

THE RELATIONSHIP BETWEEN FOOD PORTION SIZES AND THE INTAKE LEVELS OF ENERGY AND NUTRIENTS, AND THE NUTRITIONAL STATUS OF FEMALE STUDENTS AT EL-JASMEEN ISLAMIC BOARDING SCHOOL, SINGOSARI, MALANG REGENCY

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Abstract: *Islamic boarding schools, as boarding institutions, are responsible for fulfilling the nutritional needs of their students, especially adolescent girls who require high intake for growth. Food portions that do not meet standards can cause energy and nutrient deficits, thus impacting nutritional status. This study aims to analyze food portion sizes, energy and nutrient consumption levels, nutritional status, and the relationship between variables in female students at El-Jasmeen Islamic Boarding School. The study used a cross-sectional design with 41 respondents. Data were collected through weighing food portions for three days and 1x24-hour recalls, analyzed using the Spearman correlation test. The results showed that most staple food portions (51.2%), plant-based side dishes (78%), and all vegetable portions (100%) were insufficient. The level of energy consumption was classified as moderate deficit (36.6%), normal protein (39%), severe fat deficit (100%), normal carbohydrate (43.9%), and mild iron deficit (31.7%). Most students had normal nutritional status (90.2%). There was a significant relationship between staple food portions and energy and carbohydrate consumption levels, and plant-based side dish portions and protein consumption levels. As well as the level of energy, protein, and carbohydrate consumption with nutritional status ($p < 0.05$).*

Keywords: *Portion size, nutrient intake level, nutritional status, female students, Islamic boarding school*

INTRODUCTION

Islamic boarding schools are educational institutions aimed at developing students with noble character and intelligence (Khasanah, 2010). Most students are aged 11–18, a period marked by physical and mental changes and requiring increased nutritional intake for growth (Kusharisupeni, 2010). The physical and psychological maturity of adolescent girls, as future mothers who will determine the quality of

the nation's next generation, significantly influences their readiness to be part of a healthy family (Setyawati et al., 2022). Therefore, adolescent girls need to consume a balanced, nutritious diet containing energy, protein, iron, and folic acid to support growth, increase blood volume, form hemoglobin, and prevent anemia during menstruation (Ministry of Health, 2014).

Islamic boarding schools are fully responsible for the health and growth of their students, as they live

far from their families (Amalia, 2020). To support this, food portions must comply with serving standards at food service institutions (Arsyih *et al.*, 2019). However, in reality, food portions are often inappropriate, either excessive or insufficient, due to the lack of clear serving sizes (Ambarwati, 2016). Research conducted at the Kanjeng Sunan Kalijogo Islamic Boarding School found that all vegetable and plant-based side dishes did not meet standard serving sizes because the side dishes were cut too small and the vegetables were too few (Putri *et al.*, 2023).

Inaccurate portion sizes impact energy and nutrient consumption. Implementing a balanced diet with appropriate portions and types of food is crucial for meeting nutritional needs and achieving optimal nutritional status (Ministry of Health, 2014). However, students' nutritional adequacy is often inadequate due to limited food availability at Islamic boarding schools, resulting in unbalanced intake (Khasanah *et al.*, 2016). An unbalanced nutritional intake can impact adolescents' nutritional status, not only leading to malnutrition but also increasing the risk of overnutrition and obesity. Research at the Hubulo Islamic Boarding School in Gorontalo showed that only 52% of the recommended dietary allowance (RDA) for female students aged 13–15 years old was met, leading many to be underweight (Taqhi, 2014).

Based on a preliminary study conducted at the El-Jasmeen Islamic Boarding School provided meals for 105 students using a semi-cafeteria system, where rice and vegetables were provided by the food minister, while side dishes were distributed by the food minister. Female students were not permitted to bring in outside food, but a Jas Mart store was available for daily needs. Meals were provided directly by the boarding school without a catering service, with cooks also serving as caregivers.

Based on the above description, the researchers were interested in conducting research at the site to determine the relationship between portion size and nutrient intake and the nutritional status of female students at the El-Jasmeen Islamic Boarding School. Furthermore, no previous research had been conducted at the boarding school.

