Research Article

Proximate, minerals and antioxidant prospective of sub – saharan processed local biscuit (Akuri) from wild edible fruit Ziziphus Mauritiana (Lam)

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ABSTRACT

Objective: This research work was aimed at analyzing the basic information regarding nutritional and health benefit of Ziziphus mauritiana (Lam) based on the interest of prioritizing and educating the community users of this underutilized wild edible fruit.

Methods: The fruits pulp were processed into local biscuit using steaming sandwich techniques. The proximate analysis was conducted using (AOAC) standard laboratory procedure. The minerals were analysed using atomic absorption spectrophotometer (AAS shimadzu AA 6800 model). The scavenging effect of the fruits pulp local biscuit aqueous extract of Z. mauritiana was evaluated using 1, 1-Diphenyl-2-pierylhydraxyl radical (DPPH), and compared with Ascorbic acid (Vitamin C), which was the standard antioxidant used.

Results: The proximate analysis revealed the percentage of moisture content 9.69±0.30%, ash content 5.81±0.10%, carbohydrate content 40.45±0.45%, crude fat 15.75±0.20%, crude fibre 23.34±0.50%, and crude protein, 4.96±0.50%. The results of the minerals analyses revealed the values of calcium (Ca) 12.80±1.01 mg/g, magnesium 4.20±0.05 mg/g, sodium (Na) 19.56±0.07 mg/g, potassium (K) 11.56±0.08 mg/g, copper (Cu) 0.07±0.01 mg/g, iron (Fe) 0.018±0.02 mg/g, manganese (Mn) 0.041±0.01 mg/g, and zinc (Zn), 0.003±0.00 mg/g while chromium (Cr) and lead (Pb) were below detection limits. The antioxidant IC₅₀ was calculated using linear regression showing the following values 0.247 and 0.351 for vitamin C and the fruit pulp aqueous extract respectively.

Conclusions: All the nutriceutical findings on Z. mauritiana local fruit pulp biscuit falls within the safety limit and can also be compared with other industrial manufactured brands biscuit such as Digestive, Cabin, and cream cracker biscuits.

Keywords: Antioxidant, Minerals, Proximate, Wild fruit, Ziziphus Mauritiana
Introduction

The growing need to identify alternative bio-nutritional sources, to manage the protein and micronutrient deficiency among rural people in developing countries is highly demanded. To address these issues, policies should be designed to sustainably utilize wild edible plants as sources of bio-nutrients that can reduce macro and micro nutrients deficiencies in children and adults in developing countries. The wild fruits have recently drawn attention of many researchers as a natural source of treatment for curing various diseases. Some studies on wild fruits have claimed them to be better sources of nutrients. Such underutilized wild tropical fruits provide limitless opportunities for screening of novel drugs. They also serve in supplying the body with micronutrients, proteins and energy. Z. mauritiana which belongs to the family Rhamnaceae; is an evergreen shrub or tree up to 15 m tall and 40 cm in diameter. The leaves are alternate and elliptic, 2.5-3.2 cm long and with three distinct veins. In the leaf corners are two spines. The fruit is a drupe with a fleshy pulp and a single seed. It is very variable in shape and size but most are round to oval, fruits can be as small as 1.8-2.5 cm. The fruits are highly nutritious, rich in ascorbic acid and contain fairly good amount of vitamin A and B, minerals like calcium, phosphorus and iron. The ethanolic fruits extract contains secondary metabolites such as phenolics, flavonoids, alkaloids, triterpenoids, saponins, and glycosides. The Fruits is used as liver tonic, as an antioxidant, hepatoprotective, protective effect, weight gain, increases stamina and reported to have anticancer effects. The Fruit is also considered to purify blood, for chest complaints. Mixed with salt and chili peppers, the fruits are consumed as digestant. Dried ripe fruits of Z. mauritiana act as mild laxative.

The nutriceutical evaluation of locally processed biscuit from Z. mauritiana fruits pulp in addressing protein and micronutrient deficiency particularly among rural people in sub-sahara region is the major focused of this research work.

Materials and Methods

Sample collections

The sun dried fruits were collected from uncultivated land in Jigawa state of Nigeria. Jigawa is situated in the north-western part of the country between latitudes 11.00°N to 13.00°N and longitudes 8.00°E to 10.15°E. The seeds were brought to the laboratory in a black polythene bag and sorted out, the spoiled ones were removed and the good ones were washed.
to remove dust followed by re-dried in an oven (Memmert, D-91126 Germany) at 65°C.

