



# Ethnobotany and Ethnopharmacology of the Igala kingdom in Kogi East, Nigeria

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**ABSTRACT:** An ethnographic study was conducted from January to August 2018 in nine villages of the Igala kingdom located at Kogi East in Nigeria. The study aimed at identifying the plants used in the preparation of medicine, food, tools and utensils, myth, and legend using oral interviews and group discussions with experienced adults between the ages of 25 to 85 years. Information was gathered on a total number of 96 plants from 108 respondents in which 17.6 % were teachers, 66.7% were farmers, 4.6% were hunters, and 11.1% were herbalists. The study revealed that 49.5% of the plants collected are used as medicines, 28.4% as food, 12.6% for furniture, simple tools and utensils, and 9.5% for myth and legend. The present study also revealed that the leaves and stems of plants are the most used parts by the Igala people. They majorly used these plant parts for medicine and food in which over 24 ailments are identified in this work using indigenous phytotherapy as a curative remedy. Decoctions were used in most cases for the preparation of herbal remedies. The use of plants as therapeutic agents is an essential aspect of traditional indigenous medicine within the Igala kingdom because they have a common belief that all food is medicine. Their regards for plants are very high to the extent that plants are involved whenever sacrifices and communications are to be made to their gods and other mystical beings.

**KEY WORDS:** Ethnobotany, Ethnology, Ethnopharmacology, phytotherapy, Kogi East, Nigeria.

## INTRODUCTION

The basic instinct of human from time immemorial is to avoid pain and embrace pleasure. In pursuit of a healthy life, people design food, medicine, cosmetics, and entertainment products for themselves. Ethnographic studies show that virtually every aspect of human life is associated with plants. In essence, humans and plants are inseparable. People eat when hungry, beat drums and gongs when dancing, and use herbal medicine if they are sick. Ethnomedical practice is an important part of the primary health care delivery system in most parts of the developing countries, and according to the World Health Organization, an estimated 3.5 billion rural dwellers in the developing world depend on medicinal plants as part of their primary health care (Idu and Onyibe, 2007). According to Ajaiyeoba *et al.* (2003), only 8–25% of people with malaria in indigenous African communities visit modern health services. This has necessitated the investigation into African ethnobotany and ethnomedicine.

If we look critically into the things that keep human satisfied daily, we will discover that plant is the necessary thing. As believed in most cultures of the world, good health and happiness are the things plant brings. Narrowing down to Nigeria and Kogi East in particular, there is a common belief that food is medicine. As what, how, and when we eat is deeply rooted in our cultural practices (Pieters, 2013; Receveur, 1997). In 2005, Kaiser Permanente in the US implemented its

community health initiative called healthy eating and active living in order to check the widespread of chronic conditions such as obesity and diabetes in youths (Dietz *et al.*, 2015). Kuhnlein and Receveur's (1996) wrote a review on dietary change and traditional food systems of indigenous people, they quoted the Ngoni people in Asia, in which they stated that the change of diet is the chief cause of their smaller stature today and the prevalence of various illnesses. Some of the campaigns in the Pacific Island countries have focused on promoting the value of local foods in conjunction with skills training to promote local food production. An example of such a campaign is Let's Go Local, a campaign held in Pohnpei Federated States of Micronesia (Englberger *et al.*, 2010b.) and also, the salt reduction campaign by European Union and World Health Organization held in Europe and Africa consecutively in the year 2012. The structure of the EU and WHO, endorsed three pillars such as product reformulation, consumer awareness and environmental changes due to the adverse effect of excess salt intake and deviation from traditional foods (Rosanne *et al.*, 2011; Dumanovsky *et al.*, 2011).

The relationship between the people in Kogi state and plants is solid because plants contribute to over 95% of their livelihood daily. Kogi state is located in the central region of Nigeria. The state has three major ethnic groups, which are Igala, Ebira, and Okun with other minorities like Bassa, Nupe, Gwari, Kakanda, Oworo, Ogori-magongo and Eggan community. As stated in ecological works, regions of high biological



diversity in the world correlate strongly with the areas of highest linguistic and cultural diversity (Stepp *et al.*, 2005; Nettle, 1996; Carlson and Maffi, 2004). Kogi state shares common boundaries with Niger, Kwara, Nassarawa and the Federal Capital Territory to the north. To the east, the state is bounded by Benue and Enugu state, to the south by Enugu and Anambra state, and to the west by Ondo, Ekiti, and Edo state. Lokoja is the place where the river Niger (the river where the name Nigeria was coined from) and river Benue forms a confluence, and this is where the state capital is situated. Kogi is the only state in Nigeria which shares boundaries with ten other states. For this reason, the state has a high cultural and ecological diversity. Ecologically, the state is bounded to the north by the guinea savanna vegetation, to the east by the derived savanna vegetation and the west by the rain forest (Sowunmi and Akintola, 2010), for this reason, the state harbour most plants found in the Nigeria vegetation aside from the mangrove plants that are difficult to get in Kogi state.

