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. Its death toll is higher than that of 2002 and 2003 SARS-
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.thepiantlist.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:

$$ICF = \frac{N_u - N_t}{N_u - 1}$$

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       |
| Code   | Name  | Gender | Age | Year | Type |
|--------|-------|--------|-----|------|------|
| 000206 | ND    | M      | 20  | 2000 | BAL  |
| 000207 | ND    | M      | 20  | 2000 | TE   |
| 000209 | ND    | M      | 20  | 2000 | BAK  |
| 000210 | ND    | M      | 20  | 2000 | TE   |
| 000233 | 65    | M      | 20  | 2000 | ND   |
| 000234 | 59    | M      | 20  | 2000 | BAK  |
| 000267 | 60    | M      | 20  | 2000 | TE   |
| 000268 | 38    | M      | 20  | 2000 | ND   |
| ABB211 | 50    | M      | 20  | 2000 | MTO  |
| ABD243 | 37    | M      | 20  | 2000 | FOU  |
| ABI174 | 38    | M      | 20  | 2000 | EWO  |
| ABR090 | 53    | M      | 20  | 2000 | BAK  |
| ADA244 | 30    | F      | 20  | 2000 | BAM  |
| AFA252 | 38    | M      | 20  | 2000 | BAO  |
| AGA242 | 49    | F      | 20  | 2000 | MAK  |
| AKO272 | 33    | M      | 20  | 2000 | BAF  |
| AKW223 | 66    | M      | 20  | 2000 | SAW  |
| ALB198 | 37    | M      | 20  | 2000 | TIK  |
| ALE185 | 46    | F      | 20  | 2000 | BOU  |
| ALU059 | 40    | M      | 20  | 2000 | SAW  |
| ALV189 | 33    | F      | 20  | 2000 | BAO  |
| AMO162 | 40    | M      | 20  | 2000 | MTO  |
| ANA097 | 35    | F      | 20  | 2000 | NGU  |
| AND086 | 33    | M      | 20  | 2000 | BOU  |
| AND115 | 50    | F      | 20  | 2000 | EWO  |
| ANG153 | 39    | F      | 20  | 2000 | BOU  |
| ANI066 | 47    | F      | 20  | 2000 | BAO  |
| ANT246 | 41    | M      | 20  | 2000 | BOU  |
| ARE263 | 37    | M      | 20  | 2000 | MFG  |
| ASS119 | 60    | F      | 20  | 2000 | BAF  |
| ATA019 | 50    | M      | 20  | 2000 | SAW  |
| ATS241 | 42    | F      | 20  | 2000 | BAO  |
| ATU164 | 44    | M      | 20  | 2000 | BOU  |
| AUD216 | 36    | F      | 20  | 2000 | SAW  |
| AUR039 | 52    | F      | 20  | 2000 | BAO  |
| AZI262 | 43    | M      | 20  | 2000 | FOU  |
| BAL178 | 49    | M      | 20  | 2000 | BAO  |
| BAR051 | 46    | M      | 20  | 2000 | BAO  |
| BED217 | 39    | M      | 20  | 2000 | ETO  |
| BEO182 | 46    | M      | 20  | 2000 | SAW  |
| BAK055 | 60    | F      | 20  | 2000 | FOU  |
| BER046 | 50    | F      | 20  | 2000 | SAW  |
| BIS158 | 30    | F      | 20  | 2000 | SAW  |
| BIS248 | 65    | F      | 20  | 2000 | EWO  |
| BLA253 | 34    | M      | 20  | 2000 | NGU  |
| BLE231 | 49    | M      | 20  | 2000 | SAW  |
| BOU133 | 36    | M      | 20  | 2000 | BAO  |
| BRY103 | 50    | M      | 20  | 2000 | EWO  |
| CAL043 | 44    | M      | 20  | 2000 | BAO  |
| CAM078 | 52    | M      | 20  | 2000 | BAO  |
| CHA083 | 43    | F      | 20  | 2000 | BAS  |
| CHE118 | 59    | M      | 20  | 2000 | BAO  |
| CLA015 | 65    | F      | 20  | 2000 | BAO  |
| DAR230 | 45    | M      | 20  | 2000 | SAW  |
| DAV054 | 50    | M      | 20  | 2000 | SAW  |
| DAW188 | 42    | M      | 20  | 2000 | FOU  |
| DEF225 | 34    | M      | 20  | 2000 | SAW  |
| DEL064 | 36    | F      | 20  | 2000 | BAO  |
| DUK017 | 65    | F      | 20  | 2000 | SAW  |
| DJI136 | 47    | M      | 20  | 2000 | FOU  |
| DOM137 | 40    | M      | 20  | 2000 | SAW  |
| DON069 | 30    | M      | 20  | 2000 | SAW  |
| DOU214 | 52    | M      | 20  | 2000 | EWO  |
| EBA275 | 50    | M      | 20  | 2000 | EWO  |
| Code  | Gender | Age | Sex | DO  | YD  |
|-------|--------|-----|-----|-----|-----|
| EBO024 | M      | 35  | EWO | FF  | YD  |
| EBO141 | M      | 43  | EWO | FF  | YD  |
| EGO184 | M      | 33  | BAK | TE  | DO  |
| EKE190 | M      | 62  | ETO | FF  | DO  |
| ESS269 | M      | 42  | BOU | TE  | YD  |
| ETI208 | M      | 63  | BAM | TE  | DO  |
| EVA197 | F      | 31  | BAG | TE  | DO  |
| FAD260 | F      | 41  | BAN | TE  | YD  |
| FAL170 | F      | 39  | BAM | TE  | DO  |
