

# Impact of nutrition counseling and physical activity on dietary intake, knowledge, and weight reduction among students with overweight and obese

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## Abstract

Overweight and obesity contribute to chronic diseases with an increasing prevalence in Jakarta. This study assessed the impact of combined nutritional counseling and physical activity interven-

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tions on body weight, energy, and nutrient intake among overweight and obese health students. A quasi-experimental study was conducted with 42 participants divided into three groups, each receiving different intervention combinations over one month. Body weight was measured using scales, food intake was assessed through 24-hour food recalls, and nutritional knowledge was evaluated using questionnaires. Statistical analysis was performed using paired t-tests, Wilcoxon test, or ANOVA tests in SPSS. Most participants were female (83.3%) and 19–29 years old (78.6%). After the intervention, significant reductions in body weight ( $p < 0.001$ ) were observed, along with improvements in nutritional knowledge ( $p < 0.01$ ) and physical activity levels ( $p < 0.05$ ) across all groups. Energy and macronutrient intake significantly decreased in Group I, whereas fiber intake increased in all groups ( $p < 0.05$ ). Combining nutritional counseling and weekly physical activity interventions effectively reduced body weight and improved dietary habits, nutritional knowledge, and physical activity. Implementing the “My Plate” guidelines along with increased physical activity is recommended as a practical strategy for obesity management among students. Universities should integrate these guidelines to promote healthy eating and maintain students’ nutritional status.

## Introduction

Overweight and obesity are chronic conditions influenced by various factors, leading to the excessive accumulation of body fat and associated health complications.<sup>1–3</sup> Based on national research, the prevalence of overweight and obesity among adults in Jakarta has increased significantly.<sup>4</sup> Obesity in young adulthood is a known risk factor for numerous metabolic disorders, including type 2 diabetes mellitus, cardiovascular diseases, fatty liver, and certain types of cancer.<sup>5–8</sup> Additionally, obesity negatively impacts mental health, increases the risk of discrimination, and leads to economic losses.

To address non-communicable diseases, the Indonesian government launched the national program “GERMAS” (a movement for healthy lifestyles) in 2017.<sup>9</sup> However, the prevalence of overweight and obesity among adults remains high. Globally, as of 2022, an estimated 2.5 billion adults (>18 years old) are overweight, with 890 million being classified as obese.<sup>4</sup> In Indonesia, data from the 2018 Riskesdas and 2023 Indonesian Health Survey revealed an increase in the prevalence of overnutrition in adults, with overweight rates rising from 13.6% (2018) to 14.4% (2023) and obesity rates increasing from 21.8% (2018) to 23.4% (2023).<sup>10,11</sup> In Jakarta, the prevalence of overweight and obesity among adults increased from 15.6% and 29.8% in 2018 to 16.2% and 31.8% in 2023, respectively. Among health students in both

public and private medical schools across Indonesia, the combined prevalence of overweight and obesity is reported to be 35.5%.<sup>12</sup>

The causes of overweight and obesity are complex, involving genetic factors and modifiable lifestyle factors, such as energy intake, physical activity levels, and sleep patterns.<sup>2,3,13</sup> Research conducted in Banjarmasin demonstrated a significant relationship between excessive energy intake and obesity.<sup>14</sup> A sedentary lifestyle and lack of physical activity reduce energy expenditure, creating an imbalance between energy consumption and output.<sup>15</sup> Similarly, studies on students in Pakistan revealed that physical activity levels and time spent sitting were inversely proportional to Body Mass Index (BMI).<sup>16</sup>

There are several strategies to address obesity, including nutrition education, lifestyle changes, increased physical activity, dietary modifications, medication, and bariatric surgery.<sup>17</sup> Studies have shown that combining nutrition education or counseling with increased physical activity and a low-energy diet effectively reduces body weight in obese high school students and young adults in Indonesia, as well as among obese young adults in India.<sup>18-21</sup> To promote healthy eating, the Indonesian government introduced “My Plate” guidelines, which recommend consuming more vegetables and fruits, moderate portions of staple foods, and adequate protein sources.<sup>22</sup> However, national surveys indicate that Indonesians tend to consume fewer vegetables and fruits while favoring fatty and fried foods.<sup>23</sup> It is hypothesized that implementing “My Plate” recommendations could help obese students reduce their energy intake and body weight. Therefore, this study designed two intervention groups using “My Plate” recommendations as part of their dietary plans. Therefore, this study aimed to determine the effects of different combinations of nutrition education, dietary interventions, and physical activity on reducing the body weight of overweight and obese health students in Jakarta.

