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Dietary patterns, physical activity, and nutritional status of medical students at Udayana University

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ABSTRACT

Background: Indonesia faces a significant nutritional challenge among adolescents, termed the double burden, involving both undernutrition and overnutrition, notably central obesity. Lifestyle factors such as irregular dietary patterns and inadequate physical activity contribute to these issues, impacting physical and mental growth and development, particularly the cardiovascular system. This study aimed to examine the dietary patterns, physical activity, and nutritional status of medical students at Udayana University.

Methods: This descriptive observational cross-sectional study involved 165 students, selected using simple random sampling. Dietary patterns were assessed using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), physical activity was evaluated using the Global Physical Activity Questionnaire (GPAQ), and nutritional status was determined through anthropometric measurements.

Results: Most respondents exhibited dietary pattern close to the recommended dietary allowance (RDA) (53.9%), followed by low (40%) and over (6.1%). In terms of physical activity, 51.5% had insufficient activity, while 48.5% had sufficient activity. Regarding nutritional status, 55.2% were classified as normal, 10.3% underweight, 15.8% overweight, and 18.8% obese, comprising obesity I (12.7%), obesity II (6.1%), and central obesity (12.7%).

Conclusion: The study highlights prevalent abnormal dietary patterns and nutritional status among respondents, alongside inadequate physical activity. Recommendations include implementing interventions to improve dietary habits and increase physical activity among medical students at Udayana University. Further research utilizing more precise measurement methods is warranted to explore the relationship between dietary patterns, physical activity, and nutritional status.

Keywords: dietary patterns, physical activity, nutritional status, medical students.
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INTRODUCTION

Indonesia, as a developing nation, is currently grappling with significant nutritional issues among teenagers, specifically malnutrition and central obesity. Insufficient or poor nutrition in teenagers can adversely impact physical and mental growth and development, energy production, immune defense, brain structure and function, and individual behavior. On the other hand, nutritional excess or central obesity in teenagers can influence most organ systems, particularly the cardiovascular system, leading to an elevated risk of myocardial infarction, stroke, and cardiovascular-related mortality.[1]

Nutritional problems in teenagers are commonly attributed to inappropriate lifestyles, encompassing excessive energy intake coupled with inadequate physical activity.[1] The dietary patterns of teenagers, which tend to lean towards high-calorie, fatty, sugary, and salty foods due to their affordability and accessibility, such as fast food and snacks with large portions, combined with low physical activity, lead to a positive energy balance resulting in energy storage and weight gain, ultimately causing central obesity.[2,3]

In the last decade, the prevalence of obesity, particularly central obesity, has sharply risen globally, prompting the World Health Organization (WHO) to classify central obesity as a global epidemiological issue. This problem is not confined to developed nations alone; Indonesia also grapples with these nutritional challenges. Based on the Riset Kesehatan Dasar (Riskesdas) report in 2018, the prevalence of obesity in Indonesian teenagers aged 13-15 years is 20%, and for those aged 16-18 years, it is 13.6%. Specifically in Denpasar, the prevalence of obesity is 7.6%.[2,4]

In general, second-year medical

students, who are still considered late teenagers, possess greater knowledge of a healthy lifestyle, particularly regarding dietary patterns and physical activity, compared to non-medical students. This is crucial because their attitudes, as future healthcare professionals, not only impact themselves and their families but also have consequences for patients, communities, and their nation. However, research by Yousif and other studies indicate that medical students are vulnerable to irregular eating habits, lack of exercise, and addictive behaviors.[5,6]

Particularly among second-year medical students at Udayana University, the ease with which they experience weight-related issues due to irregular eating patterns and insufficient physical activity caused by academic burdens such as a dense lecture schedule and numerous assignments can lead to two distinct dietary patterns. These patterns involve either insufficient food intake, resulting in malnutrition, or the consumption of fast food coupled with sedentary behavior, leading to weight gain and eventual central obesity. This condition may persist into adulthood, posing a high risk of more serious health problems such as diabetes, heart disease, stroke, and others.[7] Considering these aspects, this study aimed to examine the dietary patterns, physical activity, and nutritional status of medical students at Udayana University

