Biomedical & Pharmacology Journal, June 2018. Vol. **11**(2), p. 769-774

The Effect of Giving Extract Etanol of Kepok Banana Peel (*Musa Acuminata*) toward total Cholesterol Level on Male Mice (*Mus Musculus L.*) Strain *Deutschland-denken-yoken* (ddy) Obese

Khairun Nisa Berawi[1] and M. Azzaky Bimandama[2]

[1]Department of Medical Physiology, Medical Faculty,Universitas Lampung.
[2]Medical Faculty,Universitas Lampung.

http://dx.doi.org/10.13005/bpj/1431

(Received: 21 March 2018; accepted: 28 April 2018)

Obesity is excess of weight due to accumulation of fat which can cause dyslipidemia. One of dyslipidemia sign is increasing of total cholesterol level. The saponin, tannin and flavonoid as antioxidants components within kepok banana peel are predicted could decrease total cholesterol level. This study aims to determine whether saponin, tannin and flavonoid in kepok banana peels are effective against total cholesterol level in obese mice. This study was a true experimental using 20 obese male mice (*Mus musculus L.*) strain *Deutschland-Denken-Yoken* (ddY) and divided in four groups, which are normal control group (K1), obese control group (K2), and groups that were given extract of kepok banana peel treatment with dose 8,4 mg/day (KP1) and 16,8 mg/day (KP2). The treatment were given in 14 days. Total cholesterol level of each group was measured by spectrophotometer. The results obtained p=0,000, in one-way ANOVA test. Furthermore, in the Post Hoc Test generally found that there was significant differences between groups. There is effect of giving kepok banana peel to decreased total cholesterol level of obese mice. The effect of kapok Banana peel extract level of 8.4 mg/day more effectively lower total cholesterol level compared to banana peel extract level of 16.8 mg / day. The anti-cholesterol effect of banana fiber ethanol extract proved to decrease total cholesterol in obesity male mice (*Mus musculus L.*) strain ddY.

Keywords: Extract kepok banana peel, Obesity, Total cholesterol level.

Obesity is defined as being overweight due to excessive accumulation of fat which increases many comorbidity in our body[1]. Obesity is a multifactorial disease because it can be caused by many factors, one of which is eating fast food containing high calories, fat and cholesterol, with sedentary life[1]. The prevalence of obesity is not only increasing in developed countries but also in developing countries where facing nutrition transition, namely changes in dietary patterns caused by urbanization and modernization[2,3].

Obesity is associated with various comorbidities, such as cardiovascular disease, type 2 diabetes, hypertension, cancer and sleep apneu. obesity or overweight leads to dyslipidemia, hypertension, glucose intolerance, and hypoventilation[4]. Obesity predisposes to the occurrence of heart failure, congestive heart disease, and death so that the big spiral in the high rate of prevalence of coronary heart disease[5]

Obesity increased incidence of dyslipidemia. Description of dyslipidemia caused

by obesity has an increased composition of low density lipoprotein (LDL), decreased HDL, elevated triglyceride levels, and high plasma free fatty acid levels[6]. High triglyceride levels and low levels of HDL is a risk factor for the occurrence of coronary heart disease[7]

The prevalence of dyslipidemia in Indonesia is increasing. The results of Riskesdas 2013 survey showed that the prevalence of dyslipidemia on the basis of total cholesterol concentration >200 mg/dl was 35.9%[8]. Efforts to control cholesterol levels can be done in various ways. Management of lifestyle and interventions medication such as statin groups, cholesterol absorption inhibitors, bile acid sequestrants, fibrates, nicotinic acid, cholesteryl ester transfer protein (CETP) inhibitors, and combination therapy can also produce significant effects in lowering cholesterol levels. However, some of the drug classes may cause disorders in the liver, arrhythmias, gastrointestinal disorders, and muscle aches[9].

The country of Indonesia is one of the largest banana-producing countries in Asia. In Indonesia, bananas are the most high-yielding fruits. Around 2006, total banana production in Indonesia reached 5,037,472 tons with 10.6% coming from Lampung Province. Based on data from the Directorate of Processing and Marketing of Holticulture, Lampung Province is one of the production centers of banana kepok. The processing of banana kepok will produce banana skin waste. Waste that is not utilized and properly empowered will be a source of pollutants [10].

