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Original Research

The Relationship between Macro Nutrient Intake and the Adequacy and Nutritional Status of Santri at Pondok Tahfidz Wadil Qur'an, South Tangerang

Hubungan Asupan Zat Gizi Makro dengan Kecukupan dan Status Gizi Santri di Pondok Tahfidz Wadil Qur'an, Tangerang Selatan

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Abstract: Nutritional problems among Islamic boarding school students need more attention, because the quality of food served at the boarding school is not widely known and tends to have a monotonous menu. On the other hand, Islamic boarding school students are known to often have the habit of consuming snack foods. The purpose of this study was to determine the relationship between the intake of macronutrients in foods provided by the boarding schools and snacks bought by the students with the adequacy and nutritional status of students at the Tahfidz Wadil Qur'an Islamic Boarding School in South Tangerang. This study was a cross-Sectional study with collecting data from all students fulfilling the inclusion criteria (n=67). Data analysis used the Spearman Rank correlation test. Research. The study showed that around 14-28% of macronutrient requirements was fulfilled from snacks bought by the students, instead of food provided by the boarding school. There is a relationship between the intake of macronutrients (energy, protein, fat, and carbohydrates) in main foods and nutritional adequacy. There is a relationship between the intake of macronutrients (energy, protein, fat, and carbohydrates) in snack foods and nutritional adequacy. There is no relationship between the intake of macronutrients (energy, protein, fat, and carbohydrates) in main foods and status. There is no relationship between the intake of macronutrients (energy, protein, and carbohydrates) in snack foods and nutritional status. Research suggestion: For Islamic boarding schools Conducting routine monitoring of the nutritional status of students, and paying more attention to the variety of foods that will be given to students.

Key word: teenager, macronutrient intake, snacks, nutritional adequacy, nutritional status

1. INTRODUCTION

Adolescence is a time when there are real changes in the physical and psychological aspects of human growth and development. During adolescence experience significant changes in body composition, hormonal activity, and metabolic demands, leading to increased nutritional requirements. These heightened needs coincide with substantial physical activities, such as school and extracurricular engagements, necessitating balanced and adequate nutrition to support growth, cognitive function, and overall well-being (1). Failing to meet these nutritional demands can lead to adverse health outcomes, including stunted growth, weakened immunity, and increased susceptibility to non-communicable diseases in adulthood.

In Indonesia, addressing adolescent nutritional issues remains a significant challenge, as evidenced by the findings of the 2018 Basic Health Research (Riskesdas). Nationally, 8.7% of adolescents aged 13–15 years were categorized as underweight, while 16% were classified as overweight. In Banten Province, the prevalence of underweight adolescents in this age group was 9.1%, and the prevalence of overweight adolescents reached 13.9%. Similarly, in South Tangerang City, these rates were recorded at 8.76% and 16.07%, respectively (2). Such disparities highlight the dual burden of malnutrition, wherein undernutrition and overnutrition coexist, posing complex public health challenges.

Adolescents living in Islamic boarding schools (known as pesantren) represent a unique subset of the population. These institutions, where students typically reside and study for extended periods, play a significant role in shaping their dietary habits and nutritional outcomes. In pesantren, students' meals are generally provided by the institution, making their nutritional status heavily dependent on the quality and quantity of food served (3). Unfortunately, studies have shown that the food provided in many pesantren often fails to meet the nutritional requirements of the students. This inadequacy is attributed to several factors, including the absence of structured menu planning, limited financial resources, and heavy reliance on donations.

To compensate for these deficits, students frequently consume snacks purchased from the pesantren canteen or local vendors. These snacks, while readily available and affordable, often consist of high-calorie, nutrient-poor items such as fried foods, sugary drinks, and processed snacks (4). While these foods may temporarily satisfy hunger, they do not contribute meaningfully to meeting daily nutritional needs. Moreover, excessive reliance on such snacks can exacerbate the risk of overnutrition and diet-related health problems.

