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Original Research

Flaxseed oil weight loss supplement in women: quasi-experimental study

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Abstract
The prevalence of obesity and overweight in 2018 was more than 650 million people. Treatment of obesity includes both non-pharmacological and pharmacological approaches, including the use of flaxseed oil. flaxseed oil, containing about 40% oil with ALA as the main component, provides omega-3 fatty acids that reduce inflammation associated with obesity, and its high soluble and insoluble fiber content increases satiety, reduces calorie intake, and improves digestive health. This study aimed to find out how flaxseed oil supplements affect body weight in women. This study used a quasi-experimental design with a control group that included a pre and post-test. Respondents used amounted to 78 people who were divided into 2 groups, namely intervention (39 participants) and control (39 participants) in the working area of Puskesmas Pesantren II and Puskesmas Kota North Region of Kediri City. The sampling technique used simple random sampling. The intervention group was given standard care and flaxseed oil supplement 1 x 1000 mg daily for 12 weeks, while the control group only received standard care. With a p-value of 0.460, the Wilcoxon test on the experimental group for body weight revealed statistically insignificant findings. In contrast, a p-value of 0.356, was observed for body weight in the control group. On the post-test difference in body weight, the p-value was 0.024. flaxseed oil supplementation reduces body weight in women. This study is expected to help health workers to provide flaxseed oil supplements to obese women as an alternative treatment.

Keywords: health and flaxseed oil; obesity; women

1. Introduction

Overweight and obesity continue to be global health issues of growing concern. Based on 2018 World Health Organization (WHO) data, more than 1.9 billion adults worldwide are overweight, and more than 650 million of them are obese (Izhar, 2020). This figure has increased rapidly compared to previous years, as reported by The Lancet in 2016, where in 1980 approximately 1.225 billion adults were facing overweight and obesity problems, and this figure increased to 2.3 billion in 2013 (NCD Risk Factor Collaboration (NCD-RisC), 2016). In Indonesia, health surveys show an increase in the prevalence of obesity from year to year, such as in East Java in 2018 which recorded around 16% of the population suffering from obesity (Dinkes Jatim, 2018). The initial study revealed that between March and July 2024, there were 105 obese women in the working area of Puskesmas Pesantren II and Puskesmas Kota Utara Region of Kediri.

A review of the literature shows that obesity is caused by various factors, including energy imbalance between calories consumed and burned by the body (WHO, 2021), genetic factors (Lin & Li, 2021), lack of physical activity (Morshedzadeh et al., 2019; Sartorius et al., 2015), unhealthy eating behavior, and environmental factors (Mosha et al., 2021; Xu et al., 2022). In addition, previous research has found that obesity can lead to a variety of serious health conditions through specific mechanisms. For example, the chronic inflammation that often accompanies obesity plays an important role in the development of insulin resistance, which can result in type 2 diabetes mellitus. This inflammation is triggered by an increased release of proinflammatory cytokines from fat tissue, especially visceral fat,

which is also associated with other metabolic disorders (Li et al., 2020; Zhou et al., 2020). In addition, body fat distribution, such as increased visceral fat, has a direct impact on cardiovascular health. Fat accumulation in this area can increase blood pressure, triglyceride levels, and LDL cholesterol, thus increasing the risk of heart disease (Redina, 2019). Furthermore, obesity also contributes to the risk of certain cancers, mainly through mechanisms such as increased production of the hormone estrogen from fat tissue, which can trigger the growth of abnormal cells in certain tissues, such as the breast and endometrium (Tadesse et al., 2017; Tang et al., 2021). In addition to physical risks, the psychological impact of obesity, including mental disorders such as depression and anxiety, has also been documented, with social stigma and negative self-perception being major contributing factors (Rindler et al., 2023).