Banana peel skin contains bioactive compounds such as pectin, tannin, saponin, and flavonoids that act as antioxidants and can lower cholesterol levels. Antioxidant activity on banana peel reach 94,25% at concentration 125 ¼g/ml, whereas in part banana fruit only about 70% at concentration 50 mg/ml [11, 12]. This antioxidant activity that cause banana skin predicted can lower cholesterol. The mechanism of tannin in lowering cholesterol is inhibiting cholesterol biosynthesis by inhibiting HMG Co-A reductase enzyme so cholesterol absorption can decrease. In addition, tannin will increase the excretion of bile acids. The research proved that banana kepok skin can be used to lower total cholesterol[13, 14,15]. Bananas have a variety of types. Lampung Province has a lot of banana kepok production and researchers try to explore further utilization of banana kepok skin waste.

Based on these, the researcher is interested to conduct research with the title "The effect of kepok banana peel (*Musa acuminata*) extract on total cholesterol level of mice (Mus musculus L.) male Deutschland-Denken-Yoken (ddY) Obesity."

MATERIALS AND METHOD

This type of research is true experimental quantitative analytic. This study aims to determine the effect of banana kepok skin extract on total cholesterol levels in obesity mice. The population used in this study was male mice (Mus musculus L.) aged 6-10 weeks with average weight 30-50 gram. While the sample used in this study as many as 20 male mice. The sample was divided into four groups, namely normal control group (K1), obesity control group (K2), and treatment group of banana peel extract 8,4 mg / day (KP1) and 16,8 mg / day (KP2) [14,26].

The dose is divided into 8.4 mg/day and 16.8 mg/day. Based on data from *Guidelines for the housing of Mice in Scientific Institutions*, 2012, the consumption of mice feed range from 4-8 grams/ day and water consumption 5-8 ml/day (Fawcett, 2013). The total cholesterol content of mice measured after 14 days of maintenance in the four study groups. The normal total cholesterol level is 26.0-82.4 mg/dl. Cholesterol levels were measured using a spectrophotometer with *cholesterol oxidase p-aminophenazone* (CHOD-PAP) method[16].

This study used ripe banana peel, because based on in vitro test, ripe banana peel has the highest antioxidant activity. Banana mashed with a yellow skin taken four kilograms and cut 4x3 cm in size. Next washed and drying with oven at 50 ^{o}C for 24 hours. The final stage through the extraction process using 96% ethanol to take concentrations of active ingredients[17].

RESULTS

Research conducted at the Laboratory of Biochemistry-Molecular Biology Faculty of Medicine, University of Lampung during the month of September-October 2016 got 20 research subjects and divided into four groups at random.

The normal control group given standard feed (K1), obesity control group given high-fat high-protein feed (K2), treatment group 1, given high-fat high-protein feed and banana peel extract 8.4 mg/day (KP1), and treatment group 2, fed high-fat high-fat protein and banana peel extract 16.8 mg/day (KP2). Calculation of the number of samples for this study using the formula.

Table 1 shows the mean total cholesterol levels of normal control group (K1) given standard feeding were normal mean of total cholesterol levels in this study. The mean total cholesterol level in the normal control group (K1) based on the measurement results was 80,000 mg/dl. These results fall into the normal range of total cholesterol in mice, is 26.0-82.4 mg/dl. Based on the table 1, it can also be seen that the total cholesterol level of the average obese control group (K2) given high-fat high-protein diet was 261,426 mg/dl. Meanwhile, levels the mean total cholesterol in the high-fat, high-protein-fed group treated with 8.4 mg/day (KP1) and 16.8 mg/day (KP2) banana peel extracts showed lower results than the obese control group (K2). The mean total cholesterol level of treatment group 1 (KP1) was 68,569 mg/dl, meanwhile total mean cholesterol group of treatment group 2 (KP2) was 12,852 mg/dl.

Table 2 shows that the effect of banana peel extract on total cholesterol levels of obesity mice is indicated by significant information. Based on the results of Post Hoc Test in Table 2, it is known that almost in all study groups showed a significant difference, except the normal control group (K1) with treatment group 1 (KP1) as well as vice versa.

DISCUSSION

Obesity is the increase in body weight beyond the limits of physical and skeletal needs due to excessive body fat accumulation[18]. The accumulation of fat is an abnormal condition that can interfere with health. Therefore, obesity is now a world problem where the incidence increases over time[1].

Obesity that persists for a certain period of time, kilocalories that enter through food in greater quantities can cause metabolic disorders of hypercholesterolaemia. The state of obesity will lead to disorder of fatty acid regulation that will increase triglyceride levels and cholesterol esters. Increased blood cholesterol can also be caused by a rise in cholesterol found in very low density lipoprotein (VLDL) and low density lipoprotein (LDL) due to a large increase of triglycerides in the circulation in case of excessive build up of fat in the body[4, 6, 18].