Kogi East harbour one of the most organized ethnic groups in Nigeria known as the Igala kingdom because they have conserved many aspects of their ancient culture and traditions for centuries. They demonstrate this act of conservation by preserving their typical language (Igala), religion, dressing, social habits, food and medical practices. They are known for eating a different sticky soup prepared from *Cissus populnea* popularly called 'Okoho soup' and they also use medicinal and culinary plants in treating themselves. The use of plants as therapeutic agents is an essential feature of traditional indigenous medicine (Soejarto *et al.*, 2005), and it is still practiced within the Igala kingdom today. Music, stories and dance move people deeply. Therefore, members of these communities use those entities to create cultural identity as a result, many social groups were created. Major social groups found in this region are 'Agbaka' (dance group), 'Eguu' (masquerade group) 'Ukpoku' (aggressive masquerade group) which mainly are made up of young people from the age of 18-35 years. Other social groups found are 'Ichabada' (music group), 'Olele' (music group) story and fortune-tellers (Amaakachee) which are majorly done by highly talented people and elders. The unique food in this region is 'Oje' (a solid food made from corn, cassava or yam) and eaten with a novel soup known as Oro-Okoho (a sticky soup made from the stem peel of *Cissus populnea* (Gbile, 1980), the stickiest of all soups in the world). The bulk of their primary health care is gotten from the native doctors who made use of herbs (in most cases) or some other materials associated with nature and divinity (rare cases).

The objective of the present study was:

- To obtain information on the relevant ethnographic inheritance of Igala kingdom that is geared towards healthy living, and to check the

phytoconstituents of the plants used as food and medicine, by the people of this region.

- To see if the compounds in the constituents can be used to explain their ethnopharmacological activities, as this may open opportunity for the development of natural products.
- To study the relationship between plant and the Igala tradition as knowledge regarding the usage of plants for medicinal practices and the use of other cultural materials (mortar, earthen materials etc) are transmitted orally from the past generations.

The people of this kingdom are experiencing massive rural-urban migration which may serve a threat to the preservation of their ancestral knowledge. For these reasons, there is an urgent need to document and preserve the ethnological, ethnopharmacological and ethnobotanical knowledge of the Igala kingdom.

## MATERIALS AND METHODS

### Study Area

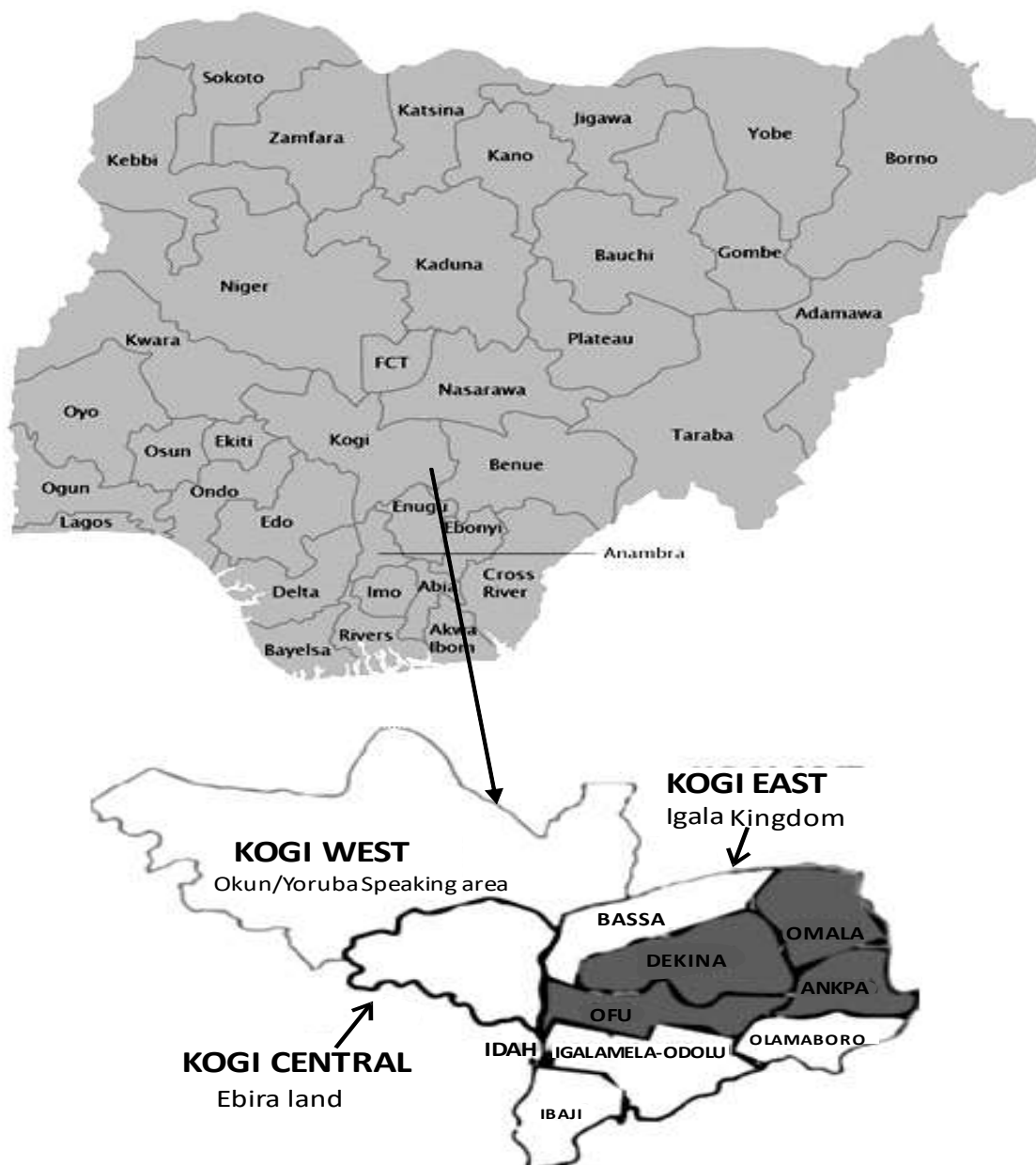
Kogi East has nine local government areas which are Ankpa, Basa, Dekina, Ibaji, Idah, Igalamela-Odolu, Ofu, Olamaboro and Omala. Of the nine local government areas, only Basa forms a different ethnic group; the rest are Igala.

