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Student Characteristics, Acceptability, and Suitability of Portion Standards with Recommended Dietary Allowance in School Meals at Al Furqan Primary School, Jember Regency

Karakteristik Siswa, Daya Terima, dan Kesesuaian Standar Porsi dengan Angka Kecukupan Gizi pada Penyelenggaraan Makan Siang di SD Al Furqan Kabupaten Jember

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ABSTRACT

Background: The school food program has the potential to contribute 30% of the total calories. The small size of students' lunch portions reduces their nutrient intake. SD Al Furqan Jember is an elementary school that has been implementing lunch programs for almost a decade. However, we have not yet assessed the appropriateness of the portions provided to students.
Objectives: This study aims to describe the student characteristics, acceptability, and suitability of portion standards in food provision at SD Al-Furqan Jember.
Methods: This research was descriptive and employed a cross-sectional methodology. The sample consisted of 61 respondents, while the population of this study consisted of 120 sixth-grade students who attended school lunch.
Results: The findings indicated that the nutritional status of 40 students was normal, and there was a greater number of female students than male students among the 11-12-year-old respondents. Students generally found the food to be acceptable, with the third menu being the most preferred (crisp chicken) and the eighth menu being the least preferred (sour vegetables). The portion standards from 20 menu cycles were primarily not in accordance with 30% of AKG. The energy, protein, fat, and carbohydrate categories were not aligned with 18 menus, 17 menus, 16 menus, and 16 menus for female students, and 14 menus, 13 menus, 16 menus, and 17 menus for male students.
Conclusions: The Crispy Chicken Menu is the most popular. The standard portion of each menu is primarily not in accordance with AKG.

INTRODUCTION

The full-day school is governed by a regulation found in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 23 of 2017, concerning school days. The purpose of this regulation is to fortify the character of students through a variety of activities. A full-day school is an educational program that combines the features of an all-day school with the integrated curriculum and activities[1]. Energy-draining and dense activities occupy the majority of the school day. It is evident that adequate nutrition is necessary for the successful execution of all of these activities. In order to ensure that students have the energy to complete lessons until the afternoon, schools with a full-day school system typically provide a controlled lunch[2].

In Indonesia, only students from middle- to upper-class families can receive school lunches in the form of complete meals. The school essentially operates under a full-day school system. Students implement the school food program as a fundamental educational activity, which provides 30% of their total energy requirements[3]. The lunch portion provided by the school is typically inadequate for the energy and macro- and micronutritional requirements of full-day school children with full-day meal provision (PM), or the food served is insufficiently sized[4]. Insufficient lunch portions and students' infrequent completion of their food rations lead to a reduction in nutrient intake. The lack of energy and nutrients impacts the nutritional status of children, leading to stunted growth and development[5]. We can use indicators of food acceptance to determine the effectiveness of food organization in schools. External and internal factors determine student acceptance. Food taste, food appearance, and the diversity of food menus are all external factors[6]. Gender, appetite, and eating habits or culture are internal factors that influence food

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acceptance.

Sholihah's 2021 research at the Insan Mulia Integrated Islamic Elementary School (SDIT) in Kediri City revealed that the availability of macronutrients in the insufficient category for energy, protein, fat, and carbohydrates was 29.6%, 24.1%, 99.1%, and 8.3%, respectively[7]. This is consistent with the findings of research conducted by Sembiring in 2022 on students at the Integrated Islamic Elementary School (SDIT) Sonaf Maneka, Kupang City. The results indicate that the availability of energy, protein, carbohydrates, and fats is insufficient, with values of 58.03%, 59.36%, 87.39%, and 12.91%, respectively. The quality of food served as is, very minimal fund allocation, and low knowledge of human resources processing all contribute to the lack of nutrient availability[8].

In Jember Regency, there are numerous private schools that operate on a full-day basis and serve lunch on-site. SD Al Furqan Jember is one of the full-day schools in Jember that provides lunch for all of its students. Yayasan Al Furqan Jember provides catering services for the luncheon at SD Al Furqan. The household section with the catering party determines the 20 menu cycles that are utilized, which are updated once a month. In this instance, the researcher is interested in evaluating the suitability of the lunch portion to 30% of the AKG at the elementary school, as the catering party has not consulted a nutritionist in the process of determining the menu. Furthermore, the researcher is also interested in the menu that is served, specifically its suitability for students. The sample in the study was drawn from grade 6, as they possess a significantly greater level of knowledge and are capable of facilitating and comprehending the questionnaire that will be administered at a later time. For these reasons, the researcher is interested in determining the acceptability of the food and the appropriateness of the portion standards in each food menu that is served during the lunch program at SD Al-Furqan Jember.

