

Research paper

PROXIMATE AND MINERAL COMPOSITION OF NINE NIGERIAN FRUITS

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Authors' contributions

All the authors participated in carrying out the experiment. The experiment was designed by author EOA who equally drafted the manuscript which was read and corrected by author FEP Author EOS executed the experiment in the lab. All the authors read and approved the final manuscript as presented.

Abstract

This study was designed to determine the proximate and mineral composition of nine known fruits obtained from Rumuolumeni market, Rivers State of Nigeria. Fresh fruit samples of guava (*Psidium guajava*), banana (*Musa esculentus*), pawpaw (*Carica papaya*), orange (*Citrus sinensis*), apple (*Malau domistica*), watermelon (*Citrus lanatus*), soursop (*Annona muricata*), bush mango (*Irvingia gabonensis*) and pineapple (*Ananas comosus*) were collected from Rumuolumeni market in Rivers state of Nigeria and analysed. Two gram of each sample of fruits was dried and ashed at 500°C for 1hr. The ash was dissolved in 10% 25ml HCl and made up to 100ml with deionized water in a standard flask. Mineral contents were determined according to AOAC, (1990) using Atomic Absorption Spectrophotometer(AAS) (Perkin-Elmer Model 372). The nutrients compositions of the fruits showed that the amount of crude fibre ranged between 0.00 - 3.55g/100g; crude protein, 0.29 – 1.28g/100g; Lipid, 0.10 - 0.99g/100g; ~~protein, 0.29 – 1.28g/100g~~; carbohydrate, 7.50 – 18.46g/100g; dry matter 10.40 – 27.44g/100g; ash, 0.27 – 2.50g/100g and moisture, 77.30 – 89.60g/100g. Elemental analysis of minerals gave the range of concentrations as zinc, 0.06 – 1.26mg/g magnesium 14.67 – 45.71mg/g, iron 0.40 – 03.28mg/g, calcium, 07.00 – 84.90mg/g. and potassium 26.15 – 380.05mg/g. Concentrations of iron were highest in *A. comosus*, magnesium and potassium in *M. paradisaca*, zinc was highest in *I. gabonensis* and calcium was found to highest in *C. papaya*. The results showed that these fruits have safe and adequate dietary nutrients if consumed in the right proportion.

Key words: Fruits, mineral content, proximate, ~~water~~, Nigeria

Introduction

Nigeria, as a developing country is experiencing food shortage as a result of population growth, competition for fertile land, poverty, lack of agricultural inputs, poor loan scheme and incentives [1]. The diets of most Nigerians are high in carbohydrates and deficient in protein. Nutritionist have advised that eating at least five portions of fruits and vegetable a day can help people to maintain good health throughout their lives, protecting them from heart disease and cancer, Type II diabetes, kidney stones [2-4]. Fruits contain high quantity of water, carbohydrate, vitamins A, B1, B2, C, D and E; and minerals such as Ca, Mg, Zn,

Fe, K and organic compounds which are required in small amounts, to make the body function properly [5-8]. Many fruits are used to make beverages, such as fruit juice (Orange, apple, grape juices etc.) or alcoholic beverage such as wine, brandy or vinegar. Studies on metals have revealed their function in plants and animals which includes their role in osmotic regulations of the body fluids, enhances growth, and ensures healthy crops and animals, act as coenzyme and in formation of chlorophyll. Besides their dietary importance, they are also useful as nutrient supplement and recommended internationally as superior to processed foods. In view of the nutritional and health benefits of fruits, this study was designed to determine the proximate and mineral composition of nine known fruits obtained from Rumuolumeni market, Rivers State of Nigeria.

