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Original Article

Anthropometry analysis of nutritional indicators in Indonesian adolescents

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الملخص

أهداف البحث: يعد سوء التغذية مشكلة صحية طارئة تحدت سلطات الرعاية الصحية في جميع أنحاء العالم. تهدف هذه الدراسة لتحديد القياسات البشرية والحالة الغذائية للمراهقين في المدارس الإندونيسية.

طرق البحث: في هذه الدراسة المقطعية المستعرضة، اشترك ٥١٠ طالبا (٢٨٨ فتاة و٢٢٢ فتى)، يدرسون في مدارس داخلية في مدرسة دار الإحسان الإسلامية في باندا اتشيه. تم فحص وزن، وطول، ومؤشر كتلة الجسم لجميع المشتركين. وتم تصنيف فئة مؤشر كتلة الجسم حسب معايير مؤشر كتلة الجسم لسكان منطقة المحيط الهادئ الآسيوية.

النتائج: كان معدل سوء التغذية للمراهقين في المدرسة في باندا اتشيه نقص الوزن ٣٦.٦٧٪ (الفتيات= ٤٧.٦٪ والفتيان =٥٢.٤٪) وزيادة الوزن/ السمنة ٢١.٩٦٪ (٦٠.٦٦٪ للفتيات و٣٩.٣٣٪ للفتيان). وكان هناك فرق واضح في زيادة الوزن للفتيات والفتيان ١٢٧(٦٠.٢٪) مقابل ٨٤ (٣٩.٨٪)، على التوالي. وكانت السمنة ١ أكثر شيوعا عند الفتيات بالمقارنة بالفتيان ٣١ (٦١٪) مقابل ١٦ (٣٤٪). وكان هناك فرق قليل في انتشار نقص الوزن ;٨٩ (٤٧٫٦٪) مقابل ٩٨(٥٢٫٤٪)، بينما لم يكن هناك فرق في عدد الفتيات والفتيان الذين يعانون من السمنة ٢; ٦ (٥٠٪) مقابل ٦ (٥٠٪) بين الفتيات والفتيان، على التوالي.

الاستنتاجات: تظهر هذه الدراسة مشاكل متعددة من سوء التغذية في مدارس المراهقين في باندا اتشيه وهي نقص الوزن، وزيادة الوزن والسمنة. هذا الأمر يتطلب اهتماما عاجلا من قبل السلطات الصحية للبدء بحملات توعية عامة للحد من سوء التغذية.

الكلمات المفتاحية: باندا اتشيه؛ المراهقين؛ القياسات البشرية؛ اندونيسيا؛ الحالة الغذائية

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 underweight 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%), $p = 0.020$. There was a slight difference in the prevalence of being underweight: 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.

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Keywords: Aceh; Adolescents; Anthropometry; Indonesia; Nutritional status

Introduction

Anthropometric measurements and monitoring are important for children and adolescents.[1] Anthropometric measurement is important for assessing and monitoring the nutritional status of adolescents.[1,2] An anthropometric examination of adolescents is important as an indicator of nutritional status and can be used to predict various health problems, co-morbidities, and their quality of life.[2–5] Malnutrition is a public health problem that occurs in almost all ages in Indonesia.[6,7] The high rate of malnutrition among Indonesian adolescents including Acehnese ones provides a real view of the nutritional status of the community in Indonesia. Today, the problem of malnutrition in Indonesia manifests as underweight, overweight, and obesity.[6,8] Malnutrition problems among adolescents affect various health issues and development.[2] Adolescence is a phase of transition from childhood to adulthood.[2]

Compared to underweight, overweight and obesity are the causes of death in many countries worldwide. The changes in lifestyle and food consumption patterns of people today are triggers, resulting in an increased prevalence of overweight and obesity among adolescents.[8] However, Benazeera has a contradictory opinion, namely that the habit of eating unhealthy food is not related to malnutrition in adolescents. Obesity is a major public health problem in most countries worldwide, both developed and developing.[6,8] Overweight and obesity are simultaneous and provide a double burden for Acehnese adolescents.

Underweight and overweight contribute to many burdens for the government including escalating government health financing; an increased risk of death; decreased productivity; decreased quality of life; and most important, increased risk of metabolic diseases such as hypertension, diabetes, stroke, and heart disease.[6,8,9] Overweight and obesity in adolescents are related to the increased risk of death, chronic health problems, and co-morbidity in adult life.[9–11]

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 malnourished 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 Ihsan 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 Ihsan 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 participate 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 (m^2). The BMI classification in this study was guided by the following Asia-Pacific[12] 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).[12]

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.

