African Journal of Food Science Vol 5.(1) pp. 22 – 25, January 2011
Available online http://www.academicjournals.org/ajfs
ISSN 1996-0794 ©2011 Academic Journals

*Full Length Research Paper*

# Comparative studies on the protein and mineral composition of some selected Nigerian vegetables

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Accepted 7 December, 2010

**Twenty seven (27) vegetable plant parts usually included in daily schedule of diet in Nigeria were analyzed for their protein and mineral compositions to evaluate their importance in human nutrition. The results showed that almost all the vegetables contain appreciable amount of proteins and minerals. The protein content ranged from 0.04% in *Sesanum indium* leaf to 2.67% in *Phaseolus vulgaris*. Mineral contents in dry weight basis were found in different concentration in all vegetables. Calcium (Ca) was the most abundant mineral in all the vegetables followed by Potassium (K) and Magnesium (Mg). Some vegetables had appreciable amount of Na. All vegetables evaluated were found to be poor source of Cd, Ni and Pb. The total ash content ranged from 4% in *Pterocarpus mildbraedii* to 12.6% in *Talinum triangulare* leaf. The results obtained in this work clearly indicate that the vegetables could provide some amount of proteins and adequate minerals for consumers.**

**Key words:** Vegetables, minerals, Nigeria, protein.

## INTRODUCTION

Vegetables are the fresh and edible portions of herbaceous plants. They are important class of food substances and highly beneficial for the maintenance of health and prevention of diseases. They contain valuable food ingredients, which can be successfully utilized to build up and repair the body. They are valued mainly for their high carbohydrate, vitamins and mineral contents. There are different kinds of vegetables; they may be edible roots, stems, leaves, fruits or seeds. Each group contributes to diet in its own way (Robinson, 1990).

The health of an individual depends on the qualities and quantities of food stuff he consumes. The food requirements are simply needed to supply the minimum requirements of the six groups of nutrients: carbohydrates, fats, proteins, mineral elements, vitamins and water (Alfred and Patrick, 1985).

According to Oke and Ojofeitimi (1988), vegetables, contain low calories and negligible quantities of utilizable energy. Hence they are ideal for obese people who can satisfy their appetite without consuming much carbohydrate. Although there are low level of proteins in vegetables, there is increasing awareness of the importance of vegetable in maintaining health, particularly in areas where animal proteins are scarce.

Vegetables contribute to the mineral, vitamin and fiber contents of diets. Minerals are naturally occurring inorganic substances with a definite chemical composition and an ordered atomic arrangement. Among the plants, vegetables are excellent sources of minerals and contribute to RDA of these essential nutrients. Minerals are very important ingredients for normal metabolic activities of body tissues. Out of 92 naturally occurring minerals 25 are present in living organisms. They are constituents of bones, teeth, blood, muscles, hair and nerve cells. Vitamins cannot be properly assimilated without the correct balance of minerals (Sonni, 2002).

Vegetables as a whole are considered as natural sources of nutrients gifted by God to human beings e.g. Carrot is a good source of vitamin A, needed for normal vision, likewise spinach and tomato contains enough amounts of vitamin C to prevent and cure Scurvy. Potato is rich in starch and provides high amount of carbohydrates (Rumeza et al., 2006).

In developing nations, numerous types of edible wild

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**Table 1.** Percentage protein contents of the selected Nigerian vegetables.

