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Traditional plant based medicines used for the treatment of COVID-19 symptoms by AWORI tribe in OJO local community of Lagos State, Nigeria

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Abstract
Background: The new corona-virus called the severe acute respiratory syndrome coronavirus (SARS-CoV-2) and COVID-19 originated for the first time in Wuhan, China in December 2019. The virus is mainly transmitted through droplets generated when an infected person coughs, sneezes, speaks or breathes. Most people who fall sick may experience mild to moderate and severe symptoms and could be fatal especially to seniors, and people with other medical conditions.
Aim: The inhibitory effects of medicinal plants extract on the replication of several viruses have been reported in the literatures. Hence, this study aimed at identification and documentation of medicinal plants used by Awori people in Ojo Local Government Area to prevent COVID-19 symptoms.
Method: An ethnobotanical survey was undertaken to collect information from herb traders, traditional healers and other people from different walks of life that gave their consent in granting the interviews in the study area between July and December, 2020.
Results: Fifty (50) medicinal plant species that belong to 20 families were identified as being used for the treatment of various COVID-19 related symptoms with the highest number of species being used for fever and malaria followed by dry cough and body pains. Trees (18 species) were found to be the most used plants followed by herbs (15 species), shrubs (10 species) and climbers (7 species). High informant consensus factor values were obtained for *Azadirachta indica, Allium sativum, Zingiber officinale, Citrus limon* and *Garcina cola,* which were reported to treat fever, sore throat, dry cough and boost immune system respectively. The traditional healers and herb sellers in the study area possess rich ethno-pharmacological knowledge.
Conclusion: This study identified and documented many indigenous medicinal plants that can serve as precursors to novel of drugs development thus, indicating high potential for economic development.

Keywords: Ethnobotany, medicinal plants, documentation

1. Introduction
The new Corona virus, also known as the COVID-19 and the severe acute respiratory syndrome Coronavirus (SARS-CoV-2) first appeared in Wuhan, China in December 2019. Most often, the virus spreads by droplets made when an infected person speaks, sneezes, coughs, or breathes. The majority of people who fall ill may have mild to severe symptoms, which could be fatal, especially for elderly people and those with existing medical disorders such as diabetes, heart disease, and cancer. This is why it is crucial that numerous research laboratories continue to focus on finding new drugs to treat this infection.
Many medicinal plants have demonstrated potential in the treatment of a range of viral diseases, and some of them exhibit broad-spectrum antiviral action. The screening of 288 plants for anti-influenza activity by Boots Drug Company in Nottingham is considered to be the first instance of recognized interest in the creation of antiviral agents from plants (Chantrill *et al*., 1952) [5]. According to literature, several viruses have been observed to be inhibited by medicinal plant extracts. Viruses such as hepatitis B virus (HBV) (Huang *et al*., 2006, Kwon *et al*., 2005), HIV (Asres and Bucar, 2005, Vermani and Garg, 2002) [4, 18], herpes simplex virus type 2 (HSV-2) (Debiaggi *et al*., 1988) [6], and diverse plant extracts have significantly reduced newly emerging viral infections linked to the poxvirus and severe acute respiratory syndrome (SARS) virus (Kotwal *et al*., 2005) [19]. Moreover, recent researches have shown that plant

extracts have the ability to combat viral strains that are resistant to traditional antiviral medications. (Serkedjieva, 2003, Tolo *et al*., 2006) [20, 21]. These have put modern drug development techniques to the test and call for a very rigorous look to the natural antiviral components of therapeutic plants.

