

## Exploration of school meal food service management: a case study of a full-day school

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### ABSTRACT

This research was aimed to capture the practice of foodservice management and food acceptance for change unbalance dietary intake children in a full-day Elementary School. School meal food service management is a program for students to improve the nutrition intake. An observation form, along with an in-depth interview was used to explore food production practice. Quantitative data on food satisfaction as well as food waste was also measured. Observation in food service management explained that low food acceptance was mainly found in vegetable products. The food quality, especially in taste and texture, became the determinant of the high vegetable food waste. Improving food service management production procedures, including menu planning and evaluation, procurement, preparation, and cooking, could be a promising strategy to increase food acceptance and to reduce food waste.

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## 1. INTRODUCTION

Unbalanced dietary intake is frequently found in children. Studies from several developing countries showed that school-age children have poor quality diets [1], [2]. Besides, one study showed several risks of low energy and nutrient intake as well as poor diet quality among children in Indonesia [3]. The quality of school-age children's diets, furthermore, is determined by several factors, including the food availability and eating habits at home and school. A pleasant food environment both at home and at school will shape good eating habits and good-quality diets in school-aged children [4]–[6].

One approach aimed at improving children's eating patterns and health is by the school meal program [7], which is done by giving breakfast or lunch to school pupils. The school feeding program has become a mandatory program in some countries. United States, for example, is one of the countries that require a school feeding program in all schools [8]. Another country, such as Mexico, tends to provide food for at-risk and vulnerable children who attend national education system schools [9]. Although it has been implemented in various countries, in Indonesia, on the other hand, there are still no mandatory feeding programs in schools.

The development of the education system in Indonesia, which adopts the full-day system, causes many schools to be voluntary organize lunch programs for their students. The school lunch program for students is expected to improve the nutrition intake of school-age children. Several studies have found that school lunch programs provide positive benefits for students, for instance, boosting the vitamins and minerals intake, improving eating patterns, and helping them increase in the students' nutritional status [7], [8], [10]–[13].

Despite numerous positive effects that can be obtained through the school lunch program, its implementation is not without obstacles. Several studies have shown that a common problem with school feeding program is the low acceptability of food. The large amount of food waste generated from the unconsumed menu is also a significant problem found in school-based food service [14], [15]. Low food acceptance is believed, leading to the increment of food waste [14]; further identified that the average school meal waste was 30%. Many factors can also affect students' acceptance of food. The food quality factors, namely the texture, taste, and smell, are, in fact, the contributing factors that cause students to be reluctant to eat the lunch provided by the school [16].

The food production process is the backbone of food quality. Food production management needs to be established to produce a consistent-quality of food for the customers' satisfaction [17]. However, studies that highlighted food production aspects as the contributing factors to food quality are still limited. Due to that reason, this study aimed to describe meal food service management in school and the students' acceptance towards the food.

## **2. RESEARCH METHOD**

### **2.1. Qualitative study**

The qualitative method of this research is used to describe the food production process of the school-based food service. Moreover, this research involved three key informants who met the criteria to be respondents, such as being involved in the whole food production system in the school. There were six sessions of in-depth interviews also carried out to the person in charge of: i) obtaining management production data; ii) food purchasing, receiving, and storage; iii) human resources management; iv) facility and equipment; v) hygiene and sanitation; and vi) waste management. Also, the food production process was further observed by using the constructed observation checklist.

### **2.2. Recruitment and selection of informants**

The selection of informants was aimed to describe the foodservice operation on the management level. The informants consisted of three people, including the school's business manager, the coordinator of the catering service unit, and a teacher as the school representative. The school's business manager was chosen because she is in charge of managing the overall food service management. The coordinator of the catering service unit, on the other hand, was interviewed to obtain data related to the foodservice operation for the students' lunch. The teacher, furthermore, was also interviewed since she was the one who has direct contact with the students and knows their eating habits in school very well.

### **2.3. Data collection**

The process of in-depth interview was carried out by a trained interviewer and was recorded by using a recorder. Before carrying out the data analysis, all the recorded conversations were first transcribed. The transcribed data then were analyzed to get keywords of the answers for each question. After that, the keywords from the conversation and the results of the observation checklists were crosschecked to be made conclusions for each item in sub-system questions. One to five keywords obtained from the most frequent answers of the interview with the three informants were chosen to describe each step of food production, namely menu development, food portioning, and food distribution.

