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Research

The contribution of school feeding programs to children's energy and nutrient intakes in six selected departments of Benin

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Abstract

Benin has implemented a school feeding program to promote children's education and enhance the quality of food and nutrition provided to them. To assess the nutritional value of school meals served by government canteens, a cross-sectional study was conducted from November to December 2020 in the departments (districts) of Atacora, Collines, Couffo, Mono, Ouémé, and Plateau among 1502 school-aged children in 167 public primary schools with and without a government canteen. The direct food weighing method and the 24-hour dietary recall questionnaire were used to assess the nutritional content (energy, iron, and vitamins A and C) of foods and the dietary diversity of the children's diets. Data were analyzed using STATA software version 16.0. The results showed an average energy supply of 669 (*SD* = 316.3) Kcal, with 57% of schools covering at least 1/3 of the children's energy needs. The nutrient content of the food offered was found to be low compared to daily intake recommendations (iron: 15.9%, vitamin A: 17.7%, and vitamin C: 12.8%). With regard to dietary diversity over the entire day, there was no significant difference between schools with and without a government canteen. To reduce the micronutrient deficiencies among these children, setting up a school garden could be an important initiative to make fresh fruits and vegetables available for use in school meals.

INTRODUCTION

Malnutrition remains a health problem throughout the world, including among school-aged children in developing countries (Best et al. 2010; González et al. 2007). In countries with limited resources, most school-aged children often travel several kilometers to school without a morning or midday meal (Intiful & Lartey, 2014). School feeding programs are generally seen as educational interventions that promote equal access to education, but when they are nutrition-sensitive, they can contribute to the nutrition and health of schoolchildren. They can also contribute to hunger reduction and food security by helping low-income and vulnerable families with children. In the long term, they can promote child development and help build human capital by improving access to education and learning, as well as nutrition (FAO & WFP, 2018).

In Benin, the school feeding program has been identified as one of the essential measures to reduce the prevalence of malnutrition and to improve school retention while contributing to the children's nutritional situation (WFP, 2019a). In 2019, only the canteens under the National Integrated School Feeding Program (PNASI), supported by the WFP, were in operation, covering 3852 schools across the country's 77 municipalities (WFP & MEMP, 2019). The overall objective of the PNASI is to support primary education in areas of food insecurity and low school enrollment. Thus, while the objective of the program was to provide a balanced diet to the children, the community was expected to participate in the functioning of the canteen by providing vegetables and condiments and/or a daily contribution of 25 Francs CFA (~$0.045 US) for food purchases. How well this aspect functioned could be expected to be a major factor affecting the micronutrient content of the diets provided by the canteens.

Several studies have shown that school feeding programs have a positive effect on the education of participants, but their effect on the nutritional outcomes has not been clearly demonstrated (Greenhalgh et al., 2007; Kristjansson et al., 2007; Adelman et al., 2008). In addition, data collection on the nutritional status of school children in low-income countries is inadequate, and investments in child nutrition

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generally focus on the first 1,000 days of life (Best et al., 2010; Fiorentino et al., 2013; Galicia et al., 2016). Such data are also lacking in the case of Benin.

Thus, this study aimed to assess the adequacy of nutrient intake from meals offered by government canteens and the contribution of the PNASI to the dietary diversity of participating children, compared to children in schools without a school canteen.

METHODS

STUDY AREA

This cross-sectional study was conducted from November to December 2020, with school-aged children in six departments of Benin, selected based on the prevalence of food insecurity according to the Consolidated Approach for Reporting Indicators of Food Security (CARI): Atacora (23.6%) in the north, Collines (15.3%) in the center, and Couffo (16.2%), Mono (6.6%), Ouémé (8.1%), and Plateau (9.1%) in the south of the country (INSAE et al., 2017).

PARTICIPANTS

The study participants were 1502 school-aged children (<15 years old), 252 children per department, in the 5th - 6th grade of primary school. Interviews were also conducted with the children's mothers (key respondents for the 24-hour recall). School principals and parents of the children gave their consent. Overall, 167 public primary schools were selected, including 84 and 83, respectively, with and without a government canteen (PNASI). The selection process of schools with government canteens was carried out through the method of proportional probability, and those without government canteens through the "Snowball sampling" method (Goodman, 1961).

