

CALCIUM NUTRITURE OF NIGERIAN ELDERLY IN IBADAN SOUTH EAST LOCAL GOVERNMENT

¹Ariyo O., ²Keshinro O.O. and ²Akinyemi A.O.

¹Department of Food Science and Technology, Wesley University of Science and Technology, Ondo, Nigeria.

²Department of Human Nutrition, University of Ibadan, Ibadan, Nigeria.

ABSTRACT

Calcium is an important mineral in human health, adequate intake is associated with higher bone mineral density, reduced risks of osteoporosis, fractures and falls among the elderly. This study assessed the adequacy of calcium intake and relationship with incidences of bone aches and fractures. 150 elderly people from 100 households selected by cluster sampling technique in Ibadan South East Local Government constituted the study population. Dietary assessment was conducted using 24-hour dietary recall and analysed for calcium intake. Consumption pattern was assessed using food frequency questionnaire, blood pressure was taken using aneroid sphygmomanometer, lifestyles and sociodemographic characteristics were obtained using a semi-structured questionnaire. The mean calcium intake was 1569.8±1209.8mg diagggregated as 1782.4±1353.4mg in males and 1432.0±1092.6mg in females. 39.3% disaggregated as 44.1% in males and 36.3% in females, met the recommended intakes of 1500mg/day. Roots and tubers were the most consumed food, followed by vegetables and then cereals and grains. Milk and dairy as well as fish and meat products were the least consumed foods. 47.3% rarely consumed milk and dairy products and 42.7% rarely consumed fish and meat products throughout the week. 56.7% had normal diastolic blood pressure and 64.7% had normal systolic pressure. 65.3% reported havin pains and bone aches, sites of pain were back (44.7%), knee and ankle (9.3%), hip joint (6.7%), and wrist (4.7%). There were no significant differences ($p>0.05$) in the calcium intake by age, systolic blood pressure and incidence of bone pains and aches. However, income and the diastolic blood pressure showed significant relationship ($p>0.05$) with calcium intake. The results show that many elderly Nigerians have inadequate calcium intake, however, calcium intake does not affect incidence of pains and aches. There is a need to promote increased consumption of calcium rich foods.

KEYWORDS: Elderly, calcium, pains, blood pressure.

INTRODUCTION

Calcium is an important mineral in human health. It functions in the maintenance of proper structure of cell membrane, blood clotting, nerve transmission, muscle contraction and relaxation, and membrane permeability. Among the elderly, several studies have reported the beneficial effect of calcium, when used alone or in combination with other nutrient (Avenell *et al.*, 2009; Tang *et al.*, 2007; Bergman *et al.*, 2010; Bischoff-Ferrari *et al.*, 2005). Calcium and vitamin D combination have been used in the prevention and treatment of osteoporosis, falls, hip and non-vertebral fractures in elderly population (Chapuy *et al.*, 1992; Trivedi *et al.*, 2003), these conditions are strongly associated with calcium nutriture. Osteoporosis and fragility fractures are global problems. Due to the aging population, incidence of hip fractures has been projected to reach 6.26 million globally by 2050 (Cooper *et al.*, 1992). Falls defined as the action of finding oneself involuntarily on the ground are a public-health problem due to their high prevalence of 30% among subjects aged 65 and over, and their adverse outcomes (Tinetti, 2003; Alexander, 1996; Dargent-Molina *et al.*, 1996). Fall-related fractures are associated with excess morbidity and mortality, and substantial financial cost (Tinetti, 2003; Dargent-Molina *et al.*, 1996; Dargent-Molina and Breart, 1995). Annweiler *et al.* (2010) reported that falls in the elderly and fall-related adverse outcomes could be prevented. Osteoporosis is defined as a disorder where the bone mineral density (BMD) is 2.5 SD below the mean peak value in young adults (WHO, 1994). Prevalence of osteoporosis is 20% among men in the U.S. (USDHHS, 2004). Direct medical costs to the National Health Service attributed to osteoporosis have been estimated at £411 million per year in the UK (Avioli, 1991). However, there is a paucity of reports from Nigeria on osteoporosis. The factors related to fracture risk include genetics, lifestyle and nutrition (Anderson and Pollitzer, 1994; Cooper *et al.*, 1992). Both a high physical activity level and adequate calcium intake have been reported to be associated with higher BMD in male athletes (Laabes *et al.*, 2008; Ruffing *et al.*, 2006). The diets of populations in Nigeria have been reported to be low in calcium and are based on cereal staples that contain chelators such as phytates (Thacher *et al.*, 1999; Prentice *et al.*, 1993).

