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Relationship between Energy Intake, Food Preferences, Peer Influence, and Parental Education with the Incidence of Overnutrition among Teenagers in Depok

Hubungan Asupan Energi, Preferensi Makan, Pengaruh Teman Sebaya, dan Pendidikan Orang Tua dengan Kejadian Gizi Lebih Remaja di Depok

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ABSTRACT

Background: Overnutrition among Indonesian teenagers is a nutritional problem that has increased in recent years from 7.3% to 13.5%. Factors that contribute in the improvement of nutritional status include diet, lifestyle, and socio-economics. Overnutrition can lead to health complications, including non-communicable diseases.
Objectives: To identify the relationship between energy intake, food preferences, peer influence, and parental education with the incidence of overnutrition among teenagers in Depok.
Methods: This study used an observational approach with a cross-sectional design. The sample was taken by stratified random sampling from a chosen Senior High School (SMA) in Depok with a total of 108 participants. Nutritional status was obtained by measuring body weight (BB) and height (TB) using BMI-for-age (BMI/U), energy intake was measured by interviewing the 2x24-hour food recall, food preferences used the food and beverage preference questionnaire (FBPQ), peered influence was measured using the peered influence scale (PIS), and parental education was gathered through a questionnaire. Relationship analysis was carried out by chi-square and Fisher's exact tests.
Results: Bivariate analysis shows that energy intake (p=0.030), food preferences (p=0.019), and peer influence (p=0. 006) were associated with the incidence of overnutrition. Parental education (father, p=0.365; mother, p=0.103) were not significantly associated with the incidence of overnutrition.
Conclusions: Individual factors among teenagers showed a relationship with the incidence of overnutrition. Teenagers need to pay attention to their energy intake, develop healthy food preferences, and utilize peered influence to adopt good eating behaviours to prevent overnutrition.

INTRODUCTION

Adolescence is a period when individuals have the opportunity to explore new experiences, to form relationships with those around them, and to delve into the development of their identity[1]. The teenage years are described as the interval between childhood and adulthood[2]. The classification of adolescence typically spans from ages 10 to 18[3]. During this period, social, psychological, physical, and biological changes occur[4], leading teenagers to develop behaviour patterns and lifestyles that can impact their current and future health[5].

Current adolescent health issues are primarily associated with excessive nutrition, resulting from an energy imbalance due to high-calorie, unhealthy fat, sugar, and salt consumption in diet and beverages. This dietary pattern leads to increased fat accumulation, while the intake of healthy foods such as vegetables and fruits is deficient, along with insufficient physical activity. Nutritional excess can also be influenced by external factors such as family socioeconomic status, including parental education[6].

Nutritional excess, including overweight and obesity, is defined as abnormal accumulation of body fat[7]. In 2016, an estimated 340 million individuals aged 5-19 experienced nutritional excess[8]. In Indonesia, the prevalence of obesity in adolescents aged 16 to 18 increased from 7.3% (5.3% overweight and 1.6% obesity) in 2013 to 13.5% (9.5% overweight and 4% obesity) in 2018. The prevalence in West Java Province exceeded the national average at 15.4% (10.9% overweight and 4.5%

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obesity). Depok, a city in West Java Province, had the highest obesity prevalence, reaching 23.88% (18.13% overweight and 5.75% obesity)[9]. Individuals with nutritional excess have a reduced life expectancy. Without prioritized attention and intervention, the prevalence of obesity in adolescents is projected to double by 2030, increasing the risk of future non-communicable diseases and their lifelong impact[10].

Energy is a macronutrient essential for human metabolism, activity, growth, and temperature regulation[11]. The rapid growth during adolescence increases the need for energy and nutrients, with the highest total daily energy requirement during this period compared to others[12]. Higher energy intake than expenditure can accumulate as fat accumulation. Chronic excess body fat can disrupt energy balance, ultimately affecting nutritional status[13]. Research indicates that adolescents with excessive energy intake (88.6%) experience nutritional excess[11].

Food preferences refer to the level of liking or disliking specific foods. Adolescents tend to prefer unhealthy, high-calorie, and low-nutrient foods, such as sweet and fatty foods, which can contribute to health problems[14]. Studies show that food preferences are related to the occurrence of obesity[15]. Adolescents with nutritional excess tend to prefer fatty and sweet foods[16]. About 42.7% and 41.3% of adolescents with high-fat and high-sweetness preferences experience nutritional excess[17].