DATA COLLECTION

Direct food weighing and a dietary diversity questionnaire were used to assess the nutritional content including for energy, iron, vitamins A and C, and dietary diversity.

SOCIO-DEMOGRAPHICS: a semi-structured questionnaire was used to collect the socio-demographic information of children and their parents.

WEIGHTED FOOD RECORD: Direct food weighing was only carried out in schools with government canteens, as the food was cooked inside the school. An electronic "SECA" scale with a capacity of 250 kilograms (kg) and an accuracy of 100 grams (g) was used to weigh the kitchen utensils and the prepared meals. For the ingredients used to prepare the food, a kitchen scale accurate to 1g and with a maximum capacity of 5kg was used. This same kitchen scale was used to measure the food served to each child, both before and after, to obtain the exact quantity of food consumed.

DIETARY DIVERSITY: Dietary information was collected using a 24-hour dietary recall questionnaire (Kennedy et al., 2007; Arimond et al., 2010; Kenny et al., 2013). Children were asked to recall and describe the composition of the various foods they had eaten at school the day before the survey. To check and confirm the children's information, the 24-hour recall was carried out in primary schools with a public canteen on the day following the direct weighing.

ETHICS STATEMENT

Written informed consent was obtained from all relevant parties involved, including school principals and children with their parents, before the interviews. The consent forms provided detailed information about the nature and purpose of the study, as well as its potential risks and benefits. During the informed consent process, emphasis was put on the voluntary nature of participation, the right to withdraw from the study at any time, and the assurance of confidentiality of the data collected. We ensured that parents were provided with a clear explanation of the research objectives, methodologies, and the expected impact on their children. The consent forms explicitly outlined the protection of participants' rights and confidentiality.

DATA ANALYSIS

ENERGY AND NUTRIENT INTAKE: To estimate the energy, iron, and vitamins A and C of the meals offered to children in the school canteens, the NutriSurvey (2007) software was used. Nutritional values used were from the FAO/INFOODS Food Composition Table for Western Africa (2019) (Vincent et al., 2020). Energy content was converted to Kcal by multiplying the obtained KJ value by 0.2388 (FAO et al., 2001). The actual energy and nutrient contents of the school meals were compared to one-third of the nutritional requirements of school children, as reported by Bhatia (2013), based on FAO and WHO (2018).

DIETARY DIVERSITY SCORE: The different food groups consumed by the children were recorded. The dietary diversity score was simply the sum of the number of food groups consumed by the respondents. Twelve food groups were considered for this calculation (FAO, 2010). An analysis of variance test was carried out to compare the results of the two school groups and determine whether canteen meals help to improve the dietary diversity of children's diets.

STATISTICAL ANALYSIS

Data were analyzed with STATA software version 16. The value associated with the probability of $p<5\%$ was considered significant. Descriptive analyses served to compute means, standard deviation, and minimum and maximum. Kruskal-Wallis and Wilcoxon-Mann-Whitney tests were used for means comparison.

RESULTS

PRIMARY SCHOOL CHILDREN'S CHARACTERISTICS

The mean age and sex distribution of participating children, by department, school grade, and presence of government canteens are presented in Table 1. Across all the schools selected, more than 54% of children were male. The average age of the children was 11.5 (SD = 1.7) years.

Table 1. Mean age and sex distribution of participating children, by department (district), school grade and presence of government canteens