Recent research has shown various approaches in the treatment of obesity, both pharmacologically and non-pharmacologically. In the context of non-pharmacological treatment, diet (Asghari et al., 2017), cognitive behavioral therapy (Spinks & Hamilton, 2015), exercise (Budde et al., 2016), acupuncture (Shafira, 2022), and the use of herbal supplements such as Flaxseed show promising results (Cassani et al., 2015). Flaxseed oil supplements, in particular, have been researched and demonstrated effectiveness in aiding weight loss as well as reducing signs of inflammation (Bongartz et al., 2022; Mohammadi-Sartang et al., 2017).

Flaxseed *(Linum usitatissimum L.) is* rich in nutrients and bioactive compounds that are beneficial for health and weight loss. Containing about 40% oil with ALA as the main component, flaxseed provides omega-3s that reduce obesity-related inflammation and insulin resistance (Li et al., 2020; Parikh et al., 2018). Soluble fiber in flaxseed increases satiety and reduces calorie intake, while insoluble fiber improves digestion (Parikh et al., 2018; Rizvi et al., 2022a). Flaxseed also contains lignans with antioxidant properties that affect fat metabolism and appetite-regulating hormones (Edel et al., 2016), as well as high-quality proteins that are important for cardiovascular health and appetite control (Sadique et al., 2021).

This study differs from previous studies in several key aspects. First, this study involved 78 respondents divided into intervention and control groups of 39 respondents each, more than previous studies such as (Nowak & Jeziorek, 2023) with 25 respondents, Almehmadi et al. (2021) with 15 respondents, and Hasaniani et al. (2019) with 57 respondents. Second, this study used a quasi-experimental method with an unequal control group and supplemented *Flaxseed oil supplement* in capsule form, which offers precision dosing, protection from external factors, ease of consumption, as well as improved absorption (Jezerska et al., 2022; Milián-Guimerá et al., 2023). In contrast, previous studies used a randomized design and various dosage forms such as steeping (Khandouzi et al., 2019), yogurt and muffins (Hasaniani et al., 2019). Lastly, the duration of this study was 12 weeks, commonly used (Rezaei et al., 2020) but different from other studies with shorter durations which lasts for 24 hours (Almehmadi et al., 2021).

This study only included women as subjects because there are strong scientific reasons for the biological, hormonal and social differences between women and men that affect obesity risk. Hormones such as estrogen and progesterone play a major role in women's body fat distribution, especially in the thighs and hips, in contrast to men's fat storage patterns that tend to be in the abdominal area. In addition, the post-menopausal decline in estrogen levels increases the risk of visceral fat accumulation in the abdomen in women. Changes in women's metabolism are also influenced by hormonal cycles, such as menstruation, pregnancy and menopause, which impact diet and energy expenditure (Bongartz et al., 2022). Social factors also play a role, such as lower physical activity and higher social pressure in women, increasing the risk of obesity. This research focuses on women to gain a deeper understanding of gender-specific mechanisms in obesity management and provide a basis for more effective interventions (Mosha et al., 2021).

The study participants were women of childbearing age in the working areas of Puskesmas Pesantren II and Puskesmas Kota Utara Wilayah Kota Kediri, and the researchers wanted to find out whether there was an effect of Flaxseed oil supplements on weight loss in women. Thus, this study is expected to provide deeper insight into the specific benefits of Flaxseed oil supplements in the context of weight loss in the population of women of childbearing age, as well as making an important contribution to prevention efforts.

2. Methods

This study was a quantitative study with a quasi-experimental design using a control group. The research design involved measuring body weight at pretest and posttest with an intervention period of 12 weeks. The subjects of the study were women of childbearing age living in the working area of Puskesmas Pesantren II and Puskesmas Kota Utara in Kediri City. A total of 78 respondents were selected by simple random sampling, consisting of an intervention group (39 people) and a control group (39 people).

The intervention group was given Flaxseed oil supplement 1x1000 mg daily for 12 weeks. The supplement was packaged in soft capsules to facilitate consumption, protect the oil from oxidation, and keep the dosage accurate. Flaxseed oil is obtained through a cold-pressed extraction process, which keeps the content of omega-3 fatty acids (ALA) and other bioactive components optimal. Each capsule contains 1000 mg of Flaxseed oil, which is standardized and free from chemical contamination.