The nutritional challenges faced by pesantren students are exemplified in a study by Nurwulan (2017) conducted at a boarding school in Sukabumi, which found that 30.3% of students had abnormal nutritional statuses, including 15 students with undernutrition and 8 students with overnutrition (5). Similar findings have been reported in other studies, underscoring the prevalence of both insufficient and excessive nutrient intake among pesantren students. Despite these findings, limited research has been conducted to evaluate the specific contributions of institutional meals and snacks to the nutritional adequacy and health outcomes of students in boarding schools. This gap in research hinders the development of targeted interventions to improve the nutritional well-being of pesantren students.

Pondok Tahfidz Wadil Qur'an, an Islamic boarding school located in South Tangerang, Banten Province, serves as a case study for exploring these issues. The pesantren accommodates approximately 80 students aged 12–20 years, all of whom rely on the institution for their primary meals. Preliminary observations indicate several challenges in the food provision system at the pesantren. Meals are prepared by a single cook without the guidance of a nutritionist, and menu planning is absent. Additionally, portioning is imbalanced, with a lack of variety and insufficient inclusion of animal protein. For instance, students reportedly receive animal-based protein sources only 2–3 times per week, while meals predominantly consist of vegetables and plant-based dishes.

The absence of systematic menu planning and adequate protein intake has observable consequences. Initial research revealed that students' nutritional statuses were

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distributed as follows: 26.7% of students were undernourished, 26.7% had normal nutritional status, and 46.6% were overweight or obese. These findings highlight the urgent need for interventions to address the nutritional deficiencies and imbalances in the pesantren's food system.

In addition to institutional meals, students at Pondok Tahfidz Wadil Qur'an frequently purchase snacks from the boarding school's canteen. On average, students buy snacks 3–4 times daily, often opting for items such as fried bananas, cilok (tapioca balls), and packaged snacks. These snacks, while providing a source of energy, contribute minimally to the intake of essential nutrients such as protein and vitamins. Furthermore, the repetitive consumption of nutrient-poor snacks may contribute to the rising prevalence of overnutrition observed among the students.

Despite the critical role of dietary intake in shaping nutritional outcomes, limited research has examined the combined impact of institutional meals and snacks on the nutritional adequacy and status of pesantren students. While studies have highlighted the inadequacies in institutional food and the overconsumption of snacks, the interaction between these two sources of intake and their collective influence on nutritional outcomes remains underexplored. This knowledge gap represents a significant barrier to developing evidence-based recommendations for improving the dietary practices of pesantren students.

To address this gap, the present study aims to evaluate the relationship between macronutrient intake from institutional meals and snacks with the nutritional adequacy and status of students at Pondok Tahfidz Wadil Qur'an in South Tangerang. By analysing the dietary patterns and nutritional outcomes of these students, the study seeks to provide insights into the contributions of different food sources to overall dietary quality. The findings are expected to inform the development of interventions aimed at optimizing meal provision and snack consumption in pesantren settings, ultimately contributing to the improved health and well-being of students.

2. METHODS

This cross-sectional study was conducted at the Tahfidz Wadil Qur'an Islamic Boarding School, Setu District, South Tangerang City, Banten Province and was carried out in July 2024. Sample selection was based on pre-determined inclusion and exclusion criteria. The inclusion criteria included students who were apparently healthy, able to communicate, following the sunnah fasting which was institutionalized by the boarding schools and consent to be respondents. All 67 students in the boarding school fulfilling the inclusions criteria was included in the study.

Anthropometric, sociodemographic and dietary data was collected in this study. Height measurement was conducted by researchers using microtoise and weight measurement used digital scales. Height and weight measurement was converted into BMI for age using WHO Anthro Plus Application.

