Research

# Effectiveness of the Implementation of the BGN Free Nutritious Meal (MBG) Program on the Nutritional Status of Junior High School Students in Makassar, Indonesia

Syamsul Alam*[1,2], Rezki Nurfatmi[3,4]

[1] Department of Public Health, Faculty of Medical and Health Science, Universitas Islam Negeri Alauddin, Makassar, Indonesia
[2] Senior Researcher, Yayasan eLSTUDIKA Indonesia, Makassar, Indonesia.
[3] Master's Student, Public Health Sciences (Nutrition Concentration), Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.
[4] Junior Researcher, Yayasan eLSTUDIKA Indonesia, Makassar, Indonesia.

* Corresponding Author: syamsul.alam@uin-alauddin.ac.id

## ARTICLE INFO

## ABSTRACT

Adolescent nutrition is a key determinant of health and human capital, yet in Indonesia, unbalanced diets and inadequate food quality continue to contribute to undernutrition among adolescents. This study aimed to assess the nutritional status and dietary intake of junior high school students participating in a free nutritious meal program implemented through the *Satuan Pelayanan Pemenuhan Gizi* (SPPG) by the National Nutrition Agency (*Badan Gizi Nasional*, BGN). A descriptive quantitative study was conducted at SMP Negeri 23 Makassar on May 7, 2025, involving 50 purposively selected students. Data collection included anthropometric measurements—body weight, height, and mid-upper arm circumference (MUAC)—and dietary assessment using a Food Frequency Questionnaire (FFQ). BMI-for-age was classified according to WHO standards. Data analysis applied Chi-square and simple linear regression to examine the association between dietary intake and BMI. Results showed that 38% of students were underweight, 48% had normal nutritional status, and the remainder were overweight or obese. Sex significantly affected BMI (p = 0.020), with females having higher mean BMI than males, while dietary intake category showed no significant association (R² = 0.006; p = 0.588). The SPPG program improved dietary patterns but requires integration with sustained nutrition education, active parental involvement, and regular monitoring to ensure long-term impact.

## 1. Introduction

Adolescent nutritional status is a critical determinant of both current and future health outcomes, as well as the development of human capital, particularly in low- and middle-income countries (LMICs). Adolescence represents a period of rapid growth and development, during which

optimal nutrient intake is essential for achieving full physical, cognitive, and psychosocial potential (Sawyer et al., 2012; Patton et al., 2016). Nutritional imbalances during this phase can lead to long-term consequences such as stunting, anemia, obesity, and impaired cognitive development (Soekirman, 2016; Black et al., 2013).

Globally, malnutrition remains a pressing issue in its dual forms — undernutrition and overnutrition — which often coexist within the same population. The World Health Organization (WHO, 2021) reports that more than 340 million children and adolescents are overweight or obese, while millions suffer from chronic undernutrition. UNICEF (2020) further notes that 45 million children under five experience wasting and 149 million are stunted, with a significant proportion residing in LMICs. In Southeast Asia, adolescent diets are often characterized by high consumption of energy-dense, nutrient-poor foods, alongside low intake of fruits, vegetables, and high-quality protein sources (Ng et al., 2014; Keats et al., 2018).

In Indonesia, data from the Basic Health Research (Riskesdas, 2018) indicate persistently high rates of undernutrition among adolescents, particularly those aged 13–15 years. Local studies have shown that poor nutritional status is associated with lower academic performance, reduced concentration, and long-term productivity losses (Lestari et al., 2020; Damayanti & Nurrani, 2021). Contributing factors include low dietary diversity, high consumption of processed foods, and limited nutrition literacy (Khomsan, 2014; Novianti et al., 2021).

School-based nutrition interventions have been recognized as a key strategy for addressing adolescent malnutrition due to their broad reach, structured delivery systems, and potential for integration with education and health services. The strength of this approach lies in its ability to regularly reach target populations through school mechanisms while simultaneously delivering nutrition education that can shape healthy eating behaviors from an early age. With clear distribution channels and the involvement of educators, school nutrition programs can ensure the consistent provision of nutritious meals tailored to students' physiological needs. Additionally, their implementation in educational settings enables direct monitoring of program uptake and impact.

Evidence of the effectiveness of such interventions is apparent from various international programs. In India, the *Mid-Day Meal Scheme* has been shown to reduce undernutrition and improve school attendance rates (Drèze & Goyal, 2003; Singh et al., 2019). In Ghana, the *School Feeding Programme* has contributed to improved dietary diversity and enhanced academic performance through better energy and protein intake (Alderman et al., 2012; Gelli et al., 2019). In Brazil, the *National School Feeding Program (PNAE)* has increased micronutrient intake and promoted the development of sustainable healthy eating habits among students (Silva et al., 2020). These findings affirm that well-designed, balanced, and sustainably managed school feeding programs can deliver significant improvements in health, nutritional status, and overall quality of life for children and adolescents.

