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Diet quality and body fat percentage before and during ramadan among college students

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ABSTRAK

Latar Belakang: *Obesitas menjadi masalah kesehatan global yang semakin mengkhawatirkan, termasuk di Indonesia. Angka kejadian obesitas pada populasi dewasa yang berusia 18 tahun ke atas terus menunjukkan peningkatan setiap tahunnya yaitu pada tahun 2007 sebesar 10,5%, menjadi 14,8% pada tahun 2013, dan pada tahun 2018 mencapai 21,8%.*
Tujuan: *Untuk mengetahui hubungan kualitas diet dengan persen lemak tubuh sebelum dan saat puasa Ramadhan pada mahasiswa UPN "Veteran" Jakarta.*
Metode: *Penelitian ini menggunakan desain studi cross sectional dengan pengambilan sampel stratified random sampling. Jumlah sampel sebanyak 103 responden. Data identitas responden dan kualitas diet diambil melalui wawancara dengan panduan kuesioner (Food Recall 24h dan DQI-I). Data antropometri (persen lemak tubuh) diperoleh melalui pengukuran langsung. Analisis data yang digunakan adalah uji chi-square dan t-test.*
Hasil: *Terdapat perbedaan yang signifikan antara kualitas diet sebelum dan saat puasa Ramadhan (p=0,000). Terdapat hubungan yang signifikan antara kualitas diet dengan persen lemak tubuh sebelum dan saat puasa Ramadhan (p=0,005; p=0,000).*
Kesimpulan: *Terdapat hubungan yang signifikan antara kualitas diet dengan persen lemak tubuh sebelum dan saat puasa Ramadhan. Mahasiswa disarankan untuk meperhatikan status gizi dan melakukan pengukuran berkala pada persen lemak tubuh diikuti dengan penerapan gaya hidup sehat.*

KATA KUNCI*: kualitas diet; persen lemak tubuh; puasa ramadhan*

ABSTRACT

Background: *Obesity has become an increasingly concerning global health problem, including in Indonesia. The prevalence of obesity in the adult population aged 18 years and over has continued to increase each year, from 10.5% in 2007 to 14.8% in 2013, and reached 21.8% in 2018.*

Objectives: *To determine the relationship between diet quality and body fat percentage before and during the Ramadan fasting period among college students at UPN "Veteran" Jakarta.*

Methods: *This study used a cross-sectional study design with stratified random sampling. The sample size was 103 respondents. Data on respondent identity and diet quality were obtained through interviews using a questionnaire (24-hour Food Recall and DQI-I). Anthropometric data (body fat percentage) was obtained through direct measurement. Data analysis used the chi-square test and t-test.*

Results: *There was a significant difference in diet quality before and during the Ramadan fasting period (p=0.000). There was a significant relationship between diet quality and body fat percentage before and during the Ramadan fasting period (p=0.005; p=0.000).*

Conclusions: *There is a significant relationship between diet quality and body fat percentage before and during the Ramadan fasting period. Students are advised to pay attention to their nutritional status and conduct regular measurements of body fat percentage, followed by the implementation of a healthy lifestyle.*

KEYWORD*: anemia; antidepressant food scores; depression; dietary patterns physical activity*

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INTRODUCTION

Obesity has become an increasingly concerning global health issue, including in Indonesia. In Indonesia, the incidence of obesity among the adult population aged 18 years and older has continued to rise each year. According to the 2023 Indonesian Health Survey (SKI), the national prevalence of obesity among individuals aged over 18 years increased from 21.8% in 2018 (1) to 23.4% in 2023. The shift toward a modern lifestyle, characterized by the consumption of high-calorie, low-fiber foods and a lack of physical activity, is a major factor contributing to obesity. Previous research has shown that as many as 37% of university students in West Java aged 18 years and older have a high body fat percentage (2). The impact of obesity includes an increased body fat percentage, which is caused by lifestyle changes related to declining food quality choices and a lack of physical activity (3). The proportion of body fat differs between men and women due to differences in fat storage centers. In women, body fat is primarily stored in the periphery, especially in the pelvic area, while in men, it is centered in the abdominal area (4). Studies show that the prevalence of overweight and obesity in adults in Indonesia, based on body fat percentage measurements, reaches 72% in men and 63% in women (5).

High body fat percentage and the incidence of overnutrition are closely related to the quality of a person's diet. Diet quality affects body composition, particularly the amount of body fat, rather than total body weight (6). Diet quality refers to the pattern or indicator of variation across major food groups suggested by dietary guidelines, serving as a method to assess whether nutrient intake aligns with dietary recommendations (7). Research by Restutiwati in 2019 illustrates that diet quality in the early adult age group tends to be low (8). Similar findings were also reported in Marchha's research, where 97.1% of students indicated poor diet quality (9). Low diet quality is directly proportional to an increased risk of overnutrition, while a high-quality diet can minimize the risk of both overnutrition and undernutrition (10).