| FER041 | M      | 42  | BAM | FF  | YD  |
| FLA200 | F      | 40  | BAM | TE  | DO  |
| FOG094 | F      | 39  | BAM | TE  | YD  |
| FOK001 | M      | 40  | BAM | FF  | YD  |
| FOP219 | M      | 48  | BAM | TE  | DO  |
| FOU172 | M      | 65  | BAM | TE  | DO  |
| GAM105 | F      | 60  | BAM | TE  | YD  |
| GAN204 | M      | 57  | BAM | TE  | DO  |
| GAR236 | M      | 61  | BAO | TE  | DO  |
| GEN060 | F      | 50  | BAM | TE  | YD  |
| GIN002 | F      | 40  | BAM | TE  | YD  |
| GIS100 | F      | 32  | BAM | TE  | YD  |
| GLA144 | F      | 62  | BOU | FF  | DO  |
| GUE029 | M      | 35  | BAM | TE  | YD  |
| GUI128 | M      | 37  | BAM | TE  | YD  |
| HAI220 | M      | 41  | FOU | TE  | DO  |
| HAM277 | M      | 51  | BAM | TE  | YD  |
| HAN127 | F      | 38  | BAF | TE  | YD  |
| HER018 | F      | 44  | EWO | FF  | YD  |
| HIP221 | M      | 50  | EWO | FF  | YD  |
| HOL227 | M      | 40  | SAW | TE  | DO  |
| ISS265 | M      | 56  | FOU | TE  | YD  |
| ITS036 | F      | 38  | BAF | FF  | YD  |
| JEA008 | M      | 36  | BAM | FF  | YD  |
| JER250 | M      | 37  | TIK | TE  | YD  |
| JPI068 | M      | 45  | BAM | FF  | YD  |
| JUL082 | M      | 41  | EWO | TE  | YD  |
| KAN273 | F      | 60  | BAF | TE  | YD  |
| KAJ087 | M      | 48  | BAM | FF  | YD  |
| KAM030 | M      | 46  | BAM | FF  | YD  |
| KAM042 | M      | 47  | BAM | FF  | YD  |
| KAM081 | F      | 39  | BAM | TE  | YD  |
| KAP072 | F      | 30  | BAM | TE  | YD  |
| KAR169 | F      | 33  | BAM | TE  | DO  |
| KAZ073 | F      | 42  | YAB | TE  | YD  |
| KEN140 | F      | 40  | BAM | TE  | YD  |
| KHO212 | F      | 55  | BAO | TE  | DO  |
| KIF247 | ND     |    | BAL | TE  | YD  |
| KIM226 | M      | 35  | BAK | TE  | DO  |
| KOA047 | F      | 36  | BOU | FF  | YD  |
| KOA050 | F      | 46  | BOU | FF  | YD  |
| KOD173 | F      | 36  | FOU | TE  | DO  |
| KOD251 | F      | 31  | FOU | TE  | YD  |
| KOF092 | M      | 50  | BAM | TE  | YD  |
| KOU156 | F      | 60  | EWO | FF  | DO  |
| LAD106 | F      | 47  | YAB | TE  | YD  |
| LAN108 | M      | 41  | BAM | TE  | YD  |
| LAN238 | M      | 50  | BAM | TE  | DO  |
| LAP245 | M      | 35  | YAM | TE  | DO  |
| LAU062 | ND     |    | BAG | TE  | YD  |
| LAU098 | M      | 36  | BAM | TE  | YD  |
| LEO161 | M      | 70  | BAM | TE  | DO  |
| LIN091 | F      | 42  | TIK | TE  | YD  |
| LOR195 | M      | 33  | BAM | TE  | DO  |
| LUK163 | M      | 40  | BOU | FF  | DO  |
| Code   | Age | Gender | Name  | Status | Position |
|--------|-----|--------|-------|--------|----------|
| 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       |
| MFO095 | 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       |
| NEF183 | 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       |
| NKA228 | 66  | M      | MAK   | TE     | DO       |
| NNN145 | 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       |
| PAH032 | 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       |
| Name     | Age | Gender | Ethnicity | Method | Location |
|----------|-----|--------|-----------|--------|----------|
| RAO003   | 40  | M      | BAI       | FF     | YD       |
| RAY053   | 36  | M      | BAM       | FF     | YD       |
| REH102   | 49  | M      | FOU       | TE     | YD       |
| RH093    | 55  | M      | EWO       | FF     | YD       |
| RIC034   | 51  | M      | SAW       | TE     | YD       |
| RIF240   | 45  | M      | BAM       | TE     | YD       |
| RIO020   | 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       |
| SIM02    | 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     | YD       |
| TOU257   | 65  | M      | ETO       | FF     | YD       |
| TSA120   | 78  | M      | BAM       | TE     | YD       |
| TSO44    | 40  | M      | BAM       | FF     | YD       |
| TUE025   | 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       |
| YYA271   | 40  | M      | YAM       | TE     | YD       |
| ZEH168   | 36  | F      | BAS       | TE     | DO       |

