Irisan Profile of Obese Women After Moderate Intensity Aerobic Exercise

Naufal Firdaus¹, Sugiharto**, Desiana Merawati³

¹,²,³Department of Sport Science / Faculty of Sport Science / State University of Malang / Indonesia
Jl. Ambarawa No.5, Sumbersari, Kec. Lowokwaru, Kota Malang, Jawa Timur 65145
¹naufalfirdaus@gmail.com, ²sugiharto@um.ac.id, ³desiana.merawati.fik@um.ac.id

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ABSTRACT
Irisin in obesity was found to be lower than in individuals with normal weight. Low irisin levels lead to decreased metabolism. Low metabolism causes a decrease in muscle mass, storage of triglyceride energy, and accumulation of excess fatty acids in the body which can lead to the risk of obesity. This study aims to prove the effect of moderate-intensity aerobic exercise on increasing irisin levels in obese women. This research method is true experimental with a random calculation design between pretest-posttest groups. A total of 18 obese women aged 20-25 years were actively involved in research activities and were divided into two groups, namely \( K_c \) (\( n = 9 \); control group), and \( K_e \) (\( n = 9 \); experimental group). Aerobic exercise was given using a set intensity of 60-70% HRmax with a treadmill for 45 minutes, 3x/week for 8 weeks. Irisin levels were evaluated before and after the intervention using the ELISA Kit method. The data analysis technique used the Paired Sample T-Test with a 5% confidence level. The results showed the average irisin level between before and after the intervention in \( K_c \) (0.83±0.97 vs. 0.86±1.25 ng/mL, \( p=0.961 \)), \( K_e \) (0.69±0.64 vs. 2.77±1.26 ng/mL, \( p=0.003 \)). Based on the results of the study it was concluded that aerobic exercise with a set intensity of 60-70% HRmax performed 3x/week for 8 weeks can increase irisin levels in obese women.

Keywords: Irisin; Obesity; Aerobic Exercise.

INTRODUCTION

Irisin in obesity was found to be lower than in normal-weight individuals of the same age and sex (Gouda et al., 2018; Glück et al., 2019). Previous research found lower irisin levels in obese patients (Ulualan et al., 2022). Other studies have also reported that irisin levels were found to be lower in obesity than in individuals of normal weight (Sahin-Efe et al., 2018; Glück et al., 2019). So far, physical exercise can increase irisin, but the exact exercise to increase irisin is still controversial.

Low irisin levels lead to decreased fat metabolism (Houti et al., 2016; Sugiharto et al., 2022). Low metabolism causes a decrease in muscle mass, triglyceride energy storage,
and accumulation of excess fatty acids in the body (Arhire et al., 2019), which can lead to the risk of obesity. Low irisin also reduces mitochondrial biogenesis, adiponectin, and adipokine secretion (Lehnig and Stanford, 2018; Sugiharto et al., 2022). In addition, low irisin levels result in insulin resistance (Efe et al., 2017) and risk of coronary atherosclerosis (Zhao et al., 2020).

Increased irisin can be done with aerobic exercise, moderate-intensity aerobic exercise increases muscle oxidative capacity and improves physical fitness and central adiposity in adolescents with obesity (Archundia-Herrera et al., 2017). However, there is still inconsistent evidence in several studies of physical exercise and irisin. Such as aerobic exercise and resistance training affect irisin levels in obese people, and resistance training has a more significant increase in irisin (Kim et al., 2016; Li et al., 2020). The same results also showed that irisin concentrations in the obese population increased after the administration of aerobic acute exercise (Elizondo-Montemayor et al., 2018). However, other studies have shown that irisin does not increase immediately after acute exercise in humans (Nygaard et al. 2015; Pang et al., 2018). Other studies have shown that irisin did not change significantly in obese patients after 8 weeks of endurance training (Besse-Patin et al., 2014; Fukushima et al., 2016). In another study, results were found to be slightly different by showing irisin levels increased after acute and strenuous exercise, but did not change after long-term exercise (Loffler et al., 2015; Gaudio et al., 2021). The study by Hecksteden et al. (2013) showed no consistent increase in irisin after exercise intervention. Meanwhile, according to Liu et al. (2015), irisin levels increased during physical exercise intervention and gradually decreased to normal levels after physical exercise.

