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NUTRIENT QUALITY OF READY-TO-EAT MEALS FROM SCHOOL CANTEENS AND VENDORS: INSIGHT INTO THE SCHOOL FOOD ENVIRONMENT

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Abstract

The school food environment, which offers limited healthy food options, contributes to the rising prevalence of overweight among adolescents in Indonesia. Various efforts have been made to improve nutritional status, including the school meal programs. However, there have been no targeted efforts to regulate food, especially the Ready-to-Eat (RTE) meals within the school environment, particularly in urban areas where the overweight prevalence among adolescent is increasing. Up to present time, there is no adequate information provided for adolescent regarding to the nutrition quality of RTE meals at school which could be potential to increase the knowledge and improve their food choice. This study aimed to analyze the nutritional quality of ready-to-eat meals (RTE) sold in school canteens and vendors in Jakarta as evidence to provide information about nutrient quality of RTE meals. In-depth interviews to explore the food recipe were conducted with food vendors from selected schools in urban and peri-urban areas. Nutrient content analysis per portion was calculated using the Indonesian Food Composition Table, based on collected recipes. Foods were categorized into snacks, one-dish meals, full meals, beverages, and side dishes. Nutrient quality was identified using Nutrient-Rich Food (NRF) index. Results showed that beverages contribute the highest sugar content with the lowest nutritional value, while one-dish provide highest sodium, and full meals are dominated by high carbohydrate, fat, and calorie content. Across all meal categories, the intake of fiber, iron, calcium, vitamin A, and vitamin C is far below recommendation. Moreover, both one-dish and full meals fail to meet protein recommendation level.

Keywords: Adolescent; Food Environment; Overweight; School; Snacks

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INTRODUCTION

Recent national data in Indonesia show that the number of overweight and obese adults jumped from 28.9% in 2013 to 35.4% in 2018 (Unicef, 2022). This sharp rise in five years span highlights how quickly eating habits and lifestyle have changed. Research shows that adult obesity starts with habits and nutrition patterns formed in childhood and adolescence. This means that what happens during adolescent can shape health for years to come. Adolescence is a period of rapid growth, hormonal

change, and more independent lifestyle compared to childhood. The eating habit developed in this period lasts into adulthood and could possibly raise the risk of chronic diseases. Therefore, obesity in adolescence is not just a short-term issue, it can lead to serious health problems later in life (Evensen et al., 2016; Simmonds et al., 2016). Overweight during adolescent is closely linked to higher risk of type 2 diabetes, heart diseases, and high blood pressure (Sakir et al., 2024). Obesity among girls can also lead problem with periods and hormones, and infertility. The effects are not just physical, adolescent with obesity often faces stigma, feel dissatisfaction over their body shape, lower self-esteem, and sometimes struggle with depression and anxiety. These wide range of impacts show why it is important to address obesity in adolescence as a part of important strategies to improve public health.

The cause of obesity in teenagers involve many factors, including the environment. Moreover, aside of the environment condition, it is also family socioeconomic background that support the decision on daily dietary habit (Nurwanti et al., 2019). Adolescents from families with higher nutrition literacy might be more likely to access balanced diets, while those from disadvantaged socio-economic backgrounds are more vulnerable to obesogenic environments (Darling et al., 2025). Therefore, the most direct and obvious influence on adolescents' eating habits comes from environmental factors (Halim Octawijaya et al., 2022). Among these include food accessibility and availability at school (Samad et al., 2024). Since adolescents spend up to eight hours a day at school, it becomes a major location for food consumption throughout the school days where breakfast, lunch, and one snack time are typically taken at (Jacob et al., 2021).

The food environment available around adolescents provides limited healthier options (de Assis et al., 2022). Foods high in sugar, salt, and fat is widely accessible, especially in schools (de Oliveira Cardoso et al., 2011). It is important that adolescents have practical and easily accessible information to identify the nutritional quality of foods around them (Langford et al., 2022). Limited availability of healthier foods within school settings restricts adolescents' ability to make informed dietary choices, reinforcing unhealthy eating behaviors that may persist into adulthood.

