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# Calcium Knowledge and Consumption Pattern of Calcium-rich Foods among Female University Students in South-west Nigeria

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**Abstract** Calcium plays a vital role in the prevention of Osteoporosis; Peak bone mass is attained in the early years of life before 30 years. The study assessed the calcium knowledge and consumption pattern of calcium-rich foods by female University students. This cross-sectional study involved 400 randomly selected female undergraduate students of the University of Ibadan, Nigeria. Information collected included; socio-demography/economy, the source of calcium information and 20-calcium knowledge questions from literature. Consumption pattern of calcium-rich foods was assessed with a modified food frequency questionnaire. Our study showed mean age was 19.8 ± (2.2) years; calcium knowledge score was 10.1(±3.7). Half (51.5%) of the respondents had good knowledge about calcium, while 48.5% had poor knowledge. The majority (47.3%) of the respondents got information on calcium from academic sources, 14.0% from family/friends, about 7.0% from health personnel and 1.0% from the media. Only 18.4% frequently consumed milk/dairy products, about 20% frequently consumed calcium-rich fish and fish products, while 8.9% and 5.8% frequently consumed legumes/nuts and fruits/vegetables that are rich sources of calcium. Receiving calcium information from academic sources was associated with significantly higher calcium knowledge scores ($X^2$=9.535, p=0.002). Having lower calcium knowledge was significantly associated with infrequent consumption of spinach ($X^2$=5.227, p=0.022) and okra ($X^2$=6.337, p=0.012). The respondents that received calcium information from non-academic sources (family/friends, health personnel, media) were 0.6 times less likely to have good calcium knowledge, (OR=0.548, 95% C.I. =0.316 to 0.951, p=0.033). A high percentage of the respondents had poor calcium knowledge, infrequently consumed calcium-rich foods and were not knowledgeable about the role of calcium in the prevention of osteoporosis. Thus, there is a need to intensify calcium education interventions through the non-academic avenues, especially the media.

***Keywords:*** *calcium knowledge, consumption pattern, osteoporosis, female adolescent, young adults*

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## 1. Introduction

Calcium is one of the essential micro-nutrients for bone health. It is a vital mineral in human metabolism, making up about 1-2% of an adult human body weight. In the body, the reservoir for calcium is bone tissue. The roles of calcium in the body include; building bones and keeping them healthy, blood clotting, muscle contraction, aid nerve in sending messages and maintenance of acid/base balance in the bloodstream [1]. Calcium homoeostasis is maintained by keeping the level of circulating ionised calcium within a narrow physiological range. The day to day regulation of serum calcium levels is supported by an endocrine system involving the parathyroid hormone and 1,25 $(OH)_2D$ [2]. The body cannot produce new calcium, and so when an individual does not take in enough from dietary sources, the calcium needs of the body is supplied by the bones. The stored calcium in bones acts as a source for metabolic need through the process of remodelling. Persistent deficiency of calcium in the diet can lead to bone loss which results in decreased bone mass and increases the risk development of osteoporosis and fractures. The absorption of calcium is influenced by vitamin D sufficiency, the presence of calcium binders in the diet (oxalate, phosphate, and phytate), age group and physiological state. Calcium deficiency presents as rickets in children, poor bone mass accrual, low peak bone mass due to poor accrual in childhood and adolescence, abnormal foetal programming during pregnancy, postmenopausal osteoporosis and osteoporosis in the elderly [3]. Bones need plenty of vitamin D and calcium throughout early life especially during childhood and adolescent periods to reach the peak strength and calcium content because, in adult life, bone modelling occurs less than remodelling [4].

Previous studies have shown that adolescents retain calcium more than adults with the same calcium intake [1].

The bone mass builds up during the first twenty years of life and achieving a high bone mass while young confers both current and deferred protection against osteoporosis [5]. Also, the bone mass peak is attained during adolescence [6]. It is, therefore, important that adolescents and young adults consume foods that are rich in calcium during the formative years and especially before 25 to 30 years so as to attain high peak bone mass. The risk of developing weak or soften bones can primarily be prevented by adequate calcium intake when it is most needed, that is during the formative years, bone strengthening exercises and avoidance of foods that prevent adequate calcium stores like caffeine or cigarette smoking [7].