The study was conducted in nine villages of the Igala kingdom located in Kogi East according to its geographical location in the state (Fig. 1). The nine villages are situated in four different local government areas (Ankpa, Dekina, Ofu and Omala). The villages selected for study are Ajiyolo, Abocho, Anyigba, Ajobe, Awo-Akpali, Ogodu, Ochadamu, Emewe-opada and Egume. The primary occupation of the people is farming and game hunting although there are traders, teachers, students and government workers, occasionally these people also partake in farming and game hunting as well. This region demarcates the southern and northern Nigeria as a result of that; it shears the characteristic vegetation of northern and southern Nigeria that is why it is called a derived savanna. There are many plants here and the people have extensive knowledge of their uses.

### Ethnobotany

Familiarization visits were made in early January 2018 to the elders and community leaders of the nine villages to explain the purpose of the study to them and to solicit their support during the process (Ajaiyeoba *et al.*, 2003).

Extensive fieldwork was carried out between late January and August the same year with some of the indigenous people of the nine villages which are made up of traditional healers (herbalist), hunters, teachers and students. With more than 12 people below the age of 87 years involved in the collection and identification process in each community. Ninety-six different species



**Fig.1.** Map of Nigeria and the studied area. **Note:** The long arrow shows the position of Kogi state in the map of Nigeria. The short arrow at the right-hand side shows the nine local government areas in Kogi east. The dark-gray-colored areas denote the four local governments where the study was carried out.

were collected from the villages. The bulk of the information was collected in Dekina local government (6 villages studied), Ankpa local government (1 village studied) and Omala local government (1 village studied). Scanty information was collected from Ofu local government (1 village studied).

In following the method described by Balick and O'Brien (2004), Idu and Onyibe (2007), Thomas *et al.* (2009) and Betti (2004), a semi-structured questionnaire was administered to 12 randomly selected respondents from each village, making a total of 108 respondents from the nine villages. The questionnaire addressed the

following issue: age, sex, education, religion, taxonomy, plants used as medicine, plants used as food, plants used for furniture, simple tools and utensils, and plants used for myth and legend. Oral interviews and group discussions were also held with the respondents, and mobile gadgets were used to record audio information and take pictures.

Herbarium specimens, monographs, literature and floras such as Flora of West Tropical Africa (Hutchinson and Dalziel 1968); A Handbook of West African Weeds (Agyakwa and Akobundu, 1987) and Annotated Checklist of Vascular Plants of Southern Nigeria



(Aigbokhan, 2014) were consulted for the authenticity of the identified plants. The data obtained were collated and tabulated showing scientific names, locality, common names, tribal names and uses. The plants collected were deposited in Paxherbals herbarium (PAX/HNO/2193 & PAX/HNO/2288 index code for first and last deposit) by following the standard procedure for specimen documentation (Aniama *et al.*, 2016). Descriptive statistics such as tables, percentages and charts were used to analyze the results, and the results were arranged systematically following the APG system of classification (Aigbokhan, 2014).

### Phytochemistry

All the chemicals were of analytical grade and were obtained from Pyrex Company, Benin City, Nigeria. Extraction of plant material by cold maceration, decoction and tincture was used based on the part of the plants prescribed by the respondents of the studied area. Preparation of aqueous extract was made using 80 g of dry powder per 1 liter of the extracting solvent in a conical flask for each sample. After the completion of extraction, the solution was passed through a Whatman filter paper number 1 and filtered.

Evaluation for the presence of glycoside, cardiac glycoside, saponin, flavonoids, tannins, phlobatannin, terpenoids, polysaccharides, alkaloids, and reducing sugars through preliminary phytochemistry was carried out using the method in Trease and Evans (2002) and Sofowora (1993). The following signs plus (+) and minus (-) were used to denote the presence or absence of chemical compounds on screened plants (+ = **mildly present**, ++ = **moderately present**, +++ = **abundantly present**, - = **absent**).

## RESULTS

Parameters accessed during this study were arranged in Fig. 2, and Table S1- 5. There were two species (2.1%) sharing the same local name 'Odegenhie' (*Phyllanthus muellerianus* and *Securinega virosa*) as seen in Table S1. The reason is because of their foliar resemblance and difficulty to separate the young ones during a medicinal plant collection.

