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Research Article

Comparative Analysis of Nutritional and Anti Nutritional Contents of Some Varieties of Mango (*Mangifera indica*) in Kaduna Metropolis-Nigeria

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Abstract: Three varieties of mangoes (*Mangifera indica*) namely; *Adansonia digitata* (Durshea*)* big seed, *Durio zubethinus murr* (Peter) middle seeded, *Foetide lour* (Julie) collected within Kaduna metropolis were subjected to proximate analysis. Analysis of the nutritional and anti-nutritional contents of the three varieties of mangoes revealed that moisture content, crude protein, carbohydrate, crude fat, ash content and vitamin c were 79.17, 1.97, 7.16, 1.89, 9.81 and 34.12% respectively for Durshea variety. The findings revealed that Peter (Middle Seeded) mango proximate values for all the nutrients analyzed were not significantly ($p>0.05$) different from the values obtained from Durshea result. The Julie (Small Seeded) mango's moisture content (72.04%) and carbohydrate contents (16.59 mg/100 g) were significantly ($p<0.05$) different from Durshea and Peter varieties. The findings also revealed that calcium contents were 0.15, 0.10 and 0.13% for durshea, peter and Julie, respectively. Iron and magnesium contents were present in small amount for all the three variaties. The contents of cyanogenic glycosides (0.28 mg/100 g), oxalates (1.60 mg/100 g) and phytate (0.62 mg/100 g) for durshea were not significantly different from peter and jullie varieties of the mango. The findings revealed that the three varieties of mango contain appreciable amounts of nutrients that the body required for its normal metabolic functions .The anti nutrients contents is negligible. The Durshea variety is the most recommended for human consumption because of its high lipids and calcium contents.

Keywords: *Adansonia digitata*, anti nutrients, *Durio zubethinus murr*, *Foetide lour*, mango

INTRODUCTION

Mango is a fruit belongs to the genus *Mangifera indica*, consisting of numerous species of tropical fruiting trees in the flowering plant family *Anacardiaceace*. The mango is indigenous to India, cultivated in many tropical and subtropical regions and distributed widely in the world. Mango is used as food in all stages of its development. Green or unripe mango contains a large portion of starch which gradually changes into glucose, sucrose and maltose as the fruit begins to ripe. It disappears completely when the fruit is fully ripe.

The half ripped mango is a valuable source of vitamin C, It contains more vitamin C than half ripe or fully ripe mangoes and it is also a good source of vitamins B_1 and B_2 and contains sufficient quantity of niacin. These vitamins differ in concentration in various varieties during the stages of maturity and environmental conditions. The ripe fruit is very wholesome and nourishing. The chief food ingredient of mango is sugar; the acids contained in the fruit are tartaric and malic acid, besides a trace of citric acid.

Mango contains phenols, this phenolic compound has powerful antioxidant and the antioxidant helps lower a person's risk of developing Alzheimer disease. The antioxidants are naturally occurring substance found in most plant (Godwin and Mercer, 1998). The mango is well-known for its medicinal properties both in unripe and ripe states. The unripe fruit is acidic, astringent and anti scorbutic. The skin of the unripe fruit is astringent and stimulant tonic. The back is also astringent and has a marked action on mucous membranes. Mango pickles preserved in oil and salted solution is used throughout India as food. However, these pickles, if extremely sour, spicy and oily are not good for health and should be specially avoided by those suffering from arthritis, rheumatism, sinusitis, sore throat and hyperacidity. The resinous gum from the trunk is applied on cracks on the skin of the feet and on scabies and is believed to be helpful in cases of syphilis (Curley and Mark, 1990).

Mango fruits sometimes may contain some anti nutrients which are believed to be toxic for human consumption. The anti-nutrients that may be present include lead, cadmium, phytate, oxalate which cause cancer. The objective of this research was to evaluate the nutritional and anti nutritional contents of three varieties of mangoes (*Mangifera indica*) namely; *Adansonia digitata magefera* (Durshea*)* big seed, *Durio zubethinus murr* (Peter) middle seeded, *Foetide lour* (Julie) respectively.

