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Varieties of *Mangifera indica* L. (Anacardiaceae) used as food and medicine by the Idoma people of Eke-Ogodumu in Okpokwu local government Area of Benue State, Nigeria

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Abstract
Mangifera indica is widely used by the people of Eke-Ogodumu in Benue State, Nigeria without proper documentation of the varieties. The aim of the study was to identify the varieties of *Mangifera indica* in this part of Nigeria, document the folklore uses and their active constituents and determine some peculiar morphological and chemical differences that exist between them. Standard methods for identifications and analysis such as macroscopic and phytochemical techniques were used. Recognised and accepted folks that have wealth of knowledge in traditional medicine in the community were also asked some relevant questions on *Mangifera indica* using structured questionnaires and samples were collected for authentication. ANOVA was used as statistical tool for the analysis. Results of the findings showed Benue mango, Normal mango, German mango, Opioro, Peter mango, Julie mango, Kerosene mango and Broken as the varieties of *Mangifera indica* used to manage stroke and cardiovascular diseases, improve blood circulation and treat iron deficiency in women; treat typhoid fever; treat dysentery, diarrhoea, hemorrhage and bleeding; treat wrinkles and infections of the mouth, face and skin; improve sight, and manage diabetes; Manage constipation, obesity, gastritis and ulcer; Manage cancer and weaknesses, boost immune system and manage diabetes and night blindness respectively. Alkaloids, flavonoids, tannins and steroids were found in all the varieties. German mango leaf has sinuate margin; Peter mango, acuminate apex; Kerosene, obtuse apex while repand margin and acute apex were common in other varieties with normal mango fruit having oblong shape different from others. The varieties of *Mangifera indica* used were identified and differentiated. The folklore uses and the active constituents were documented.

Keywords: *Mangifera indica*, anacardiaceae, variety, morphology, analysis

Introduction
Mangifera indica L. (Anacardiaceae) is known as the 'King of Fruits' because, it is the most popular fruit in tropical regions and the nationwide fruit of Indians and Philippines and the national tree of Bangladesh [1]. *Mangifera indica* (mango) is native to India and South-east Asia where it has been cultivated for over 4000 years for the good qualities of the fruits [2]. Currently, mango is also grown in Central America [3], Africa [4], and Australia [5] and for a few years in Europe [6]. Over 1000 mango fruits varieties are available worldwide, although only a few are produced on a common scale [7]. The total world production of mango was 24 420 116 metric tons in 1999 as declared by FAOSTAT in 2000 [8]. Despite lack of encouragement as to large scale production of tropical fruits in Nigeria, mango still occupies the 8th position in the world ranking of mango producing countries as at 2002 declared by FAOSTAT [8]. The main producing states in the country include: *Benue*, Jigawa, Plateau, Yobe, Kebbi, Niger, Kaduna, Kano, Bauchi, Sokoto, Adamawa, Nasarawa, Kogi, Taraba and Federal Capital Territory (Abuja) [8]. There are different varieties of mango in Nigeria, most of which are named according to where they are cultivated or produced while others may be due to a nickname generated in the locality which they are found. They are: Cotonou mango, German mango/Opioro, Benue mango, Normal mango (Ogbomosho/Calabar/Abuja mango), Sheri mango, Julie mango, Peter mango (Binta sugar/Jane mango), Kerosene mango, etc [9, 10, 11]. In traditional medicine, different parts of the mango tree (fruit pulp, extracts of fruit kernel, leaf and stem-bark) are used for food and health benefits [12]. Decoction of mango kernel is used for diarrhoea, hemorrhage and bleeding, because of its vermifuge and astringent properties [13]. Extract of unripe fruits, bark and leaves are used for their anti-bacterial activity [14]. Aqueous stem-bark extract is used as remedy for diarrhoea, fever, gastritis and ulcer [15].

Materials and Methods

Study Design

This was a descriptive cross-sectional study conducted in Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria. The design was used to assess the varieties of *Mangifera indica* L. used as food and medicine by the community.