Demographic information of respondents shows that 19 (17.6 %) were teachers, 72 (66.7 %) were farmers, 5 (4.6 %) were hunters, and 12 (11.1%) were herbalists. The age range of the respondents is between 25 and 85 years. 76 (70.4 %) of the respondents were Christians, 23 (21.3 %) Moslems, 7 (6.5 %) traditional religion practitioners ('Oguchekpo') and 2 (1.9%) practiced multiple religion. It was observed that 29 (26.9 %) respondents did not have formal education, 47 (43.5 %) had primary education, 27 (25.0 %) had secondary education and 5 (4.6 %) had tertiary education.

The plants collected were categorized based on

ethnotaxonomy, uses and believe by the people. The plants were classified into 5 categories: taxonomy (Table S1), plants used as medicine (Table S2), plants used as foods (Table S3), plants used for furniture, simple tools and utensils (Table S4), plants used for myth and legend (Table S5). It was discovered that 49.5% of the plants collected are used as medicine (Table S2), 28.4% are used as food (Table S3), 12.6% are used for furniture, simple tools and utensils (Table S4) and 9.5% is used for myth and legend (Table S5).

The local name of plants is well known among the nine villages but Awo-Akpali occupies the peak with up to 61% of the respondents knowledgeable in ethnotaxonomy and 20% in plants used as food. Respondents from Emewe-Opada are knowledgeable in phytomedicine with 17%. Ochadamu did not record any use of plants as food due to scanty information obtained from that area. Awo-Akpali, Ajobe, Emewe-Opada, Egume and Ogodu recorded substantial information for the five critical parameters accessed during the fieldwork (Table S1-5; Fig. 2).

From the graph, the leaves are the most used parts for food and medicine, covering 30% usage (Table S2-3). The seeds are majorly used for food (6.3%) and the stems are mostly used for furniture covering 8% usage (Table S4). The stem bases are majorly employed in mythological purposes covering 4% usage (Table S5). The flowers are the least used covering less than 1% usage of the four parameters listed on the graph (Fig. 3).

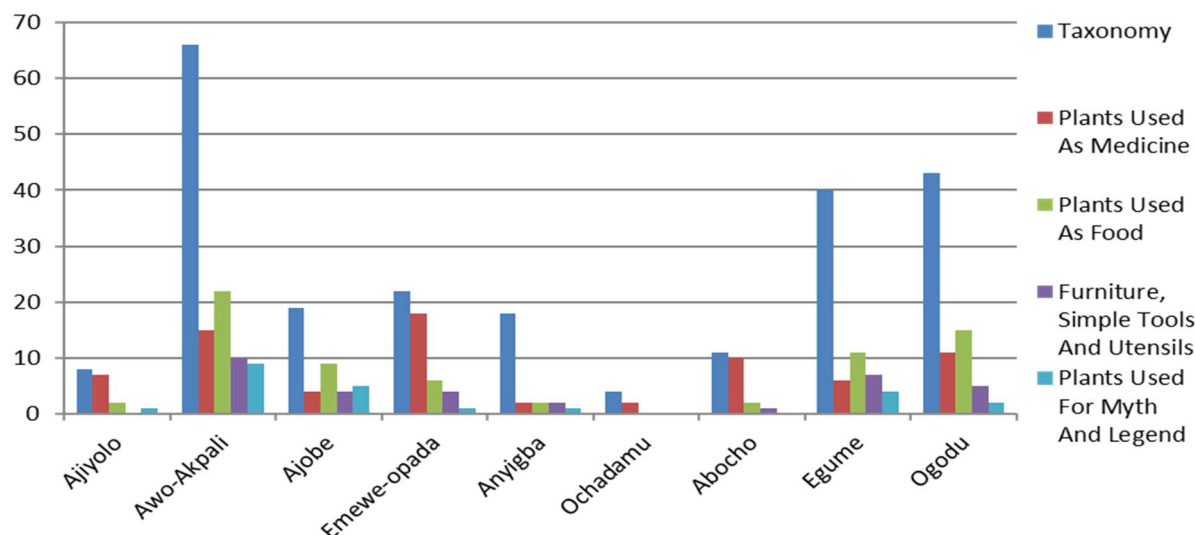
Among the diseases treated using medicinal plants, stomach ache (36.4%), malaria (32%), blood tonic (18%) and cough (14%) medicine are the most prepared remedy followed by headache, adjuvant medicine, sore throat and injury which all four covers 9%. The rest covers 4.5 % remedy preparation each (Table S2; Fig. 4).