MATERIAL AND METHODS

This is a quantitative study utilizing a cross-sectional sampling approach. Samples were collected using a simple random sampling technique. Undergraduate medical students at Udayana University in 2023 were to be research samplesBased on the research design, the study successfully

Table 1. Frequency distribution by demographic characteristic

Gender	Value
Gender, n (%)	
Male	50 (30.3)
Female	115 (69.7)
Age, n (%)	
18	39 (23.6)
19	126 (76.4)
Total, n (%)	165 (100)

Table 2. Frequency distribution by food types

Food types	n (%)	Mean ± SD
Carbohydrate		
Rice	165 (100)	2.34 ± 0.78
Noodle	161 (97.6)	0.55 ± 0.74
Potato	143 (86.7)	0.46 ± 0.56
Sweet potato	107 (64.8)	0.37 ± 0.58
Bread	145 (87.9)	0.82 ± 0.91
Corn	112 (67.9)	0.36 ± 0.45
Vermicelli	114 (69.1)	0.44 ± 0.55
Animal-based protein		
Freshwater fish	123 (74.5)	0.60 ± 0.93
Saltwater fish	106 (64.2)	0.47 ± 0.80
Shrimp	129 (78.2)	0.53 ± 0.80
Beef	131 (79.4)	0.69 ± 1.04
Pork	132 (80.0)	0.65 ± 0.99
Chicken	164 (99.4)	1.55 ± 1.30
Chicken egg	158 (95.8)	1.20 ± 1.25
Meatballs	142 (86.1)	0.77 ± 1.11
Sausage	133 (80.6)	0.72 ± 1.06
Plant-based protein		
Green bean	101 (61.2)	0.48 ± 0.80
Soybean	94 (57.0)	0.48 ± 0.78
Peanut	105 (63.6)	0.48 ± 0.73
Tofu	158 (95.8)	0.95 ± 1.08
Tempe	155 (93.9)	0.97 ± 1.10
Vegetables		
Spinach	127 (77.0)	0.65 ± 0.95
Water spinach	132 (80.0)	0.66 ± 0.98
Carrot	147 (89.1)	0.78 ± 1.07
Collard greens	133 (80.6)	0.73 ± 1.01
Cabbage	126 (76.4)	0.72 ± 1.04
Cauliflower	111 (67.3)	0.59 ± 0.99
Brocolli	116 (70.3)	0.56 ± 0.84
Cucumber	131 (79.4)	0.79 ± 1.14
Long beans	105 (63.6)	0.54 ± 0.83
Bean	116 (70.3)	0.56 ± 0.78
Fruits		
Orange	142 (86.1)	0.80 ±1.17
Papaya	124 (75.2)	0.66 ± 0.98
Apple	135 (81.8)	0.70 ± 1.07
Banana	136 (82.4)	0.81 ± 1.23
Mango	140 (84.8)	0.93 ± 1.34
Milk		
Packaged milk	155 (93.9)	0.90 ± 0.93
Condensed milk	97 (58.8)	0.43 ± 0.66
Yoghurt	115 (69.7)	0.54 ± 0.79
Cheese	127 (77.0)	0.55 ± 0.86
Ice cream	150 (90.9)	0.71 ± 1.06
Oil		
Coconut oil	128 (77.6)	0.83 ± 0,86
Margarine	116 (70.3)	0.6 ± 0.79
Butter	128 (77.6)	0.65 ± 0.75
Sesame oil	85 (51.5)	0.45 ± 0.70
Coconut milk	103 (62.4)	0.48 ± 0.70
Grated coconut	84 (50.9)	0.38 ± 0,56
Supplement		
Fish oil	77 (46.7)	0.40 ± 0.62

gathered a total 165 of respondents. The data collected in this study include gender, food types, average macronutrient nutrition values, dietary patterns, physical activity, energy balance and nutritional status.

