Gizi Indon 2024, 47(2): 109-120
GIZI INDONESIA
Journal of The Indonesian Nutrition Association
p-ISSN: 0436-0265 e-ISSN: 2528-5874

HIGH PROPORTION OF ENERGY AND FE FROM OUTSIDE DORMITORY IS ASSOCIATED WITH ANEMIA AMONG ADOLESCENT GIRL AT ALI MAKSUM ISLAMIC BOARDING SCHOOL YOGYAKARTA: A CROSS SECTIONAL STUDY

Proporsi Tinggi Asupan Energi dan Zat Besi dari Luar Asrama Berhubungan dengan Anemia pada Remaja Putri di Pondok Pesantren Ali Maksum Yogyakarta: Studi *Cross-Sectional*

Riesta Yasinta[1], Toto Sudargo[2], Prima Dhewi Ratrikaningtyas[3]
[1]Postgraduate Student of Health and Nutrition Concentration, Magister of Public Health Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada
[2]Department of Health Nutrition, Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada
[3]Department of Biostatistics, Epidemiology and Population Health, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada

E-mail: riestayasinta@mail.ugm.ac.id

Diterima: 10-07-2022 Direvisi: 23-09-2024 Disetujui terbit: 30-09-2024

ABSTRACT

Adolescent girls in urban dormitories are prone to skipping meals and replacing them with less nutritious snacks from outside, increasing the risk of anemia. The purpose of this study is to determine the association between intake from outside dormitory and meal skipping on anemia in adolescent girls at Ali Maksum Islamic Boarding School Yogyakarta. This is an observational study with a cross-sectional design. The total sample of 163 adolescent girls was selected by total sampling. Six days of 24-hour food recall were collected along with sociodemographic and nutritional status data, while hemoglobin level was measured using automated hematology analyzer machine (AHA). Bivariable analysis was performed using chi-square test and multivariable analysis was performed using logistic regression. This study showed energy intake from outside dormitory was significantly associated with anemia for the group of Q2 (47-59% daily intake) and Q3 (59-76% daily intake) (p-value 0.030 and 0.019 respectively), and the odds ratio increased along with higher intake of energy from outside dormitory (OR 3.6, 90% CI 1.4-9.3 and OR 4.3, 90% CI 1.5-12.1). The Fe intake from outside dormitory was significantly associated with anemia only in the Q3 group (70-84% daily intake) with p-value 0.024 (OR 4.8, 90% CI 1.5-15.1), and skipping breakfast was significantly associated with anemia (OR 0.3, 90% CI 0.1-0.6). High intake from outside dormitory is inevitably poor habit and should be taken seriously.

Keywords: anemia, adolescent girl, eating out, meal skipping

ABSTRAK

Remaja asrama di wilayah urban rentan melewatkan waktu makan dan menggantinya dengan jajanan kurang bergizi dari luar, yang berisiko meningkatkan anemia pada remaja putri. Penelitian ini untuk mengetahui hubungan antara asupan dari luar asrama dengan kebiasaan melewatkan makan pada anemia pada remaja putri di SMA Yayasan Pondok Pesantren Ali Maksum Yogyakarta. Penelitian ini merupakan penelitian observasional dengan desain potong lintang. Jumlah sampel 163 remaja putri dipilih secara total sampling. Data asupan dengan metode *food recall* 24 jam dikumpulkan selama 6 hari bersama dengan data sosiodemografi dan status gizi, sementara kadar hemoglobin diukur menggunakan mesin *automated hematology analyzer* (AHA). Analisis bivariabel dilakukan dengan uji chi-square dan analisis multivariabel menggunakan regresi logistik. Penelitian ini menunjukkan asupan energi dari luar asrama berhubungan signifikan dengan anemia pada kelompok Q2 (47-59% total asupan) dan Q3 (59-76% total asupan) (p-value 0,030 dan 0,019), dan *odds ratio* meningkat seiring dengan peningkatan asupan energi dari luar asrama (OR 3.6, CI 90% 1.4-9.3 dan OR 4.3, CI 90% 1.5-12,1). Asupan Fe dari luar asrama berhubungan signifikan dengan anemia hanya pada kelompok Q3 (70-84% total asupan) dengan p-value 0,024 (OR 4,8, 90% CI 1,5-15,1), dan melewatkan sarapan berhubungan signifikan dengan anemia (OR 0,3, 90% CI 0,1-0,6). Tingginya asupan tinggi merupakan kebiasaan yang kurang sehat dan harus ditanggapi dengan serius untuk mencegah anemia.