Currently, the government has implemented regulations for nutrition information and healthier choice labels on packaged foods under BPOM regulations. However, there is no such information or labeling for ready-to-eat (RTE) meals, which dominate the types of snacks sold in schools. Evaluating the nutrition value of RTE meals that are accessible to teenagers in school settings is crucial considering these problems for several reasons. First, it can offer factual data on how closely school-based food intake complies with the national dietary guidelines for the nutrition need for adolescent. Second, it produces data that support more robust nutrition policies, such as limiting the promotion and sale of unhealthy meals to children, regulating the school canteens, and creating better food standards (such

as nutrient profiling system). Third, it empowers by providing information to improve nutrition literacy. Therefore, this study aimed to analyze the nutritional quality of ready-to-eat meals (RTE) sold in school canteens and vendors in Jakarta as evidence to provide information about nutrient quality of RTE meals.

METHODS

Food Recipe Compilation

The purpose of this phase is to determine the list of school snacks available in the school environment. Identification of foods was carried out through a market survey based on previous studies. A total of 6 senior high schools in Jakarta Province and 5 in Banten Province was selected as representatives of urban and peri-urban schools.

At least five best-sellers vendors from each school, including the school canteen, was selected. Only vendors located within 1 km of the school were included. In-dept interviews with vendors about the foods they sell and their recipes formed the basis for standardized recipes and nutrient composition data. Foods was categorized into five groups: ready-to-eat snacks, one-dish meals, beverages, full meals, and side dishes. A total of 129 meals and beverages were listed in this study.

Nutrient Analysis

This phase aims to determine the nutrient content of each food. Nutrient analysis based on the Indonesian Food Composition Table (TKPI). If a food is not listed in TKPI, nutrient content was calculated from the recipe, considering raw-to-cooked conversion, oil absorption (for fried foods), and estimated salt per serving. Calculations was conducted using the NutriSurvey application. Nutrient quality was calculated using Nutrient Rich Index (NRF) 6.3 with positive nutrient includes protein, fiber, calcium, iron, vitamin A, and vitamin C, while negative nutrient includes fat, sodium, and sugar.

RESULTS AND DISCUSSION

This study gathered 129 RTE foods and drinks from 11 schools in urban and peri-urban area in Jakarta and Banten, Indonesia. The RTE meals included in this study were the food that are popular among student based on the observation during school break. The foods were then categorized into five categories based on Indonesian food culture: snack, one-dish meal; full meal; side dish; and beverage.

Snacks are smaller portions of food, typically enjoyed between main meals. This study demonstrates that snacks showed significant nutritional risks, with sodium levels exceeding recommendation (figure 1), likely due to popularity if fried ad savory snacks among adolescents. Snacks relatively have

lower energy content compared to one-dish meal and full meal, but have higher median of energy compared to side dish (table 1).

One-dish meals are single dishes that contain all the necessary components for a complete meal, providing a practical and quick way to consume a variety of nutrients. Example of one-dish meal in this study: *mie ayam, tekwan, nasi goreng,* and variety of rice bowls. This study shows that one-dish-meal contained the highest median sodium content (table 1), surpassing recommended intake levels.

Full meals are defined as the traditional Indonesian communal meal involves a staple of steamed rice served with selection of side dishes and vegetables, had the highest levels of carbohydrates, fat, and total calories, reflecting the heavy reliance on staple-based dietary patterns in Indonesian culture. Both one-dish and full meal demonstrated protein levels below dietary recommendations, suggesting an insufficient contribution of quality protein sources in adolescents diets. Across all categories, the intake of fiber, iron, calcium, vitamin A, and vitamin C was markedly below recommendation, underscoring the micronutrient gap present in school-based food environments.