**Total:** 277

| Range: 30-78 | 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 |

**Total ethnic groups:**

- 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

**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:** Yambassia; **BAS:** Bassa; **BAO:** Bamoun; **SAW:** Sawa; **BAN:** Banso; **BAK:** BAKOKO; **BOU:** Bulu; **YAB:** Yabassi; **ETO:** Eton; **FOU:** Foulbe; **BAG:** Bagueli; **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](image)

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), mentholatum (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 officinalis* 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

| Plant Species                  | Frequency |
|--------------------------------|-----------|
| Allium sativum                | 1         |
| Allium cepa                   | 1         |
| Persea americana              | 5         |
| Mangifera indica              | 5         |
| Petroselinum crispum          | 7         |
| Dacryodes edulis              | 1         |
| Gossypium arboreum            | 1         |
| Hibiscus sabdariffa           | 1         |
| Alstonia boonei               | 23        |
| Elaeis guineensis             | 2         |
| Piper umbellatum              | 2         |
| Ananas comosus                | 4         |
| Eucalyptus globulus           | 1         |
| Syzygium aromaticum           | 5         |
| Psidium guajava               | 6         |
| Aloe aageodonta               | 12        |
| Cymbopogon citratus           | 4         |
| Vernonia amygdalina           | 22        |
| Artemisia vulgaris            | 2         |
| Ageratum albidum              | 4         |
| Carica papaya                 | 5         |
| Moringa oleifera             | 5         |
| Curcuma longa                 | 3         |
| Aframomum melegueta           | 2         |
| Zingiber officinale           | 88        |
| Picralima nitida              | 59        |
| Citrus aurantifolia           | 109       |
| Allium cepa                   | 73        |
| Allium sativum                | 73        |

