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Variations in the Calcium and Magnesium Contents of Selected Nigerian Leafy Vegetables and Seeds of Legumes, Gourds and Fruits

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Abstract: *The calcium and magnesium concentrations in twenty samples comprising of leafy vegetables and seeds of legumes, gourds and fruits were determined using atomic absorption spectrophotometer (model 210 VGP) at the wavelengths of 422.7nm and 285.2nm, respectively. Standard methods were used in preparing aliquots of the samples used for the analysis. The result for calcium showed that leafy vegetables; pumpkin and bitter leaf had the highest calcium concentrations of 3.38±0.012mg/g and 3.01±0.01mg/g, respectively while the fruit seeds; watermelon seeds and melon seeds had the lowest calcium concentrations of 0.03±0.00mg/g and 0.05±0.01mg/g respectively. The result for magnesium showed that the legumes; brown and white pigeon pea contained the highest magnesium concentration of 1.34±0.00mg/g and 1.25±0.01mg/g, respectively. Also the legumes; both bold and java grade groundnut had the lowest magnesium concentrations of0.05±0.00mg/g and 0.06±0.03mg/g respectively. Although vegetables and legumes might contain anti-nutritional components that inhibit their bioavailability, these results show that vegetables and legumes are rich sources of calcium and magnesium respectively.*

Keywords*: Calcium, Magnesium, Atomic Absorption Spectrophotometer*

I. Introduction:

Minerals refer to inorganic elements that can ionize in solution. They can become charged particles and as such can form compounds (Whitney and Rolfes, 1993). Minerals protect and maintain the structural components of the body tissues and organs and are electrolyte constituents of body fluids and tissues (Rubanza*et al*., 2005). Although minerals may be present in foods, they are not bioavailable unless the body can absorb them. Antinutritional components such as phytates, oxalates limit their absorption (Wardlaw and Hampl, 2007). Attempts to increase the utilization of minerals in food have resulted in making use of a processing technique known as extrusion cooking (Frias *et al*., 1995, Alonso *et al*., 2000). Extrusion cooking improves the nutritive value by reducing the levels of heat labile, non – nutritive compounds (Marzo*et al*., 2011). Minerals are divided into macro minerals and trace minerals. Macro minerals are needed in the diet in amounts of 100 milligrams (mg) or more each day (Gropper *et al.*, 2005).Trace minerals are needed in smaller amounts (less than 100mg each day). This study focused on calcium and magnesium which are macro minerals. The calcium content of rural diets in developing countries is inadequate (Rosado *et al*., 1992; Wyatt and Triana-tegas, 1994) and dietary calcium deficiency has been epidemiologically linked to several chronic diseases including osteoporosis. Men who consume more than 2,000mg of calcium daily had a multivariate relative risk for metastatic and fatal prostate cancer compared with men consuming less than 500mg of calcium daily (Chan and Giovannucci, 2001). Without adequate magnesium, energy production falters and protein production is insufficient for normal growth and development of infants, children, adolescents and pregnant women (Mangela and Havala, 1994). Findings indicate that higher blood magnesium levels are associated with a lower risk of high grade prostate cancer (Dai *et al.*, 2011) The purpose of this study is to determine the relative abundance of calcium and magnesium in selected Nigerian legumes, gourds, fruits and leafy vegetablesso as to note the plant samples, that have more of calcium, magnesium and zinc with a view to recommending their wise use in prostate pathologies.

II. Materials and Methods:

Sample Collection:

Legumes: Pigeon pea, soya beans, black (kidney) beans, cowpea, groundnut and bambara nut. Gourds (seeds): Cucumber, water melon, melon, sponge-gourd, fluted pumpkin. Fruit Seeds: Orange, soursop and pawpaw were air dried at room temperature,Fresh Vegetables: Pumpkin (leaf) and bitter leaf. These were obtained from Nsukka market and were identified by Dr. UchenduNzekwe of Botany Department, University of Nigeria,Nsukka.

Preparation of Sample:
The samples were ground using a wooden pestle and mortar. Each sample (1g) was weighed into a conical flask. An aliquots, 20ml of acid mixture ofHCl and HNO_3 in the ratio of 3:1, was added to the conical flask. The sample was digested by heating gently on a hot plate until the sample became clear (Gregory, 2005).