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MATERIALS AND METHODS

Sample collection: Three varieties of mangoes (*Mangifera indica*) namely; *Adansonia digitata magefera* (Durshea*)* big seed, *Durio zubethinus murr* (Peter) middle seeded, *foetide lour* (Julie) small seed were collected from Anguwan Gwari (Durshea), Gonin Gora (Peter) and T/Wada (Julie) in Kaduna state. Identification of the mango varieties was authenticated by a herbarium in the Department of Biological Science, Ahmadu Bello University Zaira and Kaduna State.

Determination of crude protein: Crude protein was determined by method described by AOAC (1995). One gramme of each sample was weighed into separated digestion flask and 10 g of a catalyst $NaSO_4$: $CuSO_4$ and 25 ml of concentrated H_2SO_4 were added. The sample was heated on a micro digestion bench which is thermostatically controlled to remove organic carbon for 2 h. After heating, the content of the flask was left to cool and was transferred to a round bottom flask with distilled water. A little piece of anti bumping granules was added to prevent pumping and 80ml of 40% NaOH solution was carefully added, mixed and then subjected to distillation until all the ammonia passed over into the standard sulfuric acid solution. It was titrated with standard 0.55 M Na0H solution to an end point. The conversion factor 6.38 was use to get the percentage protein contents.

$$\% \text{ crude protein} = \%N_2 \times \text{conversion factor}$$

Moisture content: The method described by AOAC (1995) was adopted. The method is based upon the removal of water from the sample and its measurement by loss of weight.

A clean crucible was weighed and dried in the oven (W_1); 1.0 g of each of the samples was weighed into the crucible (W_2) and was dried at 105°C, for twenty four hours. The crucible was then transferred from the oven to desicator, cool and reweighed (W_3). The % moisture content was calculated from:

$$\% \text{ Moisture content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Total ash: The AOAC (1995) method was used. The porcelain crucible was dried in an oven at 100°C for 10 min, cooled in a desicator and Weighed (W_1). Two grams of the sample was placed into the previously weighed porcelain crucible and reweighed (w_2) and then placed in the furnace for four hours at 600°C to ensure proper ashing. The crucible containing the ash was removed cooled in the desicator and weighed (w_3). The % ash content was calculated as:

$$\% \text{ Ash content} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

Determination of fat: The fat content was determined as in the AOAC (1995). A clean, dried 500 ml round bottom flasks, containing few anti-bumping granules was weighed (w_1) and 150 ml of petroleum ether was transferred into the flask fitted with soxhlet extraction apparatus. The round bottom flask and a condenser were connected to the soxhlet extractor and cold water circulation was put on. The heating mantle was switched on and the heating rate adjusted until the solvent was refluxing at a steady rate. Extraction was carried out for 6 h. The round bottom flask and extracted oil was cooled and then weighed (w_2).

$$\% \text{ crude fat content} = \frac{W_2 - W_1}{\text{Weight of sample}} \times 100$$

Determination of crude fibre: The method described by AOAC (1995) was used. 1.0 g of the finely ground sample was weighed out into a round bottom flask, 100 ml of 1.25% Sulphuric acid solution was added and the mixture boiled under a reflux for 30 min. The hot solution was quickly filtered under suction. The insoluble matter was washed several times with hot water until it was acid free. It was quantitatively transferred into the flask and 100 ml of hot 1.25% sodium hydroxide (NaOH) solution was added and the mixture boiled again under reflux for 30 min and quickly filtered under suction. The soluble residue was washed with boiling water until it was base free. It was dried to constant weight in the oven at 105°C, cooled in a desicator and weighed (C_1).The weighed sample (C_1) was incinerated in a muffle furnace at 300°C for about 30 minutes, cooled in the desicator and reweighed (C_2). The loss in weight of sample on incineration = $C_1 - C_2$.

$$\% \text{Crude fibre} = \frac{C_1 - C_2}{\text{Weight of original sample}} \times 100$$

Determination of carbohydrate: The total carbohydrate content was determined by difference. The sum of the percentage moisture, ash, crude protein and crude fibre was subtracted from 100 (Muller and Tobin, 1980).

