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Research Article

Ethnobotanical Survey and Antibacterial Properties of Some Medicinal Plants Used Against Bacterial Infections in the South West Region, Cameroon

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Abstract

Background: Antimicrobial resistance is on a rise as we continually misuse antibiotics and thus the need for more alternative's antimicrobial sources. This study surveyed plants traditionally used in South West Region (Cameroon) to manage bacterial infections, and the evidence of their use was explored through antibacterial testing. **Methods:** The survey was done using questionnaires, with local tradi-practitioners as participants. The antibacterial activity of ethanol extracts of plants was done using agar-well diffusion and broth microdilution techniques against drug-resistant *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Escherichia coli*. The qualitative phytochemical screening of herbals was performed using standards. **Results:** 57 plants belonging to 33 families were identified, with Asteraceae being the most represented family (13/57). Common plant parts used were leaves (59.6%) and the main modes of preparation were decoction and maceration (36.8%). The antibacterial potential of the 57 herbals was demonstrated through the diameter of bacterial growth inhibition zones ranging from 10.3 to 17.7 mm, and the minimal inhibitory concentrations (MIC) recorded were varying from 60 to 960 µg/ml. Extracts of the leaves of *Epaltes divaricate* and the barks of *Ficus exasperate* and *Piptadeniastrum africanum* were found most active with MIC = 60 µg/mL on at least two pathogens tested. **Conclusion:** The present study provides evidence of the use of selected plants in traditional medicine and could be a ground for consideration of *E. divaricate* and *F. exasperates* extracts in further antibacterial drug discovery investigations.

Keywords: Traditional medicine; Ethnobotanical survey; MICs and MBCs; Bacterial pathogens

Introduction

In modern and indigenous societies plants are used for drug discovery, medicine, and food among others. This can be traced back to human civilization and has led to increasing dependence for most societies as a source of medication for treating infections and disease conditions [1]. Among the many different sources of drugs, plants have been demonstrated to be the most promising as 80% of the world population depends on them as a source of medication and as the primary source of treatment especially in the undeveloped world [2]. Medicinal plants refer to those plants comprising active ingredients or secondary metabolites that possess biological activity [3]. Plant-derived antimicrobials are also considered to be safer compared with synthetic compounds because of their natural origin [4]. It is well known that about a quarter parts of current medications are derived from compounds of plant origin [5].

Infectious diseases especially those caused by multi-drug resistant strains ESKAPE (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa,* and *Enterobacter spp)* bacteria has increased to a greater extent during the recent years. This increase has led to a point where the World Health Organization (WHO) warns of a post-antibiotics era [3]. Infectious diseases are the second leading cause of death in the world and the third leading cause of death in the developed world [5]. This increased prevalence of microbial infectious diseases and their complications are mainly due to microbial drug resistance toward commonly used antimicrobials [5]. This resistance can be due to the unselective use of antibiotics, immunosuppressive agents, intravenous catheters, organ transplantation, and the ongoing epidemic of human immunodeficiency virus (HIV) infections [6]. Antibiotic resistance has become one of the major problems of humanity since late the 20th century. The need for new antimicrobials, that could effectively fight against resistant microbes, has tremendously increased. Traditional approaches to finding new antimicrobial drugs are not sufficiently successful anymore due to the rapid resistance development against them [4]. Consequently, it is very important to find new approaches to antimicrobial compound discovery.

Plant-derived compounds could have other therapeutic sites than traditional antimicrobials and subsequently have different mechanisms of action against microbes [1,2]. For example *Piptadeniastrum africanum* is widely used in treating oxidative stress related diseases. Oxidative stress, defined as the disturbance in the balance between the production of free radicals and antioxidant defenses, is the root cause of many pathophysiological conditions. [7]. This study aimed at exploring the types of plants used against diseases caused by multi-drug resistant bacteria in the Southwest region of Cameroon by traditional practitioners and investigate the antibacterial activity of selected five most active extracts.

Material and Methods

Study site

Medicinal plants were collected from all divisions in the Southwest Region (SWR) of Cameroon, guided by the traditional practitioners. The SWR is situated between $5^0\,12^{'}\,00.0^{''}$ N and $9^0\,18^{'}\,00.0^{''}$ E and located about 255 km from Yaoundé the capital city of Cameroon. It has 6 divisions; Fako (between 4.0972° N and 9.2786° E), Meme (between 4.5845° N and 9.2786° E), Manyu (between 5.8206^0 N and 9.3673^0 E), Ndian (between 4.8334° N and 9.0129° E), Lebialem (between 4.8334° N and 9.0129^0 E) and Kupe Manenguba (between 5.1573° N and 9.6341° E). The divisions are further divided into 30 subdivisions with a population size of about 1,153,125 inhabitants. The majority of these inhabitants rely on cash crops for living and as such most of the inhabitants deal with plants on a daily basis. The SWR of Cameroon Garcinia Kola Heckel., Trichoscypha acuminata Engl., Zingiber officinale Rosc., Pycnanthus angolensis (Welw). Excell and Hylodendron gabunense Taubert are the most cited for the traditional treatment of bronchitis, an ailment requiring much more animal parts and other natural non-plant elements for its treatment [8].