### **2.4. Quantitative study**

The quantitative method was applied to describe the students' acceptance of the food provided by the school catering service. The acceptance indicator was the food satisfaction questionnaires along with food waste weighing. Before this research, a mini-survey was carried out to elementary students who regularly consume the school's catering. As many as 29 students were asked to fill the questionnaires for food satisfaction. Meanwhile, trained enumerators were tasked to weight the food waste of each student.

Descriptive statistics of food satisfaction (texture, appearance, color, taste, aroma, and cleanliness) performed in mean and standard deviation. Meanwhile, food waste was presented in proportion. Pearson correlation used to analyze the correlation between food acceptance (plate waste) and food satisfaction (texture, appearance, color, taste, aroma, and cleanliness).

### **2.5. The respondents**

For quantitative data, in a total of 29 students from the 4<sup>th</sup> and 5<sup>th</sup> grades of elementary school were chosen as the respondents, because it is believed that the students from those two grades could express their perception more relaxed than the students from lower grades did. On the other hand, the higher-grade students could not be included in the research due to more strict learning hours.

## 2.6. Food satisfaction

To assess the level of satisfaction, the respondents were asked to fill the questionnaires in the form of 5-point Likert scales with facial expressions to ease the students to choose the answers. Moreover, the students were asked to give their responses to each food type they received, for instance, rice, vegetables, and animal and plant protein by using a hedonic test. In addition, to complete the data collection, the weight of food waste was also measured.

The assessment of consumer satisfaction, or the students' acceptance, was done by measuring several indicators related to sensory analysis. The measurement was carried out by a hedonic test by measuring the texture, taste, and appearance of food products through the human senses using the hedonic scale. The hedonic scale, in the form of a face scale, was used to facilitate students in expressing their likes or dislikes in consuming food provided by the school [18].

Figure 1 shows the scoring of the assessment used the range of numbers 1-5, where number 5 represented "great", number 4 for "good", 3 for "so-so", 2 for "bad", and 1 for "awful."

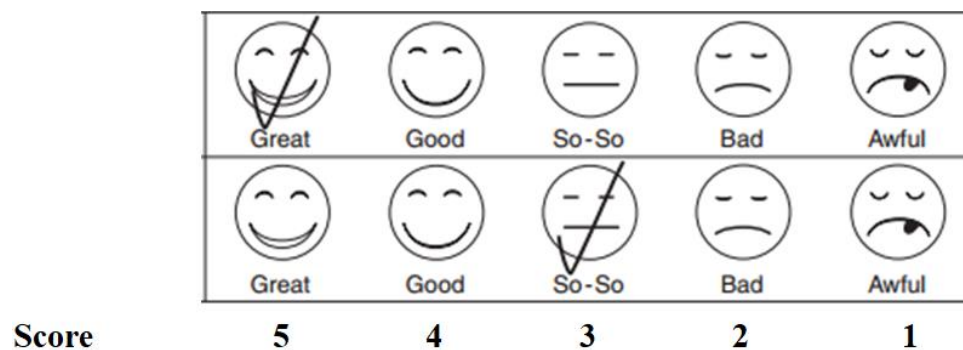


Figure 1. Facial hedonic scale and scoring assesment used for measuring children's food satifaction

## 2.7. Food waste

Food waste was measured by direct weighing by using calibrated food scale (CAMRY EK5055). For the references, one sample of served food items from the kitchen was weighed. The food waste weighing was performed after the students finished their lunch. The waste from their lunch box was weighed twice per each food item. If the weight between the first and the second weighing differed more than 5 grams, the third weighing would also be performed.

## 2.8. Ethical consideration

This research was approved by the Internal Review Board of Faculty of Nursing, Universitas Airlangga (KEPK-1354). Moreover, this study was also gained permission from the school's foundation. The approval from both the students and the parents had to be given before the data collection was carried out.

## 3. RESULTS AND DISCUSSION

### 3.1 Results

The chosen full-day elementary school is located in the eastern region of Surabaya City, Indonesia. At the time when this research was conducted, the school had approximately 652 students. Full-day school implicates that the students spend about eight hours at school. So, the students are required to take a lunch at school. The school, therefore, provides paid catering services for students. However, the students are not obligated to buy lunch from the school catering services. In total, there were 29 students from the 4<sup>th</sup> and 5<sup>th</sup> grades who enrolled in school lunch services.