Peer influence plays a role in individual food choices. Adolescents spend more time outdoors with their peers, and among their entertainment is eating out with peers. This activity often leads to unconscious high-calorie consumption[18]. Research shows a correlation between peer influence and nutritional excess, with 51.42% of adolescents influenced by peers experiencing nutritional excess[19].

External nutritional factors are influences on a person's nutritional status from outside the body, and parental education is one element that contributes to nutritional issues[6]. Research suggests a correlation between parental education and a child's nutritional status[20]. This is because education has a significant impact on how well someone understands and knows nutritional information. Someone with lower education levels tends to adhere more strongly to traditions related to food, making it difficult for them to absorb new nutritional information. Consistent with research indicating that the highest likelihood of being overweight is in adolescents with low parental educationlevels[21]. The novelty in this study is to determine the variables influencing nutritional excess among adolescents in Depok, where the phenomenon of nutritional excess has increased over the past 5 years from 2013 to 2018. Based on the previous description, researchers aim to understand the relationship between energy intake, food preferences, peer influence, and parental education on the occurrence of nutritional excess in adolescents in Depok.

METHODS

Research Design

This study employed an observational analytical approach with a cross-sectional design to explore the relationship between energy intake, food preferences, peer influence, and parental education with the occurrence of nutritional excess in adolescents in Depok. The study was conducted at Senior High School 6 (SMA Negeri 6) in Depok and took place from March to May 2023. Approval for this research had been obtained from the Research Ethics Committee of the Universitas Pembangunan Nasional "Veteran" Jakarta with the reference number: 53/III/2023/KEPK.

Sample and Sampling Procedure

The sample for this study consisted of 108 students out of a total of 646 students in grades 1 and 2, using the stratified random sampling procedure. The sample size was calculated using the Lemeshow formula (1990). Inclusion criteria for the sample were active status as a student at SMA Negeri 6 Depok, willing to participate as a respondent, and age between 16-18 years. Exclusion criteria include students currently undergoing a diet program, especially for weight loss.

Data Collection

Collected data include student characteristics such as age, gender, nutritional status, energy intake, food preferences, peer influence, and parental education. Three data collection techniques were employed, including self-administered surveys to gather information on respondent characteristics, food preferences, peer influence, and parental education. Interviews were conducted to collect data on energy intake, and measurements are taken to assess nutritional status. Nutritional status data were obtained through anthropometric measurements by the researcher, and the results were calculated using BMI-for-age (BMI/U), categorized as normal nutritional status (<+1 SD) and nutritional excess (>+1 SD). Instruments in this study include respondent characteristic data, a 2x24-hour food recall questionnaire, Food and Beverage Preference Questionnaire (FBPQ), and Peer Influence Scale (PIS). Data collection was carried out offline, with research explanations and informed consent provided to respondents before the study. In 2x24-hour food recall questionnaire, energy intake data were compared with the Recommended Dietary Allowance (RDA) and categorized as sufficient (≤100% RDA) and excess (>100% RDA)[22]. The FBPQ was used to measure food preference for unhealthy foods, with 33 food and beverage items. Results are categorized as low (score ≤99) and high (score >99)[23]. The PIS questionnaire assesses peer influence on eating behaviour and weight management, with a total of 12 questions. Results were categorized as no influence (score ≤30) and influence (score >30)[24]. Parental education data obtained through questionnaire completion, categorized as low (Elementary School (SD) and Junior High School (SMP)) and high (Senior High School (SMA), Diploma, Bachelor's degree)[25].

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Data Analysis

The data were processed and analyzed using the Statistical Package for the Social Sciences (SPSS) software to examine the relationship of each variable using Chi-Square and Fisher Exact tests with a significance level of 95% and a significance value (p-value=0.05). Chi-Square was used to test the variables of food preferences and peer influence, while Fisher Exact was used to test the variables of energy intake, father's education, and mother's education.

RESULTS AND DISCUSSION

Characteristics of Respondents

Respondent characteristic data include distribution based on gender and age. The characteristics of the study respondents are presented in Table 1. Data for variables such as nutritional status, energy intake, food preferences, peer influence, and parental education are presented in Table 2.

