

ACCEPTABILITY DIFFERENCES ACROSS FREE NUTRITIOUS MEAL MENU COMPONENTS AMONG ELEMENTARY SCHOOL STUDENTS

Perbedaan daya terima antarkomponen menu makan bergizi gratis pada siswa sekolah dasar

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ABSTRACT

Indonesia's Free Nutritious Meal Program (Makan Bergizi Gratis, MBG) requires evaluation of the foods students actually accept because an overall menu score may conceal components that are repeatedly disliked. This study analyzed acceptability patterns and differences across MBG menu components among elementary school students. An observational study with repeated measurements was conducted among students in grades IV-VI at SDN Lagoa 05 Pagi, North Jakarta, in July-August 2025. Of 96 students, 87 had complete data and were included in the analysis. Acceptability was assessed over 11 days using a three-point facial hedonic scale for five sensory attributes. Descriptive analysis covered 55 component servings. The Friedman test used nine days with a complete set of five comparable food groups, followed by Wilcoxon signed-rank tests with Holm correction. Of the 55 components, 37 (67.3%) had high acceptability and 18 (32.7%) had moderate acceptability. Fruit (2.51 ± 0.06), animal-source dishes (2.50 ± 0.10), and staple foods (2.46 ± 0.06) had the highest means, whereas vegetables had the lowest (2.19 ± 0.15); 11 of 12 vegetable servings were moderately accepted. Acceptability differed across food groups ($\chi^2(4)=30.46$; $p<0.001$; $W=0.846$). Fruit, animal-source dishes, and staple foods were accepted better than plant-source dishes and vegetables after Holm correction. Menu improvement should prioritize the taste, texture, and presentation of vegetables and plant-source dishes and monitor acceptability at the component level.

Keywords: Food acceptability, Free Nutritious Meal Program, Hedonic test, Vegetables

ABSTRAK

Program Makan Bergizi Gratis (MBG) perlu mengevaluasi makanan yang benar-benar diterima siswa karena skor menu secara keseluruhan dapat menutupi komponen yang berulang kali kurang disukai. Penelitian ini bertujuan menganalisis pola dan perbedaan daya terima antarkomponen menu MBG pada siswa sekolah dasar. Penelitian observasional dengan pengukuran berulang dilakukan pada siswa kelas IV-VI SDN Lagoa 05 Pagi, Jakarta Utara, pada Juli-Agustus 2025. Sebanyak 87 dari 96 siswa memiliki data lengkap dan dianalisis. Daya terima dinilai selama 11 hari dengan skala hedonik wajah tiga poin untuk lima atribut sensori. Analisis deskriptif mencakup 55 penyajian komponen. Uji Friedman menggunakan sembilan hari dengan susunan lima

kelompok komponen yang lengkap, dilanjutkan dengan uji Wilcoxon signed-rank dengan koreksi Holm. Dari 55 komponen, 37 (67,3%) memiliki daya terima tinggi dan 18 (32,7%) sedang. Buah ($2,51 \pm 0,06$), lauk hewani ($2,50 \pm 0,10$), dan makanan pokok ($2,46 \pm 0,06$) menunjukkan rerata tertinggi, sedangkan sayuran ($2,19 \pm 0,15$) terendah; 11 dari 12 sajian sayur berada pada kategori sedang. Daya terima berbeda antarkelompok komponen ($\chi^2(4)=30,46$; $p<0,001$; $W=0,846$). Buah, lauk hewani, dan makanan pokok diterima lebih baik daripada lauk nabati dan sayuran setelah koreksi Holm. Perbaikan menu MBG perlu diprioritaskan pada rasa, tekstur, dan penyajian sayuran serta lauk nabati, disertai pemantauan daya terima per komponen.

Kata kunci: Daya terima makanan, Makan Bergizi Gratis, Sayuran, Uji hedonik

INTRODUCTION

The Free Nutritious Meals (MBG) Program places schools as an important setting for improving children's access to nutritious food. In program management, food provision should not stop at meeting menu requirements but should be accompanied by implementation monitoring and beneficiary feedback (Badan Gizi Nasional, 2025). Experiences from school meal programs in Indonesia also indicate that nutritional benefits depend greatly on the food actually consumed, rather than merely the food served (Pramesthi et al., 2025). Therefore, acceptability should be an integral part of school meal program evaluation.

