



Research Article

ISSN : 2277-3657
CODEN(USA) : IJPRPM

Assessment of the Nutritional Value of the Food Consumed by Saudi Schoolchildren

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ABSTRACT

Objective: This study is aimed at assessing the nutritional value of the food consumed during school meal breaks by Saudi schoolchildren in a healthy school and comparing it with that in another school (a normal school). Methods: A total of 260 schoolchildren from two elementary schools in Tabuk were recruited in the present study. The children were observed at school meal time, and all food consumed by them was recorded by a trained research assistant. The portion size of the consumed food was estimated by household measures, and the nutritional information of the packed food was obtained from the packaging label. Results: Consumption of protein, fiber, vitamin A, and calcium was significantly higher in the healthy school compared to the normal school. Dairy products and fruit contributed significantly more to energy intake in the healthy school compared to the normal school; while, crisps and sweet fatty products contributed significantly more to the total energy intake for the normal school. Total energy intake was also higher in the normal school than in the healthy school. Conclusion: The nutritional value of school meals from the healthy school was better than the normal school. Therefore, school meals can be used as a strategy to teach schoolchildren food choice skills during this sensitive period.

Key words: *nutritional value, school meals, schoolchildren.*

INTRODUCTION

Nutritional status during childhood is an important issue, as it strongly influences children's growth and development [1]. Food consumed at school is one of the most critical factors that contributes to schoolchildren's nutritional status and development [2]. It is linked to their learning ability, school performance, and their overall well-being [3]. Apart from their contribution to children's daily requirements for micronutrients and nutrients, meals during school time reduce short-term hunger, which increases their concentration and attention span, and facilitates learning [4, 5].

Food consumed at school should provide schoolchildren with approximately one-third of their daily nutrient requirements [6]. It should include a good variety of food from all food groups for a full range of nutrients [7]. Usually, children rush out early in the morning from their homes with little or no breakfast, and they often spend long hours at school [8]. Skipping breakfast is associated with the incidence of childhood overweightness and obesity [9]. A regular school breakfast reduces the risk of being overweight and obese [10]. A systematic review revealed that skipping breakfast was correlated with overweightness and obesity among Saudi children [11].

For these reasons and accordingly the importance of food consumed at school and its impact on children's health and performance, the Saudi Ministry of Education introduced a new program in some Saudi schools, called healthy

schools. The program aims to improve many aspects at school, including students' eating habits, by involving them in nutritional-education programs and activities, monitoring children during their school meals, as well as monitoring food serving in school canteens. However, it is not known whether applying such a program was effective in improving the school eating habits of Saudi schoolchildren. Therefore, the present study aims to assess the nutritional value of the food consumed during school meal breaks by Saudi schoolchildren in a healthy school and compare it with a school to which this program was not applied (a normal school).

METHODS

The study was conducted between September and October 2019. Two elementary schools in Tabuk were asked to participate. One school was a healthy school and one school was not a healthy school (a normal school). The permission to conduct the study was obtained from the school's head teacher and the parents of the children. Ethical approval to conduct the study was granted from the Ethics Committee at the University of Tabuk.

Children in the first and second grade were participated in the study (310 children), except for those who did not return the consent form. The response rate was 84% with the total number of 260 children. The children were observed at school meal times, and all food consumed by them was recorded by a trained research assistant. The portion size of the consumed food was estimated by household measures, including spoons, cups, and plates. The nutritional information of packed food was obtained from packaging labels. ESHA's Food Processor Nutrition Analysis software was used to analyze the dietary data.

Statistical analysis

The data were analyzed using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, N.Y., USA). T-test for independent samples was used to compare the food intakes of the healthy and normal schools.

RESULTS

Figure 1 depicts the types of food consumed by schoolchildren at the healthy and normal schools. The percentage of students in the healthy school who consumed dairy products and fresh fruit and vegetables was higher than that in the normal school. The consumption of crisps and sweets was higher in the normal school than it was in the healthy school.

