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Contribution of Mid-day Meals to the Daily Nutrient Requirement of School Children in Nigeria

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ABSTRACT

Three hundred pupils in Ibadan were used for the study, 150 of them from Abadina Primary School located within the University of Ibadan, to represent urban areas and the other 150 pupils from Ebenezer Primary School, Akingbile, a village 10 km from Ibadan City, to represent the rural area. The school meals served in these areas were chemically analysed; the average total energy (of the school meal) contributions to the actual intakes for the rural and urban areas were about 16·3% and 15·2%, respectively, while protein contributions were about 18·0% and 24·1% in rural and urban schools, respectively. Analysis, of the 24 h recall data obtained from the children randomly selected from each school, showed that there were no significant differences ($P > 0·05$) in the calorie and iron intakes of the two groups, while crude protein and calcium were significantly higher in the urban than in the rural school children. However, the introduction of the school meal positively reduces deficiencies and bridges the gap between Recommended Dietary Allowance and actual daily intake of nutrients.

INTRODUCTION

The school meal service should fulfil the objective of providing good nutritious food and play a role in the physical, educational and mental

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development of pupils. The close relationships between these are obvious from the fact that growing children thrive better when they are well fed.

Kormad (1961) reported that school meals increased the children's vigour and vitality, brightened them, increased their resistance to common infections, reduced absenteeism and provided them enough energy for work and play to help them grow better in 'mind, body and spirit'.

In developing countries, Nigeria in particular, the rapid process of rural–urban migration has meant that most parents are unable to prepare breakfast for their children before going to work; hence the school meal programme is designed to cater for deficiencies in the home diet and to meet the physiological needs of the children. Most children, especially those from the low-socio economic groups, eat food of poor quality which is deficient in the essential growth-promoting constituents like protein, minerals and vitamins. The importance of a well-balanced diet for the physical and mental performance of children was demonstrated by Srikantia (1975). He reported that malnourished children were shorter in height, lighter in weight and made more mistakes in their competence tests than did controls. Latham (1979) stated that school meals were beneficial because they often supplied much-needed nutrients, were a good way of introducing new novel foods, and helped to reduce hunger and malnutrition. School meals are educational as they create a practical forum for Nutritional Education. The risks of the children falling victims to infectious diseases from street food hawkers' unhealthy foods are reduced by a well-organised school meal programme.

With the establishment of compulsory school meals in Nigeria, it becomes mandatory to evaluate their nutrient quality and their contribution to the daily requirement of school children.

MATERIALS AND METHODS

Materials

One-hundred-and-fifty pupils between the ages of 10–12 years were randomly selected from a rural primary school (Ebenezer Primary School, Akingbile, 10 km from Ibadan City) and 150 pupils from an urban primary school (Abadina Primary School, located within the University of Ibadan, Nigeria). A questionnaire was administered twice a year (one in January, the peak of the dry (that is, hungry) season, and the other in July (which is the peak of the season of plenty)) to obtain information on socio-economic background and dietary habits. Similarly, the average daily nutrient consumption was determined using a 24-h recall method for one week-day

and one week-end day, twice for each of these two seasons of the year (the dry and wet seasons). The periods chosen were ends of the month (when salaries are handy) and the third week of the month (when expenditure was grossly reduced). This is to reduce the margin of errors associated with quantity estimation in the recall method.

METHODS

Twenty kobo worth of each of the food samples were bought from both the rural and urban primary schools for 5 day periods during the dry and wet seasons, respectively. This is the minimum amount recommended for each child per day. The food samples were oven-dried and stored between $-4°C$ and $-5°C$ prior to chemical analysis carried out using the methods in AOAC (1985) in duplicate (Table 1) for the following:

(a) Crude protein by estimating the nitrogen content using the Kjeldahl method and multiplied by 6·25 (that is, Sample N × 6·25).
(b) Fat value was by specific gravity using petroleum ether and the index of refraction, with the standard instrument read at the boiling range of between 40 and 50°C.
(c) The macro and micro-elements: calcium, iron, copper and zinc were estimated using absorption spectroscopy methods of AOAC (1985).
(d) A recovery test was done to evaluate the mineral content of a representative sample of food for the purpose of confirming the dependency of the analytical method thus rated at between 88–93%.

