Anthropometry analysis of nutritional indicators in Indonesian adolescents

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Abstract

Objective: Malnutrition is an emerging health problem that has challenged healthcare authorities worldwide. This study aims to determine anthropometric values and the nutritional status of Indonesian school adolescents.

Methods: In total, 510 students (288 girls and 222 boys) studying at Darul Ihsan Islamic Boarding School Banda Aceh participated in this cross-sectional study. All participants were examined for weight, height, and body mass index (BMI). The BMI category was classified using BMI criteria for the Asia-Pacific population. For data analysis, a descriptive analysis, chi-square (p < 0.05), and independent sample t-test (p < 0.05) were employed.

Results: The rate of malnutrition among school adolescents in Banda Aceh was overweight 36.67% (girls = 47.6% and boys = 52.4%) and overweight/obesity 21.96% (girls = 60.66% and boys = 39.33%). There was a significant difference in the number of overweight girls and boys: 127 (60.2%) and 84 (39.8%) (p = 0.007, respectively). Obesity I was more common among girls than boys: (31; 66%) versus (16; 34%), p = 0.027. There was a slight difference in the prevalence of being overweight: 89 (47.6%) versus 98 (52.4%), p = 0.520, and no difference in the number of girls and boys with obesity II: 6 (50%) versus 6 (50%), respectively.

Conclusions: This study reports multiple malnutrition problems in adolescent schools in Banda Aceh, namely being underweight, overweight, and obesity. This calls for urgent attention by healthcare authorities to initiate public awareness campaigns to curtail malnutrition.
Introduction

Anthropometric measurements and monitoring are important for children and adolescents. Anthropometric measurement is important for assessing and monitoring the nutritional status of adolescents. An anthropometric examination of adolescents is important as an indicator of health. Malnutrition is a public health problem that occurs in almost all regions. High rate of malnutrition among underweight young people in Aceh. Underweight is an important for children and adolescents. Anthropometric measurements and monitoring are important for assessing and monitoring the nutritional status of adolescents.

Malnutrition is a double nutritional problem and public health concern for adolescents in Indonesia including in Aceh, which has only now been discovered. Currently, the Indonesian government is prioritising reducing the number of underweight children and adolescents. This data illustrates the nutritional health problems of the community, especially in adolescence in Banda Aceh. Therefore, this data is needed by the Indonesian government as a reference for a plan to prevent a surge in obesity and decrease the number of underweight young people in Aceh. Underweight is an under-nutrition condition, a serious public health problem that needs to be prioritised to be resolved. This data is preliminary and the first to describe the nutritional status of adolescents in the Acehnese community. The purpose of this study was to determine the anthropometric values and nutritional status of school adolescents at Darul Insan Islamic Boarding School in Banda Aceh.

Materials and Methods

Study design

This study was quantitative and adopted a cross-sectional design. A survey and observation of the nutritional status of adolescents were conducted by measuring anthropometric values in the form of body weight, height, and body mass index (BMI). Before examining and retrieving data, volunteer respondents filled out the identity sheet and signed a letter of approval to become a research participant. This research was conducted at the Darul Insan Islamic Boarding School in Aceh Besar, Banda Aceh, Aceh Province. All students who study here live in dormitories and consume food from the same menu. The study was conducted from July to September 2015.

Sample characteristics

This research was conducted on school adolescents; therefore, the population was junior high school and high school students. A non-probability sampling method with accidental sampling was employed. The total population was 580 students, but because data were collected on school holidays (every Friday), as many as 70 did not take part in the study because they were on holiday. Ultimately, the research subjects were 206 junior high school students and 204 high school students, girls and boys aged from 12 to 19 years. The total sample was 510 adolescent girls (n = 288) and boys (n = 222). All students consumed the same main food, namely rice, fish, and vegetables. Additional food provided was a snack once a day in the morning around 10.00 am.

