Effect of Fasting on Blood Glucose Levels

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ABSTRACT

Diabetes mellitus is a disease suffered by society. Disease This, If Not controlled with Good, can cause various dangerous complications for the body. One of the controls carried out is fasting. Fasting is holding back self. No eating and drinking, with reduced consumption of calories, mainly carbohydrates, is the purpose of the study. This is to know the influence of fast-to-level glucose in blood mice. Research methods This experiment is pure and has a time series design. The object study used galah-type male mice, as many as 36. The research was conducted from April to May 2023 at the Pharmacology Laboratory of the Deli Husada Deli Tua Health Institute. Bivariate data analysis using the One Way Anova statistical test with mark significance set $p < 0.05$. The results showed a difference in the treatment of intermittent fasting diurnal 1 and 2 times a week with the group 3 and 6 times a week $p = 0.000$ ($p < 0.05$). At the same time, there was no significant difference ($p > 0.05$) between the groups given intermittent fasting treatment diurnal 3 times a week and 6 times a week. The importance of fasting in controlling blood sugar levels. Fasting done 3 times a week is more effective in lowering blood sugar levels than fasting 6 times a week.

Keywords: Fasting, Blood Sugar Levels, Mice

INTRODUTION

Approximately 422 million people worldwide have diabetes, the majority living in low-income countries, and 1.5 million deaths are directly caused by diabetes years. Both the number of cases and prevalence of diabetes have Keep going increase over several decades. Diabetes is a metabolic disease marked by improved glucose blood (or blood sugar), which is accompanied by time and causes damage to the heart, blood vessels, eyes, kidneys, and nerves. The most common type 2 diabetes, usually in adults, occurs when the body becomes resistant to insulin or does not produce enough insulin. In 3 decades Lastly,

the prevalence of type 2 diabetes has increased drastically in countries with all levels of income (WHO, 2024).

Fast outside the month of Ramadan can be in the form of fasting, which is practiced by hundreds of millions of Muslims as additional worship or is a style of life-related to a daily food intake (Tahapary et al., 2022). However, This fasting can also be considered a change in the style of life that can influence the health of people who fast, such as a change in timetable sleep/wake, reduction in duration of Sleep in the Evening day, reduction of activity, improvement in intake of calories, and changes in pattern eating (Yuan et al., 2022). Therefore, data from a study that assesses the effect of health from restrictions on calories or types of fasting can extrapolated to fasting. Fasting is known to reduce adiposity, which causes subtraction of insulin resistance. This is caused by the reduction in intake of calories and programming repeat metabolic, which is an effect of fasting (Al-Maiman et al., 2022).

Impact from height: Blood sugar levels tend to develop slowly over several days to weeks (Aderinto, 2023). However, sometimes, no symptoms arise. Very high blood sugar levels can damage peripheral system nerves, damaging nephron kidneys and the retinal nerve of the eye, which Can cause diabetic ulcers, kidney failure, and blurry vision until blindness (Holmes-Truscott, 2020).

Observing fast blood sugar levels is important for knowing the effectiveness of declining blood sugar levels. Later intervention can be applied to humans and can be used to give care to patients with diabetes mellitus to increase the degree of health and quality of life of these patients (Speight et al., 2020).

LITERATURE REVIEW

A systematic study and meta-analysis by (Cho et al., 2019) found that DM patients who did intermittent fasting experienced a significant decrease in body mass index and fasting BG. Another study was conducted by (Furmli et al., 2018), who studied three type 2 DM patients who did intermittent fasting for several months. During the study, all patients experienced a decrease in HbA1C, a blood test that can measure the average BG over the past 3 months, weight loss, and were able to stop their insulin therapy within 1 month. Another study by (Alfin et al., 2019) at the Purwakarta City Health Center showed that Ramadan fasting lowers blood sugar levels in type 2 DM patients with an average decrease of 43.33 mg / dL.