As the duration of the intervention was quite long, researchers implemented strategies to control for other variables that could affect the results. Respondents were asked to keep their daily diet consistent throughout the study, without changing the type or amount of food consumption. In addition, they were asked to record their daily physical activity and diet in a simple journal to ensure that no significant changes affected the study results.

The study was conducted in two stages: preparation and execution. The preparation stage included obtaining research permits, collecting preliminary data related to women of childbearing age with obesity, and coordinating with the coordinating midwife for respondent selection. After informed consent was obtained, initial body weight measurements were taken using a Tanita BC-420 MA scale. During implementation, the intervention group received Flaxseed supplements along with standard care, while the control group only received standard care without additional supplements. At the end of 12 weeks, repeat weight measurements were taken for all respondents.

The collected data were processed through coding and entry into a master table. Normality tests using Kolmogorov-Smirnov confirmed the distribution of the data, while univariate analysis was conducted to examine demographic variables such as age, occupation, and education. Bivariate analysis used Wilcoxon and Mann-Whitney tests to compare differences in body weight between the intervention and control groups.

This study adhered to the four basic principles of research ethics: respect for the subject, the principle of beneficence, harmlessness, and justice. The ethics license number of the Polkesma Health Research Ethics Commission is DP.04.03/F.XXI.31/0992/2024.

3. Results and Discussion

3.1.Results

This chapter describes the results of a study on "The effect of Flaxseed oil supplement on body weight in women in the working area of Puskesmas Pesantren II and Puskesmas Kota Utara Wilayah Kota Kediri.". This study used a random selection technique to select 78 participants, 39 of whom were

included in the intervention group and 39 in the control group. Data collection was conducted from March 07, 2024 to June 15, 2024.

Women of childbearing age who become respondents are selected according to the inclusion criteria and then given an explanation of the research procedures that will be carried out and are welcome to ask questions to the researcher, after the respondent is willing, he can give his consent in the form of a signature on the consent sheet. Respondents will be interviewed to obtain the characteristics of the research sample.

3.1.1. Characteristics of Respondents in the Intervention Group and Control Group

Table 1. Frequency Table Distribution of Respondents' Characteristics in the Intervention Group and Control Group

Characteristics	Group				P-Value
	Intervention (n=39)		Control (n=39)		
	F/M	%/SD	F/M	%/SD	
Age	41,4	6,410 %	41,7	7,569%	0,356
Education					0,385
1. Basic	6	15,4%	11	28,2%	
2. Intermediate	29	74,4%	25	64,1%	
3. High	4	10,2%	3	7,7%	
Jobs					0, 253
1. Work	14	35,9%	20	51,3%	
2. Not Working	25	64,1%	19	48,7%	
Body Weight	26,33	4,696%	26,79	3,296%	0,024

Source: Primary Data, 2024

Table 1 shows that the average age of respondents in the intervention group was 41.4 years, slightly lower than the average age of 41.7 years in the control group. The majority of participants in both groups had completed secondary education, with 29 individuals in the intervention group and 25 in the control group. Regarding occupation, most participants in the intervention group were unemployed (25 individuals), while in the control group, the majority were employed (20 individuals). On average, participants in the intervention group had a body weight of 26.33 kg, compared to 26.79 kg in the control group.

3.1.2. Results of Weight Analysis in the Intervention Group and Control Group in Women of Fertile Age

Table 2. The Ratio of Body Weight Before and After Administration of Flaxseed Oil Supplement in Women of Childbearing Age in The Intervention Group

Body Weight	Intervention Group (n=39)		p-value
	Pretest	posttest	
Underweight	0	0	0,460
Normal	0	4	
With Risks	11	16	
Obesity I	21	14	
Obesity II	7	5	
Total	39	39	

Source: Primary Data, 2024

Description: Wilcoxon test

Table 2 shows the frequency distribution of body weight in the intervention group. It indicates that before the intervention, the majority, 21 respondents, were categorized as Obesity 1, while after the intervention, the majority, 16 respondents, were categorized as being at risk.