## Materials and Methods

### Research design

This study used a quasi-experimental design. From a list of overweight and obese health students in Jakarta who expressed interest in participating, the samples were randomly assigned (lottery) by the researchers to three groups: Group I, Group II, and Group III. This study was conducted in Jakarta from February to April 2021.

### Study participants

The participants in this study were selected using randomized sampling with the inclusion and exclusion criteria. Inclusion criteria included students who were overweight or obese according to anthropometric measurement with Body Mass Index (BMI) equal to 23 or more. Exclusion criteria included students on special diets, those with chronic diseases (such as diabetes mellitus, hypertension, or other chronic conditions), and those taking weight loss medications or herbal remedies. The sample size determined by G Power with a significance level of  $\alpha = 5\%$ , power  $1 - \beta = 80\%$ , and an effect size of 0.4, then the minimum sample size for each group was 14. The total sample size consisted of 42 students, with 12 participants in Group I and 15 participants each in Groups II and III. All participants were at least 18 years old (Figure 1).

### Variables, instruments, and data collection

This study implemented a four-week intervention program. Group I received weekly nutritional counseling focused on a low-

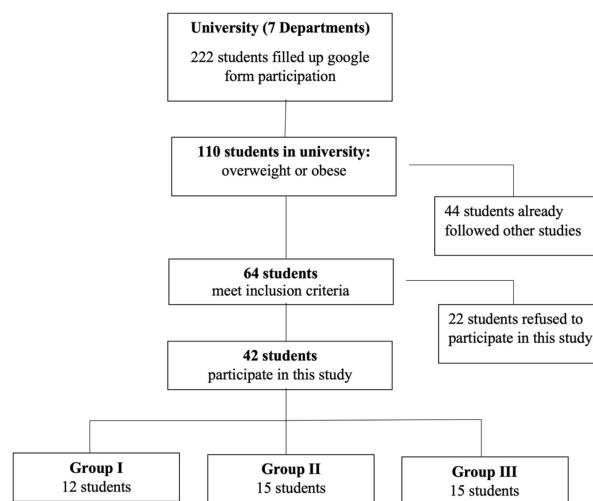
energy diet of 1500 calories for females and 1700 calories for males.<sup>24</sup> Participants were also encouraged to engage in physical exercise once a week, with their progress monitored weekly throughout the intervention. Group II participants received weekly nutritional counseling using an e-booklet about balanced nutrition and the “My Plate” guidelines. In addition, they were instructed to perform low-impact aerobic exercises at least three times a week for a minimum of 30 minutes per session, guided by a video provided by the research team. Group III participants received weekly nutritional counseling through an e-booklet on balanced nutrition and the “My Plate” guidelines. They were recommended to engage in physical activity once a week for four weeks.

This study collected various data, including anthropometric measurements (height and body weight), energy and nutrient intake, Physical Activity Level (PAL), nutritional knowledge, and participant demographic characteristics. Body weight was measured using a digital scale with an accuracy of 0.1 kg. Energy and nutrient intake were assessed using the 24-hour food recall method.<sup>25</sup> PAL and demographic data were gathered through interviews using structured questionnaires, while nutritional knowledge was evaluated through a self-administered nutritional knowledge questionnaire.<sup>26</sup> Measurements of body weight, energy and nutrient intake, PAL, and nutritional knowledge were conducted both before and after the intervention.

### Data analysis

The data in this study were analyzed using the SPSS software. A normality test was conducted using the Kolmogorov-Smirnov one-sample test to determine whether the variable data followed a normal distribution. Univariate analysis was performed to calculate percentages for each category of sample characteristics, including gender, age, and field of study.

