

## ***Pengaruh Puasa Intermiten 5:2 terhadap Berat Badan dan Resistensi Insulin pada Karyawan Obesitas di Jakarta***

### **The Effect of Intermittent Fasting 5: 2 on Body Weight and Insulin Resistance among Obese Employees in Jakarta**

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#### **ABSTRAK**

**Latar Belakang:** Prevalensi penduduk dewasa di Indonesia yang obesitas mengalami peningkatan dari tahun ke tahun. Sementara itu, angka obesitas pada pekerja, terutama di perkotaan juga makin meningkat. Puasa intermiten dapat menjadi alternatif solusi dalam tatalaksana obesitas untuk menurunkan berat badan, sehingga parameter metabolik lainnya seperti resistensi insulin juga bisa menurun.

**Tujuan:** Penelitian ini bertujuan mengetahui efek puasa intermiten 5:2 terhadap perubahan berat badan dan resistensi insulin pada karyawan obesitas di Jakarta

**Metode:** Penelitian ini menggunakan rancangan uji klinis acak terkontrol. Sampel penelitian ialah karyawan di Jakarta yang berusia 19-59 tahun, memiliki IMT  $\geq 25$  kg/m<sup>2</sup>, dan memiliki lingkaran pinggang  $\geq 90$  cm. Sampel dibagi menjadi kelompok intervensi (n=25) dan kelompok kontrol (n=25). Kelompok intervensi diminta untuk berpuasa pada hari senin dan kamis selama 8 minggu, sementara kelompok kontrol melanjutkan pola makan seperti biasa. Tidak terdapat pembatasan kalori pada kedua kelompok. Pengumpulan data melalui proses wawancara, pengukuran tubuh serta pemeriksaan laboratorium. Analisis data untuk melihat perbedaan rerata antar kelompok dengan menggunakan uji t tidak berpasangan atau uji Mann-Whitney, sementara untuk melihat perubahan dalam kelompok menggunakan uji t berpasangan atau Wilcoxon.

**Hasil:** Perubahan berat badan pada kelompok intervensi ialah -0,8kg (-5,1- 2,2), sementara perubahan berat badan pada kelompok kontrol -0,3kg(-7,9 – 2,8). Perubahan kadar HOMA-IR pada kelompok intervensi ialah -0,29 (-17,78 – 6,84), sementara perubahan kadar HOMA-IR pada kelompok kontrol -0,46 (-18,94 – 10,55). Tidak terdapat perbedaan bermakna rerata perubahan berat badan dan resistensi insulin pada kelompok yang berpuasa dibandingkan kelompok yang tidak melakukan puasa ( $p>0,05$ ). Terdapat perbedaan berat badan pada kelompok intervensi dengan  $p = 0,026$ .

**Kesimpulan:** Tidak terdapat perbedaan perubahan berat badan dan kadar HOMA-IR pada kelompok yang berpuasa dibandingkan kelompok yang tidak melakukan puasa, walaupun perbedaan berat badan pada kelompok intervensi turun bermakna. Puasa intermiten 5:2 dengan regimen puasa senin kamis dapat dilakukan dengan memperhatikan jumlah asupan total kalori pada hari berpuasa dan pada hari tidak berpuasa. Penelitian serupa juga perlu dilakukan dengan intervensi waktu yang lebih panjang dan dilakukan kontrol jumlah energi pada kelompok penelitian untuk melihat lebih jauh pengaruh puasa intermiten 5:2 terhadap berat badan dan resistensi insulin.

**Kata kunci:** Puasa Intermiten 5:2, Obesitas, Berat Badan, Resistensi Insulin, Karyawan

#### **ABSTRACT**

**Background:** The prevalence of obese adults in Indonesia has increased from year to year. Meanwhile, the obesity rate among workers, especially in urban areas, is also increasing. Intermittent fasting can be an alternative solution in the treatment of obesity to lose weight, so that other metabolic parameters such as insulin resistance can also decrease.

