BAB 5
KESIMPULAN DAN SARAN

5.1 Kesimpulan

Berdasarkan studi literatur yang telah dilakukan dan hasil analisis data yang didapatkan maka dapat diambil kesimpulan :

1. Pemberian kombinasi MCT dan kafein dapat menurunkan gula darah puasa tikus *obese* karena MCT dan kafein dapat meningkatkan sensitivitas insulin yang meningkatkan metabolisme glukosa dalam tubuh tikus.
2. Pemberiaan kombinasi MCT dan kafein dapat meningkatkan badan keton dalam darah tikus *obese* yang dapat digunakan sebagai sumber energi cadangan bagi tubuh.

5.2 Saran

1. Perlu dilakukan penelitian preklinis dari efek pemberian kombinasi MCT dan kafein pada gula darah puasa dan keton darah serta parameter kesehatan lain pada tikus *obese*.

DAFTAR PUSTAKA

Akash, S.M.,H., Pharm, K. R. B., Phil, M., Chen, S. 2014, Effects of Coffee On Type 2 Diabetes Mellitus. *Nutrition*, **30**, 755–763.

Amarasinghe, A., and D'Souza, G. 2012. Individual, Social, Economic, and Environmental Model: A Paradigm Shift for Obesity Prevention, *International Scholarly Research Network*, 1-10.

Augustin, K., Khabbush, A., Williams, S., Eaton, S., Orford, M. And Cross, J. H. 2018, Mechanisms of action for the medium-chain triglyceride ketogenic diet in neurological and metabolic disorders, *The Lancet Neurology*, **17**, 84-93

Badan Penelitian dan Pengembangan Kesehatan. 2018, Riset Kesehatan Dasar (RISKESDAS) 2018. Hasil Utama Riset Kesehatan Dasar 2018,1-88.

Center for Disease Control and Prevention (CDC). 2017, *Overweight and Obesity*. https://www.cdc.gov/obesity/adult/causes.html di akses 8 Agustus 2019.

Chamma, C.M.O., Bargut, T.C.L., Mandarim-de-Lacerda, C.A. and Aguila, M.B. 2017. A rich medium-chain triacylglycerol diet benefits adiposity but has adverse effects on the markers of hepatic lipogenesis and beta-oxidation, *Food & Function*, **8**, 778-787

Chooi, Y.C., Ding, C., Magkos, F. 2018, The Epidemiology of Obesity. *Journal of Metabolism and Clinical Experimental*, 1-16.

Courchesne-Loyer, A., Lowry, C., St-Pierre, V., Vandenberghe, C., Fortier, M., Castellano, C. 2017, Emulsification Increases the Acute Ketogenic Effect and Bioavailability of Medium-Chain Triglycerides in Humans, *Journal of Nutrition*, 1-8

Dewi, C.M. 2015, Faktor-Faktor yang Menyebabkan Obesitas pada Anak, *Majority*, **4(8)**, 54-56.

Fukazawa, A., Koike, A., Karasawa, T., Tsutsui, M., Kondo, S. and Terada, S. 2020. Effects of a Ketogenic Diet Containing Medium-Chain Triglycerides and Endurance Training on Metabolic Enzyme Adaptations in Rat Skeletal Muscle, *Journal of Nutrients*, **12(1269)**,1-15.

Geng, S.,· Zhu, W., Xie, C., Li1, X., Wu, J., and Liang, Z. 2014, Medium-chain triglyceride ameliorates insulin resistance and inflammation in high fat diet-induced obese mice, *European Journal of Nutrition*. 1-10.

Greenberger, N dan Skillman, T. 1969, Medium Chain-Triglycerides-Physiologic Considerations and Clinical Implications. *The New England Medical Journal*, **280(19)**, 1045-1058.

Guimaraes, J., Bargut, T.C.L., Mandarim-de-Lacerda, C.A., Aguila, M.B. 2018, Medium-chain triglyceride reinforce the hepatic damage caused by fructose intake in mice, *Prostaglandins, Leukotrienes and Essential Fatty Acids*, 1-31.

Hankinson, A.L., Daviglus, M.L., Bouchard, C., Carnethon, M., Lewis, C.E., Schreiner, P.J. 2010, Maintaining a high physical activity level over 20 years and weight gain, *Journal of the American Medical Association***, 304 (23)**, 2603-2610

Harvey, C. J., Schofield, G. M., dan Williden, M. 2018, The Use of Nutritional Supplements to Induce Ketosis and Reduce Symptoms Associated with Keto-Induction: A Narrative Review, *PeerJ*, **6**,1-10.

Heckman**,** M dan Demejia, E. 2010, Caffeine (1, 3, 7-trimethylxanthine) in Foods: A Comprehensive Review on Consumption, Functionality, Safety, and Regulatory Matters, *Journal of Food and Science*, **3(75),** 77-87.