Calcium is an important mineral in human health. It functions in the maintenance of proper structure of cell membrane, blood clotting, nerve transmission, muscle contraction and relaxation, and membrane permeability. Among the elderly, several studies have reported the beneficial effect of calcium, when used alone or in combination with other nutrient (Avenell *et al.*, 2009; Tang *et al.*, 2007; Bergman *et al.*, 2010; Bischoff-Ferrari *et al.*, 2005). Calcium and vitamin D combination have been used in the prevention and treatment of osteoporosis, falls, hip and non-vertebral fractures in elderly population (Chapuy *et al.*, 1992; Trivedi *et al.*, 2003), these conditions are strongly associated with calcium nutriture. Osteoporosis and fragility fractures are global problems. Due to the aging population, incidence of hip fractures has been projected to reach 6.26 million globally by 2050 (Cooper *et al.*, 1992). Falls defined as the action of finding oneself involuntarily on the ground are a public-health problem due to their high prevalence of 30% among subjects aged 65 and over, and their adverse outcomes (Tinetti, 2003; Alexander, 1996; Dargent-Molina *et al.*, 1996). Fall-related fractures are associated with excess morbidity and mortality, and substantial financial cost (Tinetti, 2003; Dargent-Molina *et al.*, 1996; Dargent-Molina and Breart, 1995). Annweiler *et al.* (2010) reported that falls in the elderly and fall-related adverse outcomes could be prevented. Osteoporosis is defined as a disorder where the bone mineral density (BMD) is 2.5 standard deviation below the mean peak value in young adults (WHO, 1994). Prevalence of osteoporosis is 20% among men in the U.S. (USDHHS, 2004). Direct medical costs to the National Health Service attributed to osteoporosis have been estimated at £411 million per year in the UK (Avioli, 1991). However, there is a paucity of reports from Nigeria on osteoporosis. The factors related to fracture risk include genetics, lifestyle and nutrition (Anderson and Pollitzer, 1994; Cooper *et al.*, 1992). Both a high physical activity level and adequate calcium intake have been reported to be associated with higher BMD in male athletes (Laabas *et al.*, 2008; Ruffing *et al.*, 2006). The diets of populations in Nigeria have been reported to be low in calcium and are based on cereal staples that contain chelators such as phytates (Thacher *et al.*, 1999; Prentice *et al.*, 1993). Adequate calcium and vitamin D through diet or supplements are however essential for the prevention of fractures and osteoporosis hip. In addition to the beneficial effects on the skeleton, calcium supplementation favorably influences serum lipids (Reid *et al.*, 2002). Furthermore, evidence suggests that calcium intake is inversely associated with cardiovascular disease in postmenopausal women (Larijani *et al.*, 2004a).

Many health conditions cause imbalance in body calcium with trickle down effect on the health (Shiva and Barzgar, 2007). Patrizi *et al.* (2011) reported changes in the serum calcium levels in elderly people with thyroid surgery. The recommended calcium intake in post menopausal women and men over the age of 50 years is 1500 mg/day (Baeksgaard *et al.*, 1998). Glew *et al.* (2004) reported a mean dietary calcium intake of 551 mg/day by Nigerian adult males, a consumption level that is significantly below the recommended intake. An earlier study among Nigerian children found a median dietary calcium intake of 191 mg/day (Thacher *et al.*, 1999).