Variables		School type	Total (n = 1502)	Atacora (n = 252)	Collines (n = 252)	Couffo (n = 252)	Mono (n = 251)	Ouémé (n = 243)	Plateau (n = 252)	*p*-value
Age (*M, SD*) (years)		All schools	11.5, 1.7	12.1, 1.6	10.9, 1.6	11.8, 1.7	11.5, 1.8	11.1, 1.6	11.6, 1.8	<.001
		Government canteen	11.7, 1.7	12.1, 1.5	11.3, 1.7	11.9, 1.5	11.4, 1.7	11.3, 1.5	12.3, 1.6	<.001
		No-government canteen	11.3, 1.7	12.1, 1.6	10.6, 1.4	11.5, 1.8	11.6, 1.8	10.8, 1.6	10.9, 1.6	
Sex (%)	Male	All schools (n=818)	54.46	57.54	56.35	52.38	52.99	52.26	55.16	
		Government canteen (n= 413)	54.63	59.52	55.56	51.59	54.76	50	56.35	
		No-government canteen (n= 405)	54.29	55.56	57.14	53.17	51.20	54.70	53.97	
	Female	All schools (n= 684)	45.54	42.46	43.65	47.62	47.01	47.74	44.84	
		Government canteen (n= 343)	45.37	40.48	44.44	48.41	45.24	50	43.65	
		No-government canteen (n= 341)	45.71	44.44	42.86	46.83	48.80	45.30	46.03	
Grade (%)	5th grade	All schools (n= 606)	40.35	37.30	39.29	38.10	43.03	41.56	42.86	
		Government canteen (n= 313)	41.40	41.27	43.65	34.13	46.83	42.06	40.48	
		No-government canteen (n= 293)	39.28	33.33	34.92	42.06	39.20	41.03	45.24	
	6th grade	All schools (n= 896)	59.65	62.70	60.71	61.90	56.97	58.44	57.14	
		Government canteen (n= 293)	58.60	58.73	56.35	65.87	53.17	57.94	59.52	
		No-government canteen (n= 453)	60.72	66.67	65.08	57.94	60.80	58.97	54.76	

ENERGY AND MICRONUTRIENT SUPPLY OF FOODS SERVED IN THE GOVERNMENT CANTEENS

Table 2 presents the energy and micronutrient supply of the food provided in school canteens, by department. The average energy supply served to children in the schools was 669.22 (*SD* = 316.29) Kcal. These values varied significantly (p =.032) across departments and were the highest in the Collines (M = 857.5, SD = 213.81 Kcal). Values obtained for the micronutrients measured were (*M, SD*): 5.32, 4.24 mg of iron, 106.33, 75.89 µg of vitamin A, and 5.13, 7.51 mg of vitamin C. Aside from vitamin C, there were no significant differences among departments. The highest value of vitamin C supplied was recorded in Ouémé (*M* = 15.40, *SD* = 9.19 µg).

Table 2. Energy and micronutrient supply of the food servings in schools with government canteens, by department (district)

Department	Average energy (Kcal) (Min; Max)	Micronutrient content		
		Iron (mg) (Min; Max)	Vit A (µg) (Min; Max)	Vit C (mg) (Min; Max)
Atacora (*M, SD*)	672.28, 290.18 (170.12; 1181.87)	4.64, 3.14 (0.93; 12.80)	91.76, 85.53 (5.40; 307.30)	2.89, 6.50 (0.09; 24.58)
Collines (*M, SD*)	857.5, 213.81 (444.1; 1197.2)	5.75, 2.54 (1.66; 10.16)	107.54, 67.10 (42.14; 288.68)	1,43, 2.42 (0.004; 8.94)
Couffo (*M, SD*)	608.93, 157.83 (295.07; 961.28)	3.63, 1.38 (1.61; 6.07)	110.54, 55.17 (38.09; 260.61)	1.82, 1.23 (0.53; 4.59)
Mono (*M, SD*)	617.39, 262.38 (253.99; 1165.04)	6.16, 6.19 (1.17; 20.95)	84.59, 45.57 (20.15; 163.67)	2.76, 3.28 (0.25; 13.07)
Ouémé (*M, SD*)	634.5, 334.32 (205.9; 1479.5)	4.89, 3.98 (1.2; 23.53)	127.10, 90.93 (3.9; 380.28)	15.40, 9.19 (2.03; 41.10)
Plateau (*M, SD*)	624.71, 504.80 (140.09; 2165.08)	6.9, 5.93 (0.02; 20.25)	117.40, 101.16 (3.88; 346.08)	6.54, 7.94 (0.31; 26.09)
p-value ($\chi 2$)	0.032 (12.2)	0.452 (4.71)	0.451 (4.72)	<.001 (36.00)

ADEQUACY OF THE ENERGY AND MICRONUTRIENT SUPPLIES OF THE MEALS SERVED

The portion sizes of meals served varied across schools, as did the coverage of children's energy needs. Overall, at least 1/3 of the children's energy needs were covered by food servings in 57% of schools. The highest proportion of schools where at least 1/3 of the children's energy needs were covered was recorded in Collines (85.7%) and the lowest in Plateau (37.5%) (Figure 1). The coverage of iron needs, as well as that of vitamins A and C, were low. The coverage rate for iron and vitamin A is lower than 33% in all the departments. As for vitamin C, Ouémé was the sole department where the coverage rate was higher than 1/3 of the children's needs (38.5%) (Figure 2).