Kata kunci: anemia, remaja putri, asupan makan, *meal skipping*

Doi: 10.36457/gizindo.v47i2.718
www.persagi.org/ejournal/index.php/Gizi_Indon

INTRODUCTION

Anemia in adolescents as global health problem remain persistent. About 21 percent of women in East Asia and Southeast Asia were anemic,[1] while in Indonesia, 32 percent of adolescents were reported to be anemic (Indonesian Basic Health Research, 2018). Adolescent girls are susceptible to anemia due to their high nutritional requirements during growth acceleration, insufficient intake of iron food sources, and blood loss during menstruation.[2] Adolescent girls who live in boarding schools are at risk for various nutritional problems.[3] Young girls who live away from their parents in the urban area may have broad access to foods and snacks due to the numorous street food vendors, cafeterias, and restaurants. Therefore, skipping meals and choosing snack food as a substitute for the main meal become prevalent.[4] Teenagers who live in dormitories show lower consumption of 8 out of 10 food groups, thus having poorer dietary quality intake compared to those who live at home.[5] Dietary quality intake significantly affects hemoglobin levels, and anemic adolescents tend to have a lower score on dietary quality intake than non-anemic adolescents.[6]

Meal skipping and snacking are common among adolescents.[7] About 47 percent of adolescents aged 15-19 years in low and middle-income countries skip breakfast, and 59 percent of adolescents purchase food out of home and enjoy snacking regularly.[8] Hemoglobin levels were significantly lower among people who skip breakfast than people who eat breakfast regularly,[9] thus skipping meals and snacking habits are considered to be determinant factors of anemia in adolescents.[10] Consumption of snacks apparently gives considerable contribution to total daily energy intake. Foods or snacks obtained from the outside home contribute 30.5 percent of the total daily intake of children in Australia, 25 percent in America, and 32.5 percent in the United Kingdom.[11] Increasing consumption of snacks and foods outside of home is associated with increased energy intake but decreased micronutrient components such as iron, vitamin A, vitamin B, vitamin E, and phosphorus.[12] A similar result show that consumption of snacks and food outside of home is associated with lower iron intake and appeared consistent with lower hemoglobin levels.[11]

Islamic boarding school is the most common form of boarding school in Indonesia and the prevalence of anemia in Islamic boarding school is varies. Some research reported the prevalence of anemia among santriwati (female students in Islamic boarding school) in Jombang was 57 percent,[13] in Bogor was 38,1 percent,[14] meanwhile in Yogyakarta was 20 percent[15] and 58.3 percent.[16] There are 347 Islamic boarding school located in Special Region of Yogyakarta, one among the largest is located in urban area Krapyak, Bantul, Yogyakarta. There was limited research related to the relationship between eating out of the home and anemia in adolescent girls who live in urban located Islamic boarding schools, thus the author was interseted to figure the meal pattern among the boarders. This study aimed at providing information about meal skipping and eating out of dormitory habits among boarders, and their relationship with anemia. This study is part of the umbrella research "Determinan of Anemia among Adolescent Girls at Islamic Boarding School". The result of this study is expected to provide information, as consideration for combating anemia among adolescents.

METHODS

This study was an observational study with a cross-sectional design. Primary data were used and collected from December 2021 – April 2022 located at Ali Maksum Islamic Boarding School. The location was selected for it's urban characteristic, offered varies foodstreet options beside the main food provided by the boarding school. Inclusion criteria were female students and willing to took part during the research, and the exclusion criteria were having chronic illness. Subjects were selected by total sampling (figure 1.). A total of 165 respondents were selected, 163 female students completed the study, while two respondents dropped out due to the inability to follow the data collection process.

The independent variables were intake from outside dormitory (energy and iron) and meal skipping (breakfast, lunch, dinner).