The management of food services is run by the school foundation itself under the supervision of school management. Besides elementary students, the catering also provides service for the employees and junior high school students under the same foundation. A total of production capacity of the food services is as many as 500 portions per day. This catering gives a lunch service only on weekdays, from Monday to Friday for students and teachers. The catering service has four employees who are responsible for food production, including buying, cooking, portioning, and another two additional personnel to help with the distribution.

Food production is a long process. This process starts from 5 a.m. every day and finishes at 10 a.m. After that, each food is packed on lunch boxes to be distributed at 11 a.m. The students start to eat their lunch

at noon. The food served is following the Indonesian's structure menu, where there are rice, plant protein, animal protein, vegetables, and fruits. The catering service employed a 25-day menu cycle. Every month, the management changes the menus. The menu development process involved a team, including the school's business manager. There were no written standard recipe documents. The amount and main ingredients of the produced foods were determined by the catering service coordinator based on the menu cycle.

The fixed cycle menu was used as a reference for the management to buy the food items. The buying process employed open-market buying systems, which was considered simple and easy. Every week, the School Union spends approximately 8 million IDR (equal to 552 USD) to meet the need for foodservice.

### 3.1.1. Food satisfaction

To measure the students' satisfaction toward each food items, six performance indicators, including texture, appearance, color, taste, aroma, and cleanliness, was assessed as shown Table 1. From the assessment, it can be noticed that no food items gained the maximum score (5 out of 5) from the students. However, plant protein and fruits obtained higher ratings of overall satisfaction than other foods did. The lowest score, moreover, was found in vegetables on the aspects of color appearance and taste. Some pupils further commented that the served vegetables were less appealing and had faded colors. The scoring of the assessment used the range of numbers 1-5, where number 5 represented "great", number 4 for "good", 3 for "so-so", 2 for "bad", and 1 for "awful from the hedonic scale measure

Table 1. Food Satisfaction Indicator (mean $\pm$ SD)

Food	Texture	Appearance	Color	Taste	Aroma	Cleanliness
Rice	3.6 $\pm$ 0.6	3.6 $\pm$ 0.6	3.6 $\pm$ 0.7	3.7 $\pm$ 0.7	3.6 $\pm$ 0.6	3.8 $\pm$ 0.6
Plant protein	3.7 $\pm$ 0.6	3.8 $\pm$ 0.6	3.7 $\pm$ 0.6	3.7 $\pm$ 0.6	3.6 $\pm$ 0.6	3.6 $\pm$ 0.6
Animal protein	3.6 $\pm$ 0.5	3.7 $\pm$ 0.5	3.5 $\pm$ 0.5	3.7 $\pm$ 0.5	3.6 $\pm$ 0.6	3.5 $\pm$ 0.6
Vegetables	3.0 $\pm$ 0.5	2.9 $\pm$ 0.5	2.9 $\pm$ 0.6	2.9 $\pm$ 0.6	3 $\pm$ 0.5	3.1 $\pm$ 0.6
Fruits	3.7 $\pm$ 0.6	3.7 $\pm$ 0.6	3.8 $\pm$ 0.6	3.7 $\pm$ 0.6	3.6 $\pm$ 0.6	3.7 $\pm$ 0.6

### 3.1.2. Food waste

In general, the average amount of plate waste was 26.4 grams, dominated by vegetables (23.8%), Animal protein (12.7%), Rice (12.5%), and Fruit (10.9%). In contrast, plant protein had the smallest amount of waste (2.1%). These results can be seen in Figure 2.

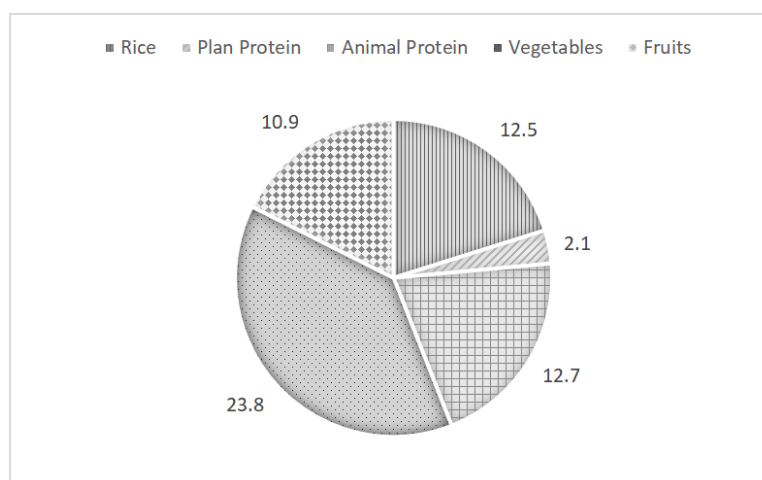


Figure 2. Composition of children food waste (% weight)