The dietary patterns were assessed using a semi-quantitative food frequency questionnaire (SQ-FFQ), a validated tool designed to capture information on food types, portion sizes, and meal frequencies consumed within a specified time frame. The SQ-FFQ results were categorized based on the Recommended Dietary Allowance (RDA), distinguishing between insufficient, normal, and excessive intake. Physical activity levels were measured using the Global Physical Activity Questionnaire (GPAQ), which quantifies activity levels in metabolic equivalent of task (MET) minutes per week and categorizes individuals into insufficient or sufficient activity groups. Nutritional status was determined through Body Mass Index (BMI) calculations and waist circumference measurements. BMI, calculated as body weight in kilograms divided by the square of height in meters, categorized individuals into underweight, normal weight, overweight, and obesity classes. Waist circumference, measured at the midpoint between the lowest rib and the top of the hip bone, provided additional information on abdominal adiposity, with predefined cutoffs indicating insufficient or excessive fat accumulation. These standardized assessment methods ensure comparability and reliability of findings across studies and contribute valuable insights into the nutritional behaviors and health status of the study population within the broader international medical community.

Data were analyzed descriptively in the form of tables. Categorical data were depicted in amount and percentage, while numerical data in mean and standard deviation (SD). The collected data were processed using the Statistical Package for the Social Sciences (SPSS) for Windows version 26.0.

RESULTS

Demographic Characteristic

Table 1 shows the distribution of respondents based on gender and age. According to the obtained data, the research results indicate that out of 165 research samples, the majority are female, comprising 115 individuals (69.7%), while the remaining are male, comprising 50 individuals (30.3%). It was also found that there were 39 respondents aged 18 (23.6%) and 126 respondents aged 19 (76.4%).

Table 3. Frequency distribution by average macronutrient nutrition values

Macronutrient	Male (Mean ± SD)	Female (Mean ± SD)
Energy (kkal)	2015 ± 718	1519 ±563
Carbohydrate (gram)	215 ± 93	162 ± 63
Fat (gram)	85 ± 33	63 ± 29
Protein (gram)	103 ± 40	80 ± 31
Fiber (gram)	12 ±8	9 ± 5

Table 4. Frequency distribution by dietary patterns

Dietary patterns	Male n (%)	Female n (%)	Total n (%)
Energy			
Deficient	16 (32.0)	50 (43.5)	66 (40.0)
Normal	32 (64.0)	57 (49.6)	89 (53.9)
Excess	2 (4.0)	8(7.0)	10 (6.1)
Carbohydrate			
Deficient	36 (72.0)	107 (93.0)	143 (86.7)
Normal	13 (26.0)	8 (7.0)	21 (12.7)
Excess	1 (2.0)	0 (0.0)	1 (0.6)
Fat			
Deficient	9 (18.0)	24 (20.9)	33 (20.0)
Normal	19 (38.0)	63 (54.8)	82 (49.7)
Excess	22 (44.0)	28 (24.3)	50 (30.3)
Protein			
Deficient	1 (2.0)	7 (6.1)	8 (4.8)
Normal	14 (28.0)	44 (38.3)	58 (35.2)
Excess	35 (70.0)	64 (55.7)	99 (60.0)
Fiber			
Deficient	47 (94.0)	112 (97.4)	159 (96,4)
Normal	2 (4.0)	3 (2.6)	5 (3.0)
Excess	1 (2.0)	0 (0.0)	1 (0.6)
Total	50 (100)	115 (100)	165 (100)

Dietary Food Pattern

Table 2 shows the distribution of respondents based on food types. According to the obtained data, the research results indicate that the majority of energy intake comes from rice (100%), noodles (97.6%), meat (99.4%), chicken eggs (95.8%), tofu (95.8%), tempeh (93.9%), and cow's milk (93.9%).