METHODS

This descriptive study used a cross-sectional approach to describe the characteristics of elementary school students, as well as the acceptability and suitability of portion standards with AKG for lunch at SD Al Furqan, Jember Regency. The population of this study consisted of 120 sixth-grade students who attended lunch at school. We obtained the sample by sampling or designating a portion of the entire object under investigation, which we deemed to be representative of the population. Consequently, we employed the sample as a research subject. The population must satisfy the inclusion criteria in order to serve as a sample. The sample for this study consisted of 61 respondents who attended and consumed catering at SD Al Furqan, Jember, and were of sixth-grade school age. The study was conducted at Al Furqan Elementary School in Jember in August 2023 for a period of 20 days, in accordance with the menu cycle that was implemented by the catering party that oversaw the provision of lunch at the school. Random sampling was implemented. The Health Research Ethics Commission, Faculty of Dentistry, University of Jember approved the study with approval No. 2020/UN25.8/KEPK/DL/2023, dated May 8, 2023.

We measured the characteristics of elementary school students, including age and gender, using student characteristic questionnaires. We also measured the nutritional status variables, based on BMI/A, using a weight scale and a microtoise height meter. We measured food acceptability using a food acceptability assessment questionnaire that included six indicators: taste, appearance, texture, color, aroma, and portion. Additionally, we used a Hedonic Scale Test form, which has a scale range of 0-2, with 0 indicating dislike, 1 indicating like, and 2 indicating very much like. We measure the suitability of portion standards using the food weighing method, and subsequently compare the measurement results with 30% AKG.

We utilized univariate analysis to analyze the data, which involved presenting descriptive statistical tests in the form of tables, narrative texts, and cross tabs. The purpose of this test was to describe the characteristics and acceptability of students. The frequency distribution table showed the suitability of lunch portions based on student characteristics.

RESULTS AND DISCUSSIONS

Respondent Characteristics

We conducted this study on 6th-grade students of SD Al Furqan, Jember, with 61 respondents. Measurement of student characteristic variables was carried out using a student characteristic questionnaire covering age and gender. We used a weight scale and a microtoise height measuring tool to measure the nutritional status (BMI/U) of children. Table 1 below displays the distribution of respondents by age, gender, and nutritional status.

Table 1. Respondent Characteristics

Respondent Characteristics	Total (n=61)	Percentage (%)
Age		
11 years	50	82
12 years	11	18
Gender		
Female	41	67,2
Male	20	3,8
Nutritional status		
Malnutrition	4	6,6
Good Nutrition	40	65,6
More Nutrition	10	16,4
Obesity	7	11,5

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Table 1 above displays the respondent characteristics based on age, gender, and nutritional status. Research on Al Furqan Elementary School students reveals that out of 61 students, 50 (82%) are 11 years old, and 41 (67.2%) are female. Based on the results of nutritional status measurements, 4 students (6.6%) are in the category of malnutrition, 40 students (65.6%) are well-nourished, 10 students (16.4%) are overweight, and 7 students (11.5%) are obese.

The results of the study showed that respondents had an age range of 11-12 years with a distribution of 50 students (82%) aged 11 years and 11 students (18%) aged 12 years. The majority of children attending elementary school are between the ages of 7 and 13, encompassing grades one through six. Children at this age experience a very rapid increase in their growth and development, both physically, psychologically, and socially[9]. In addition, children have increased nutritional needs and are in a period of rapid growth. Food intake influences significant development in school-age children, particularly in their cognitive abilities. As they grow older, their comprehension and thought patterns continue to develop, leading to improved knowledge and responses, as well as an increase in their ability to assess food[10].

Based on the research results, it is known that respondents are more likely to be female students, accounting for as many as 41 students (67.2%), compared to male students, who represent only 20 students (3.8%). Male and female have different energy needs. Female's basal calorie needs are lower—between 5 and 10% lower than males'. Males use more energy than female in body composition and physical activity, resulting in different tastes when it comes to food consumption and selection[11]. Females evaluate food more critically, so not all foods are appealing to them. Females have a more selective and considerate nature before consuming something[12]. In a study, females consumed less food than males, and the recommended RDA for males was greater than for females, so males were able to finish their food[13].

