

***Coffea Sp.* as Metabolism of Sugar Agent on Male Mice (*Mus musculus*) BABLC Albino**

Armaita^{1*}, D. Tohidin¹, Y. Afriatin²

¹ D3 Keperawatan, Sport and Science Faculty, Universitas Negeri Padang, Padang, Indonesia

*Corresponding author. Email: armaita10mei@gmail.com

ABSTRACT

Caffeine was one of main substance which has contained on coffee. It was popular of drinks in this world. The influence of caffeine on blood sugar level has been became a topic by researchers especially about it would be increase or decrease it. The purposes of this research was to know how the influence of giving caffeine in coffee (*coffea sp*) as metabolism of sugar for male mice. The type of this research was experiment by design of post test only control group design. According to the result and data analysis, it was gotten an influence by significantly by giving extract caffeine on blood sugar level. There was the significant of different between each group. They were P3 (0.56 kg/BB) as higher by significantly as P1 (0.14 kg/BB) dan P2 (0.28 kg/BB).

Keywords: *blood sugar, caffeine, coffee.*

1. INTRODUCTION

Caffeine is the main substance contained in coffee which is a drink favored by people around the world. Caffeine content in several types of coffee is 95- 165 mg at 237 mL of coffee served brewed, 47-64 mg at 30 mL espresso coffee, 63 mg at 237 mL instant coffee, and 2-5 mg at 237 mL decaffeinated coffee. The effect of caffeine on blood sugar levels is still unclear (Urzua et al, 2012).

Hyperglycemia is caused by abnormalities in insulin secretion or impaired insulin action (Johansen et al, 2005). Hyperglycemia occurs because the body does not have enough insulin or insulin cannot convert glucose into energy. The condition of hyperglycemia can give an indication that diabetes is not controlled (American Diabetes Association, 2010). Hyperglycemia, occurs because the spread of glucose into cells is hampered and metabolism is disrupted, under normal circumstances approximately 50% of glucose consumed has a perfect metabolism of CO₂ and water, 5% is converted to glycogen and fat. In diabetes mellitus the whole process is interrupted, glucose cannot not enter the cell so that the main energy is obtained from protein and fat metabolism (Ganiswarna,1995).

The results of the Basic Health Research (Riskesdas) in 2007 showed that the proportion of causes of death due to DM in the 45-54 years age group in urban areas was ranked second at 14.7%. And in rural areas, DM ranks 6th at 5.8%. According to the 2013 Riskesdas report, the

prevalence of diabetes mellitus in Indonesia is 1.5% and the prevalence of diabetes mellitus in West Sumatra Province is 1.35. The regencies / cities that occupy the 5 highest rates of diabetes mellitus in West Sumatra Province are Bukittinggi City (2.6%), Pariaman City (2.6%) (Handayani et al, 2013).

The effect of caffeine on blood sugar levels is still a discussion of researchers whether raising or lowering blood sugar levels. The effect of caffeine on glucose tolerance is still unclear (Urzua et al, 2012). Coffee which is the main source of caffeine can show protection against diabetes (Akash et al., 2012; Van et al., 2004). But apparently, in addition to containing coffee, coffee also contains chlorogenic acid which is a polyphone. Chlorogenic acid levels in coffee are quite large at 200 mL coffee is around 70-350 mg.

Based on the above background, researchers are interested in researching as experimental material in the field to see the effect of giving caffeine coffee drinks (*Coffea Sp*) as a metabolic agent in male mice (*Mus musculus* BABLC albino). The purpose of this study was to determine the effect of caffeine in coffee drinks as a sugar agent in male mice.

2. METHODS

2.1 Test Animal Preparation

Choose 28 test animals, age 2-3 months, healthy body weight 18-40 grams. Prepare a mouse cage complete with a feed and drinking water container. Pad cages of rice powder are replaced every three days. Test animals that will be used are acclimatized in the cage for 1 week. 28 mice were divided into four groups. The first group is the group without treatment (control), the second group is the group that is given coffee at a dose of 0.14g / ml, the third group with 0.28g / ml, and the last group at a dose of 0.56g / ml.