METHODS

This type of research is quantitative with descriptive observational methods and cross-sectional design. The study was conducted on December 6, 8, and 10, 2025 at the El-Jasmeen Islamic Boarding School. The study population consisted of 41 female students who received breakfast, lunch, and dinner, as well as all the menus served. The female student sample was taken using a total sampling technique (41 people), while the menu sample used purposive sampling according to the inclusion criteria, namely the menu prepared and consumed by the female students during the study, with the exclusion of special menus for allergies or those originating from outside the boarding school. The number of menu samples was nine meals during the three days of the study for 41 female students.

Portion size data was obtained through food observation and weighing, then net weight was calculated using the BDD, converted to raw weight, and compared to standard portion sizes. Data on energy and nutrient consumption levels were obtained by weighing food, converting to raw weight, then analyzing its nutritional content using the 2007 Nutrisurvey, and comparing it to the RDA for adolescent girls aged 13–18 years, plus a 24-hour recall to determine other food consumption. Nutritional status data was obtained by weighing and measuring height, then analyzed into categories of undernutrition, good nutrition, overnutrition, or obesity. Once the univariate analysis described above has been performed, the results will reveal the characteristics or distribution of each variable, and bivariate analysis can be continued. This data analysis was performed using the Spearman rank correlation statistical test.

RESULTS AND DISCUSSION

Respondent Characteristics

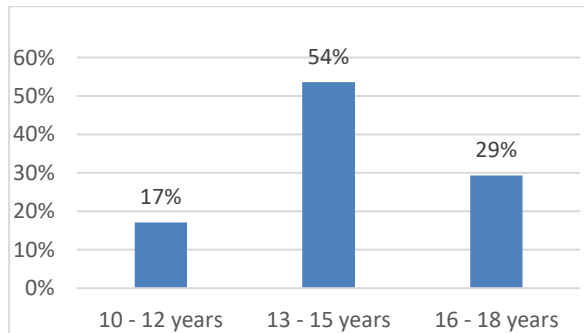


Figure 1. Respondent Characteristics

Based on Figure 1, the majority of respondents were aged 13–15 years (22 people/54%) who were generally in junior high school, while those aged 16–18 years numbered 12 people (29%) and those aged 10–12 years numbered 7 people (17%). All respondents were female students.

Portion Sizes

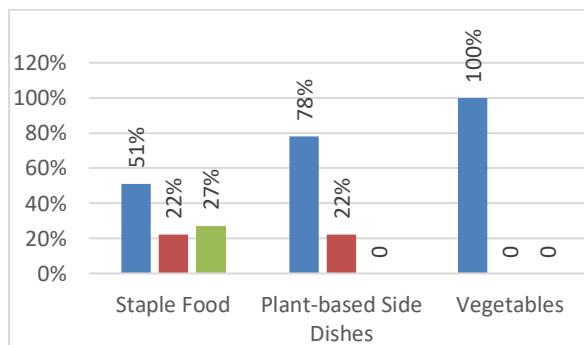


Figure 2. Portion Sizes

Based on Figure 2, most respondents consumed less staple food than they needed. This is influenced by the buffet system at El-Jasmeen Islamic Boarding School, where students help themselves to rice but are required to finish their portion to prevent waste. Fearing sanctions, some students tend to take small amounts of rice to make it easier to finish. This regulation, in addition to instilling discipline and table manners, also contributes to the finding that the majority of students consume insufficient staple food. This finding aligns with research by Crisyanti (2016) at

Al Anwar Islamic Boarding School in Mranggen, which showed that the average rice portion consumed over seven days was insufficient compared to the recommended intake for adolescent girls. That study also used a buffet system, where students helped themselves to rice and vegetables, while animal and vegetable side dishes were portioned by the cook.

The majority of respondents (78%) received less than their recommended portion of plant-based side dishes. The most frequently served plant-based side dishes were tofu and tempe, while animal side dishes were not available due to the limited cost of meals, which was only around IDR 5,000 per meal. El-Jasmeen Islamic Boarding School also does not have a standard portion size, so portioning is based on estimates. This finding aligns with Nasyithoh's (2022) study at Nurul Ihsan Cikunir Islamic Boarding School, where all respondents received less than the recommended portion size of vegetable side dishes.