CHILDREN'S DIETARY DIVERSITY

The dietary diversity scores of children over an entire day ranged from six to seven food groups. No significant difference (p = 0.6817) was found among the two school groups (with and without government canteens). However, the comparison of children's dietary diversity scores among departments showed a significant difference (p <0.001)

(Figure 3). In Atacora and Collines, children have the lowest dietary diversity scores: (*M* = 5.59, *SD* = 1.09) and (*M* = 5.77, *SD* = 1.08) respectively. Starchy foods, spices and seasonings, seeds, and nuts were the most consumed food groups (100%). Fruits and vegetables (25.5%) and dark green leafy vegetables (28.2%) are, however, poorly included in the children's diet. Eggs (5.6%), fresh food (<1%), dairy (4.5%) were little consumed (Figure 4).

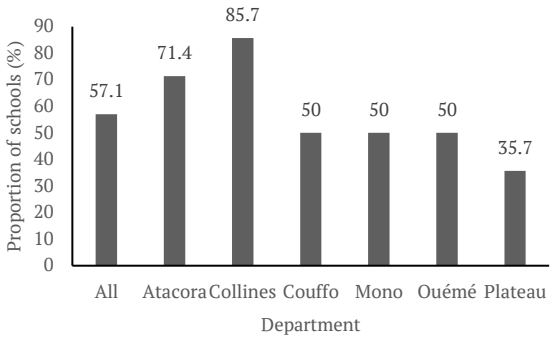

Figure 1. Proportion of schools with children having covered at least 1/3 of their energy needs by department (district).

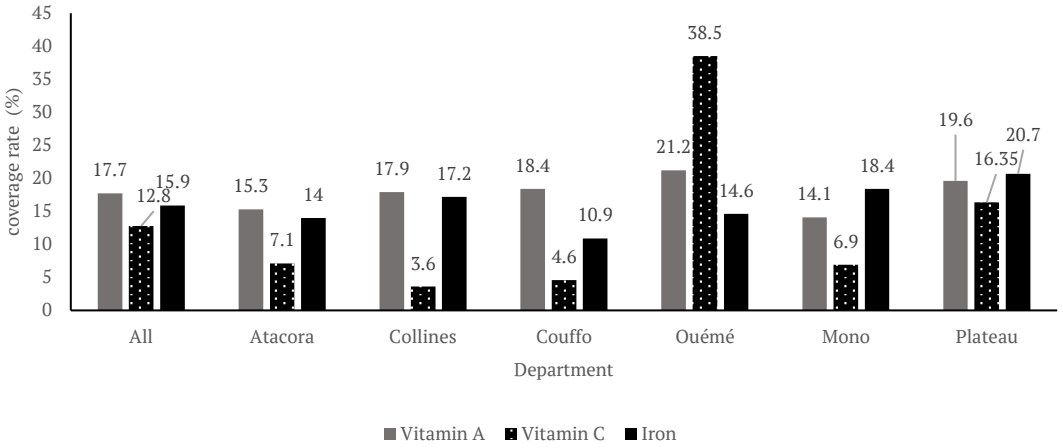

Figure 2. Coverage rate of iron, Vitamin A and C needs by school meals served in the government canteens per department (district)

