The Effect of Giving Moringa Leaf Extract (Moringa Oleifera) and Orlistat on the Body Weight of Mice Induced with D-Galactose

Maria Immaculata Esteria Nainggolan[1], Novrina Situmorang*[2], and Sanggam Hutagalung[3]

[1] Medical student, Faculty of Medicine Universitas Methodist Indonesia, Medan, Indonesia
[2] Department of Anathomy, Faculty of Medicine Universitas Methodist Indonesia, Medan, Indonesia
novrinasitumorang@ymail.com,
[3] Department of Pathology Anatomy, Faculty of Medicine Universitas Methodist Indonesia, Medan, Indonesia

Abstract. The Body weight is body mass which is usually used to measure a person's nutritional status. Each person's ideal body weight varies according to race, ethnicity, gender, age, and socioeconomic status. According to the World Health Organization (WHO), in 2014 more than 1.9 billion adults aged more than 18 years were overweight. This number is more than 600 million who are obese. Currently, there are many efforts being made to overcome the problem of obesity. The problem of obesity can also be overcome by administering herbs using a variety of herbal plants. It is found that Moringa leaves have anti-obesity properties because they can increase insulin sensitivity and reduce lipid absorption.

Keywords: Body Weight, Obesity, Moringa Leaf Extract, D-Galactose

1 Introduction

Food intake determines growth because it is related to the energy content in food. Protein plays an important role in the process of body growth, production and reproduction. [3]. Many factors cause emotional and physiological imbalances in the human body that can cause weight gain, in this case weight gain can be excessive (obesity). A common problem in society is excessive weight gain (obesity). The rate of overweight and obesity continues to increase in adults and children. [5]. Eating behavior is also very influential as part of a lifestyle, so that unbalanced eating behavior often occurs, such as consuming fast food, soft drinks, skipping breakfast, and insufficient fiber consumption. This can be a risk factor for obesity. [8].

2 Literature Review

According to the World Health Organization (WHO) in 2014 more than 1.9 billion adults aged >18 years were overweight. Of that number, more than 600

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million are obese. The number of obese people in Indonesia tends to increase in all age groups. The results of the 2018 Riskesdas showed that obese adolescents aged 16-18 years from all provinces in Indonesia were 14.1%. [10]. Obesity is a condition caused by an imbalance between the amount of energy intake and the amount of energy expended so that body weight becomes heavier than ideal body weight due to the accumulation of fat in the body. [11].

According to the 2023 Basic Health Research (Riskesdas), the prevalence of obesity among Indonesian adults reached 15.3 percent. This figure increased from the 2018 data which previously recorded around 21.8 percent.

D-galactose is metabolized and digested well by the enzymes galactokinase, galactose 1 uridyltransferase and epimerase. However, if there is excessive intake of D-galactose in the body such as through chronic injection, it induces increased oxidative stress. Accumulated D-galactose will react with amino acids in proteins and peptides that form schiff bases, forming unstable compounds that can affect body weight. [6].

The use of moringa as a nutritional supplement is increasingly widespread, as evidenced by the increasing number of reports of its use in various places both in experimental animals and humans. Srikhant reported that malnutrition can be treated by giving moringa as an additional dietary source, because moringa leaves have complete protein content (containing 9 essential amino acids), calcium, iron, potassium, magnesium, zinc and vitamins A, C, E and B which play a major role in the immune system. [4].

Moringa oleifera is rich in β carotene, vitamin C, vitamin E, polyphenols or groups of chemicals found in plants and is a good source of natural antioxidants. In addition, many studies have revealed its therapeutic value including anti-diabetic, anti-rheumatoid arthritis, anti-atherosclerosis, anti-infertility, pain reliever, anti-depressant, and diuretic and thyroid regulation. All parts of the plant. Can be administered orally or topically. Leaves are generally the most widely used, because they are rich in protein, minerals, β carotene and antioxidant compounds. [1].

In a study conducted by Dhalal et al., it was found that Moringa leaves have anti-obesity because they can increase insulin sensitivity, reduce lipid absorption in mice induced by a high-fat diet. [7].

Currently, there are many efforts being made to overcome the problem of obesity. Among them are by limiting calorie intake, regular exercise and implementing various diet patterns and by providing pharmacological therapy. In addition to these methods, obesity problems can also be overcome by administering herbs using a variety of herbal plant choices. Among them is using moringa leaf extract which has been scientifically researched. [7].

Orlistat works by inhibiting fat absorption, changing body fat metabolism by blocking the action of the lipoprotein lipase enzyme which works to break down fat, so that fat is excreted from the body through feces. Fat can be absorbed if it has been converted by lipase into fatty acids from food that are not hydrolyzed into free fatty acids and glycerol. Therefore, some fat is not absorbed by the intestines. [9].

Inhibition of lipase by orlistat will inhibit the absorption of dietary fat which causes a decrease in calorie intake due to its simplicity and relative stability, orlistat is preferred over lipstatin to be developed as an anti-obesity drug. [2].

3 Methods

This study is a True Experimental study with a Pretest & Posttest Control Group Design which is included in the pre-clinical scope using a control group and a treatment group with simple randomization. The treatment given is the administration of Moringa oleifera Leaf extract.