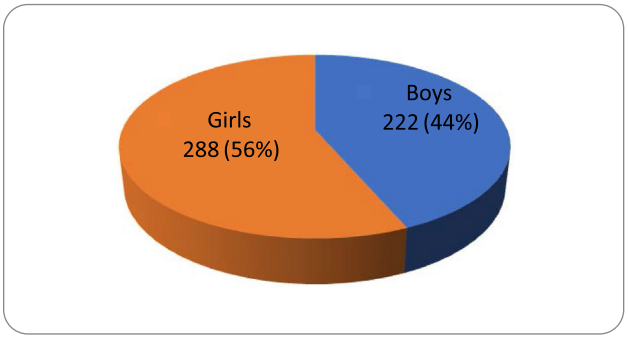

Figure 1: Number of research subjects.

Table 1: Analysis of independent sample t-test to determine differences in age, weight, height, and body mass index (BMI) based on gender.

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 (m^2)	Girls	148.30 ± 6.11	130	163.50	0.002[a]
	Boys	150.59 ± 10.22	127	185.50	
BMI (kg/m^2)	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%.

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.

Table 2: Body mass index categories by gender.

	Minimum	Maximum	n	%	x^2	p-value
Underweight						
Girl	12.88	18.40	89	47.6	59.62	0.52
Boys	14.23	18.49	98	52.4		
Total			187	100		
Normal weight						
Girl	18.52	23.03	127	60.2	86.07	0.002[a]
Boys	18.61	22.97	84	39.8		
Total			211	100		
Overweight						
Girl	23.07	24.97	35	66	41.11	0.007[a]
Boys	23.25	24.99	18	34		
Total			53	100		
Obese I						
Girl	25.07	26.01	31	66	41.80	0.02[a]
Boys	25.15	25.64	16	34		
Total			47	100		
Obese II						
Girl	30.05	33.40	6	50	10.00	0.40
Boys	30.30	31.78	6	50		
Total			12	100		

[a] Significant at the level of error of 5%.

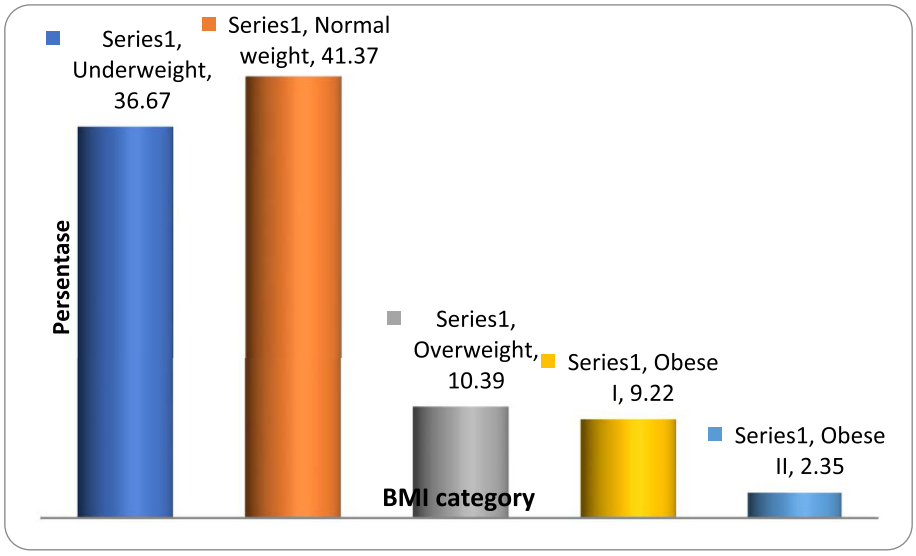

Figure 2: Adolescents' body mass index.

