

Relationship of Appetite, Body Image, and Energy Intake with Body Mass Index in Undergraduate Students in Surakarta

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ABSTRACT

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Background: Young adults are vulnerable to lifestyle changes that will eventually change their behavior, including health behavior. Behavioral changes during this period can affect nutritional status. Nutritional status is affected by energy intake, influenced by several internal factors such as appetite and body image. This study shows the correlation between appetite, body image, and energy intake with body mass index. **Method:** This study was conducted with a random sampling method through 120 undergraduate students. Appetite was measured using a visual analog scale. Energy intake was measured using the 24-hour food recall method. Statistical analysis used was Spearman's rank. Body shape perception was assessed using the Stunkard figure rating scale. **Results:** Appetite is closely related to energy intake ($p < 0.05$) but not with BMI. Body image correlates with intake energy and BMI. Most obese students (70.4%) consider themselves overweight. Energy intake is correlated with BMI ($p < 0,001$). **Conclusion:** Appetite and body image are related to food intake. Energy intake is correlated with body mass index.

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1. Introduction

Nutritional status is an individual's physiological state, resulting from the relationship between nutritional intake and the body's needs and ability to digest, absorb, and use nutrients. Malnutrition is a state of deficiency, excess, or imbalance of energy intake or other nutrients. Nutritional status can be determined in various ways, one of which is using body mass index (BMI). In 2016 1.9 trillion adults were overweight and 650 million of them were in the obese category. The highest prevalence of obesity is in European, Eastern Mediterranean, and USA countries [1]. In 2018, 13.6% of Indonesia's population was overweight, and 21.8% was obese. The incidence of overweight in Indonesia has increased from 8.6% in 2007 to 11.5% in 2013 and 13.6% in 2018. The incidence of obesity has also increased from 10.5% in 2007 to 14.8% in 2013 and 21.8% in 2018 [2].

Undergraduate students aged 18-25 experience a transition from adolescence to early adulthood. At that time, they started a new life apart from their parents where they got more freedom, including more freedom to have friends. This transition causes new habits as a form of adaptation to new life. Changes in behavior during this period will usually also impact health, one of which is nutritional status. The number of students in Indonesia in 2015 was around 6.1 million and increased in 2017 to 6.9 million. The number of undergraduate students in 2017 was around 5.5 million. Lotrean research shows that 9.4% of students are underweight, 16.5% are overweight, and 3.2% are obese [3].

Students in the lecture period, besides experiencing changes in diet, also experience changes in physical activity such as increasing screen time and doing the more light physical

activity than moderate or heavy physical activity [4]. Food intake and physical activity are two factors that are closely related to BMI. Research on students showed a decrease in fruit and vegetable consumption [5]. Spanish students showed that students consume vegetables, sausages, bread, and processed foods more often [6]. On Hungarian university students showed that students' diets rarely consumed vegetables and fruit [7]. In other studies, it appears that healthy students still have bad eating habits such as consuming junk food and soft drinks [8]. From this study, lousy food consumption patterns in students can lead to poor nutritional status. Based on these descriptions, researchers want to determine whether appetite, body image, and food intake are related to gaining BMI in healthy students.

2. Materials and Method

A cohort study was conducted on 120 health students in Surakarta, one of the popular cities in Indonesia for undergraduate education, including the undergraduate health program. This research was conducted at three universities in 2019 - 2020. Students who participate are medical, nursing, occupational safety, and health and nutrition students. Selection of subjects using random sampling techniques. In this study, participating students were students in the first year of college because, at this time, students experienced a transition period from adolescence to young adults. The study was conducted for three weeks for every subject. On the first day of the study, weight and height measurements were carried out to determine initial body weight. Research subjects were also asked about how much they slept in one day. Appetite measurement used a visual analog scale. Research subjects filled out the questionnaire after consuming food preceded by fasting for 8 hours. The study subjects marked a line along 100 mm to describe the feelings felt after he ate food. Research subject appetite was calculated based on the length of the line marked by the research subject. Measurement of appetite was determined once a week before an energy intake assessment.