2.2 Caffeine Making (coffee)

Coffee is roasted with a temperature of 1490-2130C. The roasting is stopped when the coffee is easy to solve. This shows that the roasted coffee is ready to be ground to get ground coffee. Coffee powder is put into a measuring cup, then brewed with ethanol water then macerated (soaking) for 24 hours, then filtrated (filtering) separates the water with its pulp, then evaporated (heated) to produce an extract from the coffee. the volume of coffee solution used is as follows: conversion calculation of experimental animals x coffee solution: 0.14g x 200ml = 0.28 g / ml. So 28g / ml is the second dose for the first dose 1/2 of dose 2. For dose 3, 2 times the second dose. Dosage 1: 1/2 of 28g / ml = 0.14 g / ml; Dose 2: 0.14g x 200ml = 0.28 g / ml; Dose 3: 2 x 28g / ml = 0.56g / ml Coffee powder is given by brewing with ethanol water and then given to mice through sonde.

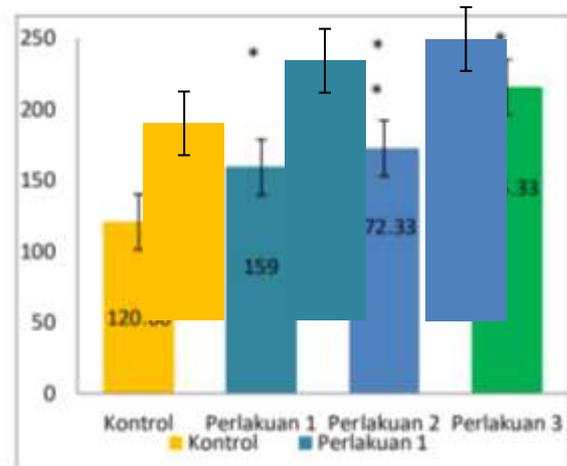
3. RESULT AND DISCUSSION

Table 1. 1 Analysis of Result diabetes for mice which has given cafein on coffee drinks (Coffea sp.) as metabolism sugar agent (n= 24).

Treatment	means±sdt	Ket
Control	120.66 ± 9.24	p = 0.000
Treatment 1	159.00 ± 2.09	
Treatment 2	172.33 ± 3.61	
Treatment 3	215.33 ± 15.16	

Based on table 5.1, It can be seen that the average change in the results of data analysis using One Way Anova is known to have a significant effect on the administration of

caffeine extract on blood sugar levels where the known P value is <0.00.



In the LSD test chart there are differences between each group. It was found that there were significant differences between the control group and other treatments. Treatment with P value of each P1 = 159.00 mg / dl, P2 = 172.33 mg / dl, P3 = 215.33 mg / dl. It is known that the results of blood sugar levels in the control group with an average blood sugar level of 120.66 mg / dl, this shows blood sugar levels in the normal control group. Group P1 had an average blood sugar level of 159.00 mg / dl. Group P (1) with a dose of caffeine extract 0.14 kg / BW had an increase in blood sugar levels, this showed an increase in blood sugar levels in P1 compared to the control group. P2 group had an average blood sugar level of 172.33 mg / dl. Group P (2) with a dose of caffeine extract 0.28 kg / BW had increased blood sugar levels, this showed that blood sugar levels in P2 had increased compared to group P1. P3 group had an average blood sugar level of 215.33 mg / dl. Group P (3) with a dose of caffeine extract 0.56 kg / BW had an increase in blood sugar levels, this showed that blood sugar levels in P3 had a significant increase compared to groups P1 and P2.

In the LSD test on the average diagram of blood sugar levels in each group it can be seen that blood sugar levels in the control group mice (K) with blood sugar levels of 108.17 mg / dl, whereas in the Treatment group 1 (P1) have blood sugar levels of 121.67 mg / dl at a dose of 1.4 g / kgBW, treatment group 2 (P2) had blood sugar levels of 134.67 mg / dl at a dose of 2.8 g / kgBW, and treatment group 3 (P3) has a blood sugar level of 153.17 mg / dl at a dose of 5.6 g / kgBW. In the control group described as normal blood sugar levels because in the control group did not give caffeine extract only given food in an ad labium. Furthermore, the group (P1) experienced a slight increase in blood sugar levels significantly compared to the control group because of the administration of caffeine extract at a dose of 1.4 g / kgBW. In group (P2) experienced a significant increase in blood sugar levels compared to (P1) due to the administration of caffeine extract which was greater than (P1) at a dose of 2.8 g / kgBW, in the group (P3) an increase in blood sugar levels was sufficient significantly compared (P1), (P2) after administration of caffeine extract at a dose of 5.6 g / kgBW. It is seen that the

higher the dose of caffeine extract given will cause high blood sugar (hyperglycemia).