**Objective:** To determine the effect of 5: 2 intermittent fasting on changes in insulin resistance in obese employees in Jakarta

**Methods:** This study used a randomized controlled clinical trial design. The research sample was employees in Jakarta aged 19-59 years, have a BMI  $\geq 25$  kg / m<sup>2</sup>, and have a waist circumference  $\geq 90$  cm. The sample was divided into the intervention group (n = 25) and the control group (n = 25). The intervention group was asked to fast on Monday and Thursday for 8 weeks, while the control group continued their normal diet. There was no calorie restriction in both groups. Collecting data through the process of interviews, body measurements and laboratory examinations. Data analysis to see the mean difference between groups using unpaired t test or Mann-Whitney test, while to see changes in groups using paired t test or Wilcoxon.

**Results:** The change in body weight in the intervention group was -0.8 kg (-5.1-22), while the change in body weight in the control group was -0.3 kg (-7.9 - 2.8). The change in HOMA-IR levels in the intervention group was -0.29 (-17.78 - 6.84), while the change in HOMA-IR levels in the control group was -0.46 (-18.94 - 10.55). There was no significant difference in the mean



change in body weight and insulin resistance in the fasting group compared to the non-fasting group ( $p > 0.05$ ). There was a difference in body weight in the intervention group with  $p = 0.026$ .

**Conclusion:** There was no difference in body weight change and HOMA-IR levels in the fasting group compared to the non-fasting group, although the difference in body weight in the intervention group decreased significantly. There is a need to do promotion and health education regularly to improve knowledge and change employee behavior nutrients balanced so it can prevent the occurrence of obesity and obesity-related metabolic diseases

**Keywords:** Intermittent Fasting 5: 2, Obesity, Insulin Resistance, Employees.

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## INTRODUCTION

Along with changing times and shifting lifestyles, the pattern of diseases that were previously dominated by infectious diseases has also turned into non-communicable diseases, which include metabolic diseases and degenerative diseases. Obesity is a risk factor for metabolic disease that needs to be watched out for. According to the World Health Organization (WHO), there has been a 3-fold increase in obesity rates since the last 40 years. In 2016, there were 1.9 billion adults who were overweight, 650 million of whom were obese<sup>1</sup>. Based on Basic Health Research (Riskesmas) in 2018, the prevalence of obesity rates has increased compared to 2013, from 14.8% to 21.8%. DKI Jakarta Province ranks the second highest in Indonesia with an obesity percentage of 29.8%, higher than the national figure. The proportion of central obesity in adults in Indonesia has also increased compared to 2013, from 26.6% to 31%<sup>2</sup>.

The prevalence of obesity among company employees, especially in urban areas, is still high 50.6% among employees in the Bogor area and 56.3% in the Jakarta area.<sup>3,4</sup> This is in line with There was an increase in the number of workers in Jakarta in 2018 from 4.5 million to 4.7 million, an increase of 4.83% compared to 2017.<sup>5</sup> While a good level of health in the productive age group, will increase work performance, and also as an effort to prepare for old age without degenerative diseases. The risk factors that can cause obesity in the workplace include work with little activity or movement as part of a sedentary lifestyle, workplace designs that were not formed for free movement, limited opportunities for physical activity during working hours, and food choices. unhealthy around the workplace.<sup>6</sup>

Obesity is a condition where there is excess accumulation of fat in the body which can interfere with health. The distribution of body fat in obese people is closely related to the risk of morbidity and mortality. Adipose tissue plays an important role in insulin resistance and obesity-related metabolic diseases.<sup>7</sup> Research conducted by Liem et al. Showed that obesity status, both as measured by body mass index (BMI) and body fat percentage, is associated with increased insulin resistance, which is indicated by an increase in the

Homeostatic value of the insulin resistance assessment model (HOMA IR)<sup>8</sup>.

One approach that has been widely used over the past 10-20 years as an effort to lose weight is intermittent energy restriction through fasting.<sup>9,10</sup> Intermittent fasting is a period of not eating and drinking, or one of the two, which has different rules, depending on the fasting regimen<sup>7</sup>. Intermittent fasting aims to reduce energy intake, which can lead to a negative energy balance, which promotes weight loss<sup>11</sup>. There were various types of intermittent fasting, including intermittent fasting, fasting 5: 2, and limiting meal times Monday and Thursday fasting is a modification of intermittent fasting using the 5: 2 methods, which is most often practiced in Indonesia.