Calcium intake among young adolescents is usually below the dietary reference intakes, as the previous study in Nigeria suggested [8]. An assessment of the eating habits among some Nigerian girls showed that female adolescents frequently consume fast foods and energy-dense foods like meat pie, egg buns, and cakes (which are usually high in sodium) along with soft drinks. In the study, about 46.5% and 53.5% of the adolescents daily consumed 350mls and 500mls of non-alcoholic beverages respectively [9]. Soft drink consumption has also been associated with decreased intakes of milk, calcium, and other nutrients and displacement of calcium in the diet [10].

The knowledge about calcium and vitamin D was reported to be satisfactory amongst undergraduate pharmacy students in Karachi, Pakistan [11]. However, the majority of previous studies on adolescents and University students reported weak and unsatisfactory knowledge of calcium [4,12,13,14]. Also, female adolescents tend to have poorer nutrient intakes and dietary pattern compared to males [15]. This study, therefore, assessed the calcium knowledge and consumption pattern of calcium-rich foods by female undergraduates of the University of Ibadan, Nigeria.

# 2. Methodology

## 2.1. Study Design/Participants

### 2.1.1. Study Design

A descriptive cross-sectional study was carried out amongst 400 female undergraduates at the University of Ibadan, Nigeria between November 2014 and February 2015.

### 2.1.2. Sample Size Estimation

The sample size was calculated using formulae for cross-sectional study [16]:

$$n = \frac{(Z_\alpha)^2 P(1-P)}{d^2}$$

where, n = minimum sample size, $Z_\alpha$ = Standard Normal Deviate corresponding to 95% confidence level set at 1.96, d = desired level of precision (0.05%), P = Assumed prevalence (0.50%), q= 1-P,

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2}$$

$$n = 384.16$$

$$n = 384.$$

The sample size was adjusted for 10% non-response rate, giving 423 respondents.

10% of 384 was added to the sample to buffer for the incomplete questionnaire and other errors that may result during data collection.

### 2.1.3. Sampling Technique

A systematic random technique selected consenting participants that meet the inclusion criteria from female halls of residence and off-campus hostels. Inclusion criteria were: absence of chronic illnesses, pregnancy or having been delivered of a baby. There are four women halls of residence on campus (Queen Elizabeth 2, Queen Idia and Obafemi Awolowo halls). Female students who stay off-campus were located in their hostels or place of residence off-campus. To recruit a total of 423 respondents from the four hostels, 423/4=105 participants from each female hostel will be recruited. Random numbers were generated within the sampling frame of 105. Within each hostel, students whose room numbers corresponds to the list of generated a random number and that met inclusion criteria was recruited, till total sample size was realised.

## 2.2. Study Instrument

A semi-structured self-administered questionnaire was distributed to participants to assess information on socio-demographic profiles of participants, knowledge on calcium and frequency of consumption of locally available calcium-rich foods. A total of 423 questionnaires were distributed, 400 questionnaires were retrieved and analysed.

### 2.2.1. Questionnaire on Knowledge on Calcium

A pretested questionnaire on knowledge about calcium comprising of 20 questions ranging from three answers; ‘yes’, ‘no’ and ‘I do not know’ was used to assess knowledge of participants about calcium. “I do not know” answer was added to allow the subjects a choice without guessing. Two questions were on the source of prior information about calcium and other issues centred on knowledge of terms associated with calcium, awareness of dietary recommendation, food sources and consciousness of diet- disease associations. The questions were developed based on literature and standard nutrition texts. The calcium knowledge section of the questionnaire demonstrated good internal reliability and consistency with a Cronbach's alpha value of 0.75.