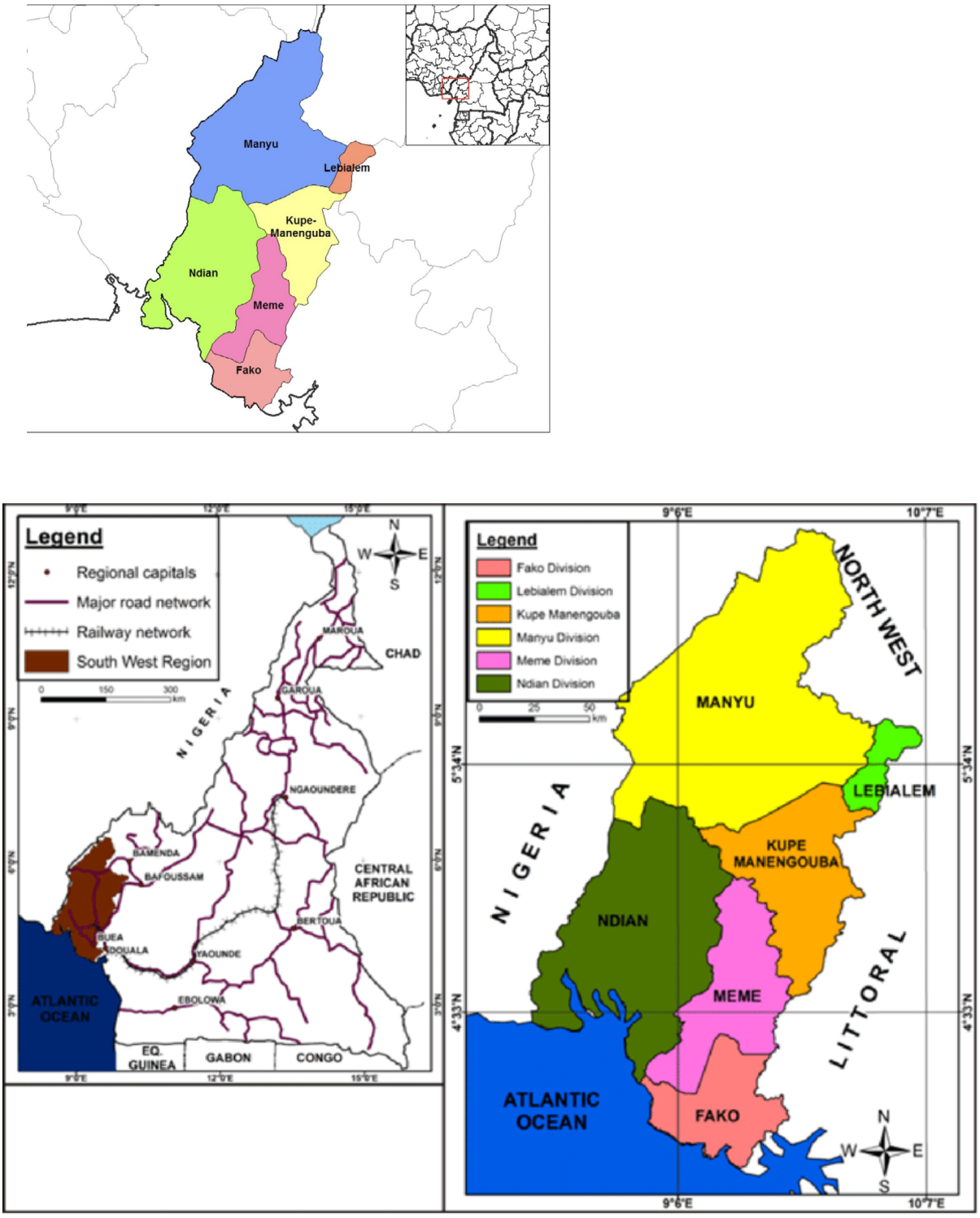

Figure 1: Map of the South West Region of Cameroon [9].

Plant survey data collection

A questionnaire divided in to three sections and made up of seven questions; concerning the use of plants in traditional medicine, its purpose for use, plant parts used, method of extraction, dose, and duration of treatment was given to traditional practitioners in the six divisions of SWR who provided the necessary information. Each traditional practitional was asked they type of plants the use to treat each of the diseases listed in the questionnaire and provide a method of plant collection, extraction, dose and duration of treatment which was the same procedure followed for plant collection and identification in this study.

Plant collection process and Authentification

For each of the plants listed by the traditional practitioners, the various plant parts were collection at the mooring periods with temperature ranging from 22-24^{0}c and only mature plant parts were collected, placed in a folder and transported within 24hour to the Limbe botanical garden for plants identification (plant family, species, and voucher numbers) by a botanist Mr. Nkemgum George who was present at the time of arrival.

Plant extraction

Amongst the 57 plants surveyed, five plants were chosen based on high activity as indicated by traditional practitioners (*Pycnanthus angolensis, Ficus exasperate, Piptadeniastrum africanum, Epaltes divaricate* and *Vernonia conferta*). These plant materials were extracted by maceration technique with ethanol (80%) (Biopharcam-Buea- Cameroon). Each plant material was ground and soaked with solvent separately at 10:1 (v/w) in an Erlenmeyer flask for 3 days with frequent agitations. The mixture was thoroughly shaken for one minute and left in the refrigerator at 5^0 C for 24 h according to the method developed by Rojas *et al* [10]. Then, the mixtures were filtered through Whatman filter paper grade 1 n^o 4 (11 µm pore size) (the number 4 is based on the diameter of the filter paper). Further, fresh solvent was added to the residue at the same ratio and left at 5^0 C for the next 24 h. This step was repeated three times to achieve maximal extraction of active compounds. The filtrates were placed in a rotary evaporator (Rota vapor R-300; TOPTION-China) to concentrate the plant extract. The extracts were later exposed in the lab for 24 hours to remove any residual solvent. Dried crude extracts were weighed and kept at 5^{0}C till further use.