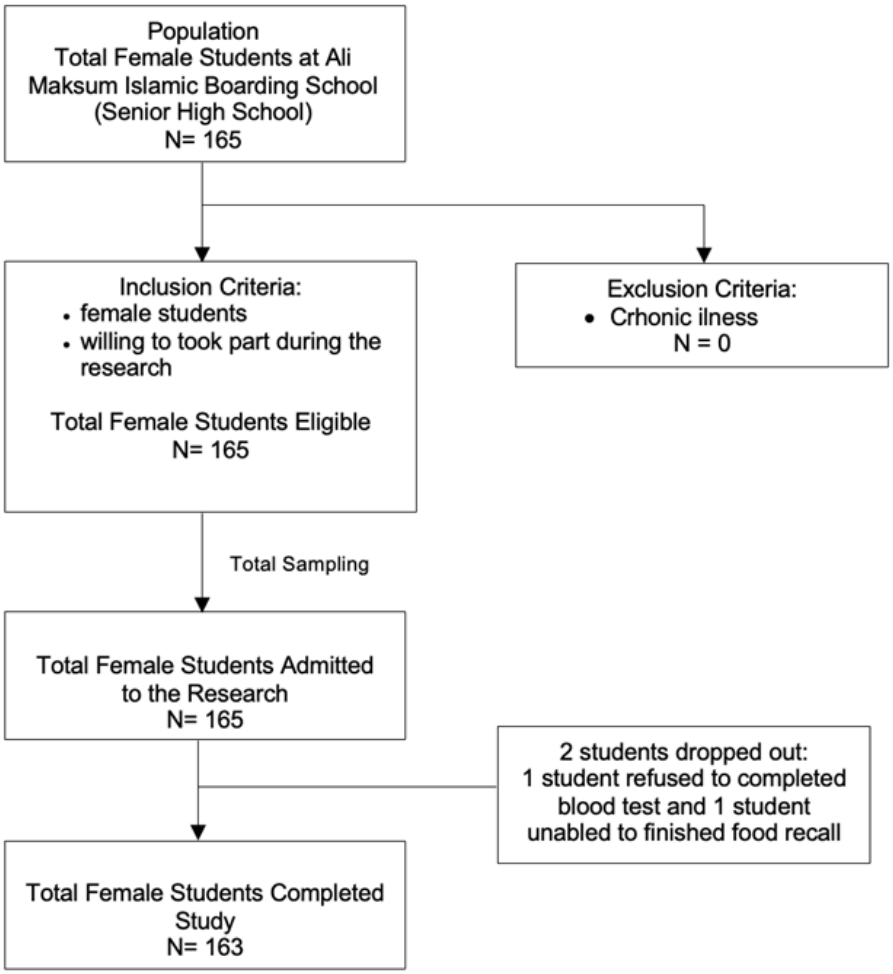

Figure 1

Sampling Process

Variable intake from outside dormitory is calculated from the percentage of energy and Fe intake obtained from outside dormitory compared to the total daily intake and categorized based on quartiles of data (Q1, Q2, Q3, and Q4). Meal skipping is defined as not consuming food between the period of breakfast time (00.00-11.00), lunch time (11.00-17.00), and dinner time (17.00-00.00), with a minimum energy of 50 kcal.[6] The output is dichotomy classified as "Yes" and "No". Daily intake data were collected by six days 24-hour food recall and analyzed using the nutrisurvey software, while the meal skipping data was collected for 2 days, including holidays and school days. The dependent variable was anemia status, obtained by measuring hemoglobin from venous blood vessel and analyzed using an Automated Hematology Analyzer (AHA) at Regional Health Laboratory. The external variables such as iron enhancers and inhibitors, consumption of Fe supplements, meal frequency and nutritional status were collected and analyzed to assess the potential confounding factor. Bivariable analysis of the relationship between intake outside the dormitory and meal skipping with anemia was performed using the chi-square test, and multivariable analysis was performed using multiple logistic regression using the STATA version 16 application.

Table 1

Distribution of Characteristic of Sociodemographic and Information Access

Characteristics	n	%
Age (years old)		
13-15	45	27.6
16-18	118	72.4
Parent's Occupation		
Working	160	98.2
Non-Working	3	1.8
Pocket Money		
< median (Rp.600.000,-)	76	46.6
≥ median (Rp.600.000,-)	87	53.4
Mother's Education		
High	138	84.7
Low	25	15.3
Social Media Access		
No	85	52.2
Yes	78	47.8
Internet Access		
No	79	48.5
Yes	84	51.5

RESULT

The prevalence of anemia in adolescent girls at SMA Ali Maksum was 20.3 percent. Table 3 shows no significant difference in the characteristics of the age group, parents' occupation, mother's education, pocket money, internet, and social media access (p>0.05). The majority of parents were working and the mothers were highly educated. Most of the respondents had access to the internet and social media. Table 2 shows no significant association between intake of iron enhancers (vitamin A, vitamin C and zinc), iron inhibitors (calcium and fiber), meal frequency, consumption of iron supplements, and nutritional status. Although not statistically significant, the odds ratio of anemia is higher among overweight and obese adolescent girls.