The promoting and inhibitory effects of other nutrients and diet components on calcium and its metabolism are well documented (Larijani *et al.*, 2004a; Bekheirnia *et al.*, 2004; Byrjalsen *et al.*, 1993; Hossein-nezhad *et al.*, 2003). Studies have also established association between osteoporosis and vitamin D deficiency (Chapuy *et al.*, 1992; Dawson-Hughes *et al.*, 1997), with high prevalence in different parts of world (Hashemipour *et al.*, 2004; McKenna, 1992).

With this body of evidence, this study assessed the relationship between adequacy of calcium intake and incidences of bone aches and fractures among the elderly in Ibadan South East Local Government of Ibadan.

MATERIALS AND METHODS

Subject

One hundred households from Wards 1, 2, 10 and 11 of Ibadan South East Local Government of Oyo State, Nigeria were selected using the cluster sampling technique. A household represents a group of persons, living in the same house, sharing meals in common and running a common food budget. The study population was the elderly who is 60 years and above and who is not living alone. One hundred and fifty elderly subjects who signed the informed consent form were recruited for the study. Demographic, socio-economic and lifestyle information of the respondents were taken using a semi-structured questionnaire.

Dietary and clinical Assessment

Dietary intake was assessed using 24-hour dietary recall and food frequency questionnaire. The recall was facilitated by a trained research assistant, prompting questions were asked to facilitate recall by the respondents. Respondents described quantities of foods consumed in price and common household measures. The food recall

was analysed for calcium intakes using the Food Composition Table for Africa (FAO, 1968) and Nutrient composition of commonly eaten foods in Nigeria (Oguntona and Akinyele, 1995). Food frequency was used to describe the usual dietary pattern of the respondents.

Blood pressure was taken using an aneroid sphygmomanometer, an average of three readings was taken as the final reading.

Simple descriptive analysis was used for result presentation.

RESULTS AND DISCUSSION

The demographic distribution and socioeconomic characteristics of the respondents are as shown in Tables 1 and 2. There were more female (60.7%) than male respondents (39.3%). Respondents within 60-64 age range accounted for more than half of the total respondents. Respondents aged 65-69 years and 70-74 years accounted for 16.7% and 13.3% respectively while 9.3% were 85 years or older. 44.0% had no formal education, 36.7% had not more than primary education and 9.3% had not more than secondary education. More than half (50.7%) were traders while artisans, farmers and respondents on paid employment constituted 16.7%, 12.7% and 4.0% respectively. Respondents that were not on any form of job accounted for 16.0%. Most of the respondents (75.3%) were Muslims and 96.7% were Yorubas. Anderson and Pollitzer (1994) reported ethnic and race differences in the prevalence and pre-disposition to osteoporosis and hypertension, blacks were found to be less susceptible to osteoporosis but more prone to hypertension.

Most of the respondents (91.4%) earned below N5000 monthly, and only 2.0% earned above N10000 monthly. 89.3% spent N5000 or below on food on monthly basis, 8.7% spent within N5001-N10000 and 2.0% spent above N10000 on food monthly. Income level found in the study was considerably lower than the national average income. Income level has been found to be related to food access and food security (Gollub and Weddle, 2004; Frongillo *et al.*, 1992). The sources of water were borehole (46.0%), well (30.7%), public tap (21.3%) and stream/river (2.0%). 84.7% used pit latrine, 11.3% used bush and 4.0% used water closet. The type of toilet facility is an indication of exposure to disease causing microorganisms. Pit latrines are commonly used in urban slums. 65.3% of the respondents lived in one-room apartment, this suggests that most of the respondents were in low socioeconomic status. 23.3% lived in flat housing type, 6.0% lived in a bungalow and 3.3% lived in a duplex.