Total carbohydrate = 100 - % moisture + % Ash + % fat + % protein + % fibre.

Determination of mineral elements: One gram of the samples was weighed into the digestion flask of 250 ml capacity a 25 ml of Nitric acid, perchloric and sulphuric acid was added to each sample. The flask was fixed to a clamp and kept over night. When the initial reaction subsided, the temperature of the micro-digestion bench was increased slowly from 180°C to 200°C. The digestion was continued at that temperature until no visible particles observe, the temperature was raised up to 240°C and the digestion acid was evaporated until dense white fume formed within the digestion flask. After the digestion was completed, the content of the flask was filtered and the digested material was kept in a dust proof glass chamber. The samples were digested with the disappearance of brown fumes, diluted to 100 ml for AAS Analysis using suitable hallow cathode lamp.

Determination of vitamins c (ascorbic acid) concentration: Hundred gram fresh samples was cut into small pieces and was grinded in a mortal and pestle. Ten ml of distilled water was added several times while grinding the samples and decanting off the liquid extract into a 100 ml volumetric flask. Finally, the ground samples pulp was strain through cheese cloth. The pulp was rinsed with a few 10 ml portions of distilled water and all filtrate and washing were collected in the volumetric flask. The extracted solution was made to 100 ml with distilled water. Five ml of the aliquot sample solution was pipetted into 250 ml conical flask and 20 ml of distilled water, 2 ml of starch indicator solution added to each of the samples. The samples were titrated rapidly with an accurately standardized 0.01N iodine solution containing 16 g potassium iodide per acid. The end point of the titration was identified as the colour changes.

Each millititre of iodine is equivalent to 0.88 mg of ascorbic acid, lactone form. The milligram of vitamin C per millitre can be calculated from the relationship, titre value x 0.88 mg

Determination of oxalate: Oxalate was determined by using the method of Oke (1969). One gram of the sample was placed in a 250 ml volumetric flask, 190 ml of distilled water and 10 ml of 6M HCl were added. The mixture was warmed in a water bath at 90°C for 5 h and the digested sample was centrifuged at a speed of 2,000 rpm for 5 min. Fifty ml aliquots of the supernatant was reduced by evaporation to 25 ml, the brown precipitate was filtered off and washed. The combined solution and washings was titrated with concentrated ammonia solution in drops until salmon pink colour of methyl orange changed to faint yellow. The solution was heated in a water bath to 90°C and the oxalate was precipitated with 10 ml of 5% calcium chloride ($CaCl_2$) solution. The solution was allowed to stand overnight and then centrifuged. The precipitate was washed into a beaker with hot 25% sulphuric acid (H_2SO_4) diluted with 125 ml with distilled water and after warming to 90°C, it was titrated against 0.05 M $KMnO_4$:

1 ml 0.05M $KMnO_4$ = 2.2 mg oxalate

Determination of phytate by Reddy (1978): Four gram of the grinded sample was weighed into a beaker and was soaked in 100 ml of 2% HCl for 5 h and then filtered. Twenty five ml of the filtrate was taken into a conical flask; 5 ml of 0.3% potassium thiocynate solution was added. The mixture was titrated with a standard solution of $FeCl_3$ until a brownish-yellow colour persisted for 5 min.

The concentration of the $FeCl_3$ was 1.04%w/v and Mole ratio of Fe to phylate = 1:1

$$\text{Concentration of phytate phosphorous} = \frac{\text{Titre value} \times 0.064}{100 \times \text{weight of sample}}$$

phytic acid content was calculated on the assumption that it contains 20% phosphorus by weight.

