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# Evaluation of Energy and Micronutrients Intake of Nigerian Adolescent Females: A Case Study of Institutionalized Secondary Schools in Akure South Local Government Area, Ondo State, Nigeria

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**Abstract:** The objective of the study is to provide information on the energy and micronutrients intake of Nigerian adolescent females. A cross-sectional surrey was conducted among the 323 institutionalized adolescent females of 10-19 years age range in Akure South LGA, Ondo State. The energy and micronutrient intake were determined by weighing the food intake of the subjects and part of the food samples were subjected to chemical analysis The mean mineral intakes were: Ca 567 mg/kg, Mg 261 mg/kg, Zn 7.58mg/kg, Fe 19.8 mg/kg and P 136.8 mg/kg. And the vitamins intakes were vit. A 860 mg/kg, Thiamine 0.7 mg/kg, Riboflavin 0.28 mg/kg, Niacin 3.27 mg/kg, vit. C 9.1 mg/kg, Vit. D 2.14 mcg/kg Folic acid 9.8 mcg/kg and Vit. $B_{12}$ 1.2 mcg/kg, and the energy intakes was 6.45 MJ. The result showed that high proportion of the subjects were not meeting the RDA for energy and some of the micronutrients intake.

**Key words:** Institutionalized adolescent female, dietary intake, micronutrients intake

## Introduction

Adolescent is the period of the growth spurt with its attendant increase in the requirement for energy, macronutrient and micronutrient. During this period, inadequate stores or intake of nutrients, can have adverse effects on the physical growth and cognitive development of children (Shinjini and Sunita, 2001). Epidemiological studies have shown that low energy intake and deficiencies of several micronutrients result to stunting and also down regulate immune responsiveness. Hence, there is an increased in morbidity and mortality rate due to infections, particularly, among young children and adolescents residing in developing countries (Bhaskaram, 2001; FAO/WHO, 1992; WHO, 1998).

The micronutrient deficiencies of public health significance are the iodine deficiency disorders, vitamin A deficiency and iron deficiency anaemia. The deficiency of these nutrients arise from inadequate intakes, impaired absorption and/or utilization, excessive losses, or a combination of these factors and are exacerbated during times of greater physiological need such as infancy, adolescent and pregnancy. In many developing countries, rural diets are based predominantly on cereals and legumes or starchy roots and tubers (Cole and Ogungbe, 1987). Consumption of flesh foods such as meat, poultry, fish with bones, fresh green vegetables and fruits, readily available sources of vitamins and minerals, is often low because of economic, cultural, environmental and religious constraints. Besides, the bioavailability of micronutrients in diets based on cereals and legumes is often poor (Gibson and Christine, 2001; Cole *et al.,* 1997).

The objectives of the study were to assess the energy and micronutrients intake of the subject over seven days period, and also, to evaluate the percentage of RDA met of nutrients intake by the subjects as recommended by the FAO/WHO (1974, 1985).

Table 1: Mean measurements of anthropometrics and Body mass index (BMI)

| Parameters | 0 ± S D | Range |
|---|---|---|
| Age (yrs) | 13.19±0. 10 | 10-19 |
| Height (cm) | 150.06±0.54 | 120-182 |
| Weight (kg) | 42.7±0.49 | 25-65 |
| BMI | 18.81±0.15 | 12.84- 33.33 |

Values are means of three replicates.

Table 2: Correlation matrix showing the relationship between Age, weight, height and BMI

| | Age (yrs) | Height | Weight | BMI |
|---|---|---|---|---|
| AGE (yrs) | 1.000 | | | |
| HEIGHT | 0.6156 | 1.000 | | |
| WEIGHT | 0.6385 | 0.8117 | 1.000 | |
| BM | 0.3805 | 0.2246 | 0.7438 | 1.000 |

## Materials and Methods

**Location and subjects:** Three hundred and twenty three females adolescent were selected randomly from two high schools with boarding facilities in Akure South Local Government area, Ondo State. The subjects age were between 10 and 18 years and they belong to families of different ethnic and socio-economic groups and are considered to be typical of average Nigerian adolescent girls.