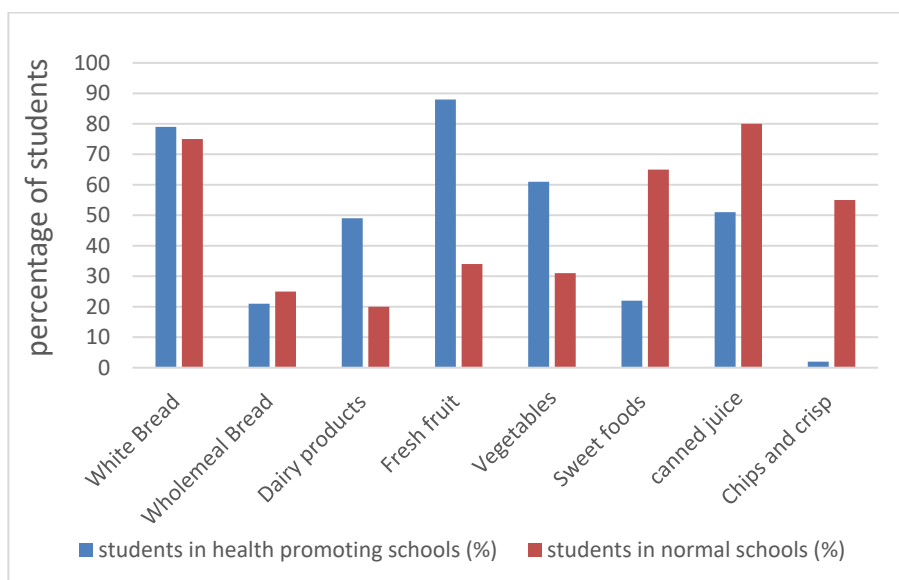


Figure 1. The types of food consumed by schoolchildren at the healthy and normal schools

Table 1 presents the nutrient intake by schoolchildren in the healthy and normal schools. The amount of protein, fiber, vitamin A, and calcium was significantly higher in the healthy school compared to the normal school. However, total fat consumption was lower than that in the normal school. They consumed one-third of their daily protein and vitamin C requirements in school meals; while, the consumption of other nutrients was less than the recommended amount.

Table 2 shows the contribution of food consumed in school meals to the total energy intake of the school meal. Dairy products and fruit contributed significantly more to the energy intake in the healthy school when compared to the normal school; while, crisps and sweet fatty products contributed significantly more to the total energy intake in the normal schools. Total energy and energy from fat received from school meals was also significantly higher in the normal school compared to the healthy school (Table 3).

Table 1. Nutrient intake from the consumed food by Saudi schoolchildren at school

	Dietary Guidelines**	Healthy School	Normal School	P Value
Protein (g)	19	10 ± 4.2*	6 ± 1.3	0.03
Carbohydrate (g)	130	35 ± 6.1	41 ± 8.2	0.45
Total fats (g)	---	8 ± 2.3	15 ± 5.2*	0.02
Dietary fiber (g)	25	4 ± 1.1*	1 ± 0.4	0.04
Vitamin C (mg)	25	8 ± 2.3*	5 ± 1.1	0.04
Vitamin A (µg)	400	60 ± 11*	31 ± 8	0.01
Iron (mg)	9	1 ± 0.4	2 ± 0.8	0.34
Zinc (mg)	6	2 ± 0.3	1 ± 0.7	0.55
Calcium (mg)	1000	276 ± 43*	187 ± 23	0.01

Data expressed as the mean ± SD.

*Nutrient intake was significantly different between schools; **source: Dietary Reference Intakes: The Essential Guide to Nutrient Requirements. National Academies press.

Table 2. The contribution (%) of the consumed food at school to total energy intake of Saudi schoolchildren

	Healthy school	Normal school	P value
Bread (%)	35	32	0.87
Dairy products (%)	20	8	0.01*
Fruit (%)	10	6	0.04*
Vegetables (%)	2	3	0.77
Sweet, fatty products (cookies, pastry, chocolate, etc.; %)	5	12	0.01*
Sweet foods (e.g., candy, lollipops; %)	4	11	0.56
Sweetened beverages (canned juice; %)	23	20	0.54
Chips and crisps	1	8	0.01*

The data are expressed as mean ± SD. *There was a significant difference between schools.

Table 3. Contribution of each macronutrient to total energy obtained from the consumed food in Saudi schoolchildren

	Healthy school	Normal school	P value
Total energy from school meal	252 ± 34	323 ± 56	0.03*
Energy from carbohydrates (%)	55	51	0.11
Energy from protein (%)	16	7	0.04*
Energy from fat (%)	29	42	0.02*

The data expressed as mean ± SD. *There was significant difference between schools.

