Agricultural Journal 1(2) : 72-76, 2006

Proximate and Selected Mineral Compositions of *Mangifera indica* and *Persea americana* Seeds Found in Nigeria

Abulude,[1]F.O.,[1]O.S. Eluyode, W.O. [1]Adesanya, [2]O.A. Elemide and [1]T.A. Koumah
[1]Department of Agricultural Engineering, [2]Department of General Studies,
Federal College of Agriculture, Akure 340001,
Ondo State, Nigeria

Abstract: The mineral and proximate compositions were analyzed in wet and dry samples of *Mangifera indica* and *Persea americana* seeds using standard methods of analyses. These determinations were determined on dry extract basis. The results revealed: ash 9.05-9.68%, crude protein 5.65-6.63%, crude fat 5.68-8.28%, crude fibre 5.31-6.75%, carbohydrate 63.26-64.25% and energy 334.64-350.04 Kcal in dry samples while wet sample produced, ash 7.20-11.28%, crude protein 4.35-10.65%, crude fat 4.21-6.42%, crude fibre 4.38-8.30%, carbohydrate 33.92-40.15 and energy 216.17-255.78%. As expected moisture content was high in the wet than dry sample. The mean values showed that *Mangifera indica* seed was higher in moisture, crude protein and crude fibre while ash, crude fat, carbohydrate and energy were higher in *Persea americana* seeds. Mineral contents showed that Zn, Cu, Pb, Ca and Mg were more concentrated in the wet sample than in the dry sample of *Mangifera indica*, while in *Persea amercana*, Zn, Fe, Mn, Pb, Ca and Mg were better concentrated in the wet sample. However, Cd, Cr and Al were not detected in both seed samples. The results are compared to those of other common seeds and it is hoped that it would add to the existing nutritional data on fruits and seeds.

Key words: Minerals, proximate composition, dry and wet samples, nutrition data

INTRODUCTION

Mangifera indica trees are deep-rooted symmetrical evergreen that attain heights of 60-75 meters and width of 10 meters. It belongs to Anacardiaceae family, which can be planted in poorer sandy types of soils provided they are not waterlogged, shallow or too acidic. It has one seed that is flattened and sticks to the flesh. The seed contains one or more embryos depending on the variety type. The tree may remain in production for 40 years or more. Fruits are usually pricked after they develop some red, orange or yellow color. The harvest season is usually between June and September depending on the variety. Mature mango keeps fairly well under refrigeration for 2 to 3 weeks at 50°-55° F[1].

Persea americana is almost evergreen being shed briefly in dry season at blooming time, the leaves are alternate dark-green and glossy on the upper surface, whitish or the underside, variable in shape (7.5-40 cm) long. The seed is round, conical or avoid, 5 cm long, hard and heavy, ivory in color but enclosed in two brown thin, papery. Seed coats often adhere to the flesh cavity, while the seed slips out readily.

Several minerals are essential nutrients to both man and animal. Mineral constitute the structural components of body organs and tissues, body fluids and tissue and serve as electrolytes concerned with the maintenance of osmotic pressure, acid-base balance membrane permeability, muscle irritability and oxygen transport. They are found in enzymes and hormone systems, forming the integral and specific components of metalloenzymes[2]. Fat, fibre, protein, carbohydrate and other food nutrients are essential in the growth, warmth, prevention of diseases of livestock and man.

Several works have been reported on nutritional values of fruits and seeds-*Mangifera indica* and *Persea americana* inclusive. Despite the relative importance of these fruits in the food habits of the populace, there is lack of data on the proximate composition and mineral values on their seeds as many studies were only carried out on the plant fruits. From personal experience seeds are being discarded. The purpose of this study is to determine the proximate composition and mineral contents of *Mangifera indica* and *Persea americana*. It is hoped that the data generated here would add to existing nutritional data.

MATERIALS AND METHODS

Mature seed samples were harvested from Federal College of Agriculture, Akure, Nigeria in April 2005. The fruits were washed with distilled water to remove adhering

Corresponding Author: F.O. Abulude, Department of Agricultural Engineering, Federal College of Agriculture, Akure 340001, Ondo State, Nigeria

dirt and the adhering water was dried by wrapping the seeds in filter paper, oven dried (60°C), ground in a Kenwood blender, served (0.5 mm) and stored in plastic containers at 4°C until use.