Figure 3. Plant parts used frequency

- Bulb: 14%
- Fruit: 14%
- Leaf: 14%
- Rhizome: 14%
- Bark: 14%
- Trunk: 14%
- Flower: 14%
- aerial part: 14%
| 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 embryos (Mohajer Shojaei et al. 2016). The antiviral activity on SARS coronavirus strain Frankfurt 1 (SARS-CoV FFM1) (Viggen et al. 2004). |
|                     | Allium cepa L. | Daniel Dang 435 25755/SRF/carn | 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 (Ali-rawi, Dalami, and Rawi 2019). |
| Apocynaceae         | Picralima nitida (Stapf) T. Durand & H. Durand | Mpom Benoit 149 1942/2/SRF J | Quinquelibia, Ebam (Ewondo) | Shrub | Fruit | 59 | Anti-measles virus activity (Oluremi and Adenji 2015) |
|                     | Alstonia boonei De Wild | Bayum H. 1 43368/HNC | ikouk (Ewondo) | Tree | Bark | 23 | Potential anti-HIV activity (Adotey et al. 2012). |
| Apatraceae          | Aloe vera (L.) Burm. f. | Daniel Dang 364 25987/SRF/carn | Aloes vera | Herb | Leaf | 12 | Inhibit the replication of a H1N1 subtype influenza virus (Sun et al. 2018, Gansuhi et al. 2016) |
| Bromeliaceae        | Ananas comosus (L.) Merr. | Daniel Dang 83 19648/SRF/carn | Pineapple | Herb | Fruit | 4 | Activity on polio virus 1 (Konowatchuk and Speirs 1978) Improvement rate of irritative coug (Peixoto et al. 2016) |
| Burseraceae         | Dacyrodes edulis (G. Don) H.J. Lam | Letouzey R. 9105 16255/SRF/carn | Bush pear tree | Safointer | Tree | 1 | No record |
| Caricaceae          | Carica papaya L. | Daniel Dang 92 19647/SRF/carn | Papaya | Tree | Bark | 5 | Active against dengue virus (DENV) (Sharma et al. 2018) |
| Compositae          | Ageratum conyzoides (L.) L. | Letouzey R. 6791 8013/SRF/carn | King of herbs | Herb | Leaf | 4 | Antiviral activity against echoviruses (Ogboile et al. 2018) |
|                     | Artemisia vulgaris L. | Coll. Inconnu (S.C.) 68501/HNC | Arthemia | Herb | Leaf | 2 | No record |
| Vernonia amygdalinella Delle | Mpom Benoit 18 1737/SRF K | Nòulel | Shrub | Leaf | 22 | Activity against atypical Fowl pox virus (Oladunmoye et al. 2020) |
| Gentianaceae        | Anthocephista amplexicaulis Baker | Kouflari 93 20738/HNC | Bopolopo (Sawa) | Tree | Bark | 1 | No record |
| Lauraceae           | Persea americana Mill | Daniel Dang 60 19604/SRF/carn | Avocado tree | Tree | Leaf | 5 | Inhibit DENV-2 replication (Wu et al. 2019) Strong inhibitory activity against Aujeszky’s disease virus (Simon 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 Bímová 2017) Antiviral Activities Against Human Influenza A Virus (Takeda et al. 2020) |
| Gossypium arboreum L. | Daniel Dang 96 18608/SRF/carn | Cotton | Shrub | Leaf | 1 | Antiviral activities against yellow fever virus (Fasola et al. 2011) |
| Family            | Species                                      | Author                  | Part       | Activity                                                                                       |
|-------------------|----------------------------------------------|-------------------------|------------|-----------------------------------------------------------------------------------------------|
| Moringaceae       | Moringa oleifera Lam.                        | Bonnoug E.d 116         | Tree Leaf  | Activity against HSV, Epstein-Barr virus, HIV/AIDS (Biswas et al. 2020, Imran et al. 2016)     |
|                   |                                              | 8573/SRF/cam            |            | Activity against Foot and mouth disease virus (FMDV), a picornavirus (Imran et al. 2016)       |