Various studies have shown an association between intermittent fasting with weight loss and other metabolic parameters, although the results have not been consistent<sup>10,12,13</sup> So far, research on the effect of intermittent fasting is generally carried out on subjects who already have a history of diseases, such as diabetes mellitus and cancer. There were also those who do it on healthy subjects, but with a different intermittent fasting regimen. There were no studies that discuss intermittent fasting with a 5: 2 fasting regimens in obese employees with sedentary lifestyle risk factors. Therefore, this study aims to determine the effect of 5: 2 intermittent fasting on body weight and insulin resistance in obese employees in Jakarta.

## METHODS

### Design and Subject

The design used in this study was a randomized controlled clinical trial conducted at selected companies in Jakarta in July-September 2020.

This study has received approval to pass an ethical review by the Health Research Ethics Committee of FKUI-RSCM with non-ethical standards of KET-281 / UN2. F1 / ETIK / PPM.00.02 / 2020 and has been registered at [clinicaltrials.gov](http://clinicaltrials.gov) with ID: NCT 04319133. The subject was an employee of a private company engaged in the service sector. Analysis of blood insulin resistance levels was carried out at the Integrated Laboratory of the Faculty of Medicine, University of Indonesia, Salemba.



Subject selection began with screening and filling out a questionnaire followed by 67 male employees in 2 companies. The screening conducted included anthropometry and screening interviews used a questionnaire. The total number of subjects who were willing to take part in the entire series of this study was 50 people, which were divided into 2 groups, the intervention group and the control group. The study sample size was determined based on the formula for the mean difference between the two populations with a confidence interval  $(1 - \alpha)$  90% and power  $(1 - \beta)$  80%. This study used an open trial, and the distribution of groups was carried out randomly through the website [www.randomlists.com](http://www.randomlists.com). The questionnaire was distributed purposively, which was carried out on prospective subjects who met the inclusion criteria, which was males aged 19-59 years, had a body mass index  $\geq 25$  kg / m<sup>2</sup>, and has a waist circumference  $\geq 90$  cm. The exclusion criterion was the subject who follow a weight loss program, whether in the form of diet or with exercise, suffering from obesity with type 2 diabetes as evidenced by examining fasting blood sugar and subjects who were taking drugs that can affect weight loss, blood sugar and insulin. Subjects who were selected to take part in the study were willing to fill out informed consent. The drop out criteria were if the subject was not willing to have blood drawn when collecting baseline and endline data, the subject of the study who refused or was unable to continue the study and the subject who did not fast for more than 4 fasts.

#### Collection and Measure Data

*Intervention procedures.* This study was divided into 3 phases, which was the baseline, treatment, and end line phases. In the baseline phase, the subjects will be interviewed, body measurements and laboratory examinations. The characteristic data interview included education, income, knowledge, physical activity, and history of food intake. Furthermore, the subject will undergo body measurements, which include weight measurement and height measurement. Research subjects will also undergo blood tests to assess insulin resistance through fasting insulin levels and fasting blood sugar. Both groups will receive education about balanced nutrition and obesity. Education was given once with media presentations through power points and continued with discussions. It was hoped that through this education the research subject will gain understanding and increase awareness of nutritional knowledge, which will be reflected in dietary changes during the study.

In the treatment phase, the modification of the fasting method was carried out for 2 days a week, on Monday and Thursday, for 8 weeks. Fasting cannot be replaced on any other day than Monday and Thursday. Fasting was done for  $\pm 14$  hours, from sunrise to sunset or from 04.00 to 18.00. There were no restrictions on the amount of calorie intake at dawn and breaking the fast. Researchers will equate perceptions about the implementation of fasting with the intervention group. Fasting groups will be reminded to fast via WhatsApp

every Monday and Thursday night. Compliance of fasting subjects was known from the control form every week and the results of food records. Furthermore, in the end line phase, the subject will be again measured for body weight and blood tests to determine the value of insulin resistance.

*Food Intake.* Food intake data before the study were obtained by using a 2x24 hour non-consecutive food recall, consisting of 1 working day and 1 non-working day. Food recall interviews were conducted by researchers and enumerators. For the fasting group, records were also made of the food and drinks consumed at dawn and breaking the fast. The recording was carried out for 16 days of fasting (32 times of recording), through the food record method.

