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 MCT dan kafein dapat menurunkan berat badan tikus obesitas.
2. Pemberiaan MCT dan kafein dapat menurunkan asupan makan tikus obesitas.

5.2 Saran

1. Perlu dilakukan penelitian lebih lanjut pada tikus obesitas tentang efek dari pemberian MCT dan kafein terhadap berat badan dan asupan makan.
2. Perlu dilakukan penelitian lebih lanjut pada tikus obesitas apakah ada efek samping yang ditimbulkan jika digunakan dalam jangka panjang dari pemberian MCT dan kafein.

DAFTAR PUSTAKA

Aizawa, T. dan Helble, M. 2016. Socioeconomic Inequity in Excessive Weight in Indonesia. Tokyo: Asian Development Bank Institute. p. 3-6.

Andina, R. E., Ridwan, A., & Rahmawati, Y. 2017. Analisis Model Mental Siswa pada Materi Hidrolisis Garam di Klaten. JRPK: *Jurnal Riset Pendidikan Kimia*, **7(2),** 144-152.

Ardies, C.M. 2014. *Diet, Exercise and Chronic Disease*. London: CRC Press.

Asl, B. H., Vaez, H., Imankhah, T., & Hamidi, S. 2014. Impact of caffeine on weight changes due to ketotifen administration. *Advanced pharmaceutical bulletin*, **4(1),** 83.

Astrup, A. dan Finer, N. 2000. Redefining Type 2 Diabetes: 'Diabesity' or 'Obesity Dependent Diabetes Mellitus, *Obesity Reviews*, Vol. **1(2):** p. 57-59.

Budipitojo, T., Wihadmadyatami, H., & Aristya, G. R. 2016. Identifikasi Sifat dan Distribusi Sel Endokrin Ghrelin di Lambung Tikus (Rattus Norvegicus): Studi Immunohis-Tokimia pada Kondisi Obesitas. *Journal of Tropical Biodiversity and Biotechnology*, **1(1),** 39-44.

Bray, G. A. dan Popkin, B. M. 2014. Dietary Sugar and Body Weight: Have We Reached a Crisis in The Epidemic of Obesity and Disease. *Diabetes Care,* Vol. **37**: p. 950-956.

Cahyaningrum, A. 2018. Leptin Sebagai Indikator Obesitas. *Jurnal Kesehatan Prima*, **9(1),** 1364-1371.

Clark, M. J. dan Slavin, J. L. 2013. The Effect of Fiber on Satiety and Food Intake: A Systematic Review. *Journal of The American College of Nutrition*, Vol. **32(3):** p. 200-211.

Clark, K. S., Coleman, C., Shelton, R., Heemstra, L. A., & Novak, C. M. 2019. Caffeine enhances activity thermogenesis and energy expenditure in rats. *Clinical and Experimental Pharmacology and Physiology*, **46(5),** 475-482.

Clegg, M. E. 2010. Medium-Chain Triglycerides are Advantageous in Promoting Weight Loss Although not Beneficial to Exercise Performance. *International Journal of Food Sciences and Nutrition*, Vol. **61(7):** p. 653-679.

Coleman, H., Quinn, P., Clegg, M.E. 2016, Medium chain triglycerides and conjugated linoleic acids in beverage form increase satiety and reduce food intake in humans, *Nutrition Research.* Diakses pada 31 oktober 2019, https://sci-hub.tw/10.1016/j.nutres.2016.01.004.

Corkey, B. E. 2012. Diabetes: Have We Got It All Wrong Insulin Hypersecretion and Food Additives: Cause of Obesity and Diabetes. *Diabetes Care*, Vol. **35**: p. 2432-2437.

Cox, P. J., Kirk, T., Ashmore, T., Wilerton, K., Evans, R., Smith, A., Murray, A. J., Stubbs, B., West, J., McLure, S. W., King, M. T., Dodd, M. S., Holloway, C., Neubauer, S., Drawer, S., Veech, R. L., Griffin, J. L., dan Clarke, K. 2016. Nutritional Ketosis Alters Fuels Preference and Thereby Endurance Performance in Athletes. *Cell Metabolism*, Vol. **24**: p. 1-13.

Dangol, M., Kim, S., Li, C. G., Lahiji, S. F., Jang, M., Ma, Y., & Jung, H. 2017. Anti-obesity effect of a novel caffeine-loaded dissolving microneedle patch in high-fat diet-induced obese C57BL/6J mice. *Journal of controlled release*, **265**, 41-47.

