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The Chemical, Fatty Acid and Sensory Evaluation of *Parinari curatellifolia* Seeds

H. N. Ogungbenle[1*] and A. A. Atere[1]

[1]Department of Chemistry, Ekiti State University, P.M.B. 5363, Ado- Ekiti, Ekiti State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author HNO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AAA managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The nutritive potentials of *Parinari curatellifolia* seeds have been analyzed with respect to its proximate, mineral, fatty acid and sensory quality. The results showed that the sample contains ash (2.68%), moisture (4.40%), crude protein (12.7%), crude fibre (5.45%), crude fat (1.77%) and carbohydrate 73.0%. Potassium was the most abundant mineral while the least abundant was copper. Myristic acid (9.75%) was the most concentrated fatty acid in the sample. The data obtained from the 10 - member panel based on 9-point hedonic scale for sensory quality showed that the sample could be perceived as dark-brown, bitter and fairly choking smell, hard but rough texture with loose attachment of testa to the seed.

Keywords: Chemical; sensory; evaluation; Parinari curatellifolia.

1. INTRODUCTION

Food analysis is an important indicator in nutritional planning and also provides useful information for epidemiological studies. Foods are evaluated based on the contents of energy, proteins, vitamins and the nutrients they possess. However, when these foods were

**Corresponding author: Email: httphenryo@yahoo.com;*

discovered and consumed for the first time, there were no such considerations or any scientific knowledge of their nutritional values. The major factors that influence consumption were availability, acceptability, assurance of crop yields, easy storage and transportation [1]. *Parinari curatellifolia* is a common savanna crop that is about 8-meter tall. It is usually called hissing tree because the bark makes a sort of hissing noise when cut with an axe. The tree is often stunted and twisted while its flower is white in colour with florescence and is finely hairy. The seed is ovoid in shape, brown in colour, smooth or sometimes rough in texture. It grows well on the sandy clay loam soil [2]. The wood may be used for the manufacture of pounding blocks or poles as well as boats. The presence of silica crystals in the stem is also problematic in wood processing industry as it blunts the blades of saws and other tools. Generally, this tree is economically important as the fruits are edible and very palatable and can readily be made into nutritious syrup or as porridge [3]. The fruits are also occasionally utilized for making alcoholic beverages. The seeds contain edible oil and may be eaten raw in the form of nuts. The leaf extracts and bark may be used as a remedy for symptoms of cataract, pneumonia and to treat eye and ear problems [3].

The aim of this work is to analyze the proximate, mineral and fatty acid, and also to evaluate the sensory quality of *Parinari curatellifolia* seeds.

2. MATERIALS AND METHODS

The *Parinari curatellifolia* sample was purchased from Oba central market in Ado-Ekiti, Ekiti state, south west of Nigeria. The coats of the seeds were removed manually, dried and ground into flour using a Kenwood food blender and kept in polythene bag prior to analyses.

2.1 Proximate Analysis

The proximate analysis of the sample for total ash, moisture, crude fibre and ether extract carried out using the method described by [4]. The nitrogen content was determined by micro-Kjedahl method described by [5] and nitrogen content was converted to protein by multiplying by 6.25 {100g/16g}. Carbohydrate was calculated by the method of difference as %CHO = {100 – (%moisture + %ash + %crude fibre + %crude fat + %crude protein)}. All determinations were carried out in triplicates.

2.2 Mineral Analysis

The minerals were determined by dry ashing the sample at 550^{o}C to constant weight and dissolving the ash in 100 ml standard flask using distilled water with 3ml of 3M HCl. Sodium and potassium were determined by using a flame photometer (model 405, Corning, U.K). All other minerals were determined using atomic absorption spectrophotometer (Perkin Elmer model 403, USA).

2.3 Fatty Acid Analysis

The fatty acid profile was determined using method [6]. The fatty esters were analyzed using a PYE Unicam 304 gas chromatogram fitted with a flame ionization detector and a PYE Unicam computing integrator. Helium was used as carrier gas. The column initial temperature was 150ºC rising at a rate 5ºC min^{-1} to a final temperature of 200ºC. The peaks were identified by comparison with the standard spectral libraries.

2.4 Sensory Evaluation

The sensory evaluation of *Parinari curatellifolia* seed was analyzed using hedonic 9- point scale of different characteristics for the seed colour, taste, smell, texture and testa attachment to the seed by a panel of ten (10) trained judges according to a method described earlier [7,8]. The 10-member panel judged the sample for colour (1= colourless, 3=black, 5=brownish black, 7=dark brown and 9=brown), taste (1=tasteless, 3=fairly sour, 5=sour, 7=fairly bitter and 9=bitter), smell (1-3=odourless,5=coffee,7=fairly choking and 9=choking), hand feel texture (1=soft, 3=fairly hard, 5=hard, 7=hard rough and 9=hard smooth), testa attachment to seed (1-3= firm, 5=fairly firm, 7=fairly loose and 9=loose).