### 2.2.2. Questionnaire on Dietary Intake

A modified food frequency questionnaire (FFQ) of selected locally available rich sources of calcium, was used to assess the usual dietary consumption pattern of calcium rich foods. The FFQ included foods of high

calcium content compiled from the West African Food Composition Table, 2012 edition [17]. These food items contain at least 20mg of the calcium/100g portion. Food models were used to ensure that respondents correctly identified food. The FFQ consisted of commonly available food components namely; milk and dairy products (milk drinks, cheese, yogurt,cottage cheese), fish and fish products (mackerel, cooked/tin sardine, catfish), meat/chicken/product (beef, chicken, turkey, eggs) legumes /nuts (white beans, kidney beans, baked beans, green beans, soy beans/soy milk, peanuts) vegetables (spinach, cabbage, okra (lady fingers), mushrooms, locus bean seed, fruits (oranges, dates). Miscellaneous food groups like spices and herbs were not included.

## 2.3. Data Analysis

The data collected was entered, cleaned and analysed using SPSS version 20.0. Descriptive analysis was reported as frequencies and percentages. The continuous variables were reported as means ±SD. Knowledge about calcium was assessed by generating knowledge scores for each respondent and reported as mean ± (S.D). Poor knowledge was categorised as knowledge score below the mean knowledge score, and good knowledge was categorised as the mean score or above mean the score. The FFQ provided information on the pattern of consumption of calcium-rich foods and frequency of consumption of fast foods. The frequency of consumption was categorised as frequent and infrequent consumption. Frequent consumers were those that consumed a food item, at least, three times a week; infrequent consumers were those that consumed a food item less than three times a week. Categorical variables were analysed using Chi-square test. Logistic regression was used to determine which socio-demographic variable best predicts good calcium knowledge. The level of significance was set at $p<0.05$.

## 2.4. Ethical Consideration

The study was approved by the joint institutional review committee of the University College Hospital/ the University of Ibadan. UI/UCHEC Registration Number: NHREC/05/01/2008a.

# 3. Results

## 3.1. Socio-demography/economic Characteristics of the Respondents

The mean age of the female respondents was 19.8 ± 2.2 years. The response rate was 94.5%. The majority (65.5%) of the respondents' age were between 16 and 20 years, 33.5% were between 21 and 25 years, while only 1.0% of the respondents' age were between 26 and 30years. Majority (41%) of the respondents were first year students (100level), about a quarter (24%) were second year (200level) students, while about 12.8% were third year (300level) students, 18.5% were fourth year (400level) students and 15(3.8%) were fifth years (500level) students. All the respondents were single. Almost 20.0% of the respondents receive a monthly allowance of ₦5,000 or less, 37% receive between ₦5000 and ₦10000, 15% receive between ₦10000 and ₦15000, 12.8% receive between ₦15000 and ₦2000, while only about 5% of the respondents receive greater than ₦20,000 as monthly allowance. About 10.5% could not give an estimate of how much they regularly receive as allowance. About 8.5% spend a quarter or less of the monthly allowance on food, while, 40.8% spend about half on food and 30.5% spend half of the monthly allowance on food, and only 5.3% spend more than three-quarters of the allowance on food. However, about 15% could not estimate how much is dedicated to food. The majority (99.5% and 91.3% respectively) were non-smokers and do not take alcohol. The majority (47.3%) got informed about calcium from the school or books read while, 14.0%, 6.7% and 1.0% respectively got calcium information from family/friends, health personnel and media, about a third (31.0%) could not provide a source of calcium information, Table 1.