## DISCUSSION

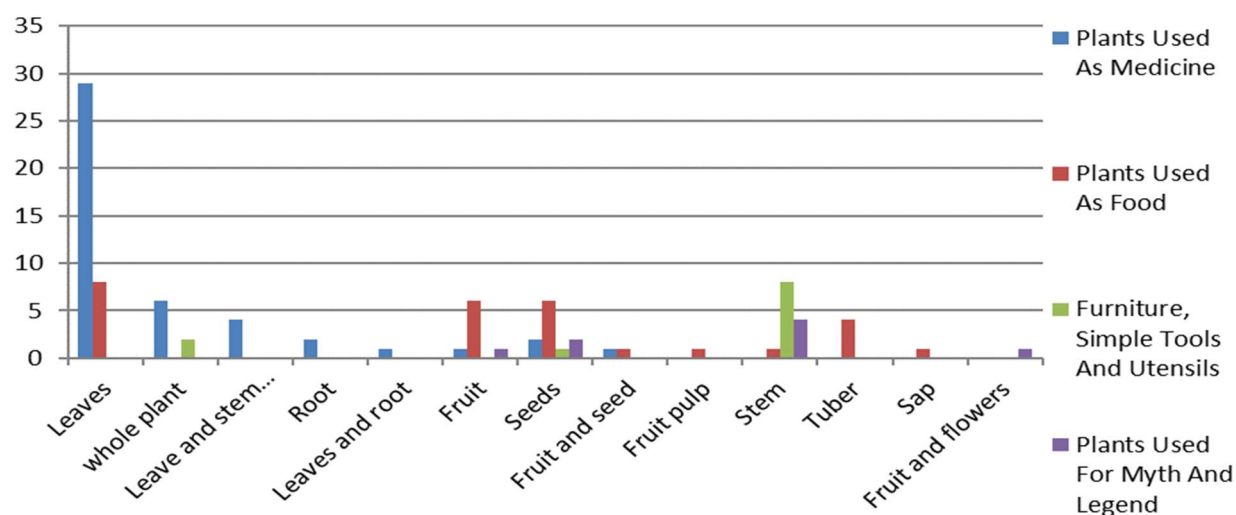
### Dynamism of indigenous knowledge, based on age and gender

It was revealed that the younger generation has limited knowledge on ethnotaxonomy and the medicinal uses of the collected plants, this mark a significant reason those below the age of 25 years were not involved in the collection, and the identification process, as many of them consulted could not provide a valuable response. The statement above was also supported in the work of Aniama *et al.* (2016) and Ancha *et al.* (2017).

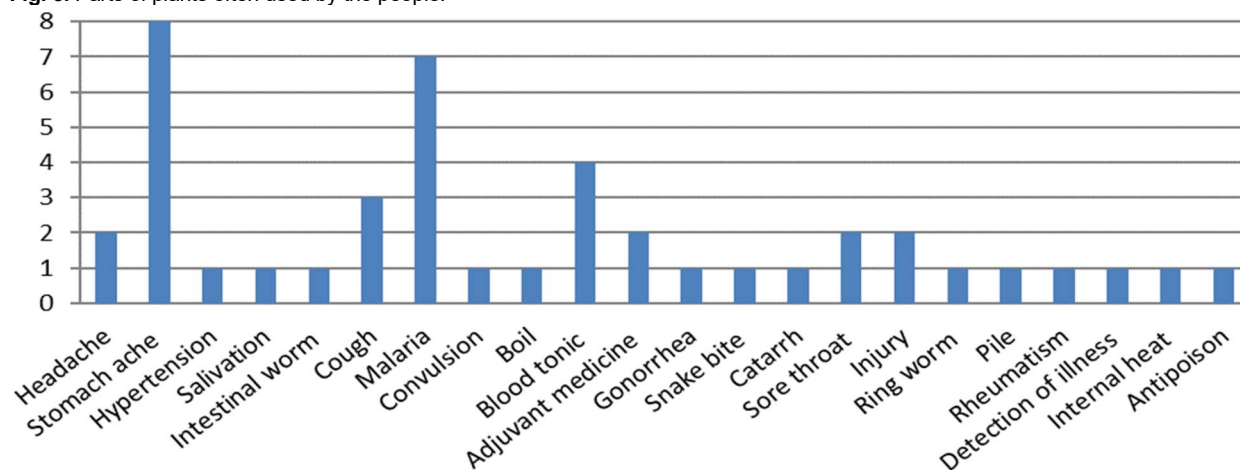
According to Chris (2017), gendered knowledge varies with the environment. Following his statement, it was observed in this area of Kogi state that men were more knowledgeable in medicinal plants than women because men have the right to become herbalist or witchdoctor and they are not forbidden to step on or cross over any medicinal preparation meant to be used by other men. The findings mentioned above are in line



**Fig. 2.** Information gathered from respondents based on plant uses and description from the eight villages.



**Fig. 3.** Parts of plants often used by the people.



Number of medicinal plants used

**Fig. 4.** Common ailment treated using different medicinal plants in the study area. **Note:** *Scoparia dulcis* was not added to the result analyzed in Fig. 4, because its use for cleansing against evil spirits does not have scientific backings. However from scientific reasoning inhalation of the smoke from the burning plant may have some therapeutic value.