Sociodemographic and dietary data was collected using direct interview. Dietary intake was assessed by 2 times 24-hour recall (2x24h-recall) during fasting days and non-fasting days in the boarding school. During the 2x24h-recall students were asked to enumerate all food ingested in the previous days from waking up to sleep again at night and identify which food were provided by the boarding school and which were snacks bought by the students in the school canteens. To assist in portion estimation,

Food Photograph was used Center for Applied Health Technology and Clinical Epidemiology, Ministry of Health of Indonesia 2014. Conversion from food to nutrients was conducted by Nutrisurvey software using the Indonesian Food Composition database TKPI 2020. In the case where food is not available in the database, recipe approach was used.

Data were then processed using the IBM SPSS 24. Correlation between variables was analyzed using Spearman rank correlation test analysis because all data showed non-normal distributions. Research ethics is provided by the university Muhammadiyah Purwokerto ethics committee.

3. RESULTS

Characteristics of Respondents

Based on Table 1, it is known that the age of most of the respondents in the sample is 15 years old with a total of 38 respondents (56.7%). Then it is known that most of the father's jobs are private employees with a total of 21 respondents (31.3%) and the mother's job as a housewife 48 respondents (71.6%). For father's education, 39 respondents (58.2%) graduated from high school, and 14 respondents (20.9%) graduated from college, while for mother's education 45 respondents (67.2%) graduated from high school and 6 respondents (9.0%) graduated from college. then for nutritional status the majority of respondents have normal nutritional status (86.6%).

Table 1. Sociodemographic characteristics of respondents

Characteristics	Frequency (n)	Percentage (%)
Age		
13 Years	16	23,9
14 Years	13	19,4
15 Years	38	56,7
Father's Job		
Farmer	8	11,9
Civil servants	4	6,0
Private employee	21	31,3
Self-employed	18	26,9
Laborer	3	4,5
Not working	4	6,0
Others	9	13,4
Mother's Job		
Farmer	2	3,0
Civil servants	4	6,0
Private employee	2	3,0
Self-employed	8	11,9
Honorary Staff	3	4,5
Not working/Housewife	48	71,6
Father's Education		
Elementary School	10	14,9
Junior High School	4	6,0
Senior High School	39	58,2
Collage	14	20,9
Mother's Education		
Elementary School	10	14,9
Junior High School	6	9,0

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Senior High School	45	67,2
Collage	6	9,0
Nutritional Status		
Underweight	2	3,0
Normal	58	86,6
Overweight	7	10,4
Total	67	100

Contribution of Intake from Islamic Boarding Schools and Snacks

Energy and macronutrient intake in this study were obtained using the 2x24-hour food recall method. Based on tables 2, for food provided by the Islamic boarding school, the lowest energy intake data was 710.17 Kcal (35%) and the highest energy intake was 2,083.79 Kcal (102%). For protein intake, the lowest protein intake data was 18.06 g (28%) and the highest protein intake was 57.71 g (89%). For fat intake, the lowest fat intake data was 13.49 g (19%) and the highest fat intake was 34.4 g (49%). And for the respondents' carbohydrate intake, the lowest carbohydrate intake data was 127.70 g (43%) and the highest fat intake was 395.25 g (132%). Meanwhile, for snack foods purchased by respondents, the respondents' energy intake data was 148.70 Kcal (7%) and the highest energy intake was 1,398.96 Kcal (68%). For protein intake, the lowest protein intake data was 3.39 g (5%) and the highest protein intake was 25.79 g (40%). For respondents' fat intake, the lowest fat intake data was 3.38 g (5%) and the highest fat intake was 43.67 g (62%). And for carbohydrate intake, the lowest carbohydrate intake data was 13.59 g (5%) and the highest carbohydrate intake was 191.20 g (64%).