Table 3 shows the distribution of respondents based on average macronutrient nutrition values. According to the obtained data, the research results for males show an average energy intake of 2015 ± 718 kcal, consisting of 215 ± 93 grams of carbohydrates, 85 ± 33 grams of fat, 103 ± 40 grams of protein, and 12 ± 8 grams of fiber. For females, the average energy intake is found to be 1519 ± 563 kcal, comprising 162 ± 63 grams of carbohydrates, 63 ± 29 grams of fat, 80 ± 31 grams of protein, and 9 ± 5 grams of fiber.

Table 4 shows the distribution of respondents based on dietary patterns. In this study, respondents' dietary patterns are categorized into three groups based on Nutrient Adequacy Ratio (NAR) in terms of energy, carbohydrates, protein, fat, and fiber intake. According to the obtained data, the research results indicate that the majority of medical students at Udayana University have a normal dietary pattern, with 89 individuals

(53.9%), comprising 32 males (64%) and 57 females (49.6%). This is followed by a deficient dietary pattern, with 66 individuals (40%), including 16 males (32%) and 50 females (43.5%), and an excessive dietary pattern with 10 individuals (6.1%), consisting of 2 males (4%) and 8 females (7%).

For carbohydrate intake, the most common pattern is deficiency, with 143 individuals (86.7%), predominantly females with 107 individuals (93%) and males with 36 individuals (72%). This is followed by a normal pattern with 21 individuals (12.7%), including 13 males (26%) and 8 females (7%), and the least common pattern is excess, with 1 individual (0.6%), a male.

For fat intake, the most common pattern is normal, with 82 individuals (49.7%), comprising 19 males (38%) and 63 females (54.8%). This is followed by an excessive pattern with 50 individuals (30.3%), including 22 males (44%) and 28 females (24.3%), and the least common pattern is deficiency, with 33 individuals (20%), comprising 9 males (18%) and 24 females (20.9%).

For protein intake, the most common pattern is excess, with 99 individuals (60%), including 35 males (70%) and 64 females (55.7%). This is followed by a normal pattern with 58 individuals (35.2%), comprising 14 males (28%) and 44 females (38.3%), and the least common pattern is deficiency, with 8 individuals (4.8%), including 1 male (2%) and 7 females (6.1%).

For fiber intake, the most common pattern is deficiency, with 159 individuals (96.4%), including 47 males (94%) and 112 females (97.4%). This is followed by a normal pattern with 5 individuals (3%), including 2 males (4%) and 3 females (2.6%), and the least common pattern is excess, with 1 individual (0.6%), a male.

Physical Activity

Table 5 shows the distribution of respondents based on physical activity. In this study, respondents' physical activity is classified into two groups: insufficient (< 600 MET (metabolic equivalent)) and sufficient (≥ 600 MET). According to the data obtained, there are more respondents engaging in insufficient physical activity, totaling 85 individuals (51.5%), with 16 individuals (32%) being male and 69 individuals (60%) female, compared to respondents engaging in sufficient physical activity, totaling 80 individuals (48.5%), with 34 individuals (68%) being male and 46 individuals (40%) female.

Table 5. Frequency distribution by physical activity

Physical activity	Male n (%)	Female n (%)	Total n (%)
Insufficient	16 (32.0)	69 (60.0)	85 (51.5)
Sufficient	34 (68.0)	46 (40.0)	80 (48.5)
Total	50 (100)	115 (100)	165 (100)

Table 6. Frequency distribution by energy balance

Energy balance	Male n (%)	Female n (%)	Total n (%)
Insufficient	37 (74.0)	2 (1.7)	39 (23.7)
Balanced	11 (22.0)	77 (67.0)	88 (53.3)
Excess	2 (4.0)	36 (31.3)	38 (23.0)
Total	50 (100)	115 (100)	165 (100)

Table 7. Frequency distribution by nutritional status

Nutritional Status	Male n (%)	Female n (%)	Total n (%)
BMI (kg/m²)			
Underweight	3 (6.0)	14 (12.2)	17 (10.3)
Normal	18 (36.0)	73 (63.5)	91 (55.2)
Overweight	13 (26.0)	13 (11,3)	26 (15.8)
Obesity I	12 (24.0)	9 (7.8)	21 (12.7)
Obesity II	4 (8.0)	6 (5.2)	10 (6.1)
Waist circumference (cm)			
Normal	40 (80.0)	104 (90.4)	144 (87.3)
Central obesity	10 (20.0)	11 (9.6)	21 (12.7)
Total	50 (100)	115 (100)	165 (100)