Study Area

Okpokwu is one of the twenty- three Local Government Areas (LGA) in Benue state, Nigeria. Okpokwu was created in 1976 during General Olusegun Obasonjo's administration with Okpoga, Edumoga and Ichama as the main districts and Okpoga, the Headquarter and has given birth to other two LGA namely; Ado (1989) and Ogbadibo (1991) since then. Okpokwu LGA took its name from the beautiful river Okpokwu. Okpokwu is an administrative and cosmopolitan town consisting of diverse ethnic groups from all over Nigeria because of the Benue State Polytechnic, Ugbokolo located in this community. Civil services, farming, hunting, fishing and small scale businesses are the predominant occupation.

Majority of the population are members of the Christianity religion with only a few Muslims. It has an area of 731 km^2 and a population of 176, 647 with about 60, 410 ((0-9), 39, 155 (10-19), 29, 844 (20-29), 19, 054 (30-39), 12, 379 (40-49), 6, 931 (50-59), 4, 361 (60-69), 1, 930 (70-79), 1, 532 (80^+)) years at the 2006 census. Okpokwu LGA has only one General Hospital, one Primary Health Care and two Private Hospitals as Healthcare Delivery System with little and primitive facilities causing over 80% of the entire population to depend on Traditional Medicine. Most of the youths in this community have left for cities and abroad in search of education and white collar jobs leaving the wealth of the knowledge in traditional medicine with the uneducated and old folks who are mainly farmers, hunters, fishermen and herbalists.

Fig 1: Map of Okpokwu Local Government Area

Study Population

The source population of the study includes patients on traditional medicine, farmers, hunters, fishermen and herbalists or any one recognized and accepted by the community to have knowledge on traditional medicine. The study population included individual from the age of 40 years and above which have lived in the community for not less than five year.

Sample Size

Sample size was calculated by using sample size determination formula:

$$n=Z2p\ (1-p)/d2$$

Where

n= the estimated sample size

Z= is the standard normal value corresponding to the desired level of confidence

d=error of precision

p= people getting health care from traditional medicine that is 80%.

Therefore, adding the non-respondent rate (20%) the final sample size 295 but 300 was used as the sample size for the study.

Oral Interview

A previously reported method was adopted for the study [16]. Information on the varieties of *Mangifera indica* L. of Eke-Ogodumu in Okpokwu LGA were gathered via oral interview of Idoma people having wealth of knowledge on traditional medicine using a structured questionnaire. Older individuals, local medicine men, herbalists and others who claim to have effective knowledge on the culture, norms and prescriptions were consulted. Samples of the plant materials were gathered along with the practitioners and collections were made. Pictures of the plants collected were taken using digital camera. Throughout the interviews, local plant names, useful plant parts, method of preparation, application mode, dosage and duration of treatment were recorded. This study lasted for about 2 years (2019-2020).

Plant Collection and Identification

Varieties of mango leaves and fruits were collected from Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria between 14th January, 2019 and 17th June, 2019. The plants were identified in the field using pharmacognostic descriptions and keys in the 'Flora of West Tropical Africa' [17] and the 'Woody plants of Ghana" [18]. The identity of the plants were authenticated at the Department of Horticulture and Landscape technology, Federal College of Forestry, Jos, Nigeria and assigned Voucher Specimen Numbers FHJ 296, FHJ 295, FHJ 292, FHJ 294, FHJ 290, FHJ 2293, FHJ 291 and FHJ 297 were assigned for Benue mango, Normal mango, German mango, Opioro, Peter mango, Julie mango, Kerosene mango and Broken respectively by Mr. Joseph Jeffrey Azila. The leaves were air dried at room temperature under shade until a constant weight was obtained for a period of three weeks for each sample. The plant was then pounded to powder using local mortar and pestle, sieved with a mesh of size-20 and stored in air-tight containers labeled: A, B, C, D, E, F, G, & H respectively to match the different Voucher Numbers for all the varieties until when they were needed for use.