Ramadan fasting, as a religious practice observed by Muslims, has the potential to

influence body weight and composition, including body fat percentage. During fasting, there are changes in daily routines, such as diet, sleep patterns, and physical activity. The change in eating patterns, from three meals a day to just two, can impact energy balance, reduce nutritional intake, and alter body fat composition if sustained (11). University students, as a group of active individuals who are vulnerable to lifestyle changes, represent an interesting population for studying the relationship between diet quality and body fat percentage during Ramadan.

Although several studies have examined changes in body weight or dietary intake during Ramadan, limited research has specifically focused on how diet quality affects body fat percentage before and during Ramadan, especially among university students. Moreover, most existing studies rely on general nutritional intake without assessing comprehensive diet quality indicators. This study aims to fill this gap by analyzing the relationship between diet quality and body fat percentage among university students in the context of Ramadan fasting.

MATERIALS AND METHODS

This research was an analytical observational study with a cross-sectional approach. Data were collected twice: before fasting in February 2024 and during fasting in March 2024, at Campus UPN “Veteran” Jakarta, located on Raya Limo Street, Limo District, Depok City, West Java. The population for this study consists of 363 college students from UPN "Veteran" Jakarta. This study used the minimum sample size calculation with the Lameshow formula, resulting in a final sample size of 97. The sampling technique used is Probability Sampling, specifically the stratified random sampling method. Stratified random sampling is a method of sample selection in which the population is divided into smaller groups based on specific characteristics or criteria, such as class year (Class of 2020, Class of 2021, Class of 2022, Class of 2023). The researcher then randomly selects subjects from each stratum proportionally to ensure representativeness. In sampling, after selecting respondents according to the research criteria, respondents were determined through randomization, resulting in a total of 103 respondents as samples for each class with the following inclusion criteria: (1) Active students from the Nutrition Study Program at UPN "Veteran" Jakarta from the 2020, 2021, 2022, and 2023 cohorts, (2) Aged 19–25 years, and (3) Willing to participate in the study by signing the informed consent form. The exclusion criteria are: (1) Students absent due to illness or other reasons that prevent data collection, and (2) Students who withdraw from the study.

Respondents' identity data, such as age and gender, were obtained through questionnaires. Diet quality was measured by collecting consumption data using the 24-hour Food Recall form and converting it into the Dietary Quality Index-International (DQI-I). Diet quality was assessed based on four categories: variety, adequacy, moderation, and overall balance. The total score ranged from 0 to 100. A score of ≤ 60% indicates low diet quality, while a score > 60% indicates high diet quality. Anthropometric data (body fat percentage) were obtained through direct measurement using Bioelectrical Impedance Analysis (BIA) with the Omron Karada Scan HBF358-BW model, which has a capacity of 130 kg and an accuracy of ±400 grams for body weights between 0.0 - 40.0 kg, and ±1% accuracy for body weights between 40.0 - 135.0 kg.

This study was conducted with the approval of the Ethics Committee of Health Research at Universitas Pembangunan Nasional "Veteran" Jakarta. The study has received ethical approval from the Health Research Ethics Committee of Universitas Pembangunan Nasional "Veteran" Jakarta under approval number 94/III/2024/KEP. Data obtained from this study will be input and cleaned using Microsoft Excel. Outliers and missing values will be identified and removed from the dataset. Bivariate analysis will be conducted using paired t-tests to examine the differences in diet quality and body fat percentage before and during Ramadan fasting. Additionally, chi-square tests were used to assess the association between diet quality and body fat percentage. All statistical analyses were performed using IBM SPSS Statistics version 23.

RESULTS AND DISCUSSIONS

Distribution of Respondent Characteristics

The study was conducted with 103 respondents who were active students in the

Nutrition Study Program at UPN "Veteran" Jakarta from the 2020, 2021, 2022, and 2023 cohorts. The distribution of respondents based on their characteristics, as shown in **Table 1**, indicates that the majority of respondents were 20 years old, totaling 35 respondents (34%). The youngest respondents were 19 years old, and the oldest were 23 years old. This age range falls within early adulthood, a period of transition from adolescence to adulthood. Age is a factor that influences body weight, body mass index, and body composition, including body fat percentage (12). Changes in age can affect a person's body fat percentage. As individuals enter early adulthood, they often experience changes in metabolism, reduced physical activity, and potentially unhealthy eating habits, all of which can contribute to increased body fat accumulation. Additionally, factors such as decreased physical activity, which often occurs with age, and hormonal changes can also lead to an increase in body fat percentage.