Table 2. Distribution of Intake provided by boarding schools and from Islamic Boarding Schools and Snacks bought by students

Variable	Nutrients	Median (Min - Max)		
		Islamic Boarding School	Snacks	Total
Amount of consumption	Energy (Kcal)	1.561,86 (710,17 - 2.083,79)	476,57 (148,70 - 1.389,96)	2.038,43 (858,87 - 3.473,75)
	Protein (g)	41,52 (18,06 - 57,71)	9,34 (3,39 - 25,79)	50,86 (21,45 - 83,5)
	Fat (g)	24,31 (13,49 - 34,40)	13,84 (3,38 - 43,67)	38,15 (16,87 - 78,07)
	Carbohydrate (g)	285,36 (127,70 - 395,25)	85,47 (13,59 - 191,20)	370,83 (141,29 - 586,45)
Intake Contribution to total daily intake (%)	Energy	76,19 (35 - 102)	23,25 (7 - 68)	99,44 (42 - 170)
	Protein	63,88 (28 - 89)	14,38 (5 - 40)	78,26 (33 - 129)
	Fat	34,74 (19 - 49)	19,78 (5 - 62)	54,52 (24 - 111)
	Carbohydrate	95,12 (43 - 132)	28,49 (5 - 64)	123,61 (48 - 196)

The Relationship between Macronutrient Intake (Energy, Protein, Fat, and Carbohydrate) in Islamic Boarding School Food and Nutritional Adequacy

Based on table 3 shows that the results of the Spearman Rank statistical test analysis state that there is a significant relationship between nutritional adequacy and Macronutrient Intake, namely Energy ($p = 0.000$; $r = 0.916$), protein ($p = 0.000$; $r = 0.933$), fat ($p = 0.000$; $r = 0.699$), and carbohydrates ($p = 0.000$; $r = 0.943$) from

provided by school. Tabel 3 also explains the results of the Spearman Rank statistical test analysis which states that there is a significant relationship between nutritional adequacy and Macronutrient Intake, namely Energy ($p = 0.000$; $r = 0.558$), Protein ($p = 0.000$; $r = 0.525$), Fat ($p = 0.000$; $r = 0.760$), and Carbohydrates ($p = 0.000$; $r = 0.481$) from snacks.

Table 3. Correlation between Macronutrient Intake (Energy, Protein, Fat, and Carbohydrates) provided by school and from snacks bought by students Nutrient Adequacy

Nutrient	Intake provided by school		Intake from snacks bought by students	
	r	p	r	p
Energy (Kcal)	0,916	0,000	0,558	0,000
Protein (g)	0,933	0,000	0,525	0,000
Fat (g)	0,669	0,000	0,760	0,000
Carbohydrate (g)	0,943	0,000	0,481	0,000

The Relationship between Macronutrient Intake (Energy, Protein, Fat, and Carbohydrates) in Islamic Boarding School Food and Nutritional Status

Based on table 4 shows the results of the Spearman Rank statistical test analysis which states that there is no significant relationship between nutritional status and macronutrient intake, namely Energy ($p = 0.191$; $r = 0.162$), Protein ($p = 0.367$; $r = 0.112$), Fat ($p = 0.510$; $r = 0.082$), and Carbohydrates ($p = 0.235$; $r = 0.147$) from Islamic boarding school food. Tabel 4 also explains the results of the Spearman Rank statistical test analysis which states that there is no significant relationship between nutritional status and macronutrient intake, namely Energy ($p = 0.348$; $r = -0.116$), Protein ($p = 0.130$; $r = -0.187$), and Carbohydrates ($p = 0.595$; $r = -0.066$) from snacks. However, there is a relationship between nutritional status and fat ($p = 0.034$; $r = -0.259$) from snacks.

Table 4. Correlation between Macronutrient Intake (Energy, Protein, Fat, and Carbohydrates) provided by school and from snacks bought by students Nutritional status

Nutrient	Nutrient	Intake provided by school		Intake from snacks bought by students	
		r	p	r	p
BMI for Age	Energy (Kcal)	0,162	0,191	-0,116	0,348
	Protein (g)	0,112	0,367	-0,187	0,130
	Fat (g)	0,082	0,510	-0,259	0,034
	Carbohydrate (g)	0,147	0,235	-0,066	0,595