Test microorganisms

Isolated bacterial species of *Escherichia coli* (15%), *Klebsiella pneumoniae* (15%), *Pseudomonas aeruginosa* (20%), and *Staphylococcus aureus* (23%) strains classified as MDR, were collected from the Laboratory for Emerging Infectious Diseases of the University of Buea.

Antibacterial tests

Determination of bacterial growth inhibition zone diameters

This was done using the agar well diffusion assay. Growth medium (nutrient agar) (25 ml) was poured into Petri dishes at 50–70 °C and it was left to solidify for 15 min. Subsequently, a sterile cotton swab was dipped into each overnight bacterial strains (adjusted to 0.5 McFarland Standard). An agar plate was inoculated by evenly streaking cotton swab over the nutrient agar. Then wells with a diameter of 8 mm were cut in the medium with a sterile cork borer. Stock solutions of the samples were diluted in 5%DMSO to get 500 µg/ml concentrations. The tested samples and controls (100 µl) were dispensed into the wells. The petri dish were incubated at 37 °C for 24 h. Then the diameters of growth inhibition zones around the wells were measured using a vernier caliper. The positive control agent was Ciprofloxacin disk (10 µg/ml) while the negative control agent was 5% DMSO [11].

Determination of Minimum Inhibition Concentration and Minimum Bactericidal Concentration

Broth microdilution method was used and two-fold serial dilution of extracts was prepared directly in a microtiter plate containing Mueller Hinton Broth to obtain various concentrations at 150 µl for each well. The inoculums of test strains prepared from fresh overnight cultures were adjusted to 0.5 McFarland standard, which equals 1.5 × 10^8 CFU/ml, and diluted in a 1:100 ratio to get 1.5× 10^5 CFU/ml concentrations. Fifty (50) µl of bacterial suspension was added to each well except the negative controls (5% DMSO) as per the protocol and procedure given by CLSI guidelines and the modified protocol of Wiegand [11]. Six dilutions (EZSPHERE Microplate, 6 well) of the samples ranging from 30 to 960 µg/ml were tested. The lowest concentration of the extract with clear suspension read using a microplate reader (Rayto RT-6900, Medical X-ray) after 24 h incubation at 37^{0}C was considered as the MIC value. For this assay, the positive control agent was both Ciprofloxacin and gentamicin (range: 10-20 µg/mL) whereas 5% DMSO and plant extracts without bacterial suspension were used as the negative controls. All dilutions of crude extracts were cultured in nutrient agar for sterility test. Minimum bactericidal concentrations (MBC) of the plant crude extracts were determined by sub-culturing the samples (5 µl) taken from the wells without growth during MIC determination on nutrient agar. The lowest concentration of crude extracts with the absence of growth after 24 h incubation at 37^0 C was considered as MBC [11]. Each process was repeated three times and the average/mean value taken.

Phytochemical screening

The presence of biologically active secondary metabolites in the plant extracts were verified using qualitative standard procedures. The major phytochemical constituents that were verified were

alkaloids, flavonoids and terpenoids in 80% ethanol extracts of each plant [12].

Test for alkaloids: Around 200 mg plant materials was boiled in 10mL ethanol and filtered. Then, 1% HCl was added followed by 6 drops of Dragendorff reagent. A brownish red precipitate was taken as a piece of evidence for the presence of alkaloids. Towards the end, an alkaloids test was applied on few plant materials by diluting 2.5mg of the extract with 2.5ml of 1% HCl in a tube and boiled. Then, 1ml of the filtrate was added to 1ml of dilute ammonia. Finally, 1ml of chloroform ($CHCl_3$) was added and shaken gently to reveal the alkaloid base.

Test for flavonoids: About 7.5mg of each dry extract was dissolved in 0.5ml of ethanol, concentrated HCl, and magnesium turnings. A yellowish coloration indicates the presence of flavonoids.

Test for terpenoids: (Salkowski test): About 0.5ml of the chloroform extract of the dried extracts was evaporated to dryness on a water bath and heated with 3ml of concentrated sulfuric acid for 10 minutes on a water bath. The gray color indicates the presence of terpenoids.

Data analysis

The data of the diameter of bacterial growth inhibition zones was analysed using SPSS version 20. Significant differences were considered at 5%. A descriptive statistic was used for other qualitative data like plant classification (order by family and scientific name), plant parts used and frequency of use, and mode of preparation.

Results

Demographic characteristics of informants

A total of 36 traditional practitioners from the six divisions of the Southwest Region were involved in this study where 29 were men and 7 were women. The mean ages of these participants ranged from 39 to 44 years. Manyu Division had the highest number of traditional practitioners who participated in this survey and no woman from Lebialem was observed as a traditional practitioner (Table 1).