*Body measurements.* Measurement of height used a shortboard. The subject stands on a plank where the heels were together and form an angle facing outwards. The position of the heels, glutes, scapulae and head against the board. Hands on the side with palms facing inward. The patient looks straight ahead and was asked to take a deep breath, then the board was pulled until it touches the top of the patient's head and was measured in the nearest millimeter. Weight measurement was carried out using an electro digital scale, which was placed on a flat side. Make sure the weigher shows "00.00". Before weighing, research subjects were asked to wear clothes that were as light as possible, do not wear footwear and all objects that can gain weight. Then make sure the position of the body was standing upright, eyes / head straight forward, legs not bent. Measurements were carried out by trained enumerators twice, the results were added and divided in half.

*Nutritional status.* Nutritional status was classified according to BMI based on WHO criteria for Asia Pacific. BMI was calculated by dividing the body weight in kilograms by the height squared in m<sup>2</sup>. Nutritional status includes obesity 1 if BMI 25-29.9 kg / m<sup>2</sup> and obesity 2 if BMI  $\geq 30$  kg / m<sup>2</sup>.<sup>12</sup>

*Education.* The level of education was obtained from a questionnaire on the last formal education level based on the Law on the education system in Indonesia. Low level of education, if the subject was illiterate, did not attend school, graduated or did not complete elementary school (SD), junior high school (SLTP), did not complete senior high school (SLTA) or the equivalent. Medium level of education, if the subject has graduated from high school or the equivalent, but has not graduated from college or college. The level of education was high, if the subject has graduated from college or college.<sup>13</sup>

*Income.* The income level was obtained from a questionnaire. The amount of income of research subjects in one month was classified based on the DKI Jakarta Regional Minimum Wage (UMR). The income level was less, if the income was <Rp. 3,940,000 per month. Enough, if your income was  $\geq$  Rp. 3,940,000 per month.<sup>14</sup>

*Knowledge.* The level of knowledge was obtained through validated questionnaires about nutrients, sources of nutrients, and guidelines for balanced



nutrition. Knowledge is said to be lacking if the value was <60%, moderate if the value was 60% -80% and good if the value was > 80%<sup>15,16,17</sup>

**Physical activity.** The level of physical activity was known using the International Physical Activity Questionnaire (IPAQ) short form. IPAQ determines the physical activity score with the formula = METs level (type of activity) x number of minutes x number of days / weeks. It was said that light physical activity was when doing activities with an intensity of <600 METs minutes / week, moderate physical activity if the total activity was at least 600 METs minutes / week, while strenuous physical activity if the total activity was at least 3000 METs minutes / week.<sup>18</sup>

**Insulin resistance.** Research subjects undergo blood tests to assess insulin resistance through fasting insulin levels and fasting blood sugar. Blood samples were taken for the subject to examine insulin resistance twice, before and after the implementation of the intervention, in the condition the subject was fasting for 8 hours and could only consume water. The subject's blood was taken as much as 5 ml by a registered nurse. The blood sample was stored in a tube then labeled according to the subject code and put into a cool box. The blood sample was then analyzed by laboratory staff at the Integrated Laboratory of the Faculty of Medicine, University of Indonesia, Salemba. Fasting insulin will be assessed by the Enzyme – Linked Immunosorbent Assay (ELISA) method through the DRG Insulin ELISA kit (EIA 2935).

#### Analysis Data

A bivariate analysis used Paired t test if the distribution was normal or Wilcoxon if the distribution was not normal to analyze the mean body weight and insulin resistance before and after treatment. Unpaired t test was used if the distribution was normal or Mann Whitney if the distribution was not normal to analyze the difference in mean changes in body weight and insulin resistance after treatment between the treatment and control groups. Data was considered significant if the p value <0.05.

#### RESULTS AND DISCUSSION

The research subjects were obtained by consecutive sampling method. In this study, there were 67 obese employees. However, after going through the socialization and screening process, 12 subjects were not willing to participate in the study and 3 people did not meet the criteria because they had a GDP level> 126 mg / dL. So that it was obtained 52 people who can become research subjects and have met the minimum sample size of the study. Then randomization was carried out to divide the subjects into 2 groups via the site [www.randomlists.com](http://www.randomlists.com) as many as 26 subjects for each group. At the end of the study, there were 1 subject from the intervention group and 1 subject from the control group who did not collect end line data because they resigned from work. Per protocol analyzes were performed on 25 subjects in the intervention group and 25 subjects in the control group. For more details, it can be seen in Figure 1.

