Assessments of medicinal plant usage for the traditional treatment of skin diseases in Akinyele Local Government Area, Ibadan, Oyo State, Nigeria

O.C. Ariyo, M.B. Usman, D.O. Adelani and M.O. Ariyo

Research

Abstract

Background: Skin diseases is one of the major health concerns worldwide because it affects people of all ages and gender from neonates to the elderly and constitute one of the five reasons for medical consultation. The study was designed to assess medicinal plants used for traditional treatment of skin diseases in Akinyele Local Government Area, Oyo State, Nigeria

Methods: A total number of 320 respondents comprising of herbalist, herb sellers, hunters and farmers were selected randomly from eight villages within the study areas. Information on the medicinal plant used for traditional treatment of skin diseases was collected by semi-structured questionnaires administered to the respondents one-on-one in the local language (Yoruba) of the people. The data collected were analysed using descriptive statistics such as tables, percentages, pie charts, bar charts, Frequency of Citation (FC), Relative Frequency of Citation (RFC), Family Importance Value (FIV) and Plant Part Value (PPV)

Results: The study revealed that 41 plant species from 25 families were used to treat 10 different types of skin disorders in the study area. The most represented families are Fabaceae and Rubiaceae. RFC ranged from 0.009 to 0.391.The most cited plant species are *Jatropha curcas* Linn. (RFC = 0.391), *Ricinus communis* L. (RFC = 0.313) and *Entandrophragma cylindricum* (Sprague) Sprague (RFC = 0.284). Trees are the most used plant form while bark is the most widely used plant parts (PPV = 0.373). The most common method of preparation was by decoction and the major route of administration of recipes was oral.

Conclusion: The study concludes that medicinal plants have great potentials to treat different kind of skin diseases and the respondents have vast knowledge of their usage. However, government should ensure a synergy between the manufacturers of herbal medicine, professional in the field of traditional and alternative therapies with the aim to synthesis them into the healthcare delivery system of Nigerian.

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Background

The skin which covers the body is an external and the largest human organ. It performs different functions such as percutaneous absorption, organ protection, fluid preservation, body shape maintenance, temperature regulation and eliminating toxins from the body by sweat excretion (Abbasi *et al*. 2010). One of the major health concerns worldwide is skin diseases (Abbasi *et al*. 2010). Skin diseases come in different forms, basically classified as non-contagious and contagious diseases, the primary which is bacteria, fungi, viral and parasites diseases. These diseases occur all around the world but are prevalent in the rural and tropical regions (Kamal *et al*. 2003). It is the most common disease among rural people, and it forms about 34% of all the ailments in the rural areas (Yadav *et al*. 2012). They affect people of all ages and gender from neonates to the elderly and constitute one of the five reasons for medical consultation (Helene De Wet *et al*. 2013). Recently, skin disease has been of major concern due to their association with the Human Immunodeficiency Virus and Acquired Immunity Deficiency Syndrome (HIV/AIDS) (Njoronge & Bussmann, 2007).

The causes of skin disorders are common in developing countries, where living conditions are poor (Helene De Wet *et al*. 2013). Overcrowding, mal-nutrition and humidity, heat, food, and medication allergies cause some of these skin diseases, especially among the school children in urban and rural settings (Dewhirst *et al*. 2010). According to Helene De Wet *et al*. (2013), high humidity, heat and lack of sanitation are associated with an increased risk of fungal and bacterial skin infections Skin ailments such as boils, itching, rashes, ringworm, chicken pox, small pox, skin disorders, leprosy, wound, dermatitis, eczema, scabies, skin allergy swelling and psoriasis are caused by a variety of microorganisms (Gonzalez *et al*. 2015). The largest group of skin diseases that occur in most of the countries are wound/ sore, eczema, dermatitis, fungal diseases, pyoderma, scabies, and skin allergies (Malik *et al*. 2019). Although the mortality for skin infection is relatively low, the infection affects the quality of life (Malik *et al*. 2019).

Currently one of the strategies used to treat skin diseases is the use of natural products from plant origin. Plants showing dermatological qualities are essential to human health and have the ability to arrest bleeding, cure wounds and cuts (Lewis & Elvin-Lewis 2003). Plants that are used to treat skin diseases may have additional properties like anti-inflammatory, antimicrobial, anti-viral, cicatrizant, hemostatic, analgesic effects that require pharmacological confirmation (Barboza *et al*. 2009). Several plants have been investigated for treatment of skin diseases ranging from itching to skin cancer. Various studies have also reported plants used in the treatment of skin infections like wound/ sore, scabies, swellings, boils etc (Anisuzzaman *et al*. 2007, Gebre *et al*. 2006, Gorsi 2005, Houghton *et al*. 2005, Kumar *et al*. 2006). According to Adebayo *et al*. (2010), the following plants are used by traditional medical practitioners in Western Nigeria, *Khaya senegalensis* bark are used against various fungal infections. The bark of *Ceiba pentandra* are used in curing sores, ulcers, cancerous sores while the bark of *Parkia biglobosa* (Jacq.) used to cure ringworms, localized skin eruption, measles, chicken pox, wound, athlete's foot and fungal infections. *Azadirachta* indica are used to cure small pox and chicken pox. Plants such as *Rhaphiostylis beninensis, Perquetin nigrescens*,*Colocynthis citrullus*, *Funtumia elastica*, *Butyrospetmum paradoxum*, *Curculigo pilosa*, and *Setaria caudula* are used for local treatment of bacterial infections, septic sore, heat rashes wound and snake bites in Nigeria. Skin infections such as eczema, pimples, and rashes are treated by rubbing the leaves of *Jatropha gossypifolia*, *Borreria* Spp., *Hymensocardia acida* and *Allamanda cathartica* on the infected part of skin. *Acalypha hispida* is known to confer antibacterial as well as anti-fungal properties and therefore leaf decoction is administered to infants for skin rashes.

The deforestation in Africa and in Nigeria in particular is at alarming rate and the loss of traditional indigenous knowledge of medicinal plants of various communities is fast disappearing from the face of the earth due to deforestation, advent of modern technology and transformation of traditional culture. Moreover, various research on medicinal plants used for the treatment of skin diseases, skin related infections and or of dematologic importance in Nigeria were carried out in Edo state (Egharevba & Ikhatua 2008, Erhenhi *et al*. 2016), Keffi state (Mowobi *et al*. 2016), Lagos state (Francis 2007) and Oyo state (Borokini *et al*. 2013). To the best of our knowledge no previous research has addressed the subject matter in Akinyele Local Government Ares. In view of this, the research was undertaken to document information on medicinal plants used in the traditional treatment of skin diseases in Akinyele Local Government area, Ibadan, Oyo State, Nigeria. The new information gained from this study might initiate further studies to aim at exploring the anti-skin disease potentials of the plants, supporting the sustainability of traditional herbal medicine in the study area, and conserving plants diversity.

