Exploring the indigenous knowledge systems to respond to coronavirus infection 2019 in Cameroon

Patrick Valere Tsouh Fokou and Roger Ducos Youmsi Fokouo

Research

Abstract

Background: Control of coronavirus infection 2019 outbreaks lack specific vaccine or drugs, highlighting the need for appropriate interventions. Indigenous knowledge has been a source of medicinal agents for thousands of years and could help to circumvent this threat. We sought to know the current indigenous knowledge used by people living in Yaounde and Douala, Cameroon to protect against covid-19.

Methods: This survey was conducted with two-hundred and seventy-seven participants. A semi-structured questionnaire aiming at understanding of the practice and common interventions use by people to prevent covid-19 infection. Interviews were conducted by telephone and face to face interviews.

Results: A total of thirty-nine recipes consisting in thirty-eight distinct ingredients were recorded. The recipe ingredients comprising twenty-nine medicinal plants and nine other alternatives were used for covid-19 prevention in the city of Yaounde and Douala, Cameroon. The twenty-nine medicinal plant species corresponded to twenty-eight genera, arranged in twenty plant families. The most cited plants in recipes were *Citrus aurantiifolia* Christm., *Zingiber officinale* Roscoe, and *Allium sativum* L.. The most cited formulation besides the basic protective measures consisting in recipe 6 [*Allium sativum* L., *Citrus aurantiifolia* (Christm.) Swingle. and *Zingiber officinale* Roscoe (RFC=Relative frequency of citation 15.16%)]. Leaves were the most commonly utilized plant part with a frequency of 45%. From the thirty-nine recipes recorded, majority were decoction (69.23%; 27/39) and were administered orally.

Conclusions: Results show common knowledge devoid of scientific proof for most hints. Thus, their clinical application is pending reasonable scientific data on recipes and their standardization to support safety and efficacy in humans.

Keywords: Complementary medicine, Covid-19, Medicinal plants, Ethnobotanical survey, Knowledge, Self-reported practice.

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Background

Viral infections caused by emerging and re-emerging viruses are rapidly spreading due to increase global travel and rapid urbanization. They therefore represent a critical threat to public health, particularly when preventive vaccines and antiviral therapies are unavailable. To date, an acute respiratory disease or of acute infectious pneumonia, caused by a novel coronavirus (SARS-CoV-2, previously known as 2019-nCoV), which initially began in China, is rapidly spreading to many countries around the globe. It death toll is higher than that of 2002 and 2003 SARS-

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CoV outbreak (Guo *et al.* 2020, Rothan &Byrareddy 2020, Yang *et al.* 2020). The emergence of SARS-CoV-2, since the severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002 and Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012, marked the third introduction of a highly pathogenic and large-scale epidemic coronavirus into the human population in the twenty-first century (Guo *et al.* 2020). The 2019-nCoV has led to a public health emergency of international concern, putting all health organizations on high alert (Habibzadeh &Stoneman 2020). SARS-CoV-2 belongs to β-coronavirus, uses the same receptor, angiotensin-converting enzyme 2 (ACE2) as that for SARS-CoV, and mainly spreads through the respiratory tract (Guo *et al.* 2020). Person-to-person transmission of COVID-19 infection led to the isolation and treatment of patients including many imports/exported cases across the globe and confinement as extensive measures have been implemented to control the current outbreak (Rothan & Byrareddy 2020, Guo *et al.* 2020). The major symptoms of COVID-19 patients include fever, chills, cough, and shortness of breath, dyspnea, fatigue, generalized myalgia, confusion, malaise, drowsy, and pneumonia. A small population of patients suffered from gastrointestinal disorder such as diarrhea (Guo *et al.* 2020, Meo *et al.* 2020). The elderly and people with underlying diseases are susceptible to infection and prone to serious outcomes, which may be associated with acute respiratory distress syndrome (ARDS) and cytokine storm (Guo *et al.* 2020).

Treatment of SARS and MERS outbreaks has been focused on general antiviral drug and good safety measures. Based on lessons learned from SARS and MERS outbreaks, lack of drugs capable of pan-coronavirus antiviral activity increases the vulnerability of public health systems to a highly pathogenic coronavirus pandemic (Totura &Bavari 2019). No specific anti-virus drugs or vaccines are available for the treatment of this sudden and lethal disease (Yang *et al.* 2020). Currently, there are few specific antiviral strategies, but several potent candidates of antivirals and repurposed drugs are under urgent investigation (Guo *et al.* 2020). The supportive care and non-specific treatment to ameliorate the symptoms of the patient are the only options currently (Yang *et al.* 2020). Many natural compounds had been biologically confirmed as against sever acute respiratory syndrome coronavirus or Middle East respiratory syndrome coronavirus. (Zhang *et al.* 2020). In china more than 85% of SARS-CoV-2 infected patients in China are receiving Traditional Chinese Medicine (TCM) treatment (Yang *et al.* 2020). This could explain the reduce number of cases of SARS-CoV-2 registered in China. Efforts are made to identify anti-coronavirus activity of chemical entities and multiple component herbal formulas. As well, due to the homology of SARS-CoV and SARS-CoV-2, these previous studies may shed light on the naturally occurring compounds with the capacity to inhibit SARS-CoV-2 (Yang *et al.* 2020). The continuous effort of research in this direction might be helpful in producing high-value biologics and pharmaceuticals on a large scale in a short time, especially during epidemics (Shanmugaraj *et al.* 2020).

The aim of the current survey was to investigate the complementary self-prevention of the Covid-19 among people living Douala and Yaounde, Cameroon.

Materials and Methods

Survey design

The study was undertaken in two different regions of Cameroon: in the political capital city of the Cameroon, Yaounde, and in the economical capital city of Cameroon, Douala, with cosmopolitan population. These are the main ports of entry and most affected cities in Cameroon. Of note, the first confirmed case of Covid-19 in Yaounde was a fifty-eight-year-old French national who arrived in the Cameroonian capital on February 24, 2020. From March to April 2020, a sample of people agreed participated in the survey. A semi-structure questionnaire survey was carried out aiming at the understanding of the complementary self-prevention practice use by people to prevent covid-19 infection. After explaining the purposes of the study, an oral informed consent was received from all interviewed informants.

Interviews were conducted by telephone and face-to-face interviews. For the face-to-face interview, the interviewer and the informant wore protective masks and were separated by a minimal security distance of 1 m. All data has been collected from conversations with local people who worked and lived in Douala and Yaoundé. Information on medicinal plants including their local names, parts used, methods of preparation and administration routes, and sources of knowledge were documented.

Plant identification

Plant species were identified by a botanist by comparison with the floristic and taxonomic references of voucher specimens deposited at the Cameroon National Herbarium, Yaounde, Cameroon. Plant names have been checked with http://www.theplantlist.org (accessed on 22/04/2020).

Data analysis

Collected data during the fieldwork were analyzed with Microsoft Excel software.

Some classical quantitative ethnobotanical indices were calculated:

For each plant species, the frequency of citation (FC) is the number of times mentioned in a recipe (either monospecific or polyspecific). For each recipe, the frequency of citation is the number of citations of a recipe, while the Relative frequency of citation (RFC) was obtained using the formula: RFC = (the number of informants who mention the use of a recipe (FC) /Total number of informants in the survey) x 100. The higher the value, the greater is the importance.

To establish the respondent's reliance on the recipes cited, the informant consensus factor (ICF) was computed as follows:

$$ICF = (Nur - Nt)/(Nur - 1)$$

Where Nur refers to the number of mentioned uses in each category, [this category describes the recipes used for the prevention of covid-19]; and Nt, the total number of recipes used. The ICF is an indicator of the homogeneity of the information provided by the respondents. ICF values close to indicate that participants chose recipes at random or did not share accurate information about the recipes they use, while values close to 1 indicated that participants have consistent selection of recipes for a particular purpose or they shared knowledge appropriately about these recipes (Cakilcioglu &Turkoglu 2010).

Results

Sociodemographic information

A total number of two-hundred and seventy-seven participants aged from 30-78 years responded to the survey amongst which one-hundred and seventy-five males and one-hundred and two females from both Douala and Yaounde. From one-hundred and eighty participants living in Yaounde, one-hundred and nine were males and seventy-one females while ninety-seven participants from Douala consisted in sixty-six males and thirty-one females (Table 1). The informants consisted of 19 ethnic groups from living in 2 cosmopolitan cities of Cameroon (Yaounde and Douala) with Bamileke (88 informants over 277) and Ewondo (25/277 informants) being the most frequent.