Macroscopical examination of the fresh leaves

The fresh leaf was observed for features like shape, margin, apex, surface, texture and venation in order to determine the leaf-type using a standard method [19].

Phytochemical screening of the powdered leaves

The presences of phytochemical constituents of the different extracts were investigated using standard methods [20].

Results

Table 1: Varieties and Vernacular names of *Mangifera indica* L. found in Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria

Variety	Table Identification	Idoma Name	Mwagavul Name	Hausa Name	Voucher Number
Benue Mango	Zil	Aja/Mangoro	Mangor seen	Mangoro maijijiya	FJH 296
Normal Mango	Yam mango	Utochi	Mangor Po-nkwak	Paparanda	FJH 295
German Mango	Hadden	Ofu mango	Mangor Diik	Dan aure	FJH 292
Opioro	Hindisina	Ikpapieka	Mangor Poweel	Bakin aku	FJH 294
Peter	Peter	Peta	Mangor Shang	Binta shuga	FJH 290
Julie	Sweet Julie	Juli	Mangor Rippe	Juli	FJH 293
Kerosene Mango	Alphonsus	Kero mango	Mangor Kero	Gwaiwan rago	FJH 291
Broken	Mabroka	Aba mango	Mangor dyes	Dan kwallo	FJH 297

------ Means 'Nickname'

Table 2: Morphological Characters of Varieties of *Mangifera indica* Leaves found in Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria

Variety/Description	Benue Mango	Normal Mango	German Mango	Opioro	Peter	Julie	Kerosene Mango	Broken
Average Length	19.7 cm	21.9 cm	23.7 cm	24.3 cm	22.2 cm	21 cm	12.7 cm	19.6 cm
Average Width	4.4 cm	5.0 cm	6.1 cm	4.7 cm	4.2 cm	4.8 cm	4.5 cm	4.9 cm
Average Petiole	2.6cm	2.9 cm	3,7 cm	3.8 cm	1.9 cm	2.7 cm	2.4 cm	2.5 cm
Shape	Lanceolate	Lanceolate	Lanceolate	Lanceolate	Lanceolate	Lanceolate	Lanceolate	Lanceolate
Margin	Repand	Repand	Sinuate	Repand	Repand	Repand	Repand	Repand
Apex	Acute	Acute	Acute	Acute	Acuminate	Acute	Obtuse	Acute
Surface	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Texture	Leathery	Leathery	Leathery	Leathery	Leathery	Leathery	Leathery	Leathery
Venation	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate
Type of Leaf	Simple	Simple	Simple	Simple	Simple	Simple	Simple	Simple

Table 3: Morphological Characters of Varieties of *Mangifera indica* Fruits found in Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria

Variety/ Description	Benue Mango	Normal Mango	German Mango	Opioro	Peter mango	Julie mango	Kerosene Mango	Broken
unripe fruit	Green	Green	Light green	Green	Green	Dark yellow	green	Green
ripe fruit	yellow	Yellow	Light green	Yellow	yellow	Green/yellow	Green/yellow	Yellow
Shape	Oval	Oblong	Ellipse	Ellipse	Oval	Oval	Ellipse	oval
Size	Moderate	Medium	Medium	Small	Large	Medium	Medium	Large
Fibre	Yes	Yes	No	No	No	No	Yes	No
Taste	Sour	Sweet	Sour	Sour	Sweet	sweet	turpentine	Sweet
Inner part	yellow	Yellow	Yellow	Yellow	Yellow	orange	Peachy	Orange
Texture of ripe	Firm	Firm	Firm	Firm	Firm	Soft	Firm but soft	Firm/fleshy
Peak available	April	February- April	February- March	February- March	March- April	February-April	February- April	February- May

Table 4: Phytochemical Results of Varieties of Methanol leaf Extracts of *Mangifera indica* L. found in Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria

Variety/Test	Benue Mango	Normal Mango	German Mango	Opioro	Peter	Julie	Kerosene Mango	Broken
Alkaloids	+	+	+	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+
Tannins	+	+	+	+	+	+	+	+
Steroids	+	+	+	+	+	+	+	+
Saponins	-	-	-	-	-	-	-	-
C/glycosides	-	-	-	-	-	-	-	-
Terpenoids	-	-	-	-	-	-	-	-