III. Determination of calcium and magnesium:

Calcium and magnesium content was determined using the method of Gregory (2005), the digest was cooled and diluted to 250ml with distilled water and filtered. The concentrations of the metals, calcium and magnesium were determined using the filtrate. Aliquots of the diluted clear digest were used for atomic absorption spectrophotometer (Model 210 VGP), using specific lamps for calcium and magnesium at 422.7nm and 285.2nm, respectively.

IV. Discussion:

The result presented in Figure 1 revealed that leafy vegetables; pumpkin leaf contained the highest calcium concentration of (3.38±0.012) followed by bitter leaf withconcentration of(3.01±0.012). Calcium was not detected in both pumpkin seeds and bambara nut. The legumes; brown pigeon pea contained an appreciable calcium concentration of (1.65±0.02) unlike the white pigeon pea which had (0.44±0.00)mg/g. This shows that leafy vegetables (pumpkin leaf, bitter leaf) and legumes (brown and white pigeon pea) are rich sources of calcium and may be beneficial in calcium deficiency (Gropper *et al*., 2005). Generally in Figure 2, legumes; pigeon pea whether brown or white is a rich source of magnesium as they contain (1.34±0.003)mg/g and (1.25±0.015)mg/g magnesium, respectively. Relative to legumes (pigeon pea), leafy vegetables; bitter and pumpkin leaf contain less amounts being (0.56±0.00) and (0.48±0.00), respectively. The relatively high concentration of magnesium in leafy vegetables may be related to its presence in chlorophyll which abounds in both bitter leaf and pumpkin leaf (Wardlaw and Hampl, 2007). The absence of or undetectable amounts of magnesium in potiskum beans, brown beans, sponge seeds, pawpaw seeds, cucumber seeds and melon seeds indicate that they ought to be supplemented with magnesium rich sources of food.

In Figure 3, the data show that the two mineral elements calcium and magnesium exhibit inverse relationship in their abundance. As calcium concentration increases, the magnesium concentration decreases in seeds of legumes (brown pigeon pea, soya beans, black (kidney) beans, cowpea,and bambara nut, seeds of gourds (Cucumber, water melon, melon, sponge-gourd and fluted pumpkin, seeds of fruits (soursop and pawpaw) and leafy vegetables (bitter and pumkin leaf) except in orange seeds and white pigeon pea where calcium decreases and magnesium increases. Groundnut seeds had equal amounts of calcium and magnesium.

Considering the calcium concentrations within the plant samples in Figure 4 the leafy vegetables with a calcium concentration of (3.195±0.083)mg/g significantly increased when compared to legumes, seeds of gourds and fruits. The leafy vegetables are good source of calcium.

The magnesium concentrations observed within the plant samples as shown in Figuer 5 revealed that legumes, seeds of gourds and fruits are rich sources of magnesium. The leafy vegetables contained the highest magnesium concentration of (0.52±0.04)mg/g and thus may be the best source of the mineral in magnesium deficient diets.

The two mineral elements within the plant samples in Figure 6: revealed that, leafy vegetables could be suggested in situations of calcium deficiency because they contain calcium. There could be some little combination of diets such as legumes and leafy vegetables when we need magnesium in the diet.

V. Conclusion:

The research made shows that each of the plant samples contains one or both of the mineral; calciumand magnesium determined. For those who are deficient in calcium and magnesium, leafy vegetables and legumes can be eaten respectively.

Although vegetables and legumes contain antinutrient that inhibits intestinal absorption, it can still be eaten by processing them with extrusion cooking, which is used to improve the nutritive value (Marzo*et al*., 2011). Since calcium and magnesium are opposite in their effects in our body structure, the more rigid and inflexible our body structure is, the less calcium and the more magnesium we need. Legumes should be eaten because they contain relative amounts of magnesium which lowers the risk of prostate cancer.