Surveyed plant species

A total of 57 plants belonging to 33 families were identified as being used to treat infections caused by multi-drug resistant bacteria based on their resistant profile and type of disease they cause. Asteraceae was the most represented family with a frequency of 13/57 (22.8%), followed by Fabaceae with 4/57 (7.01%) and Amarathaceae with 3/57 (5.2%) (Table 2). The plant parts mostly used were leaves (59.6%), followed by bark (12.3%), seeds and flowers (8.8% each) (Fig 2). Among these methods used to prepare the plant products, decoction, and maceration were mostly indicated (36.8%), followed by infusion method (26.3%). As far as doses were concerned, an estimate of one gram of the preparation was taken four (36.8%) to five (28.1%) times per day (Fig 3).

Locality	**Mean Age (Years)**	**Gender**	
		Male	Female
Fako	39	3	1
Koupe	38	6	2
Lebialem	43	3	0
Manyu	39	10	2
Meme	42	4	1
Ndian	44	3	1
Total		29	7

Table 1: Demography information of the respondents.

S/n	Plant Family	Scientific names	Common names	Plant Part	Type of bacterial infection treated	Other uses
1	Acanthaceae	*Acacia polyacantha*	mouf	L	Typhoid	Anemia, fever, fever
2	Aloeaceae	*Aloe vera*	Aloe vera	B	Urinary tract infection,	Rheumatic fever, skin infection
3	Amarathaceae	*Amaranthus spinosus*	acania	L	Diarrhea	Urinary tract infection, typhoid fever,
		Alternanthera sessilis	Bird leave	L	Pneumonia	Rheumatoid atritis
		Alternanthera brasiliana	soppo	L	Rheumatic fever	Pneumonia, diarrhoea,
4	Anacardiaceae	*Mangifera indica*	Maggree	B	cellulitis,	Typhoid fever, UTIs.
5	Apiaceae	*Coriandrum sativum*	Efiksu	L	Pneumonia	Food poisoning, abscesses, cellulitis
		Eryngium foetidum	Fiagn	L	Abscesses,	wound, pimples, boils
6	Apocynaceae	*Alstonia scholaris*	Elilibe	L	Food poisoning	cellulitis, folliculitis
		Voacanga africana	Stipsu	L	Diarrhea	wound, boils, arthritis, leprosy,

7	Asteraceae	*ageratum houstonianum*	Berat berat	L	Diarrhea	Pneumonia, food poisoning, rheumatic fever, skin infection
		aspilia african	Eson son	F	Rheumatic fever	malaria, arthritis, skin infection
		Bidens pilosa	Bellele	F	Typhoid fever	Diarrhea,
		Chromoleana odorata	Bwang	L	Rheumatic fever	skin infection
		Emiliae coccinea	Bee seed	L	boils,	Urinary tract infection, Abscesses, cellulitis, folliculitis
		Sonchus asper	Mworge	L	Pneumonia,	wound, epilepsy, boils, arthritis
		Vernonia amygdaline	Bush pepper	L	Typhoid fever	Pneumonia, Diarrhea, headache,
		Vernonia calvoana	Green leve	L	Food poisoning	Pneumonia, tuberculosis
		Vernonia conferta	Sand leave	L	Diarrhea,	Typhoid fever, Food poisoning
		Gynura pocumbens	Umbrella stick	B	cellulitis,	Abscesses, folliculitis
		Erigeron sumatrensis	magroff	L	Urinary tract infection	Pneumonia, Rheumatic fever, skin infection
		Eclipta prostrata	Monsters seed	L	cellulitis	Abscesses, folliculitis
8	Burseraceae	*Canarium schweinfurthii*	heltus	S	Urinary tract infection	Food poisoning, Abscesses, cellulitis
9	Capparaceae	*Cleome cutidosperma*		F	Abscesses,	cellulitis, folliculitis
10	Caricaceae	*Carica papya*	Paw paw leave	L	cellulitis,	Abscesses, folliculitis
11	Coctaceae	*Costus spiralis*	Cough medicine	L	cough,	arthritis, UTIs,
12	Commelinaceae	*Commelina diffusa*	Bemenda	L	Diarrhea	Urinary tract infection,
13	Compositae	*Gerbera leandril*	Goffe	L	catarrh	fever, cough,
		Epaltes divaricata	Bahama	S	UTIs	pneumonia, food poisoning
14	Crussulaceae	*Kalenchoe pinnata*	Finny	L	cellulitis	hemorrhoid, furuncles