**Processing of local biscuits**

The (fruit pulps) local biscuits were prepared using sandwich steaming techniques. Using local mortar and pestle the fruits were grinded and their epicarps were removed by sieving. The pulps (mesocarp) were obtained and kept for processing and other analysis. Two local pots were arranged and heated up to 100°C, the lower one contains water only and the upper one contains 600 g of pulp in powdered form in which 60 g were distributed in each 10 cans respectively. As the water boiled (at 100°C), the accumulated steam on the upper pot gradually dropped into the cans containing the pulps which made it dampened and took the shape of the can. After the upper pot was removed, the cans were allowed to air dried and the stiff molded pulp were gently recovered as local biscuits called (Akuri).

**Proximate analysis**

The estimation of the various proximate parameters such as moisture content, crude protein, crude fat, total ash, crude fibre and carbohydrate contents were carried out using method described by.\(^8,9\) The analysis was carried out in triplicates and the results obtained were the means average of values.

**The moisture content**

This was determined by heating 2 g of each fresh sample to a constant weight in a crucible and placed in an oven maintained at 105 °C till constant weigh observed.

**Crude fat**

This was determined by exhaustively extracting 5 g of each sample in a Soxhlet apparatus using petroleum ether (boiling point range 40-60°C) as the extractant.

**Crude protein**

The Crude protein was determined using micro Kjeldahl method. The Total protein was calculated by multiplying the evaluated nitrogen by 6.25.

**Total ash**

This was determined by the incineration of 10g samples placed in a muffle furnace maintained at 550 °C for 5 h.

**Crude fibre**

This was determined by digesting 2 g of sample with H\(_2\)SO\(_4\) and NaOH and incinerating the residue in a muffle furnace maintained at 550°C for 5 h.

The carbohydrate was given by (percentage of ash + percentage of Fat + percentage of Protein + percentage of crude fibre) subtracted from the total sample content. Each analysis was carried out in triplicate.

**Elemental analysis**

Two (2 g) grams of *Z. mauritiana* local fruits pulp was ashed at 550°C for 5 hour. The ash was dissolved in 3 ml of HCL to 1 ml of HNO\(_3\) until a clear solution was observed; the suspension was then filtered into a 100 m volumetric flask and made it up to the mark (100ml) using deionized water. Ca, Cu, Fe, Mg, Mn, Cr, Pb, Zn, Na, and K contents were determined using Atomic Absorption Spectrophotometer (AAS Shimadzu AA 6800 model).

**Antioxidant**

The in vitro antioxidant properties of the local biscuit from *Z. mauritiana* fruits pulp were performed by DPPH radical scavenging assay, using DPPH stable free radical method which is an easy, rapid and sensitive way to survey the antioxidant activity of a specific compound of the fruits extracts.\(^10\)

According to procedure about 0.1 mM of DPPH in methanol was prepared and 1 ml of this solution was added to 3.0 ml of extract solution in ethanol at different concentrations (0.5, 0.25, 0.125, 0.0625, 0.03125 mg/ml).\(^11\) Thirty minutes later, the absorbance was measured at 517 nm. Lower absorbance of the reaction mixture indicated higher free radical scavenging activity.
The same experiment was carried out on Ascorbic acid, which are known antioxidant. All tests and analyses were run in triplicate and the results obtained were averaged means values. Radical scavenging activity was expressed as the inhibition percentage of free radical by the sample and was calculated using the following formula:

\[
\text{Percentage (%) Inhibition} = \left( \frac{A_b - A_a}{A_b} \right) \times 100
\]

Where \( A_b \) was the absorbance of the control (blank, without extract) and \( A_a \) was the absorbance in the presence of the extract. All these tests were performed in triplicate and the bar chart was plotted with the mean values.

**Statistical analysis**

The data on proximate contents determined were subjected to analyses of variance (one way ANOVA) significance was accepted at the 5% probability level using the statistical package for social sciences (SPSS) Program 10.1 version. Data for proximate composition and for mineral constituents were reported as the mean ± SD for three determinations per sample. The results were given as mean ± SD.

**Results and Discussion**

The results of the proximate analysis revealed the percentage of moisture content, ash content, crude fat, crude fibre, carbohydrate, and crude protein at 9.69±0.30, 5.81±0.10, 15.75±0.20, 23.34±0.50, 40.45±0.45 and 4.96±0.50% respectively (Table 1).

