



RESEARCH ARTICLE

Overweight and Obesity among University Student: Cross Sectional Study Exposes Association with Food Habit and Physical Activity

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Abstract

This study aims to investigate the association between food habit, physical activity, and nutritional status in university students. Cross sectional study was conducted on 62 undergraduate university students (22 males, 40 females, 20.82 ± 2.52 years) enrolled from five departments. International Physical Activity Questionnaire-Short Form (IPAQ-SF) was used to measure physical activity level. Evaluation of food habit was collected through a validated Recommended Foods Score which has been adapted to measure diet quality in general with a focus on healthy food intake. Independent sample t-test and Mann-Whitney test were done to compare the measured variables between sport major and non-sport major student. Spearman correlation was performed to examine the association between measured variables. The results showed that more than one-fifth of total subjects (21%) were overweight. Food habit is associated with body mass index ($p=0.005$) and METs score ($p=0.032$). Lastly, physical activity was positively associated with BMI ($p=0.004$). From the findings it can be conclude that balance amount of healthy food and actively engage in physical activity can contribute to lower BMI, as well as maintain health and well-being. This also happens to adolescent population, include university students an age group which could be addressed to prevent several health problems.

Keywords

Adolescents, Food Pattern, Obesity, Overweight, Physical Activity, Recommended Food Score

INTRODUCTION

The prevalence of obesity in the world is increasing progressively during last few decades, especially among children and adolescents (González-Muniesa et al., 2017; Sholikhah & Tuah, 2021). The high prevalence presents in low and middle-income countries (LMIC) as well as in high-income countries (Jebeile et al., 2022). The incidence varies around the world, from less than 2% in Sub-Saharan Africa to more than 30% in the

United States (WHO, 2017). It has been estimated that in 2030, about 1.35 billion and 573 million adults would have problem related to overweight and obesity, respectively (Romano et al., 2021). In Indonesia, obesity increases at all ages, where the result of Indonesian Basic Health Research reported a rise in obesity prevalence from 15.4% in 2013 to 21% in 2018 (Merino et al., 2017; Ministry of Health, 2018a).

Obesity and overweight are being the ultimate risk factors that contribute to the development of many non-communicable diseases

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(NCDs) such as hypertension (ca 6%), cardiovascular and heart disease (ca 16%), cancer (15%), diabetes mellitus (ca 10%), and other chronic diseases (Kok et al., 2023; Nugroho et al., 2020; Qadir et al., 2014). Most of the total population is now living in countries where being obese or overweight kills more individuals than being underweight (Berhanu et al., 2023). Approximately, around 3.4 million deaths occurred every year due to overweight or obesity (Henning, 2021), making obesity a real pandemic in 21st era (Villalobos, 2016).

The issues related with obesity affect population in general, including adolescents. An obese or overweight teenager hold higher risk of being obese/overweight during adulthood (CDC, 2018) and of developing aforementioned diseases (Yun et al., 2018). Although the onset and development of obesity are most evident during youth (Gan et al., 2011), university students also experience a crucial period when their life styles and behaviors are conducive to change in favor of gaining weight (Ganasegeran et al., 2012).

College weight gain happens during an individual entering university life, which is a critical transition period when the behavior and lifestyle of young adults including food habits are prone to change as they have freedom to choose what to eat (Yun et al., 2018). These populations are at greater risk of developing unhealthy eating practices with inadequate nutrient intake (Gan et al., 2011), which might affect their health in the future (Genena & Salama, 2017). Some of these practices include skipping breakfast, irregular meals, snacking, low intake of fruit and vegetable, as well as increased consumption of fried and processed food (Ganasegeran et al., 2012). Although these behaviors are considered temporary as a part of university life, the unhealthy habit and practice built up at this age tend to persist in later life (Scaglioni et al., 2018).