According to the study's results, the majority of respondents, as many as 40 students (65.6%), have good nutritional status; only a small number, as many as 4 students (6.6%), are malnourished, as many as 10 students (16.4%), are overnourished, and as many as 7 students (11.5%) are obese. Students' daily food consumption can significantly impact their nutritional status. All foods that individuals consume influence their nutritional intake. Various factors, including food selection behavior, influence this individual consumption[14]. This aligns with research on the relationship between food intake and nutritional status, demonstrating a correlation between a balanced, nutritious food intake, adequate macro- and micronutrients, and a good nutritional status in children[15]. According to other studies, school-age children who receive lunch at school meet 30% of their daily nutritional needs. This will contribute to the improvement of children's nutritional status[16].

Student Food Acceptance Capacity

We conducted the measurement of food acceptability using the Hedonic Scale Test form, which has a scale range of 0-2. We measured the lunch portions during 20 menu cycles using the food weighing method. We evaluated the acceptability of each meal portion over 20 menu cycles and compared the weighing results with 30% of the AKG based on the students' age and gender. Table 2 displays the acceptability of lunch.

The results of the Hedonic Scale Test in Table 2 indicate that students generally accept the six categories of the 20 menu cycles. In terms of taste, appearance, texture, color, aroma, and portion, students most accept and like the menu with the highest average, which is menu 3, or crispy chicken. While the menu with the lowest average according to the Hedonic Scale Test shows that the portion of menu 8, or sour vegetables, is less acceptable to students.

The tongue perceives taste. Three factors influence the taste of a food: smell, taste, and mouth stimulation (hot and cold). The taste of the food influences its acceptability when served[17]. The primary factors influencing food taste are its appearance, which encompasses factors such as size, portion size, presentation color, and shape when served, and its taste, which includes elements such as aroma, seasoning, ripeness, and texture when consumed. The appearance and taste aspects of food are equally important to consider in order to produce satisfying food. The components that play a role in determining the taste of food include aroma, seasoning and flavoring, tenderness, crispiness, level of ripeness, and temperature of the food. The organoleptic test revealed that students most liked menu 3, or crispy chicken, with an average taste assessment score of 1.47 (like) across 20 menu cycles. The reason sixth-grade students like to consume crispy fried chicken snacks is because it tastes savory, and parents often provide it[18]. This study aligns with previous research indicating that schoolchildren favor crispy fried chicken due to its appealing taste and appearance, which sets it apart from ordinary food. Additionally, parents frequently provide it at home to satisfy their children's appetite[19].

Table 2. Acceptability of 20 Lunch Menu Cycles Based on Six Categories

	Menu	Acceptance Power						
		Flavor	Appearance	Texture	Color	Aroma	Portion	Ranking
1.	Meatball	1,24	1,06	1,32	1,32	1,27	0,96	10
2.	Crispy shrimp	1,36	1,22	1,22	1,11	1,27	1	11
3.	Crispy chicken	1,47	1,31	1,31	1,29	1,44	1,18	1
4.	Stewed Eggs	1,21	1,21	1,27	1,14	1,14	1,14	12
5.	Spinach Clear	1,19	1,03	1,11	1,03	1,01	0,91	14
6.	Yellow rice	1,27	1,27	1,21	1,24	1,21	1,19	6

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7.	Crispy chicken2	1,4	1,31	1,29	1,27	1,36	1,21	2
8.	Tamarind vegetable soup	0,9	0,91	0,91	0,98	0,86	0,83	20
9.	Fried rice	1,31	1,24	1,31	1,24	1,29	1,14	7
10.	Bakmoy	1,29	1,24	1,24	1,26	1,27	1,24	5
11.	Meatball 2	1,26	1,21	1,19	1,22	1,22	1,16	8
12.	Chicken salad	1,34	1,32	1,27	1,29	1,27	1,22	3
13.	Chicken balls	1,31	1,24	1,29	1,26	1,31	1,27	4
14.	Soy sauce chicken	1,18	1,19	1,14	1,16	1,18	1,13	13
15.	Pecel	1,32	1,24	1,26	1,22	1,16	1,08	9
16.	Meatball stew	1	1	1	1	1	1	15
17.	Mixed rice	1	1	1	1	1	1	16
18.	Soto	1	1	1	1	1	1	17
19.	Stir-fried rice noodles	1	1	1	1	1	1	18
20.	Sea food	1	1	1	1	1	1	19
Median		1,2500	1,2100	1,2150	1,1900	1,1950	1,1050	
Std. Deviation		0,16309	0,13243	0,13464	0,12360	0,15448	0,12149	