15	Euphorbiaceae	*Euphorbia pulcherrima*	Tupsey	L	Food poisoning,	fever, anti-inflammatory, headache
		Maximilien casterman	Hintus	L	cellulitis,	Abscesses, folliculitis
16	Fabaceae	*Justicia secunda*	Abere abere	S	Abscesses	cellulitis, folliculitis
		Senna tora	Soya cane	L	wound,	snakebites, epilepsy, boils, arthritis, wound, epilepsy, boils, arthritis, inflammation
		Daniella oliveri	Pinutus	B	gonorrhea,	skin infections
		Piptadeniastrum Africanum	Red stick	B	skin infection,	cellulitis, abscesses, rheumatic fever
17	Francoaceae	*Bersama abyssinica*	Chutuis	B	Diarrhea	Food poisoning, fever, nausea
18	Guttiferae	*Garcina kola*	Bitter cola	B	pneumonia	UTIs, gonorrhea, gastric diseases, cough
19	Lamiaceae	*Mentha arvensis*	Optuses	L	Typhoid fever,	cold, fever, anti-inflammatory
20	Leguminosae	*Senna alata*	Gulut	F	Typhoid fever,	eczema, hepatitis c, malaria
21	Malvaceae	*Seda acuta bum*	Kappa wa	L	Rheumatic fever	skin infection
22	Moraceae	*Ficus exasperata*	Wahn gin	L	arthritis	wound, epilepsy, boils,
23	Myristiceae	*Pycnanthus angolensis*	Carabot/small leave	L	Cellulitis,	abscesses, wound, UTIs
24	Onagraceae	*Ludwigia octovalvis*	Butter stand	L	Diarrhea	Typhoid fever, food poisoning, fever, headache
25	Piparaceae	*Piper nigrum*	Pepement	L	Diarrhea	cough, fever,
26	Pedaliaceae	*Sesamum indicum*	Bone leave	L	Cellulitis	Wound, abscesses, folliculitis
27	Poaceae	*Cymbopogon citratus*	Eskusca	L	Boils	Fever, cough,
		Cynodon dactylon	Qualindine	L	Rheumatic fever	Headache, skin infection
28	Rosaceae	*Agrimonia eupatoria*	Queen grass	L	Folliculitis	Abscesses, cellulitis,
		prunus africana	Hustusde	B	Gonorrhea	chlamydia, stomach pain, malaria,

29	Rutaceae	*Citrus lemon*	Efimme	F	Skin infection	Rheumatic fever, Pneumonia
30	Solanaceae	*Nicotiana tabacum*	Chuk kur	F	Arthritis	sinusitis, headache, gout
		Solanum torvum	Furfilele	S	Rheumatic fever	skin infection, digestion, gonorrhea
31	Sterculiaceae	*Cola acuminata*	Red cola	S	Typhoid fever,	Diarrhea
32	Zingiberaceae	*Aframomum zambesiacum*	Beeat nuts	S	Pneumonia	Urinary tract infection, Rheumatic fever, skin infection
		Zingiber officinale	Ophilus	R	Diarrhea	vomiting, fever and headache, Pneumonia
		Zingiber zerumbet	Terkle	R	Pneumonia	Food poisoning, Diarrhea
F= flowers, L= leaves, S= seeds, B= barks, R= roots.						

Table 2: Classification of plants according to their family, parts used, mode of preparation, and other uses.

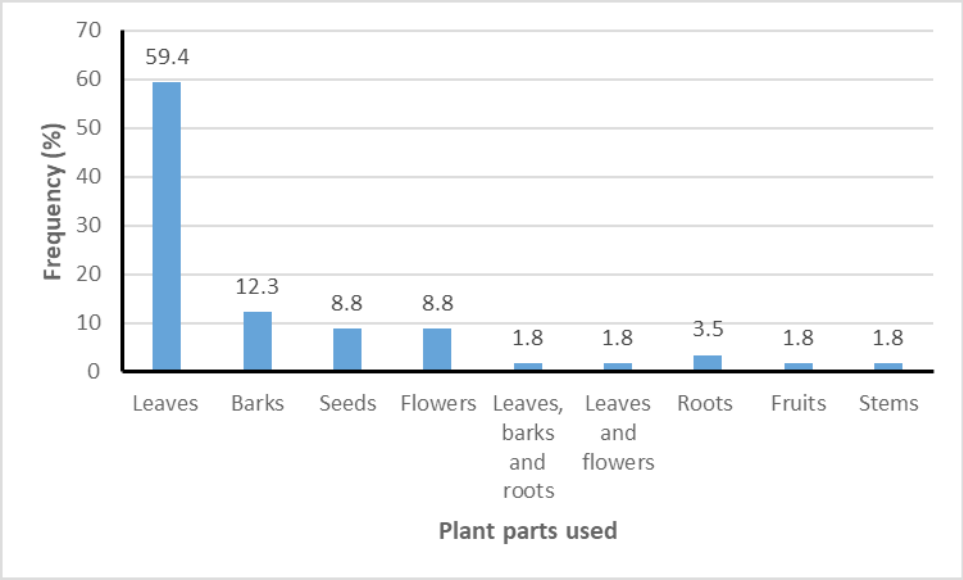

Figure 2: Frequency of plant Parts used as medicine.

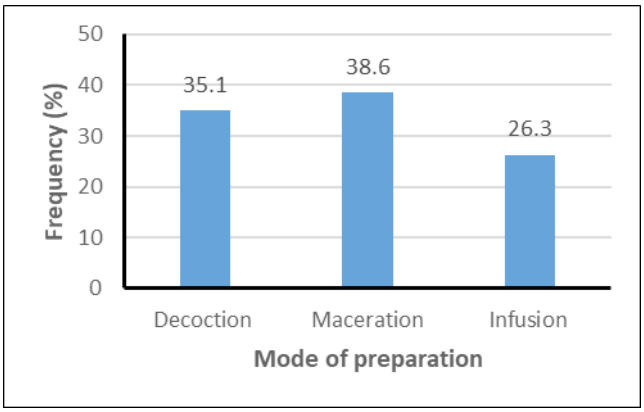

Figure 3: Modes of preparation of plant products.

