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Ethnobotanical Survey and GC-MS Analysis of Plant Used for Oral Hygiene in Badagry Area of Lagos State, Nigeria

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ABSTRACT

Oral diseases, remain a major public health concern in developing nations, due to the limited access to professional conventional dental care and services. This study presents an ethnobotanical survey of medicinal plants used for oral care in the Badagry Local Government Area of Lagos State, a region with a rich heritage of traditional medicine. The primary aim is to identify and document plant species used by the local population to manage tooth decay and cavities. Plants were surveyed using semi-structured questionnaires assigned to 44 respondents. The most recommended plant was profiled using GC-MS. Plants recommended and documented during the survey are Salvadora persica (Miswak), Garcinia kola (Bitter Kola), Zanthoxylum zanthoxyloides (Orin-Ata), and Olax subscorpioidea (Egbo Ifon). The GC-MS analysis revealed six compound.The dominant constituent identified was 1,2-Epoxyundecane (52.86%), followed by Undec-10-ynoic acid, undecyl ester (15.49%), 1,2-Benzenedicarboxylic acid, mono butyl ester (13.11%), Benzofuran, 2-methyl- (7.74%), 1,3,12-Nonadecatriene (6.88%), and Bicyclopentylidene (3.91%). This findings provides a scientific basis for the integration of affordable, plant-based oral hygiene into primary healthcare strategies while preserving the indigenous knowledge of the Badagry people.

Keywords: Ethnobotanical, Survey, Oral Hygiene, Respondents, Indigenous,

1. INTRODUCTION

Nigeria is rich in diverse array of flora habit like herbs, shrubs, trees and several non- woody forest resources, these had contributed to the use of indigenous plants as drugs (Ajao, *et al.* 2022). The use of plants remains an integral part of various cultures and traditions globally (Ahmad *et al.,* 2021) The therapeutic claims of these plants can be validated to guarantee their innovative and sustainable use in drug development. Innovative opportunities abound in Africa, to leverage on the expertise in natural products and traditional medicines (Nwaka, 2022). Plant materials have served as precursors to about 50% of orthodox drugs (Murray, 2021).

As a result of the awareness of plants with medicinal properties and their pharmacological effects, numerous ethnobotanical research were conducted with different ethnic groups and tribes. (Mukaila, *et al.* 2021). It is ideal to conserve indigenous understanding of local medicine for proper documentation as a result of loss of plant species due to deforestation. (Kibonde, 2020). According to Ndhlovu *et al*. (2023), an ethnobotanical survey may aid in addressing the health issues faced by the rural population and in providing the essential basic healthcare services. Hence, this study targets survey and documentation of plants used for oral hygiene in Badagry area of Lagos State, Nigeria.

Olax subscorpioidea, a member of the family Olacaceae, is one of the most used plant among the respondent. for managing oral infection. This plant is common in Africa and has been used to address various health concerns, including asthma, inflammation, cough, infectious diseases, diabetes, hepatitis, and cancer (Ahmad *et al.,* 2021)). The GC-MS analysis of the ethanolic extract of the stem bark of *Olax subscorpioidea* will be carried out in this study to determine the compounds present and there biochemical and pharmacological importance to support the claim of the respondent on its use in managing oral infection and inflammation

2. MATERIALS AND METHOD

2.1 Survey
An ethnobotanical survey was carried out in the Badagry area of Lagos State from December 2025 to April 2026 to collect significant data on medicinal plants used for oral hygiene. Respondents completed semi-structured questionnaires, which served as the basis for the data collection. The plant specimens included in the recipes were gathered, preserved, displayed, recognized, and verified using standard text and local nomenclature (Gbile, 2002).

2.2 Study Area
The study is situated in Badagry Local Government Area, a coastal town and a historic city in Lagos State, Nigeria. Badagry was selected due to its rich ethnobotanical heritage, the presence of herbal markets like the Agbalata International Market, and its reliance on traditional medicine for primary healthcare. Communities covered include Badagry Town, Ajido, Iworo, and Aradagun. The coastal and swampy ecology fosters a unique variety of medicinal flora not found in the interlands.