Table 1. Sociodemographic information

Name	Age	Sex	Ethnic group	Mode of interview	Locality
000011	ND	M	ND	TE	YD
000027	ND	M	YAB	TE	YD
000028	ND	M	SAW	TE	YD
000033	ND	M	ND	TE	YD
000035	60	M	EWO	TE	YD
000056	ND	M	ND	TE	YD
000057	ND	M	ND	TE	YD
000058	ND	M	ND	TE	YD
000067	ND	F	ND	TE	YD
000085	ND	F	ND	TE	YD
000109	ND	M	ND	TE	YD
000110	ND	M	ND	TE	YD
000111	ND	M	ND	TE	YD
000122	ND	M	ND	TE	YD
000123	72	M	ND	TE	YD
000124	60	M	ND	TE	YD
000125	ND	M	ND	TE	YD
000126	ND	M	ND	TE	YD
000129	ND	M	ND	TE	YD
000130	ND	M	ND	TE	YD
000142	30	M	BAL	TE	YD
000150	ND	M	ND	TE	DO
000151	ND	M	NGU	TE	DO
000152	ND	M	ND	TE	DO
000166	44	M	BAO	TE	DO
000171	45	M	MAK	TE	DO
000176	46	M	BAK	TE	DO
000186	40	M	BAN	TE	DO
000194	ND	M	BAN	TE	DO
000201	ND	F	ND	TE	DO
000203	ND	M	BAK	TE	DO

000206	ND	M	BAL	TE	DO
000207	ND	M	ND	TE	DO
000209	ND	M	BAK	TE	DO
000210	ND	M	BAK	TE	DO
000233	65	M	ND	TE	DO
000234	59	M	BAK	TE	DO
000267	60	M	ND	TE	YD
000268	38	M	ND	TE	YD
ABB211	50	M	ETO	FF	DO
ABD243	37	M	FOU	TE	DO
ABI174	38	M	EWO	FF	DO
ABR090	53	M	BAK	TE	YD
ADA244	30	F	BAM	TE	YD
AFA252	38	M	BAO	TE	YD
AGA242	49	F	MAK	TE	YD
AKO272	33	M	BAF	TE	YD
AKW223	66	M	SAW	TE	DO
ALB198	37	M	TIK	TE	DO
ALE185	46	F	BOU	FF	DO
ALI059	40	M	SAW	TE	YD
ALV189	33	F	BAO	TE	DO
AMO162	40	M	ETO	FF	DO
ANA097	35	F	NGU	TE	YD
AND086	33	M	BOU	FF	YD
AND115	50	F	EWO	FF	DO
ANG153	39	F	BOU	FF	DO
ANI066	47	F	BAM	FF	YD
ANT246	41	M	BOU	TE	YD
ARE263	37	M	BAG	TE	YD
ASS119	60	F	BAF	TE	YD
ATA019	50	M	EWO	FF	YD
ATS241	42	F	BAM	TE	YD
ATU164	44	M	BOU	FF	DO
AUD216	36	F	BAM	TE	DO
AUR039	52	F	BAM	FF	YD
AZI262	43	M	FOU	TE	YD
BAL178	49	M	BAM	TE	DO
BAR051	46	M	BAM	FF	YD
BED217	39	M	ETO	FF	DO
BEL021	46	M	EWO	FF	YD
BEN055	60	F	FOU	TE	YD
BER046	50	F	BAM	FF	YD
BIS158	30	F	BAF	TE	DO
BIS248	65	F	BAF	TE	YD
BLA253	34	M	NGU	TE	YD
BLE231	49	M	BAM	TE	DO
BOU133	36	M	FOU	TE	YD
BRY103	50	M	EWO	FF	YD
CAL043	44	M	BAM	FF	YD
CAM078	52	M	BAM	TE	YD
CHA083	43	F	BAS	TE	YD
CHE118	59	M	BAM	TE	YD
CLA015	65	F	BAM	FF	YD
DAR230	45	M	BAG	TE	DO
DAV054	50	M	SAW	TE	YD
DAW188	42	M	FOU	TE	DO
DEF225	34	M	BAM	TE	DO
DEL064	36	F	BAO	TE	YD
DIK017	65	F	SAW	TE	YD
DJI136	47	M	FOU	TE	YD
DOM137	40	M	FOU	TE	YD
DON069	30	M	BAM	FF	YD
DOU214	52	M	EWO	FF	DO
EBA275	50	M	EWO	FF	YD

EBO024	35	M	EWO	FF	YD
EBO141	43	M	EWO	FF	YD
EGO184	33	M	BAK	TE	DO
EKE190	62	M	ETO	FF	DO
ESS269	42	M	BOU	TE	YD
ETI208	63	M	BAM	TE	DO
EVA197	31	F	BAG	TE	DO
FAD260	41	F	BAN	TE	YD
FAL170	39	F	BAM	TE	DO
FER041	42	M	BAM	FF	YD
FLA200	40	F	BAM	TE	DO
FOG094	39	F	BAM	TE	YD
FOK001	40	M	BAM	FF	YD
FOP219	48	M	BAM	TE	DO
FOU172	65	M	BAM	TE	DO
GAM105	60	F	BAM	TE	YD
GAN204	57	M	BAM	TE	DO
GAR236	61	M	BAO	TE	DO
GEN060	50	F	BAM	TE	YD
GIN002	40	F	BAM	FF	YD
GIS100	32	F	BAM	TE	YD
GLA144	62	F	BOU	FF	DO
GUE029	35	F	BAM	TE	YD
GUI128	37	M	BAM	TE	YD
HAI220	41	M	FOU	TE	DO
HAM277	51	M	BAM	TE	YD
HAN127	38	F	BAF	TE	YD
HER018	44	F	EWO	FF	YD
HIP221	50	M	EWO	FF	YD
HOL227	40	M	SAW	TE	DO
ISS265	56	M	FOU	TE	YD
ITS036	38	F	BAF	FF	YD
JEA0038	36	M	BAM	FF	YD
JER250	37	M	TIK	TE	YD
JPI068	45	M	BAM	FF	YD
JUL082	41	M	EWO	TE	YD
KAH273	60	F	BAF	TE	YD
KAJ087	48	M	BAM	FF	YD
KAM030	46	M	BAM	FF	YD
KAM042	47	M	BAM	FF	YD
KAM081	39	F	BAM	TE	YD
KAP072	30	F	BAM	TE	YD
KAR169	33	F	BAM	TE	DO
KAZ073	42	F	YAB	TE	YD
KEN140	40	F	BAM	TE	YD
KHO212	55	F	BAO	TE	DO
KIF247	ND	M	BAL	TE	YD
KIM226	35	M	BAK	TE	DO
KOA047	36	F	BOU	FF	YD
KOA050	46	F	BOU	FF	YD
KOD173	36	F	FOU	TE	DO
KOD251	31	F	FOU	TE	YD
KOF092	50	M	BAK	TE	YD
KOU156	60	F	EWO	FF	DO
LAD106	47	F	YAB	TE	YD
LAN108	41	M	BAM	TE	YD
LAN238	50	M	BAM	TE	DO
LAP245	35	M	YAM	TE	DO
LAU062	ND	M	BAG	TE	YD
LAU098	36	M	BAF	TE	YD
LEO161	70	M	BAM	TE	DO
LIN091	42	F	TIK	TE	YD
LOR195	33	F	BAM	TE	DO
LUK163	40	M	BOU	FF	DO

LUN191	45	M	BAO	TE	DO
LYD075	47	F	BAO	FF	YD
MAD061	30	F	BAM	TE	YD
MAF177	32	F	BAM	TE	DO
MAG159	30	F	EWO	FF	DO
MAJ049	36	F	BAM	FF	YD
MAJ074	45	F	ETO	TE	YD
MAK010	49	F	BAM	FF	YD
MAK026	78	M	BAK	FF	YD
MAM022	68	F	BOU	FF	YD
MAN135	45	M	SAW	TE	YD
MAR063	33	F	BAO	TE	YD
MAT065	ND	F	BAS	FF	YD
MAY099	32	F	MAK	TE	YD
MAZ155	52	F	EWO	FF	DO
MBE218	40	M	BAM	TE	DO
MBI258	61	M	BAS	TE	YD
MBO149	37	M	BAM	TE	DO
MBO264	61	M	TIK	TE	YD
MEF095	37	F	TIK	TE	YD
MER193	32	M	BAM	TE	DO
MET088	52	M	BAM	FF	YD
MFO213	33	M	BAO	TE	DO
MFO274	64	M	BAO	TE	YD
MGB165	42	M	BOU	FF	DO
MIN071	50	F	BAM	TE	YD
MOK147	32	F	BAM	TE	DO
MOM131	39	F	YAM	TE	YD
MON007	31	F	BAO	TE	YD
MOU143	39	M	BAK	TE	YD
MOU157	32	F	EWO	FF	DO
MUN104	58	F	BAM	TE	YD
NAO160	47	F	BAF	TE	DO
NAR199	46	M	BAM	TE	DO
NAS224	63	M	FOU	TE	DO
NBA138	55	M	EWO	FF	YD
NDJ181	38	M	BAO	TE	DO
NDO154	45	M	EWO	FF	DO
NDO180	ND	M	EWO	FF	DO
NEB121	35	M	BAM	FF	YD
NEM183	37	F	ETO	FF	DO
NGA148	60	F	BAS	TE	DO
NGO116	33	F	BAN	TE	YD
NIC009	68	F	BAM	FF	YD
NIN179	32	F	BAM	TE	DO
NJA215	69	M	BAM	TE	DO
NKU228	66	M	MAK	TE	DO
NNM145	35	F	BAO	TE	DO
NON182	36	F	BAM	TE	DO
NOU261	40	F	FOU	TE	YD
NTO167	33	F	BOU	FF	DO
NYA031	46	F	EWO	FF	YD
NZE146	47	F	BAK	TE	DO
NZO175	40	M	BAM	TE	DO
OEL266	64	F	TIK	TE	YD
OFA259	39	M	BAN	TE	YD
OLI025	46	M	BAM	FF	YD
PAH192	40	M	BAM	TE	DO
PAT052	34	F	FOU	TE	YD
PEL256	66	M	BAS	TE	YD
PEN084	64	M	BAM	FF	YD
PIT040	40	M	BAM	FF	YD
POS048	36	M	BAM	FF	YD
PRI222	60	M	ETO	FF	YD