Determination of cyanide content: Alkaline filtration method of AOAC (1995) was adopted. Ten gram of each grinded sample was soaked in a mixture of 200 ml distilled water and 10 ml of phosphoric acid. The mixture was left for twelve hours to release all bounded Hydrogen Cyanide (HCN) (soaked to dissolve all the cyanide content). A drop of antifoaming agent (tannic acid) and antibumping agent were added and the solution distilled until 150 ml of the distillate was collected, 20 ml of distillate was taken in a conical flask and diluted with 40 ml of distilled water, 8 ml of 6M Ammonium hydroxide and 2 ml of 5% potassium iodide solution were added. The mixture was titrated with 0.02 M silver solution using a micro burette until a faint but permanent turbidity was obtained:

$$1\text{mL } 0.02\text{M } AgNO_3 = 1.08\text{mg HCN} \quad 0.2 \times 1.08 = \frac{\text{Titre value}}{10} \times \frac{100}{1}$$

RESULTS AND DISCUSSION

Three varieties of mango namely Durshea (Big Seeded), Peter (Middle Seeded) and Julie (Small

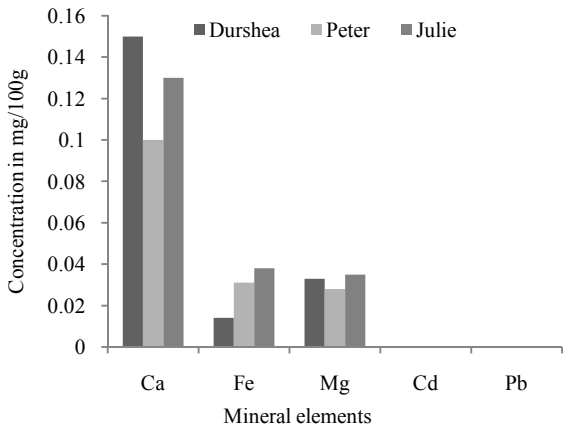

Fig. 1: Concentration of minerals in Durshea, peter and Julie varieties of mango

Seeded) were investigated for their protein, carbohydrate, lipids and moisture and ash contents. Similarly, minerals elements like Ca^{2+}, Mg^{2+}, Fe^{2+}, Pb^{2+} and Cd^{2+} contents were also determined. Vitamin C (ascorbic acid) and the anti nutritive characteristic (oxalate, phytate and cyanide) of the three mango varieties were assessed.

The results in Table 1 show percentage composition of moisture and nutritive contents of the three varieties of mango. The middle seeded (Peter) variety has the highest moisture content of 79.76%, while the small seeded (Julie) has the lowest value of 72.04%. Our findings also revealed that the protein, carbohydrate and vitamin C contents of small seeded (Julie) fruit has the highest percentage composition values of 2.16, 16.59% and 35.20 mg/100 g, respectively. The big seeded (Durshea) variety has the lowest values for protein, carbohydrate and vitamin C at 1.97, 7.16% and 34.12 mg/100 g, respectively. Similar studies conducted by Mukherjee (1953) also reported that edible portion of ripe mango fruits is 60-70 % by weight. A typical composition of the mesocarp is: water 84%, sugar 15 % (varies from 10-20%), protein 0.5%. Unripe fruit are rich in starch, which is hydrolysed to sugars during ripening. The fruit is an important source of vitamin A, fair in vitamin B and with varying quantities of vitamin C. He further revealed that the seeds contain: carbonhydrate 70%, fat 10% and protein 6 %. For the lipid content, the big seeded (Durshea) variety has the highest value of 1.89%, while the middle seeded (Peter) has the lowest value of 1.52%.Lipid contents for the big seeded (Durshea) variety was significantly ($p<0.05$) different from the other two varieties as revealed in Table 1.