Dehghan, M., Mente, A., Zhang, X., Swaminathan, S., Li, W., Mohan, V., Iqbal., Kumar R., Wentzel-Viljoen, E., Rosengren, A., Amma, L. I., Avezum, A., Chifamba, J., Diaz, R., Khatib, R., Lear, S., Lopez-Jaramillo, P., Liu, X., Gupta, R., Mohammadifard, N., Gao, N., Oguz, A., Ramli, A. S., Seron, P., Sun, Y., Szuba, A., Tsolekile, L., Wielgosz, A., Yusuf, R., Yusufali, A. H., Teo, K. K., Rangarajan, S., Dagenais, G., Bangdiwala, S., Islam, S., Anand, S. S., Yusuf, S., dan Prospective Urban Rural Epidemiology (PURE) Study Investigators. 2017. Associations of Fats and Carbohydrate Intake with Cardiovascular Disease and Mortality in 18 Countries from Five Continents (PURE): A Prospective Cohort Study. *The Lancet*, Vol. **17**: p. 1-8.

de Souza, R. J., Mente, A., Maroleanu, A., Cozma, A. I., Ha, V., Kishibe, T., Uleryk, E., Budylowski, P., Schünemann, H., Beyene, J., dan Anand, S. S. 2015. Intake of Saturated and Trans Unsaturated Fatty Acids and Risk of All Cause Mortality, Cardiovascular Disease, and Type 2 Diabetes: Systematic Review and Meta-Analysis of Observational Studies. 2015. *BMJ*, Vol. **351**: p. 1-16.

Ding., W. 2014, Drinking Coffee Burns Hepatic Fat by Inducing Lipophagy Coupled With Mitochondrial b-Oxidation, *Department of Pharmacology Toxicology and Therapeutics., The University of Kansas Medical Center*, Rainbow Boulevard, Kansas, pp 1235-1238.

Dorlan, W. A. N., 2012, *KAMUS SAKU KEDOKTERAN DORLAND*, Penerbit Buku Kedokteran EGC, Jakarta.

Foster, G. D., Wyatt, H. R., Hill, J. O., Makris, A. P., Rosenbaum, D. L., Brill, C., Stein, R. I., Mohammed, B. S., Miller, B., Rader, D. J., Zemel, B., Wadden, T. A., Tenhave, T., Newcomb, C. W., dan Klein, S. 2010. Weight and Metabolic Outcomes After 2 Years on Low-Carbohydrate versus Low-Fat Diet: A Randomized Trial. *Annals of Internal Medicine,* Vol. **153(3):** p. 147-157.

Faigenbaum, A. D., Chu, D. A., Paterno, M. V., dan Myer, G. D. 2013. Responding to Exercise Deficit Disorder in Youth: Integrating Wellness Care into Pediatric Physical Therapy. *Pediatric Physical Therapy*, Vol. **25(1):** p. 2-6.

Guyton A.C. and J.E. Hall., 2007, *Buku Ajar Fisiologi Kedokteran*, Edisi 9, EGC, Jakarta.

Icken, D., Feller, S., Engeli, S., Mayr, A., Müller, A., Hilbert, A., and Zwaan M.D. 2015, Caffeine intake is related to successful weight loss maintenance, *European Journal of Clinical Nutrition* (2015): 1-3.

Ilyas MN., Adzim MKR., Simbak NB and Atif AB. 2017. Sample Size Calculation for Animal StudiesUsing Degree of Freedom (E); an Easy and Statistically Defined Approach for Metabolomics and Genetic Research. *Current Trends Biomedical Engineering & Biosciences*. **10**: 1-2.

Harvey, C. J., Schofield, G. M., Williden, M., dan McQuillan, J. A. 2018. The Effect of Medium Chain Triglycerides on Time to Nutritional Ketosis and Symptoms of Keto-Induction in Healthy Adults: A Randomised Controlled Clinical Trial. *Journal of Nutrition and Metabolism*, 2018: p. 1-9.

Higashi, Y. Noma, K., Yoshizumi, M., dan Kihara, Y. 2009. Endothelial Function and Oxidative Stres in Cardiovascular Diseases. *Circulation Journal*, **73(4):** 411-418.