Table 1. Frequency distribution of characteristics of students at SMA Negeri 6 Depok

Characteristics of Respondents	n	%
Gender		
Male	55	50.9
Female	53	49.1
Age		
16 years	64	59.3
17 years	42	38.9
18 years	2	1.9

Table 1 presents the characteristics of respondents based on gender and age. The distribution of respondent gender is predominantly male (50.9%), while female respondents constitute 49.1%. The majority of respondents are 16 years old (59.3%). Adolescence is a vulnerable phase for nutritional disorders, including both malnutrition and overnutrition[26]. If adolescents do not pay attention to the balance of the consumed food, such as insufficient intake of plant and animal protein sources, vegetables, and fruits, they are at risk of micronutrient deficiencies such as iron, zinc, and fiber. Consuming food in excess of the recommended amounts, such as high energy intake from fats and carbohydrates, poses a risk of overnutrition. Adolescents with irregular eating habits are at risk of developing non-communicable diseases in adulthood if their lifestyle and eating patterns are not well-maintained[27]. Therefore, adolescent nutritional issues require special attention as adolescents are undergoing rapid physical development and growth[13].

Table 2. Frequency distribution of nutritional status, energy intake, food preferences, peer influence, and parental education of students at SMA Negeri 6 Depok

Variables	n	%
Nutritional status		
Excess	16	14.8
Not excess	92	85.2
Energy intake		
Excess	16	14.8
Sufficient	92	85.2
Food preference		
High	74	68.5
Low	34	31.5
Peer influence		
Influenced	30	27.8
Not influenced	78	72.2
Father's education		
Low	20	18.5
High	88	81.5
Mother's education		
Low	26	24.1
High	82	75.9

The nutritional status of adolescents can be assessed through anthropometric measurements. BMI-for-age (BMI/A) is indicated as the basic anthropometric criterion for obesity in adolescents up to the age of 18[28]. The frequency distribution of respondents' nutritional status is divided into two categories: not excess (≤+1 SD) and excess (>+1 SD)[29]. The majority of respondents have a non-excess nutritional status (85.2%), while 14.8% have an excess nutritional status. Related studies on adolescents aged 14-18 show that the majority have a non-excess nutritional status (75.9%)[30]. Based on the research location, the prevalence of excess nutrition exceeds the

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national prevalence (13.5%)[9]. This indicates a high prevalence of overnutrition among adolescents. Improved nutritional status can be influenced by factors such as poor eating patterns and habits, insufficient physical activity, transportation habits to school, knowledge related to nutrition, birth weight, and family obesity history[31]. Excess nutrition conditions lead to complications such as health problems, including hypertension, diabetes, cancer, and the formation of atherosclerotic plaques that trigger coronary heart disease[32].

Energy is the result of the metabolism of carbohydrates, proteins, and fats, playing a role as a source of energy in basal metabolism, activity, growth, and temperature regulation[11] Nutrient intake is categorized as sufficient (≤100% RDA) and excess (>100% RDA)[22]. In this study, the majority of respondents' energy intake was sufficient (85.2%), supported by research[33] indicating that the majority of respondents had sufficient energy intake (94%). Respondents consume an average of 1,557 kcal per day, with the highest intake at 3,333.25 kcal and the lowest at 548.05 kcal. This proves that the average energy intake of respondents was not in line with their needs. Current globalization has led to changes in eating patterns and lifestyles, including an increase in the consumption of fast food and ultra-processed foods rich in energy. Additionally, increasing urbanization promotes a less active lifestyle, reducing energy expenditure. Higher energy intake than expenditure accumulates as fat accumulation. Chronic excess body fat disrupts energy balance, leading to weight gain, which, if not controlled, can lead to obesity and the risk of degenerative diseases[34].

Food preference is the level of liking or disliking for certain foods[35]. The food preferences of respondents in this study show that the majority have a high preference for unhealthy foods (68.5%). Research on adolescents aged 13-15 indicates that 28.6% like fatty foods, and 61.9% like sweet foods and drinks[36]. Food preferences are a crucial factor in consumption and food choices[37], where adolescence is a period that determines their preferences as adults[35]. Several factors can influence a person's food preferences, including sensory factors such as taste (sweet, sour, bitter, salty, and umami), physiological factors, and environmental factors such as family, peers, and media[38]. The current food preferences of adolescents tend unhealthy foods and drinks that contain high sugar, fat, and calories, as well as low nutritional value for the body. High frequent of low-nutrient foods can contribute to health problems such as overnutrition[14].