Procedures and data analysis

The study tools used were questionnaire sheets, weight scales, and height scales. The survey asked subjects about their characteristics (age and sex), and the answers were filled in on the available questionnaire sheets. Body weight was measured using a weight scale (GEA ZT-120 Health Scale), and BMI by calculating the ratio between body weight (kg) and height (m²). The BMI classification in this study was guided by the following Asia-Pacific BMI categories: underweight (<18.8), normal weight (18.5–22.9), overweight (23.0–24.9), obese I (25.0–29.9), and obese II (≥30).

Data analysis employed descriptive tests, a chi-square correlation test (p < 0.05), and independent different test t-test samples (p < 0.05). The Chi-square analysis was conducted to determine the relationship between sex and BMI,
while an independent sample t-test was used to determine the differences between age, weight, height, and BMI between adolescent boys and girls.

**Results**

Figure 1 shows the characteristics of the research subjects. The number of teenage girls is more than that of teenage boys. Table 1 provides the characteristics of the research subjects based on age, weight, height, and BMI. Analysis of independent t-test samples for age, weight, height, and BMI showed no difference between the age and weight of adolescent boys and girls. The results of this study indicate that the average height of boys is higher than that of girls \((p = 0.002)\), and the BMI value for adolescent girls is greater than that for adolescent boys \((p < 0.05)\). As such, the results of this study indicate significant differences in height \((p < 0.05)\) and BMI \((p < 0.05)\) between boys and girls.

Figure 2 shows that less than 50% of adolescents have a normal weight. Malnutrition is a common problem among underweight adolescents (36.67%), while the number of those with overweight and obesity is similar. The results of this study reveal that in Banda Aceh, more adolescents exhibit malnutrition (underweight) than overweight.

![Figure 1: Number of research subjects.](image1)

![Figure 2: Adolescents' body mass index.](image2)

| Variable         | Gender | Mean ± SD   | Minimum | Maximum | \(p\)-value |
|------------------|--------|-------------|---------|---------|-------------|
| Age (year)       | Girls  | 13.82 ± 1.56| 11      | 19      | 0.36        |
|                  | Boys   | 13.95 ± 1.70| 12      | 19      |             |
| Weight (kg)      | Girls  | 45.81 ± 10.06| 23.50   | 85      | 0.96        |
|                  | Boys   | 45.76 ± 12.31| 24.00   | 86      |             |
| Height (m²)      | Girls  | 148.30 ± 6.11| 130     | 163.00  | 0.002\(^a\) |
|                  | Boys   | 150.59 ± 10.22| 127    | 185.50  |             |
| BMI (kg/m²)      | Girls  | 20.75 ± 3.82| 12.88   | 33.40   | 0.015\(^a\) |
|                  | Boys   | 19.90 ± 3.77| 14.23   | 31.76   |             |

\(^a\) Significant at the level of error of 5%.
Table 2 shows the results of the chi-square correlation analysis ($p < 0.05$) and description of the BMI category. Table 2 shows that there is no correlation between gender and underweight ($p = 0.52$), obesity I ($p = 0.26$), and obesity II ($p = 0.40$), but in contrast, there is a correlation between gender with normal weight ($p = 0.002$) and overweight ($p = 0.007$). Being overweight and having normal weight were significantly higher among adolescent girls than boys.

**Discussion**

The double burden of malnutrition is the main nutrition issue and prioritised by the government of Indonesia today. Malnutrition is generally defined as under and overweight. Under-nutrition is a condition characterised by nutritional deficiencies in the form of stunting (low height for age) and wasting (low weight for height). Stunting is currently the main nutritional problem in Aceh Province, Indonesia. We found that the prevalence of being underweight among adolescents in Banda Aceh was 36.67%. The rate of under-nutrition in Banda Aceh in 2015 was slightly lower than the national under-nutrition rate in 2010. Data from the World Bank indicates that around 25% of the world population is overweight, 17% of pre-school children are underweight, and 28% exhibit stunting. In Aceh (2010), malnutrition (stunting) is highest in the age groups 13–15 years (44.5%), 6–12 years (38.8%), and 16–18 years (37.3%).