Apart from food habit, sedentary lifestyle and low physical activity also play a role on the increase of overweight and obesity in university students (Yun et al., 2018). Many public health efforts related to exercise have been formulated, including setting standard and guidelines on the level of physical activity (PA), provided guidance as well as suggestion on the duration, frequency, and intensity of PA (Bull et al., 2020). For example, CDC recommends that adults aged 18–64 years should practice thirty minutes of moderate

to vigorous physical activity (MVPA) for at least five days a week, or preferable sixty minutes for more health benefits. However, late studies show that such efforts have been pointless, with Global Burden of Disease (GBD) reported that the level of inactivity globally has not changed from 2001 to 2016 (Grasdalsmoen et al., 2019).

Studying the physical activity among adolescents especially university students will aid in understanding the important relationship of PA with overweight and obesity. Investigation related to this matter have been done in past, however only few is known that also looked the relationship with food habit. Thus, this study was conducted to assess the association between overweight / obesity, food habit, and physical activity especially among university student in East Java.

MATERIALS AND METHODS

Study Design and Participants

This cross-sectional study was conducted among 62 undergraduate students in Universitas Negeri Surabaya. Data was collected during October to November 2022, where the samples were randomly chosen from students enrolled in sport major and non-sport major across five faculties. This study was approved by the Research Ethics Committee of Airlangga University with reference number 101/EA/KEPK/2023, and all procedures and protocol complied with the Helsinki World Medical Association Declaration on the ethical conduct of research involving human subjects. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Baseline characteristic

Baseline characteristic data was collected using self-administered questionnaire comprised of general information such as demographic (age, sex, year in university, major, place of origin, living arrangement, mothers' education, physical activity or METs score, RFS points), and socio-economic (monthly allowance and father's occupation).

Food habit

specific for adolescents which was developed by Slater et al., (2003). The questionnaire was added food items consumed locally. It consisted of a list composed of 50 food items, whose frequencies of consumption were categorized in never, less than once a month, 1-3 times a month, once a week, 2-4 times a week, once a day, and ≥ 2 times a day. Such information was evaluated using the average of healthy diet score, which refers to the Recommended Foods Score (RFS). RFS is an instrument developed by Kant (2000) which aims to confirm the quality of the diet in general using FFQ, with focused on the intake of lean meats, fruits/vegetables, and low-fat dairy products (Table 1). In this study, we modified the RFS according to Indonesian diet. We gave one point for every food item that was consumed at least once a week, made it a total 50 point in maximum score. Higher score of RFS indicating better diet quality.

Physical Activity

Physical activity was measured using International Physical Activity Questionnaire-Short Form (IPAQ-SF) that was developed by Craig et al (2003). The physical activity score was obtained from the METs-minutes/week which is the sum of walking activity, moderate activity, and vigorous activity in duration (minutes) and frequency (days), which was then multiplied by the value of each METs. The multiplication results were then classified into three categories: mild (< 600 METs minutes/week), moderate (600-3000 METs minutes/week), and severe (> 3000 METs minutes/week).

Nutritional Status

Dietary habit data was collected through a validated food frequency questionnaire (FFQ)

Nutritional status was obtained through anthropometric measurements. Bodyweight was measured using an electronic scales with accuracy 0.1 kg (Omron HN-289, Osaka, Japan) and height using portable stadiometer (Seca 213, Seca Ltd., California, US) with a level of accuracy of 0.1 cm. Body mass index (BMI) was then calculated from weight divided by the square of height (kg/m^2), and nutritional status was classified into categories proposed by Ministry of Health, (2018b): (1) very thin ($< 17 \text{ kg/m}^2$); (2) thin ($17.0 - 18.4 \text{ kg/m}^2$); (3) normal ($18.5 - 25.0 \text{ kg/m}^2$); (4) overweight ($25.1 - 27.0 \text{ kg/m}^2$); (5) obesity ($> 27 \text{ kg/m}^2$).