The appearance of food is a reflection of its processed form and is visible when it is served to consumers[20]. An attractive food display will increase a child's appetite and, ultimately, their acceptance and nutritional intake. Presenting attractive food by modifying its appearance can enhance the acceptance of the presented menu. Presenting attractive food by modifying its appearance can increase its acceptance on the menu. Based on the organoleptic test, students' average assessment of the appearance of the 20 most preferred menu cycles was 1.32, indicating a liking for menu 12, which is fried chicken salad. Research related to the acceptance of lunch with a fried chicken side dish menu with an attractive presentation of 87.46% shows that, in general, respondents stated that they liked the presentation with the right composition[21].

The sense of touch and/or the measurement of the hardness or consistency of the food product determine food texture. The method and time of cooking can influence and determine the texture of food. Texture consists of the softness and elasticity of each food[22]. Texture is an important component in food because it can affect its taste. Based on organoleptic tests, the average value of texture assessment from 20 menu cycles most preferred by students is 1.32 (like) on menu 1, or meatballs. Consumers who are mostly school-age children like the texture of meatballs that are soft, chewy, and not too hard[23].

The color of food becomes the first impression that can attract consumers and can be felt through the sense of sight. Attractive colors in food presentations will invite consumers' appetite to taste the product[17]. The color factor appears first and is very important in determining whether or not someone will accept the food. Food that is nutritious, delicious, and has a good texture will not be easily accepted if it has a pale color that looks unfresh. Color is the quickest and easiest to give an impression, but the most difficult to describe and measure. Based on the organoleptic test, the average color assessment value of the 20 menu cycles most liked by students was 1.32 (like) on menu 1 or meatballs. Other studies state that most respondents really like meatballs that have a bright gray color, namely 51.0%[24]. Other research also states that the brightness level of the color of meatballs will determine the consumer's attitude to buying and consuming meatball snacks so far[25].

The olfactory nerves in the nasal cavity detect chemical stimuli that cause aroma. One can interpret aroma as a subjective sensation that arises from the act of smelling[17]. The distinctive aroma of food provides its own appeal that can stimulate the sense of smell and arouse a person's appetite. In many ways, consumers determine their acceptance of food by the smell or aroma it emits when served. Each food ingredient gives a different aroma; the cooking process with high heating temperatures produces a strong aroma[26]. According to the organoleptic test, students preferred menu 3, or crispy chicken, with an average aroma assessment score of 1.44 out of 20 menu cycles. According to several other studies, children tend to favor chicken fried with seasoned flour due to the strong aroma produced by the addition of pepper and garlic seasonings. Crispy fried chicken with seasoned flour has an aroma that children like[27]. When combined with chicken meat, the compound in the seasoned flour creates a unique aroma and taste that can mask the unpleasant fishy smell that consumers dislike[28].

Portion size consists of the number of food groups planned for each meal using exchange units based on food standards applicable in catering[29]. The importance of food portions is related to the acceptance and calculation of food ingredients but is also closely related to the appearance of food when served and nutritional needs. Based on organoleptic tests, the average value of portion assessments from 20 menu cycles most preferred by students was 1.27 (like) on menu 13 or chicken balls. In line with research related to food portions, the size of the portion varies according to daily eating habits at home. The size of the portion is said to be still lacking if students feel hungry and need a larger portion than what is usually served at home[30].

The discussion of all acceptability test indicators, such as taste, appearance, texture, color, aroma, and portion, leads to the conclusion that all 20 menu cycles served at SD Al Furqan Jember are acceptable to students. The menu with the highest average, menu 13,

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or chicken balls, demonstrates the highest acceptance and liking among students in terms of portion, with an average value of 1.27. According to the Hedonic Scale Test, the menu with the lowest average of 0.83 indicates that students find the portion of menu 8, which consists of sour vegetables, less acceptable. Figure 1 below provides a detailed description of students' food acceptability across 20 menu cycles (M1-M20).

