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Assessment of the Proximate Composition and Mineral Content of *Ximenia Caffra* (Sour Plum) Leaves

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Abstract

This study assessed the nutritional and mineral properties of Sour plum (Ximenia caffra) (PT-001). After collection, plant identification was done by a Botanist from Biological sciences Department (Plant Science and Biotechnology), Kogi State University, Anyigba. The leaves were separated from plant, cleaned, air-dried and pulverized manually using porcelain mortar and pestle. The Powder obtained was then analyzed to determine proximate and Mineral properties using standard methods. Results obtained showed abundant presences of carbohydrates, fat, moisture content, protein, ash content, crude content and lipids contents, other minerals found include: Sodium, Potassium, Magnesium, Calcium, Iron and Phosphorus. According to this study, the most predominant element was Calcium (Ca) while the least predominant element was Iron (Fe). The importance of these content cannot be overemphasized, as they are very paramount to the health and growth of animals.

Keywords: *Assessment, Proximate composition, Mineral content, Ximenia Caffra*

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1. Introduction

Ximenia caffra, also known as sour plum, is a member of a genus of flowering plants in the Olacaceae family, which grows both in the Southern and West African region. *X. caffra* has been used as foods

and traditional Medicine (Van Wyk *et al.*, 2000; Cheikhyoussef *et al.*, 2011). Its fruit, considered to be rich in vitamin C, potassium, and protein, has been commonly added into porridges and made into jam (Van Wyk *et al.*, 2011; Ndhalal *et al.*, 2008). The dried seed of *X. caffra* contains a substantial quantity of unsaturated fatty acids; the most abundant is oleic acid (Khumalo *et al.*, 2002). As such, the extracted seed oil would be used as a feed ingredient and domestic biofuel (Chivandi *et al.*, 2012). As a traditional medicine, local herbalists have been using the leaves and root of *X. caffra* for the treatment of wounds, infections, fever, infertility, and diarrhea. Recent research confirmed that the leaf and root extracts of *X. caffra* have antigonococcal, antibacterial, and antifungal activities, which corroborate with its traditional use very well (Nair *et al.*, 2012; Mulaudzi *et al.*, 2011; Fabry *et al.*, 1998; Munodawfa *et al.*, 2013), there is however very limited scientific information on the phytochemical composition of *X. caffra* leaf, except a record that showed the total flavonoid content was only roughly estimated using vanillin assay. Bioactive phytochemicals contained in the leaf of related species *X. americana*, from western and eastern sub-Sahara Africa, were investigated and led to the identification of sambunigrin, gallic acid, and quercetin, and the glycosides by spectrometric methods (Le *et al.*, 2012). *Ximenia caffra*, commonly known as "sour plum" is traditionally used, both topically and orally to treat a wide range of human diseases and ailments such as wounds, sexually transmitted infections (STIs), infertility, stomach ache, fever, eye problems, diarrhoea, bilharzia, menorrhagia, malaria, intestinal worms, impotence and coughs (Maroyi *et al.*, 2016). The bark and fruits are used by small-scale farmers as ethnoveterinary medicine to treat dermatophilosis, foot rot, saddle sores and control ectoparasites. Oil from X. caffra seed is traditionally used as a moisturizer, soap and shampoo for dry, fragile and damaged hair. *X. caffra* is well known for its many applications in traditional medicine. Leaf decoctions are used as a wash to soothe inflamed eyes, as a gargle for tonsillitis and are also applied as a vermifuge . In addition, powdered dried leaves are taken orally for fever and infertility. Apart from this, root infusions are used for dysentery and diarrhea and together with the leaves are taken for abdominal pain and bilharzia. Furthermore, powdered roots are applied to

wounds and infections to facilitate healing and used in soups and beer as an aphrodisiac. Several studies such as, antimicrobial (Jacob *et al.,* 2021), assessment of free radical scavenging potency (Jacob *et al.,* 2021), and assessment of phytochemical components (Jacob *et al.,* 2021b), have sought to clarify the pharmacological basis to some of these traditional uses, both in South Africa (Steenkamp *et al.,* 2003) and on the African continent (Geyid *et al.,* 2005). Most of these studies evolved out of the common usage of the plant for wounds and infections, as well as for diarrhea-related ailments. Therefore, this study aimed at assessing the proximate and mineral properties of Ximenia caffra leaves.