Table 1: Demographic distribution of respondents

Variable	N	%
Sex		
Male	59	39.3
Female	91	60.7
Age range (years)		
60-64	78	52.0
65-69	25	16.7
70-74	20	13.3
75-79	5	3.33
80-84	8	5.33
85+	14	9.33
Education Level		
None	66	44.0
Primary Education	55	36.7
Secondary Education	14	9.3
Tertiary Education	7	4.7
Occupation		
Trader	76	50.7
Farmer	19	12.7
Artisan	25	16.7
Paid employment	6	4.0
Jobless	24	16.0
Religion		
Christians	36	24.0
Muslims	113	75.3
Others	1	0.7
Ethnicity		
Yoruba	145	96.7
Igbo	5	3.3

Table 2: Socioeconomic characteristics of the respondents

Variable	N	%
Income range/month		
Below N5000	137	91.4
N5001-N10000	5	3.3
Above N10000	8	5.3
Monthly expenditure on food		
≤ N5000	124	89.3
N5001-N10000	13	8.7
Above N10000	3	2.0
Source of water		
Tap water	32	21.3
Borehole	69	46.0
Well	46	30.7
Stream/River	3	2.0
Toilet facilities		
Bush	17	11.3
Pit latrine	127	84.7
Water closet	6	4.0
Housing type		
One-room	98	65.3
Bedroom flat	35	23.3
Bungalow	9	6.0
Duplex	5	3.3
Others	3	2.0

The lifestyle factors and food consumption pattern of the respondents are as shown in Tables 3 and 4. Most respondents (75.3%) ate thrice daily, 36.7% ate twice daily and 11.3% ate four times daily. Also, 4.0% and 3.3% ate once and more than four times daily respectively. Customarily, Nigerians eat three times a day though a wide variation exists depending on the socioeconomic class, education, occupation and many other factors. The participation in physical activities was daily in 45.3% of the respondents, and 19.3% rarely participated in physical activities. 12.7% consumed alcohol, 14.7% consumed caffeine and 5.2% were smokers. The low prevalence of alcohol and caffeine consumption as well cigarette and smoking is an indication of healthy lifestyle.

Roots and tubers constituted the most consumed food group, followed by vegetables and then cereals and grains. This is in line with the traditional food pattern in the area where roots and tubers products such as garri, amala, Eba, Foofoo were staple foods. Milk and dairy as well as fish and meat products were the least consumed food groups by the respondents. 47.3% rarely consumed milk and dairy products and 42.7% rarely consumed fish and meat products throughout the week. The availability of calcium from plant sources is inhibited by other constituents such as phytic acid, dietary fibers and other antinutritional factors. The poor consumption of milk and dairy products makes the respondents liable to calcium inadequacy. The pattern of food consumption suggests likelihood of inadequate intakes of good quality proteins, calcium and phosphorus, certain vitamins such as vitamin B₁₂ and certain essential fatty acids. Many studies have reported a poor intake level of milk and dairy products by older people (Iso *et al.*, 1991; Lau, 1988; Eaton and Kanner, 1985)

The calcium intake of the respondents is shown in Table 5. The mean calcium intake was 1569.8 ± 1209.8 mg for both sexes. Mean intake was higher in males (1782.4 ± 1353.4 mg) than females (1432.0 ± 1092.6 mg). Overall, 39.3% disaggregated as 44.1% in males and 36.3% in females, met the recommended intakes of 1500mg per day. 45.3% disaggregated as 40.7% and 48.4% in males and females respectively had calcium intake levels below 1000mg. The magnitude of the percentage of respondents with inadequate intakes of calcium relative to the mean intake suggest a possible excessive intakes by some of the elderly and a considerably lower intakes by others. The intakes level found in this study was higher than mean intakes of 551mg and 191mg reported by earlier studies in Nigeria (Glew *et al.* 2004; Thacher *et al.*, 1999; Prentice *et al.*, 1993), dietary calcium intake of postmenopausal Malaysian women (Chee *et al.*, 2002) and calcium intakes in elderly women (Simon *et al.*, 1992). In spite of poor intake of milk and dairy products, calcium intake was significantly higher than reported in other studies, this suggests the possibility of adequate intakes of calcium from other food sources. Earlier studies have confirmed the health promoting effect of calcium (Avenell *et al.*, 2009; Tang *et al.*, 2007; Bergman *et al.*, 2010) including the prevention and treatment of osteoporosis, falls, hip and non-vertebral fractures in elderly population (Chapuy *et al.*, 1992; Trivedi *et al.*, 2003).