| Myrtaceae         | Psidium guajava L.                           | Mpom Benoit 312         | Tree Leaf  | Anti-influenza virus activity (Sriwilaijaroen et al. 2012)                                     |
|                   | Syzygium aromaticum (L.) Merr. & L.M. Perry | 1858/SRFK               | Clove      | 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        | Tree Leaf  | Effective against H1N1 and HSV1 viruses (Brochet et al. 2017, Cermelli et al. 2008)             |
| Myrtaceae         | Psidium guajava L.                           | Mpom Benoit 312         | Tree Leaf  | Anti-influenza virus activity (Sriwilaijaroen et al. 2012)                                     |
|                   | Syzygium aromaticum (L.) Merr. & L.M. Perry | 1858/SRFK               | Clove      | 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        | Tree Leaf  | Effective against H1N1 and HSV1 viruses (Brochet et al. 2017, Cermelli et al. 2008)             |
| Piperaceae        | Piper longum L.                              | Letouzey R. 1948        | Shrub Leaf | Activity against atypical Fowl pox virus (Oladunmoye et al. 2020) and human respiratory syncytial virus (Chang et al. 2013) |
| Poaceae           | Cymbopogon citratus (DC.) Stapf              | Daniel Dang 202         | Herb Aerial part | Antiviral activity against Human mastadenovirus (Chiamenti et al. 2019), Herpes simplex type 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 (MN et al. 2006) |
| Rutaceae          | Citrus aurantiifolia (Christm.) Swingle      | Bayum H. 1 65106/HNC    | Tree Fruit | Direct virucidal activity against the human immunodeficiency virus (HIV) (Fletcher et al. 2008, Lackman-Smith et al. 2010) |
| Zingiberaceae     | Zingiber officinale Roscoe                  | Survive 773 14757/SRF/cam | Ginger Shrub Rhizome  | Activity against Foodborne viruses, particularly human norovirus (Aboubakr et al. 2016) and A/ Puerto Rico/83 (H1N1) (PR8), vesicular stomatitis virus (VSV), and Newcastle disease virus (NDV) (Talactac et al. 2015) |
|                   | Aframomum melegueta K. Schum                | Westphal 9868 44829/HNC | Shrub Fruit | Activity against atypical Fowl pox virus (Oladunmoye et al. 2020) and human respiratory syncytial virus (Chang et al. 2013) |
| Curcuma longa L.  | Folius 2069 38292/HNC                       | Curcuma                  | Shrub Rhizome | 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, Ichiyani 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
- Other ingredients used: 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 by inhalation (02) and were taken twice a day except for garlic and mentholatum that was constantly chewed and applied or Citrus aurantiifolia 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 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 antiviral 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 used 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         | 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         | NNM145, MAN135, 000056, BEL021, RICO34, PIT040, TUE205, KHO212, MBE218, DEF225, TOS232 |
| **Recipe 4:** MoLiDrOr | 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  | 5                           | 1.80                                     | Oral                   | By word of mouth *(3)* | 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)* | FOK001, MAT065, JPI068, BAR051, PEN084, |
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)