Moisture content was determined by drying at 110°C for at least 24 h until the weight became constant. Nitrogen was determined by the micro-Kjeldahl method described by Pearson[3] and the nitrogen content was converted to crude protein by multiplying by 6.25. Crude fat content was assayed by extraction with petroleum ether (40-60°C) in a soxhlet extractor. Carbohydrate was determined by difference. Energy was determined by the use of factor:

$$\text{Energy (Kcal)} = 4 \times (\text{g protein} + \text{g carbohydrate}) + 9\text{x (g fat)}.$$

The minerals were analyzed from solutions obtained by first dry-ashing the samples at 550°C in a muffle furnace and dissolving the ash in 100 mL volumetric flask using distilled water and few drops of conc. HCL and making up to mark. Flame atomic absorption spectrophotometer was used for the determination. All determinations were made in duplicate and the results were expressed as the mean, standard deviation, coefficient of variation in percent (CV%), levels of significance (p= 0.05) using SPSS for windows 10.

RESULTS AND DISCUSSION

Table 1 and 2 depict the proximate compositions of wet and dry samples of *Mangifera indica* and *Persea americana* seeds. The wet samples of *Mangifera indica* is better concentrated in crude protein, crude fibre and moisture while the dry sample is better concentrated in ash, crude fat, carbohydrate and energy, (Table 1). On the other hand, ash, moisture and crude protein are better concentrated in the wet sample of *Persea americana*, but crude fat, crude fibre, energy and carbohydrate are better concentrated in the dry sample.

The results reported in this work are in good agreement with those obtained for fruits[4], tropical plant seeds[5], apples[6] and *Carica papaya* and *Citrus sinensis* seeds[7]. The moisture content in the dry sample is low which means that such seed can be stored for a fairly long time without microbial spoilage. The data in Table 1 and 2 actually gave a pairwise comparison of the proximate compositions of *Mangifera indica* and *Persea americana*, respectively. The CV (%) for each parameter per sample is high for moisture content in both Table 1 and 2 while the other CV (%) for other parameters in the two Table are each less than 50%. This means it is only in the moisture content that great disparity occurs between the wet and dry samples in their proximate compositions.

The wet sample of *Mangifera indica* is the best source of crude protein and crude fibre among all samples while wet *Persea americana* is the best source of ash among the samples. All the other samples are also good sources of crude fat, ash, crude protein and crude fibre but wet *Mangifera indica* is low in carbohydrate. The wet samples are largely composed of moisture (28.42-35.75%). This may result in their being sources of low contents of protein, fats and carbohydrate[8]. The high moisture content also results in early processing of the seeds to avoid microbial spoilage unless when the seeds can be preserved under cold storage. Table 1and 2 show that samples have low percentage of fibre (4.38-8.30%). The spongy mass of fibre helps to satisfy the appetite and it also assists moving food through the alimentary canal by aiding the muscular action of the intestine, thus preventing constipation. The crude fat in the dry sample varies from 5.68-8.28% showing that dry seed may contribute some fat to the consumers. The crude protein content of the dry sample ranges between 5.62-6.63%. The adult man of 70 kg body weight requires 0.57 kg of protein (FAO/WHO, 1973) that is 39.9g of protein daily, assuming complete protein absorption about 601.8g of dry *Mangifera indica* will satisfy the daily requirement of an adult while about 701 g of dry *Persea americana* will satisfy same. The crude protein content of wet *Mangifera indica* is 9.32% that is 427.7 g of it will satisfy the protein requirement of an adult if this amount is totally absorbed.

Table 3 and 4 are comparisons of dry *Mangifera indica* and *Persea americana* seeds, respectively. In Table 3 the dry sample comparisons show that the proximate values are very close as shown by the values of the standard deviation and the CV (%). The highest variation is shown by the ash (31.22%) and the least variation is shown by carbohydrate (1.10%). The values of Table 4 show greater variability in the wet sample of *Mangifera indica* and *Persea americana* seeds. Variability ranges between 9.19-43.72%. This greater variability in the wet samples is due to the high differences in the proximate values of the two seeds samples. There are significant differences (p= 0.05) in the proximate compositions.