**Food intake and measurement:** The dietary intakes of the subjects were monitored for seven days in each of the schools. The subjects ate their meals in the school

Table 3: Means of energy, macronutrients and micronutrients intake of the subjects from different environmental setting. a: Mean values of energy and macronutrients intake

| Environmental Setting | | Energy (KJ) | Protein (g) | Fat (g) | CHO (g) | Fibre (g) | ASH (g) |
|---|---|---|---|---|---|---|---|
| Rural | | 5392 | 45.9 | 47.5 | 167.7 | 3.21 | 10.5 |
| Urban | | 7501 | 50.3 | 78.3 | 220.4 | 2.65 | 13.6 |
| Overall | 0 | 6447 | 48.1 | 62.9 | 194.0 | 2.93 | 12.05 |
| | SEM± | 709.7 | 6.5 | 8.5 | 27.8 | 0.4 | 1.8 |

b: Minerals intake

| Environmental Setting | | Ca (mg) | Mg (mg) | Zn (mg) | Fe (mg) | Na (mg) | K (mg) | P (mg) | Cu (mcg) |
|---|---|---|---|---|---|---|---|---|---|
| Rural | | 610.0 | 289.5 | 7.14 | 17.9 | 2147 | 25884 | 215.3 | ND |
| Urban | | 522.2 | 233.0 | 8.0 | 21.8 | 2579 | 9213 | 58.2 | ND |
| Over all | 0 | 566.5 | 261.3 | 7.58 | 19.8 | 2363 | 14169 | 136.8 | ND |
| | SEM | 67.2 | 45.5 | 0.9 | 2.9 | 418.6 | 309.3 | 35.5 | ND |

ND - Not Detected

C: Vitamin intakes

| Environmental Setting | | Vit. A (mcg) | Thiamine (mg) | Riboflavin (mg) | Niacin (mg) | Vit. C (mg) | Vit. D (mcg) | Folic acid (mcg) | vit. $B_{12}$ (mcg) |
|---|---|---|---|---|---|---|---|---|---|
| Rural | | 815 | 0.58 | 0.19 | 2.29 | 9.4 | 0.68 | 7.48 | 0.41 |
| Urban | | 950.8 | 1.10 | 0.42 | 4.91 | 8.7 | 4.6 | 15.0 | 2.5 |
| Overall | 0 | 860.4 | 0.7 | 0.28 | 3.27 | 9.1 | 2.14 | 9.8 | 1.2 |
| | SEM | 318 | 0.3 | 0.05 | 0.78 | 4.1 | 1.5 | 2.2 | 0.9 |

Table 4: Distribution of the subjects into percentage of RDA met

| Nutrients | Rural (n=150) | | Urban (n=173) | | Overall (n=323) | |
|---|---|---|---|---|---|---|
| | %RMS | %RNS | %RMS | %RNS | %RMS | %RNS |
| Energy | - | 100 | - | 100 | - | 100 |
| Calcium | 9.3 | 90.7 | - | 100.0 | 4.3 | 95.7 |
| Magnesium | - | 100.0 | - | 100.0 | - | 100.0 |
| Zinc | - | 100.0 | - | 100.0 | - | 100 |
| Iron | 59.3 | 40.7 | 58.9 | 41.1 | 31.6 | 68.4 |
| Phosphorous | - | 100.0 | - | 100.0 | - | 100.0 |
| Sodium | NR | | NR | | NR | |
| Potassium | NR | | NR | | NR | |
| Vit. A | 100.0 | - | 100 | - | 100 | - |
| Thiamine | - | 100.0 | 69.4 | 30.6 | 31.9 | 68.1 |
| Riboflavin | - | 100.0 | - | 100.0 | - | 100.0 |
| Niacin | - | 100.0 | - | 100.0 | - | 100.0 |
| Vit. C | - | 100.0 | - | 100.0 | - | 100.0 |
| Vit. D | - | 100.0 | 100 | - | 53.5 | 46.5 |
| Folic acid | - | 100.0 | - | 100.0 | - | 100.0 |
| Vit. $B_{12}$ | - | 100.0 | - | 100.0 | - | 100.0 |

%RMS = Percentage of subjects meeting RDA requirement. %RNS = Percentage of subjects not meeting RDA requirement. NR = No requirement

cafeteria between the hours of 07-07:30, 14:00-15:00 and 18:00-19:00 for breakfast, lunch and supper respectively. The served meals were starchy foods based and were weighed and remnants (if any) were collected, weighed and deducted from the amount of food served to the subjects.