Energy Balance

Table 6 shows the distribution of respondents based on energy balance. In this study, respondents' energy balance is categorized into three groups: insufficient (caloric intake < caloric expenditure), balanced (caloric intake = caloric expenditure), and excess (caloric intake > caloric expenditure). Based on the data obtained, the research results indicate that the insufficient category comprises 39 individuals (23.7%), with 37 males (74%) and 2 females (1.7%). The balanced category includes 88 individuals (53.3%), with 11 males (22%) and 77 females (67%). The excess category consists of 38 individuals (23%), with 2 males (4%) and 36 females (31.3%).

Nutritional Status

Table 7 shows the distribution of respondents based on nutritional status using body mass index (BMI) and waist circumference. In this study, nutritional status data based on BMI is categorized into several types as listed in Table 5.4, namely: underweight, with 17 individuals (10.3%), comprising 3 males (6%) and 14 females (12.18%); normal, with 91 individuals (55.2%), comprising 18 males (36%) and 73 females (63.48%); overweight, with 26 individuals (15.8%), comprising 13 males (26%) and 13 females (11.3%); obesity I, with 21 individuals (12.7%), comprising 12 males (24%) and 9 females (7.82%); and obesity II, with 10 individuals (6.1%), comprising 4 males (8%) and 6 females (5.22%). On the other hand, nutritional status data based on waist circumference is categorized into two groups: normal, with 144 individuals (87.3%), comprising 40 males (80%) and 104 females (90.43%); and central obesity, with 21 individuals (12.7%), comprising 10 males (20%) and 11 females (9.57%).

DISCUSSION

In this study, a majority of respondents maintained a normal diet (53.9%), with an average energy intake of 2015 ± 718

kcal. However, a substantial portion (40%) displayed inadequate dietary patterns, posing malnutrition risks, and a smaller percentage (6.1%) exhibited excessive dietary habits linked to potential overweight and obesity. Primary energy sources included rice, noodles, meat, chicken eggs, tofu, tempeh, and cow's milk. Carbohydrate intake for the majority (86.7%) fell below recommended levels, with values below the Nutrient Adequacy Level (AKG), raising concerns about long-term complications. Nearly half (49.7%) showed normal fat intake, but 30.3% consumed excessive fat, associated with increased adipose tissue and elevated risks of chronic diseases, particularly cardiovascular diseases and mortality. Excessive protein intake was observed in over half (60%) of respondents, with potential benefits but also warnings of associated risks. Additionally, almost all respondents (96.4%) demonstrated insufficient fiber intake, linked to gastrointestinal issues and disruptions in gut microbiota. When compared to Indonesian Government Health Regulation No. 28 of 2019 on Nutrient Adequacy Levels, the nutritional intake of medical students at the University of Udayana fell short, indicating incomplete fulfillment of nutritional requirements. These findings align with Stewart et al.'s (2020) research, identifying fat as the highest contributor to calorie intake, suggesting vulnerability to hyperlipidemia and potential cardiovascular diseases.[8] The study's results are consistent with Ughude et al. (2021), reporting 97.5% of students exhibiting normal eating patterns, and Multazami's research (2022), highlighting 52.6% with adequate dietary patterns.[9,10] This contrasts with Al-Qahtani's (2016) study, emphasizing poor eating habits among medical students, associated with negative health impacts and an increased risk of chronic metabolic diseases, including obesity and type 2 diabetes.[11]