A medicinal plant is considered any plant that has compounds that can be utilized for therapeutic purposes or that are precursors for the manufacture of valuable pharmaceuticals in one or more of its parts (Sofowora, 1993). Globally, the use of herbal medicine is growing in popularity, owing to the perception that relatively they have lesser side effects than synthetic drugs. About 80% of Africans rely on phytomedicine, which has played a significant role in global health care (Calixto, 2000) [22]. According to Elujoba *et al*. (2005) [23], phytomedicine has helped to reduce the excessive disability, morbidity, and mortality caused by diseases like tuberculosis, HIV/AIDS, diabetes, malaria, sickle-cell anemia, mental disorders and microbial infections (Iwu *et al*., 1999; Okigbo *et al*., 2005) [11]. According to Calixto (2000) [22], herbal solutions in underdeveloped nations are now extremely popular with related information on their assurance of quality, effectiveness, and safety.

In Nigeria, the majority of people still turn to traditional healers and medicinal herbs for their medical needs (Odugbemi, 2006) [15]. World Health Organization (WHO) estimated that traditional healers make up 1:110 of the population in Nigeria, compared to medical doctors, who make up 1:16 of the population. (African Health Monitor, 2003). This supports the idea that people choose practitioners of traditional medicine over orthodox medical professionals for their main healthcare requirements (Olowokudejo *et al*., 2008) [16].

The first evidence of the use of herbal treatments dates to 2800 BC and is from China. Due to the widespread preference for herbal treatment over synthetic medicine, it has now grown into a separate sector. Records from antiquity show that people in India, China, Egypt, Greece, Rome, and Syria used plants as medicines as early as 5000 years ago. The Indian subcontinent is home to an enormous collection of medicinal plants utilized in conventional medical treatments, which also serves as a rich source of information (Chopra *et al*., 1956). Several plant species are used by the various indigenous systems, including Siddha, Ayurveda, and Unani to treat various illnesses. (Rabe and Staden, 1997) [26]. Around the world, there are about 80,000 different plant species in use. Around 20,000 medicinal plant species have been identified in India (Dev, 1997), however more than 500 traditional communities use roughly 800 plant species to treat a variety of ailments (Kamboj, 2000). As a result of its lack of side effects, plant-derived medicine is currently used as the first line of basic healthcare by 80% of the world's population (WHO, 2000). This study therefore, aims at identification and documentation of medicinal plants used to treat COVID-19 symptoms by Awori people in Ojo local government area of Lagos State, Nigeria. This is necessary for possible drug development against SARS-CoV-2 and the development of strategies for biodiversity conservation of the medicinal plants.

Materials and Methods

Study Area

Ojo is a town and the sixth largest Local Government Area (LGA) in Lagos State, Nigeria. The Lagos State University, Ojo campus is located there. It is situated 37km west of Lagos along the Trans-West African Coastal Highway. It lies within the State of Lagos 6º28'N 3º11'E coordinates and occupies about 70 sq mi (182 km^2) and estimated population of 838, 900 with a density of 8,700/sq mi (3,300/km^2). It is a section of the Greater Lagos Area. Although it has some significant marketplaces, Ojo is predominantly a residential township. These markets include Iyana-Iba Market, Alaba International Market, Alaba livestock market (Alaba Rago), and the old site of the Lagos International Trade Fair. Additionally, it houses Navy Towssn and the divisional headquarters of the 81st Nigerian Army division.