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)

(Christm.) Swingle (Rutaceae) and rhizome *Zingiber officinale* Roscoe (Zingiberaceae) mixed together and boiled in water
| Recipe No. | Ingredients |
|------------|-------------|
| 9          | CaFrZoRzDrOr | Decoction: fruit of *Citrus aurantifolia* (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 |
| 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, POS046, MIN071, TOF077, TCH117 |
| 11         | CaFrCcApDrOr | Decoction: fruit of *Citrus aurantifolia* (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 |
| 12         | AvLfCaFrDrOr | Decoction: Leaf of *Aloe vera* (L.) Burm.f. (Asparagaceae) and fruit of *Citrus aurantifolia* (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 |
| 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 |
| 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 |
| 15         | PuLEgtrDrOr  | 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 |
| Recipe 16: | CaFrHyZoRzDrOr | Decoction: fruit of *Citrus aurantifolia* (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, LIO091, 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* (Stapl) 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 water | 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:          | EglLfDrOr    | 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:          | AcBuAsBuClOrRzZoRzDrOr | 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:          | CaFrCcApDeLpPgLfDrOr | Decoction: fruit of Citrus aurantiifolia (Christm.) Swingle (Rutaceae), leaf | Drink a glass twice a day | 1 | 0.36 | Inhalation | By word of mouth (1) | SAM004 |
| 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, NICO09, DIK017, SAB032, KAO047, ALIO99, 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: MiLpLaPgLfCaFrDrOr | Decoction: leaf of *Mangifera indica* L. (Anacardiaceae), leaf of *Persea americana* Mill (Lauraceae), leaf of *Psidium guajava* L. (Myrtaceae), and fruit of *Citrus aurantifolia* (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 | Inhalation | By word of mouth (19), TV (2), Social media (21) | AUR039, BEN055, 000067, MAJ074, AND086, ABR090, MAY099, 000130, SOP139, GLA144, MAZ155, LUK163, NTO167, TAM177, MAF177, NDO180 |
| Source | Code | Informants |
|--------|------|------------|
| NEM183 |     | 1          |
| EGO184 |     | 2          |
| DAW188 |     | 3          |
| 000194 |     | 4          |
| NAR199 |     | 5          |
| 000201 |     | 6          |
| 000206 |     | 7          |
| 000207 |     | 8          |
| ABB211 |     | 9          |
| NJA215 |     | 10         |
| FOP219 |     | 11         |
| AKW223 |     | 12         |
| KIM226 |     | 13         |
| NCU228 |     | 14         |
| DAR230 |     | 15         |
| 000233 |     | 16         |
| WAV235 |     | 17         |
| YAK237 |     | 18         |
| SID239 |     | 19         |
| ABD243 |     | 20         |
| ANT246 |     | 21         |
| BIS248 |     | 22         |
| KOD251 |     | 23         |
| SON255 |     | 24         |
| OFA259 |     | 25         |
| OEL266 |     | 26         |
| 000268 |     | 27         |

*(*)= 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 antimeasles virus activity (Oluwemiri &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, Sriwijaijaroen et al. 2019). *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 (Adotev et al. 2012).

Except for *Petroselinum crispum,* *Afzelia bipindensis,* *Anthocleista amplexicaulis,* *Artemisia vulgaris,* *Piper umbellatum,* *Dacryodes edulis,* and *Elaeis guineensis* 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 (Konovalchuk &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 (Ogboke et al. 2018). *Persea americana* showed strong inhibition on Aujeszky’s disease virus, DENV-2 virus, acyclovir (ACG(r)/4 and disp 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-Bílmová 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 unenthousiastic 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.
Conflict of interests: The authors declare that they have no conflict of interests.
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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 N°…………………………

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): ……………………………………………………………………………………………
•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 Herbe/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
……………………………………………………………………………………………………………………………………
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