Key:
+ means 'Present'
- means 'absent'

Table 5: Folklore Uses of Varieties of *Mangifera indica* L. found in Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria

Variety	Recipe	Uses
Benue Mango	Juice from fruit is taken 3x a day for 7 days Decoction of the stem bark is taken 3x for 30 days Decoction of the leaf is taken 3x for 30 days	Reduce risks of stroke & cardiovascular problems Improve blood circulation treatment of iron deficiency in pregnant & menopausal women
Normal Mango	Decoction of bark/leaf is taken 3x a day for 7 days	Treatment of typhoid fever
German Mango	Decoction of kernel is taken 4x a day for 5 days	Treatment of dysentery, Diarrhoea, Hemorrhage & bleeding
Opioro	Peeled skin of unripe fruit rub overnight for 7 days	Treatment of wrinkles & infections of the mouth, face & skin
Peter	Decoction of stem bark is taken 4x a day	Improve sight & night blindness & management of diabetes
Julie	Juice from fruit is taken 3x a day for 7 days Aqueous stem bark is taken 3x a day for 7 days	Management of constipation due to indigestion & obesity Remedy for gastritis & ulcer
Kerosene Mango	Decoction of leaf & stem is taken 6x a day	Management of cancer, as invigoration & immune booster
Broken	Decoction of stem bark is taken 4x a day	Improve sight & night blindness & management of diabetes

Discussion

Eight Varieties of *Mangifera indica* L. (Anacardiaceae) used as food and medicine by the Idoma speaking people of Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria were identified and documented by their vernacular names and their gross morphology. These results could help provide useful information and serve as a tool for their standardization [21]. Morphological characters of the leaves and fruits showed that, German mango leaf has sinuate margin; Peter mango, acuminate apex; Kerosene, obtuse apex while repand margin and acute apex were common to other varieties. Morphological characters of the fruits revealed that, Normal mango fruit has oblong shape; a distinct feature from other varieties that were either ellipse or oval. The unripe fruit of Julie mango was dark yellow in color but other varieties were all green while the ripe fruit of German mango was light green in color and other varieties were all yellow. These can also help in provide additional information for their identification [21]. Alkaloids, flavonoids, tannins and steroids were found in all the varieties and could be responsible for the multipurpose folklore uses and serve as lead candidates for novel drugs [22]. Phenolic compounds and flavonoids are known with anti- oxidant properties [23, 24]. The use of Benue mango to reduce the risk of stroke and cardiovascular problems and to improve blood circulation and also to treat iron deficiency in pregnant and menopausal women may be as a result of minerals such as potassium, phosphorus, calcium, magnesium, sodium, iron and manganese present in the fruit juice of mangoes [25]. These elements are useful in restoring lost electrolytes leading to rehydration thereby, help in reducing the risk of stroke. Mango is also a rich source of iron and calcium. Iron is a very important element in the body especially in its ionic state as it helps in the formation of hemoglobin which is a major constituent in blood formation [24, 25] and so, lowers the deficiency of iron that might lead to anemia. The infusion/decoction of the leaf and bark of Normal mango for the treatment of typhoid fever may be as a result of its anti-bacterial activity [14]. The use of the decoction of the kernel of German mango for the treatment of dysentery, Diarrhoea, Hemorrhage and bleeding may probably be due to its vermifuge and astringent properties [13]. The presence of vitamin A and carotenoids (α-β carotene) found in the peeled skin of the unripe fruits of mangoes [24, 25] which help to increase the production of collagen that is responsible for elasticity of the skin and its blemish-less could explain the use of Opioro mango for the maintenance of soft skin and for the treatment of wrinkles, acne, pimples and eczema. Mangoes are known to be a rich source of vitamin A and flavonoids [24, 25] and this may be responsible for the use of Peter and broken mangoes in improving sight and in the management of night blindness and diabetes since diabetes can also lead to blurred vision. Furthermore, the juice extracted from mango fruits contains pectin, fibres and vitamin C [25]. These elements can lower the amount of lipoproteins; that is, the blood cholesterol, and this could explain why Julie mango was used to manage obesity. Julie mango was also used in the treatment of constipation due to indigestion and studies have shown that mangoes contained some proteins called papain which functions as enzyme in the breaking down of protein [16], hence can improve digestion. Studies on *Mangifera indica* L. showed that it contained polyphenolic compounds such as iso-quercetin, quercetin, astragalin; fisetin, gallic acid, ellagic acid, β-glucogallin and mangiferin [23]. These compounds are known with anti-oxidant activity. Antioxidants protect the body from the effects of free radicals and, reduce the risk of cancer cells replication. This explained the use of Kerosene mango in the management of cancer. Kerosene mango was also used as invigorating agent and also to improve the immune system of their patients. The presence of carotenoids and different forms of vitamins such as vitamin A, and vitamin C among others [20, 24] may be responsible for these activities as they can serve as immune boosters.

