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Submission date: 28-Jun-2022 06:24AM (UTC-0400)
Submission ID: 1864111505
File name: nazhif_scopus_2022.pdf (135.41K)
Word count: 5605
Character count: 29547

The association of body image, percent body fat, nutrient intake, physical activity among adolescent

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Received 11 October 2021
Revised 12 January 2022
26 January 2022
Accepted 26 January 2022

Abstract

Purpose – Obesity in adolescents has been a severe public health problem in developing countries in recent years. This study aims to assess the differences in socioeconomic, nutrition knowledge, breakfast habits, body image, physical activity, smoking, total sleep quality and nutrient intake between obese and non-obese adolescents.

Design/methodology/approach – This cross-sectional study with 2,432 adolescents (16–18 years) was conducted at senior high schools in DKI Jakarta from January to November 2019. Body image, percent body fat, nutrition intake and physical activity variables were collected.

Findings – This study found that more than 30% of adolescents in DKI Jakarta were overweight and obese. Overall, adolescents have a 56.3% positive body image, participate in moderate-intensity physical activity (49.02%), and smoke was found at a rate of 6.9%. The average total sleep quality was 71.3% fair and nutrient intakes 1599 ± 413 calories. The findings suggest that monthly income ($p = 0.001$, $p = 0.016$), energy intake ($p = 0.005$, $p = 0.019$) and total sleep quality ($p = 0.008$, $p = 0.04$) variables were consistently associated with nutritional status and percent body fat. Moreover, the body image perception ($p = 0.035$) variable had a negative correlation with nutritional status, and the smoking habits variable ($p = 0.001$) had a negative correlation with percent body fat.

Originality/value – This study provides empirical evidence that establishes the association between monthly income, energy intake, total sleep quality with nutritional status and body fat percentage in adolescents.

Keywords Adolescents, Body image, Physical activity, Nutrient intake, Percent body fat

Paper type Research paper

Introduction

Adolescence is the stage of life during which the most significant growth and development occur. Thus, nutrition is critical for proper child and adolescent development and disease prevention, particularly for chronic diseases such as obesity, diabetes, hypertension and dyslipidemia (Corkins *et al.*, 2016). Obesity and overweight have increased dramatically among children and adolescents aged 5–19 years, from 4% in 1975 to just over 18% in 2016,

The authors also want to thanks to the Education Office of the Provincial Government of Jakarta, stakeholder in school, student who volunteered for this study and the reviewers for their comments of this paper.

Nutrition & Food Science
© Emerald Publishing Limited
0034-6659
DOI 10.1108/NFS-10-2021-0305

and the trends are already similar for boys and girls: in 2016, 18% of girls and 19% of boys were overweight (WHO, 2016). In Indonesia, the prevalence of overweight and obesity has increased, with 18.8% in 2007, 26.6% in 2013 and 31.0% in 2018 (Kemenkes, 2018).

In Bangladesh, a case-control study demonstrates that family income, mother's weight, physical activity at school, total physical activity, sedentary behavior, fast food consumption and cake/biscuit consumption were all possible predictors of childhood and adolescent overweight or obesity (Alam *et al.*, 2021). Similar to previous research findings, education, environmental and policy interventions may need to focus on urban areas where access to various processed and traditional high-sugar, high-fat snack foods and beverages is high (Nurwanti *et al.*, 2019). Due to the complexity of obesity and malnutrition, any solution must consider all of the contributing factors.

Adolescents' body mass index may positively affect unhealthy eating behaviors and negative body image perceptions (Farah Wahida *et al.*, 2011). In India, studies found that a sizable proportion of overweight/obese adolescents had an accurate perception of their body weight and made attempts to modify risk factors such as television viewing, computer use, a sedentary lifestyle and unhealthy dietary habits (Anitha Rani and Sathiyasekaran, 2013). The same research found that obesity-related body image problems could demonstrate negative psychological well-being across all dimensions (Yazdani *et al.*, 2018).