Table 6 shows association between energy intake from outside dormitory and anemia (P<0.05). Anemia was found 3.6 times (OR 3.6, 90% CI 1.4-9.3) in the group of Q2 and 4.4 times (OR 4.3, 90% CI 1.5-12.1) in the group of Q2. The odds ratio for anemia appeared to be higher in the larger percentage of energy intake from outside dormitory group. Fe intake from outside dormitory was significantly associated with anemia. It was found 4.8 times higher (OR 4.8, 90% CI 1.5-15.1) in the Q3 group compared to the Q1 group. Meanwhile, anemia was found 70 percent lower (OR 0.3, 90% CI 0.1-0.6) in the group of breakfast-skippers compared to non-skippers (p-value 0.010). Lunch and dinner skipping were not significantly associated with anemia. Multivariable analysis between dependent, external, and independent variables shown in table 8. After considering variables nutritional status and vitamin C intake, the energy intake outside dormitory and meal skipping remained significantly associated with anemia (p-value 0.017 and 0.009), while variables Fe from outside dormitory became insignificant (p-value 0.726).

Table 2

Average Haemoglobin Level

Variable	Mean ± SD
Haemoglobin level (g/dL)	12.8 ± 1.2

Table 3

Characteristic of Sociodemographic and Information Access by Anemic Status

Characteristic	Anemic Status			χ^2	p-value
	Anemic n (%)	Non-Anemic n (%)	Total n (%)		
Age (years old)				0.679	0.410
13-15	11 (33.3%)	34 (26.2%)	45 (27.6%)		
16-18	22 (66.7%)	96 (73.8%)	118 (72.4%)		
Parent's Occupation				0.776	0.378
Working	33 (100.0%)	127 (97.7%)	160 (98.2%)		
Non-Working	0 (0.0%)	3 (2.3%)	3 (1.8%)		
Pocket Money				0.057	0.811
< median (Rp.600.000,-)	16 (48.5%)	60 (46.2%)	76 (46.6%)		
≥ median (Rp.600.000,-)	17 (51.5%)	70 (53.8%)	87 (53.4%)		
Mother's Education				0.329	0.566
High	29 (87.9%)	109 (83.8%)	138 (84.7%)		
Low	4 (12.1%)	21 (16.2%)	25 (15.3%)		
Social Media Access				0.489	0.485
No	19 (57.6%)	66 (50.8%)	85 (52.2%)		
Yes	14 (42.4%)	64 (49.2%)	78 (47.8%)		
Internet Access				0.000	0.998
No	16 (48.5%)	63 (48.5%)	79 (48.5%)		
Yes	17 (51.5%)	67 (51.5%)	84 (51.5%)		

Analisys using chi-square: * p<0.05, ** p<0.01, *** p<0.001

DISCUSSION

The majority of the respondents have insufficient intake of nutrition and far below the recommendation of nutritional adequacy rate (RDA). Respondents dominantly obtained their nutrition intake from outside the dormitory. About 59.1 percent of energy and 70.6 percent of Fe intakes came from purchased food and snacks. Furthermore, foods which widely accessed from outside the dormitory are usually high in energy content, sugar, and saturated fat,[17,18] but significantly lower in Fe, calcium, and vitamin C, compared to food prepared from home.[19] The nutrient density intake significantly increased for the component of energy, carbohydrates, sugar, protein, and saturated fat, but significantly decreased in fiber and iron intake, along with the greater intake of food from outside of home.[17] As the consequence, the risk of anemia became greater as shown in this result that the odds ratio for anemia appeared to be higher along with larger percentage of out-of-house energy intake.

Table 4

Meal Pattern of Respondents

Meal Pattern	n (163)	% Total Respondents
Access food from outside dormitory		
No/Never	2	1.2
Yes	161	98.8
Frequency of eating out of dormitory		
Never	2	1.2
1 time	27	16.6
2 times	75	46.0
3 times	49	30.1
4 times	9	5.5
≥ 5 times	1	0.6
Meal Skipping		
No	68	41.7
Yes	95	58.3
Time of *Meal Skipping*		
Breakfast	25	15.3
Lunch	56	34.4
Dinner	34	20.9