**Table 1. Demographic and Social variables of respondents (N=400)**

| Variable | N | % |
|---|---|---|
| **Age group (years)** | | |
| 16-20 | 262 | 65.5 |
| 21-25 | 134 | 33.5 |
| 26-30 | 4 | 1.0 |
| Mean = 19.75±2.15 | | |
| **Level** | | |
| 100 | 164 | 41.0 |
| 200 | 96 | 24.0 |
| 300 | 51 | 12.7 |
| 400 | 74 | 18.5 |
| 500 | 15 | 3.8 |
| **Faculty** | | |
| Social Science | 58 | 14.5 |
| Education/Art | 123 | 30.8 |
| Science/Agric. | 116 | 29.0 |
| Law | 23 | 5.8 |
| Medical Sciences | 80 | 20.0 |
| **Marital status** | | |
| Single | 400 | 100.0 |
| **Average monthly allowance (₦)** | | |
| < 5,000 | 79 | 19.7 |
| 5,000-10,000 | 148 | 37.0 |
| 10,000-15,000 | 60 | 15.0 |
| 15,000-20,000 | 51 | 12.8 |
| > 20,000 | 20 | 5.0 |
| Non-response | 42 | 10.5 |
| **% of allowance spent on food** | | |
| 25 or less | 34 | 8.5 |
| 26-50 | 163 | 40.7 |
| 51-75 | 122 | 30.5 |
| 75 and above | 21 | 5.3 |
| Non-response | 60 | 15.0 |
| **Smoking of cigarette** | | |
| Yes | 2 | 0.5 |
| No | 398 | 99.5 |
| **Alcohol consumption** | | |
| Yes | 35 | 8.8 |
| No | 365 | 91.2 |
| **Source of calcium information** | | |
| Schools/Books | 189 | 47.3 |
| Family/Friends | 56 | 14.0 |
| Health personnel | 27 | 6.7 |
| Media | 4 | 1.0 |
| No Response | 124 | 31.0 |

**Table 2. Calcium knowledge of Respondents (N=400)**

| | Calcium Knowledge Questions | Correct | | Incorrect | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| 1 | Most vitamins and minerals cannot be made by the human body and must be obtained from the diet | 343 | 85.8 | 57 | 14.2 |
| 2 | Calcium and vitamin D are the most important nutrients for bone health | 354 | 88.5 | 46 | 11.5 |
| 3 | We lose calcium every day through our skins, nails, hair, sweat, urine and faeces | 173 | 43.3 | 227 | 56.7 |
| 4 | Calcium is used to strengthen and build bones and teeth | 383 | 95.8 | 17 | 4.2 |
| 5 | I need an amount of vitamin D to be able to absorb calcium efficiently in food | 226 | 56.5 | 174 | 43.5 |
| 6 | The most importance age for calcium absorption to take place is adolescence | 210 | 52.5 | 190 | 47.5 |
| 7 | The most important stage of bone development is adolescence | 225 | 56.3 | 175 | 43.7 |
| 8 | I know the amount of calcium I should consume daily | 39 | 9.8 | 361 | 90.2 |
| 9 | Dairy products are rich sources of calcium | 285 | 71.3 | 115 | 28.7 |
| 10 | It is difficult to get the calcium you need from vegetables alone | 189 | 47.3 | 211 | 52.7 |
| 11 | Bean is a rich source of calcium | 44 | 11.0 | 356 | 89.0 |
| 12 | Fish oil is a good source of vitamin D | 192 | 48.0 | 208 | 52.0 |
| 13 | Some foods are fortified with calcium | 317 | 79.3 | 83 | 20.7 |
| 14 | Give example of a food fortified with calcium | 157 | 39.3 | 243 | 60.7 |
| 15 | Low calcium intake puts me at risk of developing some diseases | 242 | 60.5 | 158 | 39.5 |
| 16 | What is osteoporosis? | 102 | 25.5 | 298 | 74.5 |
| 17 | Adequate calcium intake during adolescence is critical for the prevention of osteoporosis | 141 | 35.3 | 259 | 64.7 |
| 18 | Cigarette smoking can lead to osteoporosis | 48 | 12.0 | 352 | 88.0 |
| 19 | Drinking too much cola beverages or coffee can be harmful to the bones | 144 | 36.0 | 256 | 64.0 |
| 20 | Cigarette smoking increases bone growth | 389 | 97.2 | 11 | 2.8 |