DISCUSSION

To the authors' knowledge, this is the first study comparing the nutritional value of the food consumed by Saudi schoolchildren in healthy and normal schools. The study demonstrated that students in the healthy school consumed more milk, fruit, and vegetables, and fewer sweets and crisps compared to the normal-school students. The healthy-school students also consumed more protein, fiber, vitamin A, and calcium, and had lower total energy intake and less energy from fat. The literature showed no comparable study in this regard.

Since students spend a long time in school, consumed food in school should provide children with approximately one-third of their daily requirements of nutrients, and contain food from all food groups to provide them with a full range of nutrients [6, 7]. The school meals of Nigerian schoolchildren provided them with more than one-third of the recommended daily nutrient intakes for vitamins A and C, protein, and zinc; while, energy, calcium,

and iron did not meet the recommendations [12]. A study in Scotland demonstrated that schoolchildren did not consume the recommended amount of nutrients during school meals [13]. In the present study, children were found to obtain approximately one-third of their daily requirements from protein and vitamin C from the consumed food in school.

A previous study conducted in the UK revealed that the energy from consumed food in the studied school was 37% from fat, 48% from carbohydrates, and 14% from proteins [14]. Similar results were reported in the current study. Another study on Swedish and Nigerian schoolchildren showed that the total energy obtained from consumed food in the studied schools was 441 and 410 kcal, respectively, which is nearly double the consumed energy in the schools in the present study for both types of schools. The amount of zinc, iron, fiber, and calcium consumed in school food was similar to that in the present study; whereas, consumption of vitamins A and C was much higher than it was in the current study [12, 15].

The food that contributed most to the total energy intake of Saudi schoolchildren in the present study was bread, followed by sweetened beverages, dairy products, and fruit. A previous study in Australia showed that bread was the food that most contributed to the total energy intake in school, followed by biscuits and fruit [16]. Similar results were reported in [17].

The school food environment plays an important role in improving students' food intake and preventing obesity [18, 19]. It also contributes to shaping their dietary habits and behavior during the most sensitive period of preference formation [20, 21]. The most important obesity-prevention measures in school are the availability of healthy food in canteens, nutritional education, and removing access to unhealthy food, such as vending machines [22]. Healthy school meals can reduce arterial pressure, total cholesterol concentrations, and TAG concentrations [23].

The main strength of the current research is that it is the first study to have assessed the nutritional value of food consumed during school meal breaks by Saudi schoolchildren in a healthy school compared with other schools. However, the study has some limitations, including the cross-sectional design and lack of generalizability, since it was conducted in only two schools in Tabuk.

CONCLUSION:

In conclusion, the current study demonstrated that the number of schoolchildren who consumed healthy food was higher in the healthy school than it was in the normal school. The consumption of protein, fiber, vitamin A, and calcium was significantly higher and that of fat was significantly lower in the healthy school compared to the normal school. Dairy products and fruit were highly contribute to the energy intake in the healthy school compared to the normal school; while, crisps and sweet fatty products contributed significantly more to the total energy intake for the normal school. The total energy and energy from fat from school meals were also significantly higher in the normal school compared to the healthy school. On this basis, it can be concluded that health- schools are effective in improving the types of consumed food in schools.

ACKNOWLEDGEMENTS

The author would like to thank all schoolchildren and school staff for their cooperation and patience.

Conflicts of Interest

The authors declare no conflict of interest.

REFERENCES

1. WHO. Early child development – Nutrition and the early years. 2019. Available online from: <https://www.who.int/topics/early-child-development/child-nutrition/en/>.
2. Abizari A, Buxton C, Kwara L, Mensah-Homiah J. School feeding contributes to micronutrient adequacy of Ghanaian schoolchildren. *Br J Nutr* 2014;119(6):1019-1033.
3. Sørensen L, Dyssegaard C, Damsgaard C, Petersen R. The effects of Nordic school meals on concentration and school performance in 8- to 11-year-old children in the OPUS School Meal Study: a cluster-randomised, controlled, cross-over trial. *Br J Nutr* 2015; 113(8):1280-1291.
4. Akanbi GO. Home grown school feeding and health programme in Nigeria: An approach to boosting