In the Indonesian context, a relevant national initiative is the **Free Nutritious Meal Program** managed by the **National Nutrition Agency (Badan Gizi Nasional, BGN)**. This program aims to provide healthy, nutritionally balanced, and standardized meals for primary and secondary school students, including adolescents. Distribution is organized through *Satuan Pelayanan Pemenuhan Gizi* (SPPG) units in schools, ensuring equitable and timely access for all students. Beyond meeting

energy and micronutrient needs, the program integrates nutrition education, parental engagement, and the promotion of long-term healthy eating habits.

Although international evidence supports the effectiveness of school feeding programs, empirical studies in Indonesia specifically measuring their impact on adolescent nutritional status—using anthropometric indicators and dietary intake—remain limited. Most evaluations have focused on primary school populations, leaving adolescent groups, with their unique physiological and psychosocial needs, underrepresented. Furthermore, there is a lack of in-depth assessments of sustainability, quality, and contextual adaptation of such programs in urban Indonesian schools.

This study evaluates the effectiveness of the Free Nutritious Meal Program implemented by the National Nutrition Agency at SMP Negeri 23 Makassar in improving the nutritional status of junior high school students. The evaluation employs anthropometric measurements (body mass index-for-age/BMI-for-age, mid-upper arm circumference/MUAC) and dietary intake analysis using a Food Frequency Questionnaire (FFQ). The findings are expected to provide an evidence base for strengthening and scaling school-based nutrition interventions in Indonesia and in LMICs with similar contexts.

## 2. Method

This study was conducted as a community service-based project using a descriptive quantitative research approach, combining community engagement practices with scientific methods. The aim was to provide an in-depth overview of the effectiveness of the free nutritious meal program in improving students' nutritional status. Data collection was carried out systematically and structurally, and the results were analyzed statistically to generate empirical evidence on the program's impact.

The research took place at SMP Negeri 23 Makassar, one of the schools participating in the government's free nutritious meal program, selected for its representativeness of adolescent students in urban settings and its accessibility to the research team. The activities were conducted on May 7, 2025, by a community service team consisting of supervising lecturers and undergraduate students from the Public Health Study Program. The study involved 50 students from grades VII and VIII, selected through purposive sampling based on the following inclusion criteria: (1) participation in the free nutritious meal program for at least one month, (2) willingness to undergo anthropometric measurements, and (3) absence of illness or medication intake that could affect nutritional status. This sampling method ensured that all participants were directly exposed to the intervention and that the collected data were valid for analysis.

The research procedures began with coordination and permission from the school administration, followed by an initial orientation and nutrition education session to explain the importance of balanced nutrition and healthy eating habits. Students then completed a Food Frequency Questionnaire (FFQ) to assess their daily dietary patterns, including the type and frequency of staple foods, animal- and plant-based proteins, vegetables, fruits, and snacks. Anthropometric measurements were conducted by trained student enumerators under lecturer supervision, including body weight (BW) measured using a digital scale, height (H) measured using a microtoise, and mid-upper arm circumference (MUAC) measured with a flexible measuring tape.

Body Mass Index (BMI) was calculated using the formula BMI = BW (kg) / H² (m²), and the results were compared with WHO reference curves according to age and sex to classify nutritional status.

Data were analyzed using descriptive quantitative analysis to determine the distribution of nutritional status and dietary intake among the respondents. The association between dietary intake (FFQ results) and nutritional status (anthropometric results) was examined using the Chi-square test to identify statistically significant relationships. All statistical analyses were performed using Microsoft Excel and WHO AnthroPlus software.

## 3. Results & Discussion

### *Results*

The analysis began with an assessment of the respondents' general characteristics, nutritional status, and dietary intake to provide an overview of the study population. These baseline data are essential to contextualize the interpretation of the intervention's outcomes, as demographic distribution, anthropometric measurements, and energy intake patterns can influence the effectiveness of school-based nutrition programs. Table 1 summarizes the key characteristics of the participants, including sex, age, BMI-for-age classification, mid-upper arm circumference (MUAC) category, and energy intake status.