| Name of vegetables | Protein contents (%) |
|---|---|
| *Daucus carota* leaf | 2.40 ± 0.01 |
| *Sesanum indium* leaf | 1.54 ± 0.11 |
| *Hisbiscus aspeo* leaf | 0.26 ± 0.12 |
| *Manihot esculenta* | 0.18 ± 0.01 |
| *Lactuca capensis* | 0.23 ± 0.08 |
| *Helianthis tuberosus* | 0.63 ± 0.01 |
| *Colocasia esculenta* | 1.58 ± 0.03 |
| *Telfaria occidentalis* | 0.15 ± 0.01 |
| *Amaranthus hybridus* | 1.07 ± 0.06 |
| *Pterocarpus mildbraedii* | 1.00 ± 0.01 |
| *Occimum gratissimum* | 2.43 ± 0.04 |
| *Chromelena odorate* | 0.31 ± 0.01 |
| *Talinum triangulare* | 1.58 ± 0.01 |
| *Corchorus olitorus* | 0.80 ± 0.01 |
| *Adasonia digitata* | 1.54 ± 0.02 |
| *Brassica oleracea* | 1.80 ± 0.11 |
| *Murraya koenigii* | 0.26 ± 0.01 |
| *Daucus carota root* | 1.05 ± 0.01 |
| *Hisbiscus aspeo root* | 0.52 ± 0.21 |
| *Abelmoschus esculentus* | 0.40 ± 0.03 |
| *Alium cepha leaf* | 0.83 ± 0.02 |
| *Basela alba* | 0.71 ± 0.02 |
| *Phaseolus vulgaris* | 2.67 ± 0.58 |
| *Alium cepha root* | 1.00 ± 0.01 |
| *Vernonia amygdalina* | 2.27 ± 0.01 |
| *Sesanum indium root* | 0.040 ± 0.03 |
| *Piper ganiensea* | 0.57 ± 0.31 |

Values are mean ± S. D of three determinations.

plants are exploited as sources of food and provide adequate levels of nutrients for the inhabitants. Some studies in some societies in Africa indicate that these plant resources play a significant role in nutrition; food security and income generation (Asibey-Berko and Tayie, 1999). Furthermore, FAO report, indicate that at least one billion people are thought to use wild foods in their diet (Burlingame, 2000).

In this study, determination of protein and selected mineral constituents of different vegetables consumed daily by the majority of people living in Anyigba, Nigeria were carried out. The main purpose of this investigation was to raise awareness among people about the protein and mineral they take during ingestion of vegetables. These findings would also be useful for nutritionists to formulate balance diets.

## MATERIALS AND METHODS

Fresh green vegetables were obtained from different parts of Anyigba, Kogi State Nigeria. The leaves were removed from the stem and damaged ones excluded. The leaves were cut into pieces and air-dried for analysis. The root portions were oven-dried at 40°C and kept in air-tight plastic containers for further analysis. Ash and crude protein analysis were carried out by modified methods of Oke (1988).

### Mineral determination

The samples were investigated for mineral composition by using Atomic Absorption Spectrophotometer (AAS), Buck Scientific Model AVG 210, housed in Soil science laboratory, Kogi State University, Anyigba. Appropriate working standard solutions were prepared for each of the minerals. The calibration curves were obtained by plotting concentration versus absorbance. The data were statistically analyzed by using fitting of straight line by least square method. All elements were determined in the vegetables under this investigation procedure. Laboratory procedures for the preparation and determination of macro and micronutrient were used as outlined by Shah et al. (2009) for plant sample.

## RESULTS AND DISCUSSION

All data were expressed as Mean ± S.D and Graph Pad Instat- [DataSet.1.ISD] was used.

Protein composition of the selected vegetable parts is as shown in Table 1. The vegetable samples have low protein content. The crude protein content was estimated between 0.04 ± 0.03% to 2.67 ± 0.58% in all the selected vegetable parts. Although there is low level of proteins in vegetables, there is increasing awareness of the importance of vegetable in maintaining health, particularly in areas where animal protein is scarce. These selected vegetables apparently must have contributed to the protein need of the consumers in Anyigba and environs. *Daucus carota* leaf possessed the highest amount of proteins (2.40 ± 0.01%) followed by *Vernonia amygdalina* (2.27 ± 0.01%) and *Talinum triangulare* (1.58 ± 0.01%). The poorest protein source among the vegetables studied was *Sesanum indium* root (0.04 ± 0.03%). It is required that vegetables should be used frequently as they are good for health and provide all essential nutrients for normal body functions when consumed in appropriate combination. Protein is necessary for building the structural components of human body, such as muscles and organs. Protein has a large number of important functions in the human body and infact, the human body is about 45% protein. It is an essential macromolecule without which our bodies would be unable to repair, regulate, or protect itself. Essential body processes such as water balancing; nutrient transport and muscle contractions require protein to function (Robert et al., 2006). There is no doubt that the consumers of these vegetables must have in one way or the other benefited from the nutritional characteristics of these plants.