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.[7,8] Malnutrition is generally defined as under and over-nutrition.[13,14] Under-nutrition is a condition characterised by nutritional deficiencies in the form of stunting (low height for age) and wasting (low weight for height).[13,14] 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.[13] 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%).[13]

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%).[7] Research in Iran confirms the prevalence of being underweight among young girls in high school[15]; a study in Malaysia found the prevalence of being underweight among adults in Malaysia was 9.8%[16]; and research in Ekiti State, Nigeria verified the prevalence of being underweight as 11.7%.[17] Finally, research in Bijnor district of Uttar Pradesh, India confirmed that 35% of adolescents were underweight.[18]

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.[8] Hailemichael's research states that the risk factors for under-nutrition in Ethiopia are food intake, physical activity, socio-economic status, and disease.[19] Patterns of food intake, nutritional inadequacy, and physical inactivity are risk factors for overweight and obesity in adolescents.[20,21] Adolescence is an age peak of growth, and therefore nutritional status is a priority that must be met for this group.[19] Malnutrition in adolescents brings about growth disorders, impaired sexual maturation, and an increased risk of chronic metabolic diseases.[22] Currently, not only obesity, but also under-nutrition is a major public health problem in most countries worldwide.[23] Underweight is generally not directly related to increased mortality, but impacts chronic energy deficiencies associated with an increased risk of chronic infectious diseases.[24]

The epidemic of obesity and overweight is increasing in Asia-Pacific countries.[25] Underweight and obesity prevention in children and adolescents is a major priority of governments worldwide including in Indonesia,[26,27] where the prevalence of being underweight and overweight in school-aged children is around 14.5% and 20.4%, respectively.[28] 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.[28–31]

Malnutrition in school adolescents in Banda Aceh does not only manifest in the high prevalence of being underweight (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.[6] 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.[13] The rate of obesity among girls (29%) is higher than that of boys (8%).[13] 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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References