RAO003	40	M	BAI	FF	YD
RAY053	36	M	BAM	FF	YD
REH102	49	M	FOU	TE	YD
RHI093	55	M	EWO	FF	YD
RIC034	51	M	SAW	TE	YD
RIF240	45	M	BAM	TE	DO
RIQ020	46	F	BAK	TE	YD
ROD006	30	M	BAS	FF	YD
ROS045	58	F	ETO	FF	YD
RUD101	40	M	BAG	TE	YD
SAB032	46	F	BAM	TE	YD
SAB080	50	F	BAM	TE	YD
SAM004	44	M	BAM	TE	YD
SAN076	48	M	BAS	FF	YD
SEE229	33	M	MAK	TE	DO
SEN012	46	M	BAN	FF	YD
SIB187	50	M	FOU	TE	DO
SID239	54	M	BAO	TE	DO
SIE096	35	F	BAL	TE	YD
SIF270	47	M	SAW	TE	YD
SIM202	60	M	BAM	TE	DO
SIN008	55	M	SAW	TE	YD
SKE037	39	F	SAW	FF	YD
SOC276	34	M	BAM	TE	YD
SOE070	30	F	BAI	TE	YD
SON255	33	F	BAN	TE	YD
SOP023	37	M	BAM	FF	YD
SOP139	49	M	BAM	TE	YD
SOU014	40	M	BAM	TE	YD
SYL079	50	F	EWO	TE	YD
TAE249	60	M	TIK	TE	YD
TAF107	46	M	EWO	FF	YD
TCH016	39	F	BAM	FF	YD
TCH117	56	M	BAM	TE	YD
TEI089	53	F	BAS	TE	YD
TEI114	47	M	BAL	TE	YD
TOF077	46	F	BAM	TE	YD
TOS232	36	M	BAM	TE	DO
TOU257	65	M	ETO	FF	YD
TSA120	78	M	BAM	TE	YD
TSO044	40	M	BAM	FF	YD
TUE205	77	M	BAM	TE	DO
VAN112	62	F	BAM	TE	YD
WAN013	44	F	BAM	TE	YD
WAN132	62	F	FOU	TE	YD
WAS254	54	M	BAO	TE	YD
WAV235	35	M	EWO	FF	YD
WIL005	40	M	BAM	FF	YD
YAK237	33	M	BAK	TE	DO
YAN113	36	M	FOU	TE	YD
YAN134	30	M	FOU	TE	YD
YIM196	63	F	BAM	TE	DO
YVA271	40	M	YAM	TE	YD
ZEH168	36	F	BAS	TE	DO
Total: 277	**Range**: 30-78	**M:**175 **F:** 102	**Total ethnic groups**: 19 BAI: 2; TIK: 7; BAL: 5; NGU: 3; BAF: 9; MAK: 5; YAM: 3; BAS: 9 ; BAO: 16; SAW: 11; BAN: 7; BAK: 14; BOU:13; YAB: 3; ETO:9; FOU:19; BAG: 5; BAM: 88; EWO: 25; ND: 24	**TE**: 198 **FF**: 79	**YD**: 180 **DO**: 97

ND: Not determined; F: Female; M: male; FF: Face to face; TE: Telephone; BAI: Bakweri; TIK: Tikar; BAL: Bali Nyonga; NGU: Nguemba; BAF: Bafia; MAK: Maka; YAM: Yambassa; BAS: Bassa, BAO: Bamoun; SAW: Sawa; BAN: Banso; BAK: BAKOKO; BOU:Bulu; YAB: Yabassi; ETO:Eton; FOU:Foulbe; BAG: Baguieli; BAM: Bamileke; EWO: Ewondo; DO: Douala, YD: Yaounde

Of the two-hundred and seventy-seven interviews conducted one-hundred and ninety-eight were through telephone and seventy-nine through face to face with reasonable distance (at least 1 m). The wearing of the mask was compulsory.

Covid-19 preventive practices and complementary medicine

In the present study, thirty-nine recipes comprising thirty-eight ingredients were recorded as used in the prevention of covid-19 by the people of Douala and Yaounde. The documented ingredients were mainly composed of twenty-nine plant species and eight other ingredients (Rock salt, salt, hot water, mentholatum, honey, bicarbonate, olive oil and urine) and the basic protective measures. The 29 traditional plant species correspond to twenty-nine genera, arranged in twenty plant families. The plant families, scientific names, parts used, methods of preparation, administration routes, source of knowledge, frequency of citations, and number of uses are listed in Table 2. The results from the study also showed that Zingiberaceae, Compositae and Myrtaceae were the most represented families (with 3 species each), followed by Amaryllidaceae and Malvaceae (2 species), while the remaining were represented by one species only (Table 2). The most commonly used plant forms were trees (45%), herbs (28%) and shrubs (27%) (Figure 1).

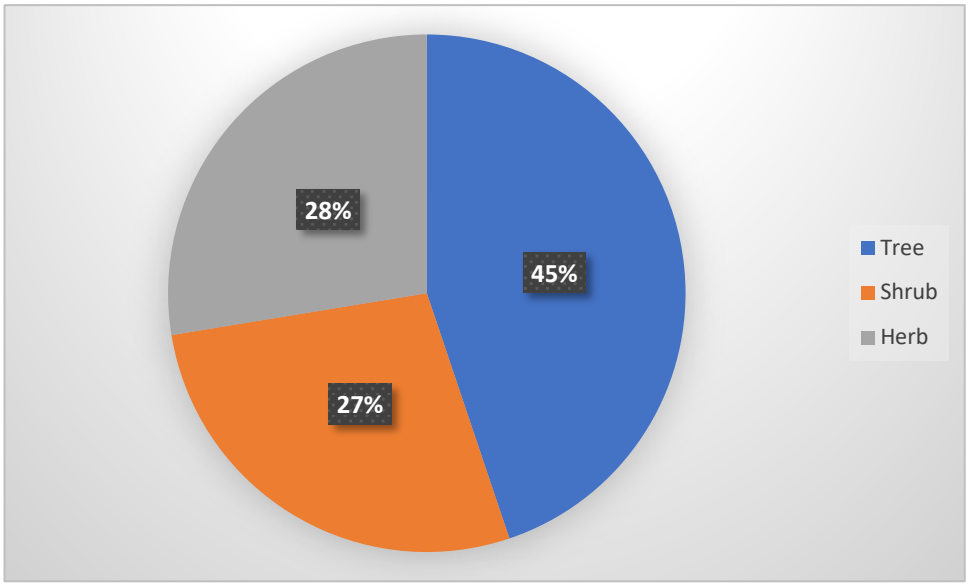

Figure 1. Life forms of cited plants

The most cited plant in a recipe were *Citrus aurantiifolia* mentioned by one-hundred and nine informants, followed by *Zingiber officinale* mentioned by eighty-eight informants, *Allium sativum L.* (73 informants), *Picralima nitida* (59 informants), *Alstonia boonei* (23 informants), and *Vernonia amygdalina* (22 informants) (Figure 2).

Apart from medicinal plant-based recipes some ingredient such as basic protective measures only (42 informants), honey (28 informants), mentholathum (13) were extensively used in the Covid-19 prevention (table 2). Though informants did not emphasize on basic protective measures they all used them as barrier measures. Honey was not used alone but rather serve as adjuvant in many recipes. Mentholatum has a long being used to manage common cold and flu symptoms which are closely related that of Covid-19.