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Constituents</th>
<th>Conc. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisture content</td>
<td>9.69±0.30</td>
</tr>
<tr>
<td>2</td>
<td>Ash content</td>
<td>5.81±0.10</td>
</tr>
<tr>
<td>3</td>
<td>Crude fat</td>
<td>15.75±0.20</td>
</tr>
<tr>
<td>4</td>
<td>Crude fibre</td>
<td>23.34±0.50</td>
</tr>
<tr>
<td>5</td>
<td>Carbohydrate</td>
<td>40.45±0.45</td>
</tr>
<tr>
<td>6</td>
<td>Crude protein</td>
<td>4.96±0.50</td>
</tr>
</tbody>
</table>

The proximate analysis pronounced the energy and other health benefit derived from this fruit pulp based on the percentage values of carbohydrate and crude fibre, which helps to prevent constipation, bowel problems and piles.12 The crude fibre level is very higher while comparing with that of industrial manufactured biscuits such as digestive, cabin and cream cracker, with 2.1±0.05, 2.2±0.15 and 2.7±0.49 respectively.13 But the carbohydrate (40.45±0.45) and protein (4.96±0.50) level is lower while comparing with those industrial manufactured biscuits such as cream cracker carbohdrates (55.4±1.1), protein (10.3±0.90) and digestive biscuit carbohdrates (62.5±1.51), protein (9.8±0.38) respectively.13

The minerals analyses revealed the values of calcium, cupper, iron, magnesium, manganese, zinc, sodium, potassium at 12.80±1.01, 0.07±0.01, 0.018±0.02, 4.20±0.05, 0.041±0.01, 0.003±0.00, 19.56±0.07, 11.56±0.08 mg/g respectively, while Chromium and Lead were below detection limit.

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Test Elements</th>
<th>Conc. in Mg/g</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Ca</td>
<td>12.80±1.01</td>
</tr>
<tr>
<td>2</td>
<td>Cu</td>
<td>0.07±0.01</td>
</tr>
<tr>
<td>3</td>
<td>Fe</td>
<td>0.018±0.02</td>
</tr>
<tr>
<td>4</td>
<td>Mg</td>
<td>4.20±0.05</td>
</tr>
<tr>
<td>5</td>
<td>Mn</td>
<td>0.041±0.01</td>
</tr>
<tr>
<td>6</td>
<td>Cr</td>
<td>Nil</td>
</tr>
<tr>
<td>7</td>
<td>Pb</td>
<td>Nil</td>
</tr>
<tr>
<td>8</td>
<td>Zn</td>
<td>0.003±0.00</td>
</tr>
<tr>
<td>9</td>
<td>Na</td>
<td>19.56±0.07</td>
</tr>
<tr>
<td>10</td>
<td>K</td>
<td>11.56±0.08</td>
</tr>
</tbody>
</table>

From Table 2 above the local biscuit from *Z. mauritiana* fruit pulp contained high level of sodium (19.56±0.07 mg/g), Calcium (12.80±1.01 mg/g) and potassium (11.56±0.08 mg/g). Sodium and potassium are necessary to maintain osmotic balance in the body as well as the pH. Calcium are also present within safety limit which is also needed for the formation of bones and it supports the synthesis and function of blood cells. Iron is present in considerable amount (0.018±0.02 mg/g) which is necessary in formation of hemogloblin and normal
functioning of the central nervous system. The other micro minerals such as manganese magnesium, copper and zinc are also present which are known to play important roles in various metabolic activities in our body, while chromium and lead were below detection limit. The antioxidant potentiality of the extract in which the absorbance was taken at 517, showed in Figure 4. The 50% inhibition of DPPH radical (IC50) by the Z. mauritiana local biscuits fruit pulp extracts was calculated using linear regression, a lower value would reflect greater antioxidant activity of the fruits pulp extracts. The radical scavenging activity was calculated as (0.247 and 0.351%) for vitamin C, and Z. mauritiana local biscuits fruits pulp extract respectively. The fruits pulp extract were concentration dependent as it showed high antioxidant potentials at 0.5 and 0.25 mg/ml.

Figure 4: Antioxidant activity of Z. mauritiana local biscuit from fruits pulp compared with standard antioxidant vitamin C.

Conclusions

In conclusion the results indicated that the Z. Mauritiiana local fruits pulp, which is popularly used by the local communities, contained appreciable amounts of nutrients and energy and can be serve as useful food and nutrients deficiency supplements. For sustainable use and conservation, the species should be integrated into Sub- Sahara agroforestry systems.

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Conflict of interest: None declared

References