Data Analysis

All data were presented descriptively as mean and standard deviation or frequency and percentage. Normal distribution was checked using Saphiro-Wilk test. Independent sample t-test and Mann-Whitney test were done to compare the measured variables between sport major and non-sport major student. Lastly, Spearman correlation was performed to examine the association between nutritional status, food habit, and physical activity. All statistical analysis was performed using SPSS 25 (IBM Corp. Armonk, NY) for Windows with significant level was set at 0,05.

RESULTS

Present study had a total of 62 students participated. Among them, 22 students (35.5%) were males and 40 students (64.5%) were females, with average age was 20.82 ± 2.52 years. The average of bodyweight and height are 60.44 ± 9.71 kg and 1.66 ± 7.58 , respectively. Most of the students had normal BMI (59.7%) (Table 2).

Table 1. List of local food items adapted from recommended foods score

Group	Food	Total Item
Vegetables	Broccoli, spinach, cabbage, tomato, carrot, lettuce, corn or peas, zucchini, cucumber, okra, potato, basil, sweet potato, beetroot, boiled cassava, eggplant, morning glory, watercress, fern sprout	19
Fruits	Orange, pear or apple, watermelon, melon, lemon, banana, pineapple, strawberry, mango, papaya, guava, avocado, starfruit, grape, dragon fruit	15
Legumes	Mungbean, soybean, peanut, almond	4
Cereals	Oatmeal, rice	2
Dairy	Skimmed milk, yogurt, cheese, soya milk	4
Lean meats	Roasted (beef/chicken/fish), grilled (beef/chicken/fish)	6
Total		50 points

Table 2. Baseline characteristic of participants

Socio-demographic Characteristic	Value
Age (year), mean (SD)	20.82 (2.52)
Gender, n (%)	
Male	22 (35.5)
Female	40 (64.5)
Weight (kg), mean (SD)	60.44 (9.71)
Height (m), mean (SD)	1.66 (7.58)
BMI (kg/m ²), n (%)	
Underweight	10 (16.1)
Normal	37 (59.7)
Overweight	13 (21.0)
Obese	2 (3.2)
Year in university, n (%)	
First year	19 (30.6)
Second year	17 (27.4)
Third year	15 (24.2)
Fourth year	11 (17.7)
Major, n (%)	
Sport major	25 (40.3)
Non-sport major	37 (59.7)
Place of origin, n (%)	
Urban	29 (46.8)
Rural	33 (53.2)
Living arrangement, n (%)	
Living with parent	12 (19.4)
Dormitory/boarding house	41 (66.1)
Living alone	9 (14.5)
Father's occupation, n (%)	
Unemployed	4 (6.5)
Entrepreneur	24 (38.7)
Civil servant	11 (17.7)
SOE official	8 (12.9)
POE official	15 (24.2)
Mother's education status, n (%)	
Uneducated	1 (1.6)
Primary school	5 (8.1)
Junior high school	14 (22.6)
High school	25 (40.3)
College/university	17 (27.4)
Monthly allowance, n (%)	
< 500.000 IDR	19 (30.6)
500.000 – 1.000.000 IDR	31 (50.0)
> 1.000.000 IDR	12 (19.4)
METs, n (%)	
Mild	37 (59.7)
Moderate	17 (27.4)
Severe	8 (12.9)
RFS score, n (%)	
> 80th percentile	23 (37.1)
< 80th percentile	39 (62.9)

Most of the students involved in this study were freshmen (30.6%) coming from non-sport major (59.7%). More than half of the students (53.2%) were from rural area of East Java. Regarding living arrangement, 66.1% of students resided in university dormitory or boarding house. The majority of students had fathers who worked as entrepreneur (38.7%) and mothers with high school diploma (40.3%). In term of socio-economic characteristic, half of the students (50.0%) got 500.000 – 1.000.000 IDR as monthly allowance. Physical activity level which was presented as METs showed that more than half of the students were in mild category (59.7%) and most of them (62.9%) had RFS score < 80th percentile (Table 2).