In the present study as shown in Figure 3, the informants have used different plant parts: leaves were the most commonly utilized plant part with a frequency of 45%; followed by fruit and bark (14% each).

A total of thirty-nine recipes were recorded. The most cited formulation besides the basic protective measures consisting in recipe 6 [*Allium sativum* L., *Citrus aurantiifolia* (Christm.) Swingle. and *Zingiber officinale* Roscoe (RFC 15.16%)], recipe 23 [*Picralima nitida* (Stapf) T.Durand & H.Durand (RFC 9.39%)], recipe 16 [*Citrus aurantiifolia* (Christm.) Swingle., honey, and *Zingiber officinale* Roscoe (RFC 6.14%)] (Table 3). Apart from the basic protective measures that are commonly used, the most relatively frequent recipes are being used to treat flu or common cold that symptoms are very close to that of covid-19. However, informants were not specific about exact amount or proportion of each ingredient in the recipe.

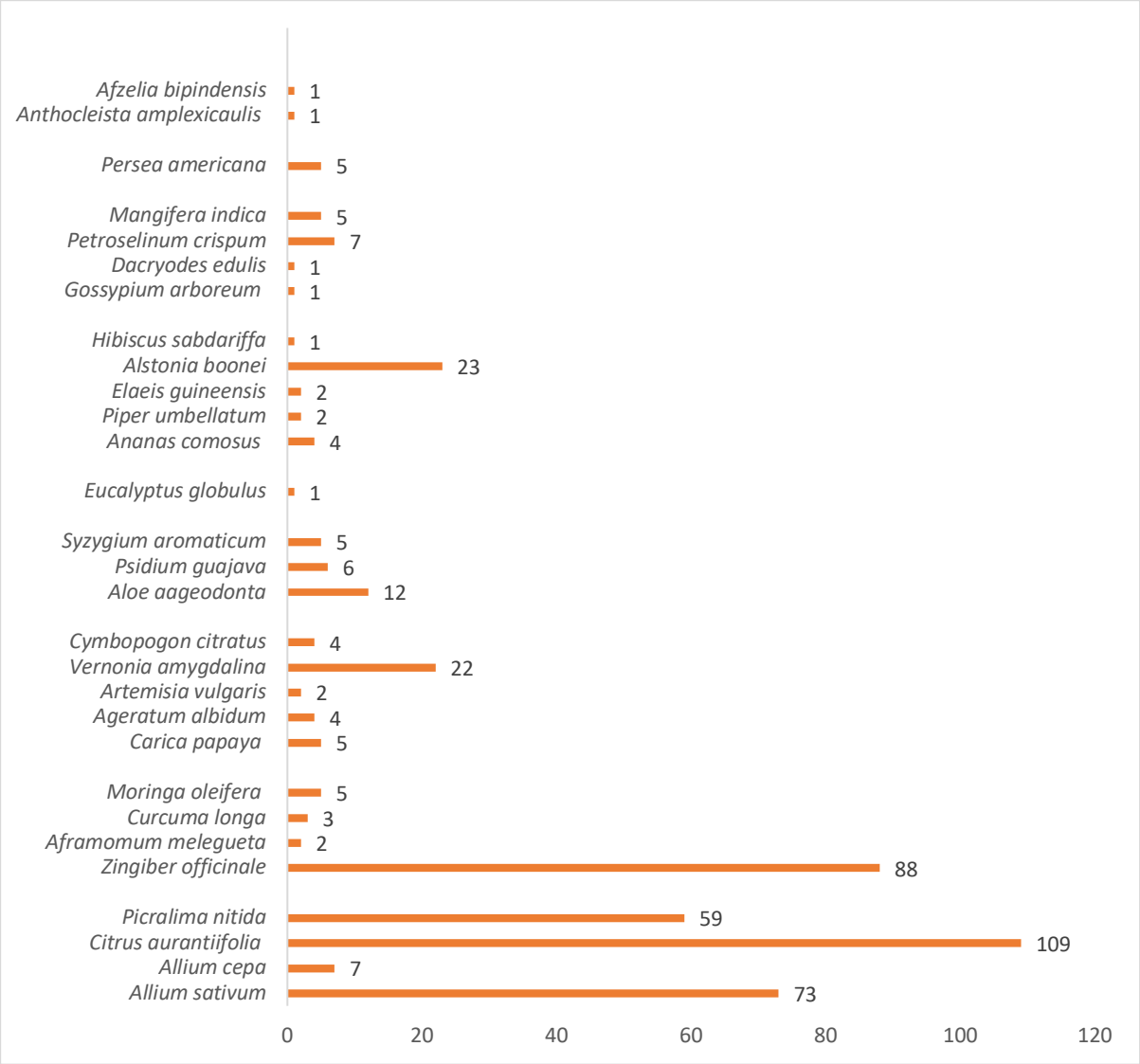

Figure 2. Frequency of citation of plant species in reported recipes

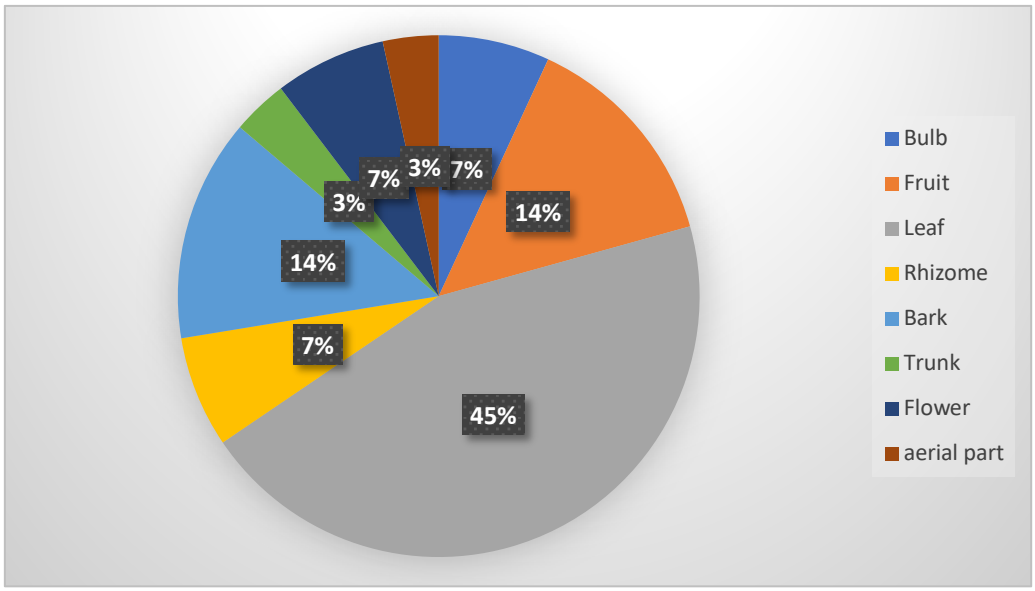

Figure 3. Plant parts used frequency

Table 2. List of ingredients used to prepare in recipes against Covid-19

List of medicinal plants used							
Family	**Scientific name**	**Collector / Reference number**	**Common / vernacular name**	**Botany**	**Plant part used**	**Frequency of citation (FC)**	**Reported antiviral activity (if known)**
Amaryllidaceae	*Allium sativum* L.	Westphal 10.019 44810/HNC	Garlic	Herb	Bulb	73	Inhibitory effects on Infectious bronchitis virus (IBV) in the chickens embryo(Mohajer Shojai et al. 2016). The antiviral activity on SARS coronavirus strain Frankfurt 1 (SARS-CoV FFM1)(Vijgen et al. 2004)
	Allium cepa L.	Daniel Dang 435 25755/SRF/cam	Onion	Herb	Bulb	7	The antiviral activity against (HSV1) (Romeilah, Fayed, and Mahmoud 2010) Inhalation of Volatile Chemicals from Onion for Isolated Patient of Mild Onset Infected Flu(Tan et al. 2020)
Anacardiaceae	*Mangifera indica* L.	SCA 353 32875/HNC	Mango	Tree	Leaf	5	Anti-virus activity to extract on influenza virus(Al-rawi, Dulaimi, and Rawi 2019).
Apocynaceae	*Picralima nitida* (Stapf) T. Durand & H. Durand	Mpom Benoit 149 1942/SRF K	Quinqueliba, Ebam (Ewondo)	Shrub	Fruit	59	Anti-measles virus activity (Oluremi and Adeniji 2015)
	Alstonia boonei De Wild	Bayum H. 1 43368/HNC	Ikouk (Ewondo)	Tree	Bark	23	Potential anti-HIV activity (Adotey et al. 2012).
Apiaceae	*Petroselinum crispum* (Mill.) Nyman ex A.W. Hill	Daniel Dang 374 25583/SRF/cam	Parsley	Herb	Leaf	7	No record
Arecaceae	*Elaeis guineensis* Jacq.	Mpom Benoit 379 34163/HNC	Eson alen (Boulou)	Tree	Trunk	2	No record
Asparagaceae	*Aloe vera* (L.) Burm. f.	Daniel Dang 364 25567/SRF/cam	Aloes vera	Herb	Leaf	12	Inhibit the replication of a H1N1 subtype influenza virus,(Sun et al. 2018, Gansukh et al. 2018)
Bromeliaceae	*Ananas comosus* (L.) Merr.	Daniel Dang 83 18648/SRF/cam	Pineapple	Herb	Fruit	4	Activity on polio virus 1 (Konowalchuk and Speirs 1978) Improvement rate of irritative coug (Peixoto et al. 2016)
Burseraceae	*Dacryodes edulis* (G. Don) H.J. Lam	Letouzey R. 9105 18258/SRF/cam	Bush pear tree Safoutier	Tree	Leaf	1	No record
Caricaceae	*Carica papaya* L.	Daniel Dang 92 18647/SRF/cam	Papaya	Tree	Bark	5	Active against dengue virus (DENV)(Sharma et al. 2019)
Compositae	*Ageratum conyzoides* (L.) L..	Letouzey R. 6791 8013/SRF/cam	King of herbs	Herb	Leaf	4	Antiviral activity against echoviruses (Ogbole et al. 2018)
	Artemisia vulgaris L.	Coll. Inconnu (S.C). 68501/HNC	Arthemesia	Herb	Leaf	2	No record
	Vernonia amygdalina Delile	Mpom Benoit 18 1737/SRF K	Ndole	Shrub	Leaf	22	Activity against atypical Fowl pox virus(Oladunmoye et al. 2020)
Gentianaceae	*Anthocleista amplexicaulis* Baker	Koufani 93 20738/HNC	Bopolopolo (Sawa)	Tree	Bark	1	No record
Lauraceae	*Persea americana* Mill	Daniel Dang 80 18604/SRF/cam	Avocado tree	Tree	Leaf	5	Inhibit DENV-2 replication (Wu et al. 2019) Strong inhibitory activity against Aujeszky's disease virus(Simoni et al. 1996) Strong inhibitory effect on acyclovir (ACG(r)4 and dlsp TK mutants) and PAA-resistant (PAA(r)5 mutant) herpes simplex virus(Miranda et al. 1997)
Leguminosae	*Afzelia bipindensis* Harms	J.J. Flomet 565 39149/HNC	Bokeng (Sawa)	Tree	Bark	1	No record
Malvaceae	*Hibiscus sabdariffa* L.	Westphal 9350 42837/HNC	Folere (Peul)	Shrub	Flower	1	Exhibit Antiviral Activity against HSV-2 (Hassan, Švajdlenka, and Berchová-Bímová 2017) Antiviral Activities Against Human Influenza A Virus (Takeda et al. 2020)
	Gossypium arboreum L.	Daniel Dang 96 18608/SRF/cam	Cotton	Shrub	Leaf	1	**Antiviral** activities against yellow fever virus(Fasola et al. 2011)

Moringaceae	*Moringa oleifera* Lam.	Bonnoug E.d 116 8573/SRF/cam	Moringa	Tree	Leaf	5	Antiviral activity against HSV, Epstein-Barr virus, HIV/AIDS (Biswas et al. 2020, Imran et al. 2016) Activity against Foot and mouth disease virus (FMDV), a picornavirus(Imran et al. 2016)