Materials and Methods

Study area

The study was conducted in Akinyele Local Government Area of Ibadan Oyo State, Nigeria (Figure 1). It is one of the eleven *local governments* that make up Ibadan metropolis. Its headquarters is located at Moniya. It has latitude of 7^0 28` and $7^0$ 31` and longitude 3^0 53` and $3^0$ 57` (Yekinni & Oguntade 2014). The whole Local Government Council area is five hundred and seventy five square kilometres (575km^2) with twelve polling wards and a projected population of 297, 600 as at 2016 from the 2006 national population census (NPC, 2006). It is located in the rain forest zone and grassland of Southwestern Nigeria. The area has a tropical climate, which is characterised by two distinct seasons, the raining season and the dry season. The raining season begins in April and last till October while the dry season commences in November and last till March. The average annual rainfall is about 1200 mm and ecological zone type is forest savanna. Akinyele Local Government is highly heterogeneous and metropolitan in nature especially in areas like Ojoo, Orogun, Sasa, Moniya and Akinyele where Nigerians from different tribes and foreign nationals reside. This development is evident of the friendly and accommodating nature of the people of the local government. The major occupations of the people residing in the area are farming, carpentry, trading, marketing, food processing as well as carving work. Crop such as cassava, maize, yam, pepper, cucumber, watermelon, tomatoes and okra are mostly grown in the area (Stella 2009, Yekinni & Oguntade 2014).

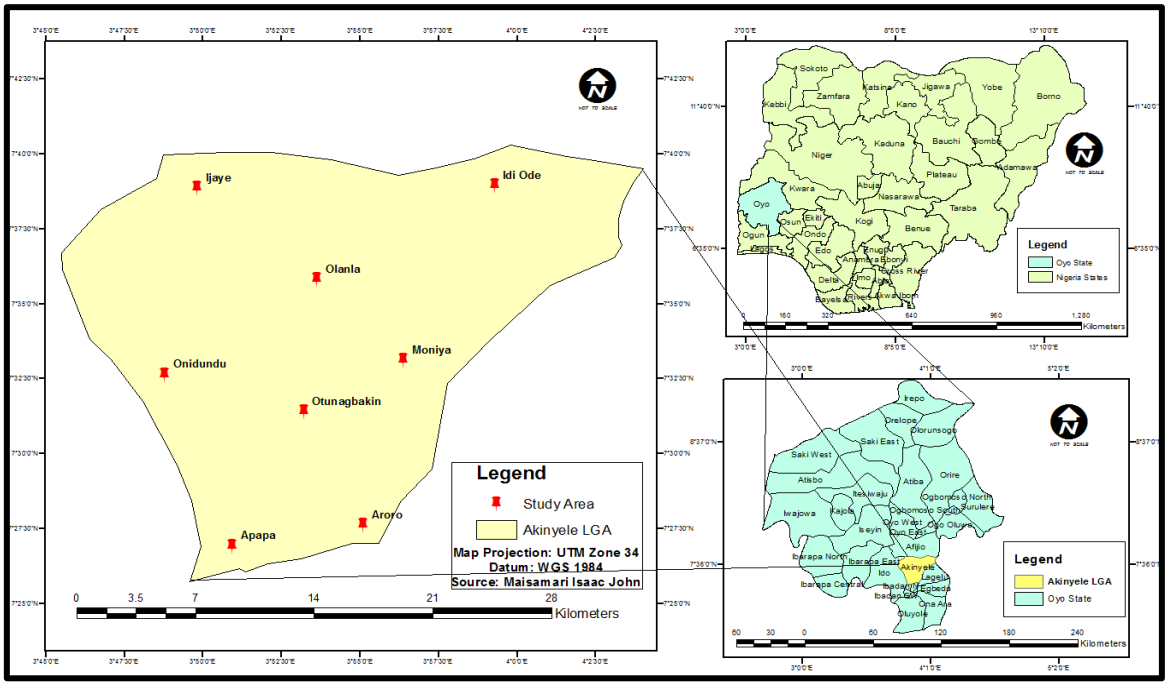

Figure 1. Map of Nigeria showing Oyo State and the Study Area

Method of data collection

Data were collected with the aid of well structured questionnaire designed to capture objectives of the study. The interview was conducted individually with the aid of questionnaire in local (Yoruba) language and information recorded by the enumerators. During the survey, information such as medicinal plants used in the treatment of skin diseases, local names of the plant, plant parts used and the form in which it is used, methods of preparation and mode of administration and doses of the herbal recipes were collected from the respondents and documented. The local names of the plant species mentioned were translated to their scientific names using the publication of Gbile & Soladoye (2002). Moreover, the scientific names and families of plant species were confirmed from the Taxonomic department of Forestry research Institute of Nigeria and from online botanical databases, namely: The Plant List (http://www.theplantlist.org/) and Encyclopedia of Life (https://eol.org/).

Sampling procedure and sample size

Eight villages were purposively selected within the study area because of the presence of relics of forest in those villages and the presence of the sample unit under consideration (herbalist, herb seller, hunters and famers**).** The villages are Ijaye, Onidundu, Otunagbakin, Moniya, Idi- ose, Apapa, Aroro and Olanla. Stratification of respondent into four strata was carried out in each village, namely Herbalist, Herb-sellers, Hunters and Famers. In each stratum, 10 respondents were selected randomly thus making

40 respondents in each village and a total number of 320 respondents used as sample size.

Data Analysis

The data collected of the knowledge of medicinal plants used in the treatment of skin diseases in the study area was analyzed with descriptive statistics such as tables, percentages, pie charts, bar charts, Frequency of Citation (FC), Relative Frequency of Citation (RFC), frequency of family occurrence, frequency of plant parts used, Family Importance Value (FIV) and Plant Part Value (PPV)

The Relative Frequency of Citation (RFC)

The local importance of each plant species was determined by using RFC. The RFC showed the most used plant species by the local respondents. It is calculated following Tardio and Pardo-de-Santayana (2008), by dividing the frequency of citation (FC) by the total number of respondents survey (N). RFC= FC/ N

Family Importance Value (FIV)

The significance of plant families was demonstrated using FIV. It is designed to assess the biological taxon value of plants and is calculated according to the following method (Sreekeesoon & Mahomoodally 2014): FIV = FC family/ NS

Where FC_{family} = RFC: is the number of informants citing the family and NS: is the total number of species within each family.

Plant Part Value (PPV)

Plant part value (PPV) is used to show use frequency of each plants part. The part with the highest PPV is the most used part by respondents. It is calculated as follows:

PPV = RU plant part/ RU

With, RU: the number of uses reported for all plant parts, and, $RU_{plant\ part}$: the sum of uses reported per plants part (Gomez-Beloz, 2002).

Results and Discussion

The inventories of medicinal plants used in the treatment of skin disorders in the study area were listed on Table 1. The table includes scientific name, botanical family, vernacular name, part used, mode of preparation, therapeutic uses and FC, RFC and FIV data for each of the plant. The table further showed a total number of 41 plant species from 25 botanical families used in the treatments of 10 different skin disorders. These skin disorders include skin rashes, sore/ wound, ring worm, smallpox, skin disease, eczema, scabies, chicken pox, pimples/acne and guinea worm. It is important to note that some medicinal plant species are used to treat more than one skin disorder. In a similar study conducted by Borokini *et al*. (2013), a total number of 47 plants spread across 30 plant families were encountered. Egharevba & Ikhatua (2008) in their study of Ethno Medicinal uses of Plants in the treatment of skin diseases from Ovia Northeast, Edo State identified 41 plant species from 29 families. Erhenhi *et al*. (2016) in the same Edo state at Umelu village, Ikpoba Okha local government area found a total of 21 plants from 18 families used in the treatment of skin diseases. Also, Mowobi *et al.* (2016) recorded 40 plant species belonging to 30 different families used in the treatment of skin diseases from Keffi, Nigeria. According to Helene De Wet *et al*. (2013), 47 plant species belonging to 35 families were recorded in the treatment of 11 skin diseases such as abscesses, acne, burns, boils, incisions, ringworm, rashes, shingles, sores, wounds and warts from rural community in northern Maputaland, South Africa. Study from literature revealed that the medicinal value of these plants used in the treatment of skin diseases lies in some phytochemical substances that produce a definite physiological action on the human body. Among these bioactive constituents of plants are alkaloids, saponins, tannins flavonoids, carbohydrates and phenolic compounds (Edeoga *et al*. 2005).