The hedonic score reflects the subjective level of liking for food and does not directly measure the amount of food consumed. However, low acceptability may be associated with food waste and reduced nutrient contributions from school lunches. Studies in elementary schools have shown that food waste varies according to the type of component, portion size, and characteristics of meal services (Martins et al., 2021; Petchoo et al., 2022; Adjapong et al., 2024). Among elementary school students, food taste is one of the most frequently reported reasons why food is not completely

consumed, while fruit tends to have lower leftovers than some vegetable dishes (Ilić et al., 2022). This pattern indicates that the average score of a complete meal may mask problems in specific components.

Children's acceptance of food is also shaped by sensory characteristics and developmental stage. Preferences for taste, perceptions of healthiness, and food choices change with age (Serrano-Gonzalez et al., 2021), while texture may be an important reason for children to accept or reject food (Cappellotto & Olsen, 2021; Lee et al., 2024). In Indonesia, an evaluation of school lunch provision found that crispy chicken was the most preferred menu, while *sayur asem* had the lowest acceptance (Fitriani & Sulistiyani, 2024). These findings reinforce the need for evaluations that examine staple foods, animal-based side dishes, plant-based side dishes, vegetables, and fruits separately. However, evidence on statistical comparisons between MBG food component groups among elementary school students repeatedly observed over one complete menu cycle remains limited. A single observation may primarily reflect the characteristics of a particular menu, whereas observations throughout a cycle allow the identification of recurring acceptance

patterns across different servings. This study aimed to analyze the patterns and differences in acceptability of staple foods, animal-based side dishes, plant-based side dishes, vegetables, and fruits during an 11-day menu cycle.

METHODS

This study used an observational design with repeated measurements among students at SDN Lagoa 05 Pagi, North Jakarta. Data were collected in July–August 2025. The analysis focused on variations in acceptability across food components over 11 school days within one MBG menu cycle during the data collection period; holidays were excluded from the observation.

The study subjects were fourth to sixth grade students who were actively attending school, regularly participating in the MBG program, willing to participate, and had obtained permission from their parents or guardians. Subjects were recruited purposively. This approach may introduce selection bias; to limit this, the inclusion criteria were applied uniformly to eligible students who could be reached. A total of 96 students were recruited to anticipate incomplete data. This number represents the observed subjects and not *n* in the Friedman test; in the inferential analysis, *n* refers to the nine days with five complete component groups. Each student was followed using the same identification code throughout the 11 observation days. Data were considered complete when assessments were available for all days and accepted food components. Nine students had incomplete assessment data and were excluded without imputation, resulting

in 87 students included in the final analysis.

The primary outcome of the study was the acceptability score of menu components. The score was assessed daily after the MBG lunch using a three-point facial hedonic scale, namely 1=dislike, 2=neutral, and 3=like. The three-point facial scale was selected to ensure that response categories were easily understood by elementary school students and was supported for use in pediatric hedonic evaluation (Wagner et al., 2020). Separate validity and reliability testing of the combined five attributes was not conducted; the score was used as an operational measure of acceptability. Before completing the assessment, members of the research team provided instructions using the same procedure on each observation day. The assessment sheet was provided immediately after the meal; students completed it individually and were not shown their scores from the previous day. Students assessed five sensory attributes for each food component: taste, appearance, texture, color, and aroma. Observations were conducted over 11 days and included staple foods, animal-based side dishes, plant-based side dishes, vegetables, fruits, and milk when available. Overall, the descriptive analysis included 55 menu component observations. At the student level, the component score was the mean of the five attributes for one component on one day. The component-day score was the mean student score for the same component on that day. The term daily mean in the inferential analysis refers to the component-day score for each food

group, rather than the mean of individual responses across days.