Myrtaceae	*Psidium guajava* L.	Mpom Benoit 312 2884/SRF K	Guava	Tree	Leaf	6	Anti-influenza virus activity(Sriwilaijaroen et al. 2012)
	Syzygium aromaticum (L.) Merr. & L.M. Perry	1858/SRFK	Clove	Tree	fFower	5	Active against Foodborne viruses, human norovirus(Aboubakr et al. 2016) and the Newcastle Viral Disease(Mehmood et al. 2020)
	Eucalyptus globulus Labill.	Letouzey R. 1948 4077/SRF K	Eucalyptus	Tree	Leaf	1	Effective against H1N1 and HSV1 viruses(Brochot et al. 2017, Cermelli et al. 2008)
Piperaceae	*Piper umbellatum* L.	Letouzey R. 2499 18628/SRF K	Abomenjan (Boulou)	Shrub	Leaf	2	No record
Poaceae	*Cymbopogon citratus* (DC.) Stapf	Daniel Dang 202 18628/SRF/cam	Fever grass	Herb	Aerial part	4	Antiviral activity against Human mastadenovirus (Chiamenti et al. 2019), Herpes simplex types 1 and 2(Almeida et al. 2018), Newcastle disease virus in-vivo(Abraham-Oyiguh et al. 2019), dengue virus(Rosmalena et al. 2019), and measles virus(M.N et al. 2006)
Rutaceae	*Citrus aurantiifolia* (Christm.) Swingle	Bayum H. 1 65106/HNC	Lim	Tree	Fruit	109	Direct virucidal activity against the human immunodeficiency virus (HIV) (Fletcher et al. 2008, Lackman-Smith et al. 2010)
Zingiberaceae	*Zingiber officinale* Roscoe	Surville 773 14757/SRF/cam	Ginger	Shrub	Rhizome	88	Active against Foodborne viruses, particularly human norovirus(Aboubakr et al. 2016) and A/Puerto Rico/8/34 (H1N1) (PR8), vesicular stomatitis virus (VSV), and Newcastle disease virus (NDV)(Talactac et al. 2015)
	Aframomum melegueta K. Schum	Westphal 9868 44829/HNC	Jujube	Shrub	Fruit	2	Activity against atypical Fowl pox virus(Oladunmoye et al. 2020) and human respiratory syncytial virus(Chang et al. 2013)
	Curcuma longa L.	Fotius 2089 38292/HNC	Curcuma	Shrub	Rhizome	3	Activity against variety of viruses including parainfluenza virus type 3 (PIV-3), dengue virus (DENV), feline infectious peritonitis virus (FIPV), vesicular stomatitis virus (VSV), herpes simplex virus (HSV), hepatitis C virus, HIV flock house virus (FHV), HIV, and respiratory syncytial virus (RSV)(Moghadamtousi et al. 2014, Praditya et al. 2019, Ichsyani et al. 2017)
			Other ingredients used				
Rock salt						3	
Salt						1	
Hot water						4	
Mentholatum						13	
Honey						28	
Bicarbonate						4	
Olive oil						4	
Urine						3	
Basic protective measures						42	

The selection of the recipes for use seemed to be homogenous among the respondents as evidenced by the ICF values = 0.86 in the surveyed population. This parameter indicated that Participants have a consistent selection of the recipes used for the prevention of covid-19. On the other hand, some underrepresented recipes such *Piper umbellatum* L. and *Elaeis guineensis* Jacq. were given with a story. *A* 78 years old lady said :'When I was still a child, we were told that there was a mysterious and highly contagious and deadly disease that killed many people around 1918 (probably the Spanish flu)". Of note, the Spanish flu, the 1918 influenza pandemic caused by an H1N1 virus arose in 1918 and killed about fifty million people worldwide. "Anybody with dry cough, runny nose, fever or flu-like symptoms was given the decoction of leaves of *Piper umbellatum* L. and trunk of *Elaeis guineensis* Jacq. mixture as treatment." She went further and declared, "I also sent this recipe to one of my sons in Europe that contracted the covid-19 and used it to recover." This information could not be verified but, it is likely as placebo effect or that the virus was cleared by the immune system of the person. However, some ethnomedicinal use of these plants could be justified by the utilization of *Piper umbellatum* species fruits to treat coughs and colds (Salehi *et al.* 2019).

Decoction was the main mode of preparation of the recipes with twenty-seven out thirty-nine recipes, followed by infusion (3/39) recipes (Table 3).

The vast majority of the recipes (36) were administered orally followed by inhalation (02) and were taken twice a day except for garlic and mentholathum that was constantly chewed and applied or *Citrus aurantifolia* and bicarbonate and salty hot water taken once a day (Table 3). As far as the mode of administration is concerned, the major medications were taken orally. These findings were comparable to earlier reports (Luitel *et al.* 2014, Ignacimuthu *et al.* 2006, Kadir *et al.* 2012). The main sources of knowledge consist in by word of mouth (144 informants) and then social media (105 informants). TV and herbal practitioner were underrepresented with respectively eleven and seventeen informants (Table 3). By word of mouth was defined as any information coming from family members (grandmother, mother, and father) and friends.