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Results:

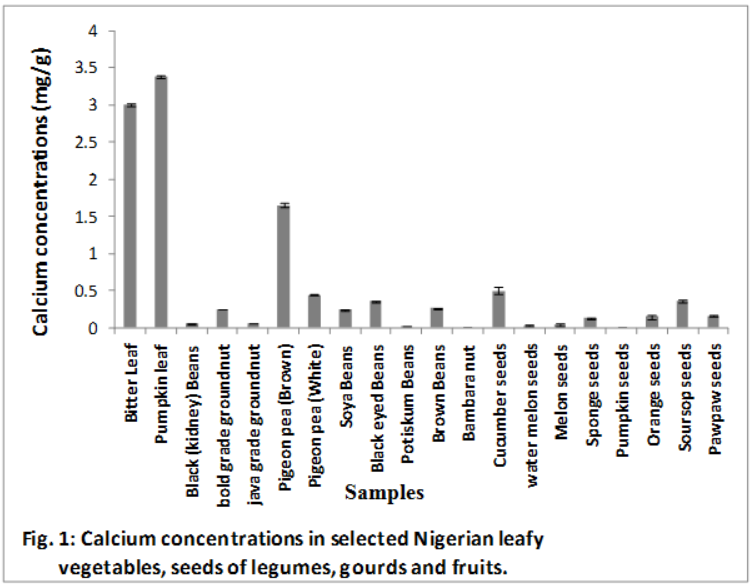

Fig. 1: Calcium concentrations in selected Nigerian leafy vegetables, seeds of legumes, gourds and fruits.

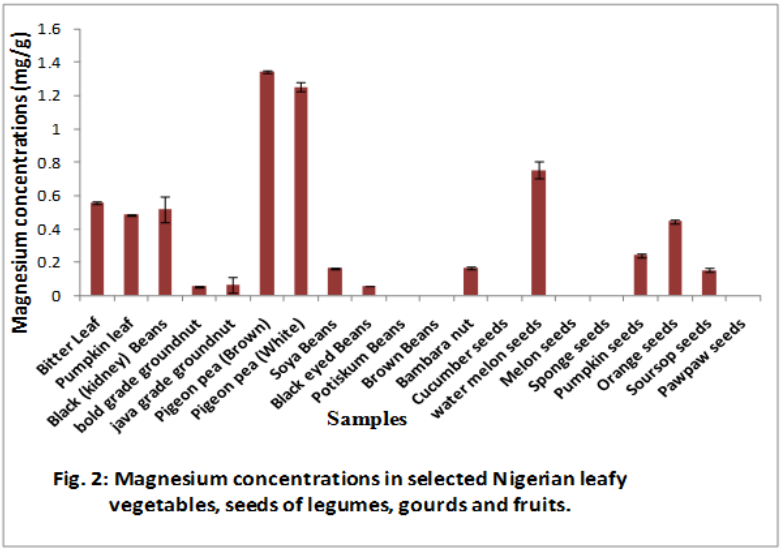

Fig. 2: Magnesium concentrations in selected Nigerian leafy vegetables, seeds of legumes, gourds and fruits.

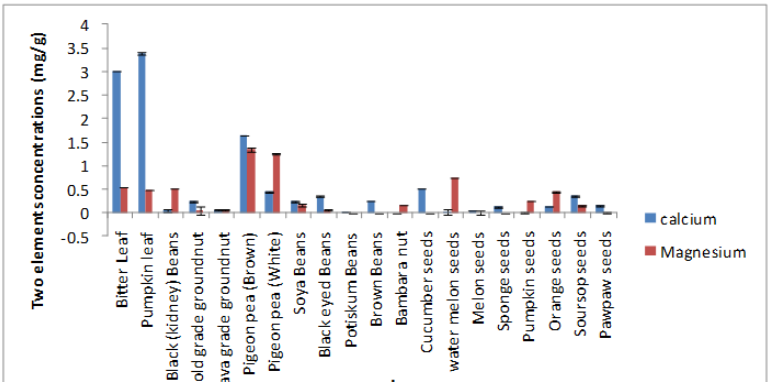

Fig. 3: Relative abundance of calcium and magnesium in selected Nigerian leafy vegetables, seeds of legumes, gourds and fruits.