Bivariate analysis was conducted using a chi-square, a paired or analysis of variance test for normally distributed data and other tests for non-normally distributed data. An intervention was considered to have a significant effect on the dependent variable if the p-value was less than 0.05.



**Figure 1.** Flowchart depicting the participant selection process for intervention.

## Ethical clearance

The study received authorization from the DKI Jakarta Health Office and successfully passed an ethical review conducted by the Jakarta II Poltekkes Kemenkes Research Ethics Committee, as evidenced by approval No. LB.02.01/I/KE/31/006/2021. Written informed consent was obtained from all participants in the study.

## Results

Based on Table 1, the majority of the participants were female (83.3%), with only 16.7% being male. Each intervention group also predominantly consisted of female participants (>70%). The univariate analysis revealed that most of the participants (78.6%) were in the age group of 19-29 years. Among the 42 overweight and obese students, the largest proportion in each group (33.3%) came from the Department of Nutrition. These findings indicate that the three intervention groups had relatively similar characteristics, which was supported by a chi-square test that showed there was no significant difference in gender and age within the three groups ( $p>0.05$ ).

Table 2 presents the changes in body weight, physical activity levels, and nutritional knowledge after the intervention. All three groups experienced significant weight loss, with Group I and Group III showing results of  $p<0.001$  and Group II showing  $p=0.001$ . The table also highlights a significant increase in nutri-

tional knowledge scores and physical activity levels (measured in PAR/hour) among participants in all groups after the intervention. Further analysis between groups showed that before intervention, the analysis of variance test showed there was no significant difference in body weight, nutritional knowledge score ( $p>0.05$ ); however, there was a significant difference in physical activity of respondents among the three groups ( $p<0.05$ ). After intervention, there was a significant difference in nutritional knowledge scores and physical activity of respondents between groups ( $p<0.05$ ); however, there was no significant difference in body weight of respondents between the three groups.

Table 3 showed the changes in energy and nutrient intake, including both macronutrients and micronutrients, after the intervention. A decrease in energy and macronutrient intake was observed across all groups, but only Group I showed significant reductions in energy, protein, fat, and carbohydrate intake ( $p<0.05$ ). Group II exhibited a significant reduction in fat intake ( $p<0.05$ ). Further analysis showed that before intervention, there was a significant difference in energy, fat, and fiber intake between groups ( $p<0.05$ ). After intervention, there was a significant difference in energy, carbohydrate, and fiber intake between groups ( $p<0.05$ ).

Regarding micronutrients, Group I, which received low-energy diet counseling and physical activity monitoring, showed significant increases in vitamin C ( $p=0.034$ ) and fiber intake ( $p<0.003$ ). Group II, which received counseling on the "My Plate" guidelines and performed aerobic exercises, demonstrated a significant

**Table 1.** Sample characteristics (n=42).

Characteristic	Group I		Group II		Group III	
	n	%	n	%	n	%
Gender						
Man	3	25.0	2	13.3	2	13.3
Woman	9	75.0	13	86.7	13	86.7
Age						
16-18 years old	7	58.3	0	0	4	26.7
19-29 years old	5	41.7	15	100.0	11	73.3
Department						
Nutrition	4	33.3	5	33.3	5	33.3
Environmental Health	2	16.7	1	6.7	0	0
Technical Electromedic	1	8.3	2	13.3	2	13.3
Radiodiagnostic Engineering	0	0	1	6.7	2	13.3
Pharmaceutical and Food Analysis	0	0	1	6.7	3	20.0
Pharmacy	2	16.7	2	13.3	2	13.3
Dental Engineering	3	25.0	3	20.0	1	6.7
Total	12	100.0	15	100.0	15	100.0