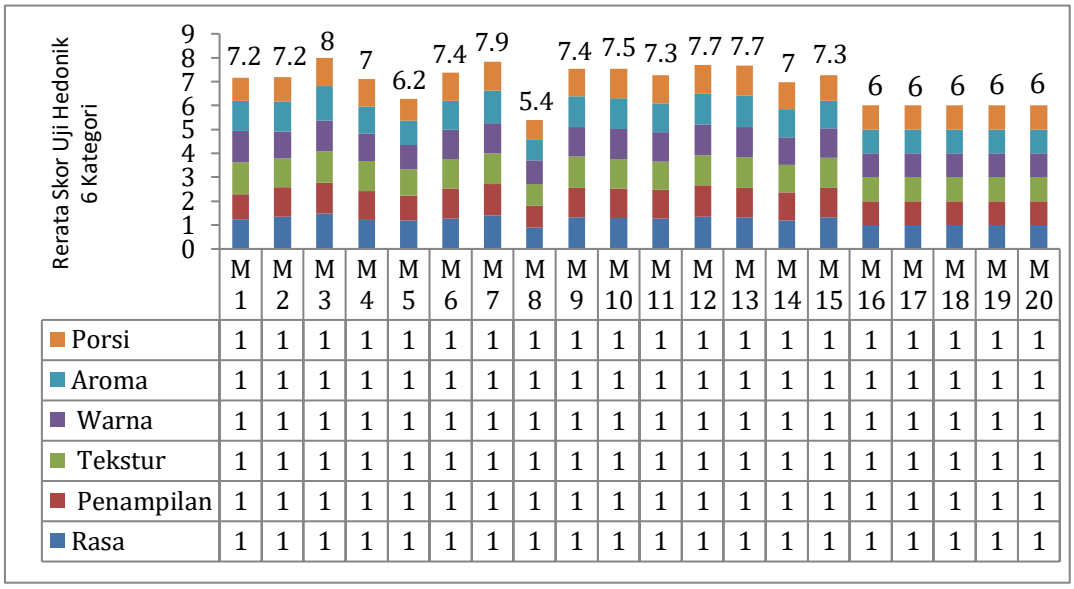

Figure 1. Average Acceptability Value Based on 6 Categories

Standard Portion Conformity Compared to AKG

Male and female students have different RDAs. At Al Furqan Elementary School, the portion standards for male and female students differ, leading to a separate presentation of results for each gender in this study. We measured the lunch portion for 20 menu cycles using the food weighing method, which involves weighing the food before each cycle. We then calculated the nutrients from the weighing results. We then compared the energy and nutrient calculation results with 30% of the total RDA, taking into account the student's gender characteristics.

The availability of lunch provided at school should meet 30% of nutritional needs, especially macronutrients, for school-age children in a day. The appropriateness of school children's meal portions is crucial in fulfilling their energy and other nutrient needs, thereby enhancing the quality of their human resources (HR). Implementing balanced nutrition for school-age children is crucial in fostering superior human resources (HR)[31]. Regulation No. 28 of 2019 concerning AKG directly dictates the energy and nutrient content of each lunch, taking into account the child's age group. Meanwhile, schools that provide food for students aged 10–12 have an average energy requirement of 600 kcal for males and 570 kcal for females, 15 g of protein for males and 16.5 g for females, 19.5 g of fat for males and females, 90 g of carbohydrates for males, and 84 g for females[32].

The results of the study presented in Table 3 show a comparison of the suitability of nutrients in lunch portions for female students and Table 5 for male students. The RDA for female students aged 10-12 years for energy is 1900 kcal, so 30% of the RDA is 570 kcal. The protein adequacy figure is 55 g, so 30% of the RDA is 16.5 g. The fat adequacy figure is 65 g, so 30% of the RDA is 19.5 g. The carbohydrate adequacy figure is 280 g, so 30% of the RDA is 84 g. Table 3 illustrates how macronutrients align with the RDA for female students. Table 3 also reveals that only protein nutrients contribute on average to 30% of the total RDA for male students. Energy and other nutrients fall short, as they account for less than 30% of the overall RDA for males. The RDA for female students aged 10-12 years for energy is 2000 kcal, so 30% of the RDA is 600. The protein adequacy rate is 50 g, so 30% of the RDA is 15 g. The fat adequacy rate is 65 g, so 30% of the RDA is 19.5 g. The carbohydrate adequacy rate is 300 g, so 30% of the RDA is 90 g. Table 3 shows how the macronutrients in the lunch portion meet 30% of the males' total RDA.