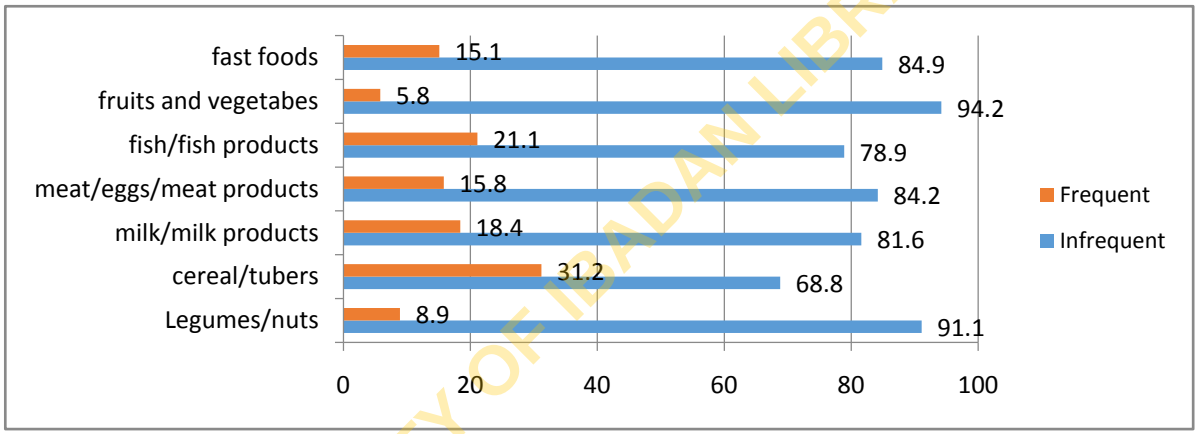


**Figure 1.** Pattern of consumption of calcium-rich foods and foods inhibiting adequate calcium intakes

**Table 3. Relationship between Calcium knowledge and socio-demographic /socio-economic characteristics of respondents**

| Variable | Calcium Knowledge | | | $X^2$ | P-value |
|---|---|---|---|---|---|
| | Good | Poor | Total | | |
| **Age group (years)** | | | | | |
| <20 | 124(48.5) | 131(51.5) | 255 | | |
| =>20 | 67(48.5) | 71(51.5) | 138 | 0.100 | 0.988 |
| **Level of study** | | | | | |
| 100 level | 86(52.4) | 78(47.6) | 164 | | |
| Above 100 level | 108(45.8) | 128(54.2) | 236 | 1.727 | 0.189 |
| **Faculty** | | | | | |
| Medical related | 40(50.0) | 40(50.0) | 80 | | |
| Non-medical related | 166(51.9) | 154(48.1) | 320 | 0.090 | 0.764 |
| **Average monthly allowance(₦)** | | | | | |
| <10,000 | 36(45.6) | 43(54.4) | 79 | | |
| =>10,000 | 137(49.1) | 142(50.9) | 279 | 0.308 | 0.579 |
| **% Spent on food** | | | | | |
| ≤50% | 15(44.1) | 19(55.9) | 34 | | |
| >50% | 151(49.3) | 155(50.7) | 306 | 0.335 | 0.564 |
| **Smoking status** | | | | | |
| Yes | 02(1.0) | 00(0.0) | 02 | | |
| No | 192(48.2) | 206(51.8) | 398 | 2.143 | 0.144 |
| **Alcohol consumption** | | | | | |
| Yes | 14(40.0) | 21(60.0) | 35 | | |
| No | 180(49.3) | 185(50.4) | 365 | 1.109 | 0.292 |
| **Source of Calcium Information** | | | | | |
| Academic | 122(64.6) | 67(35.4) | 189 | | |
| Non-Academic | 48(55.2) | 39(44.8) | 87 | 9.535 | 0.002* |

All responses to variables do not add up to N= 400
***significant difference at p<0.05.**

**Table 4. Relationship between Calcium knowledge and Consumption pattern of selected Calcium-rich foods by respondents**