The blood pressure readings and the reported incidence of bone aches and fractures among the respondents are shown in Tables 6 and 7. 56.7% had normal diastolic blood pressure, 39.3% had mild hypertension, 2.7% had moderate hypertension and 1.3% had severe hypertension. Also, 64.7% had normal systolic pressure, 29.3% had borderline isolated hypertension and 6.0% had isolated hypertension. The prevalence of pains, bone aches and fractures was 65.3%, various sites of pain as reported were back (44.7%), knee and ankle (9.3%), hip joint (6.7%), and wrist (4.7%).

There were no significant differences ($p > 0.05$) in the calcium intake by age, by systolic blood pressure and by incidence of bone aches and fractures. The result is contrary to earlier research findings, Jorde and Bonna (2000) reported a negative association between calcium intake and blood pressure. Iso *et al.* (1991) also found an inverse relationship between calcium and systolic blood pressure. However, income and the diastolic blood pressure had significant differences ($p > 0.05$) on calcium intake. Larijani *et al.* (2004b) reported a relationship between bone mineral density and blood pressure. All the lifestyle factors, smoking, alcohol, physical activity and caffeine consumption showed no statistical significance ($p > 0.05$) with calcium intake. Hernandez-Avila *et al.* (1991) reported increased risk of fracture as a result of consumption of caffeine and alcohol. The non significant relationship of the incidence of aches and fractures with calcium intake may be as a result of the subjective method of assessment which is based on the report of the respondents.

CONCLUSION

The results of this study show that many elderly Nigerians have inadequate calcium intake when judged from dietary intake and calcium intake is influenced by income. Intake of milk and dairy as well as fish and meat

products among the elderly is poor, however, calcium intake does not affect incidence of aches and fractures in Nigerian elderly. There is a need to promote increased consumption of calcium rich foods.

Table 3: Lifestyle variables

No of meals	N	%
1x	6	4.0
2x	9	36.7
3x	113	75.3
4x	17	11.3
>4x	5	3.3
Physical activities		
Daily	68	45.3
Once weekly	7	4.7
Sometimes	46	30.7
	29	19.3
Alcohol consumption		
Yes	19	12.7
No	131	87.3
Caffeine consumption		
Yes	22	14.7
No	128	85.3
Smoking cigarette		
Yes	8	5.2
No	142	94.8

Table 4: Frequencies of consumption of major food groups

Food groups	Daily		1x and 2x weekly		3x and 4x weekly		Sometimes		Rarely	
	N	%	N	%	N	%	N	%	N	%
Roots and tubers	33	22.0	41	27.3	28	18.7	21	14.0	27	18.0
Cereals and grains	61	40.7	29	19.3	19	12.7	9	6.0	32	21.3
Legumes and nuts	39	26.0	38	25.3	24	16.0	12	8.0	37	24.7
Fish and meat products	37	24.7	17	11.3	11	7.3	21	14.0	64	42.7
Milk and Dairy products	22	14.7	26	17.3	10	6.7	21	14.0	71	47.3
Vegetables	33	22.0	54	36.0	24	16.0	9	6.0	30	20.0
Fruits	57	38.0	25	16.7	24	16.0	9	6.0	35	23.3

Table 5: Calcium intake by the respondents

Intakes range (mg)	Both sexes		Males		Females	
	N	%	N	%	N	%
≥1500	59	39.3	26	44.1	33	36.3
1000-1499	23	15.3	9	15.3	14	15.4
<1000	68	45.3	24	40.7	44	48.4
Mean intake	1569.8		1782.4		1432.0	
SD	1209.8		1353.4		1092.6	

Table 6: Blood pressure readings

Classification	N	%
Diastolic Pressure (mmHg)		
<85	85	56.0
Normal range (85-89)	1	0.7
Mild hypertension (90-104)	59	39.3
Moderate hypertension (105-114)	4	2.7
Severe hypertension (>115)	2	1.3
Systolic Pressure (mmHg)		
Normal blood pressure (<140)	97	64.7
Bordeline isolated hypertension (140-159)	44	29.3
Isolated hypertension (>160)	9	6.0