The use of herbal ingredients as an alternative medicine to reduce total cholesterol levels in the blood still continues with various studies[19]. One of the herbal ingredients used as antihiperkolesterolemik namely banana peel. Banana peel skin contains high levels of antioxidants that contains bioactive compounds such as pectin, tannin, saponin, and flavonoids that act as antioxidants and can lower cholesterol levels [13, 14, 15].

Once tabulated, the results showed that giving banana peel extract in obesity mice gave effect to total cholesterol level. This is indicated by the significance value of 0,000 ($p < 0.05$) in the One-Way ANOVA test results. The mean total cholesterol level in the normal control group (K1) based on the measurement results was 80,000 mg/dl. The average total cholesterol level measurement in this normal control group (K1) goes into the normal range of total cholesterol in mice, 26.0-82.4 mg/dl.

Administration of banana peel extract in the study of 8.4 mg/day and 16.8 mg/day was obtained based on the conversion of the effective doses of banana peel extract for rats, ie 200 mg/kgbb can reduce total cholesterol levels of Sprague Dawley male white rats. This is consistent with the results of the study that the dose of banana peel extract of 8.4 mg/day in the treatment group 1 (KP1) resulted in average total cholesterol levels that fall into the normal range of total cholesterol for mice. While giving of banana skin extract 16,8 mg/day make the total cholesterol group average of treatment 2 (KP2) become less than normal, that is equal to 12,852 mg/dl. Although the administration of banana peel extract of 16.8 mg/day reduced total cholesterol levels, but the decrease in total cholesterol levels of 12.852 mg/dl was considered to be ineffective because this level is less than the normal total cholesterol level of 26.0- 82.4 mg / dl. So, it can be concluded that the content of banana peel extract is the most effective to reduce total cholesterol levels in obesity mice in this study was

8.4 mg/hari. The results showed that giving banana kepok skin extract can affect total cholesterol levels obesity mice.

Another study suggests that the antioxidant potential in banana kepok not only succeeds in lowering total cholesterol levels but can also lower other lipid fractions, in this case triglycerides. This study used 28 male rats Sprague Dawley rats maintained for 21 days with the treatment group given banana kepok feed. The result of banana kepok (Moses paradisiaca forma typical) with a dose of 9 grams / day was able to reduce serum triglyceride levels around 40.4% [20].

Recent study using gives banana kepok to Sprague Dawley male rats with a dose of 4.5 grams/ day and 9 grams/day decreased Malondialdehyde (MDA), a free radical indicator. Malondialdehyde (MDA) is the end product of Poly-Unsaturated Fatty Acid (PUFA) non-enzymatic oxidative degradation used as a mark of lipid peroxidation. MDA levels higher than normal conditions are known to occur in individuals suffering from hyperglycemia and hypercholesterolemia. MDA levels in mice decreased, meaning that antioxidants in banana kepok proved to work as anti-free radicals. Antioxidant activity in banana kepok known by 70%, while the antioxidant activity in banana kepok skin reached 94.25% [21].

The ability of banana peel skin in lowering total cholesterol levels is associated with antioxidant activity contained in it. Based on the antioxidant activity test in vitro, it was found that banana peel extract can inhibit 50% oxidation at concentration 693,15 ¼g/ml Antioksidan owned by banana peel skin include pectin, tannin, saponin, and flavonoid[11, 12].

According to research conducted by Megawati and Machsunah, banana kepok skin contains 22.4% pectin compounds. This pectin will bind to cholesterol contained in the digestive system thus preventing it from being absorbed into the bloodstream. With this mechanism, pectin will lower total cholesterol levels in the blood. The use of pectin for two weeks can lower serum cholesterol levels by 13%. Cholesterol levels can be decreased significantly by taking pectin at least 6 grams/day[22].

The amount of tannin contained in banana peel skin is estimated to reach 11.26 mg/g. The mechanism of tannin in lowering cholesterol is by inhibiting cholesterol biosynthesis by inhibiting HMG Co-A reductase enzyme so cholesterol absorption can decrease. In addition, tannin will increase the excretion of bile acids. With this mechanism in the research proved that banana kepok skin can be used to lower total cholesterol[16,23].