Adolescent body image perception will also affect the quality and quantity of nutritional intake. Increased energy consumption, increased physical activity, skipping breakfast and a negative self-image are all common weight-related behaviors associated with overweight and obesity in adolescents (Rezali *et al.*, 2012; Agusanty *et al.*, 2014). The primary purpose of this study was to, therefore, estimate the relationship between socioeconomic, nutrition knowledge, breakfast habits, body image, physical activity, smoking and total sleep quality in adolescents in DKI Jakarta province, Indonesia.

Methods

Study design

The study used a cross-sectional design and was conducted at senior high schools in DKI Jakarta from January to November 2019. The research located in five areas of DKI Jakarta: Central Jakarta, North Jakarta, West Jakarta, East Jakarta, and South Jakarta. A cluster random sampling strategy was used to choose the ten schools in DKI Jakarta. The subjects were adolescents aged 16 to 18 years old.

Study procedures

After obtaining ethics approval, this research begins by coordinating the DKI Jakarta education office. The majority of the subjects were students in grades XI and X because grades XII was being used to prepare for the final exam. The researcher scheduled each school's schedule after coordinating with and explaining the purpose of the study to the school.

This research was conducted from 7:00 a.m. to 10:30 a.m. and included completing a questionnaire and the measurement of nutritional status and percent body fat. The questionnaire was assessed for internal consistency and determined the level of nutrition knowledge of the adolescent. The questionnaire were contained socioeconomic information, nutritional knowledge, body image, breakfast habits, total sleep quality, smoking habits, dietary intake and physical activity. Although 2,500 questionnaires were distributed, only 2,432 (97.2%) were completed by respondents.

Measures

Anthropometry and percent body fat. Weight and height are determined anthropometrically using a microtome. Following that, the nutritional status of the students was determined using the WHO Anthroplus software's BMI/U index. To determine the per cent body fat using the Omron HBF 375 Body Composition Monitor. Body mass index-for-age z-scores (BMIZ) were calculated using weight and height measurements in conformity with the US Centers for Disease Control and Prevention (CDC) growth charts (CDC, 2015). The BMIZ was used to classify individuals as thin (BMIZ −2), normal weight (−2 BMIZ +1) or overweight/obese (BMIZ > +1).

Nutrition knowledge. A validated nutritional knowledge questionnaire with twenty multiple-choice questions was used to test nutritional knowledge, with items such as balance diet for adolescent (Arista *et al.*, 2021). The average was used to determine nutrition knowledge, with excellent knowledge being defined as an average knowledge score of 7 and bad knowledge being defined as an average knowledge score of 7 (Kigaru *et al.*, 2015).

Breakfast habits. Breakfast habits was measured by the question "How often do you eat breakfast?" [almost every day (7 day), sometimes (3–6 day), rarely or never] (Pengpid and Peltzer, 2020).

Body image perception. Perceptions body image through the use of a questionnaire that contains several questions. The validated FRS was constructed using the self-selection of body image figures on a subjective basis. The FRS is divided into two gender-specific categories, each of which contains nine schematic figures of women and nine schematic figures of men ranging in weight from underweight to obese. Respondents chose the figure that most closely resembled their own body image using this gender-specific scale (Jayawardena *et al.*, 2021).

Physical activity. Physical activity was evaluated using the Physical Activity Questionnaire for Older Children (PAQ-C) (Voss *et al.*, 2013). Each item was scored on a five-point scale, with higher scores indicating higher levels of activity (Cuberek *et al.*, 2021). For instance, a mean score of one indicates insufficient physical activity over a seven-day period, while a mean score of five indicates excessive physical activity (Azian *et al.*, 2016).

Smoking habit. Smoking habit data were gathered through interviews with individuals about their current and previous smoking habits. Self-administered questionnaires were used to collect data on smoking habits. Smoking habits were only assessed in the participants assigned to disease start and in the controls during the same time period. The smoking habit was classified into two groups: never and current smokers (Becker *et al.*, 2018).