Table 5 and 6 show some mineral contents of *Mangifera indica* and *Persea americana* seeds, respectively. The Zn value (93.5 mg kg^{-1}) in *Mangifera indica* wet sample is higher to the value in *Persea americana* wet sample (72.9 mg kg^{-1}). This type of high value is also observed in the wet samples of

Table 1: Proximate composition (%) of *Mangifera indica* seed (on dry extract basis)

Parameter	Wet sample	Dry sample	Mean	±SD	CV (%)
Ash	7.20	9.05	8.13	1.31	16.10
Moisture	35.72	7.64	21.68	19.86	91.59
Crude protein	10.65	6.63	8.64	2.84	32.90
Crude fat	4.212	5.68	4.95	1.04	21.02
Crude fibre	8.30	6.75	7.53	1.10	14.61
Carbohydrate$^+$	33.92	64.25	49.09	21.45	43.69
Energy (Kcal)	216.17	334.64	275.41	83.77	30.42

$^+$Calculated by difference

Table 2: Proximate composition (%) of *Persea americana* seed (on dry extract basis)

Parameter	Wet sample	Dry sample	Mean	±SD	CV(%)
Ash	11.28	9.68	10.48	1.13	10.80
Moisture	28.42	7.82	18.12	14.57	80.39
Crude protein	9.35	5.62	7.49	2.64	35.24
Crude fat	6.42	8.28	7.35	1.32	17.89
Crude fibre	4.38	5.31	4.85	0.66	13.57
Carbohydrate$^+$	40.15	63.26	51.71	16.34	31.61
Energy (Kcal)	255.78	350.04	302.91	66.65	22.00

$^+$Calculated by difference

Table 3: Proximate composition (%) of dry *Mangifera indica* and *Persea americana* seeds compared

Parameter	*Mangifera indica*	*Persea americana*	Mean	±SD	CV (%)	Level of significance
Ash	9.05	9.68	9.24	2.89	31.22	
Moisture	7.64	7.82	7.73	0.13	1.65	
Crude protein	6.63	5.62	6.13	0.71	11.66	
Crude fat	5.68	8.28	6.98	1.84	26.34	*
Crude fibre	6.75	5.31	6.03	1.02	16.89	
Carbohydrate$^+$	64.25	63.26	63.76	0.70	1.10	
Energy (Kcal)	334.64	350.04	342.34	10.89	3.18	

*There are significant differences at p= 0.05, $^+$Calculated by difference

Table 4: Proximate composition (%) of wet *Mangifera indica* and *Persea americana* seeds compared

Parameter	*Mangifera indica*	*Persea americana*	Mean	±SD	CV (%)	Level of significance
Ash	7.20	11.28	9.24	2.89	31.22	
Moisture	35.72	28.42	32.07	5.16	16.10	
Crude protein	10.65	9.35	10.0	0.92	9.19	
Crude fat	4.21	6.42	5.32	1.56	29.40	*
Crude fibre	8.30	4.38	6.34	2.77	43.72	
Carbohydrate$^+$	33.92	40.15	37.04	4.41	11.90	
Energy (Kcal)	216.17	255.78	235.98	28.01	11.87	

There are significanr differences at p=0.05 $^+$Calculated by difference

Mangifera indica and *Persea americana* seeds for Fe with respective values of 92.8 mg kg^{-1} and 78.4 mg kg^{-1}. Table 5 shows that Cu values in the wet *Mangifera indica* seed is 4.0 mg kg^{-1} which is lower than the corresponding value of 5.0 mg kg^{-1} in the dry seed of *Mangifera indica*. This type of observation is also seen for Pb, Ca and Mg where all the values are lower in the wet *Mangifera indica* sample than in the corresponding dry sample. However, in the *Persea americana* values for Zn; Fe, Cu, Pb, Ca and Mg are high in the dry sample than in the wet sample. From the results, Not Detected (ND) is recorded for Cd, Cr and Al in both samples. The results obtained are higher than those reported for fruits[10], pepper seeds[11] and breadnut seed[12]. It has been shown that seeds are rich in minerals[13].