Regarding gender characteristics in this study, it was found that the majority of respondents were female, totaling 98 respondents (95.1%). Generally, women have a higher body fat percentage than men. This is due to the greater distribution of fat in areas such as the hips, thighs, and chest. In contrast, men typically have more fat in the abdominal and waist areas (14). Other factors influencing this difference include levels of sex hormones such as estrogen and testosterone, which affect body fat distribution. Estrogen promotes fat storage under the skin in women, while testosterone promotes muscle mass growth in men, resulting in a generally lower body fat percentage for males.

Table 1. Distribution of characteristics respondents

Variabel	n	%
Age (Years)		
15	4	2.30
16	102	59.0
17	61	35.3
18	6	3.50
Antidepressant food consumption		
Low	122	70.5
High	51	29.5
Anemia status		
Anemia	54	31.2
Non Anemia	119	68.8
Physical activity level		
Light	115	66.5
Heavy	58	33.5
Depression level		
Depressed	61	35.3
Not Depressed	112	64.7

Body Fat Percentage

This study uses a Bioelectrical Impedance Analysis (BIA) tool, which utilizes electrical conductivity to measure body fat percentage. Body fat categories were defined as normal if the body fat percentage was < 30% for women and < 20% for men, whereas body fat percentages ≥ 30% for women and ≥ 20% for men were categorized as excessive. Body fat percentage was measured twice: before and during fasting. The analysis results in Table 2 show that the majority of respondents had a body fat percentage in the excessive category both before and during fasting. Before fasting, 53 respondents (51.5%) had a body fat percentage categorized as excessive, with a minimum value of 13.4% and a maximum value of 42.3%. During fasting, 52 respondents (50.5%) had a body fat percentage in the excessive category, with a minimum value of 9.1% and a maximum value of 40.8%. It is evident that a reduction in body fat percentage cannot occur rapidly due to several factors, including changes in the lipid profile. The lipid profile, which includes blood fats such as cholesterol and triglycerides, can influence the body's ability to burn fat. Changes in the lipid profile can take

several months, depending on diet, physical activity, and genetic factors (15). The results of the analysis testing the difference in body fat percentage before and during fasting, as shown in **Table 2**, indicated a significant difference ($p < 0.05$). This significant difference is attributed to the reduction in food intake during fasting, which leads the body to start using fat reserves for energy, thereby reducing body fat percentage. Several factors influence this reduction in body fat percentage, including calorie restriction, changes in eating patterns, and physical activity.

A study on students aged 19-22 years demonstrated differences in body fat percentage before and during fasting, with a decrease observed during fasting as the body utilized fat stores for energy (16). Ramadan fasting affects the reduction in body fat percentage through several closely related mechanisms. First, calorie restriction during fasting causes the body to use fat reserves as an energy source. This restriction reduces total cholesterol levels, *Low-Density Lipoprotein* (LDL), blood glucose levels, and insulin levels in the body. These changes can impact glucose absorption and fat metabolism, leading to increased breakdown of body fat as an energy source (17). During Ramadan, daily eating patterns are notably altered, typically consisting of only two main meals: suhoor before dawn and iftar at sunset. Despite a tendency to consume energy-dense and sugary foods during these meals, the limited eating window and prolonged fasting hours may lead to an overall reduction in total caloric intake throughout the fasting period (18). Additionally, physical activity may decrease during Ramadan due to changes in sleep patterns and eating habits. While some individuals continue to engage in light exercise after iftar, the overall intensity and duration of physical activity generally decrease during Ramadan (19).

Table 2. Body fat percentage distribution and difference analysis

Body Fat Percentage	n	%	Mean ± SD	*P-Value*	Min	Max
Before Fasting			29.92 ± 5.810	0.000*	13.4	42.3
Normal	50	48.5				
Excess	53	51.5				
During Fasting			29.09 ± 6.043		9.1	40.8
Normal	51	49.5				
Excess	52	50.5				

Diet Quality

In this study, diet quality was evaluated using the Dietary Quality Index-International (DQI-I). The assessment considered four components: variety, adequacy, moderation, and overall balance, based on dietary guidelines or recommendations. The total score on the DQI-I ranges from 0 to 100, with a score of 0 indicating the lowest diet quality and a score of 100 indicating the highest. Diet quality is categorized as low if the score is ≤ 60% and high if the score is > 60% (20).

