweet potato extract in 3T3-L1 adipocytes in vitro," *Journal of medicinal food*, vol. 14, no. (10), pp. 1097-1106, 2011.
- [12] S. Riyanto and H. Muwarni, "Yoghurt kedelai hitam (black soyghurt) dapat menurunkan kadar LDL tikus hiperkolesterolemia," *Jurnal Gizi dan Dietetik Indonesia (Indonesian Journal of Nutrition and Dietetics)*, vol. 3, no. (1), pp. 1-9, 2016.
- [13] W.F. Siregar, "Pengaruh perbandingan ubi jalar ungu dengan air dan konsentrasi starter terhadap mutu minuman probiotik sari ubi jalar ungu," *J. Rekayasa dan Pert.*, vol. 2, pp. 22-9, 2014.
- [14] P.F. Jacques and H. Wang, "Yogurt and weight management," *The American journal of clinical nutrition*, vol. 99, no. (5), pp. 1229S-1234S, 2014.
- [15] E. Azzini, J. Giacometti, and G.L. Russo, "Antiobesity effects of anthocyanins in preclinical and clinical studies," *Oxidative medicine and cellular longevity*, pp. 1-11, 2017.
- [16] L.V. McFarland, "From yaks to yogurt: the history, development, and current use of probiotics," *Clinical Infectious Diseases*, vol. 60, no. (suppl_2), pp. S85-S90, 2015.
- [17] T. Wu, Y. Gao, X. Guo, M. Zhang, and L. Gong, "Blackberry and blueberry anthocyanin supplementation counteract high-fat-diet-induced obesity by alleviating oxidative stress and inflammation and accelerating energy expenditure," *Oxidative medicine and cellular longevity*, pp. 1-11, 2018.