Table 7: Incidence of bone aches and fractures

	N	%
None	52	34.7
Hip joint	10	6.7
Wrist	7	4.7
Back	67	44.7
Knee and ankle	14	9.3

Table 8: Statistical relationship of selected variables with calcium intakes

Variables	P values
Age	0.1281
Income	0.0403
Diastolic blood pressure	0.0425
Systolic blood pressure	0.9043
Incidence of bone aches and fractures	0.2845
Smoking	0.3023
Alcohol	0.2930
Physical activity	0.3057
Caffeine intake	0.2074

REFERENCES

- Alexander, N. B. (1996): Gait disorders in older adults. *J. Am. Geriatr. Soc.*, 44:434-451.
- Anderson, J. B. and Pollitzer, W. S. (1994): Ethnic and genetic differences in susceptibility to osteoporotic fractures. *Adv. Nutr. Res.*, 9:129-149.
- Annweiler, C., Montero-Odasso, M., Schott, A. M., Berrut, G., Fantino, B., and Beauchet, O. (2010): Fall prevention and vitamin D in the elderly: an overview of the key role of the non-bone effects. *Journal of NeuroEngineering and Rehabilitation*, 7:50.
- Avenell, A., Gillespie, W. J., Gillespie, L. D. and O'Connell, D. (2009): Vitamin D and vitamin D analogues for preventing fractures associated with involutional and post-menopausal osteoporosis. *Cochrane Database Syst Rev.*, 2:CD 000227.
- Avioli, L. V. (1991): Significance of osteoporosis: a growing international health care problem. *Calcif Tissue Int.* 5-7.
- Baeksgaard, L., Andersen, K. P. and Hyldstrup, L. (1998): Calcium and vitamin D Supplementation increases spinal BMD in healthy, postmenopausal women. *Osteoporos Int.*, 8(3), 255-260.

