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The Effects of Traditional Processing Methods on Micro-Elements of African Breadfruit (*Treculia Africana)*

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ABSTRACT

African breadfruit (*Treculia africana*) seeds were subjected to two commonly traditional processing methods (cooking /boiling and roasting). The *Treculia africana* seeds samples analyzed were **A** (raw), **B** (boiled /cooked) and **C** (roasted). The effects of these traditional processing methods on the micro- elements contents (mg/100g) of *Treculia africana* were assayed. The micro-elements of interest were Cd, Pb, Zn, Mn, Cu, Fe and Mo respectively. The results showed that the traditional processing methods affected the copper and iron contents of the *Treculia africana* significantly at $P \leq 0.05$. The copper content (mg/100g) of the roasted (0.053 ± 0.009) was highest compared with the raw (0.033 ± 0.003), while the boiled was lowest compared with the raw and roasted at $P \leq 0.05$. The same trend was also observed in iron contents (mg/100g) of the samples. The iron contents was highest in the roasted (0.337 ± 0.005) and least in the boiled (0.157 ± 0.012) compared with the raw samples (0.257 ±0.006). The order of the effects of these traditional processing methods on copper and iron contents of the samples are $Cu_{Roasted} > Cu_{Raw} > Cu_{Boiled}$ and $Fe_{Roasted} >>> Fe_{Raw} >>> Fe_{Boiled}$ respectively. This shows that roasting increased the iron contents of the sample, while boiling decreased it compared with the raw sample $P \leq 0.05$. The manganese, molybdenum, zinc and cadmium contents (mg/100g) of the samples were not affected significantly at $P \leq 0.05$. The lead (Pb) contents (mg/100g) were not detected after the heat treatment, confirming the detoxification effects of heat. Therefore roasting could enhance the micro-element contents of *Treculia africana* seeds prior to ingestion, especially the iron and copper which are needed in many biosynthetic pathways.

Key words: *Treculia africana,* micro-element, Traditional processing methods

Introduction

The African breadfruit tree (*Treculia africana* Decn var africana) is a member of the Moracea family and it grows in the forest zone, particularly the coastal swamp zone (Agbogidi and Onomeregbor, 2008). The species is a large tree which grows up to 30m high and it flowers between October and February (Salami, 2002). It is widely grown in Southern Nigeria for its seeds and it is known by various tribal names in the country. Its seeds are commonly called by various tribal names in Nigeria. Such names include "afon (Yoruba), "barafuta" (Hausa), "Ize" (Bini) "eyo" (Igala) "edikang" (Efik) and "Ukwa"' (Igbo) (Irvine, 1961, Onweluzo and Odume (2008)). *Treculia africana* is commonly called African breadfruit because of its large compound fruit (Ejiofor, 1988). The seeds have an excellent polyvalent dietetic value whose biological value exceeds even that of soybeans (WAC, 2004).The fruit is hard and spongy in texture when ripe and contains numerous seeds like orange pips embedded at various depths in the fleshy pulp (Ejiofor, 1988; Enibe, 2001). A mature seed consists of an outer covering or seed coat and an inner edible endosperm. The husk is coated with a thin viscous highly hydrated layer or mesocarp similar to the coffee bean mucilage. African breadfruit seed husk is brown in colour but the colour changes to black due to oxidation after a fermentation period that varies between 6 to 12 days. The fermentation is done to degrade the fruit pulp and seed mucilage in order to facilitate the extraction of the seeds. The traditional fermentation process as a method of seed extraction and demucilagination imparts a characteristic offensive odour to the seeds. Besides, subsequent cleaning of the seeds after fermentation is slow, dirty and tedious requiring very large volumes of water. African breadfruit is an important food item that contributes immensely to the diet of Nigerians. Iwe and Ngoddy (2001) reported the development of a mechanical dehulling process for African breadfruit however the seeds need to be extracted from the fruit heads and demucilaginated before it can be dehulled prior to processing for eating. It is commonly roasted, cooked, mashed and consumed either directly as snack food or as flour for use in soup thickening and cakes. This work looked at the effects of the two common traditional processing methods (roasting and cooking/boiling) on the seeds of *Treculia africana*.

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Materials and Methods

Source of Materials:

The *africana Treculia* (Bread fruit) seeds were sourced from Umudike market, Abia state and other facilities were obtained from the central Laboratory services unit of National Root Crop Research Institute Umudike, Abia State, Nigeria.

Equipment and Instrument Used:

The under listed equipment and instruments were used in the practical proper: citizen digital weighing balance , Cliffton electric hot plate, Carbolite electric oven (dryer), Gallenkamp electric muffle furnace, Perkin Elmer atomic absorption spectrophotometer, Ceslab fume cupboard, Arthur Thomas laboratory mill, Excello all glass distiller, and general laboratory glass wares and consumables.

Chemicals /Reagents Used:

All chemicals and reagents used in this project work were of analytical grade (ANALAR) and include those mentioned in the body write-up on methods of analysis.

Sample Preparation:

The fresh *africana Treculia* seeds were visually examined for the presence of diseased or shredded ones which were removed. Further detection of bad seeds was done by pouring water into a trough containing the seeds. Bad seeds floated on top and were removed. The "healthy" seeds were cleaned to drain dry and then divided into three groups labelled A, B and C representing the three samples *viz* Raw, Boiled/Cooked and Roasted respectively.