Materials and Methods

Sample preparation: Fresh ripe samples of pawpaw (*Carica papaya*), banana (*Musa paradisaca*), apple (*Malus domestica*), orange (*Citrus sinensis*) and guava (*Psidium guajava*), watermelon (*Citrus lanatus*), soursop (*Annona muricata*), bush mango (*Irvingia gabonensis*), pineapple (*Ananas comosus*) were obtained at Rumuolumeni market, Rivers state, Nigeria. They were washed in distilled water and refrigerated for a day to prevent spoilage before extraction of juice for laboratory analysis. Banana, guava, bush mango, pineapple, soursop and pawpaw were blended in moulinex blender separately and the juice were sieved into different clean beakers while the apple, orange, and watermelon juices were extracted using juice extractor into a clean beaker before the analysis.

Proximate composition determination

The ash, moisture and dry matter composition of samples were determined using the standard methods [9].

Determination of mineral composition

Two gram of each sample of fruits was dried and ashed at 500°C for 1hr. The ash was dissolved in 10% 25ml HCl and made up to 100ml with deionized water in a standard flask. Ca, Mg, K, Zn, Fe, contents were determined according to [9] using Atomic Absorption Spectrophotometer (AAS) (Perkin-Elmer Model 372).

Results and Discussion

Table 1 shows the proximate composition of the fruits investigated, moisture content varied between 75.00% in *Citrus sinensis* to 89.60% in *Citrus lanatus* with mean value of 82.17%. Moisture determination followed the following trend *Citrus lanatus* > *Carica papaya* > *Ananas comosus* > *Malus domestica* > *Psidium guajava* > *Annona muricata* > *Musa paradisaca* > *Irvingia gabonensis* > *Citrus sinensis*. These values are comparable to the work of Ashaye et al., (2005) [10]. All the fruits studied had high moisture content which is typical of fresh fruits at maturity [11].

The ash value ranged from 0.3% to 2.50% and had mean value of 1.32%. The ash content value compared favourably with most fruits value [12] but lower than those reported by Bello, Amoo and Lajide [1, 13]. The percentage ash of the sample gives an idea about the

inorganic content of the samples from where the mineral content could be obtained. This study shows that *Citrus lanatus* had the highest ash value (2.50%). Samples with high percentages of ash contents are expected to have high concentrations of various mineral elements, which are expected to speed up metabolic processes and improve growth and development [1]. The observed wide range in moisture and dry matter in the fruits are similar to those reported by Kohler and Bickoff [14]. And this accounts for rapid deterioration of fruits if left unprocessed for long after harvesting. The carbohydrate content of the fruits is low (7.50% to 18.60%). Samples with low carbohydrate content might be ideal for diabetic and hypertensive patients requiring for low sugar diets.

The protein concentration ranged from 0.29% to 1.28% for *Malus domestica* and *Psidium guajava*. Proteins are essential component of diet needed for survival of animals and humans, their basic function in nutrition is to supply adequate amounts of required amino acids in nutrition [15]. Protein deficiency causes growth retardation, muscle wasting, edema, abnormal swelling of the belly and collection of fluids in the body [16].

Table 1: proximate composition of fruit samples (mg/g)

Samples of fruits	Moisture (%)	Ash (%)	Dry matter (%)	Carbohydrate (%)	Protein (%)	Lipid (%)	Crude fibre (%)
Banana (<i>Musa paradisiaca</i>)	79.58	0.30	20.42	15.95	1.25	0.99	0.75
Guava (<i>Psidium guajava</i>)	80.53	1.53	19.47	15.43	1.28	0.53	0.21
Pawpaw (<i>Carica papaya</i>)	87.30	0.27	12.70				
Orange (<i>Citrus sinensis</i>)	75.00	2.05	25.00	18.46	0.87	0.11	3.55
Apple (<i>Malus domestica</i>)	85.05	0.50	27.44	13.55	0.29	0.40	0.00
Watermelon (<i>Citrus lanatus</i>)	89.60	2.50	10.40	7.50	1.05	0.55	1.50
Soursop (<i>Annona muricata</i>)	80.25	1.03	19.75	16.05	0.51	0.69	0.77
Bush mango (<i>Irvingia gabonensis</i>)	77.30	2.50	22.70	15.97	0.61	0.21	3.5
Pineapple (<i>Ananas comosus</i>)	85.07	1.23	14.93	12.06	0.39	0.10	0.61
Mean	82.17	1.32	19.20	14.37	0.78	0.45	1.36
Standard deviation	4.83	0.89	5.63	3.59	0.37	0.31	1.41
Coefficient of variation (%)	17.04	1.47	3.41	4.00	2.11	1.45	0.96

