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Food Consumption Pattern and Calcium Status of Adolescents in Nnewi, Nigeria

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Abstract: This study investigated the food consumption pattern and calcium status of 200 adolescents (12-19 years) in Nnewi, Anambra State Nigeria. Data were obtained by means of pre-tested standard questionnaire and biochemical analysis of serum to determine calcium status. The result showed that majority of the respondent's parents were traders (35.5%) and secondary school graduates (40.5%). About 67.5% of the subjects consume 3 meals/day and the frequency of milk consumption was very low (17.7%). Consequently, their mean Body Mass Index (BMI) (19.15±3.06) was within the normal range while their serum calcium concentration (7.12±3.54) was lower than the recommended value (8.10-10.40mg). Sex was significantly related (x^2 = 15.22, p = 0.004) to the BMI and intake of milk significantly (p<0.005) affected the level of serum calcium concentration (mg/dl). Moi moi, beans pottage, fried rice and jollof rice were the strongest predictors of serum calcium concentration from food preference. The low serum calcium concentrations were attributed to the fact that the subject's main sources of calcium were cereals and legumes which most times contain anti-nutritional factors. These results points out the need for nutrition education with emphasis on improved method of food preparation and selection.

Key words: Consumption patterns, calcium status, adolescents

INTRODUCTION

Food consumption pattern not only affect an individual's well-being but also have implications for the society as a whole. It is documented that the choice of which food to eat, where to eat and when to eat are intensely personal and influenced by several factors which in-turn influence an individuals' nutrient needs (Hawarlin, 2007). Adolescents have special nutrient needs for growth and have been shown not to meet the dietary recommendation for their age (Skiba and Logmani, 1997; Geer et al., 2006; Bonnie, 2004). Globally, there is evidence that approximately 2 billion people suffer from hidden hunger which has devastating effects and significantly contributes to the global burden of disease (Kraemer, 2010). Thacher et al. (2006) revealed that nutritional rickets remain an endemic problem in many developing countries and has re-emerged in a number of developed countries where it was thought to have almost been eradicated. Sight and Life (2009) have identified Nigeria among countries with severe micronutrient malnutrition. This study was therefore designed to investigate the food consumption patterns and calcium status of adolescents in Nnewi, Nigeria.

Objectives: The main objective of this study is to assess the food consumption patterns and calcium status of adolescents in Nnewi Nigeria.

Specific objectives: To assess the food consumption patterns of the study population.
- To determine the calcium status of the study population
- To ascertain the effects of gender on the nutritional status
- To determine the relationship between consumption patterns and calcium status

MATERIALS AND METHODS

The study was conducted in Nnewi north LGA of Anambra state which was purposely selected because it represent the different socio-economic groups needed for the research. The sub-areas include the urban and rural areas from which four secondary schools (2 government and 2 private schools, comprising of borders and non-borders) was selected. Information on the socio-economic attributes and food consumption pattern of 200 participants randomly selected from the sub-areas were obtained by means of pre-tested questionnaire. The biochemical analysis to determine serum calcium concentration was performed. Information on BMI was obtained from anthropometric measurements. Adequacy of diet was determined using recommended intakes of nutrients. The responses to the questionnaire were subjected to statistical analysis and presented.
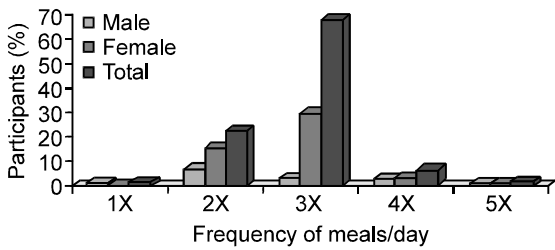
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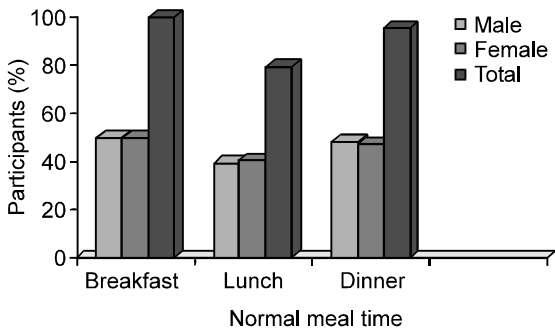
Fig. 1: Frequency of meal consumption