- Bekheirnia, M. R., Shamshirsaz, A. A., Kamgar, M., Bouzari, N., Erfanzadeh, G., Pourzahedqilani, N., Tabatabale, S. M., Abdollah, S. A., Kimiagar, M., Ezzati, F. and Larijani, B. (2004). Serum zinc and its relation to bone mineral density in beta-thalassemic adolescents. *Biol Trace Elem Res.*, 97(3): 215-224.
- Bergman, G. J., Fan, T., McFetridge, J. T. and Sen, S. S. (2010): Efficacy of vitamin D3 supplementation in preventing fractures in elderly women: a meta-analysis. *Curr. Med. Res. Opin.* 26(5):1193–1201.
- Bischoff-Ferrari, H. A., Willett, W. C., Wong, J. B., Giovannucci, E., Dietrich, T. and Dawson-Hughes, B. (2005): Fracture prevention with vitamin D supplementation: a meta-analysis of randomized controlled trials. *JAMA.* 293 (18): 2257–2264.
- Byrjalsen, I., Haarbo, J., and Christiansen, C. (1993): Role of cigarette smoking on the postmenopausal endometrium during sequential estrogen and progestogen therapy. *Obstet. Gynecol.*, 81 (6) : 1016-1020.
- Chapuy, M. C., Arlot, M. E., Duboeuf, F., Brun, J., Crouzet, B., Arnaud, S., Delmas, P. D., and Meunier, P. J. (1992): Vitamin D and calcium to prevent hip fractures in the elderly women. *New England Journal of Medicine* 1992; 327:1637-1642.
- Chee, W. S. S., Suriah, A. R., Zaifun, Y., Chan, S. P., Yap, S. C., and Chan, Y. M. (2002): Dietary calcium intake in postmenopausal Malaysian women: Comparison between the food frequency questionnaire and three day food records. *Asia Pacific Journal of Nutrition* 1: 142-146.
- Cooper, C., Campion, G., and Melton, L. J. (1992): Hip fractures in the elderly: a world-wide projection. *Osteoporosis Int.*, 2 (6) : 285-289.
- Dargent-Molina, P. and Breart, G. (1995): Epidemiology of falls and fall-related injuries in the aged. *Rev. Epidemiol. Sante Publique* 43: 72-83.
- Dargent-Molina, P., Flavier, F., Grandjean, H., Baudoin, C., Hausherr, E., Meunier, J. P., and Breart, G. (1996): Fall-related factors and risk of hip fracture: The EPIDOS prospective study. *Lancet*, 348 : 145-149.
- Dawson-Hughes, B., Harris, S. S., Krall, E. A., and Dallal, G. E. (1997): Effect of calcium and vit. D supplementation on bone density in men and women 65 y of age or older. *N. Engl. J. Med.*, 337(10): 670-676.
- Eaton, S. B. and Kanner, M. (1985): Paleolithic Nutrition: A consideration of its nature and current implication. *New England Journal of Medicine*, 312: 288-289.
- FAO. 1968. Food Composition Table for Use in Africa, by Wu Leung, W. T. FAO, Rome, Food and Agriculture Organization of the United Nations.
- Frongillo, E. A., Rausehenbach, B. S., Roe, D. A. and Williamson, A. (1992): “Characteristics related to elderly persons not eating for one or more days: Implications for meal programs” *American Journal of Public Health* 82: 600-602.
- Glew, R. H., Conn, C. A., VanderJagt, T. A., Calvin, C. D., Obadofin, M. O., Crossley, M. J., and Vanderjagt, D. J. (2004): Cardiovascular disease risk factors and diet of urban and rural dwellers in northern Nigeria. *J. Health Popul. Nutr.*, 22: 357-369.
- Gollub, E. A. and Weddle, D. O. (2004): Improvements in nutritional intake and quality of life among frail homebound older adults receiving home-delivered breakfast and lunch. *J. Am. Diet. Assoc.*, 104: 1227-1235.
- Hashemipour, S., Larijani, B., Adibi, H., Javadi, E., Sedaghat, M., Pajouhi, M., Soltani, A., Shafaei, A. R., Hamidi, Z., Fard, A. R. K., Hossein-Nezhad, A., and Booya, F. (2004): Vitamin D deficiency and causative factors in the population of Tehran. *BMC Public Health*, 4 (1):38.