The diet quality assessment was conducted twice: before and during fasting. The results indicate that the majority of respondents had low diet quality both before and during fasting. Before fasting, 90 respondents (87.4%) fell into the low diet quality category, with scores ranging from 32 to 71. During fasting, 86 respondents (83.5%) had low diet quality, with scores ranging from 29 to 70. Analysis of diet quality before and during fasting, as shown in **Table 3**, indicated a significant difference ($p < 0.05$). The results indicated improvements in the components of variety, adequacy, and overall balance. The variety component consists of two assessments: first, the consumption of all food groups, such as meat, poultry, fish, eggs, dairy products, legumes, grains, fruits, and vegetables; second, the variety of protein sources, including meat, poultry, fish, dairy products, legumes, and eggs. This component evaluates overall food diversity and the variety of protein sources to determine whether daily food consumption is diverse. The variety score increased from 14.54 ± 4.031 before fasting to 15.54 ± 3.375 during fasting, reflecting an improvement in the diversity of food consumed as respondents became more conscious of their food intake, regularly including balanced meals with staple foods, proteins, fruits, and vegetables.

The adequacy component was assessed based on three food groups (vegetables, fruits, and grains) and five nutrient groups (protein, fiber, calcium, iron, and vitamin C). It measures whether the intake from these food and nutrient groups meets the recommended portions. The adequacy score increased slightly from 16.29 ± 3.615 before fasting to 16.53 ± 3.316 during fasting, indicating improved intake of vegetables, fruits, protein, and vitamin C.

Table 3. Diet Quality Difference Analysis

Body Fat Percentage	Mean ± SD	*P*-Value	Min	Max
Before Fasting	50.01 ± 8.781	0.000	32	71
During Fasting	50.84 ± 8.295		29	70

The overall balance component consists of the macronutrient ratio (carbohydrates, proteins, fats) and the fatty acid ratio (PUFA, MUFA, SFA). This component evaluates whether the balance of energy sources and fat composition is appropriate. The overall balance score increased from 1.50 ± 2.072 before fasting to 1.84 ± 2.252 during fasting, suggesting a slight improvement in the proportion of total energy and fat intake during fasting. However, the moderation component decreased, contrary to the other three components. The moderation component assesses the intake of foods and nutrients (total fats, saturated fats, cholesterol, sodium, non-caloric foods) linked to chronic diseases, which should be limited. The moderation score decreased from 17.58 ± 5.212 before fasting to 16.92 ± 4.443 during fasting, indicating an increase in the consumption of high-fat, sugar-rich, sodium-dense, and energy-dense foods during fasting. and consider their overall nutritional needs.

Table 4. Average DQI-I Score

Diet Quality Indicator	Mean ± SD	
	Before fasting	During fasting
Variety (0-20)	14.54 ± 4.031	15.54 ± 3.375
Overall food group variety	10.98 ± 3.131	11.62 ± 2.776
Protein sources	3.56 ± 1.412	3.92 ± 1.073
Adequacy (0-40)	16.29 ± 3.615	16.53 ± 3.316
Vegetable group	1.37 ± 1.521	1.52 ± 1.520
Fruit group	1.03 ± 1.458	1.21 ± 1.525
Grain group	3.30 ± 1.399	3.30 ± 1.399
Fibre	1.27 ± 0.795	1.14 ± 0.506
Protein	3.83 ± 0.991	3.97 ± 1.043
Iron	3.06 ± 0.338	3.02 ± 0.197
Calcium	1.14 ± 0.506	1.06 ± 0.439
Vitamin C	1.29 ± 0.946	1.31 ± 0.960
Moderation (0-30)	17.58 ± 5.212	16.92 ± 4.443
Total fat	1.14 ± 1.738	1.19 ± 1.799
Saturated fat	1.81 ± 2.601	1.22 ± 2.160
Cholestrol	4.72 ± 2.084	4.72 ± 2.247
Sodium	5.94 ± 0.591	6.00 ± 0.000
Empty calory food	4.08 ± 1.964	3.79 ± 2.337
Overall Balance (0-10)	1.50 ± 2.072	1.84 ± 2.252
Macronutrient ratio (Carbohydrates : Protein : Fat)	1.22 ± 2.043	1.22 ± 1.985
Fatty acid ratio (PUFA : MUFA : SFA)	0.27 ± 0.744	0.62 ± 1.156
DQI-I Total (0-100)	50.01 ± 8.781	50.84 ± 8.295