Fig. 2 Detailed frequency of meal intake of participants

RESULTS

Personal and socio-economic characteristics of the participants: Age, religion, residence, family type and family size of participants as well as occupation and education of family heads were considered to be symbol of socio-economic status. Of the 200 participants involved in the study, only 9.0% were between 18-19 yrs. About 34.5% were between 12 and 14 yrs while majority 56.6% were between 15-17 yrs. All except two male participants were of Moslem religion. A good number of the participants (68%) were urban dwellers. Most (63.5%) were of large family size with number of siblings ranging between 5-8. Majority of the participants (85%) were from monogamous family. Trading (56.5%) was the major occupation of the people although about 21% were engaged in civil service. All the family heads had some level of education. About 9.5% completed primary school, 40% completed secondary school while 36.5 had post secondary education.

Food consumption patterns of participants: The frequency of meal consumption is shown in Fig. 1. Majority (67.5%) ate three times daily and about 6.5% and 2.0% claimed to eat four and five times daily respectively. The pattern of the frequency of meal intake broken down into the usual normal times of serving meals (breakfast, lunch and dinner) is shown in Fig. 2. All the participants always have their breakfast daily and majority (80% and 95.5%) took lunch and dinner daily respectively. The result showed evidence of meal skipping (23.6%) especially lunch (15.1%). More males
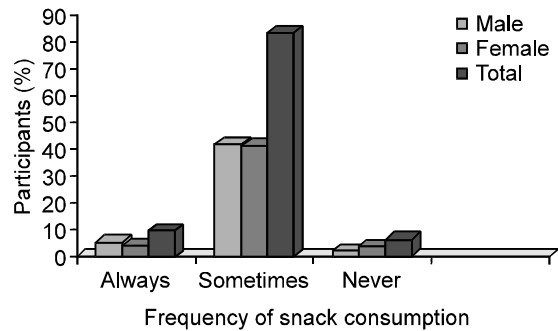

Fig. 3: Frequency of snack consumption by participants
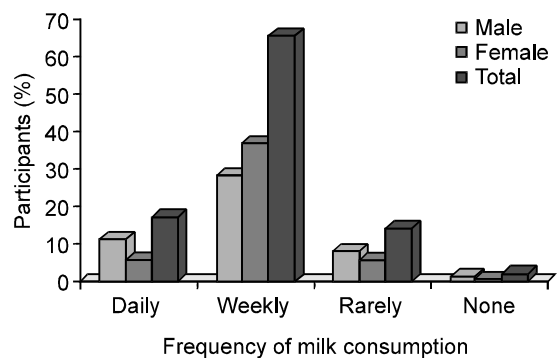

Fig. 4: Frequency of milk consumption

(14%) than females (9.5%) were involved. Reasons for meal skipping include weight loss (7.3%), lack of time (36.5%), no appetite (47.9%) and 8.3% did not cook. The participants snacking patterns reveals that majority (83.5%) of the participants sometimes have snacks especially fruits (48.4%). Other foods used as snacks include confectionaries (27.9%), beverages (13.7%), vegetables (7.9%) and nuts (2.1%). The frequency of consumption of fruits revealed that appreciable number of participants (39.1%) consumed fruits daily. It was also observed that a good number (37.6%) do not actually know how often they consume fruits.

The study revealed that rice (57.1%), noodles (15.2%), beans (11.6%), spaghetti (9.1%) and yam (2%) were their favorite foods. The frequency of milk consumption is presented in Fig. 4. Only 17.5% of the participants consume daily. As much as 65.5% do not consume milk always, 14.5% rarely with about 2.5% not consuming milk in recent times.