Discussion

Several parts of different plant species have been used against closed related disease, flu and the common cold including lime and elder flowers, meadowsweet flowers and herb, purple echinacea aerial parts and roots, wild rose, blackcurrant and sea buckthorn fruits, lemon juice, etc. (Raal *et al.* 2013). Following the onset of the Covid-19 pandemic the Chinese State Council recommend chloroquine phosphate extracted from the bark of the cinchona tree on the February 7, 2020 for the treatment of patient. Chloroquine phosphate demonstrated anti-viral activities on SARS-Cov 1 in animal model and in culture (Keyaerts et al. 2009). It is less toxic derivative hydroxychloroquine, inhibit SARS-CoV-2 infection *in vitro* (Liu et al. 2020). However, the latest data on chloroquine and its derivatives toxicity and low cure rate is hampering their use.

In this study, *Citrus aurantiifolia,* Zingiber officinale, *Allium sativum, Picralima nitida, Alstonia boonei*, and *Vernonia amygdalina* account amongst the most cited species. *Citrus aurantiifolia* is an aromatic, astringent, cooling herb. An infusion of the leaves is taken internally in the treatment of colds. The juice is also added to various medicinal preparations, especially for the treatment of flu-like symptoms such as chest colds and fevers (Raal et al. 2013). *Citrus aurantiifolia* showed direct virucidal activity against the human immunodeficiency virus (HIV) (Fletcher *et al.* 2008, Lackman-Smith *et al.* 2010). *Allium sativum* (garlic), *Zingiber officinale* (Ginger rhizoma) are used in the complementary treatment of episodes of the common cold and flu (Raal et al. 2013, Mendieta et al. 2015). *Allium sativum* has been used for many decades for the treatment of cold and flu. Garlic extract experimentally showed antiviral activity against selected viruses including, herpes simplex virus type 1, herpes simplex virus type 2, parainfluenza virus type 3 (Causative agent of flu), vaccinia virus, vesicular stomatitis virus, human rhinovirus type 2, and infectious bronchitis virus (IBV) in the chickens embryo (Mohajer Shojai *et al.* 2016, Mehrbod, Amini, Tavassoti-Kheiri 2009, Weber *et al.* 1992). Interestingly garlic also showed antiviral activity on SARS coronavirus strain Frankfurt 1 (SARS-CoV FFM1)(Vijgen *et al.* 2004). As well, *Zingiber officinale*, aqueous extract of ginger (10%), showed anti-Avian influenza virus H9N2 activity (Rasool et al. 2017). It is also active against foodborne viruses, particularly human norovirus (Aboubakr *et al.* 2016) and A/Puerto Rico/8/34 (H1N1) (PR8), vesicular stomatitis virus (VSV), and newcastle disease virus (NDV) (Talactac *et al.* 2015). *Vernonia amygdalina*, has been use in various formulations to treat many diseases including influenza (Yeap et al. 2010). It also has activity against atypical Fowl pox virus (Oladunmoye *et al.* 2020).

Table 3. Recorded recipes with their mode of preparation and route of administration

	Code	Ethnopharmacological preparation	Posology	Frequency of citations (FC)	Relative frequency of citations (RFC)(%)	Route of administration	Source of knowledge	Informants
Plant-based recipes								
Recipe 1:	AsBuChOr	The bulb of *Allium sativum* L. (Amaryllidaceae) is use through chewing in oral route	Constant chewing	2	0.72	Oral	By word of mouth *(2)	CAM078, VAN112
Recipe 2:	CaBiFrDrOr	Infusion: Mix the juice of fruit of *Citrus aurantiifolia* (Christm.) Swingle with a teaspoon of bicarbonate in a glass of hot water	Drink a glass a day	4	1.44	Oral	Social media (2), By word of mouth (2)	SEN012, YVA271, FAD260, LAN238
Recipe 3:	AsBuCaFrPnFrDrOr	Infusion: bulb of *Allium sativum* L. (Amaryllidaceae), fruit of *Citrus aurantiifolia* (Christm.) Swingle and fruit of *Picralima nitida* (Stapf) T.Durand & H.Durand (Apocynaceae) are infused in hot water	Drink a glass twice a day	11	3.97	Oral	Social media (4), By word of mouth (7)	NNM145, MAN135, 000056, BEL021, RIC034, PIT040, TUE205, KHO212, MBE218, DEF225, TOS232
Recipe 4:	MoLlDrOr	Infusion: leaf of *Moringa oleifera* Lam. (Moringaceae) in hot water	Drink a glass twice a day	5	1.80	Oral	By word of mouth (5)	NYA031, RAY053, MET088, MOU157, GAR236
Recipe 5:	CpBkDr	Decoction: Bark of *Carica papaya* L. (Caricaceae) is boiled in water	Drink a glass twice a day and make a vapor bath every night before bed	5	1.80	Oral	By word of mouth (3), Social media (2)	ITS036, KAM042, FAL170, LOR195, ESS269
Recipe 6:	AsBuCaFrZoRzDrOr	Decoction: Bulb of *Allium sativum* L. (Amaryllidaceae), fruit of *Citrus aurantiifolia*	Drink a glass twice a day	42	15.16	Oral	By word of mouth (33), Social media (9)	FOK001, MAT065, JPI068, BAR051, PEN084,

		(Christm.) Swingle (Rutaceae) and rhizome *Zingiber officinale* Roscoe (Zingiberaceae) mixed together and boiled in water						KOF092, YAN113, HAN127, 000124, 000125, GUE029, KOA050, BOU133, 000151, MOK147, 000152, ANG153, AMO162, ATU164, ZEH168, ABI174, BAL178, NIN179, ALE185, 000186, SIB187, ALV189, EKE190, LUN191, MER193, YIM196, 000203, 000209, MFO213, DOU214, BED217, HIP221, PRI222, AGA242, MBO264, DEL064, SOC276
Recipe 7:	AgcLfCaFrOoDrOr	Maceration: Macerate leaf of *Ageratum conyzoides* (L)L. (Compositae) with fruit of *Citrus aurantiifolia* (Christm.) Swingle (Rutaceae), and olive oil in water	Drink a glass twice a day	4	1.44	Oral	By word of mouth (3), Social media (1)	DON069, BLA253, LAP245, NOU261
Recipe 8:	AvLfCaFrHyDrOr	Decoction: Leaf of *Aloe vera* (L.) Burm.f., (Asparagaceae) fruit of *Citrus aurantiifolia* (Christm.) Swingle and honey are boiled in water	Drink a glass twice a day	6	2.17	Oral	Social media (6)	FER041, ROS045, BLE231, ATS241, PEL256, SIF270

Recipe 9:	CaFrZoRzDrOr	Decoction: fruit of *Citrus aurantiifolia* (Christm.) Swingle (Rutaceae) and rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are boiled in water	Drink a glass twice a day	8	2.89	Oral	By word of mouth (4), TV (2), Social media (2)	ANI066, RAO003 SIN008, MAK010, HER018, MAM022, EBO024, MAK026
Recipe 10:	SaFlDrOr	Decoction: Clove of *Syzygium aromaticum* (L.) Merr. & L.M.Perry (Myrtaceae) are boiled in water	Drink a glass twice a day	5	1.80	Oral	Herbal practitioner (2), Social media (3)	000035, POS048, MIN071, TOF077, TCH117
Recipe 11:	CaFrCcApDrOr	Decoction: fruit of *Citrus aurantiifolia* (Christm.) Swingle and leaf of *Cymbopogon citratus* (DC.) Stapf (Poaceae) are boiled in water	Drink a glass twice a day and make a vapor bath every night before bed	3	1.08	Oral	Social media (3)	GIS100, GAM105, AKO272
Recipe 12:	AvLfCaFrDrOr	Decoction: Leaf of *Aloe vera* (L.) Burm.f. (Asparagaceae) and fruit of *Citrus aurantiifolia* (Christm.) Swingle (Rutaceae) are boiled in water	Drink a glass twice a day	5	1.80	Oral	Social media (5)	CLA015, 000027, 000033, LAU062, LAU098
Recipe 13:	AsBuAcoFrZoRzDrOr	Decoction: Bulb of *Allium sativum* L. (Amaryllidaceae), *Ananas comosus* (L.) Merr. (Bromeliaceae) and rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are boiled in water	Drink a glass twice a day	4	1.44	Oral	Social media (4)	TCH016, RIQ020, OLI025, KAH273
Recipe 14:	AvLfDrOr	Decoction: Leaf of *Artemisia vulgaris* L.(Compositae) are boiled in water	Drink a glass twice a day	2	0.72	Oral	Herbal practitioner (2)	GIN002, WAS254
Recipe 15:	PuLlEgtrDrOr	Decoction: leaf of *Piper umbellatum* L. (Piperaceae) and trunk of *Elaeis guineensis* Jacq.	Drink a glass twice a day	2	0.72	Oral	By word of mouth (2)	MBI258, KOU156