The side dish in this study included variety of meats, vegetables, eggs, and fried items served alongside the main staple, commonly steamed rice. It is important to address that the intake of side dish will come along with staple foods. However, this study categorize side dish as individual group as it is essential in Indonesian food culture due to its variety and its significant role to complement the overall nutrient quality of full meal. As shown in the table 1, some type of side dish itself contribute to significant amount of protein, iron, calcium, vitamin A, and vitamin C. Therefore, the balanced amount of side dish and staple food could provide a nutritionally-balanced full meal.

Table 1. Distribution of Nutrient, Sugar, and Sodium Content of RTE Meals from School Environment (n= 129)

Nutrient/ Food Compound	**Amount (per portion)**					
	All (n=129)	**Snack (n=58)**	**One-dish meal (n=15)**	**Full meal (n=20)**	**Side dish (n=16)**	**Beverage (n=20)**
Energy (kcal)	230.20 (31 – 720)	217.80 (57 – 479)	425.60 (191 – 565)	593.65 (150 – 720)	104.25 (31 – 556)	135.50 (79 – 310)
Protein (g)	5.60 (0 – 24)	4.85 (1 – 18)	11.30 (6 – 24)	16.10 (5 – 23)	5.10 (1 – 15)	1.00 (0 – 5)
Fat (g)	9.00 (0 – 32)	9 (0 – 32)	14.60 (1– 32)	19.95 (9 – 32)	6.50 (3 – 24)	2.00 (0 – 12)
Carbohydrate (g)	29.50 (0 – 100)	28 (3 – 86)	54 (22 – 91)	79.00 (11 – 100)	5.40 (0 – 74)	25.40 (19 – 72)
Sugar (g)	0.70 (0 – 45)	0.75 (0 – 28)	0.30 (0 – 7)	0.10 (0 – 13)	0.50 (0 – 3)	18.80 (0 – 45)

Sodium (mg)	349.60 (0 – 2306)	390.85 (7 – 1371)	815 (98 – 2306)	413 (46 – 1862)	198.30 (74 – 1276)	10.30 (0 – 89)
Fiber (g)	0.60 (0 – 22)	0.75 (0 – 11)	0.80 (0 – 4)	0.90 (0 – 22)	0.35 (0 – 2)	0.40 (0 – 6)
Iron (mg)	1.10 (0 – 11)	1.00 (0 – 8)	2.80 (0 – 11)	2.35 (1 – 8)	0.90 (0 – 3)	0 (0 – 4)
Calcium (mg)	55 (0 – 717)	54.80 (0 – 717)	76.90 (0 – 460)	65.50 (14 – 461)	42.55 (5 – 130)	23.00 (0 – 202)
Vitamin A (mg)	0 (0 – 208)	0 (0 – 60)	0 (0 – 120)	0 (0 – 208)	0 (0 – 124)	0 (0 – 30)
Vitamin C (mg)	0.40 (0 – 44)	0.45 (0 – 22)	1.20 (0 – 19)	0.50 (0 – 32)	1.20 (0 – 21)	0 (0 – 44)
NRF score	100 (-750 – 600)	80 (-610 – 400)	160 (-280 – 330)	255 (-130 – 440)	40 (-430 – 300)	-370 (-750 – 600)

Data is presented as median (min – max)

Beverages were identified as having the highest sugar content and the lowest Nutrient Rich Food (NRF) Index, indicating that while they provide high energy from sugar, they contribute very little to essential micronutrient intake. Full meals. The figure 1 reveals concerning finding as beverage is found to have sugar content above the recommended intake.