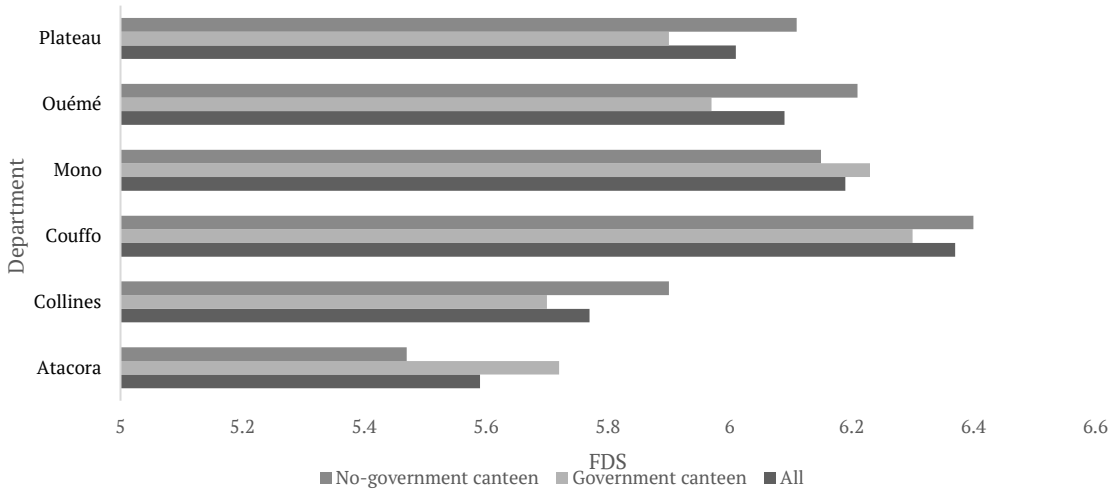

Figure 3. Average dietary diversity scores per department (district) (p = .001)

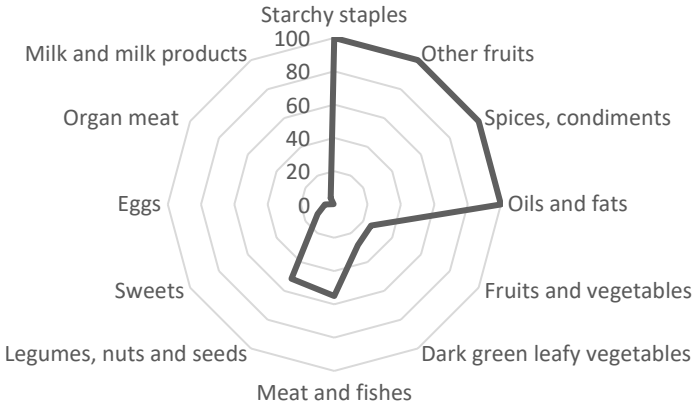

Figure 4. Most consumed food groups by all children

Table 3. Proportion of children per dietary diversity score in schools with and without a canteen

Category	Schools with government canteens (n = 746)						Schools without government canteens (n = 756)					
	Atacora	Collines	Couffo	Mono	Ouémé	Plateau	Atacora	Collines	Couffo	Mono	Ouémé	Plateau
Mean (SD)	6.00 (1.1)						6.00 (1.2)					
⩽ 5	54.7	43.7	24.6	33.6	33.3	43.6	45.3	40.5	27.8	32.6	37.3	30.2
6-7	40.5	47.6	54.8	48.8	51.3	45.3	50.8	56.4	54	40.5	54.8	59.5
⩾ 8	4.8	8.7	20.6	17.6	15.4	11.1	3.9	3.1	18.2	26.9	7.9	10.3
***p*-value (χ2)**	0.682 (0.168)											

DISCUSSION

The objective of this study was to assess the energy, iron, and vitamins A and C, supplied by canteen meals and their effect on school-aged children's dietary diversity in schools supported by the National Program of Integrated School Food (PNASI).

During our survey, we observed that the energy intake from the food offered to schoolchildren and its adequacy are generally acceptable, even when the energy intakes do not cover 1/3 of children's needs in all schools. Nelson et al., (2004) highlighted that due to the time children spend in school, it has been estimated that about one-third of their food and beverage consumption is in school settings. Based on this, the foods served to children in the canteens were expected to cover at least one-third of their energy and micronutrient needs, including of iron and vitamins A and C. In the present study, the average values of energy supply varied significantly (p =0.032) across departments and were the highest in the Collines 857.5 (SD = 213.81) Kcal. We obtained better results than those reported by Abizari et al., (2014), where the food served by government canteens contained 572.40 Kcal. The low coverage rate observed in some schools could be due to small portions served. While the documentation set a clear daily quantity of raw food per child (forming the basis for raw-material sampling), the portions served were not standardized across grades. Sometimes, this resulted in a disparity in the quantity served to children. It should be noted that the low coverage rate of at least one-third of children's energy needs in the department of Plateau, is due to the local food named *Akassa* which is the most prepared meal during the study period.