Heller, R. F. dan Heller, R. F. 1993. Hyperinsulinemic Obesity and Carbohydrate Addiction: The Missing Link is The Carbohydrate Frequency Factor. *Medical Hypotheses*, Vol. **42**: p. 307-312.

Kavanagh, K., Jones, K. L., Sawyer, J., Kelley, K., Carr, J. J., Wagner, J.D., dan Rudel, L. L. 2007. Trans Fat Diet Induces Abdominal Obesity and Changes in Insulin Sensitivity in Monkeys. *Obesity (Silver Spring*), Vol. **15(7):** p. 1675-1684.

Kesl, S. L., Poff, A. M., Ward, N. P., Fiorelli, T. N., Ari, C., Putten, A. J. V., Sherwood, J. W., Arnold, P., dan D'Agostino, D. P. 2016. Effects of Exogenous Ketone Supplementation on Blood Ketone, Glucose, Triglyceride, and Lipoprotein Levels in Sprague-Dawley Rats. *Nutrition and Metabolism*, Vol. **13(9):** p. 1-15.

Kim, H. Y., Lee, M. Y., Park, H. M., Park, Y. K., Shon, J. C., Liu, K. H., & Lee, C. H. 2015. Urine and serum metabolite profiling of rats fed a high-fat diet and the anti-obesity effects of caffeine consumption. *Molecules*, **20(2),** 3107-3128.

Kopp, W. 2003. High-Insulinogenic Nutrition – An Etiologic Factor for Obesity and The Metabolic Syndrome. *Metabolism*, Vol. **52(7):** p. 840-844.

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.

Lee, E. J., Oh, H., Kang, B. G., Kang, M. K., Kim, D. Y., Kim, Y. H., & Kang, Y. H. 2018. Lipid-lowering effects of medium-chain triglyceride-enriched coconut oil in combination with licorice extracts in experimental hyperlipidemic mice. *Journal of agricultural and food chemistry*, **66(40)**, 10447-10457.

Liu, Y. H., Zhang, Y., Xu, Q., Yu, X. M., Zhang, X. S., Wang, J., & Xue, C. Y. 2012. Increased norepinephrine by medium-chain triglyceride attributable to lipolysis in white and brown adipose tissue of C57BL/6J mice. *Bioscience, biotechnology, and biochemistry*, **76(6),** 1213-1218.

Liu, A. G., Arceneaux III, K. P., Chu, J. T., Jacob Jr, G., Schreiber, A. L., Tipton, R. C., & Primeaux, S. D. 2015. The effect of caffeine and albuterol on body composition and metabolic rate. *Obesity*, **23(9),** 1830-1835.

Maher, T., & Clegg, M. E. 2020. A systematic review and meta-analysis of medium-chain triglycerides effects on acute satiety and food intake. *Critical Reviews in Food Science and Nutrition*, 1-13.

May, A. L., Kuklina, E. V., dan Yoon, P. W. 2012. Prevalence of Cardiovascular Disease Risk Factors Among US Adolescents, 1999-2008. *Pediatrics*, Vol. **129(6):** p. 1035-1041.

Misnadiarly. 2007. *Obesitas Sebagai Faktor Risiko Beberapa Penyakit*. Jakarta: Pustaka Obor Populer.

Moore, B. J. dan Pi-Sunyer, X. 2012. Epidemiology, Etiology, and Consequences of Obesity. In: Akabas, S., Lederman, S. A., dan Moore, B. J., Editors. *Textbook of Obesity: Biological, Psychological and Cultural Influences*. Singapore: Wiley-Blackwell. p. 5-41.

Morenga, L. T., Mallard, S., dan Mann, J. 2013. Dietary Sugars and Body Weight: Systematic Review and Meta-analyses of Randomized Controlled Trials and Cohort Studies. *BMJ*, Vol. **345**: p. 1-25.

Murata, Y., Harada, N., Yamane, S., Iwasaki, K., Ikeguchi, E., Kanemaru, Y., & Poudyal, H. 2019. Medium-chain triglyceride diet stimulates less GIP secretion and suppresses body weight and fat mass gain compared with long-chain triglyceride diet. *American Journal of Physiology-Endocrinology and Metabolism*, **317(1)**, E53-E64.

Myer, G. D., Faigenbaum, A. D., Stracciolini, A., Hewett, T. E., Micheli, L. J., dan Best, T. M. 2013. Comprehensive Management Strategies for Physical Therapy in Youth. *Current Sports Medicine Reports*, Vol. **12(4):** p. 248-255.

