Original

Nutritive analysis of School Meals: An Investigation of a One-day Meal Provided in Feeding Schools of Bhutan

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ABSTRACT The School Feeding Program in Bhutan was initiated in 1974 with an objective of attracting school enrollment and retaining students in school. However, priorities have now shifted towards serving quality meals. In a quest to improve school feeding program, a nutrient analysis of one-day school menu was conducted. *Methods*: Twenty-four schools from the three different regions of the country were purposively sampled for data collection in three phases corresponding to the three school seasons. Food intake information was collected using weighted method. *Result*: Meals served in schools were inadequate in protein (27.2 grams compared to RDA of 29.5 grams for age group 6-9 years, 27.9 grams compared to RDA of 40.2 grams for age group 10-13 years and 29.6grams compared to RDA of 55.8 grams for age group 14-18 years respectively). The meals were high in fat (49.9 grams compared to RDA of 30 grams for age group 6-9 years, 54.2 grams compared to RDA of 35grams for age group 10-13 years and 59.9 grams compared to RDA of 42.5 grams for age group 14-18 years). The sodium availability in the meals was way higher than the recommendations of the World Health Organization across all age groups. The quality of food was homogenous across the phases and regions. *Conclusion*: The assessment indicates homogeneity of school meals across regions and seasons with limited diversity. Protein and energy available in the meals served were inadequate as compared to age appropriate Recommended Daily Allowances including some of the selected micro-nutrients.
Keywords: Food diversity, Micronutrient, School children, Bhutan.

INTRODUCTION

The School Feeding Program (SFP) in Bhutan was initiated in the 1974 with support from World Food Programme (WFP) (1). Back then, the primary objective of the feeding program was to increase school enrollment and retain them in school. After, over four decades into School Feeding Program, the priority has now shifted from school enrollment and retention to improving and maintaining the health and nutritional status of the school going population of the country (1). The National Nutrition Survey 2015 indicated that the nutrition situation in Bhutan remains precarious, with 21.2% of children under the age of five being stunted and nearly 40% anemic, mostly women and adolescent girls (2). In the last five years, sporadic outbreak of peripheral neuropathy has been reported amongst boarding school children across the country indicating the existence of micronutrients deficiencies, such as Thiamine (3). The Government considers School Feeding Program as a key program to bridge the nutritional gap, and is supported and implemented through the Ministry of Education (MoE) (4). There were 86,910 students in 2019 benefiting from the school feeding program. Of these, 41,734 students were boarders (receiving 3 meals); 25,940 were receiving two meals (breakfast and lunch) and 19,236 were receiving one meal (lunch) (5). The food served in feeding schools is based on dietary guideline set by the government. Nine non-perishable commodities (rice, lentils, chickpeas, processed cheese, vegetable oil, milk powder, sugar, tea leaves and salt) are provided by the government through the Food Cooperation of Bhutan (FCBL). Perishable commodities (such as leafy and green vegetables, animal source proteins and fruits) would be bought by the individual schools with the stipend money (Nu 400/child/month, exchange rate1SUD$ = 73.85 Ngultrum as of 10th March 2020) (6).

Although the Royal Government of Bhutan (RGoB) has been running the School Feeding Program for over 45 years, no formal assessments have been conducted to ascertain whether the current standard menu provides the beneficiaries with the recommended daily allowance (RDA) of both macro and micro nutrients. Therefore, the Ministry of Education with financial support from

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World Food Program (WFP) and in collaboration with Ministry of Health and Khesar Gaylpo University of Medical Sciences of Bhutan, conducted an analysis of nutrient content of the meals served in feeding schools of Bhutan. The general objective was to evaluate the nutrient content, and thereafter make appropriate recommendations to improve the overall nutrient t quality of the food in schools for the growth and development of school children.

METHODS

Study design and site

A cross-sectional nutritional assessment was conducted in 2017. Twenty-four schools with feeding program were purposively selected (eight schools from each region; Western, Central and Eastern) to represent feeding schools in the country. To present seasonality, data was collected during the three seasons (spring, summer and autumn) on a random day including all three meals, teas and snacks from the selected schools.