Conclusion

Eight Varieties of *Mangifera indica* L. (Anacardiaceae) used as food and medicine by the Idoma speaking people of Eke-Ogodumu in Okpokwu Local Government Area of Benue State, Nigeria have been identified and differentiated. The folklore uses and the active constituents were documented. These could serve as good lead candidates for novel drugs.

References

1. Usman M, Fatima B, Muhammad MJ. Breeding in Mango. International Journal of Agriculture and Biology. 2001; 3:522-526.
2. Mukherjee SK. Origin, Distribution and Phylogenetic affinities of the species of *Mangifera indica* L. the Journal of Linnean Society of Botany. 1953; 55:65-83.
3. Blancas-Benitez FJ, Mercado-Mercado G, Quiros-Sauceda AE, Montalvo-Gonzalez F, Gonzalez-Aguitar GA, Sayago-Ayerdi SG. Bio-accessibility of polyphenols in Mexican ('Ataulfo') Mango (*Mangifera indica* L.) by products. Food & Function. 2015; 6:859-868.
4. Khakimov B, Mongi RJ, Sorensen KM, Ndabikunze BK, Chove BE, Engelsen SBA. Comprehensive and Comparative GC-MS Metabolomics Study of Non-volatiles in Tanzanian grown Mango, Pineapple, Jack fruit, Baobab and Tamarind fruits. Food Chemistry. 2016; 213:691-699.
5. San AT, Joyce DC, Hofman PJ, Macnish AJ, Webb RI, Matovic NJ *et al*. Stable Isotope Dilution Assay (SIDA) and HE-SPME-GCMC Quantification of Key aroma volatiles for fruits and sap of Australian Mango cultivars. Food Chemistry. 2017; 221:613-619.
6. Rodiguez-Pleguezuelo CR, Duran-Zuazo VH, Muriel-Fernandez JI, Franco-Tarifa D. Physico-chemical Quality Parameters of Mango (*Mangifera indica* L.) grown in a Mediterranean Subtropical Climate (SE Spain). Journal of Agricultural Science and Technology. 2012; 14:365-374.
7. Marianna L, Sonia E, Giuseppe C, Michela G, Antonella D. Multifaceted Health Benefits of *Mangifera indica* L. (mango): The Inestimable value of Orchards Recently Planted in Sicilian Rural Area. Nutrients. 2017; 9(5):525.
8. Yusuf SA, Salau AS. Forecasting mango and Citrus Production in Nigeria- A Trend Analysis. Munich Personal RePEc Archive, 2007, 1-10.
9. Bello BA, Jalaluddin AK, Rilwan A, Adam AA, Sani MN, Ibrahim SI *et al*. Comparative Proximate and some micronutrients contents of four local varieties of mango pulp (*Mangifera indica* L.) commonly consumed in Wudi town, Kano State. International Journal of Scientific and Engineering Research. 2016; 7(8):840-889.
10. Aguoru CU, Ajah P, Olasan JO. Taxonomic Investigation of Four Varieties of Mangifera using Micro-Anatomical Features. International Research Journal of Natural Sciences. 2016; 4(1):20-27.
11. Igbiri AD, Nodza GI, Adeusi AD, Ogundipe OT. Morphological Characterization of Mango (*Mangifera*