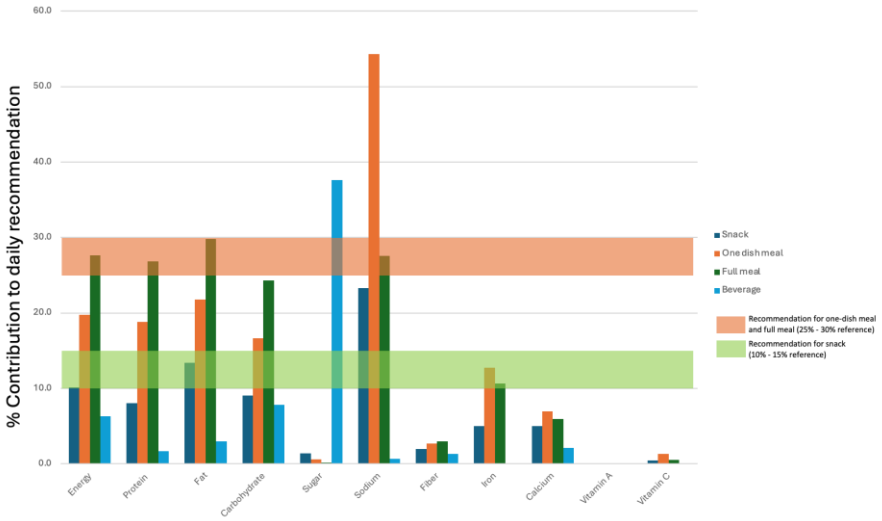

Figure 1. Median % contribution to daily recommendation of RTE meals by food categories.

These findings highlight significant nutritional challenges within the adolescent food environment in Indonesia. The dominance of sugar-sweetened beverages is consistent with global evidence that sugary drinks are strongly linked to rising rates of overweight and obesity. In Indonesia, beverages such as sweetened teas, syrup based drinks, and powdered drinks are inexpensive, widely available, and strongly embedded with youth culture, making them attractive but nutritionally poor choice. The

finding that beverages score the lowest on the NRF index reinforces their role as energy-dense, nutrient-poor products.

The excessive sodium content in one-dish meals and snacks reflects the widespread use of processed seasoning, such as flavor enhancers and sauces, in Indonesian street foods. High sodium intake is concerning because of its contributions to the risk of hypertension at early age (Nuradina et al., 2023). Moreover, some one dish meals are being adolescents' staple, such as *nasi goreng, mie goreng, and mie ayam*.

Full meals, which is high in carbohydrate, fat, and energy content, reflect the cultural dominance of rice as a primary staple in Indonesia. While rice-based meals provide satiety, they often lack diversity, as animal-based protein and vegetables are consumed in smaller amount (Nurhasan et al., 2024). Equally alarming is the consistently low amount of fiber, iron, calcium, vitamin A, and C across all meal categories. This nutrient gap consistent with national surveys showing that Indonesian adolescents are low in fruit, vegetable, and dairy products (Diana et al., 2022). Deficit is critical during adolescence, a period of rapid growth development, where lack of nutrient affects cognitive performance and long-term metabolic health.

All in all, these findings reveal how the adolescent food environment in Indonesia is heavily obesogenic. The accessibility of these foods around school, coupled with low nutrition literacy and aggressive marketing of unhealthy foods, reinforces unhealthy eating habits that might persists into adulthood.

CONCLUSION

This study demonstrates that the nutritional quality of RTE meals consumed by adolescents in Indonesian school food environments is poor and imbalanced. Beverages contribute the highest sugar content with the lowest nutritional value, while one-dish provide highest sodium, and full meals are dominated by high carbohydrate, fat, and calorie content. Across all meal categories, the intake of fiber, iron, calcium, vitamin A, and vitamin C is far below recommendation. Moreover, both one-dish and full meals fail to meet protein recommendation level. This environment fosters unhealthy dietary habits that increase risk of overweight, obesity, and long-term non-communicable diseases. It high light a strong school food policy to establish clear standards for sugar, sodium and fat content while empowering adolescent to have accessible practical tools to evaluate the nutritional quality of food and improve nutrition literacy.