**Chemical analysis of food sample:** The food samples were subjected to proximate analyses using standard procedures (AOAC, 1995). The total ash was determined after ashing for 12 hours at 550$^{o}$C. Calcium, Magnesium, Zinc, Iron, Copper and Phosphorous contents were determined on ashes samples using a Buck Model 200A flame atomic absorption spectrophotometer (I.I.T.A., 1982), while phosphorus content was determined using the vanadomolybdate

method. Vitamin A., Riboflavin, Niacin, Vitamin C, Vitamin D, Folic acid, vitamin $B_{12}$ and vitamin $B_1$ were determined using standard methods (AOAC, 1995). The results obtained from these analyses were used to compute energy and micronutrients intakes of individual subject. The percentages R D A met of the subjects were determined as compared with recommended dietary allowances of FAO/WHO (1974, 1985).

**Statistical analysis:** Results are expressed as mean values and standard deviations, (SD), standard error of means (SEM) and percentage of population. Data was processed using SPSS 10.0 version (1999) computer software.

## Results

The mean values of age and physical body measurements are displayed in Table 1. The mean age was 13.19 (SD 0.10) years with a range between 10 and 19 years. Height was 150.06 (SD 0.54) cm with a range between 120 and 182cm. Weight was 42.7 (SD 0.49) kg with a range of 25 and 65kg. And Body mass index was 18.81 (SD 0.15) kg $m^{-2}$ with a range of 12.84 and 33.33 kg $m^{-2}$.

Table 2, shows the correlation coefficients between BMI and anthropometrics variables. BMI correlated strongly with body weight (r 0.7438; $p< 0.05$), but a weaker correlation with height (r 0.2246; $p< 0.05$) and age (r 0.3805; $p< 0.05$).

The nutrients intake of the over all subjects studied are shown in Tables 3 (a, b and c). The mean energy intakes was 6.45 MJ, Protein intakes was 48.1g, carbohydrate was 194.0g, while, 62.9g, 0.4g and 12.05g were intakes for fat, fiber and ash respectively. Minerals intake were; Calcium; 567, Magnesium; 261, Zinc; 7.58, Iron; 19.8, and phosphorous; 136.8mg/kg. Vitamins intake were; Thiamine (vit. $B_1$); 0.7, Riboflavin (vit. $B_2$) 0.28, Niacin 3.27, and Ascorbic acid (vit. C) 9.1mg/kg, others were; vitamin D, 2.14, Folic acid 9.8 and vitamin $B_{12}$1.2 ; and vitamin A; 860mcg/kg

## Discussion

This study is designed to evaluate the energy and micronutrients intake of adolescents female from rural and urban communities. The findings of the study showed that the energy and micronutrients intake of the subjects were generally low in the two communities (Table 4). And it was observed that the energy and micronutrients intake of the subjects were very low in rural community than urban community. The factors responsible for this could be as result of poverty, inadequate food intake, seasonal availability of food materials, lack of nutrition education and cultural belief. In south west Nigeria, where the study was conducted, the low micronutrient intake by the subjects could be as a result of belief of the people that fresh green vegetables and fruits, available sources of minerals and vitamins are traditionally considered to be ruminant feed and do not form part of the staple diet for many Nigerians, except those in the middle to high socio-economic status.

The calculated mean values of energy and micronutrients intake of the subjects as compared with the FAO/WHO (1974, 1985) recommended dietary allowances (RDA) showed that none of the subjects was able to meet energy and micronutrients requirements, such as magnesium, zinc, phosphorous, Riboflavin, Niacin, vitamin C, folic acid and vitamin $B_{12.}$ Few were able to meet their calcium, iron, thiamine and vitamin D, while all subjects met the RDA for vitamin A. The findings of this study agreed with others findings, which established that besides protein and energy malnutrition, deficiencies of micronutrients are more pronounced among the pregnant women, young children and adolescents in developing countries (Bhaskaram, 2001; Maharaj *et al*., 2001, Ramarkrishnan *et al.,* 1999; Robert, 2001). Numerous studies have established that imbalanced in nutrients intake, especially micronutrient, may result to frequent infectious diseases, intellectual development retardation and reduced productivity at adulthood (WHO, 1995; Spur *et al*., 1977).

**Conclusion:** The study provides useful information on the energy and micronutrients intake of female adolescents in boarding schools from both rural and urban communities in Akure north local government area, Ondo State, Nigeria. It is not clear whether the findings are specific to the investigated areas alone and period of the study or they are typical of the whole communities or year round. Therefore, further studies are needed to confirm these findings.

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