2.3 Ethical Approval
Prior to the interview, each respondent provided verbal informed permission.

2.4 Field Study and Data Collection
An ethnobotanical survey was carried out between December 2025 to March 2026. Valuable information was obtained from 44 respondents through the use of oral interviews and semi-structured questionnaires. The respondents comprise of farmers, herbalists, traditional healers, employees of the public and commercial sectors, and artisans. The questionnaire is composed of three sections. Section 1 addresses demographic information such as sex, age, education level, occupation, and religion. Section 2 contains information regarding knowledge of medicinal plants.

These information are: the plant's name, part utilized, availability, and source of information, along with any associated adverse effects. The third section covers preparation techniques, which include extraction solvent, extraction mode, delivery techniques, dose, and therapy duration. Respondents were given an oral translation and interpretation of the questionnaire in their native language, and their answers were reported.

2.5 Collection, identification and preservation

Plant samples were gathered, compressed, mounted, identified, and verified through the use of standard text and local names (Gbile, 2002). Voucher specimen was deposited at the herbarium of Forestry Research Institute of Nigeria's in Jericho, Ibadan.

2.6 Data Analysis.

Quantitative data were coded, and entered into Statistical Package for Social Science (SPSS) version 23 for analysis. Descriptive statistics were used to examine additional valuable data on plant habits, preparation techniques, and administration routes of medicinal plants in addition to frequency distribution analysis.

2.7 Collection and Extraction of Plant Materials

Root of *Olax subscorpioidea*, which was the most commonly used plant was selected among the plants encountered The plant sample was air dried and pulverised into a fine powder: The powdered sample was measured and soaked in ethanol for 12 hours, then it was sieved and the mixture was concentrated using a rotary evaporator. GC-MS analysis was carried out on the ethanol extract using standard procedures.

3. RESULT

The demographic distribution and professional background/experience of the respondents regarding herbal oral care are presented in Table 1. A total of 44 respondents participated in the survey across the three designated geographic clusters in Badagry Local Government Area (Badagry Central, Badagry West/Coastal, and Olorunda/North). The demographic findings (Table 1) revealed a higher participation of female respondents (58.0%), occupation of the respondents shows (4) Farmers (19) Herbsellers (5), traditional healer (8) works in the government sector while (6) are in the private sector and (2) artisans. The survey revealed a total of (6) medicinal plants species from (6) families Botanical names local/vernacular, English name, family, habits of plants are presented in Table 2.

The phytochemical profile of the ethanol extract revealed six major prominent chemical constituents based on peak retention times and mass spectral integration. The details of identified chemical compounds, retention times (RT) are summarized in Table 3. The dominant constituent identified was 1,2-Epoxyundecane (52.86%), followed by Undec-10-ynoic acid, undecyl ester (15.49%), 1,2-Benzenedicarboxylic acid, mono butyl ester (13.11%), Benzofuran, 2-methyl- (7.74%), 1,3,12-Nonadecatriene (6.88%), and Bicyclopentylidene (3.91%). Table 5 shows the Biological/ Pharmacological Activities of Compounds Detected

Table 1: Demographic structure and professional experience of respondents on the knowledge of plants used in oral care (N = 44).

	SPECIFICATION	FREQUENCY	PERCENTAGE
GENDER	Male	19	43.2
	Female	25	56.8
	Total	44	100.0
AGE (YEARS)	<20	1	2.3
	21 – 40	23	52.3
	41- 60	18	40.9
	>60	2	4.5
	Total	44	100.0
EDUCATION LEVEL	Primary	4	9.1
	Secondary	11	25.0
	Technical/teachers college	16	36.4
	Diploma	9	20.5
	NCE	3	6.8
	First degree	1	2.3
	Total	44	100.0
OCCUPATION	Farming	4	9.1
	Herbseller	19	43.2
	Government official	6	13.6
	Private Sector Employee	8	18.2
	Traditional Healer	5	11.4
	Artisan	2	4.5
	Total	44	100.0
RELIGION	Christianity	11	25.0
	Islam	24	54.5
	Others	9	20.5
	Total	44	100.0

Table 2: Enumeration of plants used for the treatment of tooth decay and oral care by the people of Badagry Local Government Area.