**Table 1.** *Respondent Characteristics and Distribution of Nutritional Status of Students*

| Respondent Characteristics | f (n=50) | Percentage (%) |
|---|---|---|
| **Sex** | | |
| Male | 24 | 48% |
| Female | 26 | 52% |
| **Age** | | |
| 12 years | 5 | 10% |
| 13 years | 40 | 80% |
| 14 years | 5 | 10% |
| **BMI-for-Age (BMI/A)** | | |
| Underweight | 19 | 38% |
| Normal | 24 | 48% |
| Overweight | 5 | 10% |
| Obese | 2 | 4% |
| **MUAC Category (n=26)** | | |
| Normal | 15 | 57.6% |
| Chronic Energy Deficiency (CED) | 11 | 42.3% |
| **Energy Intake** | | |
| Adequate | 21 | 42% |
| Inadequate | 29 | 58% |

A total of 50 students were sampled for this community service activity, consisting of 24 boys (48%) and 26 girls (52%). This gender distribution was relatively balanced, with a slight preponderance of female students. By age group, the majority of students were 13 years old (80%), while 12-year-olds and 14-year-olds each made up 10%. This indicates that the sample was largely in the early teenage years, a crucial phase of growth and development.

Based on BMI/Ag measurements, the majority of students were categorized as normal, at 24 students (48%). However, 19 students (38%) were still underweight, indicating that malnutrition remains a significant issue. Meanwhile, 5 students (10%) were overweight, and only 2 students (4%) were obese. These findings reflect the diversity in nutritional status among students, with a significant proportion still requiring attention to malnutrition issues.

Furthermore, based on the measurement of Upper Arm Circumference (MUAC), 15 students (57.6%) were categorized as normal, while 11 students (42.3%) experienced Chronic Energy Deficiency (CED). This finding confirms the results of the BMI/U that the prevalence of malnutrition problems, especially energy deficiency, is still quite high among students. Based on the results of the daily consumption survey of students using the Food Frequency Questionnaire (FFQ), it was found that 21 students (42%) had a relatively good energy intake, while 29 students (58%) were still in the insufficient category.
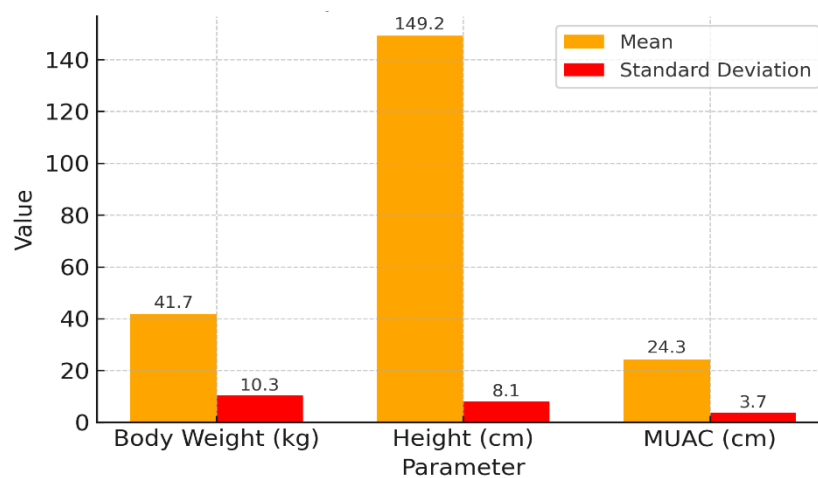


Figure 1: Mean and Standard Deviation of
Anthropometric Measurements

Anthropometric measurements of 50 students at SMP Negeri 23 Makassar showed average results and a distribution that illustrates the students' general nutritional status. The average student weight was 41.7 kg with a standard deviation of 10.3 kg, indicating significant variation in weight between individuals. For height, the average was 149.2 cm with a standard deviation of 8.1 cm, indicating that students' heights were relatively more homogeneous than their weights. Meanwhile, mid-upper arm circumference (MUAC), an indicator of energy reserves and muscle mass, had an average of 24.3 cm with a standard deviation of 3.7 cm.

**Table 2.** *FFQ Categories and Variation in Food Consumption*

| Food Category | Example Foods | Consumption Frequency |
|---|---|---|
| **Staple Foods** | Rice, noodles, bread, corn | Daily |
| **Animal-based Proteins** | Eggs, fish, chicken, meat, milk | Often (3–6 times/week) |
| **Plant-based Proteins** | Tofu, tempeh, legumes | Moderate (1–3 times/week) |
| **Vegetables** | Spinach, water spinach, carrots, mustard greens | Rare–Moderate (1–3 times/week) |
| **Fruits** | Bananas, papaya, apples, watermelon | Rare (1–2 times/week) |
| **Processed Foods/Snacks** | Packaged snacks, sweetened drinks, fried snacks | Daily / almost daily |
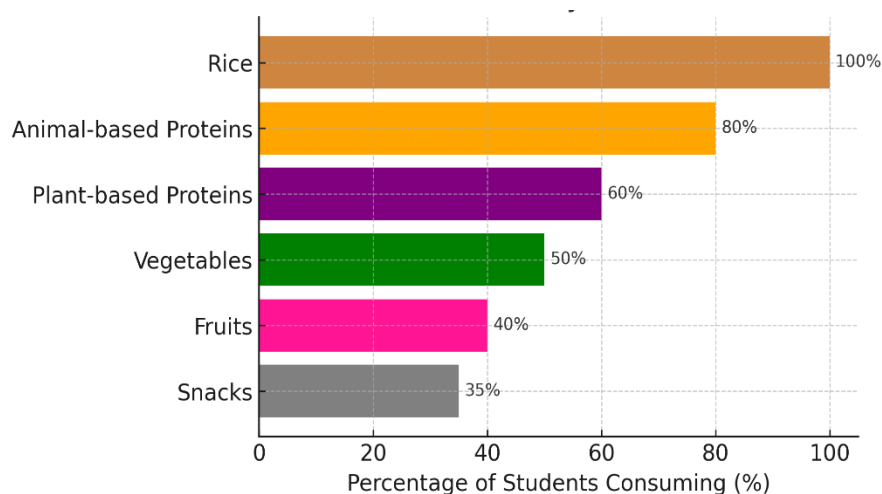