Life Forms of Medicinal Plants

All the 41 medicinal plant species recorded used in the treatment of skin diseases were represented with all the plant forms (Figure 2). Trees were the most used plants (22 species), followed by shrubs (9 species), herbs (6 species) and climbers had only 4 species. This corroborates the findings of Mowobi *et al.* (2016) which stated that trees were the most used plants (20), followed by herbs (12), shrubs (7) and climbers (1) in the treatment of skin diseases in Keffi, Nigeria. In a study conducted by Erhenhi *et al*. (2016) in Edo State, Nigeria, trees provided the highest proportion of plants at 52.38% in the treatment of skin diseases followed by herbs at 33.33% and shrubs at 14.29%. According to Ariyo *et al*. (2020a) and (2020b), trees were found to be the most cited category in the treatment of cough and pile. Also, Malik *et al*. (2019) found trees (38%) as mostly utilized in the treatment of various ailments and disorders, followed by herbs (30%), shrubs (22%), climbers (5%) and grass species (5%). However, the result of plant form in this study is in contrast with other studies in Cameroon (Bhat *et al*. 2014), Pakistan (Ghosh *et al*. 2012) and Uganda (Neamsuvan *et a*l. 2015) were herbs are the most medicinal plants used. In Ethiopia (Süntar *et al*. 2012) and Djibouti (Iyer 1992), shrubs were however the predominant life forms of medicinal plants species used in the treatment of skin diseases.

Table 1. List of medicinal plants used in the treatment of skin diseases in the study area

Family and Scientific name	**Life form**	**Locfal Name**	**Parts used**	**Mode of Preparations**	**Mode of administration/ application**	**Therapeutic uses**	**FC**	**RFC**	**FIV**
Amaranthaceae									**0.031**
Celosia argentea L.	Herb	Sokoyokoto	Leaves, Seeds	Squeezing, Grinding	Rubbing, Paste	Skin rashes	10	0.031	
Anacardiaceae									**0.022**
Lannea welwitschii (Heirn) Engl.	Tree	oora	Bark	Decoction	Drinking, Bathing	Skin rashes	7	0.022	
Annonaceae									**0.055**
Monodora myristica (Gaertn.) Dunal	Shrub	Ariwo	Seeds	Powdering, Decoction	Paste, Drinking	Guinea worms	5	0.016	
Xylopia aethiopica (Dunal) A.	Tree	Eeru	Fruit	Decoction, Grinding	Drinking, Bathing, Topical	Skin rashes	30	0.094	
Apocynaceae									**0.047**
Rauvolfia vomitoria Afzel.	Shrub	Asofeyeje	Seeds, Roots	Powdering	Bathing with black soap	Skin diseases	15	0.047	
Arecaceae									**0.026**
Pteleopsis suberosa Engl.& Diels	Tree	Okuku	Bark	Decoction	Drinking	Skin rashes	12	0.038	
Anchomanes difformis	Herb	Langbodo	Tuber	Infusion	Drinking	Smallpox	4	0.013	
Asclepiadaceae									**0.022**
Calotropis procera	Shrub	Bomubomu	Leaves	Decoction	Eating with beans	Smallpox	6	0.019	
Gongronema latifolium Benth	Climber	Madunmoro	Roots	Decoction	Drinking	Skin rashes	8	0.025	
Asteraceae									**0.013**
Ageratum conyzoides (L.) L.	Herb	Imi esu	Leaves	Grinding, Decoction	Paste, Bathing	Sore/ wound Skin rashes	4	0.013	
Bignoniaceae									**0.028**
Kigelia africana (Lam.)	Climber	Pandoro	Leaves/ vine	Decoction	Drinking	Skin rashes	9	0.028	
Bombacaceae									**0.009**
Bombax buonopozense P. Beauv.	Tree	Ponpola	Bark	Decoction	Drinking	Skin rashes	3	0.009	
Combretaceae									**0.072**
Anogeissus leiocarpus (DC.) Guill. & Perr.	Tree	Ayin	Bark	Decoction	Drinking	Skin rashes	23	0.072	
Terminalia glaucescens Planch. ex benth.	Tree	Idi-apata	Bark	Decoction	Drinking	Skin rashes	19	0.059	
Terminalia superba Engl. & Diels	Tree	Afara	Bark	Decoction	Drinking	Skin rashes	27	0.084	

Connaraceae									**0.122**
Byrsocarpus coccineus Schum, & Thonn.	Climber	Amuje	Leaves/Vine	Decoction	Drinking	Skin rashes	39	0.122	
Crassulaceae									0.063
Bryophyllum pinnatum (Lam.) Oken	Herb	Abamoda, Odundun	Latex	Squeezing	Topical	For eczema, pimples, acne	20	0.063	
Euphorbiaceae									**0.172**
Bridelia micrantha (Hochst.) Baill.	Shrub	Ira	Bark	Decoction	Drinking	Skin rashes	28	0.088	
Euphorbia lateriflora	Shrub	Enuopiri	Leaves	Grinding	Topical	Sore/ wound	12	0.038	
Jatropha curcas Linn.	Shrub	Lapalapa funfun	Leaves	Squeezing	Topical	Ringworm	125	0.391	
Ricinus communis L.	Shrub	Ewe laa	Seeds	Grinding	Bathing	Skin disease	100	0.313	
Fabaceae- Caesalpinioideae									**0.138**
Caesalpinia bonduc Roxb	Climber	Seyo, Ayo	Leaves	Decoction	Drinking	Skin rashes	24	0.075	
Daniellia oliveri (Rolfe) Hutch. & Dalziel	Tree	Iya	Bark, Leaves	Decoction	Drinking, Bathing	Skin disease	55	0.172	
*Senna alata (*L.) Roxb.	Shrub	Asuwon-oyinbo	Latex, Bark	Squeezing, Decoction	Rubbing, Drinking	Ring worm, eczema, scabies,	82	0.256	
Senna occidentalis (L.) Link	Shrub	Iya omo, Rere	Bark	Decoction	Drinking	Skin rashes	15	0.047	
Fabaceae-Mimisoideae									**0.143**
Parkia biglobosa (Jacq.) G.Don	Tree	Igbaru	Bark	Decoction	Drinking	Skin rashes	12	0.038	
Tetrapleura tetrapetra (Schum. & Thonn.) Taub.	Tree	Aidan	Pods	Decoction	Drinking	Skin rashes	79	0.247	
Lamiaceae									**0.063**
Vitex doniana Sweet	Tree	Oori	Leaves	Squeezing	Topical	Ring worm	20	0.063	
Liliaceae									**0.038**
Allium cepa	Herb	Alubosa	Leaves	Grinding	Topical	Sore/ wound	12	0.038	
Longaniaceae									**0.138**
Anthocleista vogelii Planch	Tree	Sapo	Bark	Decoction	Drinking	Skin rashes	44	0.138	
Meliaceae									**0.201**
Entandrophragma cylindricum (Sprague) Sprague	Tree	Ijebo	Bark, Leaves	Decoction	Drinking	Skin rashes, Sore/ wound	91	0.284	
Khaya grandifoliola C. DC.	Tree	Oganwo	Bark	Decoction	Drinking	Skin rashes	66	0.206	
Pseudocedrela kotschyi	Tree	Emi gbegiri	Bark	Decoction	Drinking	Skin rashes	36	0.113	
Moraceae									**0.066**
Antiaris toxicaria var. africana	Tree	Oro	Bark	Decoction	Drinking	Skin rashes	12	0.038	
Ficus exasperata Vahl	Tree	Epin, Ipin	Leaves	Squeezing	Topical	Ring worm	41	0.128	