In this study shows that most respondents have no peer influence (72.2%). Research on adolescents aged 18-20 also shows that the majority of respondents were not influenced by peers (71%)[24]. Adolescents spend a significant amount of time with their friends and tend to imitate what their friends do to become closer[19]. Peers have a significant influence on the eating behaviour of adolescents. Studies show that adolescents have eating patterns similar to their best friends, and peers' attitudes towards food choices are a significant predictor of eating behaviour. The greater the influence of peers, the more impact it has on unhealthy eating behaviour in adolescents, leading to weight gain[18].

Knowledge and education play a role in making appropriate food choices. A low level of knowledge and education related to healthy and balanced nutrition influences people to consume food according to their taste, socioeconomic level, and social trends in the community. Conversely, people with higher education, accompanied by sufficient knowledge about the role of food in body health, tend to be more selective in consuming food that is suitable for themselves and their families. In this study, both father's and mother's education show that the majority have a high level of education, with percentages of 81.5% and 75.9%, respectively. Research indicates that obesity in children is more likely to occur when parents have a low level of education. Parents with a lower level of education often lack understanding of nutrition and health, leading to less awarness in adopting a healthy lifestyle, less monitoring of their children physical activity and lifestyle, and less ability to choose food with suitable quality and quantity for their children to consume[39]. This can result in excessive energy intake, which in turn leads to weight gain[40].

Relationship Between Variables

Based on Table 3, the statistical test results show a significant relationship between energy intake and the occurrence of overnutrition (p=0.030). Adolescents with excessive energy intake are 3.3 times more likely to be at risk of overnutrition compared to adolescents with sufficient energy intake. This is consistent with the assumption that food intake is a triggering factor that directly influences nutritional statusi[41]. This aligns with research revealing a relationship between energy intake and nutritional status (p=0.0001; OR=35.65)[11]. Supported by studies showing a significant and positive relationship between energy intake and nutritional status (p=0.00)[42]. The body needs calorie intake as a source of energy for living and physical activity. However, it is crucial to maintain a balance between energy input and output to maintain stable weight. Positive imbalance occurs when energy intake exceeds needs, resulting in overnutrition[32].

Table 3. Analysis of the relationship between energy intake, food preferences, peer influence, and parental education with the incidence of overnutrition in teenagers at SMA Negeri 6 Depok

Variables	Nutritional Status				Total	*OR	p-value
	Excess		Not Excess				
	n	%	n	%			
Energy intake							
Excess	5	3.3	11	68.8	100	3.347	*0.03[a]

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Variables	Nutritional Status				Total	*OR	p-value
	Excess		Not Excess				
	n	%	n	%			
Sufficient	11	12	81	88	100	(0.978 – 11.457)	
Food preference							
High	15	20.3	59	79.7	100	8.390	*0.019[b]
Low	1	2,9	33	97.1	100	(1.060 – 66.394)	
Peer influence							
Influenced	9	30	21	70	100	4.347	*0.006[b]
Not influenced	7	9	71	91	100	(1.445 – 13.075)	
Father's education							
Low	2	10	18	90	100	-	0.365[a]
High	14	15.9	74	84.1	100		
Mother's education							
Low	6	23.1	20	76.9	100	-	0.103[a]
High	10	12.2	72	87.8	100		

Notes: a. *Fisher Exact Test*, b. *Chi Square Test*, **Odds Ratio*, *Significant Result (p=<0.05)