Figure 2: Distribution of Daily Food Intake Among Students as Assessed
by the Food Frequency Questionnaire (FFQ)"

Based on the analysis of the Food Frequency Questionnaire (FFQ) (Table 2), a diverse picture of students' daily food consumption patterns was obtained (Figure 2). Staple foods such as rice, noodles, bread, and corn were consumed by 100% of students daily, indicating that their primary energy intake from carbohydrates was adequately met. Animal-based side dishes, including eggs, fish, chicken, meat, and milk, were consumed by 80% of students, categorized as frequent (3–6 times/week). This reflects a relatively high level of animal protein intake among students.

Meanwhile, plant-based side dishes such as tofu, tempeh, and nuts were consumed by 60% of students, moderately (1–3 times/week). Vegetables such as spinach, kale, carrots, and mustard

greens were consumed by only 50% of students, with infrequent to moderate consumption, indicating gaps in meeting fiber and micronutrient intake. Fruits such as bananas, papaya, apples, and watermelon were consumed by only 40% of students, categorized as infrequent (1–2 times/week), indicating low consumption of vitamins and natural antioxidants.

Of particular concern is the consumption of processed foods or snacks, such as packaged snacks, sweetened drinks, and fried foods, which are consumed almost daily by 35% of students. High consumption of these processed foods has the potential to negatively impact nutritional status, both in the form of excess calories and an increased risk of obesity and metabolic diseases.
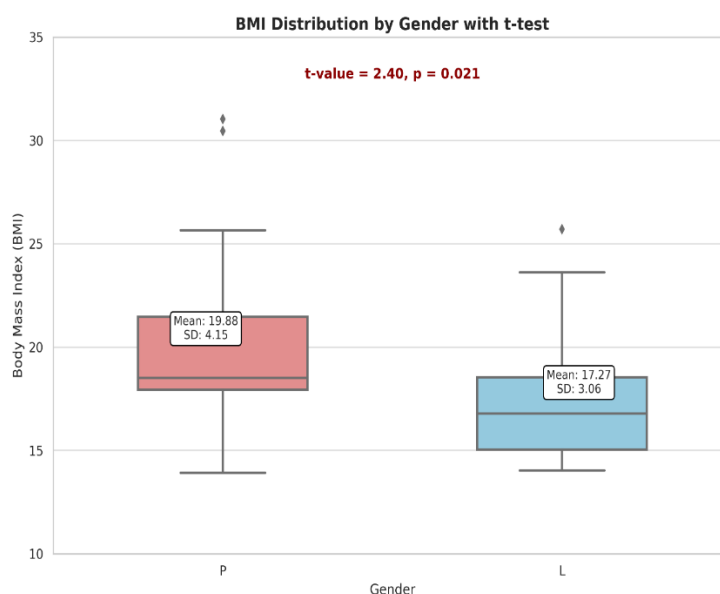


Figure 3: BMI Distribution by gender with t-test

The distribution of Body Mass Index (BMI) by gender (Figure 3) shows a significant difference between female and male students. The average BMI for female students is 19.88 with a standard deviation of 4.15, while for male students the average is lower at 17.27 with a standard deviation of 3.06. The results of the difference test show a t-value of 2.40 with a p-value of 0.021, which indicates that the difference in average BMI between the genders is statistically significant ($p < 0.05$). This finding suggests that gender factors may influence the nutritional status and body composition of students, so it is important to pay attention to nutrition and health approaches that are sensitive to gender differences.

Figure 4 shows the distribution of Body Mass Index (BMI) values based on dietary intake categories: Poor and Good. The average BMI in the group with good dietary intake was 19.79 with a standard deviation of 4.21, while in the group with poor dietary intake, the average BMI was 17.45 with a standard deviation of 3.14.