Table 2 shows the results of the mineral contents of the selected vegetables. The mineral content in all the selected vegetables varied comparatively. Calcium (Ca), Potassium (K) contents were high as compared to other

**Table 2.** Macro and micro mineral content (ppm)/ash (%) of selected vegetables.

| Names of vegetables | Ca | Cd | Cu | Fe | K | Mg | Na | Ni | Pb | Zn | Ash |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Daucus carota leaf* | 119.43 ± 0.47 | 0.77 ± 0.01 | - | 7.26 ± 0.15 | 61.13 ± 0.15 | 51.68 ± 0.13 | 7.27 ± 0.16 | 8.60 ± 0.26 | 5.69 ± 0.09 | 4.36 ± 0.05 | 5.65 ± 0.05 |
| *Sesanum indium leaf* | 30.79 ± 0.02 | 0.30 ± 0.09 | - | 23.33 ± 0.24 | 27.47 ± 0.28 | 38.30 ± 0.02 | 3.73 ± 0.04 | 9.21 ± 0.02 | 1.55 ± 0.05 | 6.04 ± 0.06 | 5.19 ± 0.28 |
| *Hisbiscus aspeo leaf* | 259.26 ± 0.30 | 0.30 ± 0.19 | - | 7.83 ± 0.04 | 12.31 ± 0.02 | 1.31 ± 0.02 | 1.73 ± 0.04 | 3.82 ± 0.01 | 11.32 ±0.02 | 4.37 ± 0.20 | 8.18 ± 0.17 |
| *Manihot esculenta* | 27.49 ± 0.04 | 0.80 ± 0.01 | - | 21.11 ± 0.19 | 106.4 ± 0.61 | 6.81 ± 0.02 | 5.46 ± 0.11 | 0.84 ± 0.04 | 9.84 ± 0.04 | 3.82 ± 0.03 | 6.04 ± 0.14 |
| *Lactuca capensis* | 2.53 ± 0.30 | 0.52 ± 0.02 | - | 4.52 ± 0.31 | 17.25 ± 0.28 | 23.22 ± 0.19 | 2.53 ± 0.02 | 1.00 ± 0.01 | 1.24 ± 0.21 | 7.48 ± 0.27 | 9.35 ± 0.55 |
| *Helianthis tuberosus* | 60.64 ± 0.36 | 0.52 ± 0.02 | - | 5.29 ± 0.13 | 94.26 ± 0.93 | 2.00 ± 0.01 | 4.00 ± 0.01 | 4.00 ± 0.01 | 4.59 ± 0.09 | 2.56 ± 0.49 | 7.00 ± 0.01 |
| *Colocasia esculenta* | 92.56 ± 0.02 | 0.52 ± 0.02 | - | 7.26 ± 0.07 | 51.33 ± 0.49 | 5.75 ± 0.05 | 2.00 ± 0.01 | 4.36 ± 0.26 | 2.36 ± 0.07 | 1.00 ± 0.01 | 7.65 ± 0.05 |
| *Telfaria occidentalis* | 167.52 ± 0.46 | 0.74 ± 0.04 | - | 9.00 ± 0.01 | 43.32 ± 0.23 | 3.52 ± 0.02 | 2.00 ± 0.01 | 1.39 ± 0.56 | 4.00 ± 0.01 | 3.40 ± 0.06 | 7.36 ± 0.08 |
| *Ameranthus hybridus* | 83.37 ± 0.34 | 0.50 ± 0.21 | - | 2.84 ± 0.35 | 134.44 ± 0.09 | 09.73 ± 0.17 | 3.00 ± 0.01 | 2.88 ± 0.09 | 2.54 ± 0.34 | 5.45 ± 0.17 | 6.00 ± 0.03 |
| *Pterocarpus mildbraedii* | 86.54 ± 0.30 | 0.80 ± 0.01 | - | 17.59 ± 0.96 | 36.61 ± 0.15 | 87.49 ± 0.26 | 4.54 ± 0.04 | 6.00 ± 0.01 | 5.00 ± 0.01 | 3.54 ± 0.02 | 4.00 ± 0.01 |
| *Occimum gratissimum* | 265.57 ± 0.02 | 0.30 ± 011 | - | 2.85 ± 0.04 | 47.45 ± 0.48 | 23.42 ± 0.21 | 3.29 ± 0.05 | 0.30 ± 0.01 | 2.00 ± 0.01 | 4.46 ± 026 | 5.64 ± 0.03 |
| *Chromolena odorata* | 95.46 ± 0.38 | 1.60 ± 0.04 | - | 26.39 ± 0.05 | 158.07 ± 0.18 | 35.58 ± 0.07 | 3.00 ± 0.02 | 3.50 ± 0.02 | 5.00 ± 0.01 | 17.35 ±0.08 | 5.45 ± 0.13 |