In contrast to the energy supply, the micronutrient content of school meals offered was low since the food basket did not include foods rich in these nutrients. Community mobilization to support the canteen was apparently weak or non-existent in some schools, especially in lower income areas. This would have led some schools into composing meals only with foods offered by the program such as rice, cowpeas/yellow peas, salt, and palm olein oil fortified with vitamins A and D. The value obtained for vitamin C was higher in the department of Ouémé and this may be due to the use of ingredients such as fresh chili (against dry red chili in most other departments) and the use of fresh tomato or other foods.

Regarding the dietary diversity score, which we based on the entire diet of the children, there was no significant (p = 0.681) difference between schools with and without canteens. This could be explained by the fact that the food supply basket did not differ from the foods that children usually eat and does not provide other food groups. We found that the consumption of vegetables, fruits, and vegetables rich in vitamin A during the entire day was low in our entire sample.

Thus, rather than improving dietary diversity, the meals provided by the government canteen allowed children to have a guaranteed meal at noon and spared them from having to walk long distances home for lunch. This could have been beneficial in supporting the other objective of PNASI, that of enhancing school enrollment.

On the other hand, some differences were observed across the departments. INSAE et al., (2017) reported that Atacora and Collines had particularly high rates of food insecurity. However, since the dietary diversity score of children was not assessed prior to the program's implementation, the specific effects of canteen meals on their dietary diversity remain uncertain.

One approach that could help change the situation we have documented is the establishment of school gardens,

defined by FAO as "cultivated areas around or near primary schools, which can be used primarily for learning purposes and also generate food and income for the school" (FAO, 2004). School-garden interventions give school children hands-on opportunities to grow and harvest fruit and vegetables (Morris & Zidenberg-Cherr, 2002; Parmer et al., 2009). Moreover, a systematic review by Ohly et al., (2016), which aimed to examine the effects of school gardening on health and well-being, reported improvements in children's willingness to taste vegetables and in preferences for fruit and vegetables. In addition, some studies have shown a positive effect of these interventions on fruit and vegetable consumption (McAleese & Rankin, 2007).

School feeding can also be complemented by school-based food and nutrition education (SFNE) that builds children's food literacy and practical skills. Integrating SFNE with meal provision can extend benefits beyond the school day, support more diversified diets and local food systems, and strengthen the long-term nutrition and health impact of school feeding programs (FAO, 2019; FAO, 2020).

One important limitation of the present study was that we used the snowballing method for sampling schools without canteens. This could have introduced biases into the data we report for them. Another limitation was that we only recorded one day's worth of meals per school, which may not be representative of the overall menus and of other days of the week. In particular, vitamin C and vitamin A levels in the diet tend to show great daily variation (Basiotis, 1987). Consequently, estimates of energy and micronutrient coverage levels and contrasts between departments may be influenced by daily and seasonal variability that we were unable to take into account in this study. This design therefore limits the generalization of the conclusions. In addition, we did not measure community contributions of vegetables to the canteens, nor whether funds provided by the community were properly used to purchase fresh foods for the canteens. Finally, we also did not examine the socio-economic levels of the children, schools or districts. In lower-income areas, the school meals, even if less than ideal, could have made a more substantial contribution to the children's overall diets.

CONCLUSION

This assessment of the nutrient supplies, including for energy, iron, and vitamins A and C of canteen meal and their effect on school-age children's dietary diversity in schools endorsed by the National Program of Integrated School Food, revealed that at least 1/3 of the children's energy needs was covered by the food served in 57% of schools. However, none of the schools has covered the needs of schoolchildren for iron, vitamin A, or vitamin C, apart from the department (district) of Ouémé where the level of vitamin C was higher than 1/3 estimated of the children's daily requirement. Concerning dietary diversity over the entire day, no significant difference was found between the children of the schools with and without a government canteen. The departments with the lowest incomes, Atacora and Collines, also had the lowest dietary diversity scores. To reduce micronutrient deficiencies among these children in areas where community participation in the school feeding program is low, we recommend setting up school gardens and providing nutrition education linked to school feeding.