RESULTS AND DISCUSSION

Table 2 shows the school meal contributions to the RDAs and Table 3 shows that the school meals' contribution to the actual food intake was quite appreciable particularly within the rural communities in most of all the nutrients. However, Table 4 shows that the iron consumption was quite high with about 194 and 186 of the Recommended Dietary Allowance in urban and rural communities, respectively. Most of these iron values were from vegetables as collated from the questionnaire. The actual protein consumption of the urban school children was slightly higher than their rural counterparts. This was a result of the better consumption of animal protein foods. Hollingsworth (1972) stated that school meals are intended to provide 35% of the Daily Recommended Allowance for energy and all other

TABLE 1

Laboratory Analysis of School Meal in Urban and Rural Schools per 100 g Edible Portion

(a) Urban school

Day of week	*Menu for urban school*	*Dry weight (%)*	*Energy (kcal)*	*Crude protein (%)*	*Ether extract (%)*	*Calcium (mg) (%)*	*Iron (mg) (%)*	*Zinc (mg) (%)*	*Copper (mg) (%)*
Monday	Mashed beans + stew	38·0 ± 3·2	311·0 ± 10·0	8·7 ± 1·2	6·6 ± 0·4	48·0 ± 3·0	5·5 ± 0·5	2·2 ± 0·0	0·6 ± 0·0
Tuesday	Yam pottage + stew	36·2 ± 2·0	368·0 ± 5·5	2·4 ± 0·2	6·1 ± 0·0	66·4 ± 8·0	2·3 ± 0·0	1·0 ± 0·0	0·2 ± 0·0
Wednesday	Rice + beans + stew	32·6 ± 4·5	252·7 ± 4·3	6·5 ± 0·5	5·2 ± 1·0	41·5 ± 1·5	4·3 ± 0·3	1·8 ± 0·0	0·4 ± 0·0
Thursday	Rice + spinach stew	35·4 ± 3·5	212·5 ± 3·5	5·1 ± 0·3	4·0 ± 0·5	57·0 ± 2·2	5·5 ± 1·0	1·0 ± 0·0	0·5 ± 0·0
Friday	Beans + stew	49·1 ± 4·0	308·8 ± 4·0	6·4 ± 1·4	6·2 ± 0·2	45·0 ± 3·0	4·1 ± 0·5	2·1 ± 0·1	0·4 ± 0·0
Average nutrient content per 100 g (Overall mean of 2 weeks food collection) (i.e. 1 week of hungry season and 1 week of plenty season)			290·4 ± 6·5	6·0 ± 0·7	5·6 ± 0·6	51·6 ± 6·0	4·5 ± 0·6	1·6 ± 0·4	0·4 ± 0·0

(b) Rural school

Day of week	*Menu for rural school*	*Dry weight (%)*	*Energy (kcal)*	*Crude protein (%)*	*Ether extract (%)*	*Calcium (mg) (%)*	*Iron (mg) (%)*	*Zinc (mg) (%)*	*Copper (mg) (%)*
Monday	Mashed beans + stew	44·9 ± 2·5	380·0 ± 15·0	7·7 ± 1·0	7·0 ± 1·5	42·5 ± 5·7	6·6 ± 1·0	2·0 ± 0·0	0·4 ± 0·0
Tuesday	Yam pottage + spinach stew	37·0 ± 2·5	395·9 ± 9·5	2·3 ± 0·0	6·2 ± 1·2	70·0 ± 6·3	4·4 ± 0·0	1·6 ± 0·0	0·3 ± 0·0
Wednesday	Rice + beans + stew	39·1 ± 3·0	280·6 ± 5·6	6·4 ± 0·4	5·8 ± 1·1	51·3 ± 4·1	4·6 ± 0·0	2·2 ± 0·0	0·2 ± 0·0
Thursday	Rice + spinach stew	−36·8 ± 4·0	256·4 ± 0·2	6·0 ± 1·0	4·5 ± 0·5	62·0 ± 2·0	6·0 ± 0·5	1·4 ± 0·0	0·3 ± 0·0
Friday	Beans + stew	32·1 ± 2·1	358·9 ± 8·5	6·7 ± 1·6	7·2 ± 1·2	46·6 ± 4·4	5·1 ± 6·0	1·9 ± 6·0	0·5 ± 0·0
Average nutrient content per 100 g (Overall mean of 2 weeks food collection) (i.e. 1 week of hungry season and 1 week of plenty season)			339·2 ± 9·1	5·8 ± 0·5	6·1 ± 1·1	54·5 ± 6·2	5·1 ± 0·3	1·8 ± 0·0	0·3 ± 0·0

TABLE 2
Percentage Contribution of School Meals to Recommended Dietary Allowance (FAO, 1974) in the Urban and Rural Schools

(a) Urban school

Nutrients	*Recommended daily allowance*	*School meals contribution*	*% RDA*
Total energy (kcal)	2600	290·4 ± 6·3	12·8
Crude protein (g)	40·0	5·8 ± 0·7	14·5
Fat (g)[a]	80·0	5·6 ± 0·6	7·0
Calcium (mg)	1000	51·6 ± 6·0	5·2
Iron (mg)	14·0	4·5 ± 0·6	32·1
Zinc (mg)	12·5	1·6 ± 0·4	13·8
Copper (mg)[b]	2·5	0·4 ± 0·0	16·0

(b) Rural school

Nutrient	*Recommended daily allowance*	*School meals contribution*	*% RDA*
Total energy (kcal)	2600	334·2 ± 9·1	12·9
Crude protein (g)	40·0	5·8 ± 0·5	14·5
Fat (g)[a]	80·0	6·1 ± 1·1	7·6
Calcium (mg)	1000	54·5 ± 6·2	5·5
Iron (mg)	14·0	5·1 ± 0·3	36·4
Zinc (mg)	12·5	1·8 ± 0·0	14·4
Copper (mg)[b]	2·5	0·3 ± 0·0	12·6