Table 5

Average Nutrition Intake of Female Adolescents

Nutritional Substances	Nutrition Intake	Percentage of Nutritional Adequacy Rate (%)	Nutritional Adequacy	
	median (min-max)	median (min-max)	Less Adequate n (%)	Adequate n (%)
Energy (kkal)	1464.9 (757.70-2295.9)	69.9 (36.1-109.3)	126 (77.3)	37 (22.7)
Iron (mg)	6.8 (2.4-22.4)	45.3 (16-149.3)	159 (97.6)	4 (2.4)
Iron Enhancers				
Vitamin C (mg)	24.7 (2-339.3)	33.1 (2.7-452.4)	142 (87.1)	21 (12.9)
Vitamin A (µg)	873.6 (128.2-2237.2)	145.6 (21.4-372-9)	24 (14.7)	139 (85.3)
Zinc (mg)	5.5 (2-9.5)	60.9 (22.2-105.7)	145 (89.0)	18 (11.0)
Iron Inhibitors				
Calcium (mg)	259.5 (57.7-2538.7)	21.6 (4.8-211.4)	159 (97.6)	4 (2.4)
Fiber (gr)	6.7 (2.6-22.2)	23.0 (9.0-76.3)	163 (100.0)	0 (0.0)

Nutritional Adequacy: less adequate when intake <80%, Adequate when intake ≥ 80%

Table 6

Association between Intake from Outside Dormitory and Meal Skipping with Anemia

Variables	Anemia Status			OR (90% CI)
	Anemic	Non-Anemic	Total	
	N (%)	N (%)	N (%)	
Total	33 (20.2)	130 (79.8)	163 (100.0)	
Intake from Outside Dormitory				
Energy				
≤ 20% daily intake	2 (6.1)	1 (0.8)	3 (1.8)	1.0
> 20% daily intake	31 (93.9)	129 (99.2)	160 (98.2)	8.3 (1.1-64.0)
Energy per quartil				
0 -47% daily intake (Q1)	13 (39.4)	27 (20.8)	40 (24.5)	1.0
47-59% daily intake (Q2)	5 (15.2)	37 (28.5)	42 (25.8)	3.6 (1.4-9.3)*
59-76% daily intake (Q3)	4 (12.1)	36 (27.7)	40 (24.5)	4.3 (1.5-12.1)*
≥ 76% daily intake (Q4)	11 (33.3)	30 (23.0)	41 (25.2)	1.3 (0.6-2.9)
Iron				
≤ 20% daily intake	0 (0.0)	0 (0.0)	0 (0.0)	1.0
> 20% daily intake	33 (100.0)	130 (100.0)	163 (100.0)	1.0
Iron per quartil				
0 -55% daily intake (Q1)	11 (33.3)	29 (22.3)	40 (24.5))	1.0
56-70% daily intake (Q2)	8 (24.2)	33 (25.4)	41 (25.2)	1.6 (0.7-3.7)
70-84% daily intake (Q3)	3 (0.1)	38 (29.2)	41 (25.2)	4.8 (1.5-15.1)*
≥ 84% daily intake (Q4)	11 (33.4)	30 (23.1)	41 (25.1)	1.0 (1.5-4.7)
Meal Skipping				
Skipping Breakfast				
No	23 (69.70	115 (88.5)	138 (84.7)	1.0
Yes	10 (30.3)	15 (11.5)	25 (15.3)	0.3 (0.1-0.6)*
Skipping Lunch				
No	24 (72.7)	83 (63.8)	107 (65.6)	1.0
Yes	9 (27.3)	47 (36.2)	56 (34.4)	1.5 (0.7-3.1)
Skipping Dinner				
No	27 (81.8)	102 (78.5)	129 (79.1)	1.0
Yes	6 (18.2)	28 (21.5)	34 (20.9)	1.2 (0.5-2.8)

OR: *Odds ratio,* 90% *Confidence Interval,* *p<0.05, **p<0.01, ***p<0.001

Iron intake from outside the dormitory appeared to show significant relationship with anemia, for the group of Q3 (70-84% total daily intake). Adolescents frequently choose bread, sweet foods and drinks, sandwiches with processed meat or vegetables, noodles soups, and fruit as food preferences from outside of home, meanwhile, adolescents consume more meat, eggs, stir-fried vegetables, and rice with meat dishes at home.[17] Food prepared from home likely provides more heme iron source, and rich in vitamin C which optimizes iron absorption and reduces the risk of anemia. On the contrary, adolescents who consume higher iron sources from outside home, are possibly at higher risk of developing anemia due to the low bioavailability of iron.[20] The odds ratio of anemia among breakfast skippers is significantly lower than non-breakfast skippers.