All respondents (100%) received insufficient vegetable portions because they were not always available at every meal. In the morning, female students received only rice and vegetable side dishes without vegetables to save time due to their busy schedules. However, Indonesian Minister of Health Regulation No. 41 of 2014 recommends that adolescent girls aged 12–18 consume 100 g of vegetables per meal. Vegetables served at the El-Jasmeen Islamic Boarding School include cabbage and carrot soup, young jackfruit lodeh, and sour vegetables.

Energy and Nutrient Consumption Levels

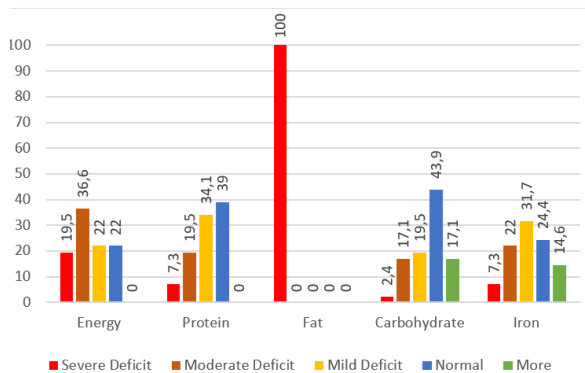


Figure 3. Energy and Nutrient Consumption Levels

Based on Figure 3, fat consumption was the lowest compared to other nutrients, with an average of 22.3 ± 2.4 grams per day, and all respondents (100%) were in the weight deficit category. This low fat consumption is thought to be due to the limited availability of animal-based foods, while vegetable side dishes such as fried tofu and tempeh only contribute small amounts of fat due to the small portion sizes.

The average energy consumption of female students was 1296 ± 217 kcal, still far below the RDA for students aged 10–18 years. Most respondents fell into the moderate deficit category. This deficit was influenced by insufficient food portions, particularly breakfast, whose portions were determined by the Minister of Food. These results align with research by Dewi (2011) at the Al-Islam Islamic Boarding School in Nganjuk and Rokhmah *et al.* (2017) at the Al-Izzah Islamic Boarding School in Batu City, which also found that the majority of students had inadequate energy intake. Energy itself is essential for growth, metabolism, and brain function, so energy deficiency can lead to weight loss, trigger nutritional deficiencies, and impact learning concentration and academic achievement (Dharmawantie, 2021).

The average protein consumption of female students was 44.1 ± 5.6 grams, with a fairly even distribution, with the majority falling into the normal (39%) and mildly deficient (34.1%)

categories. However, when combined, respondents with a protein deficit reached 60.9%, higher than those with a normal protein intake. This condition was influenced by the dominance of plant-based side dishes such as tempeh and tofu, which were limited in portion, and the absence of animal-based side dishes during the observation. However, according to the Indonesian Student Activity Unit (TKPI) (2020), animal protein such as eggs (12.4 g/egg) or chicken (18.2 g/100 g) has a fairly high protein content. The low variety of protein sources resulted in suboptimal intake for female students. This is in line with research by Fitri *et al.* (2022), which found that 62.6% of respondents had a protein deficit because they consumed more plant-based sources without balancing it with animal protein. Animal protein itself has higher nutritional quality because it contains essential amino acids that the body cannot produce, so it is recommended that one-third of protein requirements be met from animal sources. The combination of animal and plant based protein can complement the amino acid composition, for example from meat, eggs and milk (Mokoginta *et al.*, 2016).

The average carbohydrate consumption of female students was 233.5 ± 47.1 grams, with most respondents in the normal category. This condition is relatively better compared to other nutrients because rice, as a staple food, is always available, easily accessible, and preferred by students. However, there are still respondents who experience mild to moderate deficits, suspected to be due to the buffet system that makes rice portions vary according to each student's choice. Research by Rokhmah *et al.* (2017) at the Al-Izzah Islamic Boarding School in Batu City also found that 64% of respondents had inadequate carbohydrate intake due to independent staple food intake, so that the portion taken was often less than needed. Thus, even though carbohydrate availability is sufficient, portion variations and consumption habits still affect the adequacy of students' daily intake.