Several factors may contribute to the improvement in diet quality during Ramadan fasting, including increased nutritional awareness, better food choices, restriction of low-nutrient foods, and increased water consumption (12). Sulaiman's research (21) found a significant difference in diet

quality before and during fasting, with an improvement in diet quality during Ramadan. During Ramadan fasting, heightened awareness of food choices leads to healthier and more complete food selections, such as increased fruit and vegetable intake (22). The structured meal pattern, with only two main meals (iftar and suhoor), allows individuals to plan their meals better, selecting balanced and nutritious foods. Additionally, the restriction of low-nutrient foods during fasting may reduce intake of high-fat, sugary, and salty foods. Increased water consumption during iftar and suhoor also improves diet quality by reducing the intake of sugary drinks. Ramadan fasting enhances awareness of the benefits of a balanced diet and healthy eating habits, encouraging individuals to make healthier food choices

The Relationship Between Diet Quality and Body Fat Percentage

The results of this study indicate that both before and during fasting, diet quality had a significant relationship with body fat percentage among college students at UPN "Veteran" Jakarta (p-value = 0.005 and 0.000). These findings align with research by Dagoglu and Persil (23) on adult women aged 19 years and older in Turkey, which found that low diet quality was associated with a higher body fat percentage ($p < 0.05$). Diet quality is assessed based on four components: variety, adequacy, moderation, and overall balance. A varied or diverse diet tends to be more balanced and includes a wide range of food groups that provide essential nutrients to the body. Consuming a variety of foods such as vegetables, fruits, grains, proteins, and healthy fats helps ensure that the body receives sufficient vitamins, minerals, fiber, and other essential nutrients necessary for optimal metabolic function and weight regulation. Previous studies have shown a positive correlation between the Individual Dietary Diversity Score (IDDS) and body fat percentage ($p = 0.040$), indicating that a more varied diet is associated with a healthier body fat percentage (22). Individuals with low diet quality often consume high-calorie but low-nutrient foods, such as processed foods, sugary drinks, and fast food, which can lead to a calorie surplus. This excess energy is stored as fat. A lack of essential nutrients, like protein, fiber, vitamins, and minerals, can also disrupt the body's metabolism. For example, insufficient protein intake can lead to muscle loss and a slower metabolism, while inadequate fiber intake may increase hunger, contributing to overeating (24).

Table 5. The relationship between diet quality and body fat percentage

Diet Quality	Body Fat Percentage				Total		*P-Value*	*OR (95% CI)*
	Normal		Excess					
	n	%	n	%	n	%		
Before Fasting								
High	11	84.6	2	15.4	13	100	0.005*	7.1 (1.5 – 34.3)
Low	39	43.3	51	56.7	90	100		
Total	50	48.5	53	51.5	103	100		
During Fasting								
High	15	88.2	2	11.8	17	100	0.0008*	10.4 (2.3 – 48.4)
Low	36	41.9	50	58.1	86	100		
Total	51	49.5	52	50.5	103	100		

*significance at p<0.05; chi square test

A high intake of sugar and saturated fat can cause insulin resistance, making the body less efficient at controlling blood sugar levels, which in turn leads to excessive fat storage, particularly in the abdominal area. Additionally, foods high in fat and sugar can interfere with appetite-regulating hormones like leptin and ghrelin, increasing the likelihood of overeating (25). Low diet quality may also stimulate inflammation and oxidative stress in the body, both of which are linked to obesity. Deficiencies in certain nutrients can lead to fatigue and reduced energy levels, decreasing physical activity and calorie burning, which results in an increased body fat percentage (26).Another study conducted among adults in the United States found similar results, showing that good diet quality is correlated with reduced body fat, healthier fat distribution, and increased lean mass.

Good diet quality includes a diverse food variety, optimal nutrient intake, and a balanced eating pattern (27). When a person's food consumption deviates from balanced nutritional guidelines such as excessive intake of fats and sugars and insufficient fruit and vegetable consumptiontheir diet quality declines, raising the risk of higher body fat percentage and problems associated with overnutrition (28).

CONCLUSIONS AND RECOMMENDATIONS

This study demonstrates a significant relationship between diet quality and body fat percentage before and during fasting among college students at UPN "Veteran" Jakarta. This relationship is largely attributed to the majority of respondents having low diet quality, as indicated by the total scores for food variety, nutrient adequacy, moderation, and nutrient ratios in the Dietary Quality Index-International (DQI-I). Additionally, many respondents fall into the high body fat percentage category. Notably, there was a reduction in body fat percentage and an improvement in diet quality among the students before and during fasting.

It is recommended that college students' body fat percentages be regularly monitored, and a targeted wellness program be implemented. Such a program could equip students with knowledge about factors influencing diet and body fat, and encourage healthy lifestyle habits, including maintaining a nutritious and balanced diet and increasing physical activity. These efforts can help students sustain an ideal nutritional status.

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