Table 2. Mineral composition of nine fruits (mg/g)

Samples of fruits	K	Fe	Ca	Mg	Zn
Banana (<i>Musa paradisacia</i>)	380.05	00.86	07.24	45.71	00.05
Guava (<i>Psidiumguajava</i>)	166.18	02.40	16.46	15.67	00.06
Pawpaw (<i>Carica papaya</i>)	358.37	00.46	84.90	44.04	00.24
Watermelon (<i>Citrus lanatus</i>)	125.00	00.40	07.00	30.21	00.75
Soursop (<i>Annonamuricata</i>)	026.15	01.40	17.43	32.50	00.37
Bush mango (<i>Irvingiagabonensis</i>)	077.95	03.21	14.35	14.67	01.26
Orange (<i>Citrus sinensis</i>)	126.36	01.19	33.35	20.10	00.35
Apple (<i>Maladomistica</i>)	280.10	00.43	18.65	27.12	00.51
Pineapple (<i>Ananuscomosus</i>)	261.03	03.28	16.45	25.20	00.15
Mean	187.37	1.49	21.66	26.36	0.61
Standard deviation	118.16	1.04	22.65	11.64	0.67
Coefficient of variation	1.59	1.43	0.96	2.26	1.12

Table 2 shows the result of the mineral composition of the nine fruits studied. Iron (Fe) is said to be an important element in the diet of pregnant women, nursing mothers, infants, convulsing patients and the elderly to prevent anaemia and other related diseases [17]. Fe is required for energy and endurance because it delivers oxygen throughout the body. But it is necessary only in small amounts for optimal health. The fruits with the highest iron content were *Ananuscomosus* (3.28mg/g) and *Irvingiamuricata* (3.21mg/g) respectively. The recommended daily allowance of iron for men is 7mg /day and 12-18 mg/day for women during pregnancy [8,18,19]. Magnesium (Mg) is needed for over 300 of our bodies 'most important biological processes, not the least of which is ATP energy production and muscular contractions. Nonetheless, it is most typically used by active individuals to prevent muscle cramping; to enhance muscle and nerve functioning; to relieve tight sore muscles; and to help improve bone density. Mg plays a major role in relaxing muscles along the airway to the lung thus allowing asthma patients to breathe easier. The daily value for Mg is 400mg. It plays fundamental roles in most reactions involving phosphate transfer, believed to be essential in the structural stability of nuclei acid and intestinal absorption while deficiency of magnesium in man is responsible for severe diarrhoea, migraines, hyper-tension, cardiomyopathy, arteriosclerosis and stroke [1]. The highest magnesium content was obtained from *Musa paradisacia* and the least is from *Irvingiagabonensis*.

Psidiumguajava contained the lowest concentration of zinc (00.06g/g) while *Citrus lanatus* (00.75mg/g) had the highest. Zinc is involved in thousands of bodily functions, such as proper cell growth and testosterone production [8]. Zinc is said to be an essential trace element for protein and nucleic acid synthesis and normal body development. It plays a central role in growth and development, vital during periods of rapid growth such as infancy, adolescence and during recovery from illness. Zinc deficiency has been largely attributable to the high phytic acid content of diets leading to poor growth, impaired immunity, and increased morbidity from common infectious diseases and increased mortality [20].

Conclusion

These essential elements are needed for growth, production of bones, teeth, hair, blood, nerves, skin, vitamins, enzymes and hormones. The healthy function of nervous transmission, blood circulation, fluid regulation, cellular integrity, energy production and muscle contraction are influenced by essential elements and too little of any essential element can lead to deficiency disease and too much of it any can be toxic [21].