3. RESULTS AND DISCUSSION

The results of the proximate composition of the *Parinari curatellifolia* seeds are shown in Table 1. The ash value (2.68%) was lower than those of bambara groundnut (3.2%) and cowpea (5.1%) [9] but comparable with those of legumes which ranged between 2.4 – 5.0% [10]. The moisture content of the sample (4.40 %) was lower than those of improved Nigeria cowpea varieties Ife brown (11.9%) [11], 10.42% *Luthyrus sativus* [12] and 9.05% whole seed of *Caesalpinia pulcherima linn.*[13] but higher than that reported for bouillon cubes (2.68%) [14].The low level of moisture content makes it less liable to microbial attack and thereby, enhancing its storage potential.

Table 1. Proximate composition of *Parinari curratellifolia* seed

Proximate	%
Ash	2.68
Moisture	4.40
Crude protein	12.7
Crude fibre	5.45
Ether extract	1.77
Carbohydrate(by difference)	73.0

The crude protein content for *Parinari curatellifolia* was comparable with the values for kersting's groundnut (12.9%), cowpea (12.1%) and bambara groundnut (11.6%) respectively reported by [15] but lower than those of oil seeds [16], *Lathyrus sativus* (28.32%) [12] and African yam bean (22.9%) [17] but compared favorable with white coat cowpea (12.1%) [18]. The value of crude fibre of the sample (5.45%) was comparable with that of *Prosopis africana* (5.50%) [19] but higher than those of *Terminalia catappa* (4.94%) [20], cowpea (3.2-3.6%) [15], African yam bean (2.01%) [17] and kidney bean (2.68%) [9]. The crude fat value for the sample (1.77%) was comparable with that of cowpea (1.8-2.1%) [15]. This crude fat value obtained for the sample does not qualify it as oil-rich crop when compared with soy beans 23.5% reported by [21], pumpkin seed (49.2%) [22], full fat fluted pumpkin (47.0%) [23], benniseed (44.3%) [24].

The mineral content of *Parinari curatellifolia* seed is represented on Table 2.The most abundant mineral was potassium with a concentration of 459 mg/100g sample. Potassium is important in maintaining the pH balance of the body fluid. The concentration of potassium was closely followed by magnesium with a value of 428 mg/100g sample. It has been reported that potassium was the most abundant mineral in some agricultural products [25]. Lead was not detected. The magnesium level in the sample (428.2mg/100g) was lower than

that of *Terminalia catappa* (798 mg/100g) [20] but found to be higher than those of African giant rat (200mg/ 100g) reported by [26], kidney bean (72mg/100g) [9] and African nutmeg (389 mg/100g) [27]. The iron level was 13.2 mg/100g. This value was higher than those of African nutmeg (3.0 mg/100g) [27], periwinkle meat (3.0 mg/100g) [28], male and female classes of broiled goat meat (0.13 -2.6 mg/100g) [29] and cowpea (4.9 mg/100g) [15] but lower than that of African rat meat (70 mg/100g) reported by [26]. A Na/K ratio of 0.60 is recommended for human consumption [30]. The Na/K ratio of 0.47 obtained for the sample was found to be within the range recommended by [30]. Therefore, it would not promote high blood pressure and some heart diseases. The value of zinc in *Parinari curatellifolia* seeds was 21.6 mg/100g. This value was higher than those for female goat meat (5.3 mg/100g) [29] and *Luffa cylindrica* (1.0 mg/100g) [31], guinea corn (1.8 mg/100g), maize (1.4 mg/100g) and cocoyam (2.4 mg/100g) reported by [32]. Zinc is important mineral in the body as its deficiency has been shown to be the cause of dwarfism and hypogonadism among adolescents from the lowest social classes of Egypt [33]. Therefore, the diet of *Parinari curatellifolia* might help to prevent dwarfism and hypogonadism when consumed.