OECD, 2017, Obesity update, Organisation for Economic Cooperation and Development, Diakses pada 31 oktober 2019, https://www.oecd.org/els/health-systems/Obesity-Update-2017.pdf.

Praditasari, J. A., & Sumarmik, S. 2018. ASUPAN LEMAK, AKTIVITAS FISIK DAN KEGEMUKAN PADA REMAJA PUTRI DI SMP BINA INSANI SURABAYA [Fat Intake, Physical Activity and Obesity among Adolescent Girls in SMP Bina Insani Surabaya]. *Media Gizi Indonesia*, **13(2),** 117-122.

Puchalska, P. dan Crawford, P. A. 2017. Multi-Dimensional Roles of Ketone Bodies in Fuel Metabolism, Signaling, and Therapeutics. *Cell Metabolism*, Vol. **25**: p. 262-284.

Puspitasari, N. 2018. FAKTOR KEJADIAN OBESITAS SENTRAL PADA USIA DEWASA, *HIGEIA JOURNAL OF PUBLIC HEALTH RESEARCH AND DEVELOPMENT*, **2(2):** 249-259.

[RISKESDAS] Riset Kesehatan Dasar. 2007. Jakarta: Badan Penelitian dan Pengembangan Kesehatan, Departemen Kesehatan, Republik Indonesia.

[RISKESDAS] Riset Kesehatan Dasar. 2013. Jakarta: Badan Penelitian dan Pengembangan Kesehatan, Departemen Kesehatan, Republik Indonesia.

Sackner-Bernstein, J., Kanter, D., dan Kaul, S. 2015. Dietary Intervention for Overweight and Obese Adults: Comparison of Low-Carbohydrate and Low-Fat Diets: A Meta-Analysis. *Plos One*, Vol. **10(10):** p. 1-19.

Schmitt, G. C., Arbo, M. D., Lorensi, A. L., Maciel, E. S., Krahn, C. L., Mariotti, K. C., & Limberger, R. P. 2012. Toxicological effects of a mixture used in weight loss products: p-synephrine associated with ephedrine, salicin, and caffeine. *International Journal of Toxicology*, **31(2),** 184-191.

St-Onge, M. P., & Jones, P. J. H. 2003. Greater rise in fat oxidation with medium-chain triglyceride consumption relative to long-chain triglyceride is associated with lower initial body weight and greater loss of subcutaneous adipose tissue. *International journal of obesity*, **27(12),** 1565-1571.

St-Pierre, V., Vandenberghe, C., Lowry, C., Fortier, M., Castellano, C., Wagner, R., and Cunnane, S.C. 2019, Plasma Ketone and Medium Chain Fatty Acid Response in Humans Consuming Different Medium Chain Triglycerides During a Metabolic Study Day, *Frontiers in Nutrition*, **6:** 1-8.

Sugiura, C., Shiho, N., Moriyama, T., Ozasa, S., Kawada, T., and Sayama, K. 2012, Catechins and Caffeine Inhibit Fat Accumulation in Mice through the Improvement of Hepatic Lipid Metabolism, *Journal of Obesity*, **2012:** 1-10.

Sung, M. H., Liao, F. H., & Chien, Y. W. 2018. Medium-chain triglycerides lower blood lipids and body weight in streptozotocin-induced type 2 diabetes rats. *Nutrients*, **10(8)**, 963.

Syah., A.N.A., and Sumangat., D. MEDIUM CHAIN TRIGLYCERIDE (MCT): TRIGLISERIDA PADA MINYAK KELAPA DAN PEMANFAATANNYA, *Balai Besar PeneIitian dan Pengembangan Pascapanen Pertanian.* Diaksese pada 31 oktober 2019,https://repository.ipb.ac.id/jspui/bitstream/123456789/26159/1/prosiding_seminar_teknologi_inovatif_pascapanen-67.pdf.

Tabrizi, R., Saneei, P., Lankarani, K.B., Akbari, M., Kolahdooz, F., Esmaillzadeh, A., Nadi-Ravandi, S., Mazoochi, M & Asemi, Z. 2018, The effects of caffeine intake on weight loss: asystematic review and dos-response meta-analysis of randomized controlled trials, *Critical Reviews in Food Science and Nutrition*, **58:** 1-9.