2.0 Materials and Methods

2.1 Collection and Identification of Plant

The leaves of *Ximenia caffra* (PT-001) was collected from Kogi State University Quarters Anyigba and identified by a botanist, in Biological sciences Department (Plant Science and Biotechnology), Kogi State University, Anyigba, Kogi State.

2.2 Collection of Samples

The leaves were separated from their stalks, washed properly with clean tap water to remove altering matter, air-dried and pulverized using mortar and pestle. The resulting powder was then sieved through a 0.05u sized mesh to obtain a fine powder.

2.3 Analytical Methods

2.3.1 Proximate Analysis

2.3.1.1 Determination of Moisture Content.

Two grams of each of the sample was placed in the crucible and heated at 150^{o}C, until a constant weight was attained. The moisture content of the sample was calculated as loss in weight of the original sample and expressed as percentage moisture content. (FAO, year of Pub).

$$\%\text{Moisture} = \frac{W2-W3}{W2-WI} \times 100 \qquad \text{.....(1)}$$

Where:

W1 = initial weight of empty crucible

W2 = weight of crucible +Sample before drying

W3 = Final weight of crucible + sample after drying

2.3.1.2 Determination of Crude Protein

Two grams of each samples were weighed along with 20 cm^3 of distilled water in to a micro – Kjeldahl digestion flask. It was shaken and allowed to stand for some time. One tablet of selenium catalyst was added followed by the addition of 20 cm^3 concentrated sulphuric acid. The flask was heated on the digestion block at 100^oC for 4 hours, until the digest became clear. The content was transferred into 50 cm^3 volumetric flask and diluted to the mark with water.

An aliquot of the digest (10 cm^3 was transferred into another micro-kjeldahl flask and placed in the distilling outlet of the micro – Kjeldahl distillation unit. A conical flask containing 5 cm^3 of boric acid indicator was placed under the condenser outlet. Sodium hydroxide solution (10 cm^3, 40%) was added to the content in the kjeldahl flask by opening the funnel stopcock. The distillation starts and the heat supplied was regulated to avoid sucking back. When all the available distillate was collected in 5 cm^3 of boric acid, the distillation was stopped. The nitrogen in the distillate was determined by titrating with 0.01M of H_2SO_4; the end of the distillate changed from green to pink. The percentage Nitrogen was calculated and multiplied by 6.25 to obtain the value of the crude protein (A.O.A.C. *et al.*, 1990).

$$\% \text{ Nitrogen} = \frac{Vs - Vb \times Nacid \times 0.01401}{W} \times 100 \qquad (2)$$

Where: Vs = titer value of the sample

Vb = Volume of acid required to titrate

N acid normality of acid

W = weight of sample in grams

2.3.1.3 Determination of Crude Lipid

This estimation was performed using the soxhlet extraction method. Ten grams of each of the samples were weighed and wrapped with a filter paper and placed in a thimble. The thimble was covered with cotton wool and placed in the extraction column that was connected to a condenser. 200 mL of n-Hexane was used to extract the lipid (AOAC *et al.*, 1990).

$$\%\text{Fat} = \frac{W2 - W3}{W} \times 100 \quad (3)$$

Where: W2 = Weight of the filter paper and sample before extraction

W2 = Weight of filter paper and sample after extraction.