Heijning, B.J.M., Oosting, A., Kegler, D., and Beek, E.M. 2017, An Increased Dietary Supply of Medium-Chain Fatty Acids during Early Weaning in Rodents Prevents Excessive Fat Accumulation in Adulthood, *Journal of Nutrition*, **9(631),**1-16.

Hoeks, J., Mensink, M. R., Hesselink, M. K. C., Ekroos, K., & Schrauwen, P. 2012, Long- and Medium-Chain Fatty Acids Induce Insulin Resistance to a Similar Extent in Humans Despite Marked Differences in Muscle Fat Accumulation. *Journal of Clinical Endocrinology and Metabolism*, ***97*(1)**, 208-216.

Jehan, S., Zizi, F., Perumal, S., Wall, S., Auguste, E., Myers, A., Jean-Louis, G., and McFarlane, S. 2017, Obstructive Sleep Apnea and Obesity: Implications for Public Health. *Sleep Med Disord*, **1(4)**,1-7.

Kemenkes RI. 2012, *Pedoman Pencegahan dan Penanggolangan Obesitas Pada Siswa Sekolah Dasar*. Jakarta: Direktorat Jenderal Bina Gizi dan Kesehatan Ibu dan Anak.

Kesl, S., Poff, A., Ward, N., Fiorelli, N., Ari, C., Van Putten, A. 2016, Effects of exogenous ketone supplementation on blood ketone, glucose, triglyceride, and lipoprotein levels in Sprague–Dawley rats. *Nutrition & Metabolism*, **13(9)**, 1-15.

Kim, N., Nakamura, H., Masaki, H., Kumasawa, K., Hirano, K. and Kimura, T. 2017, Effect of lipid metabolism on male fertility, *Biochemical and Biophysical Research Communications*, 1-28.

Krinke, G. J. 2000. *The Handbook of Experimental Animals The Laboratory Rat*. Academy Press. New York, 46-51.

Kyrou, I., Randeva, H., Tsigos, C., Kaltsas, G., and Weickert, M. 2018, Clinical Problems Caused by Obesity. Journal of Endocrinology, 1-18.

Lee, S-II., Kim, J.W., Lee, Y.K., Yang, S.H., Lee, I., Suh, J.W., and Kim, S.D. 2011, Anti-obesity Effect of Monascus pilosus Mycelial Extract in High Fat Diet-induced Obese Rat. *Journal Applied Biomolecular Chemistery*; **54**, 197-205.

Lim, J.K., Lee, J.H.., Kim, J.S., Hwang, Y.I., Kim, T.H., Lim, Y.S., Yoo, K.H., Jung, K.S., Kim, Y.K., and Rhee, C.K. 2017, Comparison of World Health Organization and Asia-Pacific body mass index classifications in COPD patients, *International Journal of COPD*, **12**, 2465-2475.

Liu, C., Tsai, C., Huang, C., Tsai, C. and Su, Y., Lin, M. 2017, Effects and mechanisms of caffeine to improve immunological and metabolic abnormalities in diet-induced obese rats, *The American Journal of Physiology-Endocrinology and Metabolism*, **314**, 433-447

Lozano, I., Van der Werf, R., Bietiger, W., Seyfritz, E., Peronet, C., Pinget, M. 2016, High-fructose and high-fat diet-induced disorders in rats: impact on diabetes risk, hepatic and vascular complications. *Nutrition & Metabolism*, **13(15)**, 1-13.

Masood, W and Uppaluri, K.R. 2019, Ketogenic diet. North Carolina.

Matsuda, Y., Kobayashi, M., Yamauchi, R., Ojika, M., Hiramitsu, M., Inoue, T. 2014. Coffee and Caffeine Improve Insulin Sensitivity

and Glucose Tolerance in C57BL/6J Mice Fed a High-Fat Diet, *Bioscience, Biotechnology, and Biochemistry*, **75(12)**, 2309-2315.

Mustamin, 2010, Asupan Energi dan Aktivitas Fisik dengan Kejadian Obesitas Sentral pada Ibu Rumah Tangga di Kelurahan Ujung Pandang Baru Kecamatan Tallo Kota Makassar. Media Gizi Pangan, **10 (2)**, 63-67.

Ogunbode, A.M., Fatiregun, A.A., Ogunbode, O.O. 2017, Health Risks of Obesity, **7(2)**, 22-25.

Okumura, T., Tsukui, T., Hosokawa, M. and Miyashita, K. 2012, Effect of Caffeine and Capsaicin on the Blood Glucose Levels of Obese/Diabetic KK-*Ay* Mice, *Journal of Oleo Science*, **61(9)**, 515-523

Panchal, S.K., Wong, W.Y., Kauter, K., Ward, L.C. and Brown, L. 2012, Caffeine attenuates metabolic syndrome in diet-induced obese rats, *Journal of Nutrition*, 1055-1062.

Pati, D. and Lorusso, L.N. 2017, How to Write a Systematic Review of the Literature. *Health Environments Research & Design Journal*, **20(2)**,1-16.