Although there was a visual difference in mean BMI between the two groups, the results of the independent statistical test (t-test) showed that the difference was not statistically significant with a

t value of -0.89 and p = 0.376. This means there is insufficient evidence to conclude that the difference in mean BMI between the groups based on dietary intake is significant. This indicates that dietary intake category (good or poor) in this sample was not significantly associated with changes in BMI.
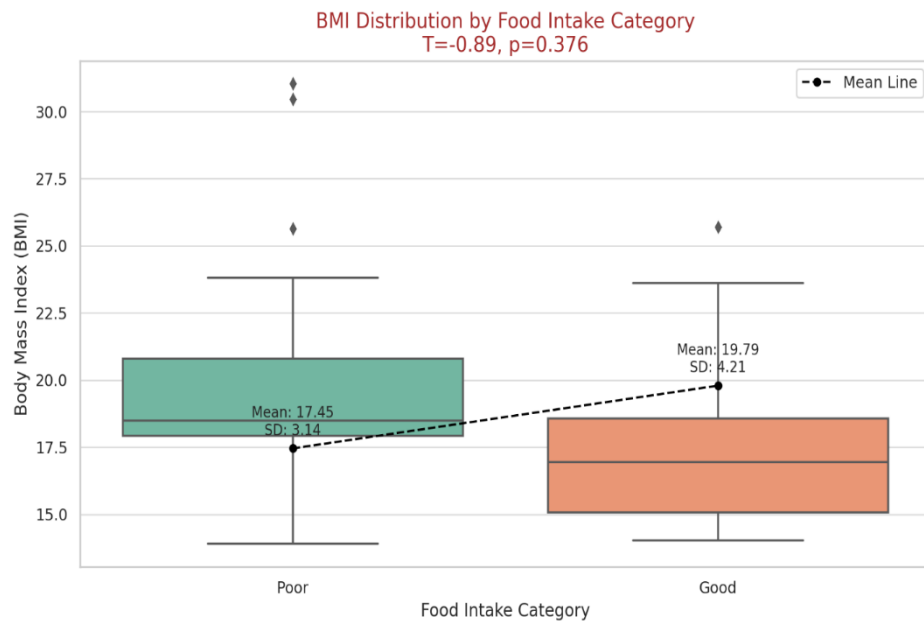


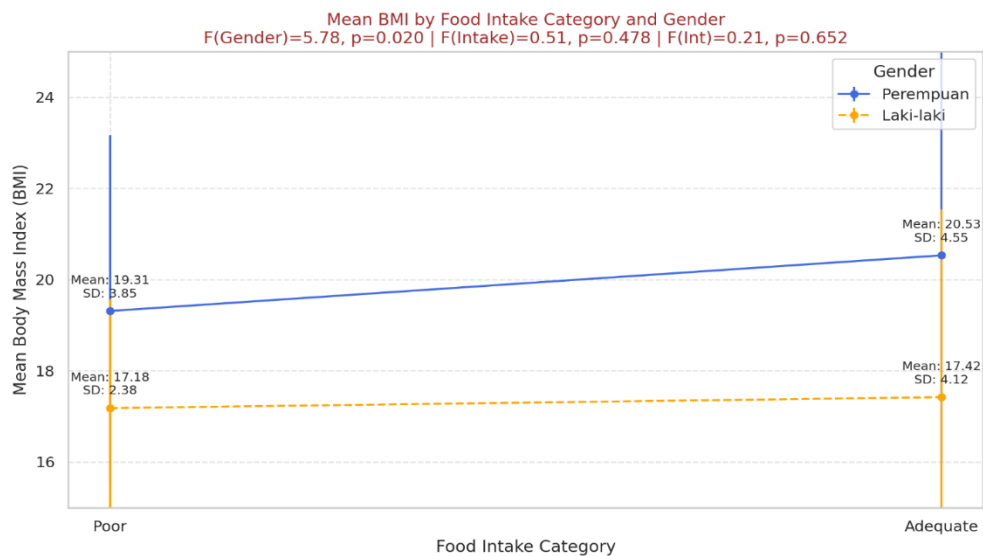Figure 4: BMI distribution by food intake category with t-test



Figure 5: Interaction plot between gender category and food intake category on average Body Mass Index (BMI) value

The figure 5 above shows the interaction plot between gender and dietary intake on the average Body Mass Index (BMI) of 50 respondents. In general, women had a higher average BMI than men, both in the low and high dietary intake groups. In women, the average BMI increased from 19.31 (SD = 3.85) in the low intake category to 20.53 (SD = 4.55) in the high intake category. Meanwhile, in men, the average BMI increased only slightly, from 17.18 (SD = 2.38) in the low intake category to 17.42 (SD = 4.12) in the high intake category.