AUTHOR CONTRIBUTIONS

MWT, and NFF contributed to the conceptualization of the study. MWT, AA, AAOA, ENS, IT, and AH carried out the research and investigation. Data curation and formal analysis were undertaken by MWT and AA. The writing - original draft was prepared by MWT, BB, and MA, with critical revisions provided by NFF. Project administration, supervision, and writing - review & editing were ensured by NFF. All authors have read and approved the final version of the paper and its submission.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN SCIENTIFIC WRITING

Nothing to disclose.

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REFERENCES

Abizari, A. R., Buxton, C., Kwara, L., Mensah-Homiah, J., Armar-Klemesu, M., & Brouwer, I. D. 2014. "School feeding contributes to micronutrient adequacy of Ghanaian school children". *British Journal of Nutrition*, 112(6), 1019–1033. https://doi.org/10.1017/S0007114514001585

Adelman, S., Gilligan, D., & Lehrer, K. 2008. "How effective are food for education programs? A critical assessment of the evidence from developing countries. *International Food Policy Research Institute*. https://doi.org/10.2499/0896295095FPRev9

Arimond, M., Wiesmann, D., Becquey, E., Carriquiry, A., Daniels, M. C., Deitchler, M., Fanou-Fogny, N., Joseph, M. L., Kennedy, G., Martin-Prevel, Y., & Torheim, L. E. 2010. "Simple measures of women's diet quality in developing countries: methods and findings simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor setting". *The Journal of Nutrition,* 140, 2059S-2069S. https://doi.org/10.3945/jn.110.123414.2059S

Basiotis, P. P., et al. (1987). Sources of variance in 24-hour dietary recall data. *Journal of the American Dietetic Association*, 87(11), 1547-1551.

Best, C., Neufingerl, N., Van Geel, L., Van Den Briel, T., & Osendarp, S. 2010. "The nutritional status of school-aged children: Why should we care?" *Food and Nutrition Bulletin*, 31(3), 400–417. https://doi.org/10.1177/156482651003100303

FAO. (2004). Improving Child Nutrition and Education through the Promotion of School Garden Programmes (Issue September).

FAO. (2007). L'éducation nutritionnelle dans les écoles primaires : Guide de planification pour le développement des programmes scolaires (Vol. 1).

FAO. (2010). Guidelines for measuring household and individual dietary diversity. Rome. https://doi.org/613.2KEN

FAO. (2019). School Food and Nutrition Framework. Rome. Licence: CC BY-NC-SA 3.0 IGO.

FAO. (2020). School-based food and nutrition education – A white paper on the current state, principles, challenges and recommendations for low- and middle-income countries. Rome. https://doi.org/10.4060/cb2064en

FAO, & WFP. (2018). Home-Grown School Feeding. Resource Framework. Technical Document. Rome.

FAO, WHO, & UNU. 2001. Human energy requirements: Report of a joint FAO/ WHO/UNU Expert Consultation. Rome, 17-24 October 2001.

Fiorentino, M., Bastard, G., Sembène, M., Fortin, S., Traissac, P., Landais, E., Icard-Vernière, C., Wieringa, F. T., & Berger, J. 2013. "Anthropometric and micronutrient status of school-children in an urban West Africa setting: A cross-sectional study in Dakar (Senegal)." *PLoS One*, 8(12). https://doi.org/10.1371/journal.pone.0084328

Galicia, L., Grajeda, R., de Romaña, D. L., Galicia, L., Grajeda, R., & de Romaña, D. L. 2016. "Nutrition situation in Latin America and the Caribbean: current scenario, past trends, and data gaps". *Revista Panamericana de Salud Pública*, 40(2), 104–113. **Full text here**

González, H. F., Malpeli, A., Etchegoyen, G., Lucero, L., Romero, F., Lagunas, C., Lailhacar, G., Olivares, M., & Uauy, R. 2007. "Acquisition of visuomotor abilities and intellectual quotient in children aged 4-10 years: Relationship with micronutrient nutritional status." *Biological Trace Element Research,* 120(1), 92–101. https://doi.org/10.1007/s12011-007-8023-5

Goodman, L. A. 1961. "Snowball Sampling". *The Annals of Mathematical Statistics*, 32(1), 148–170. https://doi.org/10.1214/aoms/1177705148

Greenhalgh, T., Kristjansson, E., & Robinson, V. 2007. "Realist review to understand the efficacy of school feeding programmes". *BMJ*, 335(7625), 858–861. https://doi.org/10.1136/bmj.39359.525174.AD

INSAE, WFP, & MAEP. (2017). Analyse Globale de la Vulnérabilité et la Sécurité Alimentaire (AGVSA).