Body image distortion was assessed by differences in perceived body size and actual body size based on BMI. A zero score indicated an undistortion body image, while a negative or positive score indicated a body image distortion. The numbers on the scale of body image perceptions (perceived or ideal) were also classified according to standard procedures into four groups: 1 and 2 underweight; 3 and 4 normal weight; 5-7 overweight; and 8 and 9 obese shapes. Measurement of energy intake was done by doing a 24-hour recall. Data collection was carried out by professionals and used a food portion book tool, so it is hoped to reduce the possibility of flat slope syndrome and validated household size. Research subjects were interviewed about what they consumed during the past 24 hours. Measurement was done once a week with two days weekdays one day weekends after measuring appetite. The results of the interview were processed using Nutrisurvey software to find out the energy intake in kcal. The calculation results were compared with the nutritional adequacy rate. Participants were divided into three groups: low with energy intake below 70%, adequate with energy intake 70 – 110%, and Over with above 110%. The data is displayed in the form of a percentage of nutritional adequacy fulfillment. Anthropometric measurements were attained using the following procedure: bodyweight measurement used was a digital weight scale with an accuracy of 0.1 kg. Bodyweight measurements were carried out on the first and 22nd days of data collection. Bodyweight measurements on the first and 22nd days were carried out using the same weight scale. Height was measured by microtoise with a level of accuracy of 0.1 cm. Body mass index (BMI) was calculated by dividing weight by height squared. Participants were divided into four groups: underweight with BMI <18.5, Normal weight with BMI 18.5 - 22.9, overweight with BMI 23 - 24.9, and obese > 25. The univariate data analysis used (minimum, maximum, mean, and standard deviation) and bivariate (Spearman's rank). Relative risk analysis was achieved by comparing the underweight group with the normal group and the obese group with the normal group. Statistical analysis was performed using SPSS software version 24.

3. Results and Discussion

3.1. Results

Based on Table 1, most students are 18-19 years old (61.7%). Most of the students weighed 41-60 kg at the beginning of the study, while most had normal weight based on BMI. Their energy intake was around 1500 - 2000 kcal (75%), and in a day, they usually slept 6 to 8 hours (82.5%). Sleeping habits of less than eight hours per day are associated with improving nutritional status. People with less than eight hours' sleep tend to have a higher energy intake to gain weight. Based on Table 2, the body image and food intake are related to body mass index ($p < 0.001$). The Relative Risk (RR) of body image to Body Mass Index is 4.970 (2.528 – 9.772), which means

that students who consider themselves thin have a 4.970 greater risk of being underweight than students who consider themselves normal. The Relative Risk (RR) of food intake to the Body Mass Index is 2.241 (1.710 – 2.939), which indicates that students who eat more food have a 2.241 times greater risk of being overweight. There is no significant relationship between appetite and body mass index ($p > 0.05$).

Table 1. Characteristics of Research Subjects

Variable	n	%
Age (year)		
18 – 19	74	61.7
20 – 21	46	38.3
Initial Body weight (kg)		
31 – 40	11	9.2
41 – 50	40	34.2
51 – 60	38	31.7
61 – 70	17	14.2
71 – 80	4	3.3
81 – 90	3	2.5
91 – 100	6	5
Height (cm)		
141 – 160	95	79.2
161 – 180	25	20.8
Initial BMI (kg/m²)		
<18.5	26	21.7
18.5 – 22.9	56	46.7
23.0 – 24.9	14	11.7
>25	24	20
Energy Intake (Kcal)		
>1,500	18	15
1,500 – 2,000	90	75
>2,000	12	10
Sleep Duration (hour)		
>6	11	9.2
6 - 8	99	82.5
>8	10	8.3

Table 2. Bivariate Analysis Result

Variabel	Body Mass Index				Total	p	RR (95% CI)
	Under weight	Normal	Over weight	Obesity			
Appetite						0.818	
Low	9	30	10	15	64		
Good	11	28	5	12	56		
Body Image						<0.001	
Under Weight	11	4	1	0	16		4.970 (2.528 – 9.772)
Normal	9	52	9	6	76		
Over Weight	0	2	5	19	26		4.148 (2.25 – 6.554)
Obesity	0	0	0	2	2		
Energy Intake						<0.001	
Low	12	22	4	6	44		1.941 (0.895 – 4.212)
Adequate	8	36	9	20	73		
Over	0	0	2	1	3		2.241 (1.710 – 2.939)

3.2. Discussion

Undergraduate students aged 18-25 experience a transition from adolescence to early adulthood [24]. During this time, many changes occur, such as changes in the friendly environment, living separately from parents, and having more freedom to choose friends or make decisions [25]. These changes impact behavioral patterns that can affect health, one of which is nutritional status.

Energy can be defined as the capacity to do work. Food is the primary source of energy for humans. Energy needs can be interpreted as the energy needed by the human body to grow and develop. A person's energy needs depend on age, gender, body weight, height, and level of physical activity [9,26]. If the intake exceeds the need, overweight and obesity can occur [10]. Eating behavior is influenced by several factors, including appetite and body image [11]. Appetite is the desire to eat food. For more than 50 years, researchers have attempted to create a possible framework for the relationship between appetite and nutritional status. Appetite is thought to influence food selection and the amount of food consumed [12]. This research subjects who have an appetite below the average of 52.5%. Appetite reflects the motivation to eat and the behavior directed towards consuming food and drink items available in the environment [13]. As seen in the by-product of our study that appetite has a relationship with energy intake.