Milicia exclesa	Tree	Iroko	Latex	Squeezing	Topical	Sore/ wound	10	0.031	
Myrtaceae									**0.05**
Syzygium guineense (Wild.) DC.	Tree	Oori	Bark	Decoction	Drinking	Skin rashes	16	0.05	
Palmae									**0.009**
Elaeis guineensis Jacq	Tree	Ope	Oil	Extraction	Topical	Skin rashes	3	0.009	
Rubiaceae									**0.259**
Sarcocephalus latifolius (Smith) Bruce	Tree	Egbesi	Bark	Decoction	Drinking	Skin rashes	83	0.259	
Sapotaceae									**0.013**
Chrysophyllum albdium G. Don.	Tree	Agbalumo	Leaves	Decoction	Drinking	Skin rashes	4	0.013	
Zingiberaceae									**0.034**
Aframomum meleguecta (Roscoe) K. Schum.	Herb	Atare	Fruits, Pod, Leaves	Decoction	Drinking	Smallpox and chicken pox	12	0.034	

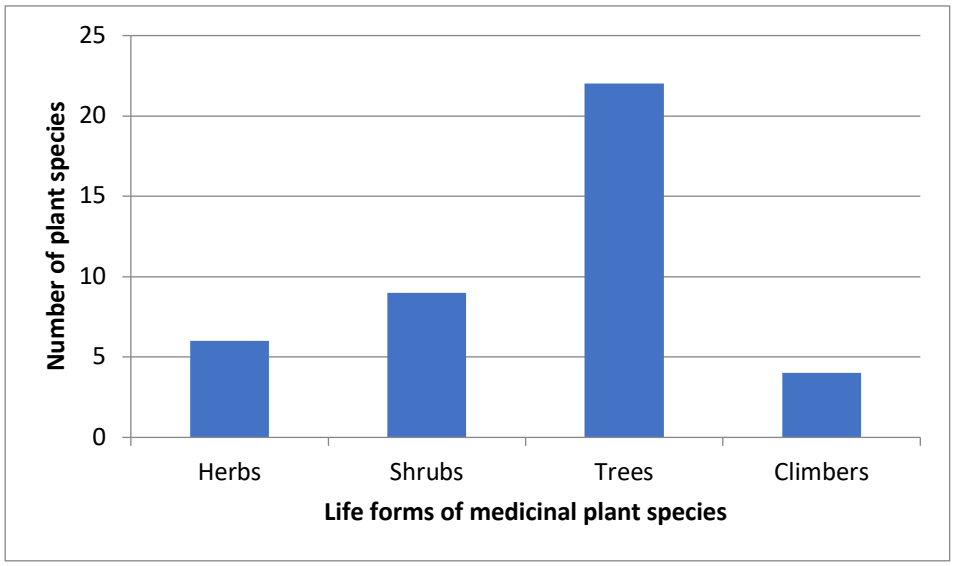

Figure 2. Life forms of medicinal plants

Family Importance Value

The importance of a plant family increases with the increase in the frequency of citations of all its species. Table 1 reported 25 important families. The most representative family are Euphorbiaceae (4 species with FIV= 0.172) and Fabaceae-Caesalpinioidea (4 species, with FIV= 0.138). Combretaceae (3 species, with FIV= 0.072), Meliaceae (3 species, with FIV= 0.201), Moraceae (3 species with FIV= 0.066). Families such as Annonaceae had (2 species, with FIV= 0.055), Arecaceae (2 species, with FIV= 0.026), Asclepiadaceae (2 species, with FIV= 0.022) and Fabaceae- Mimisoideae (2 species, with FIV= 0.143). Other botanical families such as Amaranthaceae (FIV= 0.031), Anacardiaceae (FIV= 0.022), Apocynaceae (FIV= 0.047), Asteraceae (FIV= 0.013), Bignoniaceae (FIV= 0.028), Bombacaceae (FIV= 0.009), Connaraceae (FIV= 0.122), Crassulaceae (FIV= 0.063), Lamiaceae (FIV= 0.063), Liliaceae (FIV= 0.038), Longaniaceae (FIV= 0.138), Myrtaceae (FIV= 0.05), Palmae (FIV= 0.009), Rubiaceae (FIV= 0.259), Sapotaceae (FIV= 0.013), and Zingiberaceae (FIV= 0.034) were represented with only one specie (Figure. 3). This revealed that Fabaceae (sub family of Mimisoideae and Caesalpinioidea) with 6 species and Euphorbiaceae (4 species) are the dominant families in terms of the number of species used in the treatment of skin diseases. This is in line with the findings of Helene De Wet *et al*., (2013) which found Fabaceae (eight species) as the most frequently represented family, followed by Asteraceae and Solanaceae (three species each), Anacardiaceae (two species) and the remainder, had one species each. According to Mowobi *et al.* (2016), the family Euphorbiaceae had the highest number of plants (4) used in treatments of skin diseases in Keffi, followed closely by the families Compositae (3), Rutaceae (2), Malvaceae (2), Liliaceae (2), Rubiaceae and Asteraceae (2), others such as Fabaceae, Solanaceae etc had just one member of their family each. In this study, families such as Fabaceae (sub family of Mimisoideae and Caesalpinioidea), Rubiaceae, Meliaceae and Euphorbiaceae with 0.281, 0.259, 0.201 and 0.172 FIV (Table 1) are commonly used in curing skin diseases as reported by the respondents. However, Khan *et al*. (2015) documented the maximum value of FIV for Juglandaceae (45%) followed by Punicaceae (44%) whereas the lowest value was noted for Vitaceae and Rubiaceae (3%). The result of this study vary from previous literature reports, this variation could be due to differences in climate and vegetation (Adnan *et al*. 2014).