**Table 2.** Changes in weight, physical activity, and knowledge before and after the intervention.

Variables	Group I (Mean, CI)	p	Group II (Mean, CI)	p	Group III (Mean, CI)	p
Body Weight (kg)						
Before	68.06 (60.70, 75.43)	0,000*	71.60 (63.69, 79.51)	0,001*	71.5 (67.35, 75.66)	0*
After	66.01 (58.55, 73.47)		68.90 (60.81, 76.98)		69.7 (65.73, 73.82)	
Physical Activity (PAR/hour)						
Before	1.37 (1.26, 1.47)	0,000*	1.53 (1.46, 1.60)	0,013*	1.51 (1.47, 1.56)	0*
After	1.82 (1.76, 1.87)		1.78 (1.68, 1.88)		1.68 (1.62, 1.73)	
Nutrition Knowledge (score)						
Before	74.58 (63.96, 85.20)	0,010*	62 (53.64, 70.36)	0,002*	69.3 (63.43, 75.24)	0*
After	96.25 (93.18, 99.32)		78,33 (73.35, 83.32)		80 (73.55, 86.45)	

\*Significant p-value if  $p<0.05$ .

increase in fiber intake ( $p=0.015$ ). In Group III, which also received “My Plate” counseling along with physical activity monitoring, there were significant increases in iron intake ( $p=0.047$ ) and fiber intake ( $p=0.017$ ).

## Discussion

The study results showed that combining nutritional counseling with increased physical activity significantly improved nutritional knowledge and led to a substantial reduction in body weight among overweight and obese students in all three intervention groups. However, energy and macronutrient intake only decreased significantly in Group I, which followed a low-energy diet. Additionally, all participants across the three groups showed a significant increase in fiber intake.

The largest reduction in body weight was observed in Group II, which received nutritional counseling on balanced nutrition using the “My Plate” guidelines and performed aerobic exercises three times a week. This may be attributed to the higher energy expenditure in this group compared to the other groups, where participants were only encouraged to engage in physical activity once a week. The aerobic exercise videos provided as part of the intervention in Group II helped participants better understand the guidance and adopt regular physical activity. Monitoring physical activity, as was done in this study, can encourage individuals to increase activity levels and reduce sedentary behavior by enhancing self-awareness.<sup>27</sup>

These findings align with the results of a study on obese young adults in India, which reported significant weight loss following a three-month intervention involving nutrition education and physical exercise programs.<sup>21</sup> Similarly, a study in Semarang found a

significant reduction in the average body weight of obese female students who participated in an Instagram-based nutrition program that included counseling and physical activity over 30 days.<sup>28</sup>

Although the paired t-test showed there was a significant decrease in body weight among respondents after intervention in all three groups, the ANOVA test showed that after intervention, there was no significant difference in body weight among the three groups. This might be because there were factors that influenced, including significant differences in the level of physical activity of respondents before the intervention. Group I, which adhered to a low-energy diet, showed a significant decrease in energy and macronutrient intake. In contrast, no significant reductions in energy or macronutrient intake were observed in Groups II and III, which followed “My Plate” recommendations. A low-energy diet, as prescribed by a dietitian, consisted of fixed caloric content (1700 calories for males and 1500 calories for females) and significantly improved BMI among overweight and obese participants. On the other hand, the “My Plate” approach is a general nutritional guideline based on visual food proportions on a plate, leading to variations in energy and nutrient intake among participants.

All three groups showed a significant increase in fiber intake. Both the low-energy diet and the “My Plate” recommendation emphasize high fiber intake through increased consumption of vegetables and fruits. Studies have demonstrated that higher fiber intake is significantly associated with weight reduction, contributing to weight loss across all groups.<sup>29</sup>

Improvements in energy and nutrient intake may also be influenced by increased nutritional knowledge gained from counseling on low-energy diets and “My Plate” recommendations. Nutritional counseling is known to enhance knowledge, which in turn encourages behavior changes, including improved dietary intake.<sup>30,31</sup> This is supported by findings where obese young adults experienced