Table 3. Suitability of Energy and Macronutrients in Each Menu Cycle to the 2019 AKG for Male and Female Students

Menu	Gender	Energy (kcal)	AKG	Protein (g)	AKG	Fat (g)	AKG	KH (g)	AKG
Menu 1	Male	555,68	600	15,40	15	12,26	19,5	86,39	90
	Female	465,68	570	13.90	16,5	12,11	19,5	**76,49**	84
Menu 2	Male	374,25	600	11,75	15	10,36	19,5	78,06	90
	Female	284,25	570	10,25	16,5	10,21	19,5	58,16	84
Menu 3	Male	635,94	600	19,84	15	30,69	19,5	104,86	90
	Female	**545,96**	**570**	**18,34**	**16,5**	**30,54**	**19,5**	**84,96**	**84**
Menu 4	Male	404,46	600	11,79	15	19,28	19,5	79,92	90
	Female	314,46	570	10,29	16,5	19,13	19,5	60,02	84

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Menu 5	Male	349,71	600	12,42	15	11,10	19,5	67,68	90
	Female	259,71	570	10,92	16,5	10,95	19,5	47,78	84
Menu 6	Male	375,26	600	14,93	15	26,06	19,5	49,01	90
	Female	304,90	570	13,31	16,5	**25,25**	19,5	34,76	84
Menu 7	Male	616,47	600	19,29	15	31,13	19,5	100,69	90
	Female	**526,47**	**570**	**17,79**	**16,5**	**30,98**	**19,5**	**80,79**	**84**
Menu 8	Male	382,05	600	16,55	15	16,33	19,5	69,81	90
	Female	292,05	570	15,05	16,5	16,18	19,5	49,91	84
Menu 9	Male	506,24	600	8,85	15	12,27	19,5	52,37	90
	Female	368,24	570	7,25	16,5	10,67	19,5	37,27	84
Menu 10	Male	435,77	600	14,54	15	12,23	19,5	64,76	90
	Female	345,77	570	13,04	16,5	12,08	19,5	44,68	84
Menu 11	Male	573,41	600	15,84	15	12,70	19,5	89,35	90
	Female	483,41	570	**14,34**	16,5	12,55	19,5	**79,45**	84
Menu 12	Male	551,97	600	24,13	15	40,05	19,5	64,31	90
	Female	461,97	570	**22,67**	16,5	**39,09**	19,5	39,41	84
Menu 13	Male	365,75	600	10,19	15	6,15	19,5	70,40	90
	Female	275,75	570	8,69	16,5	6	19,5	50,50	84
Menu 14	Male	596,96	600	22,50	15	23,17	19,5	79,50	90
	Female	506,96	570	21	16,5	**23,02**	19,5	59,60	84
Menu 15	Male	498,70	600	23,32	15	26,40	19,5	67,56	90
	Female	408,70	570	21,82	16,5	**26,25**	19,5	47,66	84
Menu 16	Male	489,85	600	12,22	15	18,92	19,5	83,78	90
	Female	399,85	570	10,72	16,5	**18,77**	19,5	63,88	84
Menu 17	Male	360	600	16,22	15	19,58	19,5	58,03	90
	Female	289,64	570	12,56	16,5	**18,77**	19,5	43,78	84
Menu 18	Male	407,64	600	17,97	15	13,41	19,5	62,48	90
	Female	317,64	570	**16,47**	16,5	13,26	19,5	42,58	84
Menu 19	Male	485,71	600	16,27	15	19,57	19,5	76,78	90
	Female	395,71	570	**14,77**	16,5	**19,42**	19,5	56,88	84
Menu 20	Male	349,06	600	11,99	15	10,90	19,5	67,56	90
	Female	259,06	570	10,49	16,5	10,75	19,5	47,66	84
Average	Male	**465,74**	600	**15,80**	**15**	**18,63**	**19,5**	**73,67**	**90**
Min-max		**540 - 660**	**13,50 – 16,50**	**17,55 - 21,45**	**81 – 99**				
Average	Female	**375,31**	**570**	**14,18**	**16,5**	**18,30**	**19,5**	**55,31**	**84**
±10% AKG		**513 – 627**	**14,85 – 18,15**	**17,55 – 21,45**	**75,60 - 92,40**				