The study was conducted at the Medical Pharmacology Laboratory of the Methodist University of Indonesia Medan in August 2023 for 14 days. This location was chosen because it provides facilities and infrastructure for experimental animals that are in accordance with research ethics.

The sample in this study was 36 male mice aged 2-3 months and weighing 20-35 g with inclusion criteria including male mice, healthy, from the same breeding place, kept in the same place and time, never used as research material. While the exclusion criteria are all female mice, male mice that appear sick during the maintenance process are determined by limited movement, dull fur or there are wounds/bite scars.

The research data was analyzed using statistical software. This study has received ethical approval from the Research Ethics Committee of the Faculty of Medicine, Methodist University of Indonesia. Mice were acclimatized for 1 week, placed in a cage lined with rice husks, placed in a room with lighting for 12 hours and a room temperature regulator. The cage was cleaned and the rice husks were replaced every week.

The tools and materials needed in this study are: mouse cages, wire mesh, gloves, scales, beakers, 1 mL syringes, masks, lamps. The materials used are D-galactose (anhydrous galactose brand), Moringa Leaf Extract, and Orlistat. Work process: Before being injected with D-galactose, Moringa Leaf Extract and Orlistat, the mice were first weighed. After the mice were weighed, the mice were then weighed every day for 1 week.

The study used a sample of 36 mice with a standard feed adaptation period of 7 days. On the 8th day, the first group of mice was given standard feed, the second group of mice was given standard feed and D-Galactose, the third group of mice was given standard feed, D-galactose, and moringa leaf extract, the fourth group of mice was given standard feed, D-galactose and orlistat with the treatment carried out for 7 days.

- Group 1 Mice with standard feed for 7 days. During the treatment, the weight of the mice was weighed every day. After that, the mice in group one were only given standard feed for 7 days.
- Group 2 Mice with standard feed for 7 days. During the treatment, the weight of the mice was weighed every day. After that, the mice in group two were given standard feed and D-Galactose at a dose of 0.15 g/Kg/BW for 7 days.

• Group 3 Mice after the adaptation period with standard feed for 7 days During the treatment, the weight of the mice was weighed every day. after that group 4 mice were given standard feed, D-Galactose probe dose of 0.15 g/Kg/BW and 1 hour later given orlistat drug probe for 7 days.

• Group 4 Mice after adaptation period with given standard feed for 7 days, During the treatment the weight of the mice was weighed every day. After that group 3 mice were given standard feed, D-Galactose probe dose of 0.15 g/Kg/BW and 1 hour later given moringa leaf extract probe for 7 days.

4 Results

In the first week, 4 groups of mice were acclimatized for 1 week, placed in cages used during the study that were well maintained and had been lined with rice husks, placed in a room with lighting for 12 hours and a room temperature regulator. The cages were cleaned and the rice husks were replaced every week.

Then in the second week, the first group of mice was given standard feed, the second group of mice was given standard feed and D-Galactose, the third group of mice was given standard feed, D-galactose and orlistat, the fourth group of mice was given standard feed, D-galactose, and moringa leaf extract. The following is the average body weight of mice after acclimatization.

Reporting Research Results

Table 1. Body weight of male mice before and after treatment

Kelompok	**Mean ± SD**	**p-value**
p1 (Standard)	28.62 ± 3.82	
p2 (D-Galactose)	30.06 ± 3.37	
p3 (D-Galactose + Orlistat)	31.00 ± 3.56	
p4 (D-Galactose + Moringa Leaf Extract)	25.93 ± 3.42	0.04

5 Discussion

The results of the study in Table 1 above stated that there was a significant difference in the weight of mice (Mus musculus) pretest and post-test given standard feed + D-Galactose + Moringa Leaf Extract with a value of p = 0.04 ($p < 0.05$), at p4 (given Standard feed + D-Galactose + Moringa Leaf Extract) of 25.93 ± 3.42 while the other groups showed results that did not differ significantly. The results of the study in Table 1 above showed that the difference in the weight

of mice (Mus musculus) pretest and post-test at p1 (given standard feed) was 28.62 ± 3.82. While at p2 (given standard feed + D-Galactose) was 30.06 ± 3.37. According to Sumehag, D-Galactose provides a nutrient substrate that is converted into glucose without a significant increase in plasma glucose and insulin concentrations so that D-Galactose has a significant effect on weight gain in mice. According to research by Hui Han in mice given D-galactose as much as 20 g / kg / bw for 2 weeks there was an increase in body weight.67 In p3 (given standard feed + D-Galactose + Orlistat) showed results of 31.00 ± 3.56. According to Suyog Compared to placebo, orlistat caused significant weight loss ($P < 0.05$) where in this study the absolute weight loss in the orlistat group in this study was 5-10In p4 (given standard feed + D-Galactose + Moringa Leaf Extract) it was 25.93 ± 3.42. This is in line with the research results of Idohou Dosson, et al. stating that Moringa oleifera can prevent significant weight loss. Moringa leaves that are used as part of animal feed ingredients that are intensively raised can act as feed that is of sufficient quality and quantity for production needs.

6 Conclusion

Based on the research results, it can be concluded that administration of orlistat induced with D-Galactose can prevent weight gain in male mice and administration of Moringa oleifera leaf extract induced with D-Galactose can better prevent weight gain.

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