Relative Frequency of Citation (RFC)

The RFC indicates the most prominent plant species used for the treatment of skin diseases based on the ratio between the frequency of citation (FC) of a particular plant species by the respondents and the total number of respondents survey (N). It showed the use frequency of each plant species in the treatment of skin diseases in the study area. RFC is used to select medicinal plant species with high potential for future research in the production of anti-skin disease drug. The RFC in this study ranges from 0.009 to 0.391 with the highest representation of species such as *Jatropha curcas* Linn. (RFC = 0.391), *Ricinus communis* L. (RFC = 0.313), *Entandrophragma cylindricum* (Sprague) Sprague (RFC = 0.284), *Sarcocephalus latifolius* (Smith) Bruce (RFC = 0.259), *Senna alata* (L.) Roxb. (RFC = 0.256), *Tetrapleura tetrapetra* (Schum. & Thonn.) Taub. (RFC = 0.247), *Khaya grandifoliola* C. DC. (RFC = 0.206), *Daniellia oliveri* (Rolfe) Hutch. & Dalziel (RFC = 0.172), *Anthocleista vogelii* Planch (RFC = 0.138), *Ficus exasperata* Vahl (RFC = 0.128), *Byrsocarpus coccineus Schum, & Thonn.* (RFC = 0.122), *Pseudocedrela kotschyi* (RFC = 0.113) and *Xylopia aethiopica* (Dunal) A (RFC =

0.094). This revealed the relative importance of these plant species in the treatment of skin rashes, sore/ wound, ring worm, smallpox, skin disease, eczema, scabies, chicken pox, pimples/acne and guinea worm (Table 1). However, medicinal plant species with high RFC should be further analyzed for phytochemical and pharmacological compounds, to recognize their active chemical components for drug discovery; similar observation was made by (Vitalini *et al*. 2009).

Previous Literature on Phytochemicals and Pharmacological Activities of some of the Plants Recorded

Some of the plants stated in this study might have compound that are directly or indirectly active against parasites. These compounds are known as secondary metabolic compounds. Plants are rich in a wide variety of secondary metabolites, such as tannins, terpenoids, alkaloids, and flavonoids, which have been found *in vitro* to have antimicrobial properties (Marjorie 1999). Many of these plants have been investigated in vitro for their phytochemicals and pharmacologic compounds from the previous studies.

The preliminary phytochemical screening of the alcoholic extract of various parts of *Jatropha curcas* Linn revealed the presence of alkaloids, phenolic groups, flavonids, saponins, steroids, tannins, cardiac glycosides, and terpenoids (Sharma *et al*. 2016). Most secondary metabolites, such as alkaloids, saponins, tannins, anthraquinones and flavonoids, are known to possess activity against several pathogens, and therefore aid the antimicrobial activity of *Jatropha curcas* and justify its traditional use for the treatment of various illnesses (Hassan *et al*. 2004). *Jatropha curcas* rich in tannins, which might be responsible for the inhibition of cell protein synthesis, as they form irreversible complexes with proline-rich proteins (Shimada, 2006). The methanolic extract exhibited considerable inhibition of the test organisms, which could be compared to the standard drug. This is suggestive of the presence of some compounds or groups in the extract with similar mechanism of action to that of the standard drugs used to treat bacterial and fungal infections (Sharma *et al*. 2016). The latex of Jatropha possesses antifungal activity **(**Fagbenro-Beyioku *et al*. 1998).

The various phytochemicals which are found in *Ricinus communis* are steroids, terpenoids, saponins, alkaloids, flavonoids, and glycosides (Alugah & Ibraheem 2014; Jeyam *et al*. 2014; Vermeer *et al*. 2013). Studies have shown that extracts of various parts of *Sarcocephalus latifolius* have shown the presence of bioactive compounds such as; tannins, flavonoids, alkaloids, saponins and anthraquinones (Abreu *et al*. 1999). *Senna alata* has been used as a traditional medicine to treat various diseases, especially skin diseases (Sri *et al.* 2020). In addition, *Senna alata* has been reported to have potential anti allergic, anti inflammatory, antioxidant, anticancer, antidiabetic, and antifungal (Sri *et al.* 2020). Metabolite compounds that have been isolated from *Senna alata* leaves include flavones, flavonols, flavonoids glycosides, alatinon, alanonal and β-sitosterol-β-D-glucoside. The compounds have been isolated mainly from the leaves (Sri *et al.* 2020).