Table 4 displays the frequency distribution of macronutrients to AKG in female students. Table 4 demonstrates that the majority of nutrients in the lunch portion during each of the 20 menu cycles do not align with 30% of the total AKG of female students. The table shows that 18 menus (90%) have inappropriate energy content, 17 menus (85%) have inappropriate protein content, 16 menus (80%) have inappropriate fat content, and 16 menus (80%) have inappropriate carbohydrate content when compared to the energy and nutrients needed for one meal (30% of the total AKG). Table 4 also presents the results of energy and macronutrient suitability for male students in each lunch menu, revealing that the majority of these items do not align with the AKG. For male students, the categories where energy, protein, fat, and carbohydrates are not in accordance with AKG include 14 menus (70%), 13 menus (65%), 16 menus (80%), and 17 menus (85%).

Table 4. Frequency Distribution of Macronutrient Conformity to 2019 AKG in Female and Male Students

Number	Macronutrients	Female		Male	
		N	Percentage (%)	N	Percentage (%)
1	Energy (kcal)				
	Not AKG compliant	18	90	14	70
	AKG compliant	2	10	6	30
2	Protein (g)				
	Not AKG compliant	17	85	13	65
	AKG compliant	3	15	7	35
3	Fat (g)				
	Not AKG compliant	16	80	16	80
	AKG compliant	4	20	4	20

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4	Carbohydrate (g)				
	Not AKG compliant	16	80	17	85
	AKG compliant	4	20	3	15

Energy is the number of calories obtained from each type of food and served. In male students, in detail, among the 20 menu cycles, there are 14 menus whose energy does not match 30% of the AKG, including menus 2, 4, 5, 6, 8, 9, 10, 13, 15, 16, 17, 18, 19, and 20. Each food menu's lack of energy primarily stems from the small portions served, which fall short of the nutritional adequacy figure and directly correlate with the energy-contributing protein, fat, and carbohydrate content. Children use energy for various physical activities, brain functions, and other physiological processes[33]. If energy needs are not met, children will not be able to carry out activities at school, such as disrupting learning tasks because the body feels weak, cannot focus on lessons, and kids are susceptible to disease.

Side dishes made from processed animal and vegetable foods serve as the source of protein. Female students receive an average protein intake of 14.18 g, which falls short of the AKG of 16.5 g. In detail, among the 20 menu cycles, there are 17 menus whose protein nutrients do not match 30% of the AKG, including menus 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, and 20. Male students provide an average protein of 15.80 g, surpassing the AKG of 15 g. In detail, among the 20 menu cycles, there are 13 menus whose protein nutrients do not match 30% of the AKG, including menus 2, 3, 4, 5, 7, 9, 12, 13, 14, 15, 16, 18, and 20. Small portions and incomplete protein provision, with only one serving of vegetable or animal protein, account for the low protein levels in some menus. The amount of protein content in each type of side dish varies. Each food menu's composition and portion size influence its protein content. The incomplete provision of animal and vegetable protein sources in each food menu cycle can influence the presentation of food with low protein content. This is in line with other studies that state that low protein availability is caused by the non-availability of one or both proteins in each food menu, and the portions served still have protein content that is far from the nutritional adequacy figure[34]. Protein is essential for repairing damaged body cells, including skin cells, blood, tissue, and body organs[35]. Research indicates that a lack of protein intake initially triggers hunger, eventually leading to a decrease in body weight. This, in turn, impacts students' concentration and learning achievement, ultimately resulting in poor nutritional status[36].

Fat comes from animal foods, oils, and nuts. In female students, the average fat provided is 18.30 g, which is smaller than the AKG, which is 19.5 g. Male students provide an average fat of 18.63 g, which is lower than the AKG of 19.5 g. In detail, among the 20 menu cycles for female and male students, there are 16 menus whose fat nutrients do not match 30% of the AKG, including menus 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, and 20. The low fat availability can be attributed to the smaller portion sizes compared to the AKG. Sources of high-fat foods included fish, chicken, shrimp, and eggs. According to research on fat nutrients, children typically enjoy high-fat foods like fish, chicken, and eggs due to their delicious taste. Excess fat nutrients in some food menus can be caused by the use of food sources of fat with inappropriate portions. Additionally, the frying process increases the amount of fat in food due to the absorption of oil into the food[37]. Fat functions as a reserve energy storage for carrying out daily activities and plays a role in distributing nutrients and vitamins throughout the body38. When the body lacks fat nutrients, it leads to a decrease in energy availability due to protein breakdown[38]. This reduction in fat reserves can lead to weight loss, which in turn can lead to malnutrition. A deficiency in fatty acids can lead to growth disorders and the emergence of abnormalities in the child's skin.