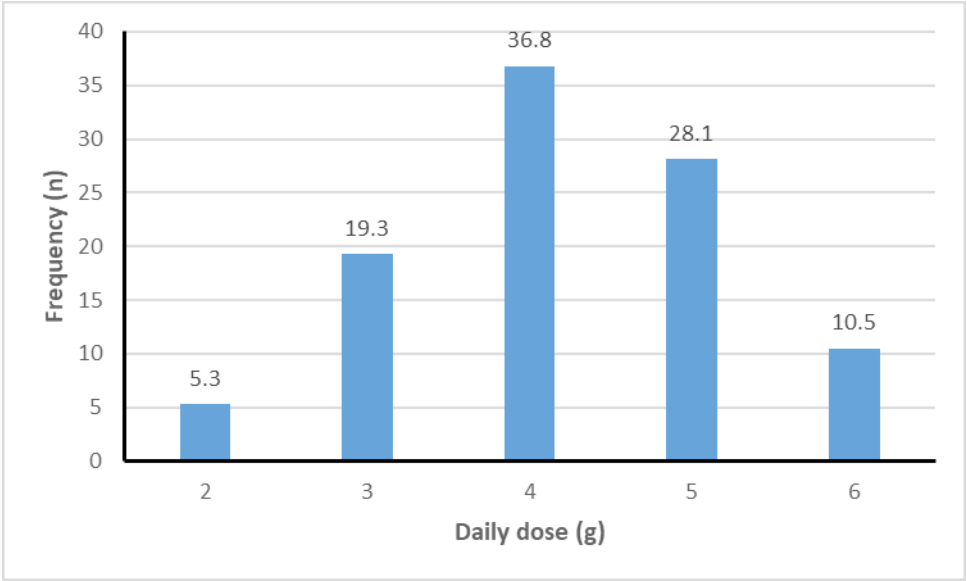

Figure 4: Variation of daily doses of surveyed plants.

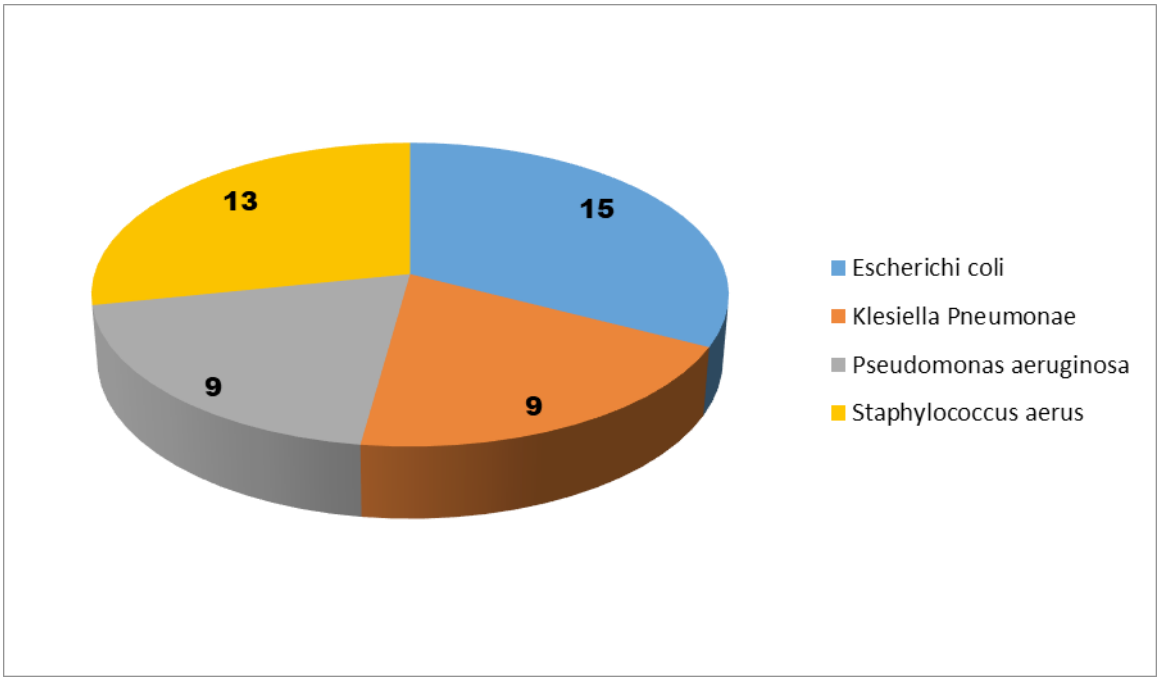

Figure 5: Most common Bacteria treated.