Sleep quality. To determine sleep quality, we used the Pittsburgh Sleep Quality Index (PSQI), a highly reliability and validity instrument developed specifically for this purpose. It is formed of 19 questions that combine to form seven major components. Each component is assessed on a scale of 0 to 3, with a lower score indicating no problems and a higher score indicating developing problems in the following order:

- subjective sleep quality (very good vs very bad);
- sleep latency (15min to > 60min);
- sleep duration (7 h to 5 h);
- sleep efficiency (85 to 65% hours sleep/hours in bed);
- sleep disturbances (not in the past month to 3 times per week);
- sleeping medication use (none to 3 times per week); and
- daytime dysfunction (not a problem to a very big problem).

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After that, the seven components are added together to generate a scale ranging from 0 to 21 points. For the purposes of this study, we used each of the seven components separately and classified the final score into two categories: 5 (enough sleep) vs >5 (poor sleep quality) (Table 1).

Nutrient intake. Registered nutritionists assist in the collection of nutrient intake data. A 24-h recall method (weekday and weekend) was used in the nutritional intake method. The amount of food consumed was measured in household portions (tablespoons, teaspoons, cups, etc.). To determine the portions consumed, pictures were employed as a visual help. For calculate nutrient intake, food consumption was converted to grams and assessed using the Nutrisurvey software (Sulistiyono *et al.*, 2020). The nutritional content of the food was then determined using data from the Indonesian Food Composition to determine its energy, protein, fat and carbohydrate content (Iqbal and Permadi, 2018).

Statistical analysis. SPSS for Windows version 23.0 was used to analyze the data. The variables social socioeconomic, nutrition knowledge, breakfast habits, body image, physical activity, smoking, sleep quality, nutrient intake and nutritional status were described using descriptive statistics. To compare the difference in means between the two groups, an independent sample *t*-test was used. Associations between variables were determined using

Characteristics	Obese *n* (%)	Non-obese *n* (%)	Total *n* (%)	*p*-value
Monthly family income				0.38
Good (≥ IDR 4.000.000)	563 (94.1)	1708 (93.1)	2271 (93.4)	
Low (< IDR 4.000.000)	35 (5.9)	126 (6.9)	161 (6.6)	
Region (N)				
North Jakarta	92 (15.4)	399 (21.8)	491 (20.2)	0.000**
West Jakarta	121 (20.2)	368 (20.1)	489 (20.1)	
East Jakarta	104 (17.4)	371 (20.2)	475 (19.5)	
South Jakarta	146 (24.4)	343 (18.7)	489 (20.1)	
Central Jakarta	135 (22.6)	353 (19.2)	488 (20.1)	
Nutrition knowledge				0.17
Good (score ≥7)	104 (17.4)	276 (15.0)	380 (15.6)	
Low (score <7)	494 (82.6)	1558 (85.0)	2052 (84.4)	
Breakfast				0.63
Rarely or never	104 (17.4)	321 (17.5)	425 (17.5)	
Sometimes	316 (52.8)	991 (54.0)	1307 (53.7)	
Almost every day	178 (29.8)	522 (28.5)	700 (28.8)	
Body image				0.001**
Negative	295 (49.3)	767 (41.8)	1062 (43.7)	
Positive	303 (50.7)	1067 (58.2)	1370 (56.3)	
Physical activity				0.59
Low	154 (25.8)	485 (26.4)	639 (26.3)	
Moderate	292 (48.8)	903 (49.2)	1195 (49.1)	
High	152 (25.4)	446 (24.3)	598 (24.6)	
Smoking habit				0.047*
Never	546 (91.3)	1718 (93.7)	2264 (93.1)	
Current smoker	52 (8.7)	116 (6.3)	168 (6.9)	
Total sleep quality				0.038*
Good sleep	405 (67.7)	1238 (70.9)	1733 (71.3)	
Poor sleep	193 (32.3)	506 (29.1)	699 (28.7)	

Table 1.
Characteristics of the study population

Notes: *$p < 0.05$, **$p < 0.01$, in the comparisons between obese and non-obese

the Chi-square and Pearson correlation tests. Statistical significance levels were set at $p < 0.05$ and $p < 0.001$, respectively.