**Table 3.** Changes in energy and nutrient intake before and after the intervention.

Variables	Group I (Mean, CI)	p	Group II (Mean, CI)	p	Group III (Mean, CI)	p
Energy (Cal)						
Before	1970.86 (1728.04, 2213.67)	0*	1599.6 (1242.74, 1956.49)	0,281	1325 (1066.10, 1583.89)	0.112
After	1056,97 (873.88, 1240.05)		1367.7 (1182.36, 1553.02)		1120 (924.62, 1315.37)	
Protein (g)						
Before	62.91 (45.60, 80.21)	0.007*	46.56 (36.48, 56.64)	0,910	42 (29.67, 54.88)	0.363
After	38.02 (34.43, 41.60)		43.36 (35.67, 51.06)		36 (24.47, 47.52)	
Fat (g)						
Before	85.02 (66.01, 104.02)	0.007*	67.93 (50.14, 85.72)	0,031*	55 (43.66, 67.38)	0.609
After	46.58 (33.34, 59.81)		46.28 (38.51, 54.04)		49 (37.00, 60.99)	
Carbohydrate (g)						
Sebelum	216.27 (178.18, 254.35)	0.013*	198.09 (151.33, 244.83)	0,609	150 (103.16, 197.22)	0.691
Sesudah	145.93 (118.20, 173.65)		192.72 (165.12, 220.31)		139 (115.04, 163.40)	
Vitamin C (mg)						
Before	12.31 (7.12, 17.49)	0.034*	69.20 (39.58, 98.81)	0,061	56 (-15.70, 127.70)	0.532
After	50.16 (38.91, 61.40)		128.79 (61.49, 196.09)		134 (-22.05, 290.24)	
Calcium (mg)						
Before	414.66 (327.06, 502.25)	0.158	529.65 (329.18, 730.11)	0,307	327 (189.14, 464.85)	0.820
After	289.51 (240.34, 338.67)		620.85 (423.95, 817.74)		341 (227.11, 455.03)	
Iron (mg)						
Before	21.05 (20.36, 21.73)	0.272	16.07 (8.98, 23.16)	0,609	4.1 (2.74, 5.45)	0.047*
After	28.40 (27.97, 28.82)		11.53 (8.72, 14.34)		9.5 (7.28, 11.71)	
Fiber (g)						
Before	4.88 (3.97, 5.78)	0.003*	6.28 (4.36, 8.20)	0,015*	3 (2.12, 3.90)	0.017*
After	13.18 (12.59, 13.76)		9.99 (7.51, 12.47)		7 (3.49, 10.51)	

\*The p-value is significant if  $p<0.05$ .

significant decreases in energy and protein intake after receiving nutritional counseling and participating in a physical activity program for three months.<sup>32</sup> Similarly, studies reported a significant increase in fiber intake among Japanese high school students who received nutritional counseling over four months.<sup>33,34</sup>

The frequency of counseling may also affect outcomes, such as increased nutritional knowledge, improved nutrient intake, and weight loss. In this study, nutritional counseling was conducted once a week for four weeks. In contrast, a study on obese breast cancer patients found no significant weight loss after providing nutritional counseling once a month for six months.<sup>35</sup> However, a review highlighted that more frequent nutritional counseling is positively associated with greater weight loss, suggesting that increased counseling frequency yields better results.<sup>36</sup>

A strength of this study was that the three groups received different combinations of interventions, allowing for an exploration of the varying impacts of these interventions on overweight and obese participants. However, a limitation of this study was the small sample size and the short duration of the intervention (only 4 weeks), which may have influenced the results. Future research with a larger sample size and a longer intervention period is needed to further investigate these effects.

## Conclusions

Based on the research conducted, it can be concluded that the combination of nutritional counseling, increased physical activity, and either a low-energy diet or the “My Plate” recommendation over 4 weeks led to a reduction in body weight among overweight and obese students. Participants who engaged in aerobic exercise three times per week for 4 weeks experienced a greater reduction in body weight compared to those who exercised once a week. While energy and macronutrient intake significantly decreased with the low-energy diet, both the low-energy diet and the “My Plate” recommendation significantly increased fiber intake and contributed to body weight reduction. This study recommends to use my plate as one of nutrition guidelines to decrease body weight for students with overweight or obese. My plate recommendation is a practical way for implement healthy eating for students. University can use this recommendation as part of wellness program to improve eating behavior and nutritional status of students.

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