Tabel 7

Analisys of Potential Confounding Variables with Anemia

Variables	Anemia Status			OR (90% CI)
	Anemic N (%)	Non-Anemic N (%)	Total N (%)	
Total	33 (20.2)	130 (79.8)	163 (100.0)	
Iron Enhancer				
Vitamin A				
Adequate	29 (87.9)	110 (84.6)	139 (85.3)	1.0
Inadequate	4 (12.1)	20 (15.4)	24 (14.7)	1.3 (0.5-3.5)
Vitamin C				
Adequate	2 (6.1)	19 (14.6)	21 (12.9)	1.0
Inadequate	31 (93.9)	111 (85.4)	142 (87.1)	0.4 (0.1-1.3)
Zinc				
Adequate	5 (15.1)	13 (10.0)	18 (11.0)	1.0
Inadequate	28 (84.9)	117 (90.0)	145 (89.0)	1.6 (0.6-4.1)
Iron Inhibitor				
Calsium				
Adequate	0 (0.0)	4 (3.1)	4 (2.5)	1.0
Inadequate	33 (100.0)	126 (96.9)	159 (97.5)	1.0
Dietary Fiber				
Adequate	0 (0.0)	0 (0.0)	0 (0.0)	1.0
Inadequate	33 (100.0)	130 (100.0)	163 (100.0)	1.0
Meal Frequency				
<3 times	8 (24.2)	38 (29.2)	46 (28.2)	1.0
3-4 times	22 (66.7)	70 (53.9)	92 (56.4)	0.7 (0.3-1.4)
>4 times	3 (9.1)	22 (16.9)	25 (15.4)	1.5 (0.5-5.1)
Iron Supplement				
Yes	10 (30.3)	31 (23.8)	41 (25.2)	1.0
No	23 (69.7)	99 (76.2)	122 (74.8)	1.4 (0.7-2.8)
Nutrition Status				
Normal	25 (75.8)	81 (62.3)	106 (65.0)	1.0
Overweight	6 (18.2)	25 (19.2)	31 (19.0)	1.3 (0.6-3.0)
Obesity	2 (6.0)	24 (18.5)	26 (16.0)	3.7 (1.0-13.1)

OR: *Odds ratio,* 90% *Confidence Interval,* *p<0.05, **p<0.01, ***p<0.001

This result appears contradictory to various previous studies and should be carefully interpreted. Adolescents and kids who skip breakfast are likely to be hungrier and consume more food in the next meal period as compensation.[17] In addition, adolescents tend to skip breakfast after having late dinner or bedtime snacks,[21] thus there is no significant difference in nutrition intake among brekafast skipper and non-skipper. Meal frequency and skipping meals more than one time a day, need to be investigated to provide better analysis in the future. A study mentioned that nutritional intake per meal time varies greatly, thus instead of meal skipping, the characteristics of food consumed probably have more influence on anemia.[22] Eventually, the preventive effect of skipping breakfast remains inconclusive.

Table 81

The Result of Multivariable Analisys

Variables	Anemia Status			AOR (90% CI)	P-value
	Anemic n (%)	Non-Anemia n (%)	Total n (%)		
Total	33 (20.2)	130 (79.8)	163 (100.0)		
Intake from Outside Dormitory					
Energy per quartil					
0 -47% daily intake (Q1)	13 (39.4)	27 (20.8)	40 (24.5)	1.0	
47-59% daily intake (Q2)	5 (15.2)	37 (28.5)	42 (25.8)	15.8 (2.4-105.9)	0.017*
59-76% daily intake (Q3)	4 (12.1)	36 (27.7)	40 (24.5)	8.7 (1.1-67.5)	0.084
≥ 76% daily intake (Q4)	11 (33.3)	30 (23.0)	41 (25.2)	4.6 (0.3-62.7)	0.336
Iron per quartil					
0 -55% daily intake (Q1)	11 (33.3)	29 (22.3)	40 (24.5)	1.0	
56-70% daily intake (Q2)	8 (24.2)	33 (25.4)	41 (25.2)	0.2 (0.02-1.1)	0.123
70-84% daily intake (Q3)	3 (0.1)	38 (29.2)	41 (25.2)	0.6 (0.07-5.4)	0.726
≥ 84% daily intake (Q4)	11 (33.4)	30 (23.1)	41 (25.1)	0.3 (0.02-4.8)	0.502
Meal Skipping: Breakfast					
No	23 (69.70	115 (88.5)	138 (84.7)	1.0	
Yes	10 (30.3)	15 (11.5)	25 (15.3)	0.2 (0.09-0.6)	0.009*
Nutrition Status					
Normal	25 (75.8)	81 (62.3)	106 (65.0)	1.0	
Overweight	6 (18.2)	25 (19.2)	31 (19.0)	1.5 (0.6-3.8)	0.434
Obesity	2 (6.0)	24 (18.5)	26 (16.0)	3.7 (1.0-14.3)	0.105
Vitamin C					
Adequate	2 (6.1)	19 (14.6)	21 (12.9)	1.0	
Inadequate	31 (93.9)	111 (85.4)	142 (87.1)	0.2 (0.04-1.1)	0.126