| | | CALCIUM KNOWLEDGE | | | | |
|---|---|---|---|---|---|---|
| **Food Groups** | **Consumption pattern** | **Good** | **Poor** | **Total** | **$X^2$** | **P value** |
| **Legumes** | | | | | | |
| Beans | Frequent | 37(56.9) | 28(43.1) | 65 | 2.205 | 0.138 |
| | infrequent | 157(46.9) | 178(53.1) | 335 | | |
| Soya bean | Frequent | 5(83.3) | 1(16.7) | 6 | 2.959 | 0.085 |
| | Infrequent | 189(48.0) | 205(52) | 394 | | |
| African locus bean | Frequent | 13(56.5) | 10(43.5) | 23 | 0.629 | 0.428 |
| **Meat/meat products** | Infrequent | 181(48.0) | 196 (52.0) | 377 | | |
| Beef | frequent | 98(50.0) | 98(50.0) | 196 | 0.346 | 0.556 |
| | infrequent | 96(47.1) | 108(52.9) | 204 | | |
| Goat meat | Frequent | 28(65.1) | 15(34.9) | 43 | 5.326 | 0.021 |
| | Infrequent | 166(46.5) | 191(53.5) | 357 | | |
| Pork | Frequent | 2(40.0) | 3 (60.0) | 5 | 0.146 | 0.702 |
| | Infrequent | 192(48.6) | 203(51.4) | 395 | | |
| Chicken/turkey | Frequent | 23(41.8) | 32(58.2) | 55 | 1.140 | 0.286 |
| | Infrequent | 171(49.6) | 174(50.4) | 345 | | |
| Snail | Frequent | 3(100) | 0(0) | 3 | 4.290 | 0.117 |
| | Infrequent | 190(48) | 206(52) | 397 | | |
| Periwinkle | Frequent | 6(60.0) | 4(40.0) | 10 | 0.543 | 0.461 |
| | Infrequent | 188(48.2) | 202(51.8) | 390 | | |
| **Milk/ dairy products** | | | | | | |
| Milk | Frequent | 68(48.2) | 73(51.8) | 141 | 0.007 | 0.936 |
| | Infrequent | 126(48.6) | 133(51.4) | 259 | | |
| Yoghurt | Frequent | 23(40.4) | 34(59.6) | 57 | 1.767 | 0.184 |
| | Infrequent | 171(49.9) | 172(50.1) | 343 | | |
| Ice cream | Frequent | 14(36.8) | 24(63.2) | 38 | 3.299 | 0.192 |
| | Infrequent | 179(49.6) | 182(50.4) | 361 | | |
| Cottage cheese | Frequent | 9(75.0) | 3(25.0) | 12 | 3.478 | 0.062 |
| | Infrequent | 185(47.7) | 203(52.3) | 388 | | |
| Milk drinks | Frequent | 35(53.0) | 31(47.0) | 66 | 0.649 | 0.420 |
| | Infrequent | 159(47.6) | 175(52.4) | 334 | | |
| Soya milk | Frequent | 4(44.4) | 5(55.6) | 9 | 1.121 | 0.571 |
| | Infrequent | 189(48.5) | 201(51.5) | 390 | | |
| **Fish/fish products** | | | | | | |
| Mackerel | Frequent | 37(50.0) | 37(50.0) | 74 | 0.082 | 0.775 |
| | Infrequent | 157(48.2) | 169(51.8) | 326 | | |
| Tin/cooked sardine | Frequent | 56(56.0) | 44(44.0) | 100 | 3.003 | 0.083 |
| | Infrequent | 138(46.0) | 162(54.0) | 300 | | |
| Crayfish | Frequent | 35(44.3) | 44(55.7) | 79 | 0.694 | 0.405 |
| | Infrequent | 159(49.5) | 162(50.5) | 321 | | |
| **Cereals/grains** | | | | | | |
| Golden morn | Frequent | 53(48.6) | 56(51.4) | 109 | 0.001 | 0.976 |
| | Infrequent | 141(48.5) | 150(51.5) | 291 | | |
| Corn flakes | Frequent | 66(46.8) | 75(53.2) | 141 | 0.249 | 0.617 |
| | Infrequent | 128(49.4) | 131(50.6) | 259 | | |
| **Fruits/vegetables** | | | | | | |
| Spinach | Frequent | 24(66.7) | 12(33.3) | 36 | 5.227 | 0.022* |
| | Infrequent | 170(46.7) | 194(53.3) | 364 | | |
| Okra | Frequent | 20 (71.4) | 8(28.6) | 28 | 6.337 | 0.012* |
| | Infrequent | 174(46.8) | 198(53.2) | 372 | | |
| Oranges | Frequent | 180(63.6) | 169(36.4) | 349 | 9.820 | 0.308 |
| | Infrequent | 14(48.1) | 37(51.9) | 51 | | |
| Cabbage | Frequent | 9(55.9) | 10(44.1) | 19 | 3.331 | 0.370 |
| | Infrequent | 184(47.7) | 195(52.3) | 379 | | |

*significant at $p<0.05$.