Raw Sample:

The seeds in group A (Raw) were dried in the oven at 65^0C for 8 hours and dehulled manually by passing a wooden roller over the seeds spread on a laboratory bench. The graded seeds were winnowed to remove the hulls, while the cotyledons were dried further in the oven until they were brittle enough to grind. The dry sample was ground in a laboratory mill in which it was sieved through a 1mm test sieve to obtain powdered processed sample used in the analysis.

Boiled Sample:

The seeds were put in an aluminum pot and water was added to it to cover the seeds completely. The seeds in the pot were heated on an electric stove (hot plate) until it boiled. Boiling was allowed to last for an hour before the boiled seeds were removed to drain dry. They were spread on a laboratory wooden tray and dried in the oven at 65^0C for 8 hours. The boiled dry seeds were dehulled as described earlier, dried further at the same temperature until they were brittle. Then the seeds were ground in a Laboratory mill as before to obtain the processed sample used in the analysis.

Roasted Sample:

Roasting was done using the traditional method in which the seeds were put in a bolan earthen pot (clay) and placed on an electric stove. The seeds were turned manually until they roasted well. The roasted seeds (with most of the hulls gone under the heat) were then dehulled manually. The roasted seeds were ground as described earlier to obtain the processed sample used in the analysis.

Sample Analysis:

Micro-elements (minerals) in the samples were determined by atomic absorptions spectrophotometery following dry ash acid extraction method (James, 1995). A measured weight of each sample (5.0g) was put in porcelain crucible and incinerated in a muffle furnace until it becomes ashes. The resulting ash was dissolved in 10mls of 2M HCl solution and made up 100mls in a volumetric flask. The filtrate from each sample was filtered through Whatman No. 42 grade of filter paper to obtain the extract used in the analysis.

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Atomic Absorption Spectrophotometric (AAS) Analysis:

In accordance with the manufacturers' instructions, the instrument, Perkin Elmer atomic absorption spectrophotometer (AAS) PE 600c, was set up. It was switched on and allowed for 15mins equilibration period. It was then set up by putting in place the hollow cathode tube appropriate for the element being determined. The monochromator was set at the wavelength of the element being determined, Example, 325nm for Copper. With these in place, the instrument was flushed by aspirating distilled de-ionized water in it. It was then calibrated at zero with the reagent blank (HCl solution).

Meanwhile, standard solutions of each of the test elements being determined were prepared separately and diluted in series according to chosen concentrations. The diluted solutions of the test elements were aspirated in-turns into the instrument and their respective absorbencies were recorded and plotted into a standard curve. Then the sample extracts were aspirated in-turns into the instrument and their absorbance were also recorded. The standard curve was used to extrapolate contents of the test element in the sample extract.

The general formula below was used to quantify the content of each element in the samples tested.

$$E\ (mg/100g) = \frac{100}{W} \times \frac{X}{1000} \times D$$

Where: E = element being determined, W = weighing of sample used, X = concentration (in ppm) obtained from the standard curve, D = Dilution factor applied

Table 1: The results of the effects of traditional processing methods on the mineral contents (mg/100g) *africana Treculia* seeds

Samples	Fe (mg/100 g)	Cu (mg/100 g)	Mn (mg/100 g)	Mo (mg/100 g)	Zn (mg/100 g)	Cd (mg/100 g)	Pb (mg/100 g)
Raw	0.257±0.005**	0.033±0.005*	0.106±0.005	0.033±0.005	0.100±0.008	0.027±0.005	0.007±0.005
Boiled	0.157±0.012**	0.023±0.005*	0.023±0.005	0.033±0.005	0.083±0.005	0.023±0.005	Not detected
Roasted	0.337±0.005**	0.053±0.009*	0.393±0.250	0.027±0.005	0.087±0.005	0.017±0.005	Not detected

Iron (Fe), Copper (Cu), Manganese (Mn), Molybdenum (Mo), Zinc (Zn), Cadmium (Cd), Lead (Pb)
Values are Means ± Standard deviation Values with Asterisk (*) are Significant, while ** are highly significant at $p \leq 0.05$

Results and Discussion

The results as shown in table 1.0, shows that the traditional processing methods affected the copper and iron contents of the *Treculia africana* significantly at P≤0.05. The copper content (mg/100g) of the roasted (0.053 ± 0.009) is highest compared with the raw (0.033 ± 0.005), while the boiled (0.023±0.005) was lowest compared with the raw and roasted at P≤0.05. The same trend was also observed in iron contents (mg/100g) of the samples. The iron contents was highest in the roasted (0.337 ± 0.005) and least in the boiled (0.157 ± 0.012) compared with the raw samples (0.257 ±0.006). The order of the effects of these traditional processing methods on copper and iron contents of the samples are $Cu_{Roasted} > Cu_{Raw} > Cu_{Boiled}$ and $Fe_{Roasted} >>> Fe_{Raw} >>> Fe_{Boiled}$ respectively. This shows that roasting increased the iron contents of the sample, while boiling decreased it compared with the raw sample P≤0.05. The manganese, molybdenum, zinc and cadmium contents (mg/100g) of the samples were not affected significantly at P≤0.05. The lead (Pb) contents (mg/100g) were not detected after the heat treatment, confirming the detoxification effects of heat.

Conclusion:

Therefore roasting could enhance the micro-element contents of *Treculia africana* seeds prior to ingestion, especially the iron and copper which are needed in many biosynthetic pathways.

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