METHODS

Study This experiment is pure and has a time series design. Research This only uses the group that will be given 3 treatments with different durations to see which treatment is most effective for making the latest model from the treatment given. The object studies used Male rat strain Wistar as many as 36 animals. The research was conducted from April to May 2023 at the Pharmacology Laboratory of the Deli Husada Deli Tua Health Institute. The research procedure was to prepare a nicotinamide solution of 230 mg and a streptozotocin solution of 65 mg, each dissolved in 10 ml of 0.9% NaCl. Preparation of test animals: male white mice weighing 180-200 grams were divided into 3 groups, each consisting of 9 mice. Before the experiment, they were first acclimatized for 2 weeks. Blood glucose levels were measured by taking blood from the tip of the mouse's tail, which was then washed with 70% alcohol. The tip of the mouse's tail was then cut 1 mm using scissors connected to a glucometer paper strip installed on the device. Treatment with fasting in the first group (strain mice) lasts 1 week (2 days per week, namely Monday and Saturday, for 10 hours per day). In the second group (rat strain) with a duration of 1 week (3 days per week, namely Tuesday, Thursday, and Saturday, for 10 hours per day). In the third group (rat strain) with a duration of 1 week (6 days per week, namely Monday-Saturday for 10 hours per day). On the day before and after treatment, an evaluation of glucose blood level after each group fasting was given treatment fast for 10 hours per day. Data analysis was carried out using SPPS. Bivariate data analysis using the One Way Anova statistical test. The significance value set was $p < 0.05$. Bivariate analysis compared blood sugar levels before and after fasting treatment. Study This has been agreement Commission Ethics Faculty of Animal Research Mathematics and Science Natural Sciences University of North Sumatra No. 0571/KEPH-FMIPA/2023

RESULTS

The research results can be seen in the following table.

Table 1. Average Blood Sugar Levels

Group	Average KGD (mg/dL) ± SEM	p
Group 1 x Week	114.11 ± 3.06	0.159 0.000 [a]

		0.000 [b]
		0.159
Group 2 x Week	109.11 ± 2.77	0.000 [a]
		0.000 [b]
		0.000 [c]
Group 3 x Week	92.33 ± 2.08	0.000 [d]
		0.526
		0.000 [c]
Group 6 x Week	90.11 ± 1.59	0.000 [d]
		0.526

Based on Table 1, the results demonstrated that all treatment groups experienced a reduction in KGD levels in diabetic rats. The average KGD levels decreased by 114.11 mg/dL in the group receiving diurnal intermittent fasting once a week, by 109.11 mg/dL in the group fasting twice a week, by 92.33 mg/dL in the group fasting three times a week, and by 90.11 mg/dL in the group fasting six times a week.

Statistical analysis revealed significant differences ($p < 0.05$) when comparing the groups subjected to diurnal intermittent fasting once or twice a week with those fasting three or six times a week. However, no significant difference ($p > 0.05$) was found between the groups fasting three and six times a week.

DISCUSSION

Lack of insulin hormone causes accumulation of glucose in the blood, which increases blood glucose levels. This condition is known as diabetes mellitus and is characterized by metabolic disorders (Khalilov et al., 2023). Weight loss, poly dyspnea, polyuria, and increased urine volume caused by osmotic diuresis (caused by increased glucose levels causing hyperglycemia) and the presence of ketone bodies in the urine are signs of diabetes mellitus (Veneti et al., 2023). This is because STZ, a chemical molecule that directly destroys pancreatic cells and is diabetogenic, is induced. Type 2 diabetes mellitus in test animals caused by streptozotocin has three phases, namely hyperglycemia (increased blood sugar levels), hypoglycemia (decreased blood sugar levels), and finally, persistent hyperglycemia

(Ohno et al., 2022). Free radicals are removed by the cytotoxicity of STZ, which initiates oxidative stress in cells. Through the GLUT 2 glucose transporter, STZ enters Langerhans cells. DNA changes in pancreatic cells are caused by the intracellular activity of STZ (Eleonore, 2023).

During fasting, there are physiological changes in the body. Along with decreasing blood glucose levels, insulin secretion decreases in hypoglycemia (blood glucose levels. During fasting, there are physiological changes in the body. Along with decreasing blood glucose levels, insulin secretion decreases (Albosta & Bakke, 2021). In hypoglycemia (blood glucose levels <65-70mg/dl), there is the activation of the counter-regulator mechanism (liver glycogenolysis) involving the hormones glucagon and epinephrine to maintain normal KGD. As fasting progresses, glucose metabolism has a metabolic switch, namely a combination of glycogenolysis and gluconeogenesis (Li et al., 2023).

The intermittent fasting model has also been reported to improve glycemic control in DM patients (Lichtash C et al., 2020). Decreased energy intake during fasting is associated with decreased insulin production and increased AMP (activated protein kinase (AMPK)) levels. AMPK activation in depletion conditions is associated with improved insulin sensitivity and glucose homeostasis and is beneficial for the healthy aging process (Behl et al., 2021).