References

1. Bello MO, Falade OS, Adewusi SR, Olawole NO. Studies on the chemical compositions and anti-nutrients of some lesser known Nigerian fruits. *African Journal of Biotechnology*, (2008); 7 (21): 3972-3979.
2. Wenkam A. Utilization and processing of fruits. Macmillan press, London, (1990); 5: 388-506.
3. Food Commission Food label fib. The Food Commission Research charity 94 White Lion Street, London N1 9PF. United Kingdom <http://www.foodcomm.org.uk> (2009). (Viewed 4/2/2013).
4. USDA: United State Department of Agriculture. Juice or fruit drink? Nibbles for Health 20 Nutrition Newsletters For Parents Of Young Children, Food And Nutrition Service, 1400 Independence Ave., S.W. Washington, DC 20250 USDA 1-2. (2003)
5. Okwu DE, Emelike IN. Evaluation of the phytonutrients and vitamin content of citrus fruits. *Int. J. Mol. Med. Adv. Sci.* (2006); (2): 1-6.
6. Onibon VO, Abulude FO, Lawal LO. Nutritional and anti-nutritional composition of some Nigerian fruits. *Journal of Food Technology*, (2007); 5 (2): 120-122.
7. Dosumu OO, Oluwaniyi OO, Awolola GV, Okunola MO. Stability studies and mineral concentration of some Nigerian packed fruit juices, concentrate and local beverages. *African Journal of Food Science*, (2009); 3 (3): 82-85.
8. Dimari GA, Hati SS. Vitamin C composition and mineral content of some Nigerian packaged juices drinks. *Journal of life and Physical Sciences*, (2010); 3 (2): 129-134.
9. AOAC Official Methods of Analysis, Association of Analytical Chemists, Washington DC (USA) 15th edition (1990).
10. Ashaye OA, Babolalao SO, Aina JO, Fasoyiro SB. Chemical and organoleptic characterization of pawpaw and guava leathers. *World Journal of Agricultural Sciences*, (2005); 1(1): 50-51.

11. Umoh IB. Commonly used fruits in Nigeria, In: Nutritional quality of plant foods. (EdsOsagie Au, EkaOu). Post-Harvest Research Unit University of Benin, Benin City, Nigeria.(1998).
12. Brain F A, Alan GC. Food Sci. Nutri.Health Edward Arnold, London, (1992); 8:22.
13. Amoo IO, Lajide L. Chemical composition and nutritional significance of the fruit of Nauclealatifolia. Riv.LtdSostanze Grasse, (1999); 76: 331-332.
14. Kohler GO, Bickott EM Leaf protein presented at the 3rd International Congress of Food science and Technology, Washington DC, . (1970); 9-14.
15. Pugalenth M, Vadivel V,Gurumoorthi P,Janardhanam K. Comparative nutritional evaluation of little known legumes *Tamarandusindica*, *Erythrinaindica*, *Sesbaniabispinosa*. *Trop. Subtrop.Agroecosyst.* (2004). 4:107-123.
16. Perkins-Veazie PM, Collins JK, Robert W. Screening carotenoid content in seeded and seedless watermelon fruit. *Journal of Horticultural Science*, (2005); 39, 830.
17. Oluyemi EA, Akinlua AA, Adenuga AA, Adebayo MB. Mineral content of some commonly consumed Nigerian foods. *Sci. Focus.* (2006); 11(1): 153-154.
18. National Health and Medical Research Council Recommended dietary intakes for use in Australia. Australian Government Publishing Service, G.P.O. Box 84, and Canberra Act 2601.(1991).
19. Waller MF,Haymes EM. The effects of heat and exercise on sweat iron loss. *Med. Sci. Sports Exerc.*(1996); 28 (2): 197-203.
20. Melaku U, Clive EW,Habtamon F. Content of zinc, iron, calcium and their absorption inhibitors in foods commonly consumed in Ethiopia. *Trace Elem.Exp. Med.*(2005); 10:29-35.
21. Schauss A. (White Papers) Minerals, trace elements and human health. Life Science press: Tacoma WA(1995). 2-23.