At the student level, the score for each component was calculated as the mean of the five sensory attributes. The component-day score was then calculated as the mean student score for the same component on a given day and categorized as low (≤ 1.66), moderate (1.67–2.33), and high (≥ 2.34). The category cutoffs were determined by dividing the 1–3 scale range into three equal-width intervals, namely $(3-1)/3=0.67$ (Pimentel, 2019). Descriptive analysis used all 55 component servings over the 11-day observation period. For inferential comparisons across component groups, nine days with complete and comparable compositions were used, namely staple foods, animal-based side dishes, plant-based side dishes, vegetables, and fruits. Days 4 and 6 were included in the descriptive analysis but excluded from the inferential analysis because their component compositions were incomplete.

In the inferential analysis, the outcome was the component-day score, the comparison factor was the five food component groups, and the days ($n=9$)

served as both the unit of analysis and the block. Differences in acceptability among the five component groups were tested using the Friedman test, with observation days as blocks. The analysis was followed by paired Wilcoxon signed-rank tests with Holm correction when the Friedman test was significant. Effect size was reported as Kendall's W. A p-value <0.05 was set as the threshold for statistical significance. Analyses were performed using SPSS version 29 and verified by recalculation using statistical software.

The study received ethical approval from the Health Research Ethics Committee of Universitas Binawan (No. 477/KEPK-UBN/VII/2025).

RESULTS

Of the 96 students recruited, 87 had complete data and were included in the analysis; nine students were excluded because their assessment data were incomplete for one or more days or components. The majority of subjects were aged 10–12 years (86.2%), while the proportions of males (51.7%) and females (48.3%) were relatively balanced. Table 1 presents the characteristics of the subjects.

Table 1.
Characteristics of subjects

Characteristics	n	%
Age		
7-9 years	1	1.1
10-12 years	75	86.2
13-15 years	11	12.6
Gender		
Male	45	51.7
Female	42	48.3
Total	87	100.0

At the menu component level, 37 of 55 components (67.3%) were classified as having high acceptability, while 18 components (32.7%) were classified as moderate. All staple food, animal-based side dish, and fruit servings were classified as high. In contrast, 11 of 12 vegetable

servings and seven of nine plant-based side dish servings were classified as moderate. The highest group means were observed for fruits and animal-based side dishes, whereas vegetables had the lowest mean (Table 2).

Table 2.
Food acceptability by menu component group over 11 days

Component group	n	Mean $\pm$ SD	Range	Moderate (n)	High (n)
Staple foods	11	2.46 $\pm$ 0.06	2.39-2.63	0	11
Animal based side dish	11	2.50 $\pm$ 0.10	2.36-2.68	0	11
Plant based side dish	9	2.27 $\pm$ 0.08	2.11-2.39	7	2
Vegetables	12	2.19 $\pm$ 0.15	1.89-2.48	11	1
Fruits	11	2.51 $\pm$ 0.06	2.43-2.61	0	11
Milk	1	2.60	2.60	0	1
Total	55	-	1.89-2.68	18	37

Note:

(n) servings represent the number of occurrences of each component over 11 days, not the number of subjects.

SD was calculated from the component means within the same group.

Categories: moderate=1.67–2.33; high $\geq$ 2.34.

Table 3.
Components with the highest and lowest acceptability on each observation day

Observation day	Highest-Scoring Component (Score)	Lowest-Scoring Component (Score)
1	Banana (2.52)	Stir-fried green beans and corn (1.89)
2	Nasi uduk (2.63)	Cucumber-tomato (2.05)
3	Watermelon (2.61)	Carrot and pumpkin clear soup (2.18)
4	Full cream milk (2.60)	Stir-fried carrots and green beans (2.12)
5	Watermelon (2.49)	Stir-fried angled luffa (2.11)
6	Mushrooms (2.48)	Capcay (2.18)
7	Watermelon (2.61)	Carrot-corn (2.19)
8	Watermelon (2.49)	Fried tempeh (2.23)
9	Orange (2.44)	Stir-fried green beans and corn (2.17)
10	Melon (2.50)	Fried tempeh; pakcoy-meatball (2.30)
11	Chicken katsu (2.68)	Stir-fried carrots and mustard greens (2.30)

Note:

Score represents the mean of five sensory attributes: taste, appearance, texture, color, and aroma.