Based on Table 3, the statistical test results show a significant relationship between food preferences and the occurrence of overnutrition (p=0.019). Adolescents with a high preference for unhealthy foods have an 8.4 times greater risk of overnutrition compared to adolescents with low food preferences. This is supported by research showing that a high preference for sweet and fatty foods is associated with the likelihood of overweight, with p-values and ORs of (p=0.004; OR=3.77) and (p=0.017; OR=2.42), respectively[17]. As age increases, personal choices and preferences become more dominant than family eating habits; they have control over what they eat, and the quality of their food tends to decline. The food preferences of today's adolescents tend to unhealthy foods. This is due to the current dominance of high-energy but low-nutrient industrial foods, with high sugar, saturated fat, and sodium content[44]. The tastiness of food becomes a crucial factor in influencing food preferences and is a primary driver of adolescent food choices. Better taste contributes to increased food palatability and, thus, overconsumption[17]. Research shows that adolescents consume fast food because it is tasty and easy to obtain[45]. Highly frequent exposure to food can also increase food preferences[46] The Mere Exposure Theory states that a single exposure is enough to create a positive attitude toward a stimulus; thus, repeated exposure to food increases positive acceptance over time[47]. Studies show that food preferences affect various aspects related to individual health, including weight status. Those who like fatty and sweet foods tend to be overnourished[48].

Statistical test results show a significant relationship between peer influence and the occurrence of overnutrition (p=0.006). Adolescents influenced by peers in eating behaviour and weight management are 4.3 times as high as experience overnutrition compared to those with no peer influence. Supported by research indicating a relationship between peer influence and the occurrence of obesity in adolescents (p=0.002)[19]. Another study also shows results that peer influence contributes to the increased prevalence of overweight among adolescent subjects (OR=6.64; p=0.001)[49]. During adolescence, when parental influence diminishes, adolescents begin to develop habits under the influence of peer groups. Shared meals are one of the activities frequently done by adolescents with their peers. This activity influences their food choices and is a significant predictor of eating behavior[18]. A negative relationship was found between peer influence and healthy food choices, meaning the greater the peer influence, the lower the likelihood that adolescents will choose healthy foods[50]. Studies show that peers can influence the consumption of sweetened beverages and junk food[18]. A study in Sweden shows that up to 83% of adolescents eat out with their friends, consuming high-energy foods and drinks such as tea, coffee, cakes, and cookies[51]. Peers also influence adolescents' BMI; the influence of peers on adolescents' BMI is that there is a prevailing social norm among adolescents regarding body size, where adolescents with overnutrition report lower self-esteem and body satisfaction and receive teasing about their weight from peer[52]. Therefore, interactions between adolescents and peers can affect their body perception through conversations related to appearance, modelling of peer diet behaviour, and perceptions of attitudes related to peer appearance[53] Research found that an increase in peers' BMI increases adolescents' BMI and the likelihood of overweight and obesity[54].

Statistical test results show no relationship between father's education (p=0.365) and mother's education (p=0.103) with the occurrence of overnutrition. Research on adolescents in Samarinda shows no relationship between the mother's education level and adolescent obesity (p=0.912). This is because education is not a direct factor in nutritional status. However, education influences insights or knowledge related to health and nutrition, which then affects a person's consumption patterns[55]. Other research shows similar results, namely, no association between parental education and nutritional status in adolescent girls. Education cannot be used as a benchmark that higher education means expertise in all fields is also good. Parental interest in seeking information from various

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sources can be associated with good nutritional knowledge[56]. Parental education level influences the level of knowledge that impacts food provision, as well as monitoring physical activity and lifestyle in adolescents. The father's education level is related to the aspect of accepting or denying nutritional or health information, which then affects the encouragement and attention given to adolescents[39]. Parents significantly influence the development of children's consumption behaviour and food choices. The knowledge and attitudes of children towards nutritional status are crucial in their development, and parents are examples in forming children's eating habits[55]. Research on adolescents in Iceland shows that the highest probability of overweight is in adolescents with low parental education levels[21].

The limitations of the study include time constraints during data collection and the respondents' memory during interviews affecting the accuracy of food intake data. The strengths of the study include data collection assisted by trained enumerators, resulting in more accurate data, and the use of a standardized questionnaire with validity and reliability tests to obtain accurate data.

CONCLUSIONS

Most respondents are male, 16 years old, and have a normal nutritional status. Based on the research results, there is a relationship between energy intake, food preferences, and peer influence with the occurrence of overnutrition in adolescents in Depok. It is recommended for respondents to always monitor their weight, pay attention to food choices and eating patterns, develop healthy food preferences, and use friendships to cultivate good eating habits. For future research, it is suggested to explore other contributing factors to nutritional status, including physical activity, nutritional knowledge, and parental obesity history.

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