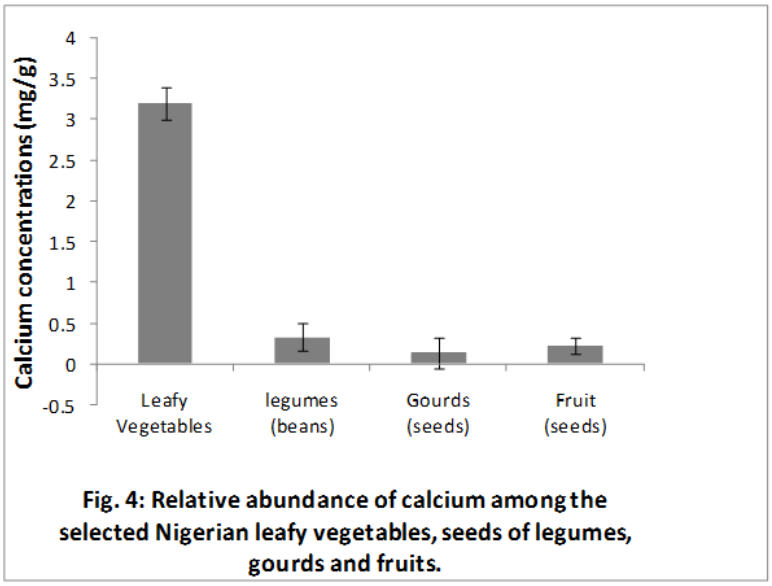

Fig. 4: Relative abundance of calcium among the selected Nigerian leafy vegetables, seeds of legumes, gourds and fruits.

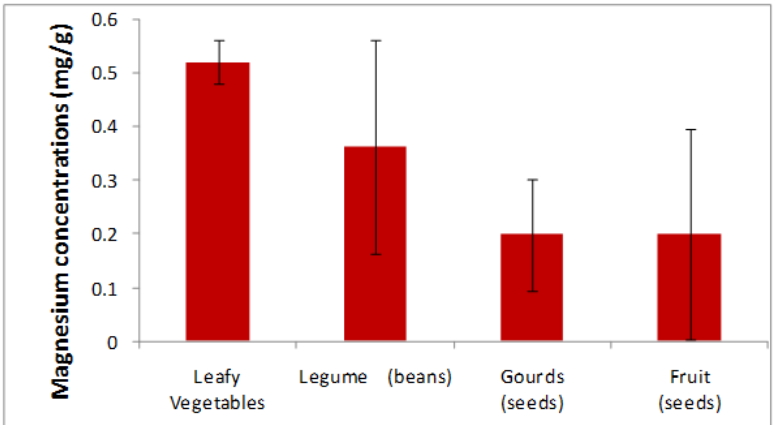

Fig. 5: Relative abundance of magnesium among the selected Nigerian leafy vegetables, seeds of legumes, gourds and fruits.

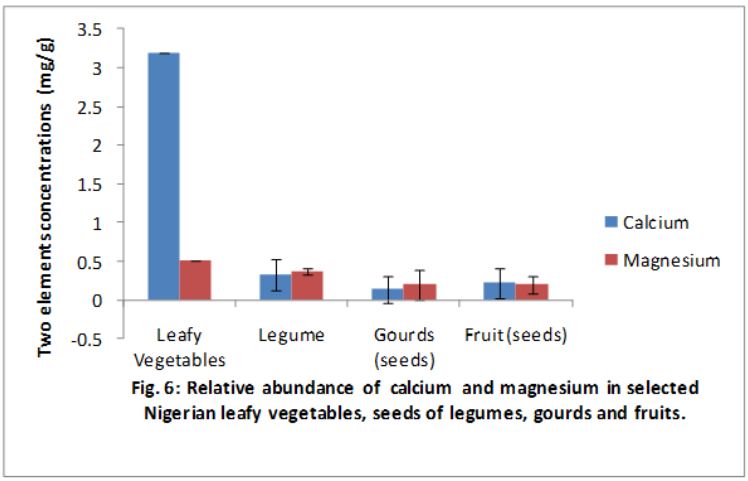

Fig. 6: Relative abundance of calcium and magnesium in selected Nigerian leafy vegetables, seeds of legumes, gourds and fruits.