Ethical approval. The Education Office of the Provincial Government of Jakarta's Special Capital Region approved the research as well. The Institutional Review Board was approved by the Esa Unggul University and approved this research for the ethical committee under the reference Number: 0319–19.198/DPKE-KEP/FINAL-EA/UEU/VII/2019.

Results

This research investigated 2432 high school students in the DKI Jakarta Province. According to the data collected from adolescent respondents in this study, most adolescents were female (71.4%) and male (30.6%). Although 93.4% of adolescents' parents' monthly income falls into a suitable category, there was no significant difference between obese and non-obese adolescents ($p > 0.05$). North Jakarta accounted for 20.2% of the research subjects, while East Jakarta accounted for 19.5%. Most adolescents have a low level of nutritional knowledge of 84.4%; based on the different obese and non-obese, there was no significant difference ($p > 0.05$). Furthermore, breakfast habits of obese and non-obese adolescents were relatively the same, namely, regularly (28.8%), sometimes (53.7%) and skip (17.5%); there was no significant difference ($p > 0.05$).

According to research, the percentage of adolescents who rate their body perception positively or negatively in several areas of DKI Jakarta was nearly identical. Adolescents have a 56.3% positive body image and a 43.7% negative body image; this is a statistically significant difference ($p < 0.05$). Approximately 58.2% of the positive category were classified as non-obese adolescents. As is the case in Central Jakarta, adolescents with positive body perceptions outnumber those with negative perceptions by around 4%; this indicates that a large percentage of adolescents have negative body perceptions. Even in North Jakarta, adolescents who have negative body perceptions outnumber those who have positive body perceptions.

The majority of adolescents in DKI Jakarta actively participate in moderate-intensity physical activity (49.02%), followed by low-intensity physical activity (26.04%) and high-intensity physical activity (24.05%). There was no significant difference in the level of physical activity between obese and non-obese adolescents ($p > 0.05$). Smoking was found at a rate of 6.9% among adolescents, while non-smoking was identified at 93.1%. On average, sleep quality was 51.7% fair, and less than that is 21.9%. According to the data, obese adolescents had more inferior sleep quality than non-obese adolescents, a statistically significant difference ($p < 0.05$). Around one in ten adolescents had abdominal obesity, which was associated with maternal education (>8 years) and television screen time (>2 h/day) (Castro *et al.*, 2016)

As shown in Table 2, there were significant differences in the distribution of anthropometric data, such as general height, weight, and BMI for age, between obese and non-obese adolescents ($p < 0.05$). The average BMI for age in the obese group averaged $1{,}78 \pm 0{,}6\ kg/m^2$, while the non-obese group averaged $-0{,}41 \pm 0.9\ kg/m^2$. Overall, adolescents consumed an average of 1599 ± 413 calories. There was no difference in the averages of fat and carbohydrate variables, which were 64.60 ± 23.6 g and 189.67 ± 56.7 g, in both. However, the obese group consumed more protein than the non-obese group by 60.91 ± 21.8 g and 59.72 ± 24.5 g.

In Table 3, monthly income ($r = 0.071$, $p < 0.001$; $r = 0.49$, $p < 0.05$), energy intake ($r = 0.057$, $p < 0.001$; $r = 0.48$, $p < 0.05$), sleep quality ($r = 0.071$, $p < 0.001$; $r = 0.49$, $p < 0.05$) had a positive correlation with nutritional status, and only fat intake ($r = 0.049$, $p < 0.05$) had a

positive correlation with percent body fat. Body image perception variable ($r = -0.43$, $p < 0.05$) had a negative correlation with nutritional status and smoking variable ($r = -0.102$, $p < 0.001$) had a negative correlation with percent body fat.