		(Arecaceae) Are boiled in water						
Recipe 16:	CaFrHyZoRzDrOr	Decoction: fruit of *Citrus aurantiifolia* (Christm.) Swingle. (Rutaceae), honey and rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are mixed and boiled in water	Drink a glass twice a day	17	6.14	Oral	Social media (17)	PAT052, 000057, MAR063, SAB080, JUL082, CHA083, LIN091, LAN108, TSA120, GUI128, NBA138, MOU143, HAI220, KIF247, TAE249, JER250, TOU257
Recipe 17:	CoBkPnFrDrOr	Decoction: Bark of *Alstonia boonei De Wild.* (Apocynaceae) and fruit of *Picralima nitida* (Stapf) T.Durand & H.Durand (Apocynaceae) are mixed and boiled in water	Drink a glass twice a day	1	0.36	Oral	By word of mouth (1)	ARE263
Recipe 18:	AmFrHyZoRzDrOr	Decoction: fruit of *Aframomum melegueta* K. Schum. (Zingiberaceae), honey and rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are mixed and boiled in water	Drink a glass twice a day	1	0.36	Oral	By word of mouth (1)	000171
Recipe 19:	AmFrChOr	Fruit of *Aframomum melegueta* K.Schum. (Zingiberaceae) are chewed	Constant chewing	1	0.36	Oral	By word of mouth (1)	NZO175
Recipe 20:	CoBkDrOr	Decoction: Bark of *Alstonia boonei De Wild.* (Apocynaceae) is boiled in water	Drink a glass twice a day	7	2.53	Oral	Herbal practitioner (2), By word of mouth (2), Social media (3)	LYD075, 000166, FOU172, ALB198, SIM202, NDJ181, 000085

Recipe 21:	PnFrClFrDrOr	Decoction: fruit of *Picralima nitida* (Stapf) T.Durand & H.Durand (Apocynaceae), fruit of *Citrus limon* (L.) Burm. f. (Rutaceae) and rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are boiled in water	Drink a glass twice a day	5	1.80	Oral	By word of mouth (5)	RUD101, NGO116, 000122, 000176, EVA197
Recipe 22:	AcBuAsBuZoRzDrOr	Decoction: Bulb of *Allium cepa* L. (Amaryllidaceae), bulb of *Allium sativum* L. (Amaryllidaceae), rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are mixed and boiled in water	Drink a glass twice a day	4	1.44	Oral	Social media (4)	HAM277, RIF240, SEE229, ADA244
Recipe 23:	PnFrDrOr	Decoction: fruit of *Picralima nitida* (Stapf) T.Durand & H.Durand (Apocynaceae) is boiled in water	Drink a glass twice a day	26	9.39	Oral	Herbal practitioner (6), By word of mouth (10), TV (5), Social media (5)	BER046, 000058, SOE070, KAM081, KAJ087, SIE096, MUN104, 000109, ASS119, 000129, WAN132, YAN134, DOM137, 000142, NGA148, NDO154, MAG159, LEO161, MGB165, KAR169, KOD173, NON182, TAF107, AND115, NEB121, PAH192

Recipe 24:	HsFlDrOr	Decoction: flower of *Hibiscus sabdariffa* L. (Malvaceae) is mixed with honey and boiled in water	Drink a glass twice a day	1	0.36	Oral	By word of mouth (1)	HOL227
Recipe 25:	VaLfCoBkPnFrDrOr	Decoction: leaf of *Vernonia amygdalina* Delile (Compositae), bark of *Alstonia boonei De Wild.* (Apocynaceae), and fruit of *Picralima nitida* (Stapf) T.Durand & H.Durand (Apocynaceae) are boiled in wa ter	Drink a glass twice a day	15	5.42	Oral	Herbal practitioner (1), By word of mouth (9), TV (2), Social media (3)	RHI093, ANA097, LAD106, TEI114, CHE118, 000123, 000126, MOM131, DJI136, EBO141, NZE146, MBO149, 000150, NAO160, AFA252
Recipe 26:	EgLfDrOr	Decoction: leaf of *Eucalyptus globulus* Labill. (Myrtaceae) is boiled in water	Drink a glass twice a day	1	0.36	Oral	By word of mouth (1)	AUD216
Recipe 27:	AcBuAsBuCloRzZoRz DrOr	Maceration: Bulb of *Allium cepa* L. (Amaryllidaceae), bulb of *Allium sativum* L.(Amaryllidaceae), rhizome of *Curcuma longa* L. (Zingiberaceae) and rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are macerate in water	Drink a glass twice a day	3	1.08	Oral	Herbal practitioner (3)	ETI208, 000210, ISS265
Recipe 28:	ZoRzAvLfGaLfDrOr	Decoction: Rhizome of *Zingiber officinale* Roscoe (Zingiberaceae), leaf of *Aloe vera* (L.) Burm.f. (Asparagaceae), Leaf of *Gossypium arboreum* L. (Malvaceae) are mixed together and boiled in water	Drink a glass twice a day	1	0.36	Oral	Social media (1)	MON007
Recipe 29:	CaFrCcApDeLfPgLfDr Or	Decoction: fruit of *Citrus aurantiifolia* (Christm.) Swingle (Rutaceae), leaf		1	0.36	Inhalation	By word of mouth (1)	SAM004

		of *Cymbopogon citratus* (DC.) Stapf (Poaceae), leaf of *Dacryodes edulis* (G.Don) H.J.Lam (Burseraceae) and leaf of *Psidium guajava* L. (Myrtaceae) are boiled together in water						
Recipe 30:	AaBkAbBkPnFrDrOr	Decoction: bark of *Anthocleista amplexicaulis* Baker (Gentianaceae), bark of *Afzelia bipindensis* Harms (Leguminosae) and fruit of *Picralima nitida* (Stapf) T.Durand & H.Durand) (Apocynaceae) are boiled together in water	Drink a glass twice a day	1	0.36	Oral	By word of mouth (1)	MFO274
Recipe 31:	VaLfDrOr	Decoction: leaf of *Vernonia amygdalina* Delile is boiled in water	Drink a glass twice a day	7	2.53	Oral	By word of mouth (5), Social media (2)	ROD006, NIC009, DIK017, SAB032, KOA047, ALI059, KAZ073
Recipe 32:	AsBuPcLfDrOr	Decoction: bulb of *Allium sativum* L. (Amaryllidaceae), leaf of *Petroselinum crispum* (Mill.) Nyman ex A.W. Hill (Apiaceae) are boiled in water	Drink a glass twice a day	7	2.53	Oral	By word of mouth (5), Social media (2)	SOU014, ATA019, SOP023, KAM030, JEA0038, TSO044, DAV054
Recipe 33:	MiLfPaLfPgLfCaFrDrOr	Decoction: leaf of *Mangifera indica* L. (Anacardiaceae), leaf of *Persea americana* Mill (Lauraceae), leaf of *Psidium guajava* L. (Myrtaceae), and fruit of *Citrus aurantiifolia* (Christm.) Swingle (Rutaceae) are boiled in water	Drink a glass twice a day	5	1.80	Oral	Herbal practitioner (1), By word of mouth (4)	EBA275, 000011, SKE037, FOG094, KEN140

Recipe 34:	CaFrZoRzHyRsDrOr	Decoction: fruit of *Citrus aurantiifolia* (Christm.) Swingle. (Rutaceae), honey, rock salt and rhizome of *Zingiber officinale* Roscoe (Zingiberaceae) are mixed and boiled in water	Drink a glass twice a day	3	1.08	Oral	By word of mouth (2), Social media (1)	WIL005, NAS224, AZI262
Others recipes								
Recipe 35:	SltDr	Boil water with salt	Drink a glass thrice a day	1	0.36	Oral	By word of mouth (1)	000267
Recipe 36:	MtmTop	Mentholatum (camphor and menthol)	Topical: Apply in the nose	13	4.70	Inhalation	By word of mouth (10), Social media(3)	MAJ049, GEN060, MAD061, KAP072, SAN076, SYL079, TEI089, MEF095, REH102, BRY103, 000110, 000111, BIS158
Recipe 37:	UrDr	Urine	Drink a glass twice a day	3	1.08	Oral	By word of mouth (3)	WAN013, 000028, CAL043
Recipe 38:	Blw	Boil water	Drink a glass twice a day	3	1.08	Oral	By word of mouth (1), Social media (2)	FLA200, GAN204, 000234
Recipe 39:	BPM	Basic protective measures only	As needed	42	15.16		By word of mouth (19), TV (2), Social media (21)	AUR039, BEN055, 000067, MAJ074, AND086, ABR090, MAY099, 000130, SOP139, GLA144, MAZ155, LUK163, NTO167, MAF177, NDO180,