Nutritional status of participants: The nutritional status of the study population was based on anthropometric measurements and serum calcium concentration is presented in Table 1. The result showed that males have significantly better BMI (18.04±2.14) than females (20.26±3.42) at $p < 0.05$. The participants aged 12-14 yrs were found to have significantly lower BMI (18.62±3.17)

Table 1: Anthropometric measurement, BMI and serum calcium concentration of participants

Variable	Weight (kg)	Height (m)	BMI (kg/m^2)	Calcium conc (mg/dl)
Sex				
Male	49.09±9.80	1.64±0.12	18.04±2.14	5.06±3.87
Female	53.16±9.10	1.62±0.06	20.6±3.42	9.18±1.29
t-value (p-value)	3.038(0.003)	1.733(0.085)	5.512(0.00)	10.105(0.00)
Age				
12-14	46.64^b±10.73	1.58^c±0.09	18.62^a±3.17	7.30±3.10
15-17	53.30^a±8.45	1.65^a±0.07	19.55^a±3.04	7.43^a±3.58
18-19	54.67^a±5.77	1.72^a±0.11	18.62^a±2.47	4.49^b±3.96
t-value (p-value)	12.903(0.000)	28.205(0.000)	2.321(0.101)	5.74(0.004)
Location				
Urban	50.17±9.75	1.63±0.10	18.83±2.92	7.81±3.13
Rural	53.14±9.20	1.64±0.09	19.82±3.24	5.65±3.92
t-value (p-value)	2.044(0.042)	0.634(0.053)	2.147(0.033)	7.87(0.000)
General	51.12±9.65	1.63±0.09	19.15±3.06	7.12±3.54

Table 2: Calcium status of participants by sex

Serum calcium conc (mg/dl)	Males		Female		Total	
	N	%	N	%	N	%
Low (<8.10 mg/dl)	64	32	13	6.5	77	38.5
Normal (8.10-10.4 mg/dl)	30	15	83	41.5	113	56.5
High (>10.4 mg/dl)	6	3	4	2	10	5.0

Table 3: Body mass index of participants

BMI category	Male		Female		Total	
	N	%	N	%	N	%
Underweight (<18.49 kg/m^2)	62	31	26	13	88	44
Normal (18.5-24.99 kg/m^2)	36	18	66	33	102	51
Overweight (25.0-29.90 kg/m^2)	0	0	10	5	10	5

than other age groups. However, the mean BMI of all participants (19.15 kgm^2) were within the normal range. The serum calcium concentration (7.12 mg/dl) was lower than the recommended value (8.10-10.4 mg/dl). The table also showed that males had significantly lower weights (49.09±9.80), BMI (18.04±2.14) and serum concentration (5.06±3.87) at p<0.05 than females. However the height of both sexes was similar. It is equally important to note that participants aged 18-19 yrs had the lowest serum calcium concentrated other age groups. The result also showed that the weight and BMI of rural participants (53.14 kg; 19.82 kg/m^2) were significantly higher than the urban (50.17 kg; 18.83 kg/m^2) while the serum calcium concentration of the urban (7.81 mg/dl) were significantly higher than the rural (5.65 mg/dl).

Table 2 showed that 56.5% had normal serum concentration. Although more males (32%) had low calcium concentration as confirmed by the chi-square test that revealed that sex was significantly related to serum calcium grade (X^2 59.04, p = 0.00). This according to WHO (2002) may be due to the fact that the peak rate of calcium retention occurs ealier in girls but continues longer in boys. Only 5% of participants have high serum calcium concentration. Table 3 categorized the body mass index of participants into underweight, normal and overweight. Although 51% of participants had normal BMI and 5% overweight, as much as 44%

were underweight. All the overweight participants were females. The result of a backward stepwise multiple regression analysis on influence of food consumption pattern on serum calcium concentration shows that "how often do you drink milk" was the only predictor of serum calcium concentration and that the intake of milk significantly (p<0.05) affected serum calcium concentration of the participants. The backward stepwise multiple regression analysis was also used to determine the influence of food preference on serum calcium concentration. The result showed that the preference for moi moi, beans pottage, fried rice and jollof rice were the strongest predictors of serum calcium concentration.

