American Journal of Food and Technology 1 (1): 77-80, 2006
ISSN 1557-4571


# Microbial and Chemical Qualities of Raw and Trona Processed African Breadfruit (*Treculia africana* Decne)

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**Abstract:** A comparative study of the microbial and chemical qualities of African breadfruit, *Treculia africana* Decne raw seed and seed boiled with trona was investigated. There was a significant ($p<0.05$) decrease in the viable count of the seed boiled with trona (6.28 cfu $g^{-1}$) when compared to the raw seed (6.53 cfu $g^{-1}$). Bacteria isolated from the raw seed include *Bacillus* sp., *Staphylococcus* sp. and *Micrococcus* sp. while in the boiled seed and seed boiled with trona, only *Bacillus* sp. was isolated. The protein, fibre and ash content of the raw seed sample was significantly ($p<0.05$) higher when compared to the boiled seed and seed boiled with trona. The antinutrients viz; phytate, tannin and cyanide of the boiled seed and seed boiled with trona were significantly ($p<0.05$) lower when compared to the raw seed. Boiling *T. africana* seed with trona improve the microbial quality and reduce the antinutrient content, however, the protein, ash and carbohydrate content of the seed boiled trona reduced when compared to the raw seed.

**Key words:** *Treculia africana,* boiling, trona, microbial, chemical, quality

## Introduction

African breadfruit (*Treculia africana* Decne) is a tropical tree crop belonging to the taxonomic family moraceae, genus, Treculia (Enibe *et al*., 2003). The family consist of about 50 genera and over 1000 species (Tindal, 1965). It can be cultivated from seed and buds. Seed propagated *T. africana* fruits within four years at reduced height (Okafor, 1980).

Enibe *et al*. (2003) stated that post harvest processing of the fruit heads can be done in two ways. The harvested fruit head can be sliced and the seeds extracted manually. The mucilaginous layer on the freshly extracted seeds can then be removed using graded concentrations of trona (1-5%) and wood ash as hydrolysing acids for 5-25 min. It can also be processed by partial fermentation of the fruit for some days after which the mucilaginous layer is removed using sand instead of wood ash. The extracted seeds from either method can be boiled, dried and put to various uses.

The seed is a rich source of vegetable oil (10%), protein (17%), carbohydrate (40%) as well as minerals and vitamins (Enibe *et al*., 2003). Many delicacies including porridges are commonly produced from the seed. Sunday *et al*. (2000) suggested that pastries, weaning foods, breakfast cereals and beverages can be developed from the seed. In the Southern part of Nigeria, *T. africana* seed is normally processed for consumption by boiling with trona. Trona is the second most used salt in Nigeria. It is locally known as "kaun". It is a hydrated sesquicarbonate of sodium (Makanjuola and Beetlestone, 1975). It is commonly used as tenderising agent of food materials such as pulses, cereals, meat and vegetables (Ankara and Dovlo, 1978). The present study was aimed at assessing the microbial and chemical qualities of raw and trona processed African breadfruit (*Treculia africana*).

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## Materials and Methods

*Materials*

Fresh seeds of *T. africana* were bought at Oba's Market, Akure. The seeds were transferred to the Microbiology and Food Science and Technology laboratories of the Federal University of Technology, Akure in a sterile polythene bag. The study was conducted between May to August 2005.

*Treatment of Seeds*

The seeds were weighed (10 g) each into 3 different portions. The first part (A) was analysed immediately to determine the microbial and chemical qualities. The second portion (B) was boiled for 30 min after which it was left for 6 h for adequate cooling. Trona (0.2 g) was added to the third portion (C), which was also boiled for 30 min after which it was left for 6 h to cool. The three different samples (A, B and C) were subjected to microbial and chemical analyses.

*Microbial Analysis*

Nutrient agar (Oxoid) and Potato dextrose agar (Oxoid) were prepared according to manufacturer's instruction and used for the isolation of bacteria and fungi, respectively.

Standard microbiological methods were used for the characterisation of bacteria and fungi isolates (Buchanan and Gibson, 1974; Barnet and Hunter, 1972).

*Chemical Analysis*

The proximate composition (ash, fat, crude fibre and moisture content) of *T. africana* samples was determined using standard Association of Official Analytical Chemists (AOAC, 1984) method. Protein content was determined using the microkjeldah method (N×6.25). Percentage soluble carbohydrate was determined by subtracting the sum of percentage ash, crude fibre, crude protein, crude ash and moisture content from one hundred.

Antinutrients viz., tannin, phytate and cyanide were evaluated by the methods of Makkar *et al.* (1993), Wheeler and Ferrel (1971) and De Bruijn (1971), respectively.

*Analysis of Data*

The data gathered were analysed using one-way analysis of variance and Duncan Multiple Range Test compared means.

## Results

*Microbial Quality of T. africana Seed*

The microbial load reduced significantly ($p<0.05$) when the seeds were boiled. There was a further significant reduction in the microbial load when the seed was boiled with trona (Table 1).

*Bacillus* sp., *Staphylococcus* sp., *Micrococcus* sp. and *Rhizopus stolonifer* were isolated from the raw seed while *Bacillus sp.* was the only bacterium isolated from the cooked seed and the seed boiled with trona. *Saccharomyces cereviseae* and *Byssochlamys fulva* were, respectively isolated from boiled seed and seed boiled with trona (Table 2).