## 3.2. Calcium Knowledge of Respondents

The mean score of total knowledge was 10.1 ± 3.7 out of a maximum possible score of 20. About half (51.5%) of respondents have poor knowledge about calcium and its functions while 48.5% have good knowledge. Thus indicating a low level of knowledge about calcium among the respondents shown in Table 2.

## 3.3. Frequency of Consumption of Some Selected Common Calcium-rich Foods

About 18.4% of the respondents were frequent consumers of milk and dairy products while 81.6% were infrequent consumers. Only 8.9% of respondents frequently consumed calcium-rich foods like legumes, while 91.1% are infrequent consumers. Just 21.1%

frequently consume fish and fish products rich in calcium while 78.9% do not. Only 5.8% frequently consumed fruits and vegetables that are rich sources of calcium, while 94.2% were infrequent consumers. About 31.2% frequently consumed calcium-fortified cereals and tubers, while 68.8% were infrequent consumers. About 15.0 % of respondents frequently consume fast foods while 84.9% are infrequent consumers, Figure 1.

### 3.4. Relationship between Calcium Knowledge and Socio-demographic/ Economic Characteristics of Respondents

There were no significant differences in the scores of knowledge of calcium based on the age groups of respondents, University levels, faculties, average monthly allowance, the percentage of allowance spent on food, smoking or alcohol intake status between respondents, except by source of calcium information. Respondents that received calcium knowledge from academic sources had significantly better calcium knowledge scores. ($X^2$=9.535, P=.002), as in Table 3.

### 3.5. Relationship between Calcium Knowledge and Consumption of Selected Common Calcium-rich Foods

There is no significant difference in calcium knowledge of respondents based on the frequency of consumption of legumes, meat/meat products, milk/dairy products, fish /fish products, cereals. However, for fruits and vegetable consumption, having poor calcium knowledge was significantly associated with infrequent consumption of spinach ($X^2$=5.227, P= 0.022) and okra ($X^2$=6.337, P= 0.012), as shown in Table 4.

**Table 5. Predictors of Calcium knowledge of respondents**

| Variable | O.R | 95% C.I | P value |
|---|---|---|---|
| **Age (years)** | | | |
| 20[ref] | 1.000 | | |
| =>20 | 1.467 | 0.779 to 2.761 | 0.236 |
| **Level** | | | |
| level [ref] | 1.000 | | |
| >100 level | 0.907 | 0.483 to 1.705 | 0.762 |
| **Faculty** | | | |
| Medical related [ref] | 1.000 | | |
| Non-medical related | 0.769 | 0.386 to 1.531 | 0.455 |
| **Average monthly allowance** | | | |
| <₦10,000[ref] | 1.000 | | |
| >₦10,000 | 1.194 | 0.617 to 2.311 | 0.599 |
| **% Spent on Food** | | | |
| <50%[ref] | 1.000 | | |
| >50% | 1.101 | 0.469 to 2.583 | 0.825 |
| **Alcohol consumption** | | | |
| Yes [ref] | 1.000 | | |
| No | 1.798 | 0.624 to 5.180 | 0.277 |
| **Source of Calcium Information** | | | |
| Academic [ref] | 1.000 | | |
| Non-academic | 0.548 | 0.316 to 0.951 | 0.033* |

*Significant at p<0.05.

### 3.6. Predictor of Calcium Knowledge among the Sociodemographic Variables of the Respondents.

The only significant predictor of calcium knowledge of the undergraduate students was the source of information. Respondents whose source of information was non-academic were 0.6 times less likely to have good calcium knowledge compared to those from academic sources (OR=0.548, 95% C.I. = 0.316 to 0.951, p=0.033), shown in Table 5.

## 4. Discussion

The purpose of this study was to assess the knowledge of female undergraduate students of the University of Ibadan on calcium, its sources and its role in health especially as regards osteoporosis as well as the frequency of consumption of calcium-rich foods. The emphasis on female students is because they are more prone to calcium insufficiency later in life due to the reproductive cycle.