Table 3. Body Weight Before and After Administration of Flaxseed Oil Supplement in Women of Childbearing Age in The Intervention Group

Variables	Intervention group		p-value
	Pretest Mean (± SD)	Postest Mean (± SD)	
BMI body weight (Kg)	26,59 (3,986)	26,33 (4,696)	0,460

Source: Primary Data, 2024
Description: Wilcoxon test

In Table 3, the weight analysis results for the intervention group show an average BMI of 26.59 before the intervention and 26.33 after. Based on these averages, there was no significant weight loss observed in the intervention group. The Wilcoxon test conducted on body weight in this group yielded a non-significant p-value of 0.460 ($p < 0.05$). The weight value in the intervention group did not decrease after receiving *Flaxseed Oil Supplement.*

3.1.3. Weight Analysis of the Control Group in Women of Fertile Age

Table 4. Weight Ratio of Women of Fertile Age in the Control Group

Body Weight	Control Group		p-value
	Pretest	posttest	
Underweight	0	0	0,356
Normal	0	4	
With Risks	7	7	
Obesity I	29	24	
Obesity II	3	4	
Total	39	39	

Source: Primary Data, 2024
Description: Wilcoxon test

Table 4 illustrates the frequency distribution of body weight in the control group, showing that before the test, the majority were classified as Obesity 1, with 29 respondents, and after the test, the majority were categorized as being at risk, with 24 respondents.

Table 5. Weight of Women of Childbearing Age in the Control Group

Variables	Control Group		p-value
	Pretest Mean (± SD)	*postest* Mean (± SD)	
BMI body weight (Kg)	26,99 (2,869)	26,79 (3,296)	0,356

Source: Primary Data, 2024
Description: Wilcoxon test

Based on Table 5 regarding the results of weight analysis in the intervention group, the mean BMI at the pretest was 26.99 and the mean BMI at the posttest was 26.79. Based on the average

pretest and posttest, it was found that there was no weight loss in the intervention group. intervention. Non-significant results were shown by the Wilcoxon test on body weight in the intervention group, with a p-value of 0.356 (p-value <0.05). The results showed that the control group did not experience significant weight loss.

3.1.4. Results of Analysis of Differences in Body Weight of Women of Fertile Age in the Intervention Group and Control Group

Table 6. Differences in Weight of Women of Childbearing Age in the Intervention Group and Control Group

Variables	Group Intervention (n=39) Mean (±SD)	Control (n=39) Mean (±SD)	P-Value
BMI body weight (Kg)	26,33 (4,696)	26,79 (3,296)	0,024

Source: Primary Data, 2024
Description: Mann-Whitney Test

Based on the data in Table 6, comparisons were made using the Mann- Whitney Test to evaluate the body weight between the intervention group and the control group after the Flaxseed Oil Supplement and standard care. After analysis, the intervention group showed a mean BMI of 26.33, while the control group had a mean BMI of 26.79. Significant findings were shown by the Mann-Whitney Test on body weight in the intervention group and control group, with a p-value of 0.024 (p-value <0.05). It can be seen that the body weight of both groups after administration of Flaxseed Oil Supplement is different compared to normal treatment.

3.2. Discussion

This study examined the effect of Flaxseed Oil Supplement on the body weight of women of childbearing age in the working area of Puskesmas Pesantren II and Puskesmas Kota Utara Wilayah Kota Kediri. The results showed that neither the intervention group that received flaxseed oil supplements nor the control group that did not receive supplements, experienced significant weight loss within their respective groups. However, when comparing the two groups, a statistically significant difference in body weight was found between the intervention group and the control group after the administration of Flaxseed Oil Supplement. Thus, although Flaxseed Oil Supplement did not cause significant weight loss in each group individually, the comparison between the two groups showed a significant effect of Flaxseed Oil Supplement on body weight.