**METHOD**

This study used the true experimental method with the randomized pretest-posttest control group design. A total of 18 obese women aged 20-25 years, with body mass index (BMI) of 25-30 kg/m², normal systolic and diastolic blood pressure, normal oxygen saturation (SpO₂), normal resting heart rate was actively involved in research activities and divided into two groups, namely Kᵦ (n = 9; control group), and Kₑ (n = 9; experimental group).

Aerobic exercise was carried out with an intensity of 60-70% HRₘₐₓ using a treadmill for 45 minutes, with details of 5 minutes of warm-up, 35 minutes of core exercises, and 5 minutes of cool-down (Pranoto et al., 2023). The exercises were carried out 3x/week for 8 weeks.
Data analysis was carried out in several stages, namely first, descriptive statistical analysis was carried out to determine the size of the distribution and concentration of the data, and then a normality test was carried out using the Shapiro-Wilk test. A different test was carried out using the Paired Sample T-Test to determine differences in irisin levels before and after the intervention in the two groups, while to determine differences in irisin levels between groups (K_K vs K_E) was carried out using an Independent Sample Test with a significant level (p ≤ 0.05).

RESULTS AND DISCUSSION
Results

The results of the descriptive analysis of the characteristics of the research subjects which include age, height, weight, body mass index, muscle mass, and body fat percentage can be seen in Table 1 below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>K_K</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>9</td>
<td>22.67</td>
<td>0.231</td>
<td>23.78</td>
<td>0.172</td>
<td></td>
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<tr>
<td>Height</td>
<td>9</td>
<td>157.39</td>
<td>5.80</td>
<td>154.34</td>
<td>4.04</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>9</td>
<td>69.26</td>
<td>9.13</td>
<td>68.82</td>
<td>9.38</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>9</td>
<td>33.36</td>
<td>11.71</td>
<td>28.96</td>
<td>3.13</td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>9</td>
<td>23.96</td>
<td>4.23</td>
<td>24.360</td>
<td>2.77</td>
<td></td>
</tr>
<tr>
<td>BFP</td>
<td>9</td>
<td>34.32</td>
<td>2.51</td>
<td>32.86</td>
<td>2.92</td>
<td></td>
</tr>
</tbody>
</table>

Description: BMI: Body mass index, SM: Skeletal muscle, BFP: Body fat percentage

The results of the analysis in Table 1 determined that on average there were no significant differences in the characteristics of the subjects in each study group so the two groups were at the same baseline. Analysis of the average irisin levels before and after the intervention in the two groups can be seen in Table 2.

Table 2.
Results of Analysis of Irisin Levels Before and After in Both Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Before</th>
<th></th>
<th></th>
<th></th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K_K</td>
<td>9</td>
<td>0.83</td>
<td>0.97</td>
<td>0.86</td>
<td>1.25</td>
<td>0.961</td>
</tr>
<tr>
<td>K_E</td>
<td>9</td>
<td>0.69</td>
<td>0.64</td>
<td>2.77</td>
<td>1.26</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

Description: (*) Indicates a significant value before training (p < 0.05).
Moderate-intensity aerobic exercise increased self-esteem more than the control group (Table 2). Further analysis showed differences in irisin levels before and after the intervention between the two groups (Table 3).

### Table 3.
Results of Analysis of Irisin Levels Before Intervention, After Intervention between the Two Groups

<table>
<thead>
<tr>
<th>Observation</th>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Normality</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>K_K</td>
<td>9</td>
<td>0.83</td>
<td>0.97</td>
<td>0.109</td>
<td>0.716</td>
</tr>
<tr>
<td></td>
<td>K_E</td>
<td>9</td>
<td>0.69</td>
<td>0.64</td>
<td>0.123</td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>K_K</td>
<td>9</td>
<td>0.86</td>
<td>1.25</td>
<td>0.101</td>
<td>0.005*</td>
</tr>
<tr>
<td></td>
<td>K_E</td>
<td>9</td>
<td>2.77</td>
<td>1.26</td>
<td>0.468</td>
<td></td>
</tr>
</tbody>
</table>

Description: (*) Shows significant value with K\_K (p < 0.05).