	NEM183, EGO184, DAW188, 000194, NAR199, 000201, 000206, 000207, ABB211, NJA215, FOP219, AKW223, KIM226, NKU228, DAR230, 000233, WAV235, YAK237, SID239, ABD243, ANT246, BIS248, KOD251, SON255, OFA259, OEL266, 000268

*( )= The number in brackets indicates the number of informants who mentioned each source of knowledge

Picralima nitida is a medicinal plant used to treat symptoms associated with covid-19 infection such as fever and gastro-intestinal disorders (Erharuyi *et al.* 2014). Kariman, filled a patent in 2018 describing a formulation comprising of at least 5% of an extract of *Picralima nitida*. This formula was reported to reduce symptoms associated with an upper respiratory tract infection (common cold), a seasonal allergy reaction, or an acute respiratory illness (flu) of viral or bacterial origin, producing antitussive, expectorant, and bronchodilating effects in subjects (Kariman 2018). *Picralima nitida* displayed anti-measles virus activity (Oluremi &Adeniji 2015). *Psidium guajava* is one of the valuable of herbal medicine that showed anti-influenza virus activity through many mechanisms of action making this plant a promising source of novel inhibitor of the COVID-19 (Sukmawan &Suhendy 2020, Sriwilaijaroen *et al.* 2012). *Alstonia boonei* is one traditional medicinal plant, belonging to the Apocynaceae family. It has been use in ethnomedicine to treat sore throats, colds and cough (Ja *et al.* 2017) and is regarded as one of few herbs with potential anti-HIV indicators (Adotey *et al.* 2012).

Except for *Petroselinum crispum, Afzelia bipindensis, Anthocleista amplexicaulis, Artemisia vulgaris, Piper umbellatum, Dacryodes edulis,* and *Elaeis guineensis* for which we have no record of antiviral activity other reported species are deem of antiviral potency. Laboratory studies have previously reported the antiviral activity of extracts from many of these plants growing in Cameroon. *Allium cepa* also showed antiviral activity against (HSV1) (Romeilah, Fayed, Mahmoud 2010). Inhalation of volatile chemicals from onion for treatment of isolated patient of mild onset infected flu (Tan *et al.* 2020). *Mangifera indica* extract present anti-virus activity on influenza virus (Al-rawi, Dulaimi, Rawi 2019). *Aloe vera* inhibit the replication of a H1N1 subtype influenza virus (Sun *et al.* 2018, Gansukh *et al.* 2018), while *Ananas comosus* is known to inhibit on polio virus 1 replication (Konowalchuk &Speirs 1978) and to improve rate of irritative cough (Peixoto *et al.* 2016). *Carica papaya* is active against dengue virus (DENV) (Sharma *et al.* 2019). *Ageratum conyzoides* present antiviral activity against echoviruses (Ogbole *et al.* 2018). *Persea americana* showed strong inhibition on Aujeszky's disease virus, DENV-2 virus, acyclovir (ACG(r)4 and dlsp TK mutants) and PAA-resistant (PAA(r)5 mutant) on herpes simplex virus replication (Wu *et al.* 2019, Simoni *et al.* 1996, Miranda *et al.* 1997). *Hibiscus sabdariffa* exhibit antiviral activity against HSV-2 and human influenza A virus (Hassan, Švajdlenka, Berchová-Bímová 2017, Takeda *et al.* 2020). *Gossypium arboreum* showed antiviral activities against yellow fever virus (Fasola *et al.* 2011). *Moringa oleifera* present antiviral activity against HSV, Epstein-Barr virus, HIV/AIDS, and Foot and mouth disease virus (FMDV), a picornavirus (Biswas *et al.* 2020, Imran *et al.* 2016). *Syzygium aromaticum* displayed active against foodborne viruses, human norovirus (Aboubakr *et al.* 2016) and the Newcastle viral disease (Mehmood et al. 2020). *Eucalyptus globulus* is effective against H1N1 and HSV1 viruses (Brochot *et al.* 2017, Cermelli *et al.* 2008). *Cymbopogon citratus* showed antiviral activity against human mastadenovirus (Chiamenti *et al.* 2019), herpes simplex types 1 and 2 (Almeida *et al.* 2018), Newcastle disease virus *in* vivo (Abraham-Oyiguh *et al.* 2019), dengue virus (Rosmalena *et al.* 2019), and measles virus (Nurul *et al.* 2006). *Aframomum melegueta* showed activity against atypical fowl pox virus (Oladunmoye *et al.* 2020) and human respiratory syncytial virus (Chang *et al.* 2013). *Curcuma longa* is active against varieties of viruses including parainfluenza virus type 3 (PIV-3), dengue virus (DENV), feline infectious peritonitis virus (FIPV), vesicular stomatitis virus (VSV), herpes simplex virus (HSV), hepatitis C virus, HIV flock house virus (FHV), HIV, and respiratory syncytial virus (RSV) (Moghadamtousi *et al.* 2014, Praditya *et al.* 2019, Ichsyani *et al.* 2017). Overall, majority of cited species possess antiviral properties and demonstrate capacity to prevent viral replication and could serve as complementary therapy against Covid-19.

Limitations

The survey was undertaken in only two cities of Cameroon, and although an appropriate sample of people was used, our finding cannot be generalized the survey cities or the whole country nor for different demographic groups. The fewer female informants who agreed to take part to the survey might be linked to their unenthusiastic attitude. Henceforward, the survey design might be improved.

Conclusions

Overall, the diversity of medicinal plants used, and the associated indigenous knowledge is of great value to the local community. Unfortunately, no clinical evaluation has been carried out to ascertain their effectiveness in the prevention of covid-19. Therefore, their clinical application is pending reasonable scientific data on recipes and their standardization to support safety and efficacy in humans. This call for the government to substantially support interdisciplinary research in terms of funds and material resources in its COVID-19 priority research plan.

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Declarations

List of abbreviations: Not applicable.

Ethical approval and consent to participate: Ethics approval and consent to participate: This ethnobotanical survey was performed according to the current legislation and the status of the biodiversity rights of rural communities in Cameroon (Mahop 2004) and the provisions of the United Nations Framework Convention on Biodiversity, Brazil in 1992. All participants provided oral prior informed consent

Consent for publication: Not applicable.

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Authors' contributions: PVTF and RDYF **equally** participated in designing of the study; the collection of data and identification of plant samples, the analysis of the data and wrote the manuscript. All the authors approved the final version of the manuscript.

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FICHE D'ENQUETE/ *SURVEY FORM N⁰……*

THEME:

Médecine traditionnelle et croyance populaire face à la pandémie de Covid-19

Traditional medicine and popular beliefs in the face of the pandemic of covid-19

A. INFORMATIONS LEGALES/ *LEGAL INFORMATION*

•Localité /*Locality*:……

•Communauté (ethnie)/ Quartier/ village (*Community/Town/village*):……..……

•Nom de l'informateur (*Informant's name*): …….....Age:……

•Collecteur (*Investigator*):……..

•Interview N°…… ……

•Date de récolte (*Date of collection*):……..

B. QUESTIONNAIRE

1. Avez-vous entendu parler de Corona virus/*Have you heard of Corona virus*

2. Qu'est-ce que vous utilisez pour prévenir ou traiter Covid-19/What do you use to prevent or treat covid-19 :
……
……..

3. Comment avez-vous eu cette information ?/ how did you get this information
……
…
……
….

4. Comment utilisez-vous? *How do used?*
……
……
……
……

5. Quel est le mode d'administration ? *How do you administer?*
.....

a. Type de plante/ *Type of plant* (Tick to select)

O Arbre/*Tree;* O Arbuste/*Shrub;* O Herbacee/*Herb;* O Liane/*Liana;* O Plante aquatique/*Aquatic plant;* O Autres/*Other*

…..……..……..…
……..…

b. Nom(s) vernaculaire (s)/*Local name(s)* (*specify dialect/language*):……..

c. Nom(s) commun (s)/*Common name(s)*:…….

d. Nom scientifique/ *Scientific name* (genre/*genus*, espece/*species*, famille/*family*):
……

e. Partie utilisée/*Plant part used* (specify whether fresh or dried):……..

O Ecorce de tronc/*Stem bark;* O Tige/*Stem;* O Feuille/*Leaf;* O Racine/*Root;* O Ecorce de racine/*Root bark;* O Fleur/*Flower;* O Fruit; O Graine/*Seed;* O Plante entière/*Whole plant* small; O Autres/ *Others:*……
…….....

8. Organes collecté pour les essais au laboratoire/*Plant parts collected for laboratory screening*
……

9. Autres informations utiles/*Other useful notes*
……
……
……
……