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Declaration of Interest Statement

Authors declare there is no conflict of interest

REFERENCES

Darling, K. E., Panza, E., Warnick, J., Small, E., Derrick, A., & Jelalian, E. (2025). Weight Stigma in Adolescents With Obesity From Low-Income Backgrounds: Qualitative Perspectives From Adolescents and Caregivers. *Journal of Adolescent Health*.

de Assis, M. M., Gratão, L. H. A., da Silva, T. P. R., Cordeiro, N. G., do Carmo, A. S., de Freitas Cunha, C., de Oliveira, T. R. P. R., Rocha, L. L., & Mendes, L. L. (2022). School environment and obesity in adolescents from a Brazilian metropolis: cross-sectional study. *BMC Public Health*, *22*(1), 1229.

de Oliveira Cardoso, L., de Castro, I. R. R., da Silva Gomes, F., & da Costa Leite, I. (2011). Individual and school environment factors associated with overweight in adolescents of the municipality of Rio de Janeiro, Brazil. *Public Health Nutrition*, *14*(5), 914-922.

Diana, R., Rachmayanti, R. D., Khomsan, A., & Riyadi, H. (2022). Influence of eating concept on eating behavior and stunting in Indonesian Madurese ethnic group. *Journal of Ethnic Foods*, *9*(1), 48.

Evensen, E., Wilsgaard, T., Furberg, A.-S., & Skeie, G. (2016). Tracking of overweight and obesity from early childhood to adolescence in a population-based cohort–the Tromsø Study, Fit Futures. *BMC pediatrics*, *16*(1), 64.

Halim Octawijaya, I., Mariane Virenia Wariki, W., Hori, A., & Ichikawa, M. (2022). Food Environment Of Junior High Schools In Tomohon City, Indonesia.

Jacob, C. M., Hardy-Johnson, P. L., Inskip, H. M., Morris, T., Parsons, C. M., Barrett, M., Hanson, M., Woods-Townsend, K., & Baird, J. (2021). A systematic review and meta-analysis of school-based interventions with health education to reduce body mass index in adolescents aged 10 to 19 years. *International Journal of Behavioral Nutrition and Physical Activity*, *18*(1), 1.

Langford, R., Davies, A., Howe, L., & Cabral, C. (2022). Links between obesity, weight stigma and learning in adolescence: a qualitative study. *BMC Public Health*, *22*(1), 109.

Nuradina, R. A. A., Lestari, W. A., & Arumsari, I. (2023). Overweight and High Sodium Intake Increased Risk of Hypertension among Adolescents: A Case-control Study in Urban Setting. *Amerta Nutrition*, *7*(2), 274-278.

Nurhasan, M., Ariesta, D. L., Utami, M. M. H., Fahim, M., Aprillyana, N., Maulana, A. M., & Ickowitz, A. (2024). Dietary transitions in Indonesia: the case of urban, rural, and forested areas. *Food Security*, *16*(6), 1313-1331.

Nurwanti, E., Hadi, H., Chang, J.-S., Chao, J. C. J., Paramashanti, B. A., Gittelsohn, J., & Bai, C.-H. (2019). Rural–urban differences in dietary behavior and obesity: Results of the riskesdas study in 10–18-year-old Indonesian children and adolescents. *Nutrients*, *11*(11), 2813.

Sakir, N. A. I., Hwang, S. B., Park, H. J., & Lee, B.-H. (2024). Associations between food consumption/dietary habits and the risks of obesity, type 2 diabetes, and hypertension: a cross-sectional study in Jakarta, Indonesia. *Nutrition Research and Practice*, *18*(1), 132-148.

Samad, N., Bearne, L., Noor, F. M., Akter, F., & Parmar, D. (2024). School-based healthy eating interventions for adolescents aged 10–19 years: an umbrella review. *International Journal of Behavioral Nutrition and Physical Activity*, *21*(1), 117.

Simmonds, M., Llewellyn, A., Owen, C. G., & Woolacott, N. (2016). Predicting adult obesity from childhood obesity: a systematic review and meta-analysis. *Obesity reviews*, *17*(2), 95-107.

Unicef. (2022). Landscape analysis of overweight and obesity in Indonesia. *Jakarta: united nations children. s fund*.