Figure1 shows the percentage mineral contents of the three varieties of mango that were investigated. Our

Table 1: Mean moisture and nutrient contents in the three varieties of mango

Sample	Moisture (%) ±S.D.	Protein (%)±S.D.	Carbohydrate (%) ±S.D.	Lipid (%) ±S.D.	Ash (%) ±S.D.	Vitamin C±S.D. (mg/100 g)
Durshea	79.74±4.29	1.97±0.15	7.16±0.35	1.89±0.01*	9.81±1.55	34.12
Peter	79.76±0.93	2.13±0.38	10.19±052	1.52±0.28	6.40±0.98	35.10
Julie	72.04±1.47*	2.16±0.36	16.59±1.96*	1.57±0.14	7.64±1.04	35.20

SD = Standard Deviation; *: Significantly different ($p<0.05$) from control group

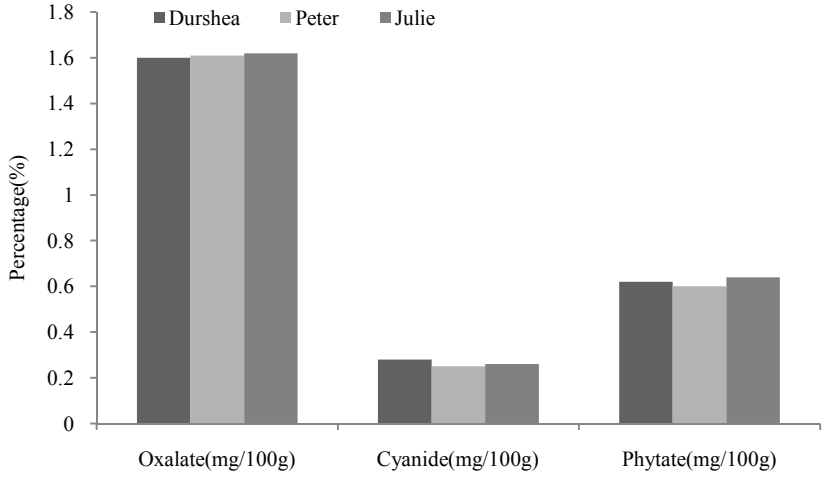

Fig. 2: The anti nutritive value of Durshea, peter and Julie varieties of mango

analysis revealed that the mineral contents, for the big seeded (Durshea) have the highest calcium content of 0.15%, while the middle seeded (peter) has the least value of 0.10%. Iron was found to be highest in the small seeded variety with a value of 0.038% compared with the least value of 0.0114% found in the big seeded variety. Magnesium was found to be highest in the small seeded variety with a value of 0.035%, while the middle seeded variety contained the least value of 0.028%.

The anti nutrients results shown in Fig. 2 reveals that the small seeded variety has the highest values for oxalate and phytate at 1.62 mg/100 g and 0.64 mg/100 g respectively. The small seeded variety has the highest value for phytate at 0.64 mg/100 g, while middle seeded variety has the least value of 0.60 mg/100 g. The highest cyanide value of 0.028 mg/100 g was found in the big seeded variety compared with least value of 0.25 mg/100 g for the middle seeded variety.

CONCLUSION

The findings reveal that the three varieties of mango contain appreciable amounts of nutrients that the body requires for its normal metabolic functions. The anti nutrient contents is negligible by international standard. The Durshea variety is most recommended for human consumption because of its high lipids and calcium contents.

REFERENCES

AOAC, 1995. Official Method of Analysis of the Association of Official Analytical Chemist. 16th Edn., Association of Official Analytical Chemists, Washington, DC, USA.

Curley, S. and G. Mark, 1990. The Natural Guide to Good Health. Supreme Publishing, Lafayette, Louisiana.

Godwin, T.W. and E.F. Mercer, 1998. An Introduction to Plant Biochemistry. 2nd Edn., Pergamon Press, Oxford, New York.

Mukherjee, S.K., 1953. Origin, distribution and phylogenic affinity of the species of *Mangifera* L. J. Soc. Linn. London, 55: 65-83.

Muller, H.G. and G. Tobin, 1980. Nutrition and Food Processing. Groom Helm Ltd., London, England.

Oke, O.L., 1969. Chemical studies on some Nigerian foodstuffs. Latum W. Afr. J. Biol. Appl. Chem., 8: 53-56.

Reddy, P., 1978. Phytate content of food plant and some prepared foods. J. Sci. Food Agric. Wiley Inter. Science, pp: 186-191.