### Discussion

Based on the results of the study it was reported that irisin levels increased after exercise in the experimental group (KE), compared to the control group (KK). Previous research conducted by Boström et al. (2012) showed that irisin increased in the blood after physical exercise. The same results were also found in the study by Gaudio et al. (2021) which showed that the irisin value was significantly higher compared to the control group when providing physical exercise through soccer. However, in another study in an obese population, irisin increased after aerobic exercise but did not increase when given a long-term program (Elizondo-Montemayor et al., 2018). The difference was found not because of the characteristics of the subjects used, but allegedly due to long-term training so that the results did not increase irisin. Meanwhile, another study conducted by Jandova et al. (2021) showed the results of long-term physical exercise can increase irisin levels in obesity and normal weight (Rashid et al., 2020). Likewise with the research results found in the study of Teimourian et al. (2020) aerobic exercise for 12 weeks increased irisin levels compared to resistance training in obesity. In another study, results were different from the type of aerobic and endurance exercise in obese adults for 8 weeks, with the results of a significant increase in circulating irisin in resistance exercise, but not an increase in aerobic exercise (Kim et al., 2016; Arhire et al., 2019).

The increase in irisin in this study is thought to be influenced by the increase in muscle mass. Muscle mass in the subjects increased after the intervention of moderate-intensity aerobic exercise for 8 weeks. Increased muscle mass reduces fat levels in the body. The increase in fat mass occurred because it was caused by an increase in irisin levels. Increased irisin levels are affected by the provision of exercise interventions. Exercise plays...
a role in the browning of white adipose tissue, as a result, fat in the body can be converted into energy and excreted through thermogenesis (Polyzos et al., 2018).

The increase in irisin levels in obese women during the intervention of moderate-intensity aerobic exercise for 45 minutes is thought to be due to the effect of the intervention. This is because, at the time of the intervention, there was an increase in energy requirements for muscle contraction, so energy reserves in the muscles decreased which increased the release of irisin into the blood circulation to maintain energy balance during exercise. Huh et al. (2012) stated that the concentration of irisin increased significantly when ATP in the muscles decreased. Previous studies conducted on healthy human subjects stated that the concentrations of irisin and lactate had a positive correlation, both of which increased with increasing training load. al., 2014). This correlation indicates that an increase in muscle contraction and a decrease in ATP in the muscles is one of the markers for increasing the release of irisin into the blood circulation (Maalouf & Khoury, 2019).

Exercise induces irisin release via peroxisome proliferator-activated receptor-γ (PPAR-γ) and PGC-1α (Norheim et al., 2014). PPAR-γ and PGC-1α are multispecific transcriptional coactivators capable of regulating several genes in response to nutritional and physiological signals in tissues, PPAR-γ and PGC-1α are expressed in skeletal muscle, brown adipose tissue, liver and heart (Moreno-Navarrete et al. al., 2013; Xu, 2013; Norheim et al., 2014; Gizaw et al., 2017). Exercise that is performed at intervals increases PGC-1α activation, especially in the heart and skeletal muscles and improves various metabolic parameters such as insulin sensitivity and signalling, promotes AMPK activation, PGC1α phosphorylation and FNDC5 production, followed by cleavage of FNDC5 to produce irisin which will be released into the blood circulation. (Moreno-Navarrete et al., 2013; Xu, 2013; Norheim et al., 2014). The release of irisin into the blood circulation activates the AMPK pathway by reducing intracellular ATP or by increasing the intracellular calcium concentration in muscle cells, causing increased glucose and lipid uptake and increased fat metabolism. In addition, the activation of irisin can also cause a decrease in the processes of glycogenolysis and gluconeogenesis in muscle cells (Perakakis et al., 2017). Increased irisin in blood circulation can also affect fat cells. Irisin will stimulate the browning process in white fat tissue by inducing UCP-1 gene expression through p38-MAPK and ERK signalling (Perakakis et al., 2017; Fatouros, 2018). In addition, irisin can increase lipolysis through the cAMP and PKA pathways, thereby reducing fat accumulation (Perakakis et al., 2017).
CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the results of the study it was concluded that aerobic exercise with a set intensity of 60-70% HRmax performed 3x/week for 8 weeks can increase irisin levels in obese women.

Suggestions

The results of this study cannot be generalized to both sexes, so further research is suggested to analyze the effect of aerobic exercise on both sexes. To see whether aerobic exercise responds to changes in irisin levels the same or different.

Acknowledgements

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REFERENCES


Ulualan, G., KÜSKÜ KİRAZ, Z. E. Y. N. E. P., & KİREL, B. (2022). Relation of serum irisin levels to obesity and non-alcoholic fatty liver disease. Turkish Journal of Pediatrics, 64(2)