From Table 3, it was found that age, height, and RFS score were not significantly different between sport major and non-sport major, with $p=0.076$, $p=0.113$, and $p=0.215$, respectively. The differences were found in bodyweight ($p=0.048$), BMI ($p=0.029$) and METs score ($p=0.036$) which sport major students had higher bodyweight and physical activity level, as well as had lower BMI compared to non-sport peers.

In term of all-group differences, bodyweight and BMI of non-sport major students were found to be significantly different compared to sport major and all subjects ($p<0.05$). But, METs score of non-sport major was only different with sport-major peers (Table 3).

Table 3. The difference of measured variables between sport and non-sport major students

Characteristics	Mean ± SD			Sig.
	All (n=62)	Sport Major (n=25)	Non-sport Major (n=37)	
Age	20.82 ± 2.52	21.05 ± 1.49	20.92 ± 1.93	0.076 ^a
Bodyweight (kg)	57.40 ± 8.36	58.00 ± 14.66	55.83 ± 10.22*†	0.048 ^b
Height (cm)	159.40 ± 5.24	161.24 ± 8.73	159.83 ± 8.08	0.113 ^a
BMI (kg/m ²)	22.93 ± 2.68	21.95 ± 2.35	23.82 ± 3.08*†	0.029 ^a
RFS score	30.25 ± 1.50	31.22 ± 1.85	31.90 ± 1.72	0.215 ^a
METs score	972.50 ± 10.24	1024.77 ± 13.82	925.64 ± 12.15†	0.036 ^a

Description: ^aanalysed using Mann-Whitney test; ^banalysed using independent t-test

(*Significantly different with all group ($p \leq 0.05$). (†)Significantly different with sport major group ($p \leq 0.05$).

Table 4. Correlation between food habit, physical activity, and body mass index

	BMI		RFS score		METs score	
	sig.	r	sig,	r	sig.	r
BMI	-	-	0.005*	-0.518	0.004*	-0.729
RFS	0.005*	-0.518	-	-	0.032*	0.625
METs	0.004*	-0.729	0.032*	0.625	-	-

Description: *significant at 0.05

Spearman test shows that food habit is significantly associated with body mass index, with $p=0.005$ and $r=-0.518$. The same result is observed in physical activity level which is found to had strong negative relationship with body mass index with $p=0.004$ and $r=-0.729$. Lastly, physical activity was positively associated with food habit assessed by RFS, with $p=0.032$ and $r=0.625$ (Table 4).

DISCUSSION

Present study revealed high frequency of overweight among university students, which was

more than one-fifth of the total subjects. Previous investigation has also uncovered worrying profiles of overweight and obesity among the adolescents from different region of the country. A cross sectional study involving senior high school students across five big cities in Indonesia found that more than one-third of the sample was overweight (Sarintohe et al., 2022). In other hand, previous literature study reported the prevalence of overweight and obese students from 29 medical faculties across Indonesia was 35.5% (Diani et al., 2023) and the highest prevalence was found in medical students based in Jakarta (Azzahra et al., 2020).

These findings present that the nutritional status of adolescents, especially university students, becomes serious public health problem (Bulqini et al., 2021), since overweight and obesity developed in these age groups is often associated with the early onset of other chronic or non-communicable diseases such as diabetes mellitus, dyslipidemia and hypertension in future life (Coelho et al., 2012; Enes & Slater, 2010). Moreover, overweight and obesity in young people may lead to other long term health problems, such as the increased risk of morbidity, premature deaths, and disability in adulthood (Coelho et al., 2012).

It is well-understood that preserving a healthy lifestyle since younger age is important for obesity prevention (Jakobovich et al., 2023; Janicke et al., 2021), once numerous attributes of adulthood are achieved and/or associated with this age group, making it more important to involve determinant factors such as practice of physical activities and food habit into the investigation (Coelho et al., 2012; Mello et al., 2004). As for physical activity, it is important to highlight that its practice among children and adolescents should be repeatedly stimulated, because although the majority of health problems associated with physical inactivity or sedentary lifestyle will present only in later life, it is known that their onset can start and develop since childhood or adolescence (Dias et al., 2014).