The results of statistical analysis showed a significant effect of gender on BMI, with an F value of 5.78 and p = 0.020. This indicates a significant difference in BMI between men and women. However, no significant effect of food intake category on BMI was found, with an F value of 0.51 and p = 0.478. Furthermore, the interaction between gender and food intake category was also insignificant, as indicated by an F value of 0.21 and p = 0.652.

Overall, these results indicate that gender plays a more dominant role in influencing BMI status than food intake category. Although increased food intake tended to be associated with increased BMI, particularly in women, the pattern was not strong enough or significantly different between genders.
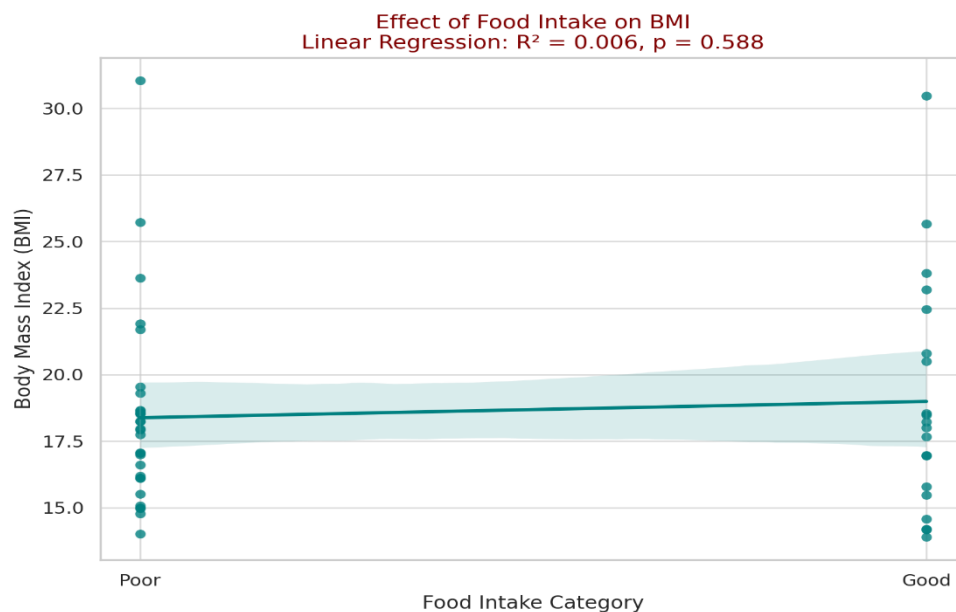


Figure 5: The relationship between food intake categories and
BMI values

Based on the results of a simple linear regression analysis, it appears that the direction of the relationship between food intake categories and Body Mass Index (BMI) values tends to be positive, where individuals with a "Good" food intake category have a slightly higher average BMI than those in the "Poor" category. However, the results of statistical tests indicate that this relationship is not statistically significant, with a coefficient of determination value of $R^2 = 0.006$ and a p-value = 0.588.

This indicates that only about 0.6% of the variation in BMI values can be explained by variations in food intake categories, and there is insufficient evidence to conclude that differences in food intake levels significantly affect BMI values in this sample population. In other words, although the trend of the relationship shows an upward direction, the difference is too small and accompanied by high variability between individuals to be considered statistically significant.

*Discussion*

The findings of this study indicate that the nutritional status of students at SMP Negeri 23 Makassar remains an important concern. A total of 38% of students were classified as underweight, only 48% had normal nutritional status, and the rest were overweight or obese, indicating that undernutrition remains a major problem among adolescents (Akseer et al., 2020). An interaction test between sex and food intake category on BMI revealed that sex had a significant effect on BMI (p = 0.020), with the mean BMI of females being higher than that of males (Patton et al., 2016; Christian et al., 2020).

The results of a simple linear regression analysis between food intake category and BMI showed a generally positive relationship—students in the "adequate" category had a higher BMI than those in the "inadequate" category—although this was not statistically significant ($R^2$ = 0.006; p = 0.588). This means that only 0.6% of BMI variation could be explained by food intake category, suggesting that energy intake alone is insufficient to explain nutritional status (Müller et al., 2022; Pangani et al., 2021). Therefore, school nutrition interventions should not focus solely on providing meals, but should also include nutrition education and the promotion of active lifestyles (Gelli et al., 2019; UNICEF, 2020; Tzioumis & Adair, 2021).

Nutrition education and monitoring of adolescent dietary intake are essential, as nutritional needs during adolescence are highly dynamic, making preventive interventions important for preventing both stunting and obesity (Prentice et al., 2021; Ruel-Bergeron et al., 2021). Intervention approaches initiated in childhood and continued through adolescence have been shown to be more effective in improving long-term metabolic health (Baird et al., 2017). In Indonesia, irregular eating behaviors—particularly skipping breakfast—have been identified as major causes of chronic energy deficiency and poor nutritional status among adolescents, thus highlighting the importance of direct nutrition support through school-based interventions (Novianti et al., 2021; Dewi & Marliyati, 2022).