Discussion

This study looked for factors that association the nutritional status and per cent body fat of adolescents in DKI Jakarta. The results of this study found that more than 30% of adolescents in DKI Jakarta were overweight and obese. Based on Riskesdas data in 2018, adolescents who are overweight and obese are 16.0% in adolescents aged 13–15 years and 13.5% in adolescents aged 16–18 years. In adolescents, having a high BMI or being overweight has a strong correlation with body fat percentage. Adolescents with poor nutritional status are also more likely to have a high body fat percentage. Adolescents require attention because it may increase the risk of developing degenerative diseases (Sitoayu *et al.*, 2020).

Over 80% of adolescents in DKI Jakarta have inadequate nutritional knowledge, according to this study. Nutritional knowledge regarding macro and micronutrients of adolescents is the most critical area that requires improvement beginning at the school level. In one study, adolescents in Yogyakarta have a high level of nutritional knowledge but a

Table 2. Distribution of anthropometry and nutrient intake

Characteristics	Obese Mean ± SD	Non-obese Mean ± SD	Total Mean ± SD	*p*-value
Age (y)	16 ± 1	16 ± 1	16 ± 1	0.001**
Height (cm)	162.83 ± 8.1	162.83 ± 49.9	162.83 ± 43.6	0.000**
Weight (kg)	73.40 ± 12.6	52.27 ± 16.7	57.46 ± 18.2	0.000**
BMI for age (kg/m^2)	1.78 ± 0.6	−0.41 ± 0.9	0.13 ± 1.3	0.000**
Nutrition intake				
Energy intake (Cal)	1640 ± 421	1586 ± 410	1599 ± 413	0.003**
Protein (g)	60.91 ± 21.8	59.72 ± 24.5	60.01 ± 23.8	0.09
Fat (g)	66.08 ± 23.2	64.12 ± 23.7	64.60 ± 23. 6	0.034*
Carbohydrate (g)	192.67 ± 57.6	188.70 ± 56.3	189.67 ± 56.7	0.038*

Notes: Values are mean ± SD. *$p < 0.05$, **$p < 0.01$, in the comparisons between obese and non-obese

Table 3. Association of BMI for age and percent body fat

Independent variables	BMI for age		Percent body fat	
	r	*p*-value	r	*p*-value
Monthly family income (BDT)	0.075**	0.0000**	0.049*	0.016*
Nutrition knowledge	0.005	0.8	0.023	0.25
Energy intake (Cal)	0.057**	0.005*	0.048*	0.019*
Protein (g)	0.024	0.241	0.010	0.62
Fat (g)	0.030	0.144	0.049*	0.017*
Carbohydrate (g)	0.030	0.133	0.025	0.22
Breakfast	0.004	0.84	−0.043*	0.032*
Body image	−0.043*	0.035*	−0.016	0.44
Physical activity	0.012	0.54	−0.033	0.10
Smoking habits	0.024	0.233	−0.102**	0.000**
Total sleep quality	0.053**	0.008*	0.042*	0.040*

Notes: *Significant at $p < 0.05$; **significant at $p < 0.001$

low energy and protein intake (Veronika *et al.*, 2021). While further, nutritional knowledge among adolescents must be increased to improve their health and academic performance through nutrition materials integrated into each particular topic.

In line with this, the study's findings indicated that many adolescents in the DKI Jakarta area had less healthy breakfast habits. As evidenced by data analysis, almost all areas of DKI Jakarta have adolescents in the category of rarely having breakfast above 45%, implying that time is spent without breakfast in a given week. Breakfast skipping was positively associated with the risk of overweight and obesity in a cross-sectional study of African-American students (Sa *et al.*, 2016). However, there was no correlation between breakfast habits and nutritional status or body fat percentage in this study. The same study conducted in Serbia found that students' BMI did not correlate with their breakfast frequency (Gazibara *et al.*, 2013). As a result, health promotion and nutrition education are necessary to promote an adolescent's healthy lifestyle.