The average iron consumption of female students was 9.9 ± 1.3 mg, with most respondents

in the deficit category. A total of 31.7% of respondents experienced a mild deficit, 22% moderate deficit, and 7.3% severe deficit, while only 24.4% were in the normal category and 14.6% were in excess. This indicates that the majority of students have not achieved daily iron sufficiency. This condition may be caused by providing the same food portions to all students without considering differences in iron needs based on age. Students aged 10–12 years, who have lower iron needs, tend to more easily achieve sufficiency, or even excess, while students aged 13–18 years are at greater risk of experiencing a deficit. Furthermore, limited sources of iron-rich foods also influenced these results. During the observation, animal side dishes such as meat, chicken, or fish, which are the main sources of heme iron with high absorption, were not available. Vegetable sources such as nuts and green vegetables were also minimally provided, while the available vegetable portions were relatively small and not a primary source of iron. The lack of fruit as a source of vitamin C also has the potential to inhibit the absorption of plant-based iron. These factors collectively explain the low iron sufficiency of most female students (Susiloningtyas, 2011).

Nutritional Status

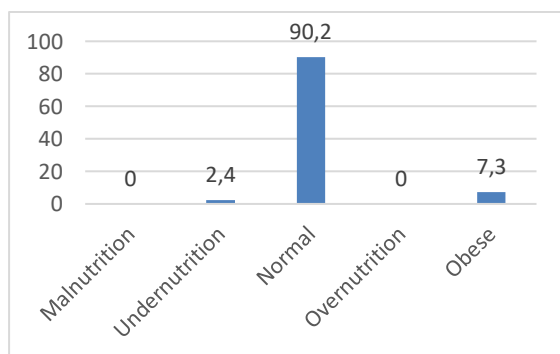


Figure 4. Nutritional Status

Overall, female students at El-Jasmeen Islamic Boarding School tend to have good nutritional status, although some cases of malnutrition, overnutrition, and obesity are still found. Energy and nutrient consumption levels from main meals (morning, noon, and evening)

show deficits, but most students still have normal nutritional status. Ideally, main meals contribute approximately 80% of daily needs, but analysis results show that energy contributes only 72%, with the remaining 28% coming from snacks. The most obvious imbalance is seen in fat, where main meals contribute only 53%, while snacks contribute 47%, indicating the important role of snacks in fat intake. The types of snacks vary, with different patterns between school days and holidays: on school days, female students more often consume bread, chips, fried foods, and packaged snacks, while on holidays, instant noodles, milk, biscuits, and high-sugar snacks are dominant. Consumption of these snacks tends to be high in energy but low in nutrients, so that the female students' daily energy and nutrition are met more from snacks than from main meals, which can explain the normal nutritional status of most respondents.

The Relationship Between Staple Food Portion Size and Energy and Nutrient Consumption Levels

Table 1. Statistical Test Results of the Relationship between Staple Food Portion Size and Energy and Nutrient Consumption Levels

Independent Variable	Dependent Variable	P-value	r
Portion size of staple foods	Energy consumption level	0.000*	0.812
	Protein consumption level	0.893	-0.022
	Fat consumption level	-	-
	Carbohydrate consumption level	0.000*	0.707
	Iron consumption level	0.560	-0.094

*significant ($p < 0.05$)

The Spearman correlation test results (Table 1) show a very strong and significant positive relationship between staple food portions and the female students' energy consumption levels ($r = 0.812$; $p = 0.000$). This means that the larger the portion of rice consumed, the higher the energy consumed. This finding emphasizes the importance of rice portions in meeting daily energy needs, especially since the buffet system allows students to determine their own portions. Rice is a major staple food for Indonesians with a high energy content. 100 g of rice contains 357 kcal, or approximately 63.1% of the daily energy requirement (TKPI). Therefore, changes in rice portion sizes significantly affect students' energy consumption levels (Dharmawantie, 2021).

Based on the Spearman correlation test in Table 1, a p-value of 0.893 was obtained with a correlation coefficient of -0.022. A p-value greater than 0.05 indicates no significant relationship between staple food portions and female students' protein consumption. A very weak negative correlation coefficient also indicates a direction of the relationship that is neither statistically nor practically relevant. These results align with research by Dharmawantie (2021), which found no significant relationship with a p-value of 0.295. This can be explained because rice is a source of energy with a high carbohydrate content but low in protein. According to the Indonesian Food and Drug Administration (TKPI), 100 grams of rice contains only 8.4 grams of protein. Protein itself is an essential nutrient in the body, the second most abundant after water, and functions to build and maintain cells and tissues, while also supporting the growth and development of school children. Generally, rice is processed into rice through a washing and cooking process. However, cooking at high temperatures can reduce the protein content and vitamins that are not heat-resistant.