Table 1. Preliminary Phytochemical screening

	Alkaloid	Cardiac glycoside	Flavonoid	Saponin	Starch	Steroid	Phlobatanin	Reducing sugar	Terpenoid	Tannin	Anthraquinones	Resin
<i>Acacia ataxacantha</i>	++	-	++	++	-	-	-	++	+	+++	+	-
<i>Acanthospermum hispidum</i>	+	-	++	+	-	-	-	++	-	-	-	-
<i>Aeschynomene americana</i>	+++	+	++	-	-	-	+	-	+	-	+	+
<i>Aframomum augustifolia</i>	++	-	++	-	-	+	-	-	-	-	+	-
<i>Aframomum melagueta</i>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<i>Amaranthus spinosus</i>	++	+	++	+	-	-	-	-	+	+	-	+
<i>Ampelocissus africanus</i>	+	-	-	+	+	+	-	-	-	+	-	++
<i>Annona senegalensis</i>	++	-	-	+	+	-	-	-	+	++	-	-
<i>Anthocleista djalensis</i>	-	+	++	++	-	-	+	-	-	+	+	-
<i>Aspilia africana</i>	++	++	++	+	-	-	-	-	++	+	-	-
<i>Astraea lobata</i>	+++	++	+	++	-	-	-	-	+	++	-	+
<i>Atiaris toxicaria</i>	+++	++	++	+	-	-	-	-	+	++	-	+
<i>Bambusa vulgaris</i>	+	-	++	+	-	-	-	++	-	+	-	-
<i>Boerhavia diffusa</i>	++	+	+	++	++	++	-	-	+	-	-	+
<i>Bridelia ferruginea</i>	+	-	+	++	-	+	-	+	-	+	-	-
<i>Cola milleni</i>	+	-	-	++	-	++	-	-	-	+	+	+
<i>Commelina benghalensis</i>	++	-	++	+	+	-	-	-	-	+	-	-
<i>Crescentia cujete</i>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<i>Desmodium velutinum</i>	-	-	+	+	-	++	+	-	-	++	-	++
<i>Euphorbia hirta</i>	-	-	-	+	-	++	-	-	+	+	-	-
<i>Ficus capensis</i>	++	+	+++	++	++	++	-	+	+	++	-	+
<i>Ficus exasperata</i>	-	-	+	+	+	-	-	-	+	+	-	-
<i>Garcinia kola</i>	+	-	++	++	+	+	-	+	-	+	-	-
<i>Gloriosa superba</i>	++	+++	++	-	+	+	-	-	++	++	-	-
<i>Holarrhena floribunda</i>	-	+	+	-	-	+	-	-	+	+	-	-
<i>Hymenocardia acida</i>	++	+	++	+	-	+	-	+	++	+	-	-
<i>Ipomoea asarifolia</i>	+	+++	++	++	-	+	-	+	-	++	-	-
<i>Landolphia owariensis</i>	+	-	++	+++	+	++	-	-	-	+	-	-
<i>Laportea aeustuans</i>	+	+	++	-	-	+	-	-	+	+	-	+
<i>Laportea ovalifolia</i>	+	+	++	+	-	-	-	-	+	+	-	+
<i>Lophira lanceolata</i>	-	-	++	++	-	+	-	-	-	++	++	-
<i>Luffa cylindrical</i>	+++	++	-	+++	-	++	-	+	-	-	-	-
<i>Malacantha alnifolia</i>	-	++	+	+	-	+	-	-	-	+	-	++
<i>Morinda lucida</i>	++	-	+	++	-	+	+	-	-	+	+	-
<i>Nauclea latifolia</i>	+	-	+++	++	-	-	-	-	+	++	+	-
<i>Parkia biglobosa</i>	-	-	++	+	-	-	-	-	+	-	-	-
<i>Paullinia pinnata</i>	++	-	++	++	-	+	-	-	-	++	++	-
<i>Phyllanthus amarus</i>	+	-	++	++	-	-	+	++	-	+	-	-
<i>Phyllanthus muellerianus</i>	++	+	++	+	-	+	-	+	-	+	+	-
<i>Prosopis africana</i>	-	-	++	+	-	+	-	+	+	-	-	++
<i>Scoparia dulcis</i>	-	+	++	++	+	-	-	-	-	-	-	-
<i>Securidaca longipedunculata</i>	+	+++	++	++	-	-	+	++	-	++	-	-
<i>Senna occidentalis</i>	-	+	++	++	-	++	-	++	+	++	+	+
<i>Solanum americanum</i>	+++	++	++	+	-	+	-	++	-	++	-	+
<i>Steriospermum kunthianum</i>	-	-	+	+	-	+	-	-	+	-	+	-
<i>Synedrella nodiflora</i>	++	-	++	+	-	-	-	+	-	++	+	++
<i>Uvaria chamae</i>	++	+	++	+	-	+	-	+	+	++	++	-
<i>Vitex doniana</i>	++	-	++	++	-	+	-	-	+	+	+	-

with the study of Ogbole (2010), that men are more implicated in treatments with medicinal plants than women but contrary to the work of Betti (2004) where the bulk of the information was obtained from women.

In the utilization of plants for either food or medicine, women have always played vital roles as they are always involved in the preparation process since they cook food

and medicine for their families in most cases. Because they are actively involved in nurturing their children, they understand infant ailments and possible herbal remedy as supported by the work of Chris (2017) on the role of women in the sustainability of indigenous knowledge in western highlands of Kenya, and Ajaiyeoba *et al.* (2003) on the cultural categorization of



febrile illnesses in Southwestern Nigeria. The above findings slightly agree with the work of Oyelakin (2009), according to him, there are forms of medicine which are marked for the care of pregnant women and elders. But contrary to the statement of Togola *et al.* (2005) which states that women merely treat children and typical child diseases while men treat both children and adult diseases. The primary role of most indigenous women in the studied areas are child breeding and to be a successful mother in such area, you must understand infant medicine which is one of the vital functional roles of mothers in Igala kingdom. The role of men in food or herbal medicine in Kogi East is rather prescriptive than administrative as men will always provide and suggest what to be prepared than preparing it themselves.