- enrollment in public primary schools: A study of Osun state 2002-2010. *Afr Symp* 2011; 11: 20-8.
5. Haapala E, Eloranta A, Venäläinen T, Jalkanen H, Poikkeus A, Ahonen T, et al. Diet quality and academic achievement: a prospective study among primary school children. *Eur J Nutr* 2017; 56:2299–2308
 6. Bevans KB, Sanchez B, Teneralli R, Forrest CB. Children’s eating behavior: The importance of nutrition standards for foods in schools. *J Sch Health* 2011; 81: 424-9.
 7. World Health Organization. Food and nutrition policy for schools: a tool for the development of school nutrition programmes in the WHO European Region. 2019.
 8. Ugochukwu E, Onubogu C, Edokwe E, Okeke K. Nutritional Contents of Lunch Packs of Primary School Children in Nnewi, Nigeria. *Ann Med Health Sci Res* 2014; 4(2): S108–S114.
 9. Okada C, Tabuchi T, Iso H. Association between skipping breakfast in parents and children and childhood overweight/obesity among children: a nationwide 10.5-year prospective study in Japan. *Int J Obes* 2018; 42(10):1724-1732.
 10. Wang M, Schwartz B, Sheb F, Read E, Henderson M, Ickovics R. School breakfast and body mass index: a longitudinal observational study of middle school students. *Pediatr. Obes* 2017; 12 (3): 213-220.
 11. Alhilabi H, Payne A. The Impact of Skipping Breakfast on the Body Weight of Children and Young People in Saudi Arabia: A Systematic Review. *AJNE* 2018; 3 (3): 67–104.
 12. Ayogu, R.N.B., Eme, P.E., Anyaegbu, V.C. et al. Nutritional value of school meals and their contributions to energy and nutrient intakes of rural school children in Enugu and Anambra States, Nigeria. *BMC Nutr* 2018. <https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-018-0216-0>.
 13. Gatenby L. Nutritional content of school meals in Hull and the East Riding of Yorkshire: a comparison of two schools. *J Hum Nutr Diet.* 2007 Dec; 20(6):538-48.
 14. Harrison F, Jennings A, Jones A, Welch A, van Sluijs E, Griffin S, Cassidy A. Food and drink consumption at school lunchtime: the impact of lunch type and contribution to overall intake in British 9-10-year-old children. *Public Health Nutr.* 2013 Jun; 16(6):1132-9.
 15. Osowski CP, Lindroos AK, Barbieri HE, Becker W. The contribution of school meals to energy and nutrient intake of Swedish children in relation to dietary guidelines. *Food Nutr Res.* 2015. <https://www.tandfonline.com/doi/full/10.3402/fnr.v59.27563>.
 16. Sanigorski AM, Bell AC, Kremer PJ, Swinburn. Lunchbox contents of Australian school children: room for improvement. *Eur J Clin Nutr.* 2005; 59(11):1310-6.
 17. Owusu J. Contribution of School Meals to Nutrient Intakes of School-age children enrolled in two feeding programs in Ghana. *THE FASEB journal* 2016; 30 (1):234-9.
 18. Jennifer J. Otten, Jennifer Pitzi Hellwig, Linda D. Meyers. *Dietary Reference Intakes: The Essential Guide to Nutrient Requirements.* National Academies press.
 19. Welker E, Lott M, Story M. The School Food Environment and Obesity Prevention: Progress over the Last Decade. *Obesity Prevention.* 2016. <https://link.springer.com/article/10.1007/s13679-016-0204-0#article-info>
 20. Masse L. Associations between the school food environment, student consumption and body mass index of Canadian adolescents. *International Journal of Behavioral Nutrition and Physical Activity* 2014. <https://ijbnpa.biomedcentral.com/articles/10.1186/1479-5868-11-29>.
 21. Lucas P. Preschool and School Meal Policies: An Overview of What We Know about Regulation, Implementation, and Impact on Diet in the UK, Sweden, and Australia. *Nutrients* 2017; 9(7): 736.
 22. Totura C. Assessing implementation of evidence-based childhood obesity prevention strategies in schools. *Preventive Medicine Reports* 2015; 2: 347-354
 23. Damsgaard C. Provision of healthy school meals does not affect the metabolic syndrome score in 8–11-year-old children, but reduces cardiometabolic risk markers despite increasing waist circumference. *British Journal of Nutrition* 2014; 112 (11):1826-1836.