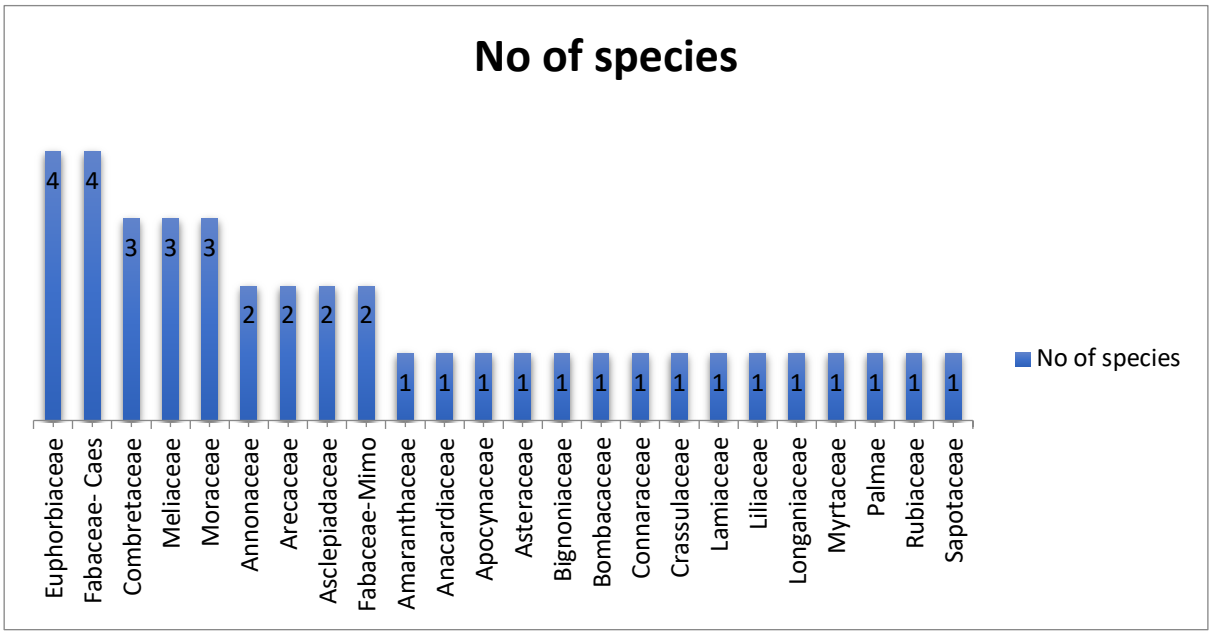

Figure 3. Frequency of the family representation

Plant parts used for remedy preparation

The result of the study showed that different plant parts such as leaves, bark, leaves, seeds, latex, fruits, pods, roots, vines, oil, and tubers were used in the preparation of remedy for the treatment of skin diseases in the study area. Plant species such as *Celosia argentea*, *Rauvolfia vomitoria*, *Kigelia africana*, *Byrsocarpus coccineu, Senna alata, Entandrophragma cylindricum, Aframomum meleguecta* and *Daniellia oliveria* has more than one parts used. The plant part value (PPV) showed that bark is the most widely used plant part (PPV = 0.373). This may be due to the presence of medicinal bioactive compounds in the bark of the trees. This agrees with the findings that the active ingredients of medicinal and aromatic plants can be found in the roots, leaves, stems, flowers or barks (Okigbo *et al.* 2009). The use of bark was followed by Leaves (PPV = 0.294), seeds (PPV = 0.078) and latex (0.059). Fruits, pods, roots and vine had equal PPV of (0.039) while oil and tuber also had same value (0.020) (Figure 4). This result is contrary to most other ethnobotanical studies where leaves are the most plant used to treat various skin disorders (Adetutu *et al*. 2011, Mabona & Vuuren, 2013, Martínez & Barboza 2010, Saikia *et al*. 2006). However, the use of bark and roots may threaten the continuity and survival of the plant (Lulekal *et al*. 2008, Yin 2009), unless a sustainable harvesting strategy has been developed (Cunningham 2001).The use of leaves second to bark in this study can be explained by their harvesting ease and use simplicity (Salhi *et al*. 2010), as well as that they are sites both of photochemical reactions and storage of secondary metabolites responsible for many biological activities (Bigendako-Polygenis & Lejoly 1990). However, the plant part(s) collected for herbal medicine preparations, as well as the frequency of harvesting and the amount harvested, could have an impact on the harvested plant (Cunningham 1996).

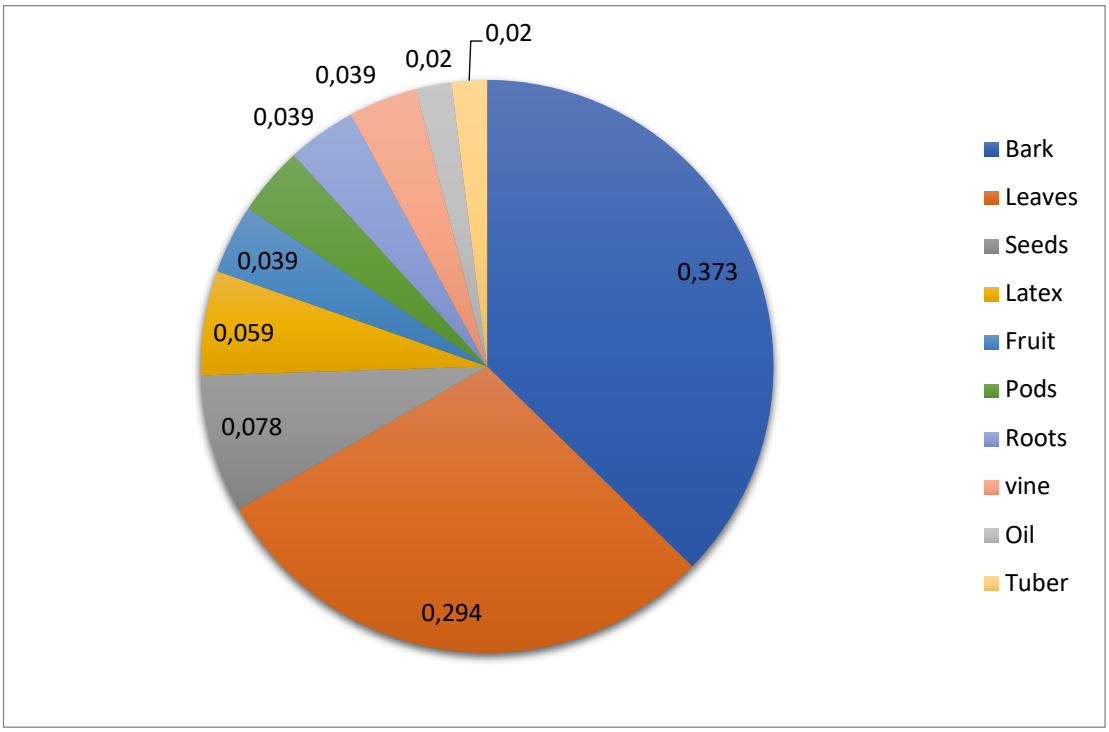

Figure 4. Plant parts used in the treatments of skin infections

Mode of preparation of recipes

The result on Figure 5 showed that different methods of preparation of medicinal plant species in the treatment of skin diseases are used in the study area. The methods of preparation include decoction, squeezing of the leaves to extract the juice, grinding, powdering, soaking and extraction. This is in line with the statement of Naoufal *et al*. (2020) that several methods of medicinal plant preparation are used in traditional medicine such as decoction, infusion, inhalation- a preparation to be inhaled in the form of vapour or spray, grinding, maceration, injection, powder and cataplasm. The figure further showed that decoction (63.04%) was the most preferred method of preparation of recipes used in the treatment of skin diseases in the study area, followed by squeezing (15.22%) of leaves to extract the juice, grinding (13.04%), powdering (4.35%), infusion and extraction had equal percentage of 2.17%). This agreed with the finding of Naoufal *et al*. (2020) which found decoction (37.7 b%)as the most common preparation method used by the population studied, followed by infusion (27.37%), powder (22.69%), and other rarely used methods (cataplasm, maceration and fumigation). According to Mowobi *et al.* (2016), method of preparations mostly preferred for the

treatment of skin diseases are by infusion and decoction others include grinding, cream and paste. However, Malik *et al*. (2019) stated that powder (23 species) was the most frequently used methods of recipes preparation for skin disease followed by paste (19 species), decoction (16 species), extract (14 species), raw and poultice (each has 8 species). Decoction found in this study as the most methods of herbal preparation for the treatment of skin diseases is justified because it allows better extraction of the active ingredients responsible for the plants therapeutic activities and remove toxic effect of some herbal remedies, similar report was made by Naoufal *et al*. (2020). Also the findings corroborate the studies carried out on medicinal plants in Taza region (Khabbach *et al*. 2012), in Marrakech (Ouakrouch *et al*. 2017), in Middle Central Atlas (Daoudi *et al*. 2014), in Kenitra (Salhi *et al*. 2010), and also in Mechraa Bel Ksiri region (Benkhnigue *et al*. 2014). However, this method could destroy some active compounds of the used medicinal plants (Benlamdini *et al*. 2014). However, decoction was reported as the most prevalent method of preparation of herbal materials for the treatment of diseases in Rivers state, Nigeria and Babungo, Cameroon (Kola *et al*. 2012, Simbo, 2010). In addition, 5 non- biological ingredients were used in the preparation of recipes in the study area. These includes water, palm wine, native/ local soap or black soap, palm kernel oil and gun powder.

The respondents of the study area have showed comprehensive knowledge in the use of plant combinations and single plants in the treatment of skin diseases (Table 2). The use of plants in an holistic approach to treat diseases and the synergy of plant combinations can have greater effects on the treatment of infectious diseases. From the table, 21 different recipes were reported by all the respondents in the treatment of skin diseases. 6 of the recipes are prepared with different plants combinations and various plant parts while the remaining 15 recipes are prepared from single medicinal plant species and from single to different plant parts of the same plant. This corroborates the findings of Pronob (2016) and Ariyo *et. al*. (2020b) that different parts of the same plants were used either singly or in combination with other plant parts in herbal medicine to treat diseases. According to Mowobi *et al*. (2016), different plants combinations are used by different people to treat one type of ailment or the other and this varies from one community to another and in different ecosystem. However, it was observed in this study that the plant species were used either fresh or dry in the preparation of recipes. This agreed with the findings of Ariyo *et al*. (2020a) and Kwon-Ndung *et al*. (2018).