4. DISCUSSION

In this study, the percentage of normal nutritional status (86.6%) was more dominant compared to the incidence of obesity and malnutrition. The findings of this study are similar to those conducted by Febrianti et al. (2023) at Modern Gaza Al Islami Boarding School, which also found that 64% had normal nutritional status and 35% were abnormal (a combination of over-nutritional status 32% and obesity 3%) (6). Respondent characteristics based on age are an important factor in determining nutritional status. In this study, female students aged 13-15 years had the highest percentage of normal nutrition in adolescents aged 15 years. Adolescents in this age

group have increasing nutritional needs, and lifestyle changes such as consuming a more balanced diet can affect their aspirations and food needs, which ultimately affect both (7).

The role of parents is very important for the growth and development of children by paying attention to parenting patterns and nutritional intake given to children. Family characteristics are external factors that can affect a person's nutritional status, including education, work, and family income (8). In this study, most of the sample fathers worked as private employees, while the mother's job was more dominant as a housewife. The type of work of the head of the household affects the amount of family income used to meet living needs. The better the job, the higher the family income. The high or low socioeconomic status of parents determines in choosing nutritious food, encouraging children to exercise enough, and teaching healthy living so as not to endanger health in adulthood (9).

The Ministry of Health (2012) stated that the most significant underlying causal factor is the lack of knowledge and education of parents, especially mothers, because this has a significant impact on how well individuals, families, and communities manage their resources to obtain sufficient food supplies and how well they use available health, nutrition, and environmental sanitation services (10). In this study, most of the respondents' fathers graduated from high school, as did the majority of mothers who graduated from high school.

Islamic boarding schools are one of the educational institutions that educate students to become intelligent and noble individuals. Students are essentially the same as public school students, who must grow and develop as provisions for the next generation of the nation who need extra attention, especially in terms of growth and health. Meeting the nutritional needs of students is one of the factors that play a role in this (11).

Based on the results of a 2x24-hour food recall interview conducted on 67 respondents, it is known that the provision of meals at the Tahfidz Wadil Qur'an Islamic Boarding School does not use catering services, but is directly provided by the boarding school by employing 1 cook and assisted by students of the Tahfidz Wadil Qur'an Islamic Boarding School through the available picket schedule. Based on the results of direct interviews, there is no menu planning for the students and there is also no reference in compiling the menu, what is provided by the boarding school and donors is what is processed by the students.

In line with research (Pattern & Suitability, 2023) the availability of inadequate nutrients can be caused by large portions that are not in accordance with unbalanced menu components (12). Research conducted by Bakri & Saputri, (2019) stated that limited funds can result in the food menu served being very rarely found in animal protein. Observations in this study indicate that animal protein has contributed to the protein intake of students (13).

The low fat intake of 54.52% which can be seen in Table 2, is because the menu served rarely uses the frying cooking method, and is also caused by the source of fat in animal protein. Research Anggraini & Ruhana, states that the availability of sufficient nutrients is an important thing in preparing individual nutritional needs, especially for adolescents. One of the problems experienced by the Gaza Al-Islami Modern Islamic Boarding School is the absence of a menu cycle that makes the menu repetitive so that students feel bored, so there needs to be menu planning management and menu cycles,

so that the daily needs of students can be met from the food provided by the Islamic boarding school (14).

Based on the results in Table 2, it shows that the total intake consumed from within and outside the Islamic boarding school is 2,038 kcal of energy, 50.86 grams of protein, 370.83 grams of carbohydrates and 38.15 grams of fat. The intake of energy and nutrients in Islamic boarding schools is still below 80% while the intake of energy and nutrients from outside the Islamic boarding school is above 20%. The results of this study are in line with research (Choiriyah, 2019) where students tend to prefer to buy fried foods or side dishes from outside the Islamic boarding school (15).