Research conducted by Tjekyan (2007) states that high caffeinated drinks can reduce the risk of type 2 diabetes mellitus and impaired sugar tolerance and increase insulin responsiveness and sensitivity. Caffeine increases insulin sensitivity by being mediated by adrenaline and insulin sensitivity is increasingly related to the amount of coffee consumed, and caffeine also stimulates fat oxidation and mobilization of glycogen from muscle tissue and stimulates the release of free fatty acids from peripheral tissues. Consumption of coffee for 2-4 weeks in healthy adults can increase fasting insulin concentration, which can reduce insulin sensitivity. Short-term research shows that consumption of caffeine in a short time (2-4 weeks) can reduce insulin sensitivity for only 100-180 minutes (Van Dam et al, 2004). This research is supported by Arnlov (2004), finding that an increase in consumption of 1 cup of coffee a day is associated with an increase in insulin sensitivity of 0.16 units. Thus the consumption of coffee and tea containing caffeine are independently associated with increased insulin sensitivity. Because caffeine can interfere with the action of insulin, there are other elements in coffee that play a role in increasing insulin sensitivity. Caffeine contains phenol compounds which have antioxidant activity. Antioxidants in coffee can increase insulin sensitivity because it has been reported that antioxidants can increase insulin sensitivity in people with type 2 diabetes. Previous studies have shown that glucose concentrations in plasma will decrease by the presence of chlorogenic acid (a strong antioxidant), which may be able to combined with other antioxidants in coffee that can reduce oxidative stress. The research of Johnston et al (2003) also states that chlorogenic acid might have an antagonistic effect on glucose transport. The possibility of phenol compounds in food can reduce the speed of glucose absorption in the intestine and shift the absorption of glucose into the more distal part of the intestine. Coffee also seems to have a greater effect on women who are overweight and obese. Among obese women, C-peptide levels in women who consumed > 4 cups of caffeinated coffee a day for 1 year were 0.84 g / ml lower than those

4. CONCLUSION

Based on observations and data analysis, it can be concluded that oral administration of caffeine gives significant results on blood sugar levels in normal mice and hyperglycemia. Group (P3) an increase in blood sugar levels experienced quite significant compared (P1), (P2) after administration of caffeine extract at a dose of 5.6 g / kgBW. It is seen that the higher the dose of caffeine extract given will cause high blood sugar (hyperglycemia).

REFERENCES

- [1] Agus pribadi. Gutama. 2008. Penggunaan mencit dan tikus sebagai hewan model penelitian nikotin. Skripsi. Program Studi Teknologi Produksi Temak, Bogor.
- [2] Annonim, 1991, Penapisan Farmakologi, Pengujian Fitokimia dan Pengujian Klinik (Pedoman Pengujian dan Pengembangan Fitofarmaka), 233- 240, Balai Pengembangan dan Pemanfaatan Obat Bahan Alam, Jakarta.
- [3] Arnolv, Je. (2017). Coffee Consumption and Insulin Sensitivity. *The Journal of the American Medical Association*; 291; 1199-1201.
- [4] Assyifa, H. 2016. Perbedaan Kadar Glukosa Metode CHOD-PAP Menggunakan NaF Segera dengan Ditunda 12 Jam dan 24 Jam. Universitas Muhammadiyah Semarang, Semarang.
- [5] Badan Penelitian dan Pengembangan Kesehatan Kementrian Kesehatan RI. (2007). Riset who had never consumed coffee. Thus, long-term caffeinated and decaffeinated coffee consumption can reduce insulin secretion, which may therefore be an effective strategy for reducing insulin resistance, especially in overweight women.

According to the research of Millah et al (2017), there is a significant difference in the provision of coffee to cholesterol and triglyceride levels. At low dose the equivalent of 3 cups of coffee (0.39 mg / 3ml), a moderate dose is equivalent to 6 cups of coffee (0.78 mg / 3ml), and a high dose is equivalent to 10 cups of coffee (1.3 mg / 3ml) . An increase in cholesterol levels occurs due to the effect of coffee which can induce the release of free fatty acids (FFA). FFA is one of the main precursors of acetyl CoA which will be a precursor of cholesterol biosynthesis. Several studies conducted on humans show an increase in FFA as a result of high lipolysis due to coffee consumption (Greenberg et al, 2010).