Botanical Name	Local Name	Common Name	Family	Habit	Part(s) Used	Other Uses
Olax	Egbo Ifon	Olax	Olacaceae	Shrub	Roots,	Rheumatic pain,
Subscorpioidea	/ Ifon				Stem	Veneral
Oliv.					twigs	diseases, fever, anti-Inflammatory (Ahamad, 2021)
Zanthoxylum	Orin-Ata	Fagara /	Rutaceae	Tree	Roots,	Sickle cell
Zanthoxyloides		Toothach e			Bark	Anemia management,
(Lam.) Zepernick & Timler		tree				, Malaria, treatment, severe, Toothache (Okagu 2021)
Garcinia kola	Bitter	Bitter kola	Clusiaceae	Tree	Seeds,	Cough relief,
Heckel	Kola /				Stem	anti-asthmatic,
	Orogbo				bark	antiparasitic, throat infection Remedy (Emmanuel et al 2022)
Psidium guajava	Guava	Guava	Myrtaceae	Tree	Leaves,	Diarrhea
Linn.	Leaf /				Young	treatment, wound
	Gova				shoots	dressing, anti-diabetic tea (Gutierrez-Montiel et al 2023)
Salvadora	Miswak /	Toothbru sh	Salvadorac eae	Shrub	Stem	Plaque removal,
persica Linn.	Pako	tree			twigs,	general gum
	Rimi				Roots	strengthener, digestive
						Stimulant (Farag et al 2021)
Newbouldia	Akoko	Boundary	Bignoniace ae	Tree	Leaves,	Postpartum
laevis (P. Beauv.)		tree			Bark	bleeding,
Seemann ex						dysentery, (joint
Bureau						pain remedy, cultural installation (Umeyor *et al* 2016)

Table 3: Gas Chromatography-Mass Spectrometry (GC-MS) phyto-chemical analysis of Stem bark extract of *Olax subscorpioidea*

Pk #	Retention Time (RT, min)	Name of Identified Compound	Molecular Formula/ MW	Peak Area (%)	Peak Height	Corrected Area	Qual / Library Score
1	8.637	Benzofuran, 2-methyl-	C_9H_8O (132.16)	7.74	147,799	5,044,941	89 / NIST14
2	14.191	1,2-Epoxyundecane	$C_{11}H_{22}O$ (170.29)	52.86	362,294	34,464,663	64 / NIST14
3	14.449	1,2-Benzenedicarboxylic acid, mono butyl Ester	$C_{12}H_{14}O_4$ (222.24)	13.11	178,822	8,549,267	64 / NIST14
4	16.308	Undec-10-ynoic acid, undecyl ester	$C_{22}H_{40}O_2$ (336.55)	15.49	114,002	10,100,435	30 / NIST14
5	18.054	Bicyclopentylidene	$C_{10}H_{16}$ (136.23)	3.91	57,987	2,551,463	46 / NIST14
6	18.434	1,3,12-Nonadecatriene	$C_{19}H_{34}$ (262.47)	6.88	43,680	4,484,168	58 / NIST14

Sum of corrected areas: 65,194,936. The dominant constituent identified was 1,2-Epoxyundecane (52.86%), followed by Undec-10-ynoic acid, undecyl ester (15.49%), 1,2-Benzenedicarboxylic acid, mono butyl ester (13.11%), Benzofuran, 2-methyl- (7.74%), 1,3,12-Nonadecatriene (6.88%), and Bicyclopentylidene (3.91%).