Data collection

Data was collected in three phases (1st phase from April-May; 2nd phase in September and 3rd phase from October-November of 2017) representing the different seasonal variations. Weighted method was used to estimate the average consumption of the food items served on a typical day. Among the various assessment methods, weighted method is considered as the only practical approach in societies where it is usual for all household members to eat from the same pot (7). Since the selected schools were residential schools, all three meals were provided by the schools, thus, each school was considered as a household. First the raw ingredients used for preparing dishes were individually weighed and recorded. Then, the ingredients were cleaned off their non-edible portion, weighed again and recorded. After cooking, the entire cooked dish was weighed and recorded. The approximate average portion size served to students of various age-groups was weighed in the following manner: Three students each from classes PP-III representing the 6-9 years, classes IV-VII representing 10-13 years, and classes VIII-XII representing 14-18 years old were randomly selected from each participating school. The randomly selected students collected food in three incidences (beginning, middle and towards the end) of food serving. The three servings were weighed, recorded and the average of the three readings was recorded as the standard portion for that age group.

Data analysis

Data from the weighted method was entered in Nutri-survey TM software to deduce the nutrient content of the food(s) item(s) based on the approximate serving size that each student presumably would receive. The deduced data was transferred to Microsoft excel for data management and SPSS version 22 for analysis. Descriptive statistics such as frequency, mean, median and percentage was used to quantify the nutrients and compared with the Recommended Dietary Allowance (RDA) of various age groups. Analysis of variance (ANOVA) was used to compare the difference in nutrient content of the food served in participating schools among various age groups, seasons and regions.

Ethical Clearance

This project was a programmatic assessment of quality of diet served in schools; therefore, all communication including permission to collect data was overseen by the Ministry of Education, Royal Government of Bhutan.

Table 1. Number of observations by weighted method

			Class		
			PP-3	4-7	8-12
		n (%)	n (%)	n (%)	n (%)
Regions	Western	58 (35.6)	21 (36.8)	24 (36.4)	13 (32.5)
	Central	45 (27.6)	12 (21.1)	21 (31.8)	12(30.0)
	Eastern	60 (36.8)	24 (42.1)	21 (31.8)	15 (37.5)
	Total	163 (100)	57 (100)	66 (100)	40 (100)
Food Type	Veg	153 (93.8)	54 (94.7)	61 (92.4)	38 (95.0)
	Non veg	10 (6.2)	3 (5.3)	5 (7.6)	2 (5.0)
	Total	163 (100)	57 (100)	66 (100)	40 (100)

**Significant an P-value < 0.0*

Table 2. Age-wise mean nutrient availability from meals served in schools

Nutrients	Class PP – 3 (n= 57)				Class 4 – 7 (n=66)				Class 8 -12 (n=40)			
		Nutrient availability				Nutrient availability				Nutrient availability		
	RDA	Mean	SD	% RDA	RDA	Mean	SD	% RDA	RDA	Mean	SD	% RDA
Protein (gm)	29.5	27.2	10.4	92.2	40.2	27.9	10.2	69.4	55.8	29.6	12.9	53.0
Fat (gm)	30	49.9	15.7	166.3	35	54.2	17.7	154.9	42.5	59.9	19.1	140.9
Vitamin A(mcg)	600	445.8	192	74.3	600	480.4	248.1	80.1	600	546.1	276.9	91.0
Thiamine (mg)	0.8	0.7	0.6	87.5	1.1	0.7	0.5	63.6	1.3	0.7	0.5	53.8
Pyridoxine (mg)	1.6	1	0.6	62.5	1.6	1	0.5	62.5	2	1.1	0.5	55.0
Folate (mcg)	120	99.8	31.9	83.2	140	96.9	32.8	69.2	175	104.9	31.2	59.9
Cobalamin (mcg)	1	0.5	0.9	50.0	1	0.5	1	50.0	1	0.7	1.5	70.0
Niacin (mg)	13	8.2	4.7	63.1	14	8.8	6.6	62.9	15.3	8.3	4.3	54.2
Vitamin C (mg)	40	40.2	19.1	100.5	40	40.5	21.5	101.3	40	44.9	24.2	112.3
Calcium (mg)	600	271.3	113.6	45.2	800	277	109	34.6	800	314.4	108.2	39.3
Iron (mg)	16	7.8	4	48.8	24	7.9	3.3	32.9	28.3	8.3	3.3	29.3
Zinc (mg)	8	4.7	2.5	58.8	9	4.8	2.1	53.3	11.5	5.2	2.5	45.2
Sodium (mg)	2000	4669.6	2031.9	233.5	2000	4995.7	1918.8	249.8	2000	5007.5	1598.4	250.4