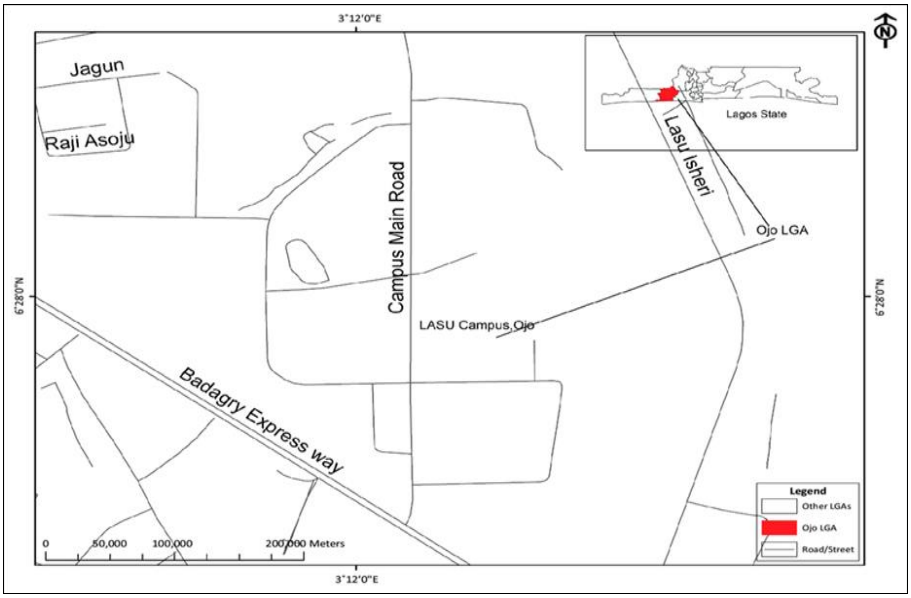

Fig 1: Map of Ojo Local Government Area of Lagos State.

Ethnomedicinal Data Documentation

Semi structured questionnaires (Table 1) were designed to collect ethno medicinal data on the plants used to treat a variety of symptoms of COVID-19 in Ojo local community. A total of 120 informants were interviewed in the area of study. The age of the interviewees ranges from 18- 65 years with 53 females and 67 males. The assessment was carried out between June and December, 2020. Interviews were conducted in Yoruba language for simple interaction with the people there. Information gathered included plant parts used, techniques of collection, storage, mode of preparations, administration methods as well as the dosage of the herbs.

Table 1: Questionnaire for collecting ethnomedicinal data in badagry local government area of lagos state, nigeria during ethnobotanical study

Informants' consent for the participation in the study:

I..... (Full name of Informant) hereby give my full agreement and participation in this study and certify that the information I have supplied is true, accurate, and complete to the best of my knowledge.

Date..... (Signature/Thumb)

Informants' details:
Full Name.....
Gender.....
Present Age.....
Education Level.....
Job Description.....
Location/Address.....

Data of medicinal plant and its use:
Plant (Local name) .....
Habit (Tree/ Herb/ Shrub/Climber/…...)
Plant part used.....
Cultivated/ Wild.....
If cultivated, cultivated for…….....
Conservation measures taken by Government and local residents……...
Method of collection and storage…….....
Name of disease(s) treated with plant…….....
Procedure of crude drug preparation.....
Method of administration.....
Dosage ....
Other uses (if any) ……..…….....

Plant collection and identification
The medicinal plants were collected from their natural environment while some were bought from the herb merchants. The collected plant samples were identified and verified with the assistance of a plant taxonomist and validated using The Useful Plants of West Tropical Africa (Burkill, 1985) [24] and Vernacular Names of Nigerian Plants (Yoruba) (Gbile, 2002) [25]. According to typical herbarium procedures, the plants were air dried, pressed, and mounted on herbarium sheets (Alexiades and Wood, 1996) [3]. The voucher specimens were deposited in herbarium of the Department of Botany, Lagos State University, Ojo, and Lagos, Nigeria.

Analysis of ethnomedicinal data
Relative Frequency of Citation (RFC) and Informant Consensus Factor (ICF) were used to examine the data gotten from the study area.
Informant Consensus Factor (Logan, 1986; Heinrich *et al*., 1998) [12, 8] was determined using the formula below.

ICF= Nur – NT/ (Nur – 1)
Where "Nur" = Total number of use reports for each disease cluster.

Nt = Total number of species used for that cluster.

Frequency of Citation (FC) and Relative Frequency of Citation (RFC)
The FC was calculated using the formula below:

FC= (Number of times a particular species was mentioned)/ (total number of times that all species were mentioned) × 100.
Also, the RFC index (Tardio and Pardo-De-Santayana, 2008) [27] was calculated by dividing the number of informants who listed the use of the plant species (FC) by the total number of informants participating in the survey (N). The RFC index varies from "0" when nobody mentioned a plant as being useful to "1" when every informant mentioned a plant as being useful.