1. Batubara JR. Practices of growth assessment in children: is anthropometric measurement important? **Paediatr Indones 2005**; 45(7–8): 145–153.
2. Baliga SS, Naik VA, Mallapur MD. Assessment of nutritional status of adolescent girls residing in rural area of Belagavi. **Int J Med Sci Public Health 2017**; 6(2): 323–326. https://doi.org/10.5455/ijmsph.2017.05082016610.
3. Uddin J, Nag SK, Sil SK. Anthropometric assessment of nutritional status of adolescents in rural school of Unokoti district of Tripura, North-East India. **Anthropol 2015**; 19(1): 277–284.
4. Mukhopadhyay A, Bhadra M, Bose K. Anthropometric assessment of nutritional status of adolescents of Kolkata, West Bengal. **J Human Ecol 2005**; 18(3): 213–216.
5. Chande S, Mahavidyalaya SSRMM. Anthropometry as tool for assessing nutritional status of adolescent tribal population. **Int J Adv Res 2016**; 4(4): 1276–1283. https://doi.org/10.21474/IJAR01.
6. Susilowati D. The relationship between overweight and socio demographic status among adolescent girls in Indonesia. **Bul Penelit Sist Kesehat 2011**; 14(1): 1–6.
7. Astini D. Nutritional status of children in Bali-Indonesia. In: *IOP conf. Series: materials science and engineering*; 2018. pp. 1–5. https://doi.org/10.1088/1757-899X/434/1/012153.
8. Hanandita W, Tampubolon G. The double burden of malnutrition in Indonesia: social determinants and geographical variations. **SSM-Popul Health 2015**; 1: 16–25. https://doi.org/10.1016/j.ssmph.2015.10.002.
9. Fruh SM. Obesity: risk factors , complications , and strategies for sustainable long-term weight management. **J Am Assoc Nurse Pract 2017**; 29: S3–S14. https://doi.org/10.1002/2327-6924.12510.
10. Cavazzotto TG, Brasil MR, Oliveira VM, et al. Nutritional status of children and adolescents based on body mass index: agreement between World Health Organization and International Obesity Task Force. **Rev Paul Pediatr 2014**; 32(1): 44–49.
11. Rahim NNA, Chin YS, Sulaiman N. Socio-Demographic factors and body image perception are associated with BMI-for-age among children living inWelfare homes in Selangor, Malaysia. **Nutrients 2019**; 11(142): 1–13. https://doi.org/10.3390/nu11010142.
12. World Health Organization (WHO). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. **Public Health 2004**; 363: 157–163.
13. Shrimpton R, Rokx C. *The double burden of malnutrition in Indonesia*. Report 761. World Bank Jakarta; 2013. pp. 1–70., https://openknowledge.worldbank.org/handle/10986/17007 License: CC BY 3.0 IGO.
14. Abdullah A, Aceh B. The double burden of undernutrition and overnutrition in developing countries: an update. **Curr Obes Reports e-ISSN 2015**; 4(February). https://doi.org/10.1007/s13679-015-0170-y.
15. Jamalikandazi F, Ranjbar E, Gholami-parizad E, Ghazanfari Z, Mostafavi S. Nutritional status and anthropometric indices in high school girls in Ilam , west Iran. **Scientifica (Cairo) 2016**; 2016: 1–5. https://doi.org/10.1155/2016/4275148.
16. Ka N, Khan AR. Body mass index and nutritional status of adults in two rural villages in Northern Malaysia. **Mal J Nutr 2007**; 13(1): 9–17.
17. Kelvin AA, Sanusi RA. Nutritional status of in-school adolescents in Ekiti state , Nigeria. **Glob J Med Public Health 2016**; 5(4): 1–11.
18. Lamba A, Garg V. A study on the nutritional status of adolescent girls (12-14yrs) residing in rural area of Bijnor district of Uttar Pradesh. **Int J Food Sci Nutr 2017**; 2(4): 181–183.
19. Hailemichael F, Girma B. Predictors of nutritional status among adolescent school girls in Southwest Ethiopia. **Int J Nutr Metab 2017**; 9(1): 1–9. https://doi.org/10.5897/IJNAM2016.0209.
20. Henrique P, Roberto M, Nobre C, Augusto J, Augusto J, Carrazedo A. School-based physical activity and nutritional education interventions on body mass index: a meta-analysis of randomised community trials—project PANE. **Prev Med 2014**; 61: 81–89. https://doi.org/10.1016/j.ypmed.2014.01.005.
21. Parimalavalli R, Sangeetha M. Anthropometric measurements and nutrient intake of adolescent girls. **Anthropol 2011**; 13(2): 111–115.
22. Dasgupta A, Butt A, Saha TK, Basu G, Chattopadhyay A. Assessment of malnutrition among adolescents: can BMI be replaced by MUAC. **Indian J Community Med 2010**; 35(2): 276–279. https://doi.org/10.4103/0970-0218.66892.
23. Frison S, Kerac M, Checchi F, Prudhon C. Anthropometric indices and measures to assess change in the nutritional status of a population: a systematic literature review. **BMC Nutr 2016**; 2(76): 1–11. https://doi.org/10.1186/s40795-016-0104-4.
24. De K. Growth pattern and relation with age at Menarche. **Pediatr Health Res 2017**; 2(1:8): 1–3. https://doi.org/10.21767/2574-2817.100012.
25. Inoue S, Zimmet P, Caterson I, Chunming C. *The Asia-Pacific perspective: redefining obesity and its treatment*; 2000. pp. 1–56. http://www.wpro.who.int/nutrition/documents/docs/Redefiningobesity.pdf.
26. Pysz K, Leszczyńska T, Kopeć A. Anthropometric assessment of the nutritional status of children and adolescents residing in selected polish orphanages based on their energy intake and physical activity level. **Rocz Panstw Zakl Hig 2015**; 66(1): 77–83.
27. Nuttall FQ. Body mass index: obesity, BMI, and health: a critical review. **Nutr Today 2015**; 50(3): 117–128. https://doi.org/10.1097/NT.0000000000000092.
28. Syahrul S, Kimura R, Tsuda A, Susanto T, Saito R, Ahmad F. Prevalence of underweight and overweight among school-aged

children and it“ s association with children”s sociodemographic and lifestyle in Indonesia. **Int J Nurs Sci 2016**; 3(2): 169−177. https://doi.org/10.1016/j.ijnss.2016.04.004.

29. Tamanna S, Rana M, Ferdoushi A, Ahmad I. Assessment of nutritional status among adolescent Garo in Sherpur district, Bangladesh. **Bangladesh J Med Sci 2013**; 12(03): 269−275. https://doi.org/10.3329/bjms.v12i3.15423.
30. Wolde T, Amanu W, Mekonnin D, et al. Nutritional status of adolescent girls living in Southwest of Ethiopia. **Food Sci Qual Manag 2014**; 34: 58−65.
31. Pujilestari CU, Nyström L, Norberg M, Weinehall L, Hakimi M. Socioeconomic inequality in abdominal obesity among older people in Purworejo District, Central Java, Indonesia−a decomposition analysis approach. **Int J Equity Health 2017**; 16(214): 1−11. https://doi.org/10.1186/s12939-017-0708-6.

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