- Hernandez-Avila, M., Colditz, G. A., Stampfer, M. J., Rosner, B., Speizer, F. E., and Willett, W. C. (1991): Caffeine, moderate alcohol intake and risk of fractures of the hip and forearm in middle-aged women. *Am. J. Clin. Nutr.*, 54(1):157-163.
- Hosseini-nezhad, A., Soltani, A., Rahimi, I., Shafaie, A., Maghbooli, Z., and Larijani, B. (2003): Relation between tea drinking and bone mineral density. *Tabib-Shargh* 2(1), 29.
- Iso, H., Terao, A., Kitamura, A., Sato, S., Naito, Y., Kiyama, M., Tanigaki, M., Lida, M., Konishi, M., Shimamoto, T., and Komachi, Y. (1991): Calcium intake and blood pressure in seven Japanese populations. *American Journal of Epidemiology* 133 (8):776-783.
- Jorde, R. and Bonna, K. H. (2000): Calcium from dairy products: Vitamin D intake and blood pressure, the Tromso study. *American Journal of Clinical Nutrition*, 71:1530-1535.
- Laabes, E. P., VanderJagt, D. J., Obadofin, M. O., Sendeht, A. J., and Glew, R. H. (2008): Assessment of the bone quality of black male athletes using calcaneal ultrasound: a cross-sectional study. *Nutrition and Metabolism*, 5:13 doi:10.1186/1743-7075-5-13.
- Larijani, B., Mohajeri Tehrani, M.R., Hamidi, Z., Soltani, A., and Pajouhi, M. (2004a): Osteoporosis, Global and Iranian Aspects. *Iranian J. Publ. Health, A supplementary issue on Osteoporosis*, pp.1-17.
- Larijani, B., Bekheirnia, M. R., Soltani, A., Khalili-Far, A., Adibi, H., and Jalili, R. B. (2004b): Bone mineral density is related to blood pressure in men. *Am. J. Hum. Biol.*, 16(2):168-171.
- Lau, E., Donnan, S., Barker, D. J., and Cooper, C. (1988): Physical activity and calcium intake in fracture of the proximal femur in Hong Kong. *BMJ* 297:1441-1443.
- McKenna, M. J. (1992): Differences in vit. D status between countries in young adults and the elderly. *Am. J. Med.* 93(1): 69-77.
- Oguntona, T. and Akinyele, I. O. (1995): The Composition of Nigerian Foods: Cooked, Raw and Processed. Food Basket International. FBI. Ibadan.
- Patrizi, G., Federici, S., Fazi, M., Pelle, F., Fiengo, L., Venturini, L., Di Rocco, G., Giannotti, D., Frezzotti, F., Giordano, R., and Redler, A. (2011): Changes of serum calcium levels after thyroid surgery in the elderly. *BMC Geriatrics* 11(Suppl 1): A41.
- Prentice, A., Laskey, M. A., Shaw, J., Hudson, G., Day, K., Jarju, L. M. A., Dibba, P., and Paul, A. A. (1993): Calcium intake in rural Gambian women. *Br. J. Nutr.*, 69: 885-896.
- Reid, I. R., Mason, B., Horne, A., Ames, R., Clearwater, J., Bava, U., Orr-Walker, B., Wu, F., Evans, M. C., and Gamble, G. D. (2002): Effects of calcium supplementation on serum lipid concentrations in normal older women: a randomized controlled trial. *Am. J. Med.*, 112(5): 343-347.
- Ruffing, J. A., Cosman, F., Zion, M., Tendy, S., Garrett, P., Lindsay, R., and Nieves, J. W. (2006): Determinants of bone mass and bone size in a large cohort of physically active young adult men. *Nutrition and Metabolism*, 3:e14. (doi: 10.1186/1743-7075-3-14).
- Shiva, S. and Barzgar, M. (2007): Antiepileptic Drugs Effect on Vitamin D Status of Epileptic Children *Iran J. Pediatr.*, Vol. 17 (Suppl. 2), 168-172.
- Simon, J. A., Browner, W. S., Tao, J. C., and Hulley, S. B. (1992): Calcium intake and blood pressure in elderly women. *American Journal of Epidemiology*. 136 (10):1241-1247.
- Tang, B. M., Eslick, G. D., Nowson, C., Smith, C., and Bensoussan, A. (2007): Use of calcium or calcium in combination with vitamin D supplementation to prevent fractures and bone loss in people aged 50 years and older: a meta-analysis. *Lancet*, 370(9588): 657-666.

Thacher, T. D., Glew, R. H., Isichei, C., Lawson, J. O., Scariano, J. K., Hollis, B. W., and VanderJagt, D. J. (1999): Rickets in Nigerian children: response to calcium supplementation. *Journal of Tropical Pediatrics*, 45:202-207.

Tinetti, M. E. (2003): Clinical practice. Preventing falls in elderly persons. *N. Engl. J. Med.*, 348:42-49.

Trivedi, D. P., Doll, R., and Khaw, K. T. (2003): Effect of four monthly oral vitamin D3 (cholecalciferol) supplementation on fractures and mortality in men and women living in the community: randomised double blind controlled trial. *BMJ*. 326:469.

United States Department of Health and Human Services (2004): Bone Health and Osteoporosis: a report of the Surgeon General, Rockville, MD. United States Department of Health and Human Services, Office of the Surgeon General.

World Health Organization (1994): Assessment of osteoporotic fracture risk and its role in screening for postmenopausal osteoporosis. Geneva.

Received for Publication: 12/09/2012

Accepted for Publication: 10/11/2012

Corresponding Author

Ariyo O.,

Department of Food Science and Technology, Wesley University of Science and Technology, Ondo, Nigeria.

e-mail: ariyoseun@gmail.com

UNIVERSITY OF IBADAN LIBRARY