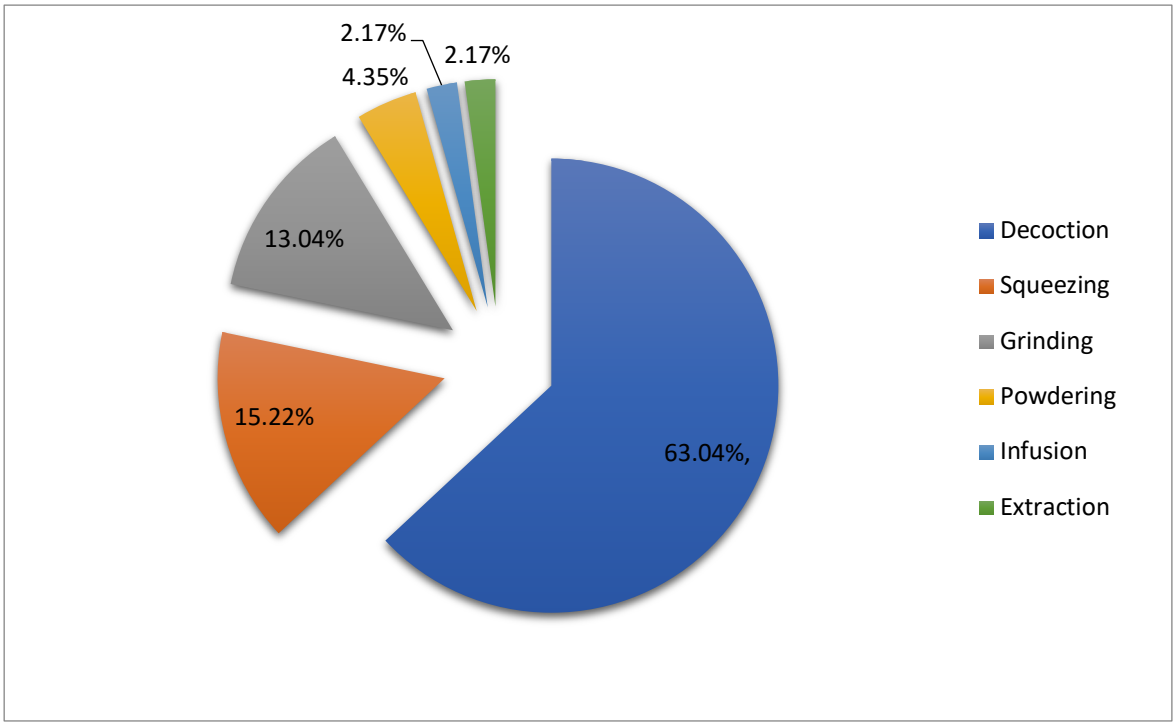

Figure 5. Frequency of different plants preparation methods used in the study area

Table 2. Plant combinations used to treat skin disease in the study area

Plant species combination	Part used	Skin disorder treatment	Method of preparation
Anthocleista vogelii + *Bridelia micranthra* + *Khaya grandifoliola* + *Entandrophragma cylindricum* + *Xylopia aethiopica* + *Pteleopsis suberosa* + *Senna occidentalis* + *Byrsocarpus coccineus* + *Gongronema latifolium* +	Bark + bark + bark + bark + fruit/seed + bark + bark + leaves/vine + roots	Skin rashes	Collect all the herbs together and boil with clean water in a covered pot. Drink half stainless cup three times daily.
Khaya grandifoliola + *Xylopia aethiopica* + *Lannea welwitschii* + *Antiaris toxicaria* + *Aframomum meleguecta*	Bark + fruit + bark + bark + Vine	Skin rashes	Put nine male stone for male and seven for female under the pot, put *Xylopia aethiopica* on top of it, add four spoons of *Aframomum meleguecta*, put other bark of trees on top of it, put *Xylopia aethiopica* on it again and add the remaining five spoons of *Aframomum meleguecta*, put another *Xylopia aethiopica* on top again and the remaining bark of the trees. Boil all together with clean water and drink half stainless cup three times daily. Also use it to bath regularly.
Khaya grandifoliola + *Xylopia aethiopica* + *Pteleopsis suberosa* + *Sarcocephalus latifolius* + *Kigelia africana* + *Chrysophyllum albdium* +	Bark + fruit + bark + bark + leaves/ vine + leaves	Skin rashes	All the herbs are boiled together in a container. Drink half stainless cup twice daily (morning and night).
Anogeissus leiocarpus + *Terminalia glaucescens* + *Terminalia superb* + *Parkia biglobosa* + *Syzygium guineense* + *Tetrapleura tetrapetra*	Bark + bark + bark + bark + bark + pod	Skin rashes	All the herbs are boiled together in a container. Drink half stainless cup twice daily (morning and night).
Caesalpinia bonduc + *Bombax buonopozense* + *Byrsocarpus coccineus* + *Pseudocedrela kotschyi* + *Senna occidentalis*	Leaves + bark + leaves/vine + bark + bark	Skin rashes	All the herbs are boiled together in a container. Drink half stainless cup twice daily (morning and night).
Euphorbia lateriflora + *Allium cepa* + *Xylopia aetiopica*	Fresh enuopiri + Fresh onion leaves + fruit	Incurable sore	Grind the leaves of *Euphorbia lateriflora* with *Allium cepa* leaves and *Xylopia aetiopica* together and mix the powder with black or local soap. Use your urine to wash the sore and also put the paste on the sore
Monodora myristica	Seeds	Guinea worm	Seed grounded into powder and used to treat the worm Seed are boiled in water and drink
Rauvolfia vomitoria	Seeds + root	Skin disease	Powder the seeds and roots of *Rauvolfia vomitoria* together and mix it with black soap and use it to bath regularly
Ageratum conyzoides	leaves	Saw or wound Skin rashes	Grind the leaves into powder and apply on the wound Decoction of the leaves is applied to the raches
Vitex doniana	Leaves	Ringworm	Squeeze the leaves and apply the extract to the spot on the skin

Ficus exasperata Vahl	Leaves	Ringworm	Squeeze the leaves and apply the juice from fresh leaves to the ringworm spot on the skin
Celosia argentea	Fresh Leaves + seed (Extract)	Skin rashes	The juice from the leaves are used to rob the body The seeds are grinded into paste and apply
*Daniellia oliveri*a	Leaves + bark	Skin disease	Soak wood ash in water and filter. Use the filtrate to boil the bark, leaves and drink half a cup three times daily. Add the boiled extract to water and used it to bath.
Jatropha curcas	Fresh leaves (Extract)	Ring worm	The leaves are squeezed ,and the liquid obtained is applied on the affected part with cotton.
Senna alata	Fresh leaves + stem (Latex, extract)	Ring worm Eczema and scabies	The juice is squeezed out from the leaves and stems and rubbed on the affected part of the skin Mixed the leaves extract with palm kernel oil and rub mixture on affected part.
Bryophyllum pinnatum	Fresh leaves (Latex)	Eczema & pimples	The latex from the plant is applied directly to the pimples and eczema spots with cotton.
Anchomanes difformis	Fresh tube	Small ox	Cut the tuber into small pieces and soak it in water or preferably with palm wine for 24 hrs, drink half of a cup 3 times daily.
Calotropis procera	Fresh leaves	Smallpox	Collect some quantity of fresh leaves, cut it to pieces and boil it with some quantity of white beans, allow the water to dry on fire. Eat the beans together with the leaves.
Entandrophragma cylindricum	Fresh leaves + dried bark	Sore or wound	Cook the fresh leaves and use it to wash the wound before applying any medicine. Grind the dry bark of the plant into powder and apply small quantity on the wound.
Milicia exclesa	Fresh latex (Latex)	Sore or wound	Put the latex on the wound to heal up
Ricinus communis	Matured seeds	Skin disease	Grind some quantity of the matured seeds with gunpowder and mix it with black soap. Use it to bath regularly.