indica L.) cultivars from South-West Nigeria. Ife Journal of Sciences. 2018; 21(1):155-163.
12. Guevara GM, Gonzalez LS, Alvarez LA, Riano MA, Garrido GG, Nunez-Selles AJ. Ethnomedicinal uses of *Mangifera indica* L. stem-bark extract in Cuba (Spanish). Cuban Medicinal Plant Journal. 2004; 9:27-32.
13. Sairam K, Hemalatha S, Kumar A, Srinivasan T, Ganesh J, Sarkar M *et al*. Evaluation of Anti-diarrhoeal activity in seed extracts of *Mangifera indica* L. Journal of Ethnopharmacology. 2003; 84:11-15.
14. Thambi PA, John S, Lydia E, Iyer P, Sarah-Jane-Monica SJ. Antimicrobial efficacy of mango peel powder (*Mangifera indica* L.). International Journal of Home Science. 2016; 2:155-161.
15. Masibo M, He Q. Mango Bioactive Compounds and Related Nutraceutical Properties-A Review. Food Review International. 2009; 25:346-347.
16. Olotu PN, Olotu IA, Kambasha MB, Ahmed A, Ajima U, Ohemu TL *et al*. Culture and traditional medicine practice among the Idoma people of Otukpo Local Government Area of Benue State, Nigeria. International Research Journal of Pharmacy. 2017; 8(11):33-39.
17. Burkill HM. Useful plants of west tropical Africa; 2nd edn. Royal Botanical Gardens Ken Richmond, United Kingdom. 1997; 4:430.
18. Irvine FR. Woody Plants of Ghana, Oxford University Press London, 1961, 81-83.
19. Evans WC. Trease and Evans pharmacognosy: *15th* edn Saunders an imprint of Elsevier India, 2005, 488-496.
20. Olotu PN, Olotu IA, Kambasha MB, Ahmed A, Ajima U, Ohemu TL *et al*. Pharmacognostic Studies and antidiabetic evaluation of the ethanolic root extract of *Anacardium occidentale* Linn (Anacardiaceae) in mice. Journal of Natural Products and Plant Resources. 2017; 7(4):65-70.
21. Olotu PN, Ahmed A, Kunle OF, Olotu IA, Ajima U. Pharmacognostic evaluation of the leaf of *Cochlospermum planchonii*, Hook. F (Cochlospermaceae). Journal of Pharmacognosy and Phytochemistry. 2018; 7(2):868-872.
22. Olotu PN, Olotu IA, Kambasha MB, Ahmed A, Ajima U, Ior LD *et al*. Pharmacognostic, acute toxicity and analgesic studies of the methanolic stem extract of *Guiera senegalensis* J. F. Gmel (Combretaceae). Journal of Pharmacognosy and Phytochemistry. 2016; 5(6):120-124.
23. Paschal ME, Correetero ME, Sloving KV, Villar A. Simplified screening by TLC of plant drugs. Pharmaceutical Biology. 2002; 40(2):139-143.
24. Budzianowski J, Budzianowska A. Chromatographic and Spectrophotometric analyses of the DPPH free radical scavenging-activity of the fractionated extracts from *Lamium album* L., *Lamium purpureum* L. and *Viscum album* L. Herba Polonica. 2006; 52(1/2):51-57.
25. Shahidi F, Janitha PK, Wanasundara PD. Phenolic Antioxidant. Critical Reviews in Food Science and Nutrition. 1992; 32:67-103.
26. United State Department of Agriculture (USDA). National Nutrition Database for Standard Reference, SR-28, and Full Report (All Nutrients): Mangoes Raw Data Agricultural Library, 2016, 09176.