Based on table 3, the results of the Spearman rank correlation test showed that there was a significant relationship between energy, protein, fat, and carbohydrate intake from Islamic boarding school food and nutritional adequacy ($P < 0.05$). This is supported by the results of a 2x24-hour food recall interview which showed that adolescents living in Islamic boarding schools, the food they consume is very dependent on the food provided by the Islamic boarding school. However, the food menu served at the Islamic boarding school tends to be insufficient to meet the needs of students because all the food ingredients available at the Tahfidz Wadil Qur'an Boarding School in South Tangerang are very dependent on donations from donors who donate, so this encourages students to consume snacks to be able to complete their daily nutritional intake. The results of this study are in line with the research conducted by Sudrajat, & Sinaga, (2016) at the Darul Arqam Garut Islamic Boarding School obtained an r value (0.823) p -value ($p < 0.05$) where the management must review the financing to ensure the fulfillment of the nutritional needs of students, in addition to efforts to improve the balanced and healthy food menu for students (16).

In table 3, the results of the Spearman rank correlation test were obtained which stated that there was a significant relationship between energy, protein, fat, and carbohydrate intake from snack foods with nutritional adequacy ($P < 0.05$). This is supported by the results of a 2x24-hour food recall interview which showed that the types of snack foods often consumed by students at the Tahfidz Wadil Qur'an Boarding School in South Tangerang were Cilok (65%) and Fried bananas (25%). These results are not much different from the research conducted at SD Hj. Isriati Semarang in (2005), where these foods were also included among those often consumed by students. School-age children generally buy types of snacks that have less diverse nutritional content, namely only consisting of carbohydrates, or carbohydrates and fat (oil) (17).

In table 4, the results of the Spearman rank correlation test were obtained which stated that there was no significant relationship between energy, protein, fat, and carbohydrate intake from Islamic boarding school food and nutritional status ($P > 0.05$). The findings of this study are similar to the findings of a study conducted by Nurlabibah, et al. (2023) ($P > 0.05$) which shows that food consumption in this study does not accurately reflect the current nutritional condition of students because nutritional status is a function of past consumption and also underlying infections, so that no significant correlation was found between energy, protein, fat, and carbohydrate intake from Islamic boarding school food and current nutritional status (18).

In table 4, the results of the Spearman rank correlation test were obtained which stated that there was no significant relationship between energy, protein, and carbohydrate intake from snack foods and nutritional status ($P > 0.05$). However, there is a significant relationship between Fat intake from snacks and nutritional status. This is due to

several factors, including the type of snacks consumed, each respondent has different physical activity and has different snacking habits. The fat intake of respondents' snacks in this study was 19.78%. In addition, this can be attributed to the fact that most of the snacks purchased and consumed by respondents were like fried bananas, so that the fat intake from snacks purchased by respondents contributed to the fulfillment of total daily fat intake. The findings of this study are similar to the study conducted by Anggiruling, et al. (2019) the r value (0.257) and p-value (0.007) indicate that the selection of snacks plays an important role in children's snacking habits and the contribution of snack nutrition has an impact on children's nutritional status, so the availability of snacks in schools needs to consider the determinants of children's snack selection and the contribution of snack nutrition (19).

5. CONCLUSION

Most of the samples were 15 years old and the majority of respondents had normal nutritional status. Most of the fathers' jobs were private employees and the mothers' jobs were housewives with the last education graduated from high school. Food intake is still below daily needs. The fulfillment of students' nutritional intake is mostly obtained from within the Islamic boarding school. The results of the correlation test obtained that there is a relationship between the intake of macronutrients (energy, protein, fat, and carbohydrates) in the main food and nutritional adequacy. There is a relationship between the intake of macronutrients (energy, protein, fat, and carbohydrates) in snacks and nutritional adequacy. There is no relationship between the intake of macronutrients (energy, protein, fat, and carbohydrates) in the main food and status. There is no relationship between the intake of macronutrients (energy, protein, and carbohydrates) in snacks and nutritional status. It is recommended for Islamic Boarding Schools to routinely monitor the nutritional status of students, and pay more attention to the variety of foods that will be given to students.

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