[a] Source: Food and Nutrition Board RDA (1964).
[b] Source: Daily Recommended Allowance by the US National Research Council (1968).

nutrients as based on the 'Provision of Meals Acts of 1906' passed in England. Although the percentage of the nutrient contribution by the school meal did not meet this stipulation, here in Nigeria, the school meals provide between 5·2 and 36·4% of the various nutrients as seen in Table 3. Improvement can be made in the nutrients that are below recommendation now that the establishment of school meals has come to stay. It is particularly important that the school meal is consumed because this research work shows that some of the children did not eat breakfast. The school meal is usually given between 10 and 11 a.m., a period when the low blood glucose level would affect learning (Ajileye, 1985). It is, therefore, recommended that the Government should subsidise the cost of school-meals and give all necessary support.

TABLE 3

Percentage Contribution of School Meals to the Actual Daily Intake in the Urban and Rural Schools[a]

(a) Urban school

Nutrient	*Mean value of school meals*	*Mean value of actual daily intake*[a]	*% Contribution of the actual daily intake*
Total energy (kcal)	290·4 ± 6·3	1 915 ± 262·5	15·2
Protein (g)	5·8 ± 0·7	36·5 ± 9·4	24·1
Calcium (mg)	51·6 ± 6·0	306 ± 79·2	16·9
Iron (mg)	4·5 ± 0·6	27·1 ± 5·4	16·6

(b) Rural school

Nutrient	*Mean value of school meals*	*Mean value of actual daily intake*[a]	*% Contribution of the actual daily intake*
Total energy (kcal)	3 374 ± 9·1	2 015 ± 274·4	16·3
Protein (g)	5·8 ± 0·5	32·2 ± 7·0	18·0
Calcium (mg)	54·5 ± 6·2	219 ± 87·0	24·9
Iron (mg)	5·1 ± 0·3	26·1 ± 2·2	19·6

[a] The actual daily intakes were calculated using the Food Tables for Africa (1968). Data were mean value of figures compiled for the two seasons of the year (wet and dry seasons) as illustrated under 'Materials and Methods'.

TABLE 4

Comparison of the Percentage met from the Mean Value of Actual Daily Intake of Urban and Rural School Children Compared to the Recommended Dietary Allowance*

Nutrient	*Recommended dietary allowance*	*Mean SD of actual daily intake in urban school children*	*% Met*	*Mean SD of actual daily intake in rural school children*	*% met*
Total energy (kcal)	2 600	1 915·0 ± 262·5[a] ($P > 0·05$)	73·7	2 015 ± 274·4[a] ($P > 0·05$)	77·5
Crude protein (g)	40·0	36·5 ± 9·4[a] ($P < 0·05$)	91·1	32·4 ± 7·0[b] ($P < 0·05$)	81·0
Calcium (mg)	1 000	305·9 ± 79·2[a] ($P < 0·05$)	30·6	218·6 ± 87·0[b] ($P < 0·05$)	21·9
Iron (mg)	14·0	27·1 ± 5·4[a] ($P > 0·05$)	193·6	26·1 ± 2·2[a] ($P > 0·05$)	186·4

$\bar{x} \pm$ SD, Means not sharing the same superscript are significantly different ($P < 0·05$).

* Data as compiled from the average record of the 24-h recall dietary method for the two seasons of the year (season of plenty and hungry dry season).

REFERENCES

Ajileye, B. O. (1985). Nutritional Status of Primary School Children. BSc project report, Department of Human Nutrition, University of Ibadan, Nigeria.

AOAC (1985). *Official Methods of Analysis of the Association of Official Agricultural Chemists* (1955) and *Official Methods of Analysis of the Association of Official Analytical Chemists* (1970). AOAC, Washington, DC.

FAO (1974). Recommended Daily Allowance of Nutrients for Population in Africa.

Food Composition Table for use in Africa (1968). Department of Health, Education and Welfare Public Service Food, FAO (Nutrition Division).

Food and Nutrition Board (1964). R.D.D.A. Publication No. 1146, National Academy of Sciences, National Research Council, USA.

Hollingsworth, D. (1972). *Nutrition Dev. of the School Meals, Milk and Welfare Food Services, Vol. 26, No. 1,* pp. 32–40.

Kormad, R. (1961). *Outline of National Nut. Prog. for School Feeding.* Report of the School Health Committee, Ministry of Health, India, 227.

Latham, M. C. (1979). *Human Nutrition in Tropical Africa* (2nd ed.). FAO of the United Nations, pp. 50.

Srikantia, S. G. (1975). Malnutrition and Mental Function. *Proc. 10th Int. Congress Nutrition, Kyoto, Japan.*