CONCLUSION

Diurnal intermittent fasting in the 3 x weekly group has shown optimal results in reducing BG, and increasing the time of diurnal intermittent fasting to 6 x weekly did not significantly differ from the 3 x weekly group.

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REFERENCES

Aderinto , N., Olatunji, G., Abdulbasit, M., Ashinze , P., Faturoti , O., Ajagbe, A., ... & Aboderin, G. (2023). The impact of diabetes on cognitive impairment: A review of current evidence and prospects for future investigations. *Medicine* , *102* (43), e35557.

Albosta, M., & Bakke, J. (2021). Intermittent fasting: is there a role in the treatment of diabetes? A review of the literature and guide for primary care physicians. *Clinical diabetes and endocrinology* , *7* , 1-12.

Al-Maiman, R.S., Al-Orf, S.M., & Bawazeer, N.M. (2022). Impact of Fasting during Ramadan on Daily Habits, Diet and Body Weight of individuals with diabetes: A sample from Saudi Arabia. *Malaysian Journal of Medicine & Health Sciences* , *18* (4).

Behl, T., Gupta, A., Sehgal, A., Sharma, S., Singh, S., Sharma, N., ... & Bungau , S. (2021). A spotlight on the underlying mechanisms of AMPK in diabetes complications. *Inflammation Research* , *70* , 939-957.

Eleonore, N., Van Wijk, R., & Ngouakam , H. (2023). Evaluation of the Key Mechanism Justifying the High Sensitivity of Obese Rodents to Treptozotocin (STZ). *Journal of Biosciences and Medicines* , *11* (12), 376-394.

Holmes-Truscott, E., Ventura, A.D., Thuraisingam , S., Pouwer , F., & Speight, J. (2020). Psychosocial moderators of the impact of diabetes stigma: results from the Second Diabetes MILES–Australia (MILES-2) Study. *Diabetes Care* , *43* (11), 2651-2659.

Khalilov, R., & Abdullayeva, S. (2023). MECHANISMS OF INSULIN ACTION AND INSULIN RESISTANCE. *Advances in Biology & Earth Sciences* , *8* (2).

Li, L., Zhou, H., Wang, J., Li, J., Lyu, X., Wang, W., ... & Li, P. (2023). Metabolic switch from glycogen to lipid in the liver maintains glucose homeostasis in neonatal mice. *Journal of Lipid Research* , *64* (10).

Lichtash , C., Fung, J., Ostoich, K. C., & Ramos, M. (2020). Therapeutic use of intermittent fasting and ketogenic diet as an alternative treatment for type 2 diabetes in a normal weight woman: a 14-month case study. *BMJ Case Reports CP* , *13* (7), e234223.

Ohno, T., Miyasaka, Y., Yoshida, K., Kobayashi, M., Horio, F., Yokoi, N., ... & Ikegami, H. (2022). A novel mouse model for type 2 diabetes mellitus with early onset and persistent hyperglycemia. *Experimental Animals* , *71* (4), 510-518.

Stageary , DL, Astrella, C., Kristanti , M., Harbuwono , DS, & Soewondo , P. (2020). The impact of Ramadan fasting on metabolic profile among type 2 diabetes mellitus patients: a meta-analysis. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* , *14* (5), 1559-1570.

Veneti, S., Grammaticopoulou , M.G., Kintiraki , E., Mintziori , G., & Goulis , D.G. (2023). Ketone Bodies in Diabetes Mellitus: Friend or Foe?. *Nutrients* , *15* (20), 4383.

Wang, S., Ma, P., Zhang, S., Song, S., Wang, Z., Ma, Y., ... & Jin, Y. (2020). Fasting blood glucose at admission is an independent predictor for 28-day mortality in patients with COVID-19 without previous diagnosis of diabetes: a multi- center retrospective study. *Diabeologia* , *63* (10), 2102-2111.

Yuan, X., Wang, J., Yang, S., Gao, M., Cao, L., Li, X., ... & Sun, C. (2022). Effect of intermittent fasting diet on glucose and lipid metabolism and insulin resistance in patients with impaired glucose and lipid metabolism: a systematic review and meta-analysis. *International journal of endocrinology* , *2022* (1), 6999907.

World Health Organization. (2024). Diabetes. Access https://www.who.int/health-topics/diabetes#tab=tab_1