Table 2. Mineral content of *Parinari curratellifolia* seed

Mineral	Mg/100g
Zinc (Zn)	21.6
Copper (Cu)	12.0
Iron (Fe)	13.2
Magnesium (Mg)	428
Sodium (Na)	214
Manganese (Mn)	52.0
Phosphorus (P)	196
Lead (Pb)	ND
Potassium (K)	459
Na/K ratio	0.47

ND = not detected

The fatty acid composition of the oil from *Parinari curatellifolia* seed is presented on Table 3. The saturated fatty acids were myristic (14:0) and linoleic (18:2). The monounsaturated fatty acid (oleic) was not detected with the saturated fatty acid (lauric) (12:0). Table 3 also shows that myristic acid had the highest concentration of 9.75% while stearic acid (18:0) was in second position with a concentration of 2.91%. Linoleic acid (18:2) had concentration of 0.01%. It has been shown that linoleic acid was the most concentrated fatty acid in pigeon pea (54.8%)[34], soy beans (52.0%)[21], corn oil (55.7%) and safflower oil (72.6%) [35] but this observation differs in the case of the sample studied. The value of myristic (9.75%) was higher than those values reported for *Adenopus breviflorus* (0.06%) [39], calabash seed (5.36%), bottle gourd (0.16%) [36], soy beans (0.2%) [21], cowpea (1.0%) [37], pigeon pea (0.2%) [34], tree parts of *Moringa oleifera* (0.20 -0.40%) [38] and date palm fruit (5.36%) [27]. The value of stearic acid in the sample (2.91%) was comparable with that of leaves of *Moringa oleifera* (2.96%) [38] but lower than those of African nutmeg (8.23%) [27], date palm fruit (9.42%) [27], whole seed and dehulled seed of *Adenopus breviflorus* seed (8.01%) [39], soy beans (4.0%) [21], lima bean (7.1%) [37], pigeon pea (7.6%) [34] and *Terminalia catappa* (4.14%) [20] but higher than that of kidney bean (2.3%) [9].

Table 3. The fatty acid composition of *Parinari curratellifolia* seed oil

Fatty acid	%
Linoleic	0.01
Myristic	9.75
Stearic	2.91
Oleic	ND
Lauric	ND

ND = not detected

Table 4 shows the sensory evaluation of *Parinari curatellifolia* seeds. Sensory questionnaire was presented to a 10-member panel of judges who scored the sample for colour, taste, smell, texture (handfeel) and testa attachment to seed based on 9- point hedonic scale [7,8]. Colour: Consumers eat with his eyes and the major quality characteristic that create attractiveness towards any food product is its colour and it is one of the important quality parameters [40]. It can also be an index of measuring the acceptability of any food item. Based on the 9-hedonic scale, the result obtained for the sample was 6.20 ± 0.03, indicating a dark brown colour.

Table 4. The sensory evaluation of *Parinari curratellifolia* seed

Sensory Parameters	
Colour	6.20±0.03
Taste	9.00±0.01
Smell	7.00±0.29
Texture (Hand feel)	6.60±0.09
Testa attachment to the seed	8.95±0.07

Taste is mainly due to sugar/acid ratio. It is perceived by specialized taste bud in the tongue [40]. Although there are many different tastes, most appears to primarily represent combinations of four dominant chemical sensations (sweet, sour, bitter and salty) in which sweet and sour predominate whereas bitterness is important in some fruits. Saltiness in the other hand, is a seldom factor in fresh fruit while sweetness due to sugar and sourness from organic acids are dominant components in the taste of many fruits [40,41]. The taste value of *Parinari curatellifolia* seed (9.00 ± 0.01) shows that it is bitter in taste based on the 9-point hedonic scale. This indicates that the sample has high level of acid compared to the sugar and may also contain some primary bitter taste compounds can enhance human perception. The smell of the sample was fairly choking with a mean value of 7.00±0.29 as observed by a 10-member panel based on the 9- point hedonic scale. Flavor is the blend of taste and smell perceptions noted when food is in the mouth. The overall flavor impression is the result of the taste perceived by the taste bud in the mouth and the aromatic compounds detected by the epithelium in the olfactory organ in the nose.

Texture is one of the important quality parameters in sensory evaluation, which play an important role at the time of selection of fruit by consumer [40]. Pectic substances are polysaccharides responsible for the firmness of fruits and softening of fruits and this occurs when it is not tightly bound to the fruit cell walls during ripening process. Therefore, firmness could also be used as index for fixing optimum stage of maturity for harvest [42]. Table 4 also shows the texture (hand feel) score for the sample. The value was 6.60±0.09. The texture rating for the sample was found to be hard but rough and the testa attachment to seed cell wall was relatively loose with the mean value of 8.95±0.07.

4. CONCLUSION

It can be concluded that *Parinari curatellifolia* seed has bitter taste with choking smell and is a good source of energy, protein, nutritionally valuable minerals and contain good quality oil useful for both domestic and industrial purposes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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