The amount of saponin in banana peach skin can reach 49.7 mg/g. With that amount, saponin can function as an antioxidant and is useful to lower total cholesterol. Saponin work mechanism in lowering cholesterol is by binding to cholesterol in the lumen intestinal so that will reduce the absorption of cholesterol. In addition, saponins also bind to bile acids that will decrease the cycle of enterohepatic bile acids and increase cholesterol excretion. With this mechanism, saponins will lower total blood cholesterol levels[24, 25].

Banana skin contains 24.6% flavonoid compounds. Flavonoids are believed to protect

Table 1. Average Measurement of Total Cholesterol Levels in Four Research Groups

Total Cholesterol Levels	Research Group	Mean ± Std (mg/dl)
Total Cholesterol *(mg/dl)*	Group K1	80,000 ± 5,976
	Group K2	261,426 ± 11,951
	Group KP1	68,569 ± 9,585
	Group KP2	12,852 ± 5,974

Table 2. Post-Hoc Test Results

Dependence variable	Group treatment(I)	Group treatment(J)	p
Total cholesterol (mg/dl)	K1	K2	,000*
		KP1	,332
		KP2	,000*
	K2	K1	,000*
		KP1	,000*
		KP2	,000*
	KP1	K1	,332
		K2	,000*
		KP2	,000*
	KP2	K1	,000*
		K2	,000*
		KP1	,000*

*Sig:Significant if p<0,05

the body from free radicals by preventing lipid peroxidation. As an antioxidant, flavonoids act as LDL reducers in the body. In addition to reducing LDL, flavonoids also increase the density of LDL receptors in the liver and binding to apolipoprotein B. Flavonoids also act as compounds that can reduce triglycerides and increase HDL. In research of Banana flavonoids work to lower cholesterol levels in the blood by inhibiting the action of enzyme *3-hydroxy 3-methylglutaril coenzyme A reductase (HMG Co-A reductase)*.

CONCLUSIONS

Through this research, it is concluded that there is the effect of banana peel extract on the total cholesterol level of obesity mice and it is known that banana peel extract level of 8.4 mg/day is more effective to lower total cholesterol level compared to banana peel extract level of 16.8 mg/day.

REFERENCES

1. WHO. Obesity: preventing and managing the global epidemic. Report on a WHO Consultation on Obesity, Geneva, 3–5 June, 1997. WHO/NUT/NCD/98.1. Technical Report Series Number 894. Geneva: World Health Organization (2000)
2. Rachmi CN, Li M, Alison Baur L., Overweight and obesity in Indonesia: Prevalence and Risk factors-a literature review. *Public Health,* **147**: 20-29 (2017).
3. Popkins BM, Adair LS, Ng SW. Now and Then: Global Nutrition Transition: The Pandemic of Obesity in Developing Countries., **70**(1):3-21 (2013).
4. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, et al. Obesity and cardiovascular disease: Pathophysiology, evaluation, and effect of weight loss. *Arteriosclerosis, Thrombosis, and Vascular Biology*, **26**(5); 968-976 (2006).
5. Lavie CJ, Milani RV, Blair SN, McAuley PA, Church TS. Obesity and Cardiovascular Disease Implications Regarding Fitness, Fatness and Saverity in the Obesity Paradox. *Journal of the American College of Cardiology*, **63**(14): (2014).
6. Jung U, Choi M-S. Obesity and Metabolic Complications: The Role of Adipokines and The Relationship between Obesity, Inflammation, Insulin Resistance, Dyslipidemia and Nonalcoholic Fatty Liver Disease. *International Joural of Molecular Sciences*, **15**(4): 6184-6223 (2014).
7. Lee JS, Chang P, Zhang Y, Kizer JR, Best LG, Howard BV. Triglyceride and HDL-C Dyslipidemi and Riska of Coronary Heart Disease and Ischemic Stroke by Glycemic Dysregulation Status: The Strong Heart Study.: 1-9 (2017).
8. Badan Penelitian dan Pengembangan Kesehatan (Banlitbangkes),. 2013. Riset Keseshatan Dasar. (RISKESDAS) 2013. Laporan Nasional: 1-384 (2013).
9. Barton, M., Baretella, O., & Meyer, M. R. Themed Section/ : Fat and Vascular Responsiveness Correspondence Obesity and risk of vascular disease/ : importance of vasoconstriction. *British Journal of Pharmacology*, **165**: 591–602 (2012).
10. Hendra, J. Suprapto dan Mulyanti, N. *Teknologi Budidaya Pisang*. Bandar Lampung: Balai Besar Pengkajian dan Pengembangan Teknologi Pertanian (2008).
11. Fatemeh, S.R., Saifullah, R., Abbas, F.M.A., Azhar, M.E. Total Phenolics, Flavonoids, and Antioxidant Activity of Banana Pulp and Peel Flours: Influence of Variety and Stage of Ripenes. *International Food Research Journal* **19**(3): 1041–1046 (2012).
12. Canales, Aguirre A., Carvalo, Aceves A., Manzano, Chávez L., Padilla, Camberos E., Lugo, Cervantes E. Wound healing and antioxidant activities of extracts from Musa paradisiaca L. Peel. *Planta Med* **74**(9): (2008).
13. Nagarajaiah, S dan Prakash, J. Chemical composition and antioxidant potential of peels from three varieties of banana. *As. J. Food Ag-Ind* **4**(01): 31–46 (2011).
14. Onasanwo, S. Anti ulcer and ulcer healing potentials of methanol extract of *Musa Sapientum* peel in laboratory rats. *Pharmacognosy Res* **5**(3):173×178 (2013).
15. Shodeinde, S.A dan Oboh, G. Antioxidant Properties of Aqueous Extracts of Unripe Musa paradisiaca on Sodium Nitroprusside Induced Lipid Peroxidation in Rat Pancreas in vitro. *Asian Pac J Trop Biomed* **3**(6): 449–457 (2013).
16. Sekhon-Loodu, S. Antioxidant, Antiinflammatory and Hypolipidemic Properties of Apple Flavonols [Skripsi]. Nova Scotia: NovaScotia Agricultural College Truro (2012).
17. Atun, S, Arianingrum, R., Handayani, S., Rudyansyah, and Garson, M., Identification and Antioxidant Activity test of some compounds from methanol exract peel of Banan (Musa paradiasiaca Linn.), *Indo. J. Chem.,* **7**(1)83 – 87: (2007).
18. Després, J.-P., Lemieux, I., Bergeron, J., Pibarot, P., Mathieu, P., Larose, E., Rodes-Cabau J, Bertrand OF, Poirier, P. Abdominal Obesity