DISCUSSION

These results showed that most of the participants were in the middle in-come group when the occupations of family heads were considered. This could explain the affordability of three square meals daily by 67.5% participants despite the large family size (5-8). The evidence of milk skipping by 23.6% of the participants is in line with the report of Savige et al. (2007) which states that on a daily basis, more and more adolescents skip breakfast. These authors associated meal skipping with female but this work identified that more males (14%) skipped meals than females (9.5%). This may be attributed to the differences in culture between the two

populations under study. This difference in culture is further supported by the major reasons given for meal skipping which was because of snacking as was documented by Savige *et al.* (2007) but because of no appetite (47.9%) and lack of time (36.5%). The major snack consumed fruits (48.4%) can be implicated as one of the reason for low serum calcium concentration of most of the participants since several authors (Anderson, 2004; Whitney and Rolfes, 2008; Gao, 2006) have not associated fruits as sources of available calcium. The frequency of snack consumption showed that some participants (37%) lack interest in food consumption as they cannot remember how often they consume snacks. The list of favorite foods showed that the participants favor cereals, legumes and tubers which obviously are not good sources of available calcium. This is rather very sad considering that milk, fish and certain vegetables which are good sources of calcium are not included as favorite foods. The frequency of milk consumption showed that only 17.5% drank milk daily. Gao (2006) stated that it is especially difficult for children who do not drink milk to meet their calcium needs; but Whitney and Rolfes (2008) documented that it is possible for people who do not drink milk to obtain adequate calcium from carefully selected calcium rich foods. This view had already been expressed by National Kidney Foundation (2005) which documented that the bioavailability of calcium from vegetables is generally high except for spinach which is high in oxalate that makes calcium virtually unavailable. However, the percentage that consumed milk is rather too poor considering that milk and its product are significant sources of calcium. The normal BMI and low serum calcium of participants was not surprising because majority of the participants could afford 3 square meals daily but their consumption of calcium-rich foods were poor. The lower weight of male participants can also be likened to the fact that more boys skipped meals. This result contradicts the report of Whitney and Rolfes (2008) which states that adolescent boys have high lean body mass than girls and that of Bowman (2002) which revealed that adolescent girls calcium intake begins to decline when needs are greatest. The poor milk intake by participants is in line with the report of Bonnie (2004) which states that at this age, high soft drink consumption in adolescent contributes to low calcium intake because of the likelihood of soda being substituted for milk. The differences in weight and calcium status due to location was because the rural dwellers are more likely to consume tubers, roots, fruits, vegetables and grains and urban participants were more likely to consume more milk products which are readily available in cities. This is in line with the report of Whitney and Rolfes (2008) which states that the consumption of milk products not just dairy products can supply the bulk of dietary calcium as dairy products are

milk fats that contain negligible calcium because calcium is not soluble in fat. The food consumed by rural participants reflected WHO (2002) report that stated that phytates present in the husk of these foods form insoluble complexes in the gastro-intestinal tract and oxalates precipitates calcium in the bowel. The higher weight of females may be attributed to the fact that female deposits more fat than males.

Conclusion: This study has shown that the mean serum calcium concentration of the participants were lower than the recommended value (8.10-10.4 mg/dl) because the food consumption patterns of the study population do not favor the consumption of calcium-rich foods. Most of the participants can afford to eat 3 times daily and have snacks once in a while. This goes to show that cost was not the main reason for poor consumption of calcium rich foods Since meal skipping was mainly because of lack of time and appetite, it can further be deduced that lack of knowledge of what constitute an adequate diet is the problem. Consequently, it is recommended that nutrition education on the importance of milk and other calcium rich foods as well as nutritious foods and snacks will help the participants to make informed choice that will improve their calcium status.

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