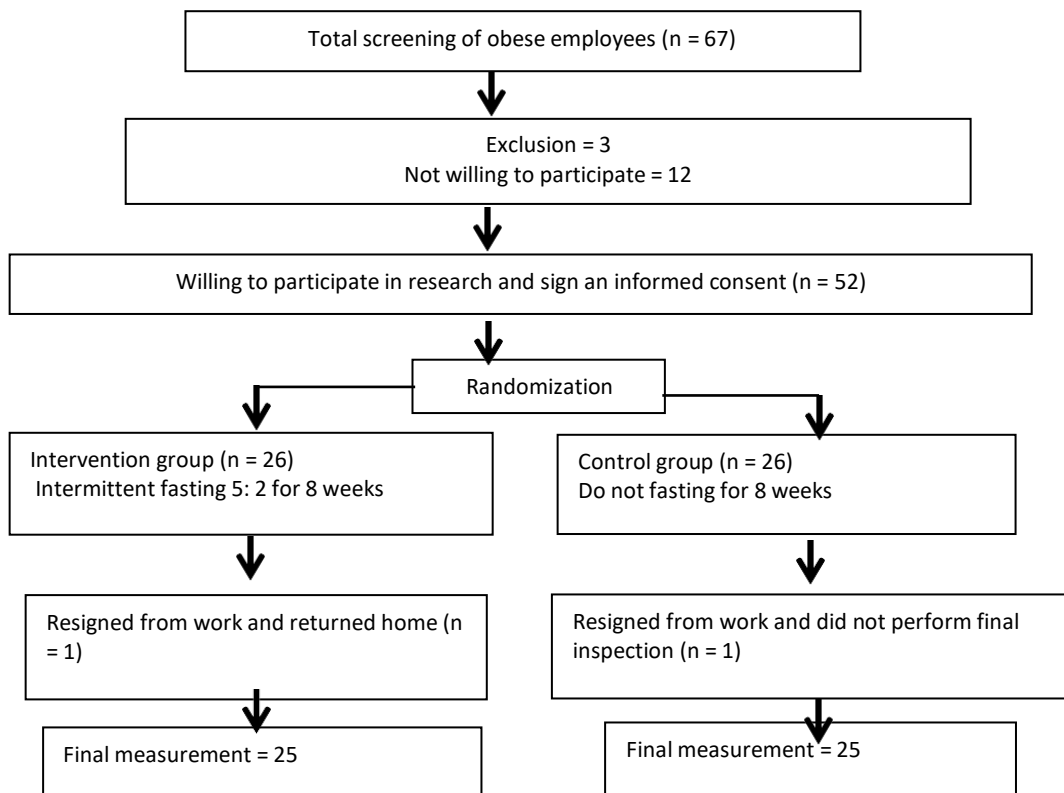


Figure 1. Subject selection flow



**Subject Characteristics**

Characteristics of research subjects including age, height, weight, nutritional status, education level,

income level, knowledge level, type of work and physical activity can be seen in Table 1.

**Table 1.** Characteristics of Subjects

Variable	Group		p value
	Intervention (n=25)	Control (n=25)	
Age, years	32 (19-52)	30 (22-54)	0,763 <sup>1</sup>
Nutritional Status, n (%)			0,774 <sup>2</sup>
Obesities I	10 (40)	11(44)	
Obesities II	15 (60)	14(56)	
Education, n (%)			>0.999 <sup>2</sup>
Moderate	7 (28)	7 (28)	
High	18 (72)	18(72)	
Income, n (%)			0,269 <sup>2</sup>
Less	3 (12)	6 (24)	
Enough	22 (88)	19 (76)	
Knowledge, n (%)			0,916 <sup>3</sup>
Less	4 (16)	3 (12)	
Moderate	15 (60)	16 (64)	
Good	6 (24)	6 (24)	
Physical activity, n (%)			0,276 <sup>3</sup>
Light	11 (44)	9(36)	
Moderate	9 (36)	14 (56)	
Heavy	5 (20)	2 (8)	

<sup>1</sup>: Mann Whitney, <sup>2</sup>: Chi Square, <sup>3</sup>: Fisher's exact

Table 1 shows the equivalent data between the intervention group and the control group. The mean age of the study subjects in the intervention group was 32 years and in the control group 30 years. Obesity grade II had a greater percentage than grade I obesity, both in the intervention group and in the control group. Most of the respondents in both groups have a high level of education, have sufficient income according to the regional minimum wage of DKI Jakarta in 2018, have a moderate level of knowledge regarding balanced

nutrition and obesity, and have a moderate level of physical activity.