Table 7 and 8 are compared values of mineral contents of dry *Mangifera indica* and *Persea americana* and wet *Mangifera indica* and *Persea americana*, respectively. The CV (%) is low among the dry samples with Cu being the highest (47.2%) while Ca (7.85%) shows the lowest variation. Cd, Cr and Al are Not Detectable (ND). The dry weight concentrations of the minerals are not similarly distributed in the two samples, on the other hand, the CV (%) are also comparatively low in the wet samples. The low CV (%) is an indication of similar values of the minerals in the two samples. Significant differences exist in the mineral values at p= 0.05 (Table 7 and 8).

Essential elements are needed in significant quantities to form part of the rigid body structure, soft tissues and body fluids. They are needed for growth, formation of bones, teeth, blood and nerves[14]. The healthy functionality of nervous transmission, blood circulation, fluid regulation, cellular integrity, energy production and muscle contraction are influenced by

Table 5: Mineral content (mg kg^{-1}) of *Mangifera indica* seed (on dry extract basis)

Minerals	Wet sample	Dry sample	Mean	±SD	CV (%)
Zn	93.50	68.00	80.75	18.03	22.33
Fe	92.80	118.00	105.40	17.82	16.91
Cu	4.20	5.00	4.60	0.57	12.30
Mn	30.00	22.00	26.00	5.66	21.57
Cd	ND	ND	-	-	-
Cr	ND	ND	-	-	-
Al	ND	ND	-	-	-
Ca	325	468	396.50	101.12	25.50
Mg	540	667	603.50	89.80	14.88
Pb	1.2	2.5	1.85	0.92	49.69

ND-Not detected

Table 6: Mineral contents (mg kg^{-1}) of *Persea mericana* seeds (on dry extract basis)

Minerals	Wet sample	Dry sample	Mean	±SD	CV (%)
Zn	72.90	102.00	87.45	20.58	23.53
Fe	78.40	92.00	85.20	9.62	11.29
Cu	8.00	10.00	9.00	1.41	15.71
Mn	28.5	18.00	23.25	7.43	31.93
Cd	ND	ND	-	-	-
Cr	ND	ND	-	-	-
Al	ND	ND	-	-	-
Ca	457	523	490.00	46.67	9.52
Mg	625	667	642.00	29.70	4.60
Pb	0.80	2.50	1.65	1.20	72.85

ND-Not detected

Table 7: Mineral contents of dry *Mangifera indica* and *Persea americana* seeds compared

Parameter	*Mangifera indica*	*Persea americana*	Mean	±SD	CV (%)	Level of significance
Zn	68.00	102.00	85.00	24.04	28.28	
Fe	118.00	92.00	105.00	18.39	17.51	
Cu	5.00	10.00	7.50	3.54	47.20	
Mn	22.00	18.00	20.00	2.83	14.15	
Cd	ND	ND	-	-	-	*
Pb	2.50	2.50	0.00	0.00	0.00	
Cr	ND	ND	-	-	-	
Al	ND	ND	-	-	-	
Ca	468.00	523.00	495.50	38.89	7.85	
Mg	667.00	667.00	667.00	0.00	0.00	

*These are significant differences at $p<0.05$

Table 8: Mineral contents of wet *Mangifera indica* and *Persea americana* seeds compared

Parameter	*Mangifera indica*	*Persea americana*	Mean	±SD	CV (%)	Level of significance
Zn	93.50	72.00	82.75	15.20	18.37	
Fe	92.80	78.40	85.60	10.18	11.89	
Cu	4.20	8.00	6.10	2.69	44.10	
Mn	30.00	28.50	29.25	1.06	3.62	
Cd	ND	ND	-	-	-	
Pb	1.20	0.80	1.00	0.28	28.00	*
Cr	ND	ND	-	-	-	
Al	ND	ND	-	-	-	
Ca	325.00	457.00	391.00	93.34	23.87	
Mg	540.00	625.00	582.50	60.10	10.32	

There are significant differences at $p<0.05$

essential elements[15]. The non-essential and rare elements are not yet recognized by health authorities as essential to human or livestock nutrition, but may have some valid health benefits. However, vomiting, fatigue and headache could result if tin is consumed in large quantities and above threshold concentrations of cobalt in man could result in cardiac disease[16].