Therefore, many studies were conducted to investigate the practice of physical activity, showing higher percentages of sedentarism in adolescents (Fadillah et al., 2021; Ziaei et al., 2022) which is in line with the result of present work. Present study found that overweight/obesity was associated with physical activity, where higher BMI was correlated with lower MET score. This finding was similar to previous study which showed negative correlation between BMI and physical activity in adolescents, where the higher of body mass index would lower the physical activity level, and vice versa (Correa-Rodríguez et al., 2017; López-Sánchez et al., 2019; Muharam, 2019). It could be implied that an increase in percentage of fat mass (%FM) which is observed by BMI might be responsible for a decrease in physical activity score (Dewi et al., 2021). This could lead to many serious problem in the future as lower physical activity level would cause numerous health disorders such as cardiovascular

diseases, diabetes mellitus (Maulana et al., 2021; Ridwan et al., 2022; Sholikhah & Ridwan, 2021), and even could impact physical fitness thus affecting their performance at school or university (Hariyanto et al., 2023).

As for dietary habit, we found that body mass index was related with food intake assessed by RFS, corroborating the longitudinal study conducted by Wolongevicz et al. (Wolongevicz et al., 2010) where females with lower diet quality were more likely to become overweight or obese after 16-year of follow up. Other study also reported similar finding where the higher score of healthy food pattern, the lower was BMI of the adolescents (Gutiérrez-Pliego et al., 2016). Overweight and obesity is undoubtedly linked with food intake. Food intake is a complex thing in which diverse variables are combined, as it is built by a set of biological and social interactions mediated by the culture where it takes place such as belief, surrounding environment, the influence of friends and family, etc (Gutiérrez-Pliego et al., 2016). In many occasions, the university living environment placed students in a new and unfamiliar settings such as detachment from home and parents, new friends or roommates, and new campus life coming with more competing demands in academic life, which possibly make them struggle in adapting to this situation (Kabir et al., 2018). Thus, healthy food choice might not become first priority (Nelson et al., 2009) which motivates them to buy food that is convenience, fast, and inexpensive instead (Marquis, 2005). This phenomenon could also be seen in present study where majority of students had lower score of RFS, indicating low intake of healthy food.

Similar to diet quality in general, many researchers have documented an association between food pattern and physical performance in adults. Granic et al. (2016) in their prospective study found that healthy diet consisting of a high intake of nuts, fruits, fish, vegetables, cereals, and dairy products, has a prolonged effect on improving age-related physical performances. Considering that food pattern/habit and RFS are related, a higher score of it may indicate that adequate food intake of healthy nutrients is associated with various health benefits (Jeong et al., 2019). These findings suggest that the reduction of overweight and obesity risk may be possible through various strategies which optimize the nutrient quality of the individual's habitual

eating behavior, as well as promoting physical activity on university students.

Conclusion

We can conclude through this study, that the studied population shows a high prevalence of overweight, which is significantly associated with low level of physical activity and low quality of the healthy diet assessed by RFS. Balance amount of healthy food and actively engage in physical activity can contribute to maintain health and well-being. This also happens to adolescent population, include university students—an age group which could be addressed to prevent several health problems. Therefore, further research should be carried out to identify possible interactions between these factors and even other factors than those already investigated that may influence the occurrence of overweight in this age group, thus supporting the development of measures and strategies to control and fight obesity among the young generation.

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Conflict of interest

The authors declared to have no conflict of interest. In addition, no financial support was received.

Ethics Statement

The study was approved by Research Ethics Committee of Airlangga University with reference number 101/EA/KEPK/2023.

Author Contributions

Study Design, P and DY; *Data Collection*, EFY; *Statistical Analysis*, AMS; *Data Interpretation*, EFY and AMS; *Manuscript Preparation*, P and SHPP; *Literature Search*, DY. All authors have read and agreed to the published version of the manuscript.

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