When examined by sensory attribute, taste had a mean score of 2.59 for animal-based side dishes and 2.56 for fruits, whereas the mean taste score for vegetables was only 2.12. For plant-

based side dishes, the mean aroma score was also relatively low (2.22). The only vegetable serving that reached the high category was mushroom vegetables on day 6 (2.48). This pattern indicates that

the low acceptance of vegetables was not attributable to a single menu item but occurred across most of the observation cycle. Chicken katsu on day 11 was the component with the highest score throughout the observation period (2.68). A similarly favorable acceptance pattern was observed for fruits, particularly watermelon, which had the highest score on days 3, 5, 7, and 8. In contrast, the component with the lowest score was almost always vegetables; the only exceptions occurred on days 8 and 10, when plant-based side dishes had the lowest score. These findings indicate a consistent pattern according to component type, rather than merely variation across days.

Across the nine days with five comparable component groups, acceptability differed significantly

among groups (Friedman test $\chi^2(4)=30.46$; $p<0.001$; Kendall's $W=0.846$). This finding indicates that the acceptability rankings of the five component groups differed systematically and were highly consistent at the menu-day level. A W -value approaching 1 indicates very strong agreement in rankings across the nine days, but does not imply that every student had an identical preference pattern. Post-hoc tests showed that fruits, animal-based side dishes, and staple foods had higher acceptability than plant-based side dishes and vegetables after Holm correction ($p<0.05$). No significant differences were found among staple foods, animal-based side dishes, and fruits, or between plant-based side dishes and vegetables.

Table 4.
Differences in acceptability among component groups across nine days with complete menu compositions

Component group	Median (range)	Mean Rank	p^*
Staple foods	2.45 (2.39–2.63) ^a	3.56	<0.001
Animal based side dish	2.48 (2.37–2.68) ^a	3.78	
Plant based side dish	2.26 (2.18–2.39) ^b	1.83	
Vegetables	2.18 (1.89–2.30) ^b	1.17	
Fruits	2.51 (2.44–2.61) ^a	4.67	

Note:

Data represent the mean component score per day ($n=9$ days).

Friedman test: $\chi^2(4)=30.46$; $p<0.001$; Kendall's $W=0.846$.

Different superscript letters indicate significant differences in the Wilcoxon signed-rank test with Holm correction (adjusted $p<0.05$)

Days 4 and 6 were excluded from the inferential analysis because they did not have the same five component groups.

DISCUSSION

Most MBG components in this study had high acceptability, but acceptance was not evenly distributed. Fruits, animal-based side dishes, and staple foods consistently fell into the high

category, whereas vegetables and plant-based side dishes were more often in the moderate category. This consistency refers to the component-day score level and cannot be directly generalized as the same pattern for every student. A similar

pattern was observed in school lunch provision in Jember, where crispy chicken was the most preferred menu, while sayur asem was among those with the lowest acceptance (Fitriani & Sulistiyani, 2024). An analysis across school levels also showed that elementary school students had lower acceptability than junior high school students, highlighting the importance of identifying less-preferred components to determine which parts of the menu need improvement (Srimiati et al., 2026).

Vegetables were the component group that most consistently faced acceptability problems. Eleven of the 12 vegetable servings were in the moderate category, and the mean taste score for vegetables was the lowest among the main component groups. This finding is consistent with research in elementary schools showing that taste is the most frequently reported reason why students do not finish their food, and that vegetable leftovers can be substantially higher than fruit leftovers (Ilić et al., 2022; Petchoo et al., 2022). Plate waste studies across different schools have also shown that menu composition and the meal service context are associated with the amount of food left over (Adjapong et al., 2024). Because food waste was not measured, this relationship cannot be directly inferred from the present study; the findings only indicate that improving sensory acceptability should be considered before increasing vegetable portions.

The vegetable-related problems in this study appear to involve more than taste alone. Vegetable appearance and

texture scores were also lower than those of fruits and animal-based side dishes. In children, texture preferences are associated with sensory sensitivity and tendencies to reject certain types of food (Cappellotto & Olsen, 2021), while a texture preference instrument for children aged 5–12 years showed that children's assessment of texture was associated with preferences after tasting (Lee et al., 2024). In practical terms, degree of doneness, cut size, water content, crispness or softness, and color appearance may be considered as potential areas for improvement, although these factors were not directly measured. The high score for mushroom vegetables on day 6 suggests that formulation or presentation may play a role, but this mechanism requires further specific investigation.