CONCLUSION

This study concludes that seeds of *Mangifera indica* and *Persea americana* of Akure, Nigeria are valuable sources of essential minerals and other nutrients which could be beneficial to the health of man and livestock. Further study is in progress into possible toxic and antinutrient factors, amino acid patterns, digestibility and fatty acid composition.

ACKNOWLEDGEMENT

The authors are grateful to the contributions of Mrs. O. Oladimeji, Mrs. O. Gabriel and Miss. B. Adeyeye for providing the technical assistance.

REFERENCES

1. Kulavit, W., K.M. Yokohama, S.T. Nakamoito and C.L. Chia, 1991. Mango economic. Department of Agriculture and Resources Economics CTAHR.
2. Anhwange, B.A., V.O. Ajibola and S.J. Oniye, 2005. Composition of bulk, trace and some rare earth elements in the seeds of *Moringa Oliefera* (Lam), *Detarium microcarpum* (Guill and P)err) and *Bauhinia monomdra* (Kurz). J. Food Tech., 3: 290-293.
3. Pearson, D.C., 1976. Chemical Analysis of Foods. 7th Edn. London; J and A Churchill.
4. Adeyeye, E.I. and F.A. Arogunjo, 1997. The nutritional value of the fruits from *Pyrus communis*, *Irvingia gabonensis* and *Mangifera indica* consumed in Nigeria. La Riv. Ital. Del. Sostanze Grasse- Marzo, XXIV: 117-121.
5. Ezeagu, I.K., C.C. Mertges, Proff and K.J. Petzke and A.O. Akinsoyinu, 2003. Chemical composition and nutritive value of some wild-gathered tropical plant seeds website: Fil...\ chemical composition and nutritive value of some wild-gathered, Tropical Plant Seeds. ht.
6. Usda Nutrient Database for Standard Reference, 2001. Apples nutrition facts. Health, food, diet. http: // www. the fruitspages. com/chartapples. Shtml.
7. Abulude, F.O., 2000. Chemical composition and nutritive values of *Carica papaya* and *Citrus sinensis* seeds J. Technoscience, 4: 25-27.
8. Adeyeye, E.I. and M.K.O. Otokiti, 1999. Proximate composition and some nutritionally valuable minerals of varieties of *Capsicum annum* L (Bell and Cherry peppers). Discov. Innov., 11: 75-81.
9. FAO/WHO, 1973. Energy and Protein Requirements. In Nutritional Evaluation of Protein Foods Eds P.L. Pelletand V.R. Young United Nations University. pp: 1-6.
10. Adeyeye, E.I. and O.O. Agesin, 1999. Nutritional composition of *Chrysophyllum albidum*, *Malus pumila* and *Psidium guajava* fruits. Bangladesh J. Sci. Ind. Res., 34: 452-458.
11. Abulude, F.O., 2004. Composition and properties of *Cola nitida* and *Cola acuminata* flour in Nigeria. Global J. Pure and Applied Sci., 10: 11-16.
12. Wiilliams, K. and N. Badrie, 2005. Nutritional composition and sensory acceptance of boiled breadnut (*Artocarpus camansis Blanco*) seeds. J. Food Tech., 3: 546-551.
13. Fagbemi, T.N. and A.A. Oshodi, 1993. Nutritionally valuable mineral composition and distribution in tropical chillies (pepper). Ghana J. Chem., 1: 344-348.
14. Reddy, M.B. and M. Love, 1999. The impacts of food processing on the nutritional quality of vitamins and minerals Adv. Exp. Med. Biol., 459: 99-106.
15. Schauss, A., 1995, (White papers). Minerals, Trace Elements and Human Health, Life Science Press Tacoma. W.A., pp: 72-89.
16. WHO, 1972. Health hazards of human environment. World Health Organization. Geneva, Switzerland pp: 72-89.