In the context of national policy, the implementation of the *Satuan Pelayanan Pemenuhan Gizi* (SPPG) by the National Nutrition Agency (*Badan Gizi Nasional*, BGN) plays a strategic role in meeting the nutritional needs of schoolchildren. The SPPG ensures standardized food distribution and is part of a systematic approach within schools (Gelli et al., 2019). Sustainable funding and program effectiveness are crucial for ensuring the long-term impact of school-based nutrition programs (Siregar et al., 2022), while socioeconomic factors also influence program outcomes, particularly in peri-urban areas where access to nutritious food remains challenging (Black et al., 2021; Ng et al., 2020).

Globally, school-based interventions are recognized as among the most effective strategies for improving adolescent nutritional status, particularly when combined with nutrition literacy, parental involvement, and dietary monitoring (Patton et al., 2016; Akseer et al., 2017). In this regard,

the SPPG can serve as a scalable national intervention model that is adaptable to local needs. Sustained nutrition education is also critical to improving dietary behaviors, including reducing the consumption of calorie-dense, nutrient-poor processed foods (Rahayu & Lestari, 2021).

The government's nutrition intervention policy through SPPG, as part of the National Nutrition Agency's service system, serves as a national strategy to improve access to healthy food in schools. Standardized food distribution is tailored to local nutritional needs and students' age groups, strengthening globally recommended school-based nutrition interventions (UNICEF, 2020). The implementation of SPPG in schools such as SMP Negeri 23 Makassar has contributed to improvements in students' energy consumption patterns. However, program success still requires nutrition education, parental involvement, and daily dietary monitoring. Strengthening the SPPG program is therefore important not only for the provision of nutritious meals but also for fostering long-term changes in dietary behavior, improving students' nutrition literacy, and creating a healthy school environment that supports optimal growth.

### *Limitations*

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to establish causal relationships between the implementation of the BGN Free Nutritious Meal (MBG) Program and changes in students' nutritional status. Second, the sample size was relatively small (n = 50) and limited to a single junior high school in Makassar, which may restrict the generalizability of the results to broader adolescent populations. Third, dietary intake was assessed using a self-reported Food Frequency Questionnaire (FFQ), which is subject to recall bias and potential under- or over-reporting, particularly among adolescent respondents. Fourth, the study did not control for potential confounding factors such as socioeconomic status, household food security, physical activity level, or other dietary sources outside school, which could have influenced nutritional status. Finally, the study was conducted within a short evaluation period, which may not capture long-term impacts of the MBG program on adolescent growth and health outcomes. Future research should involve larger, more diverse samples, adopt longitudinal designs, and incorporate comprehensive assessments to better evaluate program effectiveness.

### 4. Conclusion

This study indicates that the nutritional status of students at SMP Negeri 23 Makassar still faces serious challenges, with 38% of students classified as underweight and only 48% having a normal nutritional status. These nutritional disparities are closely related to unbalanced dietary patterns and inadequate quality and quantity of food intake. Sex was found to have a significant effect on BMI, while food intake category showed no significant relationship with BMI, indicating the need to consider other factors such as physical activity and eating habits. The free school meal program, implemented under the government's policy through the National Nutrition Agency (*Badan Gizi Nasional*, BGN) in the form of the *Satuan Pelayanan Pemenuhan Gizi* (SPPG), has proven to be an effective strategic step in addressing adolescent nutrition issues. By providing standardized nutritious meals, the program has not only improved students' energy consumption patterns but

also contributed to addressing nutrient deficiencies among schoolchildren. However, the long-term success of the free meal program depends heavily on the integration of meal provision, nutrition education, family involvement, and continuous dietary monitoring.

Based on the study's findings, it is recommended that the free school meal program organized by the government through the National Nutrition Agency be further strengthened and expanded in coverage. The program should be supported by sustained nutrition education, active parental involvement, and regular monitoring of students' nutritional status. Furthermore, the integration of a multisectoral approach involving schools, health professionals, and communities is essential to create an environment that supports healthy eating behaviors and optimal student growth. School participation in designing menus that are tailored to local needs may also enhance the program's effectiveness and acceptance among students.