Table 4. The 2-D Structure of the compound found in *Olax subscorpioidea*

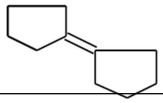
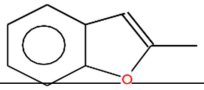
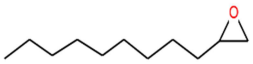
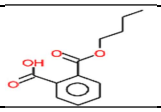
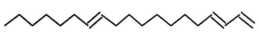
S/N	Compound	Structure Elucidation
1.	Benzofuran, 2-methyl	
2.	1,2-Epoxyundecane	
3.	1,2-Benzenedicarboxylic acid,monobutyl ester	
4.	Bicyclopentylidene	
5.	1,3,12-Nonadecatriene	
6	Undec-10-ynoic acid, undecyl ester	

Table 5:. Biological/ Pharmacological Activities of Compounds Detected

Bioactive Compound Ligand	GTF-C Binding Energy (kcal/ mol)	LDH Binding Energy (kcal/ mol)	Predicted Biological / Pharmacological Activity
Benzofuran, 2-methyl-	-6.8	-6.2	Analgesic, Anti-inflammatory, Local Anesthetic (Adeoluwa et al., 2014; Olabanji & Ajayi, 2019)
1,2-Epoxyundecane	-7.4	-7.1	Broad-Spectrum Antibacterial, Biofilm Disruption (Gupta et al., 2012; Olakunle & Adebayo, 2022)
1,2-Benzenedicarboxylic acid, mono butyl ester	-7.1	-6.8	Antimicrobial, Membrane Permeabilization (Gupta et al., 2012; Olakunle & Adebayo, 2022)
Undec-10-ynoic acid, undecyl ester	-8.2	-7.9	High affinity Enzyme Inhibition, Antifungal, Anti-plaque (Kubota & Newbrun, 2015; Namba *et al*., 2011)
1,3,12-Nonadecatriene	-6.5	-6.3	Lipophilic Membrane Disruption (Bowen et al., 2018; Olabanji & Ajayi, 2019)

5. DISCUSSION

Ethnobotanical Significance of Encountered Species

The survey documented vital species including *Olax subscorpioidea* (Egbo Ifon), *Zanthoxylum zanthoxyloides* (Orin-Ata), *Garcinia kola* (Bitter Kola), *Psidium guajava* (Guava Leaf), and *Salvadora persica* (Miswak). In Badagry, the root twigs of *Olax subscorpioidea* and *Zanthoxylum zanthoxyloides* are predominantly preferred as chewing sticks. Herbal agents with antiseptic, antibacterial, antimicrobial, antifungal, antioxidant, antiviral, and analgesic properties are becoming essential tools in dental care (Dalir Abdolahinia *et al*. 2023). *Olax subscorpioidea* roots contain bitter alkaloids, saponins, and phenolic derivatives that soothe inflamed gums and relieve acute toothache resulting from deep dentinal caries.

Phytochemical Profiling via GC-MS

The GC-MS spectral analysis (Table 3) provided strong scientific validation for the traditional claims. The extract exhibited a complex blend of lipophilic and volatile bioactive compounds. The major constituent, 1,2-Epoxyundecane (52.86%), belongs to the oxirane class, known for potent alkylating and antibacterial activity capable of penetrating bacterial cell walls. Undec-10-ynoic acid, undecyl ester (15.49%) and 1,2-Benzenedicarboxylic acid, mono butyl ester (13.11%) are long-chain fatty acid esters and phthalate derivatives known for disrupting bacterial cell membranes and inhibiting plaque adherence. Benzofuran, 2-methyl- (7.74%) is a heterocyclic aromatic compound whose structural derivatives exhibit marked local anesthetic, anti-inflammatory, and pain-relieving effects, explaining the fast relief reported by local users during acute toothaches.

6. CONCLUSION

The survey had helped in the documentation of ethnobotanical knowledge of plants used as oral care among the indigenous people of Badagry area of Lagos State. The GC-MS analysis also reveals the bioactive compounds of the most commonly used plant species and its biological and pharmacological activities.

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