Research conducted by Hery, et al (2007) administration of kefein in pregnant mice with a dose of 5.4 mg g / BW which is equivalent to 300 mg / day in humans has been able to significantly reduce body weight and fetal size. Caffeine is given for 14 days during pregnancy. Stating that the weight and length of the fetus body of the treatment group there was a growth disturbance in the womb due to caffeine. This research is also supported by Beck and Urbano (1991) who stated that caffeine can cause delays in ossification, ectroductility and cleft palate. Birth defects usually occur as a result of interactions between teratogenic agents and the maternal and embryonic genomes. In the period of preimplantation, fertilization, blastulation, gastrulation and early erosion of the uterine wall, the effects of an agent will be manifested in an embryoletal form and rarely teratogenic. Entering the period of organogenesis there will be a process of histogenesis, functional maturation and growth. In this organogenesis the fetus becomes more resistant to lethal effects compared to the stage of embryogenesis and the incidence of embryonic death (Manson et al., 2006).

- Kesehatan Dasar (RISKESDES) 2007. Jakarta : Kementrian Kesehatan Republik Indonesia.
- [6] Farah, Adriana. Coffee :Emerging Health Effects and Disease Prevention, First Edition. John Willey & Sons, Inc and Institute of Food Technologist (USA): Wiley Blackwell Publishing Ltd; 2012.
- [7] Ganiswarna, S. 1995. Farmakologi dan Terapi, edisi IV, 271-288.
- [8] Handayani, DS. 2013. Perilaku Self-Management Pasien Diabetes Melitus (DM). *Jurnal Keperawatan*, 1(1), <https://doi.org/10.24198/jkp.v1i1.49>
- [9] Hery Wijayanto., Tri Wahyu Pangestiningih., Erdiansyah Rahmi., 2007. Pengaruh Pemberian Kafein Pada Masa Organogenesis Terhadap Berat Lahir Fetus Tikus Putih (*Rattus Norvergicus*). Fakultas Kedokteran Hewan Universitas Gadjah Mada Yogyakarta.
- [10] Johansen, JS., Harris, AK., Rychly, DJ., & Ergul, A. 2005. Oxidative stress and the use of antioxidants in diabetes: Linking basic science to clinical practice. *Cardiovascular Diabetology*, 4(5).
- [11] Johnson Carr. 2005. Prosedur perawatan di rumah. EGC, Jakarta.
- [12] Millah Fithriyah Zindany., Husnil Kadri., Almurdi., 2007. Pengaruh Pemberian Kopi Terhadap Kadar Kolesterol dan Trigliserida pada Tikus Wistar (*Rattus Novergicus*). Fakultas Kedokteran Universitas Andalas Padang.
- [13] Ningsih Himawati Arie. 2015. Pengaruh Lama Penyimpanan dalam Magic Com Terhadap Kadar Glukosa Pada Nasi Merah dan Nasi Jagung. Universitas Muhammadiyah Semarang, Semarang.
- [14] Smara, F. 2016. Perbedaan Kadar Glukosa Serum Darah Beku 1 Jam, 2 Jam, dan 3 Jam. Universitas Muhammadiyah Semarang, Semarang.
- [15] Tjekyan, R. (2007). Risiko Penyakit Diabetes Mellitus Tipe 2 di Kalangan Peminum Kopi di Kotamadya Palembang Tahun 2006-2007. *Makara, kesehatan*; 11; 54-60.
- [16] Urzua, Z., Trujillo, X., Huerta, M., Trujillo-Hernandez, B., Rios-Silva, M., Onetti, C., Ortiz-Mesina, M., & Sanchez-Pastor, E. 2012. Effects of chronic caffeine administration on blood glucose levels and on glucose tolerance in healthy and diabetic rats. *The Journal of International Medical Research.*, 40(6), 2220-2230.
- [17] Van Dam RM, Pasman WJ, Verhoef P. (2004). Effects of coffee consumption on fasting bloodglucose and insulin concentratin.
- [18] Widowati, L., Dzulkarnain, B., dan Sa'roni, 1997, Tanaman Obat untuk Diabetes Mellitu, *Cermin Dunia Kedokteran*, 116, 53-60, Jakarta.
- [19] Wulandari Silvi. 2016. Gambaran Kadar Glukosa Darah Dalam Sampel Serum Dengan Plasma Naf Yang Ditunda 1 Dan 2 Jam Di Stikes Muhammadiyah Ciamis. Sekolah Tinggi Ilmu Kesehatan Muhammadiyah Ciamis, Ciamis.