| *Talinum triangulare* | 53.24 ± 0.31 | 0.50 ± 0.01 | - | 8.01 ± 0.02 | 375.06 ± 0.44 | 21.68 ± 0.27 | 4.30 ± 0.02 | 3.30 ± 0.11 | 5.85 ± 0.04 | 4.52 ± 0.04 | 12.53 ± 0.17 |
| *Corchorus olitorus* | 40.78 ± 0.41 | 0.50 ± 0.10 | - | 3.63 ± 0.04 | 4.71 ± 0.06 | 47.53 ± 0.03 | 3.00 ± 0.02 | 8.41 ± 0.13 | 1.32 ± 0.02 | 2.56 ± 0.49 | 5.00 ± 0.01 |
| *Adasonia digitata* | 77.21 ± 0.18 | 0.72 ± 0.02 | - | 6.00 ± 0.12 | 64.48 ± 0.41 | 31.29 ± 0.05 | 2.00 ± 0.31 | 9.16 ± 0.05 | 3.70 ± 0.01 | 2.29 ± 0.06 | 5.63 ± 0.06 |
| *Brassica oleracea* | 77.29 ± 0.32 | 0.70 ± 0.01 | - | 1.84 ± 0.03 | 104.49 ± 0.54 | 44.27 ± 0.07 | 5.00 ± .0.03 | 2.85 ± 0.02 | 1.00 ± 0.13 | 3.37 ± 0.06 | 8.30 ± 0.06 |
| *Murraya koenigii* | 14.26 ± 0.07 | 0.30+0.01 | - | 14.51+0.21 | 38.46 ± 0.24 | 42.25 ± 0.06 | 1.70+0.11 | 5.00 ± 0.01 | 3.25 ± 0.05 | 4.54 ± 0.01 | 6.00 ± 0.03 |
| *Daucus carota root* | 32.26 ± 0.12 | 0.20 ± 0.01 | - | 8.67 ± 0.011 | 89.13 ± 0.23 | 8.23 ± 0.01 | 11.40 ± 0.13 | 0.76 ± 0.02 | 3.00 ± 0.01 | 6.00 ± 0.02 | 6.30 ± 0.05 |
| *Hisbiscus aspeo root* | 40.69 ± 0.06 | 0.70 ± 010 | - | 4.00 ± 0.15 | 201.39 ± 0.09 | 7.30 ± 0.21 | 3.00+0.01 | 2.01 ± 0.11 | 7.10 ± 0.12 | 9.00 ± 0.15 | 7.07 ± 0.01 |
| *Abelmochus esculentus* | 42.33 ± 0.23 | 1.30 ± 0.06 | - | 12.00 ± 0.03 | 181.32 ± 0.02 | 4.00 ± 0.04 | 4.00 ± 0.04 | 1.21 ± 0.14 | 2.22 ± 0.51 | 1.88+1.22 | 7.60 ± 1.23 |
| *Alinum cepha leaf* | 107.32 ± 0.28 | 1.00+0.01 | - | 27.46 ± 0.11 | 435.37 ± 0.16 | 1.00 ± 0.17 | 23.5 ± 0.05 | 14.78 ± 0.09 | 5.50 ± 0.16 | 5.31 ± 0.66 | 8.00 ± 0.01 |
| *Basela alba* | 256.75 ± 0.07 | 1.30 ± 0.13 | - | 25.01+0.12 | 397.14 ± 0.18 | 1.81 ± 1.21 | 73.11 ± 1.23 | 12.33+0.33 | 3.57 ± 3.10 | 5.81+1.13 | 10.00 ± 0.01 |
| *Phaseolus vulgaris* | 40.00 ± 1.01 | 0.53+0.01 | - | 8.22 ± 1.00 | 32.17 1.22 | 185.31 ± 0.07 | 77.81 ± 2.01 | 32.00 ± 0.05 | 7.23 ± 1.00 | 2.55 ± 1.33 | 5.33 ± 1.56 |
| *Alium cepha root* | 20.01 ± 0.11 | 0.33 ± 1.01 | - | 7.00 ± 0.01 | 107.6 ± 0.55 | 24.61 ± 1.17 | 6.00 ± 0.76 | 2.33+0.01 | 3.11+1.51 | 3.22 ± 0.15 | 4.01 ± 0.03 |
| *Vernonia amygdalina* | 200.40 ± 1.23 | 1.00 ± 0.01 | - | 126.88 ±1.04 | 133.7 ± 0.19 | 63.81 0.59 | 27.71 ± 2.11 | 6.11+1.05 | 22.2 ± 1.13 | 13.24 ±3.01 | 8.00 ± 0.01 |
| *Sesanum indium seed* | 251.7 ± 1.77 | 0.71 ± 0.01 | - | 7.17 ± 0.57 | 27.60 ± 1.09 | 3.00 ± 0.05 | 0.71 ± 1.16 | 9.00 ± 1.00 | 2.33 ± 1.55 | 3.22 ± 1.10 | 7.34 ± 0.05 |
| *Piper ganienses* | 50.60 ± 0.01 | 0.50 ± 0.01 | - | 10.25 ± 0.39 | 175.56 ± 3.10 | 9.51 ± 1.66 | 2.00 ± 1.23 | 4.56 ± 1.30 | 6.25 ± 0.03 | 13.52 ±0.12 | 4.41 ± 0.39 |