Based on the elucidation of the food waste above, a simple statistic analysis using Pearson correlation to measure the correlation between food acceptance showed by plate waste, and food satisfaction was carried out. Pearson's correlation test as presented in Table 2, furthermore, revealed that texture ( $p=0.038$ ,  $r=-0.388$ ) and taste ( $p=0.005$ ,  $r=-0.509$ ) were significantly correlated to vegetables food waste. Additionally, the results showed that the more the students satisfied with the texture and taste of vegetables

were, the lower the vegetables food waste would be. Meanwhile, animal protein waste was correlated to appearance ( $p=0.014$ ,  $r=-0.451$ ) and cleanliness ( $p=0.001$ ,  $r=-0.587$ ). Whereas, rice, fruits, and plant protein plate waste did not show any meaningful correlation with any food satisfaction indicator.

Table 2. Association of food acceptance (food waste) and food satisfaction

Food	Texture	Appearance	Color	Taste	Aroma	Cleanliness
Rice	0.445	0.921	0.797	0.387	0.921	0.299
Plant protein	0.252	0.445	0.394	0.347	0.263	0.405
Animal protein	0.382	0.014*	0.628	0.058	0.285	0.001*
Vegetables	0.038*	0.061	0.057	0.005*	0.274	0.303
Fruits	0.542	0.146	0.123	0.542	0.431	0.189

\*) Statistically significant ( $p<0.05$ )

### 3.2 Discussion

According to the results of the observation carried out, the food acceptance level of the meals produced by the school needed to be improved. Other studies that analyzed the same issue found that there were no zero wastes for each served food items [14]–[16]. Food waste is the most abundant form of waste in the world. The increasing amount of food waste, consequently, has a further impact on the increase in economic and environmental losses [19]. The elevation of food waste, moreover, can be caused by multi factors. Food waste, additionally, is significantly related to the food satisfaction that also affects the level of food acceptance that is determined by the food quality. Food quality cannot be separated from food production aspects [17]. Therefore, this research aims to analyze each production factor that might interfere with the food acceptance of the pupils.

In the school where this research was conducted, the most prevalent food waste was vegetable waste, with the percentage of almost a quarter of the standard distributed portion. This result indicated that the food acceptance of vegetables among elementary students was low. The similar finding was also highlighted in some studies, which showed that vegetables were the primary food waste found in school lunch programs [14], [16], [20].

Vegetables, moreover, had the lowest food satisfaction score (based on texture, appearance, color, taste, aroma, and cleanliness), compared to other food types. On the other hand, fruits obtained the highest food satisfaction. The served portion of vegetables (20 grams) and fruits (20 grams) was, in fact, inadequate, according to the Indonesian dietary guidelines for school-age children, which recommends them to consume 300 to 400 grams fruits and vegetables per day. The texture and taste of vegetables, in consequences, were correlated to the vegetable plate waste. Therefore, the cooking technique as well as the standardized recipes for vegetables needed to be modified to produce the acceptable texture and taste [21]. Furthermore, the enhance of spices/herbs in vegetables dishes is believe in increasing vegetables palatability [22], which will raise the food acceptance level. Besides, menu evaluation and plate waste monitoring also needed to be done periodically per cycle, instead of being performed once a year.

Protein-source food can be obtained from either animal or plant protein. The Indonesian dietary guidelines recommend the proportion of animal protein consumption of 30% and plant protein of 70% (Ministry of Health of Republic of Indonesia, 2014). Plant protein is the type of food which has a higher acceptance than other types of food have. Based on the research carried out, fried or the students preferred stir-fried tempeh and tofu as sources of plant protein. Furthermore, animal protein also had a quite good level of food satisfaction. However, this type of food was the second most frequent plate waste after vegetables. Research proved that the appealing serving, easiness to eat, and cleanliness of animal protein product could reduce the plate waste. Thus, in brief, based on the research done, it can be concluded that the performance of the food itself influenced the satisfaction and acceptability of food.