The study revealed that more than half of the participants demonstrated insufficient physical activity, with 85 individuals (51.5%), while 80 individuals (48.5%) engaged in physical activity at a sufficient level. This finding is consistent with Basri's (2020) study, reporting 53.3% of respondents having insufficient physical activity, possibly due to time constraints associated with academic commitments.[12] However, this contrasts with Al-Drees et al.'s (2016) findings, suggesting a positive correlation between physical activity and academic performance.[13] The current study's results align with research in Sudan by Yousif (2019) and Al-Qahtani (2016), indicating that despite medical students' awareness of the health benefits of physical activity, this knowledge doesn't necessarily influence their lifestyle choices.[6,11] The importance of adopting a healthy lifestyle, particularly for medical students, is emphasized by Bin Abdulrahman (2021) and Malatskey (2019)'s research, establishing a strong correlation between the habits of medical students and their future health practices as medical professionals.[14,15]

The study classifies samples into three categories, noting that over half (53.3%) fall into the balanced category, mainly represented by 86% of participants. Most male respondents (74%) are categorized as negative, while nearly a third of female respondents (31.3%) are in the positive category, possibly due to variations in physical activity levels between genders. Bo's (2020) research emphasizes that energy balance is crucial, with weight changes occurring based on the equilibrium or imbalance between energy intake and expenditure. An excess energy difference leads to weight gain, while a deficit results in weight loss.[16]

The study reveals that the majority of participants exhibit a normal BMI status (55.2%), in line with Riskesdas Bali Province data (2018), which indicates prevalence in Denpasar as underweight (7.15%), normal (49.15%), overweight (15.88%), and obesity (27.82%). Consistency is also observed in Widyastuti et al.'s (2018) study, reporting 76.8% normal nutritional status.[17] Janice et al.'s (2023) research indicates a dominant normal nutritional status (53.1%), undernutrition (10.2%), overweight (14.3%), and obesity (22.4%).[18] Adelita (2020) emphasize that nutritional status is influenced by dietary patterns, physical activity, genetics, and the environment.[19] Several studies support this, indicating a positive relationship between excess energy intake and BMI. Conversely, Munawar's findings (2021) differ, stating there was no significant relationship between physical activity and nutritional status but respondents with physical activity less than 600 METs had an 1.325 times higher risk having obesity, with the causes include prolonged computer use, stress-induced eating, and snacking between meals.[20] Mutia's study (2021) underscores the heightened risk of chronic diseases in teenagers with obesity, such as type 2 diabetes, metabolic syndrome, and cardiovascular diseases, reinforcing the importance of addressing and understanding nutritional patterns and their implications.[21]

However, the study acknowledges limitations including potential sampling bias, reliance on self-reporting methods, and the cross-sectional design's inability to establish causality. Additionally, the study's focus on a single-center population may limit generalizability. Despite these constraints, the findings underscore the importance of addressing lifestyle factors among medical students for improved health outcomes and suggest the need for further research to explore causal relationships and potential interventions. As for suggestions, addressing these limitations and longitudinal dynamics are crucial for a comprehensive understanding of lifestyle factors and health outcomes among medical students. Further research with precise measurements on the relationship between dietary patterns, physical activity, and nutritional status is also advised. The implementation of targeted programs to improve dietary habits and increase physical activity, especially among medical students at Udayana University, is also suggested.

CONCLUSION

This study reveals that a majority of respondents exhibit normal dietary patterns (53.9%), while 40% have insufficient patterns, and 6.1% show excessive patterns. Males' average energy intake is 2015 ± 718 kcal, characterized by high fat, and low fiber. Females' average energy intake is 1519 ± 563 kcal, displaying similar dietary patterns. Physical activity is insufficient for the majority (51.5%), while 48.5% engage in sufficient activity. Nutritional status is mostly normal (55.2%), followed by undernourished (10.3%), overweight (15.8%), obesity class I (12.7%), and obesity class II (6.1%), with 12.7% having central obesity.

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CONFLICT OF INTEREST

The author(s) report no conflicts of interest in this work.

ETHICAL STATEMENT

This research was approved by the Research Ethics Commission of the Faculty of Medicine, Udayana University, with approval number 2321/UN14.2.2.VII.14/LT/2023.

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AUTHORS' CONTRIBUTION

All of the authors equally contributed to preparing this article until the article was published.

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