The study found out that general calcium knowledge of the respondents was low. However, the majority (88.5%-95.6%) knew the importance of calcium in bone health similar to previous studies in South Africa, Bangladesh and Pakistan [6,11,18]. Despite knowing the importance of calcium, the majority (90.2%) of the respondents are not aware of the amount of calcium they should consume daily and are frequently not consuming dairy products and non-diary alternatives that are known to be rich in calcium. This suggests that female undergraduates are aware of the major health benefits of calcium, but lack accurate information on daily requirements or how it can be met as previously reported [6,12]. The Nigerian food culture is not supportive of milk/ dairy product consumption, especially the southwestern region where the study was done. Nevertheless, only 11% the respondents correctly identified legumes and pulses (beans/bean products) as a rich source of calcium and an affordable means of meeting daily calcium requirements. Beans and bean product [akara (bean buns) and moi moi (bean cake)] are popular delicacies in the southwestern states of the country. It is often consumed with local gruels (pap/ agidi) at breakfast or dinner. These delicacies (pap/agidi and moi moi/akara) are commonly rejected by children, adolescents and young adults, on the basis that it is a meal for the ill or convalescent and the elderly. In response to a question that relates to dairy products as a rich source of calcium, a key proportion (71%) of respondents gave the correct answer to the question contrary to the previous study where more than 60% were not aware of the right dietary source of calcium [14,18]. Above 50% of the respondents in the current study knew that adolescence is the most important period for calcium and bone building contrary to the finding from South Africa, where 31% of the adolescent girls in the study knew this [6]. In the same survey, a good number (61%) of the respondents know that low calcium intake puts them at a risk of developing some diseases, as similarly documented. However, a larger percentage (69% and 75% respectively) of the respondents are not familiar with the term osteoporosis

and do not know what the term means, or the role of calcium in the prevention, in contrast with previous studies among higher secondary school students in Bangladesh and University students in Pakistan were above 50.0% and 90.0% of the students respectively were familiar with the term osteoporosis [11,18].

In response to the influence of cigarette smoking and intake of fast foods and carbonated drinks, the majority of the respondents do not know the roles these agents play in preventing calcium adequacy. Most of the students in the current study learned about calcium from teachers or reading books, similarly to previous reports from South Africa and Bangladesh where the majority of the respondents first learnt about calcium from the academic environment [6,13,18] However, more respondents got informed in a family setting contrary to previous reports where less than 10% got briefed in a family setting [13,18]. The role of the media/ internet was low in current study contrary to the previous report by Akher were close to 14% (urban), and 5% (rural) setting got informed through the media or the internet [18]. More efforts need to be put into calcium education through the non-academic avenues because, from the current study, the source of calcium information was the only predictor of the calcium knowledge. Respondents that got informed from non-academic sources (family, friends, media) were 0.6 times less likely to have good knowledge compared to respondents that got informed through academic sources (teachers and textbooks).

The current study reported the majority of respondents infrequently consume calcium-rich foods such as milk/dairy products, legumes and selected vegetables, as previously documented [13]. However, in contrast to Elhassan *et al*., 2013, fewer respondents do not frequently or never consumed lentils/ legumes and fish which are rich sources of calcium [14]. According to Gao, 2006, it is difficult for individuals to meet their calcium intake if they do not drink milk [19] However, it is possible for people who do not consume milk to obtain adequate calcium, provided that they consume vegetables that are rich in calcium [15]. From the current study, the respondents reported minimal awareness of alternate sources of calcium similar to Edmonds *et al.,* finding, suggesting a need for nutrition education [12]. On the source of calcium knowledge, the media was not a popular avenue to receive information especially on nutrition, contrary to the previous study were about 40% got informed about calcium from the media [14].

## 5. Conclusion

A right step towards the possible approach to reducing the risk of osteoporosis is the provision and promotion of adequate calcium knowledge and intake during the formative years. Therefore, more efforts to impact calcium knowledge amongst adolescents and young adults should be put in place in schools, homes, and in particular through the social media. Efforts to promote consumption of locally available alternative rich sources of calcium should also be intensified in our environment.



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