Table 3. Region-wise nutrient availability from meals served in schools

Nutrients	Region	N	Mean	Std. Deviation	Median	ANOVA p-value
Energy (kcal)	Western	58	1132.4	289.98	1085	
	Central	45	1262.3	288.75	1200.8	
	Eastern	60	1590.81	482.93	1386.95	.000*
Protein (gm.)	Western	58	25.15	11.71	22.2	
	Central	45	26.37	9.73	24.6	
	Eastern	60	32.13	9.86	29.8	.001*
Fat (gm.)	Western	58	49.92	18.51	45.6	
	Central	45	59.3	20.7	52.4	
	Eastern	60	54.27	13.2	51.95	.028*
Vitamin A (mcg)	Western	58	489.78	286.06	423.95	
	Central	45	513.27	300.48	395.1	
	Eastern	60	457.57	98.6	448.65	0.49
Thiamine (mg)	Western	58	0.48	0.13	0.5	
	Central	45	0.65	0.15	0.6	
	Eastern	60	0.94	0.8	0.5	.000*
Pyrodoxine (mg)	Western	58	0.83	0.31	0.8	
	Central	45	0.98	0.26	1	
	Eastern	60	1.26	0.72	0.85	.000*
Folate (mcg)	Western	58	106.78	27.81	101.05	
	Central	45	80.18	26.25	75.5	
	Eastern	60	108	33.87	96.25	.000*
Cobalamin (mcg)	Western	58	0.46	1.2	0	
	Central	45	0.58	0.99	0.1	
	Eastern	60	0.61	1.02	0.1	0.716
Niacine (mg)	Western	58	7.25	6.53	5.7	
	Central	45	8.16	2.5	7.5	
	Eastern	60	9.76	5.77	7.25	.041*
Calcium (mg)	Western	58	249.82	115.5	225.85	
	Central	45	301.81	118.71	257.9	
	Eastern	60	304.21	93.33	283.85	.013*
Iron (mg)	Western	58	6.31	1.91	6.05	
	Central	45	8.5	1.98	8.4	
	Eastern	60	9.13	4.8	7.1	.000*
Zinc (mg)	Western	58	3.89	1.74	3.5	
	Central	45	4.82	1.26	4.8	
	Eastern	60	5.84	2.96	4.3	.000*

RESULTS

During the entire data collection process a total of 163 direct observations were made for weighted methods across 24 schools in three phases. Data was collected on a random day of each of the three seasons. Schools were found to serve non-vegetarian meals (meats such as pork, beef or chicken) only during 10 observations (6.2%). More of non-vegetarian meals were served towards the end of school season corresponding to the second and last phase of data collection (Table 1). Mean age-wise nutrient availability from one-day menu estimated using weighted method is presented in Table 2. The menu was found to be deficient in protein as compared to the RDA for all the three age-groups. Higher classes had higher gaps in protein as indicated by a higher standard deviation. However fat intake exceeded by more than 10% of the RDA in all age groups. The mean availability of most of the micronutrients was inadequate as compared to age appropriate RDA except for vitamin C. Among them calcium, iron and zinc were deficient by almost 50% from the menu in all the age group. However, mean sodium intake exceeded the RDA by over 50%. Region-wise nutrient availability from meals served in school is presented in table 3. ANNOVA test detected significant difference in the mean intake of all the macronutrients and energy between the regions. The menu from the eastern region provided significantly higher levels of energy and protein and almost all the other micronutrients such as thiamine, pyridoxine, iron, zinc, cobalamin, and niacin. There was no statistical difference in phase-wise (seasonality) analysis of nutrient intake (data not presented) were poor in animal source protein, it also hints towards deficiency of iron, vitamin A, zinc and other micro nutrients, as animal source foods are considered the best source of protein, iron and zinc (12).