Taharuddin, T., Tua, M., & Silalahi, N. 2010. Cordierite sebagai Katalis Heterogen pada Metanolisis Minyak Kelapa (Coconut Oil). *SEMINAR REKAYASA KIMIA DAN PROSES*, p.1-7.

Tobias, D. K., Chen, M., Manson, J. E., Ludwig, D. S, Willet, W., dan Hu, F. B. 2015. Effect of Low-Fat Diet Interventions versus Other Diet Interventions on Long-term Weight Change in Adults: A Systematic Reviw and Meta-Analysis. *The Lancet*, Vol. **3**: p. 968-979.

Wang, Y., Liu, Z., Han, Y., Xu, J., Huang, W., Li, Z. 2018, Medium Chain Triglycerides enhances exercise endurance through the increased mitochondrial biogenesis and metabolism, *PLOS ONE*, **13(2):** 1-11.

Weeratunga, P., Jayasinghe, S., Perera, Y., Jayasena, G., dan Jayasinghe, S. 2014. Per Capita Sugar Consumption and Prevalence of Diabetes Mellitus – Global and Regional Associations. *BMC Public Health*, Vol. **14(186):** p. 1-6.

WHO. 2008. *Physical Activity*. Dalam *http://www.who.int/mediacentre/factsheets/fs385/en/*, diakses pada 2 Februari 2020.

WHO. 2015. Obesity and overweight. Diakses pada 21 januari 2020, http://www.who.int/mediacentre/factsheets/fs311/en/.

WHO. 2015. *World Health Statistics 2015*. WHO: Luxemburg.

Widiyanto, W. 2005. Metode Pengaturan Berat Badan. *Medikora*, vol **1(2),** 105-118.

Wing, R. R., Lang, W., Wadden, T. A., Safford, M., Knowler, W. C., Bertoni, A. G., Hill, J. O., Brancati, F. L., Peters, A., dan Wagenknecht, L. 2011. Benefits of Modest Weight Loss in Improving Cardiovascular Risk Factors in Overweight and Obese Individuals With Type 2 Diabetes. *Diabetes Care*, Vol. **34**: p. 1481-1486.

Xu, M., Yang, L., Zhu, Y., Liao, M., Chu, L., Li, X., & Zheng, G. 2019. Collaborative effects of chlorogenic acid and caffeine on lipid metabolism via the AMPKα-LXRα/SREBP-1c pathway in high-fat diet-induced obese mice. *Food & Function*, **10(11),** 7489-7497.

Yang, X., Mei, S., Gu, H., Gup, H., Zha, L., Cai, J., Li, X., Liu, Z., dan Cao, W. 2014. Exposure to Excess Insulin (Glargine) Induces Type 2 Diabetes Mellitus in Mice Fed on A Chow Diet. *Journal of Endocrinology*, Vol. **221**: p. 469-480.

Zhang, X., Zhang, Y., Liu, Y., Wang, J., Xu, Q., Yu, X., & Xue, C. 2016. Medium-chain triglycerides promote macrophage reverse cholesterol transport and improve atherosclerosis in ApoE-deficient mice fed a high-fat diet. *Nutrition Research*, **36(9),** 964-973.

Zhang, Y., Qing, X. U., Liu, Y. H., Zhang, X. S., Jin, W. A. N. G., YU, X. M., & Xue, C. Y. 2015. Medium-chain triglyceride activated brown adipose tissue and induced reduction of fat mass in C57BL/6J mice fed high-fat diet. *Biomedical and Environmental Sciences*, **28(2)**, 97-104.

Zhao, Y., Yang, L., Huang, Z., Lin, L., & Zheng, G. 2017. Synergistic effects of caffeine and catechins on lipid metabolism in chronically fed mice via the AMP-activated protein kinase signaling pathway. *European journal of nutrition*, **56(7),** 2309-2318.

Zheng, G., Qiu, Y., Zhang, Q. F., & Li, D. 2014. Chlorogenic acid and caffeine in combination inhibit fat accumulation by regulating hepatic lipid metabolism-related enzymes in mice. *British Journal of Nutrition*, **112(6),** 1034-1040.

Zhou, S., Wang, Y., Jiang, Y., Zhang, Z., Sun, X., & 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*, **82(8),** 1968-1977.

Zufry, H. 2010. Terapi Farmakologis pada Obesitas. *Jurnal Kedokteran Syiah Kuala*, **10(3)**, 157-168.