Therefore, RFC = FC/N

Results and Discussion
Fifty (50) plant species from 32 families were recognized for the treatment of different Covid-19 symptoms reported by residents of Ojo local government area. (Table 3) The majority of plant species belonged to the Fabaceae family (7) then comes Euphorbicaeae (3), Asteraceae (3), Arecaceae (2), and Aracaceae (2) while other species had one species each as shown in Table 2.

Table 2: Medicinal plants used to cure various COVID 19 in Ojo Local Government Area, Lagos State, Nigeria Nigeria.

S/N	Botanical Name	Yoruba	Family	Plant Parts	Uses
1	*Acalypha fimbriata* Linn.	Aworoso	Euphorbiaceae	Leaves	Malaria, Dysentery
2	*Acanthaspernum hispidium* D.C.	Egun-Igba	Asteraceae	Leaves	Yellow fever
3	*Adansonia digitata* Linn.	Ose	Bombacaceae	Bark & leaves	Body pain, Immune booster, Sore throat.
4	*Adenia venenata* Forssk.	Aro-eke	Passifloraceae	Leaves	Cough, Bronchitis, Fever
5	*Alchornea cordifolia Schumach* and Thonn.	Ewe-Epa	Euphorbiaceae	Leaves, fruits, twigs & shoots	Fever, Flu,
6	*Aframomum melegueta* K. Schum.	Ataare	Zingiberaceae	Seeds/ Grains	Antiviral, cough
7	*Allium sativum* Linn.	Ayu	Amaryllidaceae	Bulb	Cough, Immune booster
8	*Annona muricata* Linn.	Apekan	Annonaceae	Fruits	Fever, Dysentery,
9	*Anthocleista vogelii* Planch.	Saapo	Longaniaceae	Leaves	Fever, body pains
10	*Artocarpus altilis* (Parkinson) Fosberg.	Epa Oyinbo	Moraceae	Fruits	Fevers, Astringent, Sedative
11	*Aspilia africana* CD Adams	Yunyun	Asteraceae	Leaves	Stomach Disorders, Cough
12	*Asystasia gangetica* (Linn) T.Anderson	Lobiri	Acanthaceae	Leaves	Fever
13	*Azadiratcha indica* ***Linn***.	Domgoyaro	Meliaceae	Leaves, Bark and Roots	Fever, Malaria
14	*Bixa orellana* Linn.	Aje	Bixaceae	Pulp & whole plant	Dysentery, Headache
15	*Basilicum polystachyon (*Linn) Moench.	Ogirisi	Lamiaceae	Leaves	Fever, Cough, Cold, Nasal Congestion
16	*Burkea Africana*	Apasa	Fabaceae	Bark and Twigs	Sore throat, Headache, Astringent
17	*Bysocarpus coccineus* Schcum and Thonn.	Amuje-wewe	Connaraceae	Leaves and Roots	Jaundice, Pile, Gonorrhoea, Impotence, Inflammation
18	*Calapogonium mucunoides* Desv.	Egbon Adagudu	Fabaceae	Leaves	Diarrhoea, Skin Infection
19	*Calotropis procera* R. Br.	Bomubomu	Asclepiadaceae	Leaves, fruits and Roots	Headache, severe body pain, malarial fever & convulsion
20	*Caprar ia biflora* Linn.	Imi-esu	Scrophulariaceae	Roots	Antifungal Agent.
21	*Capsicum annuum* Linn.	Aata-Sonbo	Solanaceae	Fruits and Seeds	Cold and Cough. Immune system booster