Research disclosed that food performance is greatly influenced by the way the food handled. In other words, the production process will undoubtedly affect the quality of the food produced [17], [23]. The selection of menus, especially the menus aimed for children, requires a different approach from the one for adult's menus. Instead of choosing the food based on its nutritional values, children tend to select a menu based on taste, texture, appearance, and smell [24]. Based on the observation of this research, the school management had considered the previous food acceptance in the menu planning process as one of the strategies to reduce food waste. Menu planning based on the last consumption food, additionally, is believed helping to reduce food waste [25]. However, even though the management had applied such strategy, the amount of the food waste was still high due to the less attractiveness on the appearance of the menus offered by the school catering.

In addition to menu planning, the procurement and purchasing processes also influence the amount of food waste [26]. Planning the procurement, purchase of appropriate food ingredients, by following the

desired quality and specifications, as argued, will likely minimize food waste. The procurement and purchasing process carried out by the school catering in this research, otherwise, did not follow the clear standard procedures. The catering service did not have standard procedures for the whole process of food processing. In consequences, the employees bought the ingredients only based on their experiences toward the quantity as well as the quality of food items and not according to the real countable needs. The buying process without proper planning, most of the time, tends to result in over-purchasing food items and may imply the food waste [23], [27]. Furthermore, the school catering service also did not have precise food specifications.

According to the prior research, lack of food specifications may result in the inconsistency of the quality of the material purchased [28], which impacts to the difference in the quality of the cuisine and the ingredients produced. For example, in this research on animal protein, some children expressed dissatisfaction toward food hygiene due to the presence of feathers left on chicken skin. The issue might occur because the purchase of the ingredient itself did not follow any particular specification, particularly about the cleanliness or the hygiene of the food purchased. Besides, the direct purchase to the market may also contribute to the lack of hygiene and the inconsistency of the quality of the food provided by the catering service. Whereas, given the routine and the large production capacity, the school catering party should have contracted the best food distributor to ensure the quality of the food provided for students and teachers [28].

Preparation and processing also play an essential role in shaping the performance of the food served. In this research, in the preparation process, there were no specific work standards regarding the shape of the cut, how to handle raw materials, preparation of spices, and so forth. According to research, food preparation procedures will affect not only food acceptance but also the nutrition content of the cuisines [21]. Moreover, a study by Poulman [29] showed that food preparation and cooking time give a significant impact on vegetable acceptance among the children. In this research, during the observation, it is noticed that the texture of the served vegetables was too soft due to overcooking. The absence of a standard recipe or spice standard, additionally, resulted in the flavor to vary especially if the cook on duty was different. Even though the catering manager disapproved the issue, from the observations, it can be disclosed that the low acceptance of vegetables was related to dissatisfaction with the texture and taste of the vegetables served.

Furthermore, portioning and distribution carried out by the school catering also influence the acceptability of food. From the observation, it was recalled that the portioning was done without tools, except for serving the rice, which caused the inconsistency amount of the food served. Moreover, from the weighing of each lunchbox, it was known that the portion of food served was tiny following the low price of the food. However, the size of the serving portion affected the students' appetite; the more significant the serving size, the more energy will be consumed by the children [30]. On the other hand, the small size of portioning is also believed to help reducing food waste [31]. Even though the portion served was in a small amount, according to the observation, there were still some students who did not finish their food. Vegetables served by the catering service were, in fact, in a tiny amount, which was about two tablespoons or was equal to 20 grams per portion. Although it was small, vegetables were discovered as the most waste among other types of food.

From the analysis that had been done, it can be affirmed that the catering run by the school foundation did not yet have a standardized work system despite their easy workflow. As a result, every part of the production process did not produce the standard-quality food. Therefore, there it is essential to establish a written work system, starting from the distribution of duties and functions to the making of the standard work procedures as guidance for all employees. Nonetheless, building a new system by overhauling the old way of working is not easy. It needs full commitment and supervision from the relevant authorities to maintain the sustainability of the system. In brief, this research is one of the few studies on food waste produced by the school-based food service organization in Indonesia. However, due to the limitation of the study, other factors that can influence students' acceptance of school meal, such as home-food environment and family eating pattern, were not assessed.




#### 4. CONCLUSION

After carrying out the observation and the analysis, in the end, it can be stated that all aspects of food service management play an important role in shaping food quality. Also, food quality affect overall food acceptance based on the level of food satisfaction and the amount of food waste. In this research, the most common trash found was vegetables. Improving food production procedures (including menu planning and evaluation, procurement, preparation, and cooking) are the promising strategies to increase food acceptance and to reduce food waste. The melioration, furthermore, can be started by establishing the standardized working procedures of the school-based food service management.




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