Scientific name	**Part of plant used**	**Mean diameter of inhibition zone (mm)**			
		SA	PA	KP	EC
Acacia polyacantha	Leaves	2	-	-	1
Aframomum zambesiacum	Seeds	-	4	-	3
ageratum houstonianum	Leaves	3	-	1	-
Agrimonia eupatoria	Leaves	-	-	1	2
Aloe vera	Bark	8	7	6	9
Alstonia scholaris	Leaves	3	4	3	3
Alternanthera brasiliana	Leaves	-	1	-	-
Alternanthera sessilis	Leaves	4	-	3	5
Amaranthus spinosus	Leaves	6	-	8	-
aspilia african	Flower	9	8	7	-
Bersama abyssinica	bark	-	-	-	-
Bidens pilosa	Flower	1.1	3.3	-	6.3
Canarium schweinfurthii	seeds	-	2	1	-
Carica papya	Leaves	3.3	5.1	3.2	-
Chromoleana odorata	Leaves	-	-	-	-

Citrus lemon	Fruits	2	-	-	-
Cleome cutidosperma	Flower	-	6	-	8
Cola acuminate	Seeds	1	2	3	7
Commelina diffusa	leaves	-	4	3	-
Coriandrum sativum	leaves	-	-	-	-
Costus spiralis	Leaves	1	1	1	1
Cymbopogon citratus	Leaves	3	1	6	2
Cynodon dactylon	Leaves	1	1	1	1
Daniella oliveri	bark	2	-	-	1
Eclipta prostrata	leaves	-	-	-	-
Emiliae coccinea	Flower	3	2	1	1
Epaltes divaricata	Stems	17	16	16	17
Erigeron sumatrensis	Leaves	-	-	-	-
Eryngium foetidum	Leaves	-	1	1	-
Euphorbia pulcherrima	Leaves	-	1	2	-
Ficus exasperate	Leaves	15	17	17	14
Garcina kola	Bark	11	7	10	10
Gerbera leandril	Leaves	-	-	-	-
Gynura pocumbens	Leaves	4	-	5	5
Justicia secunda	Seeds	-	3	2	4
Kalenchoe pinnata	leaves	-	-	-	-
Ludwigia octovalvis	leaves	3	2	1	1
Mangifera indica	Bark	2	3	1	1
Maximilien casterman	Leaves	-	-	-	-
Mentha arvensis	Leaves	4	6	7	8
Nicotiana tabacum	Flower	4	5	5	8
Piper nigrum	Leaves	-	-	-	-
Piptadeniastrum Africanum	bark	17	13	14	13
prunus Africana	Bark	1	7	6	5
Pycnanthus angolensis	Leaves, barks, roots	11	13.5	10	13
Seda acuta bum	Leaves	-	-	-	-
Senna alata	Flower and leaves	-	-	-	-
Senna tora	Leaves	8	6	7	6

Sesamum indicum	Leaves	-	-	-	-
Solanum torvum	seeds	1	1	1	1
Sonchus asper	Leaves	1	3	1	2
Vernonia amygdaline	Leaves	-	-	-	-
Vernonia calvoana	Leaves	2	4	3	1
Vernonia conferta	Leaves	11	16	15.3	13.3
Voacanga africana	Leaves	2	-	3	2
Zingiber officinale	Roots	4	-	-	4
Zingiber zerumbet	Roots	2	-	3	-

Table 3: Antibacterial activity of the 57 plants.

Plants	**Part tested**	**Growth inhibition zone diameter (mm) Mean±SD**			
		SA	**PA**	**EC**	**KP**
Pycnanthus angolensis	Barks	11±1.0	13±0.0	10.3±0.6	13.5±0.7
Ficus exasperate	Leaves	15.30±0.6	17.7±0.6	16±1.0	11.7±1.5
Piptadeniastrum africanum	Barks	17.5±0.7	13±1.0	14±0.0	17.3±0.6
Epaltes divaricata	Leaves	17.7±0.6	16.3±0.6	17.7±0.6	16±0.0
Vernonia conferta	Leaves	13.3±0.6	15.3±0.6	16.3±0.6	11±1.0
Ciprofloxacin		20.0±1.4	16.0±1.4	15.0±2.4	18.2±1.9
Test strain: *Staphylococcus aureus* (SA), *Pseudomonas aerogenosa* (PA), *Escherichia coli* (EC), *and Klebsiella pneumonia* (KP). SD: standard deviation. All experiments were independently repeated in triplicate.					

Table 4: Effects of plant extracts on bacterial growth.

MIC and MBC of selected crude plant extracts

(*Pycnanthus angolensis* showed a bacteriocidal effect against *S. aureus, P. aeruginosa and K. pneumoniae* with an MBC/MIC ratio of 2, *Ficus exasperata* showed bacteriocidal effect against *S. aureus, P. aeruginosa, E. coli.* MBC/MIC ratio of 2, *Piptadeniastrum Africanum* showed bacteriocidal effect on *S. aureus, P. aeruginosa and K. pneumonia* with MBC/MIC ratio of 2, while *Epaltes divaricata* showed a bacteriocidal effect against all test organisms.

Plants species	***SA***			***PA***			***EC***			***KP***		
	MIC	**MBC**	**MBC/ MIC**	**MIC**	**MBC**	**MBC/ MIC**	**MIC**	**MBC**	**MBC/ MIC**	**MIC**	**MBC**	**MBC/ MIC**
Pycnanthus angolensis	240	480	2	240	480	2	960	>960	-	240	480	2
Ficus exasperata	120	240	2	60	120	2	60	120	2	240	>960	-
Piptadeniastrum Africanum	60	120	2	240	480	2	120	480	4	60	120	2

Epaltes divaricata	60	120	2	60	120	2	120	240	2	60	120	2
Vernonia conferta	480	960	2	240	480	2	240	480	2	960	>960	-
Ciprofloxacin	2	4	2	16	32	2		16	32	8	32	

Minimum inhibition concentration (MIC), Minimum bactericidal concentration (MBC), SA:*Staphylococcus aureus* , PA: *Pseudomonas aureus* EC: *Escherichia coli* , KP: *Klebsiella pneumonia*.