#### Similarities in utilization among various cultures and synergistic phytomedicine.

The use of *Morinda lucida* in this study for treating fever (Table S2) is in line with the study of Ajaiyeoba *et al.* (2003) also, the same plant was used to treat the rainy season fever and typhoid fever which has similar generic name 'Iba' between the Yoruba and Igala tribe of Nigeria. Contrary to the work of Frausin *et al.* (2014) on the use of plants in the family Annonaceae traditionally as anti-malaria, the Igala people in Nigeria used plants in this family to treat snakebite, stomach ache, and gonorrhoea/toilet infection as seen in the medicinal uses of *Annona senegalensis* and *Uvaria chamae* (Table S2), the study of Alquasim (2013) partially harmonized both studies in which he stated the possibilities of *Annona senegalensis* to be used as a remedy for snakebite, stomach ache and malaria. The use of *Uvaria chamae* for the treatment of stomach ache associated with gonorrhoea, in the study conducted by Oluremi *et al.* (2010) is in line with the present study.

*Acanthospermum hispidum* in combination with *Cymbopogon citratus* was used in this study for the treatment of headache and catarrh but the study conducted by Artur *et al.* (1997) on the antiviral properties of *Ac. hispidum*, it was discovered during incubation that the replication of alphaherpesviruses, pseudorabies virus, and bovine herpesvirus treated with extract of *Ac. hispidum* was impaired in a concentration-dependent manner whereas replication of swine fever virus, foot-and-mouth disease virus and vaccinia virus was not affected. They further stated that the delineation of the mechanism of the antiviral activity demonstrated inhibition of alphaherpesvirus attachment to the cell and to a lesser extent, penetration into the cells. In contrast, viral gene expression was not inhibited by the extract when added after the entry of virions into the target cells. From their study, it could be deduced that though the plant extract showed some antiviral properties by inhibiting viral replication, but its effective usage for the treatment of catarrh may be due to synergy action with

the extract of *Cymbopogon citratus*. The anti-inflammatory and antimalarial activity of *Cy. citratus* in the work of Shah *et al.* (2011) ultimately support the use of the plant in this study as drug adjunct in the treatment of headache and catarrh. In a review on *Ac. hispidum* by Chakraborty *et al.* (2012), they stated in conclusion that the immense potential of the plant in the treatment of diarrhoea, as an antiviral, antitrypanosomal, antiplasmodial, antimicrobial, antitumor, anthelmintic and many more may be due to the presence of the phytochemicals in it (carbohydrates, alkaloids, glycosides, flavonoids, tannins, terpenoids and saponins). The chemicals mentioned above were also detected in the phytochemistry of the plant in this current study (Table 1). In seven of the plants that contain steroids and flavonoid with possible use as pain killers, four of them (*Senna occidentalis*, *Landolphia owariensis*, *Ficus capensis* and *Morinda lucida*) are used for treating malaria and symptoms arising from it, the rest three (*Uvaria chamae*, *Hymenocardia acida* and *Aframomum augustifolia*) are used for treating stomach ache. Further research on the plants mentioned above and other plants mentioned can lead to the discovery of novel drugs for the treatment of malaria and stomach ache or ulcer because medicines derived from plants are widely used in recent times as they are believed to be relatively safer than their synthetic substitutes.

Twenty-one species (*Bridelia ferruginea*, *Phyllanthus muellerianus*, *Holarrhena floribunda*, *Landolphia owariensis*, *Solanum americanum*, *Boerhavia diffusa*, *Gloriosa superba*, *Senna occidentalis*, *Uvaria chamae*, *Desmodium velutinum*, *Lophira lanceolata*, *Ficus capensis*, *Hymenocardia acida*, *Laportea aestuans*, *A. augustifolia*, *Malacantha alnifolia*, *Prosopis africana*, *Paullinia pinnata*, *Vitex doniana*, *Garcinia kola*, *Morinda lucida*) identified in this study as revealed by the preliminary phytochemistry in table 1, tends to contain steroids and flavonoids combined. The ethnomedicinal information derived from most of their uses indicates them as pain killers. Rice-Evans *et al.* (1995) stated the potential health benefits arising from the antioxidant activities of polyphenolic compounds and functional hydroxyl groups in flavonoids which reconcile their antioxidant effects by scavenging free radicals. This is in line with the result of the current study (Table 1). Although some research work strongly stressed on the adverse effect of steroids (Jaturapatporn, 2012; Flower, 1978), but steroidal drugs such as diosgenin have been isolated from yam tubers and other plants and used as precursors for the synthesis of hormones and corticosteroids which improve fertility in human (Bhushan and Ravindra, 2017; Adeleye, 2018; Crabbe, 1979). Therefore the aforementioned analysis will possibly open a scientific window into the research of synergistic application of steroids and flavonoids in natural products.



It was discovered from Table S2–5 that twelve species (*Isacina trcantha*, *Bambusa vulgaris*, *Solanum americanum*, *Boerhavia diffusa*, *Annona senegalensis*, *Landolphia owariensis*, *Ficus capensis*, *Cola milleni*, *Kigelia africana*, *A. augustifolia*, *A. melagueta* and *Elaeis guineensis*) have more than one uses, which is in line with the work of Fakim (2006) as described by Dar *et al.* (2016) on the uses of the oils from *Commiphora* species, *Cedrus* species, *Glycyrrhiza glabra*, *Papaver somniferum* and *Cupressus sempervirens* for the cure of diseases extending from colds and coughs to inflammation and parasitic infections.