The prevalence of being underweight in adolescents in Banda Aceh is higher when compared to data from other regions in Indonesia or other Asian countries. Astini reported that the prevalence of malnutrition among adolescents (aged 10–19 years) in Bali in 2013 was underweight (48.6%), overweight (8.7%), and obese (1.1%). Research in Iran confirms the prevalence of being underweight among young girls in high school; a study in Malaysia found the prevalence of being underweight among adults in Malaysia was 9.8%; and research in Ekiti State, Nigeria verified the prevalence of being underweight as 11.7%. Finally, research in Bijnor district of Uttar Pradesh, India confirmed that 35% of adolescents were underweight.

We have not found data about why the prevalence of malnutrition in Aceh is high, but assume that the probability of the socio-economic factor is one risk factor. Hanandita contended that socio-economic status is one factor causing underweight and overweight in Indonesia. Halimetham’s research states that the risk factors for under-nutrition in Ethiopia are food intake, physical activity, socio-economic status, and disease. Patterns of food intake, nutritional inadequacy, and physical inactivity are risk factors for overweight and obesity in adolescents. Adolescence is an age peak of growth, and therefore nutritional status is a priority that must be met for this group. Malnutrition in adolescents brings about growth disorders, impaired sexual maturation, and an increased risk of chronic metabolic diseases. Currently, not only obesity, but also undernutrition is a major public health problem in most countries worldwide. Underweight is generally not directly related to increased mortality, but impacts chronic energy deficiencies associated with an increased risk of chronic infectious diseases.

The epidemic of obesity and overweight is increasing in Asia-Pacific countries. Underweight and obesity prevention in children and adolescents is a major priority of governments worldwide including in Indonesia, where the prevalence of being underweight and overweight in school-aged children is around 14.5% and 20.4%, respectively. Many factors contribute to the occurrence of malnutrition (underweight and overweight) in adolescents, such as a lack of macro and micronutrient consumption, breakfast habits, adequate hours of sleep, socio-economic status, physical activity, and well-balanced nutrition.

Malnutrition in school adolescents in Banda Aceh does not only manifest in the high prevalence of being overweight (36.67%), but also in overweight (10.39%) and obesity (11.57%), which is high and above the national prevalence. Our study found that 21.96% of adolescents at school in Banda Aceh were overweight/obese. The rate of overweight and obesity in Banda Aceh is higher than the national overweight/obesity rate in Indonesia, which is 9.7% and 1.1%, respectively. The prevalence of overweight and obesity has increased in both developed and developing countries. The data from Indonesia Basic Health Research 2007 showed that 19% of the population aged over 15 years was overweight/obese in Indonesia. The rate of obesity among girls (29%) is higher than that of boys (8%). We also found a higher rate of overweight/obesity for adolescent girls (60.66%) than adolescent boys (39.33%). The double burden of malnutrition in Banda Aceh is likely related to the socio-economic conditions of the Acehnese people, although this was not examined in this study. However, the determinants of malnutrition in adolescents in Aceh should be further examined.

**Study limitations**

The results of this study may not provide an overall description of adolescents in Banda Aceh. This research was conducted in a specific community and it is likely that the results may differ for adolescents in different communities, for example in non-boarding schools. Further research is needed as comparative data.

**Conclusions**

Based on the results of the study, it can be concluded that the prevalence of malnutrition (underweight) is highest among adolescents in Banda Aceh compared to other types of malnutrition (overweight and obese). Gender and overweight and obesity are related, with a greater relationship among adolescent girls than boys. There is no relationship between gender with underweight, obesity I and obesity II. We suggest that further research be conducted to identify risk factors for malnutrition in adolescents in Banda Aceh.

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Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

This research has received ethical approval from the Medical and Health Research Ethics Committee. All participants volunteered and signed a written consent form with the approval of the principal.

Authors contributions

YY designed and conceived this study, designed and conducted the study, collected data, and performed the statistical analysis and data interpretation. MM examined the subject, and corrected and finalised the article. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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