Table 5: Mean MIC and MBC (µg/ml) of tested plants extracts.

Plants species	**Phytochemicals tested**		
	Alkaloids	Flavoids	Terpenoids
Pycnanthus Angolensis	+	-	+
Ficus exasperate	+	+	-
Piptadeniastrum Africanum	+	+	+
Epaltes divaricata	+	+	+
Vernonia conferta	+	-	-

Table 6: Phytochemicals screening.

Piptadeniastrum Africanum, and *Epaltes divaricata* having alkaloids, flavoid, and terpenoids, *Ficus exasperate* having alkaloids and flavoids, *Vernonia conferta* having only alkaloids and *Pycnanthus Angolensis* lacking only flavoids.

Discussion

Plants have been demonstrated to be the most promising as 80% of the world population depends on them as the source of medication and as a primary source of treatment especially in the underdeveloped world [2]. And men were observed to be mostly involved in the use of medicinal plants for medicines as majority of the participants in this study were males. This may be traced back to the fact that our ancestors were initiating mainly their boy children to the practice of the traditional medicine [12]. Elsewhere like Garifuna women in Nicaragua [13] and some places in Cameroon [14] women were reported to be more in the use of traditional medicine for the treatment of illnesses profession than men. However, these women sometimes ask a male traditional healer to get herbs from the mountains and other risky and insecure places and pay for them.

In this study the highest number of traditional practitioners was recorded in the Manyu division, probably due the fact that it is the largest division in terms of population in the Southwest Region of Cameroon.

In this study we had an inventory of 57 plants of varied families and with therapeutic virtues as considered by tradipractitioners. The family with most of these plants used for medicinal purposes was Asteraceae as compared to any other plant family in the Southwest Region and this is most likely due to the fact that it contain a wide range of biologically active compounds and also because being one of the largest families in the plant kingdom, a large number of plants belong to this family [15]. These findings were similar to a study conducted in Babungo, Northwest Region, Cameroon. The authors equally reported that some of these plants have been used in the treatment of many diseases [16].

Relatively to bacterial infection, the antimicrobial activity of many of the above mentioned plants has been proven [10]. With a percentage of 59.4%, leaves were the most plant parts used. In fact, leaves are known to accumulate plants secondary metabolites, which are known to possess many biological properties [17]. Moreover, utilization of leaves and stem bark rather than root is advantageous for the survival of plants since their harvest does not induce the irreversible destruction of plants. Besides, leaves are easier to harvest than root. This finding is in line with a study conducted in the Northern part of Cameroon [12].

In agar well diffusion assay, the extract of *Ficus exasperate* gave a zone of bacterial growth inhibition of 17.7mm, 16mm and 15mm for *Pseudomonas aeroginosa, Escherichia coli,* and *Staphylococci*

aureus respectively and an average zone of inhibition 11.7mm for *Klebsiella pneumonia.* The extract of *Pycnanthus angolensis* was observed here to be active against bacterial growth. Other researchers have reported its weak antibacterial activity [18-20]. The extracts of *Piptadeniastrum africanum* and *Epaltes divaricata* showed an activity similar to the findings of [21]. They reported that this antibacterial property was due to the presence of alkaloids, terpernoids and flavonoids; known to possess antimicrobial properties.

Vernonia conferta just like the other studied plants showed inhibition of *E. coli* and *P. aeruginosa* and *K. pneumoniae.* Z [22].

Results of broth microdilution assay confirmed that Gram-positive bacteria were more susceptible than Gram-negative bacteria. It was suggested that crude extracts with MIC superior to 1000 ug/mL are inactive and but those with interesting activity have MIC of 100 ug/mL and below [23]. Active extracts with MIC above 625 ug/mL are classified as weakly active [24]. Following these ideas, extract of *Ficus exasperate* was active (MIC <100 ug/ml) on *Pseudomonas aureus* and *Escherichia coli*; *Piptadeniastrum africanum* was active against *Staphylococcus aureu* and *Klebsiella pneumonia* MIC <100 ug/ml; and *Epaltes divaricate* extract was active (MIC <100 ug/ml) against *Staphylococcus aureus*, *Pseudomonas aureus* and *Klebsiella pneumonia.* While extracts of *Vernonia conferta* and *Pycnanthus angolensis* were weakly active against these bacteria. According to other authors [25] antibacterial extracts or compounds are categorized into two classes: bacteriostatic (MBC/MIC ratio >4) and bactericidal (MBC/MIC ratio <4). Following this classification, *Piptadeniastrum africanum* and *Epaltes divaricata* are bactericidal against all test strains with a ratio of 2, these findings are different from a similar study where the extract of *Epaltes divaricata* gave MIC values of 0.48 mg/ml [21]. These differences can be due to the differences in solvents used for extractions.

Conclusion

This study has shown that traditional practitioners from the six targeted Divisions of southwest Region use a variety of medicinal plants against infections caused by bacteria. It provides valuable insight regarding the potential antibacterial properties of these selected plants (*Pycnanthus angolensis, Ficus exasperate, Piptadeniastrum africanum, Epaltes divaricate* and *Vernonia conferta*).The *in vitro* results suggest that these plant extracts may have promising applications in the treatment of microbial infections pending further research.

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