DISCUSSION

The assessment found that the school meals were deficit in protein and most of the micronutrients. Meals were homogeneous across the regions and seasons but with limited diversity and minimal animal source foods with non-vegetarian meals being served only 10 times (6.2%) out of 163 observations. The World Health organization recommends less than 2000 milligrams of sodium per day (8). However, the assessment also found that the mean sodium availability from the meals served was more than 4500 milligrams in the lowest age groups with higher availability in higher age groups. High sodium intake in the Bhutanese population was reported by the WHO step survey of Bhutan 2015 (9).

School meals have been under scrutiny in the region where some similar findings have been reported. In a narrative of a study from Allahabad district of India, they reportedly mentioned that the mean nutrient intake for energy, protein, iron and calcium were lower than RDA but fat intake was higher in all age groups (10).

A Chinese study reported that the calories from fat exceeded the RDA by almost 30% (11) which is consistent with the present finding in Bhutanese schools where fat availability in the meals exceeded almost by 50% as compared to the RDA. The study also reported that vitamin B2 and calcium were inadequate, whereas, vitamin C, vitamin B1, iron and zinc were adequate. In Bhutanese schools except for vitamin C (40.2 mg, 40.5 mg and 44.9 mg for age group 6-9 years, 10-13 years and 14-18 years respectively), all other micronutrient was far lower than the RDA. This could be because for the Chinese student's, livestock and poultry were served more than twice the required amount. In contrast, of the 163 observation only 10 incidences recorded non-vegetarian (meat, chicken or pork) side dish during the study period of boarding schools in Bhutan. Since the meals served in schools

The Royal Government of Bhutan (RGOB) having realized the role of school feeding program has now shifted the focus of school feeding program from retaining in school to providing diverse and nutritionally wholesome meals. A System Approach to Better Education Result (SABER) assessment conducted by the MOE in 2014 recommended establishing a clear policy for the school feeding program (13). The Bhutan Education Blueprint (2014 - 2024) has given priority to school feeding program and recommended for a strong school feeding policy (1). The School Health and Nutrition Division (SHND) under Ministry of Education is responsible for school feeding program in providing quality meals and have been collaborating with other agencies / ministries such as the ministry of Agriculture and Forestry, Finance, Gross National Happiness Commission and the World Food Program (4).

As an immediate measure to improve the quality of the meals in feeding schools, the MoE with technical and financial assistant from WFP started providing fortified rice towards the end of 2017(5). The rice is fortified with six vitamins (vitamin A, Thiamine, folic acid, vitamin B3, B6 and B12) and two minerals (iron and zinc) by blending with the fortified rice kernels (14). During the time of the data collection for this study, the supply of fortified rice had not reached schools and therefore the finding of this study is timely and informative and the fortification of rice with vitamins and minerals are very timely for the given situation.

LIMITATIONS

The project was a programmatic review on nutrient adequacy of meals served in feeding schools. The nutrients were analyzed from standard portion size served and not based on actual consumption by the students.

CONCLUSION AND RECOMMENDATION

The assessment indicates the homogeneity of school meals across regions and seasons. The average protein availability from the meals served was similar for different age-groups, (27.2 grams, 27.9 grams and 29.6 grams for age group 6-9 years, 10-13 years and 14-18 years respectively) which might not be sufficient to meet the requirements of the higher age-groups. Most of the micro-nutrients were deficient which was even more pronounced in the higher age-groups. This is probably because of the limited variety of school meals as indicated from infrequent provision of meats and fruits. The assessment recommends to implement initiatives that will improve the availability of micronutrients such as food fortification, integration of school agriculture programs with school feeding and linkages with local farmers, strengthen monitoring and supportive supervision and promote local creativity and involvement of students in the menu planning and decision making process.

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