Intiful, F. D., & Lartey, A. 2014. "Breakfast habits among school children in selected communities in the eastern region of Ghana". *Ghana Medical Journal*, 48(2), 71–77. https://doi.org/10.4314/gmj.v48i2.3

Kennedy, G. L., Pedro, M. R., Seghieri, C., Nantel, G., & Brouwer, I. 2007. "Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children". *Journal of Nutrition*, 137(2), 472–477. https://doi.org/10.1093/jn/137.2.472

Kenny, G., Ballard, T., & Dop, M.-C. 2013. "Guide pour mesurer la diversité alimentaire au niveau du ménage et de l'individu." FAO.

Kristjansson, E. A., Robinson, V., Petticrew, M., MacDonald, B., Krasevec, J., Janzen, L., Greenhalgh, T., Wells, G., MacGowan, J., Farmer, A., Shea, B. J., Mayhew, A., Tugwell, P., & Kristjansson, B. 2007. "School feeding for improving the physical and psychosocial health of disadvantaged students". *Cochrane Database of Systematic Reviews,* 1. https://doi.org/10.1002/14651858.CD004676.pub2

McAleese, J. D., & Rankin, L. L. 2007. "Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents". *Journal of the American Dietetic Association,* 107(4), 662–665. https://doi.org/10.1016/j.jada.2007.01.015

Morris, J. L., & Zidenberg-Cherr, S. 2002. "Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge of nutrition and preferences for some vegetables". *Journal of the American Dietetic Association* 102(1); 91–93). https://doi.org/10.1016/S0002-8223(02)90027-1

Nelson, M., Bradbury, J., Poulter, J., McGee, a, Msebele, S., & Jarvis, L. (2004). School Meals in Secondary Schools in England. Kings College. National Centre for Social Research. **Full text here**

Nutrisurvey 2007 "Nutrition Surveys and Calculations, Guidelines, Software and additional Information". https://www.nutrisurvey.de/

Ohly, H., Gentry, S., Wigglesworth, R., Bethel, A., Lovell, R., & Garside, R. 2016. "A systematic review of the health and well-being impacts of school gardening: Synthesis of quantitative and qualitative evidence". *BMC Public Health,* 16(1). https://doi.org/10.1186/s12889-016-2941-0

Parmer, S. M., Salisbury-Glennon, J., Shannon, D., & Struempler, B. 2009. "School Gardens: An Experiential

Learning Approach for a Nutrition Education Program to Increase Fruit and Vegetable Knowledge, Preference, and Consumption among Second-grade Students". *Journal of Nutrition Education and Behavior*, 41(3), 212–217. https://doi.org/10.1016/j.jneb.2008.06.002

Vincent, A., Grande, F., Compaoré, E., Amponsah Annor, G., Addy, P. S., Aburime, L. C., Ahmed, D., Bih Loh, A. M., Dahdouh Cabia, S., Deflache, N., Dembélé, F. M., Dieudonné, B., Edwige, O. O., Ene-Obong, H. N., Fanou Fogny, N., Ferreira, M., Omaghoni Jemide, J., Kouebou, P. C., Muller, C., ... Charrondière, U. R. 2020. "FAO/INFOODS Food composition table for western africa (2019) User guide & condensed food composition table". Rome, FAO. http://www.fao.org/publications/card/ru/c/CA7779B/

WFP. (2019a). Programme d'alimentation scolaire du Bénin Analyse Coût-Bénéfice. **Full text here**

WFP. (2019b). WFP School Feeding Programmes in 2018 (Issue July).

WFP & MEMP. 2019. Evaluation conjointe à mi-parcours du Programme National d'Alimentation Scolaire Intégré (PNASI) Aout 2017 – Mai 2019.