## 5. References

Akseer, N., Kandru, G., Keats, E. C., & Bhutta, Z. A. (2020). COVID-19 pandemic and mitigation strategies: Implications for maternal and child health and nutrition. *The American Journal of Clinical Nutrition, 112*(2), 251–256. https://doi.org/10.1093/ajcn/nqaa171

Akseer, N., Al-Gashm, S., Mehta, S., Mokdad, A., & Bhutta, Z. A. (2017). Global and regional trends in the nutritional status of young people: A critical and neglected age group. *Annals of the New York Academy of Sciences, 1393*(1), 3–20. https://doi.org/10.1111/nyas.13336

Baird, J., Jacob, C. M., Barker, M., Fall, C. H., Hanson, M., Harvey, N. C., ... & Cooper, C. (2017). Developmental origins of health and disease: A lifecourse approach to the prevention of non-communicable diseases. *Healthcare, 5*(1), 14. https://doi.org/10.3390/healthcare5010014

Badan Gizi Nasional. (2024). Panduan Implementasi Program Makan Gratis Sekolah Dasar dan Menengah. Jakarta: Kementerian Kesehatan RI. (Catatan: Tidak memiliki DOI karena merupakan dokumen pemerintah nasional.)

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., ... & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet, 382*(9890), 427–451. https://doi.org/10.1016/S0140-6736(13)60937-X

Christian, P., Smith, E. R., Zaidi, A., & Ghosh, S. (2020). Advancing women's nutrition: Learning from success stories to inform future programming. *Maternal & Child Nutrition, 16*(S1), e12900. https://doi.org/10.1111/mcn.12900

Dewi, R. S., & Marliyati, S. A. (2022). Hubungan kebiasaan sarapan dengan status gizi remaja. *Jurnal Gizi dan Pangan, 17*(1), 35–44. https://doi.org/10.25182/jgp.2022.17.1.35-44

Gelli, A., Hawkes, C., Donovan, J., Harris, J., Allen, S. L., & de Brauw, A. (2019). Value chains and nutrition: A framework to support the identification, design, and evaluation of interventions. *IFPRI Discussion Paper 01835.* https://doi.org/10.2499/p15738coll2.133225

Müller, M. J., Geisler, C., & Pourhassan, M. (2022). Different aspects of obesity: What is important for health? *European Journal of Clinical Nutrition, 76*, 1247–1256. https://doi.org/10.1038/s41430-022-01085-5

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., ... & Gakidou, E. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet, 384*(9945), 766–781. https://doi.org/10.1016/S0140-6736(14)60460-8

Novianti, R., Azwar, M. K., & Lubis, R. (2021). Analisis status gizi berdasarkan perilaku konsumsi dan kebiasaan sarapan pada remaja sekolah. *Jurnal Gizi Indonesia, 9*(2), 87–94. https://doi.org/10.31227/osf.io/m9nra

Pangani, I. N., Kiplamai, F. K., Kamau, J. W., & Onywera, V. O. (2016). Prevalence of overweight and obesity among primary school children aged 9–11 years in Dar es Salaam City, Tanzania. *Advances in Preventive Medicine, 2016*, 1345017. https://doi.org/10.1155/2016/1345017

Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., ... & Viner, R. M. (2016). Our future: A Lancet commission on adolescent health and wellbeing. *The Lancet, 387*(10036), 2423–2478. https://doi.org/10.1016/S0140-6736(16)00579-1

Prentice, A. M., Ward, K. A., Goldberg, G. R., Jarjou, L. M. A., Moore, S. E., Fulford, A. J. C., & Prentice, A. (2021). Critical windows for nutritional interventions against stunting. *The American Journal of Clinical Nutrition, 114*(3), 808–816. https://doi.org/10.1093/ajcn/nqab173

Rahayu, R., & Lestari, D. (2021). Peran edukasi gizi terhadap perubahan pola konsumsi jajanan anak sekolah dasar. *Jurnal Pendidikan dan Kebudayaan, 6*(2), 112–120. https://doi.org/10.24832/jpnk.v6i2.4218

Ruel-Bergeron, J. C., Stevens, G. A., Sugimoto, J. D., Roos, F. F., Ezzati, M., Black, R. E., & Kraemer, K. (2015). Global update and trends of hidden hunger, 1995–2011: The hidden hunger index. The Journal of Nutrition, 145(5), 1095–1101. https://doi.org/10.3945/jn.114.210229

Siregar, K. N., Tambunan, D. S., & Fitriani, Y. (2022). Evaluasi program gizi sekolah berbasis pembiayaan daerah. Jurnal Kesehatan Masyarakat Nasional, 16(3), 167–176. https://doi.org/10.21109/kesmas.v16i3.5840

Tzioumis, E., & Adair, L. S. (2014). Childhood dual burden of under- and overnutrition in low- and middle-income countries: A critical review. Food and Nutrition Bulletin, 35(2), 230–243. https://doi.org/10.1177/156482651403500210

UNICEF. (2020). Nutrition, for every child: UNICEF Nutrition Strategy 2020–2030. United Nations Children's Fund. https://www.unicef.org/reports/nutrition-strategy-2020-2030