Thus according to research, the percentage of adolescents who rate their body perception positively or negatively in several areas of DKI Jakarta is essentially equal. Girls in adolescence are less satisfied with their bodies and have a more negative body image than boys. Adolescents who have negative body perceptions are at risk for having eating disorders. Adolescents make numerous attempts to achieve the ideal body shape. Extreme restriction of many types of food will consequence in eating disorders (Kurniawan *et al.*, 2015).

Sleep quality is one of the determinants of adolescent health. In general, the duration of adequate sleep, which influences the quality of sleep, is approximately 8 h. The findings of this study indicated that the majority of respondents slept well and for an adequate amount of time. Quality sleep is critical for the neuroendocrine and appetite regulation systems to function optimally (Caples, 2013). In adolescents, insufficient sleep duration, poor sleep quality and late bedtimes are associated with excessive food consumption, poor diet quality and obesity (Chaput and Dutil, 2016). Too much sleep, lack of physical activity and poor diet all interact and influence each other due to their significant negative impact on health.

According to the findings of this study, the majority of adolescents in DKI Jakarta lacked energy in the majority of areas. In general, the data on overall intake and nutritional adequacy in adolescents indicate that the average adolescent has a DKI of 76%. However, protein consumption is still deficient in some areas, except the East Jakarta adolescent area. Adolescents with a high energy intake are more likely to consume nutritionally unbalanced snacks, such as those high in sugar, salt, and fat. It was found in this study that there was a significant relationship between fat intake and percent body fat in Jakarta adolescents. Fast food consumption is associated with a low-quality diet and a high prevalence of overweight and obesity among adolescents (Rouhani *et al.*, 2012; Panchal *et al.*, 2016). Excessive fat intake is one of the factors that contribute to adolescent obesity. Increased energy intake and decreased carbohydrate intake were associated with a higher BMI z-score, and reduced-fat consumption may result in improved glucose tolerance, a decreased risk of developing diabetes mellitus, and thus a decreased risk of developing a cardiometabolic disease in adulthood (Vizzuso *et al.*, 2020). It is necessary to promote healthy food consumption that is high in fiber, whole grains, dairy products and foods that are low in energy density (Gazibara *et al.*, 2013).

The prevalence of obesity and overweight was significantly higher among students who spent more than two hours per day watching television or using computers (Panchal *et al.*, 2016). Based on this research, obese and non-obese adolescents are actively involved in moderate physical activity levels, emphasizing the importance of physical activity in adolescents. To increase muscle strength, current recommendations suggest a minimum of

150 min of moderate-intensity exercise or 75 min of moderate-intensity exercise per week combined at least twice a week (Okely *et al.*, 2021). Exercise program with a frequency of increased than three times per week to aid in weight loss in overweight and obese individuals (Kuswari *et al.*, 2015). It has been demonstrated that physical activity patterns are associated with anthropometric status and mortality (Hills *et al.*, 2011). The studies have found that combining nutrition and exercise programs is the most effective strategy for improving the nutritional status of overweight adolescents (Gifari *et al.*, 2021). As adolescence is a critical developmental stage, it is necessary to sustain good health to achieve high and productive resources.

Adolescents in DKI Jakarta smoke at a rate of up to 7%. Smoking is a bad habit, not only for health but also for the long-term physical health of adolescents. Adolescent smoking requires serious attention from schools and parents, as it is still too early to learn about smoking, especially in a school environment where smoking is prohibited. Our study has several limitations that may affect how the findings are interpreted. The questionnaire used in this study was self-administered, and relying on self-reported data is contingent upon the adolescents' honesty and ability to comprehend the questions.

Conclusion

In conclusion, our study reported a positive association between monthly income, energy intake, sleep quality with nutritional status and body fat percentage. The perception of one's body image was negatively correlated with nutritional status, and smoking was negatively correlated with percent body fat. Prevention strategies for adolescent obesity should include measures that promote a healthy lifestyle, positive body image perception and physical activity. Thus, both government and non-government organizations are encouraged to implement nutrition and physical activity programs in schools to promote a healthy lifestyle among adolescents.

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