Table 1: Total viable counts of raw and heat processed *Treculia africana* seeds

| Treatments | Microbial Load (cfu $g^{-1}$)* |
|---|---|
| A | $6.53\pm0.03^{c}$ |
| B | $6.38\pm0.02^{b}$ |
| C | $6.28\pm0.02^{a}$ |

* Values are means±SEM of 3 replicates. Values with different superscript are significantly different ($p<0.05$). A: Raw seed; B: Seed boiled for 30 min; C: Seed boiled with trona

Table 2: Microorganisms isolated from raw and heat processed *T. africana* seeds

| Microorganisms | A | B | C |
|---|---|---|---|
| *Micrococcus* sp. | + | -- | -- |
| *Staphylococcus* sp. | + | -- | -- |
| *Bacillus subtilis* | + | + | + |
| *Rhizopus stolonifer* | + | -- | -- |
| *Saccharomyces cereviseae* | -- | + | -- |
| *Byssochlamya fulva* | -- | -- | + |

+: Present; --: Absent; A: Raw seed; B: Seed boiled for 30 min; C: Seed boiled with trona

Table 3: Proximate compositrion (% wet weight basis)* of raw and boiled *T. africana* seed samples

| Proximate composition | A | B | C |
|---|---|---|---|
| Protein | $22.21\pm0.20^{c}$ | $11.41\pm0.02^{b}$ | $10.00\pm0.00^{a}$ |
| Fat | $2.39\pm0.01^{a}$ | $2.85\pm0.03^{b}$ | $5.74\pm0.02^{c}$ |
| Crude fibre | $7.74\pm0.01^{c}$ | $2.65\pm0.01^{b}$ | $2.13\pm0.02^{a}$ |
| Ash | $5.70\pm0.02^{c}$ | $0.90\pm0.03^{a}$ | $1.30\pm0.02^{b}$ |
| Carbohydrate | $51.44\pm0.02^{cc}$ | $16.40\pm0.02^{a}$ | $19.30\pm0.02^{b}$ |
| Moisture content | $10.23\pm0.01^{a}$ | $64.82\pm0.09^{c}$ | $60.45\pm0.39^{b}$ |

* Values are means±SEM of 3 replicates. Values with different superscript are significantly different ($p<0.05$). A: Raw seed; B: Seed boiled for 30 min; C: Seed boiled with trona

Table 4: Antinutrient content (mg/100 g wet weight basis)* of raw and boiled seeds of *T. africana*

| Antinutrients | A | B | C |
|---|---|---|---|
| Phytate | $2.30\pm0.06^{c}$ | $1.60\pm0.00^{b}$ | $1.30\pm0.00^{a}$ |
| Tannin | $0.012\pm0.00^{b}$ | $0.00\pm0.00^{a}$ | $0.00\pm0.00^{a}$ |
| Cyanide | $1.34\pm0.00^{c}$ | $0.86\pm0.01^{b}$ | $0.66\pm0.03^{a}$ |

* Values are means±SEM of 3 replicates. Values with different superscript are significantly different ($p<0.05$). A: Raw seed; B: Seed boiled for 30 min; C: Seed boiled with trona.

*Chemical Quality of T. africana Seed*

The protein, fibre and ash content of the raw seed sample was higher when compared to the boiled seed and seed boiled with trona (Table 3). However, the fat and moisture contents of the boiled seed samples (fat, 2.85%; moisture content 64.82%) and seed boiled with trona (fat, 5.74%; moisture content, 60.45%) were higher and significantly different ($p<0.05$) from the raw seed. The antinutients level in the boiled seed and seed boiled with trona were significantly lower ($p<0.05$) when compared to the raw seed (Table 4).

## Discussion

*Treculia africana* Decne seed is an important food item in many parts of Nigeria. The seed is rich in carbohydrate, fat, protein and fibre (Nwufor and Mba, 1987). It may be eaten after boiling or frying (roasting). Sunday *et al.* (2001) had earlier reported that boiling proved more effective than roasting in reducing the levels of trypsin inhibitor, phytic acid and polyphenols in *T. africana* seed.

In the present study, *T. africana* seed was boiled with trona and it was observed that the microbial load and type after boiling with trona was significantly ($p<0.05$) lower than in the raw seed (Table 1 and 2). The predominant bacteria in the raw seed are *Staphylococcus* sp., *Micrococcus* sp. and *Bacillus* sp. Micrococci are known to be part of the fermentation flora of some foods (Jay, 1996). *Bacillus* sp. was the only bacteria isolated from the boiled seed and the seed boiled with trona. Bacilli are known to produce spore (Jay, 1996) and this may be responsible for their ability to survive in the heat treated seeds. The results of the proximate composition reveal some differences in the raw seed

when compared to the boiled and boiled with trona seeds. The protein, ash and fibre contents in the raw seed were high and significantly different ($p<0.05$) when compared to the heat treated samples (Table 3). However, the fat and moisture content of the boiled seed and seed boiled with trona were higher and significantly different ($p<0.05$) from the raw seed. A report by Sunday *et al.* (2000) revealed that heat processed samples of *T. africana* had significantly higher and more stable water and fat absorption capacities. In essence, heat processing has a lowering effect on the protein, ash and carbohydrate content of the seed when compared to the raw seed.

The antinutrients (tannin, phytate and cyanide) contents were significantly lower ($p<0.05$) in the boiled *T. africana* seeds when compared to the raw seeds. Fasasi *et al.* (2003) had earlier reported a significant reduction in oxalates, phytate, tannin and cyanide contents of *T. africana* seeds fermented, autoclaved and toasted. A further reduction of phytate, tannin and cyanide was observed in the seeds boiled with trona (Table 4). This is an indication that the trona may facilitate the reduction of the levels of these antinutrients in the seed. The mechanism behind this is not yet known.

The results of the present study reveal that boiling *T. africana* seeds with trona may further increase the microbial quality and thereby make it safe for consumtion. Moreover, boiling the seeds with trona may further reduce the level of antinutrients of the seeds and consequently improve the nutritional potentials *T. africana* seeds.

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