The results showed that appetite was related to energy intake with an r-value of 0.26. Research in the elderly showed a 25% decrease in appetite, indicating a 16-20% decrease in food intake. Appetite influences food selection and the amount of food consumed [12,27-28]. Kessler developed the "food hedonic" theory. This theory is based on the palatability factor is the dominant factor on which to choose the type of food. In simple terms, it can be stated that humans eat for pleasure. The "food hedonic" theory is widely used to explain the causes of obesity. One of the factors suspected to be the cause of obesity is "hedonic eating." The term "hedonic eating" refers to food consumption that is not rooted in the metabolic feedback mechanisms but is related to cognitive, reward, and emotional factors. Hedonic eating is controlled by cortico-limbic areas of the brain, including the accumbens and caudate nuclei (the dopaminergic reward pathway that regulates anticipation and motivation); amygdala and hippocampus (learning); anterior insula (sensory processing); and the orbitofrontal cortex (executive control, decision making, reward value appraisal). Apart from affecting the energy balance, the limbic corticoid area has a role in memory, learning processes, and emotional regulation [14].

Satiety is considered the primary control controlling the amount of food consumed [29,30]. Blundell developed a theoretical framework of "Satiety Cascade" 30 years ago to explain the process of satiety. This theoretical framework identifies several factors that control food consumption. Factors that play a role include; 1) physiological sensory factors caused by the smell and taste of food, 2) Psychological factors such as cognition, beliefs, and expectations, 3) physiological factors, especially in the stomach area and other parts of the digestive tract. Gastrointestinal peptides such as ghrelin, CCK, PYY, GLP1, and others are appraised to be closely related to appetite control [12]. Appetite is directly related to energy intake, but a person can have appetite variability caused by acute or chronic stress, physical activity, weight loss programs, and pharmacology [13]. Appetite measurements that assess the control of satiety in one episode have not been able to explain the incidence of obesity because of the high variability of appetite in a person, which is a weakness of this study. In the future, appetite measurements can be carried out to measure motivation to eat, food choices, and hedonic processes that can modulate homeostatic systems.

Body image is a picture of our thoughts about the size and shape of bodies and feelings about the characteristics of limbs [15]. Body image is influenced by family and friendship [16]. Differences in body shape image can be caused by adults' active users of social media. Social media such as Instagram or Facebook are an arena for teenagers and young adults to picture the ideal body figure [17]. The use of social media causes someone to compare their body shape with the body shape of friends or the figure of an artist or celebrity. The habit of comparing body shapes can cause a person to want to be thinner to reach their ideal body weight [18]. Perception of body shape can lead to feelings of dissatisfaction. These feelings can lead to eating disorders. Dissatisfaction with the body makes a person undergo a strict diet to lose weight [19]. Research on adolescents also shows that adolescents with a positive image will have better-eating behavior [16]. The results showed that there was no difference in food intake between students. The results can be due to various other factors that affect a person's food intake, such as appetite, stress [20], environmental influences, and social media. Students also tend to consider other factors in choosing food, such as price, activity level, health, and beauty [16]. Body image is related to body mass index, which means that most respondents consider their body shape

the same as their body mass index. In this study, what should be noted is that most students who have obese nutritional status do not realize it and only consider themselves overweight, and some even consider their weight to be expected, so education about average weight is needed.

The results of this study are in line with several studies that show poor food intake and food habits among nutrition, nursing, and medical students [21–23]. Apart from being influenced by knowledge factors, food intake is also affected by environmental factors such as family eating habits and the availability of food in the environment [11]. Students tend to eat street food and rarely eat fruits and vegetables [6]. A person's eating behavior can be influenced by internal factors such as appetite and body image. Our study shows that energy intake correlates with BMI. Excessive energy intake may occur by a high intake of foods with high energy density. Foods with high energy density contain a large amount of energy per gram of food weight. Consumption of foods with high energy density will increase energy intake and body fat to increase the risk of obesity [8]. According to the Indonesian Nutritional Adequacy Rate, the results showed that only three students had excessive food intake, but 15 people were overweight, and 27 were obese. The low physical activity of students can cause this result. A person's nutritional status is influenced by energy intake and several other factors, such as physical activity, total daily energy expenditure, and the thermic effect of food that can affect energy balance.

4. Conclusion

Based on the research results, we can conclude that there is no relationship between appetite and BMI. Obese students tend to consider themselves overweight. Students who consider themselves underweight have a lower energy intake than students who think they are normal, overweight, or obese. Energy intake is also influenced by appetite. Good appetite causes a higher energy intake. The greater the energy intake, the greater risk of becoming obese. Based on the results of this study, we suggest that a nutrition intervention program for malnourished students is carried out. The optimal nutritional status of prospective health workers is expected to be an example and motivation for the community to achieve good nutritional and health status.

Declaration

Conflicts of Interest: The author has no commercial interests related to this manuscript and there is no conflict of interests for the authors of this manuscript.

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