Polikandrioti, M. And Stefanou, Evagelia. 2014, Obesity Disease, *Health Science Journal*, **3(3)**, 132-138

Sidhu, S, Parikh, T., dan Burman, K. 2017. Endocrine Changes in Obesity.

Sherwood, L. 2011, Fisiologi manusia: dari sel ke sistem. 6th ed. Yesdelita N, editor. Jakarta: EGC.

Sherwood, L. 2014, Fisiologi manusia dari sel ke sistem. 8th ed. Jakarta: EGC.

Shi X., Xue W., Liang S., Zhao J., Zhang X. 2016, Acute caffeine ingestion reduces insulin sensitivity in healthy subjects: a systematic review and meta-analysis, *Journal of Nutrition*. **15(103)**, 1-8.

Shinohara, H., Wu, J., Kasai, M., and Aoyama, T. 2010, Randomly Interesterified Triacylglycerol Containing Mediumand Long-Chain Fatty Acids Stimulates Fatty Acid Metabolism in White Adipose Tissue of Rats, *Bioscience, Biotechnology, and Biochemistry*, **70(12)**, 2919-2926.

Sinha, R.A., Farah, B.L., Singh, B.K., Siddique, M.M., Li, Y. and Wu, Y. 2014, Caffeine stimulates hepatic lipid metabolism via autophagy-lysosomal pathway, *Journal of American Association for the Study of Liver Diseases,* **59(4)**, 1366-1380.

Stubbs, B., Cox, P., Evans, R., Santer, P., Miller, J., Faull, O. 2017, On the Metabolism of Exogenous Ketones in Humans. *Frontiers in Psycholog,* **8(848)**, 1-13.

Syah, A.N.A., Sumangat, D. 2005, *Medium Chain Triglyceride* (*MCT*): Trigliserida Pada Minyak Kelapa dan Pemanfaatannya. *Proseding Seminar Nasional Teknologi Inovatif*. Balai Besar Penelitian dan Pengembangan Pascapanen Pertanian. Departemen Pertanian. Bogor.

Terada, S.,Yamamoto, S., Sekine, S. and Aoyama, T. 2012, Dietary intake of medium- and long-chain triacylglycerols ameliorates insulin resistance in rats fed a high-fat diet, *Journal of Nutrition,* **28**: 92-97.

Thevenet, J., De Marchi, U., Domingo, S., Christinat, N., Bultot, L., Lefebvre, G. 2016, Medium-chain fatty acids inhibit mitochondrial metabolism in astrocytes promoting astrocyte–neuron lactate and ketone body shuttle systems, *Federation of American Societies for Experimental Biology,* **30**, 1913–1926.

Thorning, T. K., Raziani, F., Bendsen, N. T., Astrup, A., Tholstrup, T., dan Raben, A. 2015, Diets with High-Fat Cheese, High-Fat Meat, or Carbohydrate on Cardiovascular Risk Markers in Overweight Postmenopausal Women: A Randomized Crossover Trial. *The American Journal of Clinical Nutrition*, **102**, 573-581.

Trumbo, P., Schlicker, S., Yates, AA., Poos, M., Food and Nutrition Board of the Institute of Medicine, 2002, The National Academies. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. *Journal of the American Dietetic Association*, **102(11),** 1621-30.

Vandenberghe, C., St-Pierre, V., Courchesne-Loyer, A., Hennebelle, M., Castellano, C., Cunnane, S. 2016, Caffeine intake increases plasma ketones: an acute metabolic study in humans. *Journal of Physiology ans Pharmaco*l, 1-11.

Volek, J.S., D.J. Freidenreich, C. Saenz, L. J. Kunces, B.C. Creighton, J.M. Bartley,... and S.D. Phinney. 2016 ”Metabolisme characteristic of keto-adapted ultra-endurance runners.” *Metabolism*, **65(3)**, 100-10.

Wadden, TA., Webb, VL., Moran, CH., Bailer, BA. 2012, *Lifestyle modification for obesity: new developments in diet, physical activity, and behavior therapy.* Journal of the American Heart Association. **125**, 1157-1170.

World Health Organisation (WHO), 2018, *Obesity and Overweight.* https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight di akses 12 April 2019.

Yeh, T.C., Liu, C.P., Cheng, W.H., Chen, B.R., Lu, P.J. and Cheng, P.W. 2014, Caffeine Intake Improves Fructose-Induced Hypertension and Insulin Resistance by Enhancing Central Insulin Signaling, *AHA Journals*, **63**, 535-541.

Zhou, Z., Wang, Y., Jiang, Y., Zhang, Z., Sun, X. and Yu, L. 2017, Dietary Intake of Structured Lipids with Different Contents of Medium-Chain Fatty Acids on Obesity Prevention in C57BL/6J Mice, *Journal of Food Science*, **00**, 1-31.