Obesity is a complex condition characterized by the accumulation of excess body fat, which can lead to a variety of serious health problems such as diabetes, cardiovascular disease and musculoskeletal disorders. The main cause of obesity is an energy imbalance between the calories consumed and those burned by the body. This condition is the result of the interaction of various factors, including genetics, environment and lifestyle. Management of obesity often involves comprehensive lifestyle changes, including a healthy diet and regular exercise. Supplementation with pharmacological therapies and surgical procedures can also be effective in aiding weight loss (Lin & Li, 2021).

In this study, some intervention group respondents did not experience significant weight loss. Several factors may have influenced why the respondents did not see weight loss after taking Flaxseed Oil Supplement. This may be due to the following. First, the age of the respondents. In this study, the intervention group consisted of women of childbearing age with a mean age of 41.4 years. Age plays an important role in the development of obesity through various mechanisms. Younger individuals tend to have a higher metabolism and more easily convert body fat into fat. energy, which lowers the risk of

obesity. In contrast, in older individuals, body fat is more difficult to convert into energy, which increases the risk of obesity (Chen et al., 2018). Secondly, lifestyle also affects, where younger individuals tend to have a more active and healthy lifestyle compared to older ones, who often exercise less and have an unhealthy diet (Blüher, 2020). Research conducted by Azam et al. (2023) concluded that the 45-64 years age category had a higher risk of obesity compared to the ≥ 65 years age category, with the 15-44 years age category having almost double the odds ratio. Third, occupational factors were also found to have a significant impact on obesity. Sedentary work can lead to an increase in body weight due to the lack of physical activity needed to burn the calories consumed. In this study, most respondents in the intervention group did not work (64.1%), while most respondents in the control group worked (51.3%). Inactive work can lower the body's metabolism, which can lead to fat accumulation and increase the risk of obesity (Butt et al., 2024; McCarthy et al., 2021). Previous research by Butt et al. (2024) has found that occupation has a significant influence on diet and physical activity in the adult population, which supports this study. Other factors that influenced the intervention outcomes during implementation included differences in respondent compliance and lack of supervision of physical activity and diet.

The findings from this study indicated that providing flaxseed oil supplements for 12 weeks did not result in notable weight reduction among participants in the intervention group. This is in line with previous studies by Khandouzi et al. (2019) and Saleh-Ghadimi et al. (2019) which also showed that Flaxseed oil supplementation had no significant impact on anthropometric indices after 10 and 12 weeks, respectively. The control group in this study also did not exhibit significant changes in body weight. However, upon comparing the two groups, a significant difference in weight loss was observed. Despite the intervention group not showing significant weight loss individually compared to the control group, the mean difference in weight loss between the two groups was significant.

Flaxseed oil supplements contain about 40% oil, with Alpha-Linolenic Acid (ALA) as the main component. ALA is an n-3 polyunsaturated fatty acid (PUFA) that serves as a precursor for other omega-3 fatty acids such as EPA and DHA in the human body (Parikh et al., 2018). Omega-3s are important in reducing inflammation, which is often associated with obesity (Li et al., 2020). In addition, Flaxseed oil supplement is rich in both soluble and insoluble fiber (about 95%). Soluble fiber increases satiety and slows nutrient absorption, which may reduce overall calorie intake, while insoluble fiber improves digestive health by accelerating food transit through the gut (Rizvi et al., 2022b; Tabrizi et al., 2024).

Flaxseed oil supplements also contain lignans such as secoisolariciresinol diglucoside (SDG), which are converted by gut microbes into enterolactone and enterodiol. These lignans have antioxidant properties and may affect fat metabolism as well as hormones that regulate satiety and appetite (Edel et al., 2016). In addition, Flaxseed oil supplements provide high-quality protein that is essential for building and repairing muscle tissue, which is essential for healthy metabolism. Although not a complete source of protein, the protein in Flaxseed oil supplements may contribute to cardiovascular health and help control appetite (Sadique et al., 2021). This nutrient provides a range of health benefits, including reducing the risk of heart disease, diabetes, hypertension, and inflammatory diseases (As et al., 2020; Kang et al., 2020; Tang et al., 2021).