AOR: *Adjusted Odds ratio,* 90% *Confidence Interval,* Pseudo R2 0.156, *p<0.05, **p<0.01, ***p<0.001

Iron enhancers and inhibitors intake, meal frequency, and nutritional status were not significantly associated with anemiaThis result was quite different from many previous studies. Numerous research found significant interactions between iron and micronutrient enhancers and inhibitors using in vivo experimental study designs, while in this research, the author cross-sectionally observed the relationship between nutrient enhancers and inhibitors through food intake. In addition, one type of food often contains both iron enhancers and inhibitors, therefore the direct effect of these substances on iron absorption and anemia was difficult to prove.[23]

This study has several limitations, firstly, the limited number of samples due to the impact of the Covid-19 pandemic restriction policy. The limited number of respondents will widen the study's confidence level, consequently, there were possibilities that many risk factors will be statistically insignificant although theoretically have influence.[24] Secondly, the 24-hour food recall method is very dependent on the memory, honesty of the respondents, and the estimation of the food consumed.[10] Some respondents were unable to fully state the composition and cooking methods of food purchased from outside dormitory, especially for unbranded ready-to-eat foods such as sushi, tempura, or seblak, thus prone to under-or over-reporting. Furthermore, the long recall period (6 days) can cause respondents to feel bored. However, the biases were expected to be limited because the team researcher hold similar nutrition education backgrounds and knowledge to perform 24-hour food recall. In addition, the team also used food model tools to obtain higher accuracy for estimating food intake.

CONCLUSION AND RECOMMENDATION

Conclusion

The majority of respondents have poor nutritional intake, have a meal skipping habit, and most of their nutritional intake comes from outside the dormitory. The large proportion of intake from outside dormitory and meal skipping habits are still considered unhealthy and may lead to broader nutrition problems such as obesity[6], therefore respondents, the school administrator, and the government institutions could take serious effort to prevent anemia as well as other nutrition problem at Islamic boarding school.

Recommendation

The dietary quality, food preference, and food service satisfaction in boarding school are important topics for further research by academics or educational institutions. The school administrator of Islamic boarding schools is encouraged to make prevention efforts by optimizing the function of health services for anemia such as screening and building commitment to improve the quality of food supply and school canteens. Government and private institutions can establish prevention programs that are more closely related to adolescent eating habits, such as education on choosing nutrient-dense foods and snacks, or developing and providing fortified snacks products for adolescents.

ACKNOWLEDGMENT

The authors mainly wish to thank the academic supervisor as well as the lead team researcher who provided funding and guidance for this research; and the Indonesia Endowment Funds for Education (LPDP) for the opportunities and provided funding to pursue postgraduate study at Universitas Gadjah Mada.

REFERENCES

1. Stevens GA, Finucane MM, De-Regil LM, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: A systematic analysis of population-representative data. *Lancet Glob Heal*. 2013;1(1):16-25. doi:10.1016/S2214-109X(13)70001-9
2. Mahan KL, Raymond JL. *Krause's Food & The Nutrition Care Process*. Vol 51. 14th Editi. Elsevier; 2017.
3. Indriasari R, Fitayani NS, Mansur MA, Tunru A. Alarming nutrition problems among adolescent students attending islamic boarding school in Indonesia. *Enferm Clin*. 2020;30:44-47. doi:10.1016/j.enfcli.2019.10.037
4. Blum LS, Mellisa A, Kurnia Sari E, et al. In-Depth Assessment of Snacking Behaviour in Unmarried Adolescent Girls 16–19 Years of Age Living in Urban Centres of Java, Indonesia. *Matern Child Nutr*. 2019;15(4):1-12. doi:10.1111/mcn.12833
5. Chen Q, Pei C, Zhao Q. Eating more but not better at school? Impacts of boarding on students' dietary structure and nutritional status in rural Northwestern China. *Sustain*. 2018;10(8). doi:10.3390/su10082753
6. Agustina R, Nadiya K, El Andini A, et al. Associations of meal patterning, dietary quality and diversity with anemia and overweight-obesity among Indonesian schoolgoing adolescent girls in West Java. *PLoS One*. 2020;15(4):1-19. doi:10.1371/journal.pone.0231519
7. Rachmi CN, Jusril H, Ariawan I, Beal T, Sutrisna A. Eating Behaviour of Indonesian Adolescents: A systematic Review of The Literature. *Public Health Nutr*. 2020;24(Lmic). doi:10.1017/S1368980020002876
8. Keats EC, Rappaport A, Jain R, Oh C, Shah S, Zulfiqar A. Diet and Eating Practices Among Adolescent Girls Countries: a Systematic Review. *Strength Partnerships, Results, Innov Nutr Glob Proj*. 2018;(February):1-166.
9. Sayed SF, Nagarajan S. Haemoglobin Status to Determine Nutritional Anaemia and Its Association with Breakfast Skipping and BMI Among Nursing Undergraduates of Farasan Island, KSA. *J Nutr Sci*. 2022;11(7):1-11. doi:10.1017/jns.2022.33
10. Wiafe MA, Apprey C, Annan RA. Patterns of Dietary Iron Intake, Iron Status, and Predictors of Haemoglobin Levels among