#### Food and drinks.

The research work of Van Den Eynden *et al.* (2003) on wild foods from Southern Ecuador is also supported by this work as the Igala people eat ‘Okoho’ which is gotten from *Cissus populnea*, ‘Ejiji’ from *Vitex doniana* and ‘Oro-dudu’ from *Sesamum radiatum* because they are all gotten from the wild. The foods mentioned above are becoming popular beyond the boundaries of Kogi State. The people in this region eat the same kind of solid food called ‘Oje’ and they have a unique soup known as Okoho (Table S3) which is also identified with the Idoma tribe of Benue state in Nigeria. *C. populnea*, (Okoho) although used as food in this study (Table S3), the phytochemical profile revealed the presence of anthraquinones (Table 1), a phytochemical which justify the use of the stem bark in the treatment of indigestion as seen in the work of Ibrahim *et al.*, (2011).

Fermented seeds of *Parkia biglobosa* are transformed into a food condiment (Table S3) which is widely eaten in Kogi State but given minimal preference in Kogi East compared to the fermented seeds of *Prosopis africana* which are widely eaten in Kogi East as an alternative herbal maggi because it has some particular nutritional value unlike flavouring industrially manufactured maggi which mainly consist of glutamate compound. The uses of *P. biglobosa* for food and other purposes was supported by the work of Kourouma *et al.* (2011) in which they grouped their findings on the plant from respondents into medicinal, food, commercial, handicrafts and domestic, medico-magic, veterinary and cultural. In support of this study on the use of *Pr. africana* as food, Asoiro and Ohagwu (2017) commended the fermented seeds of *Pr. africana* as highly-priced food condiment rich in protein, fatty acids and other vital nutrients and minerals.

The Igala people have a popular drink known as ‘Ote-oburukutu’ which is prepared using *Pennisetum typhoides*. Ote-oburukutu is the best of all locally prepared alcoholic drinks in Nigeria. Similar drink with the name Burukutu is also prepared in Niger, Nassarawa and Kaduna state using *Sorghum bicolor* but it does not have the quality possessed by the one produced in Kogi East and some part of Benue state. Palm wine (Ote-ekpe)

is also a popular drink in this region. Palm wine can be found and popularly drunk in virtually all parts of Nigeria. *E. guineensis* is the most useful plant in this region because it is used in building, for production of palm wine, for making brooms, black soap and as an ingredient for performing a sacrifice (Table S1–5). The uses of *E. guineensis* in the context above partially satisfy the question asked in the work of Guèze *et al.* (2014).

#### Herbs and myth.

In this present study, the seed of *A. melagueta* was added to every herbal preparation made by the herbalist in the study area. According to them, it is believed that their gods and ancestors work therapeutic magic through the plant seed. Furthermore, the work of Doherty *et al.* (2010) possibly confirmed the multiple usages of the seed of *A. melagueta* in most herbal preparation due to its antibacterial and antimycotic activity. The study above suggested the possible use of the extracts of *A. melagueta* in treating bacteria and fungi infections associated with the test organisms and in addition, it could be used as food and as a preservative. The multiple usages of this plant were further confirmed in the work of Lawal *et al.* (2007) in which it was discovered that consumption of the seeds of *A. melagueta* resulted in the lowering of cardiovascular indices such as systolic blood pressure, diastolic blood pressure, pulse pressure and mean arterial pressure in normotensives and hypertensives human test subjects, respectively.

Igala people believe in the gods, which in most of the communities they call ‘Iboegu.’ *A. melagueta*, is a plant used to bridge the communication gap between the people and the gods, some people use *C. nitida* or *C. acuminata* though in rare cases (Table S5). They used psychoactive plants like *Datura stramonium* (Table S5) in the process of communicating with the spirit world, which conforms with the work of Armijos *et al.* (2014) on the use of sacred and psychoactive plant species in traditional medicine by the people in the southern region of Ecuador.

#### Art and culture.

The people in this region of Kogi state have similar dressing patterns and social activities as it reflects in their music, dance and masquerades. *Antiaris toxicaria* is a plant that is found very useful in this region as it was used in time past for making clothes and it is currently used for making masquerades clothes. Although the Igala culture is unique but apart from language, they share similar cultural characteristics with the Idoma tribe of Benue state. This is in line with the work of Knick (2011) where he stated that traditional culture is not the sole province of any one ethnic group and he made a comparison of cultural similarities between the Bantu people (Central Africa) and the Yoruba people (Nigeria).

During the collection of ethnobotanical information, it was gathered from two elder in Awo-Akpali that





cassava (*Manihot esculenta*) was introduced into the Igala kingdom. According to them, pounded yam (Oje-uchu) is the indigenous solid food of the Igala people, which is gotten from *Dioscorea* spp. and for that reason, *M. esculenta* was not extensively discussed in this study.

## CONCLUSION

The Igala people in Nigeria have prolonged historical usage of plants which has been demonstrated in their culture and primary health care system up to date in most villages. They know the history of plants base on uses and legend. Virtually the whole villages studied have more than one herbalist which shows that their primary health care system is profoundly grounded. They eat almost the same type of food and in almost all the things they do, plant are involved. Every incision or injury made in their body is dressed using plants, and above all, plants must be involved before divine entities can be communicated. The information regarding the uses and location of the present study has been documented in a herbarium as a repository.

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