22	*Carica papaya* Linn.	Ibepe	Caricaeae	Leaves Unripe Fruits	Malaria. Antiviral.
23	*Cassia occidentalis* Linn.	Rere	Fabaceae	Leaves	Tiredness, Irritation
24	*Cissus quadrangularis* Linn.	Ogbakiki	Vitaceae	Bark	Caries, Urinary Disorders
25	*Citrus limon.* Linn.	Osan-lemo	Rutaceae	Leaves, Bark and fruits.	Dysentery, Fever, Headache,
26	*Citrullus vulgaris* Schrad.	Baara	Curcubitaceae	Leaves & fruits	Measles, Fever
27	*Clerodendrum volubila* P. Beauv	Marugbo	Lamiaceae	Leaves	Anti-viral, Astringent
28	*Cocos nucifera*	Aagbon	Arecaceae	Leaves and Fruits	Bronchitis, Fever Migraine, Antiseptic,
29	*Cola nitida*	Obi-Abata	Sterculiaceae	Leaves and Fruits	Diarrhoea, Stimulant, Diuretic, Cardiac Tonic
30	*Colocasia esculenta* (Linn.) Schott	Koko	Aracaceae	Tuber	Fever, antiviral
31	*Commelina diffusa* Burm. f.	Godogbo.	Commelinaceae	Leaves and Petals	Yellow Fever, Sore throat,
32	*Cnestis ferruginea* Vahl ex DC	Omu-aja	Connaraceae	Leaves	Appetite stimulant
33	*Corchorus aestuans* Linn.	Ewedu-igbo	Tiliaceae	Leaves and stem	Fever, diarrhoea,
34	*Croton lobatus* Linn.	Ajeofole	Euphorbiaceae	Leaves	Irritated eyes, Skin Diseases
35	*Culcasia scandens* P. Beauv.	Agunmona	Aracaceae	Leaves and Fruits	Skin Disease, Stomach ache
36	*Cyathula prostrata* Linn.	Awere-pepe	Amaranthaceae	Leaves	Antiviral, Dysentery
37	*Cyperus esculentus* Linn.	Ofio	Cyperaceae	Tuber	Tiredness.
38	*Dalbergia saxatilis* Hook f.		Fabaceae	Leaves	Cough, Small Pox, Skin Lesions,
39	*Daniellia oliveri* Hutch. & Dalziel	Iyaa	Fabaceae	Leaves	Backache, headache,
40	*Deinbollia pinnata* Schum &. Thonn., Guin.	Ogiri-egba	Sapindaceae	Bark and Leaves	Cough, Bronchial Asthma.
41	*Desmodium gangeticum* (Linn.) DC.	Ewe-emo	Fabaceae	Leaves	Astringent, Fever, Chest pain
42	*Dioscorea alata* Linn.	Isu Ewura	Discoreaceae	Tuber	
43	*Dioscorea dumetorum* Linn.	Esuru	Discoreaceae	Tuber	Abdominal, Vomiting, Analgesic,
44	*Elaeis guineensis Jacq*.	Eeyin	Arecaeae	Fruits and seeds	Malaria, Diarrhoea, Measles.
45	*Emilia coccinea* (Sims) G. Don.	Odundun odo	Asteraceae	Leaves	Skin rashes, aches and pains
46	*Entada Africana* Guill. & Perr.	Ogunrobe	Fabaceae	Leaves, Bark	Astringent, Malaria.
47	*Garcina cola* Linn.	Orogbo	Clusiaceae	Seeds	Cough, Catarrh, Hay-Fever, Increase La
48	*Gongronema latifolium (*Endl.) Decne.	Utazi	Asclepiadaceae	Leaves	Sore throat, Tiredness,
49	*Morinda lucida* Benth.	Ewe-Oruwo	Rubiaceae	Leaves	High fever and Malaria
50	*Zingiber officinale* Roscoe	Ata-ile	Zingiberaceae	Rhizomes	Sore throat, Cough, Immune booster