**Calorie intake**

The recording of food intake data before treatment was carried out using the 2x24 hour food recall method and during treatment by the food record method. The value of energy intake can be seen in Table 2.

**Table 2.** Energy Intake in Subjects

Variable	Group		P value
	Intervention	Control	
Total energy intake (kcal / day)			
Before intervention	1615,56 ± 540,94	1578,34 ± 393,87	0,782 <sup>1</sup>
During intervention	897,05(505,45-1344,25)	1357,35(871,2-2946,72)	0,000 <sup>2</sup>
P value for the mean difference before and during treatment	0,000 <sup>3</sup>	0,115 <sup>3</sup>	
Change of total energy intake	-628 ± 526,81	-154,73 ± 576,56	0,004 <sup>1</sup>

<sup>1</sup>: Unpaired T test, <sup>2</sup>: Mann Whitney, <sup>3</sup>: Wilcoxon

Based on the food intake data, there was no significant difference in the intake of the two groups

before the study was conducted. However, during the study, there were significant differences between the intervention group and the intake group in the total



calorie count ( $p < 0.05$ ). The average intake of the intervention group was lower than that of the control group.

The results of this study were consistent with the results of research by Teng et al.<sup>19</sup>The study was conducted for 12 weeks in men aged 50-70 years who had a BMI of 23-29.9 kg / m<sup>2</sup> and had no history of type 2 diabetes or other cardiovascular disease. There was a significant difference in intake between the group who fasted Monday and Thursday with a calorie restriction of 500 kcal on the day of fasting and the group who did not fast.

### Weight Change and Insulin Resistance

Body weight and insulin resistance levels, as assessed by HOMA-IR, were found to be insignificant both before and after the intervention in both groups. The pre-posttest in the intervention group with variable weight showed statistically significant results with  $p$  value  $< 0.05$ , which means that there was a significant difference in body weight in the intervention group. This can then be seen in Table 3.

**Table 3.** Changes in Body Weight and HOMA -IR Levels in Subjects

Variable	Group		p value
	Intervention (n=25)	Control (n=25)	
<b>Weight (kg)</b>			
Before	90,54 ± 13,35	89,77 ± 12,71	0,835 <sup>t</sup>
After	89,76 ± 13,2	89,24 ± 12,67	0,888 <sup>t</sup>
P value for the mean difference before and after treatment	0,023 <sup>pt</sup>	0,253 <sup>pt</sup>	
Change in body weight	-0,8(-5,1- 2,2)	-0.3(-7,9 – 2,8)	0,420 <sup>MW</sup>
<b>HOMA-IR level</b>			
Before	3,20 (0,9-19,6)	3,98 (2,3-23,9)	0,09 <sup>MW</sup>
After	3,11(1,54-12,44)	3,5 (1,58-17,75)	0,181 <sup>MW</sup>
P value for the mean difference before and after treatment	0,968 <sup>w</sup>	0,797 <sup>w</sup>	
Change in HOMA-IR level	-0,29(-17,78 – 6,84)	-0,46 ( -18,94 – 10,55)	0,846 <sup>MW</sup>

<sup>1</sup>: Mann Whitney, <sup>2</sup>: Unpaired T test, <sup>3</sup>: Paired T test, <sup>4</sup>: Wilcoxon

Intermittent fasting intervention 5: 2 for 8 consecutive weeks did not reduce body weight and HOMA-IR value in obese employees in Jakarta compared to the non-fasting group. Based on the HOMA-IR data, it was found that the intervention group tended to have a lower value than the control group, but the value was not statistically significant. The fasting factor which is done 2 times a week for 8 weeks, also gives different results compared to the Ramadan fast which was done for 30 consecutive days, even though the duration of the fast was the same for about ± 14 hours. This was influenced by the post-absorption phase which lasts 6-24 hours from the first fasting. In this phase, glucose was produced from the breakdown of glycogen. Furthermore, if the fast was continued for 1-10 days, glycogen reserves will be depleted and the body will carry out more intense lipolysis, ketogenesis and gluconeogenesis. Meanwhile, if it was more than 10 days, energy will be used from fatty acids and ketone bodies, so that Ramadan fasting can lead to significant weight loss and waist circumference.<sup>20</sup> Fasting in this study was carried out not consecutively, so that the body's metabolism did not completely change like during the fasting month of Ramadan.