Based on Table 1, the relationship between staple food portions and fat consumption could not be analyzed because all respondents were underweight, resulting in no variation in the data. Low fat intake is likely due to the unavailability of animal fat sources, limited

vegetable side dishes such as fried tempeh and tofu, and the generally clear or soupy nature of vegetables with very low fat content.

Based on Table 1, the Spearman correlation test results indicate a strong and positive relationship between staple food portion sizes and the level of carbohydrate consumption of female students ($r = 0.707$; $p = 0.000$). This means that the larger the portion of rice consumed, the higher the carbohydrate intake, and this relationship is statistically significant ($p < 0.05$). This finding aligns with research by Dharmawantie (2021), which also found a significant relationship between appropriate rice portion sizes and carbohydrate intake ($p = 0.002$). This is understandable, as rice is a primary source of carbohydrates, with 100 grams of rice containing 77.1 grams of carbohydrates.

Based on the Spearman correlation test (Table 1), a p-value of 0.560 and a correlation coefficient of $r = -0.094$ were obtained, indicating no significant relationship between staple food portion sizes and the level of iron consumption of female students. The negative and very weak correlation indicates that rice portions do not contribute significantly to iron intake. This is because rice contains only low amounts of iron, is non-heme iron with less efficient absorption, and during the observation period, animal side dishes as the main source of heme iron were not available, and vegetables were provided in limited quantities. These results align with Dharmawantie (2021), who also found no significant relationship between rice portions and iron intake. Rice does contribute approximately 21.5% of iron, but this content is easily lost during washing and cooking (Indrasari, 2016).

The Relationship Between Portion Size of Vegetable Side Dishes and Energy and Nutrient Consumption

Table 2. Statistical Test Results of the Relationship between Portion Size of Plant-Based Side Dishes and Energy and Nutrient Consumption Levels

Independent Variable	Dependent Variable	P-value	r
Portion size of plant-based side dishes	Energy consumption level	0.171	0.218
	Protein consumption level	0.022*	0.356
	Fat consumption level	-	-
	Carbohydrate consumption level	0.084	0.273
	Iron consumption level	0.071	0.285

*significant ($p < 0.05$)

Based on the Spearman correlation test (Table 2), a p-value of 0.171 and $r = 0.218$ were obtained, indicating no significant relationship between the portion of plant-based side dishes and the energy consumption of female students. The weak positive correlation indicates that a larger portion of plant-based side dishes tends to increase energy intake, although not significantly. The limited quantity and frequency of vegetable side dishes and the unavailability of animal side dishes during the study limited the increase in overall energy intake.

Based on Table 6, there is a significant positive correlation between the portion of vegetable side dishes and the protein consumption of female students ($p = 0.022$; $r = 0.356$). The larger the portion of vegetable side dishes, the higher the protein intake received by the female

students. This occurs because during the study, the main sources of protein were tofu and tempeh, which have a relatively high protein content. According to Astawan (2008), the mold in tempeh also makes nutrients such as protein easier for the body to digest.

Based on Table 2, the Spearman correlation test between plant-based side dish portion and carbohydrate consumption showed a p-value of 0.084 and $r = 0.273$, indicating it was not statistically significant, although it was weakly positive. This is understandable, as the carbohydrate content of plant-based side dishes is relatively low, at 0.8 g per 100 g of tofu and 13.5 g per 100 g of tempeh (TKPI). The portion of plant-based side dishes and iron consumption have a p-value of 0.071 and $r = 0.285$, so it is not significant even though the direction is weakly positive, because the iron content in tempeh and tofu is lower than animal sources.