and the Metabolic Syndrome: Contribution to Global Cardiometabolic Risk. *Arteriosclerosis, Thrombosis, and Vascular Biology*, **28**(6): 1039–1049 (2008).

19. Javed, I., Rahman, Z.U., Khan, M.Z., Muhammad, Aslam., Iqbal, Z. Sultan. Antihyperlipidaemic efficacy of *Trachyspermum ammi* in albino rabbits. *Acta Vet Brno* **78**: 229–236 (2009).
20. Adianingsih, S. Puspitasari. Pengaruh Pemberian Pisang Kepok (*Musa paradisiaca forma typical*) terhadap Kadar *Malondialdehyde* (MDA) Tikus *Sprague Dawley* Pra-Sindrom Metabolik. Semarang: Universitas Diponegoro (2015).
21. Mateos, R., Lecumberri, E., Ramos, S., Goya, L., Bravo, L. Determination of malondialdehyde (MDA) by high-performance liquid chromatography in serum and liver as a biomarker for oxidative stress: Application to a rat model for hypercholesterolemia and evaluation of the effect of diets rich in phenolic antioxidant. *J Chromatogr B Anal Technol Biomed Life Sci* **827**(1): 76–82 (2005).
22. Megawati dan Machsunah, E. Lutfiatul. Ekstraksi Pektin dari Kulit Pisang Kepok (*Musa paradisiaca)* Menggunakan Pelarut HCl sebagai *Edible Film*. *Jurnal Bahan Alam Terbarukan* **5**(1): 14–21 (2016).
23. Singhal, M., Ratra, P. Antioxidant activity, total flavonoid and total phenolic content of Musa Acuminata peel exctracts. *Global J. Pharmacol* **7**(2): 188–22 (2013).
24. Okorondu, S. I., Akujobi, C.O., Nwachukwu, I.N. Antifungal properties of *Musa paradisiaca* (Plantain) peel and stalk extracts. *International Journal of Biological and Chemical Sciences* **6**(4): 1527–1534 (2012).
25. Okechukwu, R.I., Onyedineke, N.E., Mgbemena, I.C., Opara, F.N., Ukaoma, A.A. Inhibition of Pathogenic Microorganisms by Ethnobotanical Extracts of Fruit Peels of Musa paradisiaca. *Journal of Applied Pharmaceutical Science* **02**(04): 01–03 (2013).
26. fawcett, A. *Guideline 22. Guidelines for the Housing of Mice in Scientific Institutions Table of Contents*. Australia: West Pennant Hills Public School (2012).