Table 3: Frequency of Medicinal Plants Distribution in Families

S/N	Family	Frequency of Distribution
1	Euphorbiaceae	4
2	Asteraceae	3
3	Bombacaceae	1
4	Passifloraceae	1
5	Zingiberaceae	2
6	Amaryllidaceaea	1
7	Annonaceae	1
8	Longaniaceae	1
9	Moraceae	1
10	Acanthaceae	1
11	Meliaceae	1
12	Bixaceae	1
13	Lamiaceae	1
14	Connoraceae	2
15	Fabaceae	7
16	Ascleipidaceae	1

17	Scrophulariaceae	1
18	Solanaceae	1
19	Caricaceae	1
20	Vitaceae	1
21	Cucurbitaceae	1
22	Arecaceae	2
23	Araceae	2
24	Sterculiaceae	1
25	Rutaceae	1
26	Commelinaceae	1
27	Tiliaceae	1
28	Amaranthaceae	1
29	Cyperaceae	1
30	Sapindaceae	1
31	Discoreaceae	2
32	Rubiaceae	1
33	Clusiaceae	1

Table 4: Shows the informant consensus factors (FIC) for some of the used medicinal plants in the study area.

S/N	Plant species	Quotation frequency	Informant consensus factor (FIC)
1.	*Zingiber officinale*	75	1.00
2.	*Garcina cola*	68	0.95
3	*Allium sativum*	60	0.90
4	*Citrus limon*	60	0.90
5	*Azadiratcha indica*	57	0.83
6	*Morinda lucida*	40	0.44
7	*Calotropis procera*	12	0.11

Zingiber officinale had the highest FIC because of the high quotation frequency while *Calotropis procera* had the lowest FIC value.

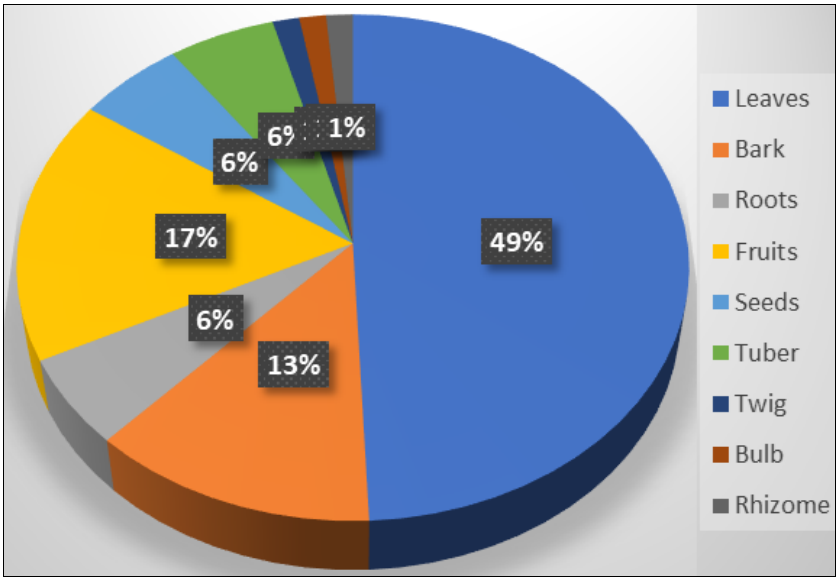

Fig 2: Plant parts used

Conclusion

The ethnobotanical studies in the study area revealed that the local herb sellers and traditional practitioners in Ojo area have extensive knowledge of ethnopharmacology. This study found and recorded numerous indigenous medicinal plants that can be used as starting materials for the production of pharmaceuticals, showing a significant potential for economic growth. The local and rural populations might benefit financially from bio-prospecting in this region. The identified medicinal plants have marketing potentials as well, thus efforts should focus on fostering a supportive environment. Therefore, it is important to carefully maintain the knowledge of how to use these medicinal herbs so that it does not become lost.

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