The Relationship between Energy and Nutrient Consumption Levels and Nutritional Status

Table 3. Statistical Test Results of Energy and Nutrient Consumption Levels

Independent Variable	Dependent Variable	P-value	r
Energy consumption level	Nutritional status	0.171	0.218
Protein consumption level		0.022*	0.356
Fat consumption level		-	-
Carbohydrate consumption level		0.084	0.273
Iron consumption level		0.071	0.285

*significant ($p < 0.05$)

Based on Table 3, energy and nutrient consumption levels were obtained through a 24-hour recall. The Spearman test showed a

significant relationship between energy, protein, and carbohydrate consumption and the nutritional status of female students. Energy consumption had a $p = 0.001$ and $r = 0.500$, indicating a moderate positive correlation, meaning that higher energy intake tends to improve nutritional status. These results are consistent with research at the Al-Izzah Islamic Boarding School, which also found a significant relationship between energy sufficiency and nutritional status ($p = 0.049$; $r = 0.296$).

Energy is needed for basal metabolism, growth, and daily activities, and is sourced from protein, fat, and carbohydrates (Arifiyanti & Mardiyati, 2016; Emilia, 2009). Long-term energy deficiency can lead to weight loss and nutritional deficiencies (Alice, 2021). A balanced diet is achieved through a varied diet (Utama, 2017). According to the Acceptable Macronutrient Distribution Ranges (AMDR), daily energy intake comes from 10–30% protein, 25–35% fat, and 45–65% carbohydrates (Rokhmah *et al.*, 2022).

Protein consumption levels were significantly associated with nutritional status ($p = 0.010$; $r = 0.398$) with a moderate positive correlation, indicating that adequate protein intake supports good nutritional status. However, most students still experience a protein deficit due to low consumption of animal-based side dishes and low portions of plant-based side dishes. These results align with research at the Al-Izzah Islamic Boarding School, which also found a significant but weak relationship ($p = 0.028$; $r = 0.328$) (Rokhmah *et al.*, 2016). The protein contribution to total energy of 12.6% is still within the AMDR range (10–30%), but is considered low, indicating that protein intake is not optimal. Furthermore, students' snacks are dominated by low-protein snacks, such as fried foods, chips, biscuits, and instant noodles, thus contributing little to protein intake.

The correlation test results showed that fat consumption was not significantly related to the students' nutritional status ($p = 0.612$; $r = 0.082$) with a very weak correlation. Fat from main meals

only contributed 53% of the total, while 47% came from snacks such as fried foods, chips, and snacks. Although snacks were high in fat, the total contribution of fat to energy was only 22.3%, still below the AMDR range of 25–35%, so overall fat intake was insufficient.

The correlation test results showed that carbohydrate consumption was significantly related to the nutritional status of students ($p = 0.009$; $r = 0.405$) with a moderate positive correlation. The average carbohydrate consumption was 298 grams, contributing 65.5% of energy, which is within the upper limit of the AMDR recommendation (45–65%). Carbohydrates are the main source of energy from rice, bread, biscuits, instant noodles, and sweet drinks. However, some students still experience a deficit because the rice portion is taken independently using a buffet system and is influenced by Islamic dining etiquette, resulting in variations in intake that impact nutritional status.

The correlation test results showed that iron consumption was not significantly related to the nutritional status of the students ($p = 0.159$; $r = 0.224$), although the correlation was weakly positive. The average intake was only 9.9 mg, below the daily requirement for adolescent girls, putting them at risk of anemia, which can lead to decreased immunity, physical activity, and academic achievement. This deficiency was influenced by the lack of animal-based side dishes, limited iron-rich vegetables, and the absence of vitamin C-rich fruits. Therefore, although not directly related to nutritional status, iron deficiency is still important to address to prevent anemia (Soekirman, 2000).

CONCLUSIONS

The majority of respondents were aged 13–15, with the 10–12 age group having the lowest number. More than half of the respondents' staple food portions were classified as insufficient, as were most vegetable side dishes, which were insufficient, lacking all vegetables, and no animal side dishes or fruit were found during the study. Energy and nutrient consumption levels were also

largely deficient, particularly in energy and fat, although the nutritional status of the majority of female students was still within the normal category, with a small number being underweight and obese. Analysis showed that staple food portions were significantly related to energy and carbohydrate consumption, while vegetable side dish portions were related to protein, but not to other nutrients. Furthermore, energy, protein, and carbohydrate consumption levels were significantly related to nutritional status, while fat and iron consumption levels showed no significant association.

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