Mode of administration/ application of recipes

The mode of administration of herbal recipes used in the treatment of skin diseases varied from oral administration by drinking and eating. This is because it is believed that the parasites causing skin infections are in the blood. The infections emanated from the internal before it is expressed outwardly on the skin. Other modes of administration as found in this study includes bathing, rubbing, infusion, topical application and paste (Figure 6). However, some recipes have more than one method of administration/ application. The major mode of administration is by drinking (oral administration), this corroborate the findings of Benlamdini *et al*. (2014) which stated that oral route allows a better absorption of active compounds contained in an herbal remedy. The oral administration was followed by topical application, bathing, paste, rubbing and infusion. Naoufal *et al*. (2020) study on chronic disease treatment stated that medicinal plants used by local people were administered mainly orally (89%) followed by the dermal route (8.5%). According to Ariyo *et al*. (2020b), the mode of administration of recipe in the treatment of piles was mainly by drinking (oral administration) and topical application. Also, similar study conducted in Bolivia shows that, the most frequently used route of administration of herbal medicine is oral ingestion (Hunde *et al*. 2004).

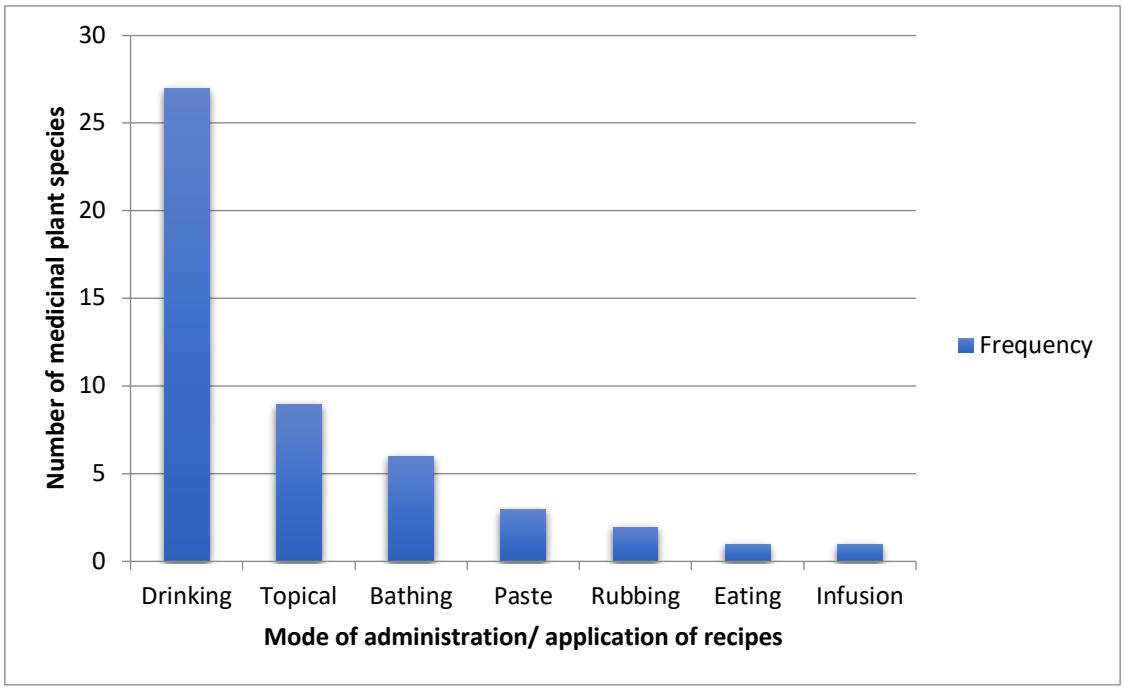

Figure 6. Mode of administration/ application of recipes

Conclusion and Recommendation

This study showed that medicinal plants have great potentials to treat different kind of skin diseases and the respondents have vast knowledge of their usage. They have many useful advantages such as low side effects, better patient tolerance, being relatively less expensive and acceptable due to a long history of use. The study identified 41 plant species from 25 families used in the treatments of 10 different skin disorders. The most represented families are Fabaceae and Rubiaceae. RFC ranged from 0.009 to 0.391.The most cited plant species are *Jatropha curcas* Linn. (RFC = 0.391), *Ricinus communis* L. (RFC = 0.313), *Entandrophragma cylindricum* (Sprague) Sprague (RFC = 0.284), *Sarcocephalus latifolius* (Smith) Bruce (RFC = 0.259) and *Senna alata (*L.) Roxb. (RFC = 0.256). The reason could be the presence of secondary metabolite compounds in these plants that are active against parasites. These secondary metabolites are alkaloids, phenolic groups, flavonids, saponins, steroids, tannins, cardiac glycosides, anthraquinones and terpenoids. Trees are the most used plant form while bark is the most widely used plant parts (PPV = 0.373). Decoction is the most common method of preparation while oral administration (drinking) is the mode of administration of recipes by the respondents. The study recommended research on the phytochemical and pharmacological constituents of these medicinal plants to confirm their bioactive ingredients relevant to the treatment of skin diseases to be utilized for synthetic drugs. Also, government should ensure a synergy between the manufacturers of herbal medicine, professional in the field of traditional and alternative therapies with the aim to synthesis them into the healthcare delivery system of Nigerian.

Declarations

List of abbreviations: FC: Frequency of Citation, RFC: Relative Frequency of Citation, FIV: Family Importance Value, PPV: Plant Part Value, N: Total number of respondents

Ethics approval and consent to participate: All the respondents were informed about the objectives of the study before they were interviewed. Respondents consent and approval was sought ,and they were made to appendix their signature on the questionnaire

Consent for publication: Not applicable

Availability of data and materials: The data that support the findings of this study are available from the first author (Ariyo, O. C), upon reasonable request. The data was not deposited in public repositories.

Competing interests: The authors has declared that no competing interests exist

Funding: No grant was received from any funding agencies for the research.

Author's contributions: The work was carried out in collaboration between all authors. Author Ariyo, Oluyinka Christopher designed the study, performed the analysis, wrote the protocol, and wrote the first draft of the manuscript. Author Usman Mohammed Bello and author Adelani D. O. managed the analyses while author Ariyo, Mary Oluyemisi managed literature searches of the study. All authors read, reviewed and approved the final manuscript.

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