Fat comes from animal foods, oils, and nuts. Female students provide an average fat of 18.30 g, which is less than the AKG's 19.5 g. Male students provide an average fat of 18.63 g, which is lower than the AKG of 19.5 g. In female and mIn detail, among the 20 menu cycles for female and male students, there are 16 menus whose fat nutrients do not match 30% of the AKG, including menus 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15. The smaller portion sizes compared to the AKG account for the low fat availability. Sources of high-fat foods included fish, chicken, shrimp, and eggs. According to research on fat nutrients, children typically enjoy high-fat foods like fish, chicken, and eggs due to their delicious taste. The use of food sources with inappropriate portions can lead to excess fat nutrients in some food menus. Additionally, the frying process increases the amount of fat in food due to the absorption of oil in it. Fat functions as a reserve energy storage for carrying out daily activities and plays a role in distributing nutrients and vitamins throughout the body38. When the body lacks fat nutrients, protein breakdown results in a decrease in energy availability. This reduction in fat reserves can lead to weight loss, which in turn can lead to A deficiency in fatty acids can lead to growth disorders and the emergence of abnormalities in the child's skin.

Cereals, tubers, and pure sugar all contain carbohydrates. The average carbohydrate intake for female students is 55.31 g, significantly less than the AKG of 84 g. In detail, among the 20 menu cycles, there are 16 menus whose carbohydrate nutrients do not match 30% of the AKG, including menus 2, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, and 20. Male students' average carbohydrate intake is 73.67 g lower than the AKG of 90 g. In detail, among the 20 menu cycles, there are 17 menus whose carbohydrate nutrients do not match 30% of the AKG, including menus 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17, 18, 19, and 20. The main source of carbohydrates provided by the school is rice. Although rice is widely available, students only consume a small portion of it. In addition to the small portion, the lack of diversity in carbohydrate food sources results in an inappropriate amount of nutrients being consumed. The body relies heavily on carbohydrates as its primary energy source, accounting for 60-65% of total energy

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intake[31]. A lack of carbohydrate availability will impact the amount of energy the body consumes[39]. Lack of carbohydrate intake can negatively impact nutritional status, weaken the body, induce lethargy, and disrupt the growth and development of children. dies also state that a lack of carbohydrate intake will cause fatigue, decreased concentration in learning, reduced comprehension, and less ability to think well. Long-term risks can lead to suboptimal growth and development, resulting in children tending to be shorter and potentially at risk of stunting[40].

There are advantages and disadvantages to the conducted research. This study's advantage lies in its uniqueness, allowing researchers to use its results as a reference to address any shortcomings they may have identified. The study's limitations include restricting the sample to only grade 6 students, with an average age of 11-12 years, which may not accurately reflect the appropriateness or acceptance of the lunch menu for all elementary school students.

CONCLUSIONS

The research concludes that most respondents are between the ages of 11 and 12 years old, with a higher proportion of female students than male students, and that their nutritional status is generally good. Students generally accept food based on six indicators, with the third menu, crispy chicken, being the most preferred, and the eighth menu, sour vegetables, being the least preferred. Most of the portion standards from the 20 menu cycles do not align with 30% of the AKG guidelines. For female students, the energy, protein, fat, and carbohydrate categories do not align with 18 menus (90%), 17 menus (85%), 16 menus (80%), and 16 menus (80%), while for male students, the categories align with 14 menus (70%), 13 menus (65%), 16 menus (80%), and 17 menus (85%). We anticipate that SD Al Furqan Jember's foundation and catering will substitute unfavorable menus with more acceptable ones, complete the presentation of animal and vegetable protein in each food menu, adjust food portions based on AKG to meet children's daily needs, and enhance their nutritional status.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors declare that there is no conflict of interest in this research. This research is an independent study without any funding assistance from any party.

AUTHOR CONTRIBUTIONS

JI: Writing–original draft, investigation, supervision, data curation, writing–review and editing; S: conceptualization, methodology, formal analysis, funding acquisition, resource, validation.

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