The benefits of Flaxseed oil supplements in weight loss can be seen from several mechanisms. First, the high fiber content in Flaxseed oil supplements helps to increase satiety after a meal, thereby reducing calorie intake at the next meal (Parikh et al., 2018; Rizvi et al., 2022a). Secondly, the soluble fiber in Flaxseed oil supplement helps slow down the absorption of glucose, which can stabilize blood sugar levels. Stable blood sugar levels prevent insulin innovation, which can reduce fat storage in the body (Sadique et al., 2021). Thirdly, ALA in Flaxseed oil supplement may help improve fat metabolism by reducing inflammation and increasing fat oxidation (Parikh et al., 2018). Fourth, the omega-3 fatty

acids in Flaxseed oil supplement have anti-inflammatory properties that may help reduce chronic inflammation often associated with obesity (Li et al., 2020).

Lignans in Flaxseed oil supplement may affect hormones that regulate satiety and appetite, such as leptin and ghrelin. By modulating these hormones, Flaxseed oil supplement may help control appetite and reduce calorie intake. Overall, regular consumption of Flaxseed oil supplements may provide a range of benefits that support weight loss and metabolic health (Rizvi et al., 2022a; Sadique et al., 2021) However, these benefits must be balanced with physical activity and dietary changes for optimal results. Previous research has shown that supplementing Flaxseed oil fiber can increase satiety, but is not enough for significant weight loss without additional physical activity (Bongartz et al., 2022). In addition, genetic variants may also affect the effectiveness of Flaxseed oil supplements in regulating body weight (BS et al., 2023).

Although Flaxseed oil supplementation did not lead to significant weight loss in the intervention group, there was a significant difference in weight loss between the intervention and control groups. Flaxseed oil supplementation shows potential benefits in reducing weight, especially if accompanied by lifestyle changes such as increased physical activity and dietary changes. Interventions involving Flaxseed oil supplements as part of a holistic approach to weight loss may be an effective option for women of childbearing age who are obese.

This study has a weakness because the researchers did not properly monitor other factors associated with obesity, such as physical activity and diet. As a result of this lack of monitoring, there were respondents who did not experience weight loss after receiving the intervention.

This study also has advantages. The intervention was a standardized Flaxseed oil supplement, not a brew or muffin as in previous studies. This ensured that the dose each respondent received was the same, thus reducing dose-related bias. In addition, the number of respondents in this study was three times larger than the minimum sample size required for experimental research.

The study found that although flaxseed oil supplementation did not lead to significant weight loss in the intervention group, there was a statistically significant difference between the intervention group and the control group, indicating a potential effect of flaxseed oil in aiding weight management. Unlike previous studies that used dosage forms such as muffins or brew, this study used standardized flaxseed oil capsules, thus ensuring a more accurate and uniform dosage. In addition, this study included a larger number of participants than previous studies, thus providing more representative results. These findings provide new insights into the benefits of flaxseed oil, especially in the context of group comparisons and the effect of more standardized dosage forms.

This study can be used as a reference for health workers in providing information about alternative weight treatment in women of childbearing age. This study is also useful for midwifery students to increase knowledge about the benefits of Flaxseed oil supplements in reducing blood sugar levels and body weight.

4. Conclusion

Research on the effect of Flaxseed oil Supplements on body weight in women found that, body weight in the intervention group did not experience a significant decrease after being given the intervention, and body weight in the control group also did not experience a significant decrease. Nevertheless, there was a notable difference in weight between the intervention and control groups following the administration of Flaxseed oil supplements. This suggests that Flaxseed oil supplements could be considered by midwives as a viable alternative treatment for weight reduction in women of childbearing age who are obese. The results of the study can be used as information about Flaxseed oil supplements as an alternative treatment for patients who are obese. Future research can examine other

factors that affect body weight in obese women of childbearing age and other alternatives to overcome this.

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