Plant-based side dishes also require attention. Seven of the nine servings were classified as moderate, although tofu and tempeh are widely recognized as part of the Indonesian diet. An MBG study among junior high school students in Makassar reported increased acceptance of plant-based side dishes following nutrition education, although the change did not occur across all menu components (Nadimin et al., 2026). Because the age group differed, these findings cannot be directly generalized to elementary school students, but they provide a rationale for combining recipe improvements with gradual food exposure.

Fruits showed a different pattern. All fruit servings were classified as high, and watermelon repeatedly had the highest score on several days. Studies on food preferences and leftovers have

shown that fruits are generally more accepted than many vegetable dishes, and higher preference is associated with less food waste (Ilić et al., 2022; Shanks et al., 2021). However, oranges on day 9 received a score of only 2.44, which was lower than the scores for watermelon on several previous days. This variation indicates that food group labels alone are insufficient. Variety, degree of ripeness, sweet-and-sour taste, ease of peeling, and children's prior experience with the food may be associated with acceptability, but these factors were not measured, so such explanations remain hypothetical.

The Friedman test reinforced the descriptive pattern that differences in acceptability among components did not occur by chance in a single menu. A Kendall's W of 0.846 indicated strong consistency in rankings across the nine days analyzed with comparable menu compositions, namely staple foods, animal-based side dishes, plant-based side dishes, vegetables, and fruits: fruits, animal-based side dishes, and staple foods tended to rank higher, whereas plant-based side dishes and vegetables ranked lower.

Post-hoc tests also showed that plant-based side dishes and vegetables did not differ significantly from each other, but both had lower acceptability than the three component groups with high acceptance. Thus, improvement priorities should not be directed toward vegetables alone. Plant-based side dishes should also be evaluated in terms of seasoning, texture, dryness, cut size, and compatibility with staple foods within the same menu package.

From implementation perspective, component level evaluation can complement overall menu assessment. The BGN technical guidelines place monitoring and evaluation as part of MBG implementation (Badan Gizi Nasional, 2025). A brief feedback form that separates staple foods, animal-based side dishes, plant-based side dishes, vegetables, and fruits would help SPPG identify recurring rejection. These findings could be used to improve recipes, texture, cut size, and presentation before the menu is repeated in the next cycle.

This study has several limitations. Acceptability was measured subjectively using a three-point facial scale and was not confirmed by weighing food leftovers; therefore, liking scores cannot be treated as measures of actual consumption. The inferential analysis used mean component scores per day and included only nine days with comparable compositions of the five food component groups; therefore, the results reflect the consistency of menu-day patterns rather than individual response variation. Two days with different compositions were still presented descriptively. The small number of analysis blocks, consisting of only nine days, also limits the precision of estimates of differences among components.

The study was also conducted in a single school, so the application of the findings to other schools should consider differences in menu and student characteristics. Purposive sampling may have introduced selection bias, while analysis based only on complete data may have introduced bias

if data incompleteness was related to acceptability levels. The use of a subjective three-point scale may have introduced measurement bias, and repeated assessments may have influenced responses through familiarity or fatigue. Standardized instructions, individual completion, and not displaying previous scores helped limit these biases but could not eliminate them. Future studies should use repeated individual-level data, weighed food leftovers, and statistical models that account for clustering by students, days, and menu types.

CONCLUSION

MBG menu acceptability at the menu-day level differed among component groups. Fruits, animal-based side dishes, and staple foods were better accepted than plant-based side dishes and vegetables, with a consistent ranking pattern across the nine days with complete menu compositions. Menu improvements should prioritize the sensory quality of vegetables and plant-based side dishes, particularly taste, texture, and presentation, and should be reevaluated in each menu cycle through component-specific feedback.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest to disclose.

DECLARATION USE AI

The authors declare that generative AI tools were used only for language editing and grammar correction. The authors remain fully responsible for the content and integrity of the manuscript.

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