Based on the intake data during fasting, there was a decrease in intake compared to before the intervention, which was from 1615 kcal to 938 kcal. The theory of weight loss from the National Heart, Lung, and Blood Institute (NHLBI) states that one effort that can be done

in dealing with obesity was to reduce intake of 500-1000 kcal / day to achieve weight loss of 0.5-1 kg / Sunday.<sup>21</sup>There was a trend towards weight loss in the intervention group, even though it had not achieved the recommended weight loss. The difference in results in this study could be influenced by food intake on non-fasting days. If it was assumed that on non-fasting days, the amount of energy intake was greater than on fasting days, then there was no energy deficit, so that body weight did not decrease significantly.

Another thing that plays a role was the level of physical activity of the research subjects. Most of the subjects fit the criteria for light-moderate physical activity. Only about 14% of study subjects who regularly exercise. During the pandemic, working conditions have also changed. About 80% of work was done from home, making activities more sedentary. Physical activity was said to be sufficient if a person did physical exercise or exercise for 30 minutes every day or at least 3-5 days a week. Decreasing food intake if it was not followed by adequate physical activity will make the energy balance positive, so that this will prevent weight loss from occurring.

The results of this study were in line with research conducted by Nabawiyah et al.<sup>22</sup>There was a significant reduction in body weight and fat mass percent in the intervention group who fasted Monday for 2 months, but there was no significant difference between the intervention group and the control group. Dietary



changes that occur during fasting and decreased intake during fasting cause the body to burn fat reserves to meet energy needs. This stimulates weight loss in the fasting group.

Teng et al who conducted a study in Malaysia found that the study subjects could reduce their energy intake by  $\pm$  18% after three months of fasting intervention on Monday. This reduction in intake was in line with the goal of reducing the intake of 300-500 kcal / day from daily energy intake. A decrease in fat intake of 22.4% was considered to be the most influential on changes in energy intake in research subjects.

Gabel et al<sup>23</sup> conducted a 12-week study of time restriction. The research subjects were obese men and women, aged 25-65 years, had sedentary physical activity, and did not have diabetes and cardiovascular disease. Meal times were set from 10 a.m. to 6 p.m., while fasting was from 6 p.m. to 10 a.m. There was no calorie restriction at meal times. There was a decrease in insulin resistance values, but it was not significant compared to the control group. Research shows that glucose regulation factors and fat concentrations can only occur when weight loss was more than 5% of initial body weight<sup>24</sup>, while the weight loss in this study was 0.92%. The results of the study by Wang et al<sup>25</sup> showed a 6.2% reduction in body weight in the short term significantly improved insulin resistance levels, decreased serum leptin and increased serum ghrelin levels.

The results of the meta-analysis suggest that the effective time to lose weight through intermittent energy limiting methods was as effective as continuous energy restriction if done for more than 3-6 months.<sup>26</sup> Weight loss was considered to provide significant results in clinical conditions, if there was a weight loss of about 7 kg.<sup>27</sup> In this study, the fasting intervention was only carried out for 8 weeks and no energy restriction was performed. That was what may also be the cause of body weight not decreasing significantly, and in the end there was also no significant reduction in insulin resistance levels.

The strength of this research lies in the research design which was a randomized controlled and parallel clinical trial. Knowledge and physical activity questionnaires were obtained from validated questionnaires. Laboratory tests in the form of fasting blood sugar and fasting insulin were also carried out in standardized laboratories. The limitation of this study was that there was no recording of food intake on non-fasting days, so the researchers could not assess the effect of intake on non-fasting days on body weight and insulin resistance.

## CONCLUSION

There was no significant difference in the mean change in body weight and insulin resistance in the fasting group compared to the non-fasting group, during the 8-week intervention period, but there was a difference in body weight in the intervention group. It is necessary to carry out regular health promotion and education to increase knowledge and change employee behavior

regarding balanced nutrition so as to prevent obesity and obesity-related metabolic diseases. And it is necessary to did a similar study with a larger sample size, longer intervention time, and limit the amount of energy in the study group to see further the effect of fasting on body weight and insulin resistance.

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