2.3.1.4 Determination of Crude Fiber

The estimation was done using the method of A.O.A.C. Five grams of each of the sample and 200 ml of 1.25% H_2SO_4 were heated for 30 minutes and filtered with distilled water Buchner funnel. The residue was washed with distilled water until it acid free, 200ml of water 1.25% NaOH was used to boil the residue for 30 minutes, it was filtered and washed several times with distilled water until it was alkaline-free. It was then rinsed once with 10% HCl and twice with petroleum ether three times. The residue was put in an oven overnight. After cooling in a desicator, it was ignited in a muffla furnace at 550^{o}C for 90 minutes, to obtain the weight of the ash.

$$\%\text{ of crude fibre} = \frac{W2-W3}{W1} \times 100 \quad (4)$$

2.3.1.5 Determination of ash content

This was done using the method of A.O.A.C. The total ash content of a substance is the percentage of inorganic residue remaining after the organic matter has been ignited. 2 g of each of the sample was placed in a crucible and ignited in a muffle furnace at 550 ^{o}C for 6 hours. It was then cooled in a dedicator and weighed at room temperature to get the weight of the ash, using the formula:

$$\% \text{ of Ash content } = \frac{W2-W3}{W1} \times 100 \quad (4)$$

2.3.1.6 Carbohydrate Determination

The carbohydrate content was determined by subtracting the summed up percentage compositions of moisture, protein, lipid , fibre and ash content from 100 (Otitoju *et al.*, 2009).

%carbohydrate: = 100 – (%protein + %moisture +%ash + %fibre)

2.3.2 Mineral Analysis

The method of AOAC [18] was employed for the determination of mineral content. One gram of the pulverized samples was placed in a crucible and ignited in a muffle furnace at 550^{o}C for 6 hours. The resulting ash was dissolved in 10 mL of 10% HNO_3 and heated slowly for 20 minutes after heating, it was filtered and the filtrate was used for the determination of mineral content. Atomic absorption spectrophotometer (AAS) (include brand name, number and country of origin) was used to determine Ca and F, while Flame photometer (include brand name, number and country of origin) was used for the determination of Na and K in the filtrate.

3.0 Results and Discussion

3.1 Results

Table 1 proximate composition of *Ximenia caffra* leaves powder

parameter	unit (%)
Moisture	**11.95**
Crude protein	**21.31**
Crude lipid	**4.90**
Crude fibre	**21.10**
Ash content	**7.00**
Carbohydrates	**33.79**

Table 2 Mineral Element Analysis

	Na (ppm)	K (ppm)	Mg (ppm)	Ca (ppm)	Fe (ppm)	P (ppm)
A	48.00	51.00	160.80	402.00	25.71	195.7
	48.10	51.00	160.50	403.00	25.41	195.4

3.2 Discusion

The nutritive value of Ximenia caffra leaf, was determined, using standard procedures, the proximate composition of the Ximenia caffra leaf were determines and presented in table 1.

Table 1 showed that the proximate analysis of Ximenia caffra leaf contained: crude fiber (21.10%), crude lipid (4.90%), moisture content (11.90%), ash content (7.0), protein content (21.31%), and carbohydrate content (33.79%). This data was the average of the three determinations and the result obtained showed that Ximenia caffra has high carbonhydrate content. It was low in crude lipid and protein as compared to carbohydrate content. The moisture content and ash content, are higher than values reported by Shumaila and Mahpara (Shumaila *et al.,* 2009), while the crude fibre is lower than the values reported by Shumaila *et al.,* 2009. while, the mineral contents were determined and presented in table 2.

Table 2 showed that Ximenia caffra leaf contained Sodium (48 ppm), Potassium (51 ppm), Magnesium (160 ppm), Calcium (402 ppm), Iron (25.71 ppm) and Phosphorus (195.7 ppm). Among the mineral contents of Ximenia caffra, Calcium shows the highest while Iron shows the lowest content. The mineral contents are all lower than the values reported by (Shumaila *et al.,* 2009).

Conclusion

This study has presented data on the nutritional value and mineral value of ximenia caffra, the result shows abundant presences of carbohydrates, fat, moisture content, protein, ash content, crude content and lipids contents, other minerals found include: Sodium, Potassium, Magnesium, Calcium, Iron and Phosphorus.

According to my study, the most predominant element was Calcium (Ca) while the least predominant element was Iron (Fe). The importance of these content cannot be overemphasized, as it is very paramount to the health and growth of animals.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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