Early Adolescents in a Rural Ghanaian District. Md Akim A, ed. *J Nutr Metab*. 2020;2020:3183281. doi:10.1155/2020/3183281
11. Fayet-Moore F, McConnell A, Kim J, Mathias KC. Identifying Eating Occasion-Based Opportunities to Improve The Overall Diets of Australian Adolescents. *Nutrients*. 2017;9(6):1-16. doi:10.3390/nu9060608
12. Mitsopoulou A V., Magriplis E, Dimakopoulos I, et al. Association of Meal and Snack Patterns with Micronutrient Intakes Among Greek Children and Adolescents: Data from The Hellenic National Nutrition and Health Survey. *J Hum Nutr Diet*. 2019;32(4):455-467. doi:10.1111/jhn.12639
13. Sya`Bani IRN, Sumarmi S. Hubungan Status Gizi Dengan Kejadian Anemia pada Santriwati di Pondok Pesantren Darul Ulum Peterongan Jombang. *J Keperawatan Muhammadiyah*. 2016;1(1):8-15.
14. Ekayanti I, Rimbawan R, Kusumawati D. Faktor Risiko Anemia Pada Santri Putri di Pondok Pesantren Darusalam Bogor. *Media Gizi Indones*. 2020;15(2):79. doi:10.20473/mgi.v15i2.79-87
15. Chibriyah R. Hubungan Pola Makan dan Aktivitas Fisik Terhadap Kadar Hemoglobin Santriwati Pondok Pesantren Al-Munawwir Krapyak Bantul. *Naska Publ*. Published online 2018:12.
16. Hidayah SM. Faktor-Faktor yang Berhubungan dengan Kejadian Anemia pada Santri Pondok Pesantren Fadlun Minalloh Yogyakarta. *J Ilm Ilmu Keperawatan dan Ilmu Kesehat Masy*. 2018;13(1).
17. Vandevijvere S, Lachat C, Kolsteren P, Van Oyen H. Eating out of home in Belgium: Current situation and policy implications. *Br J Nutr*. 2009;102(6):921-928. doi:10.1017/S0007114509311745
18. Llanaj E, Adany R, Lachat C, D'Haese M. Examining Food Intake and Eating Out of Home Patterns Among University Students. *PLoS One*. 2018;13(10):1-14. doi:10.1371/journal.pone.0197874
19. Lachat C, Nago E, Verstraeten R, Roberfroid D, Van Camp J, Kolsteren P. Eating out of home and its association with dietary intake: A systematic review of the evidence. *Obes Rev*. 2012;13(4):329-346. doi:10.1111/j.1467-789X.2011.00953.x
20. Ghose B, Yaya S. Fruit and vegetable consumption and anemia among adult non-pregnant women: Ghana Demographic and Health Survey. *PeerJ*. 2018;2018(2):1-16. doi:10.7717/peerj.4414
21. Okada C, Imano H, Muraki I, Yamada K, Iso H. The Association of Having a Late Dinner or Bedtime Snack and Skipping Breakfast with Overweight in Japanese Women. *J Obes*. 2019;2019. doi:10.1155/2019/2439571
22. Matsumoto M, Hatamoto Y, Sakamoto A, Masumoto A, Ikemoto S. Breakfast skipping is related to inadequacy of vitamin and mineral intakes among Japanese female junior high school students: A cross-sectional study. *J Nutr Sci*. 2020;9. doi:10.1017/jns.2019.44
23. Amir S. Analisis Konsumsi Zat besi, Enhancer Zat besi dan Inhibitor Zat besi pada Ibu Hamil Berdasarkan Data Stusi Diet Total tahun 2014 Di indonesia. Published online 2017.
24. Sastroasmoro S, Ismael S. *Dasar-Dasar Metodologi Penelitian Klinis*. 4th ed. CV Sagung Seto; 2011.