Mean values are mean ± S.D (N = 3).

minerals. Second abundant minerals found in the selected vegetables are Magnesium (Mg) and Sodium (Na). The results obtained in this study shows a close agreement with those found in literature (Oke, 1988). Thus, some of the differences in chemical composition is not unexpected. Some of the factors might be linked to species, climate, growing conditions, nature of soil, application of natural or artificial manure and period of analysis. *Hisbiscuss asp*eo leaf had 259.26 ± 0.03 ppm of Calcium followed by *Basela alba* (256.75 ± 0.07 ppm). Similarly, potassium content was high in *A. cepha* leaf (435.37 ± 0.16 ppm) followed by *B. alba* (397.14 ± 0.18 ppm). These variations spread across all the vegetable parts analyzed. Iron is a micro nutrient required for erythropiosis and found high as compared to Cadmium Cd) in all the selected vegetables. All

the results are in range with the results given by Howard et al. (1962). Minerals are important for vital body functions such as acid-base and water balance. Calcium is one of the largest mineral present in the structure of the body and in bones. Na and K are used as an electron carrier in the body. Iron (Fe) is an important constituent of Hemoglobin. Vegetables contribute these minerals and enhance their availability in daily life.

## Conclusions

From this investigation one can safely conclude that the selected vegetables are rich in protein and mineral elements needed for normal body function, maintenance and reproduction. It was discovered that the protein and mineral element composition in all the selected vegetables were different. Some vegetables contained high amount of protein and minerals while some have low amount of these nutrients. It is obvious from the results obtained in this investigation that vegetable intakes in different combination is essential for the maintenance of healthy life and normal body functioning. However, further investigations must be carried out to determine the effects of cooking and storage conditions on these valuable nutrients in the vegetables studied.

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