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Traditional herbal remedies for managing COVID-19 major symptoms: A case study of Kole district, Northern Uganda

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Abstract

Background: Today, the world is battling COVID-19 which has claimed millions of lives within a short period. As biotechnological research is in progress, it's expedient to explore alternative sources of medication. Exploring plants that have been used in the management of COVID-19 related symptoms for ages may unveil a potential treatment option for this pestilence. We, therefore, conducted a study in Kole district, Northern Uganda to document the plants that are used in the management of the four key COVID-19 related symptoms including flue, cough, sore throat, and difficulty in breathing. **Materials and Methods:** We employed a cross-sectional quantitative survey design. We used stratified sampling to select 50 participants from each of the five sub-counties in the district, and convenience sampling to select a total of 250 participants and administered interviewer-administered questionnaires. **Results:** We identified over 50 herbs that are used in the treatment of COVID-19 related symptoms. However, we were able to report on the fourteen most common ones that belonged to 12 families in this paper. *Clematis hirsute* Perr. & Guill, (68.0%) and *Citrus limon burm.* F. (30.8%); *Eucalyptus grandis* M., (49.2%) and *Zingibar officinalis*, (28.0%); *Conyza floribunda* H.B.K. (26.4%) and *Allium sativum* A. (23.6%); *Capparis tomentosa* Lam. (19.4%) and *Acacia hockii De Wild*, (17.4%): for the treatment of flu, cough, sore throat and breathing difficulties respectively. Different plant parts of the diverse plant species were used in treating the symptoms. For *Clematis hirsute* Perr. & Guill, all plant parts were used differently to treat each of the 4 symptoms. **Conclusion:** Kole district possesses a multitude of herbs with the potential of treating COVID-19 symptoms. There is a need for further pharmacological investigations to validate their activity and possible development for clinical use in the management of COVID-19.

Keywords: Herbal remedies, COVID-19, major symptoms, Uganda

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Authors' contributions:

NR: concept, methods, data collection, analysis, and the first draft of the manuscript
MKA: methods, data collection, analysis, and manuscript review
AK: data collection and manuscript review. All authors read and approved the final manuscript

***Competing interests*:**

The authors declare no conflicts of interest.

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Background

Today, the world is battling COVID-19 which has claimed thousands of lives in just a short period with over 175 million confirmed cases [1-7]. As biotechnological research is in progress [8], it's expedient to explore alternatives. Moreover, viruses have a quite high mutation rate [9,10] requiring continuous viral structure surveillance and update of vaccines and/or drugs. It's therefore logical to consider approaches that tackle symptoms and boost the immune system. Although the mechanisms of action of most herbs remain a mystery, they are believed to act by boosting the body's immunity among others [11,12]. Coupled with this, viral diseases are handled by the immune system and are thus self-limiting at large [13,14]. Hence, immune-boosting is a great deal.

Before the ascent of conventional medicines, humans explored nature to find solutions to ill-health with undeniable success. For example, the Chinese were using the Cinchona bark for treating malaria out of which the antimalarial drug quinine was discovered [15]. Traditional knowledge of plant uses avail a benchmark for the pharmaceutical industry to advance the plants materials into products [16,17]. Regrettably, there is poor certification of the traditional therapeutic uses of plants since it is often secretly verbally passed on from one generation to another with a high risk of loss [18,19].

Several low-cost and well-tolerated herbal remedies for flu, sore throat, and cough have been documented [20]. In 2013, Raal discovered that people were in the habit of treating minor conditions like flu using herbs [21]. In 2011, Kal documented some botanicals used in the treatment of colds and flu including Thyme leaf (Thymus vulgaris) which expels phlegm and relieves congestion [22] and is usually incorporated in cough syrups; Honeysuckle (Lonicera japonica) cools fever by stimulating perspiration and clearing infection and is taken orally for cold and other upper respiratory tract infections, influenza, swine flu, pneumonia, encephalitis, fever, inflammation, viral and bacterial infections [22]; and Andrographis (Andrographis paniculata)-which has antiviral and immune-stimulatory effects.

A study conducted in South Africa revealed the antiviral activity of some plants [23]. Further, a study by Tabuti in Nakapiripirit, Uganda unveiled some herbal approaches to the treatment of flu-like symptoms [24] whereas a survey conducted in Luwero district, Uganda, revealed a variety of medicinal plants in the management of flu such as Mormodica feotida, Lantana camara and Erigeron floribundus Sch. Bip [25]. The methods of administration traditionally include chewing raw leaves, steaming, and stewing [26]. In 2016, Mousa documented many herbal remedies for the treatment of influenza-like symptoms [26].

COVID-19 presents with flu, sore throat, and cough complicating difficulty in breathing and death [27]. As indicated above, many herbal remedies have been recognized in the prevention of influenza-like symptoms [28]. Several herbals have been suggested for the treatment of COVID-19 in different countries. Clinical trials to compare the effectiveness of combined herbal and western medicine vs. western medicine alone revealed an increase in the effectiveness of the combinational approach [29,30]. The integrated treatment using traditional Chinese and western medicine was noted to reduce the conversion rate of severe COVID-19 cases, as well as improving the clinical cure rate [31]. In a related study, Lianhua Qingwen (a Chinese herbal remedy) combined with Western medicine had a higher therapeutic efficacy for COVID-19 patients and could significantly cure the main symptoms, mostly fever [32]. Herbal remedies have proven potential to control infectious diseases and in China, the National Health Commission has already approved the use of herbal medicines in combination with Western medicine for the treatment of COVID-19 [33]. Exploring plants in COVID-19 management in different settings may, therefore, unveil a potential treatment option for this pestilence. However, Uganda as a nation is yet to take a stand on the subject. In this study, we conducted a rapid survey of the medicinal plants used in the management of COVID-19 related symptoms by the community of Kole district, Northern Uganda. We also documented the modalities of use of these plants.

Materials and methods

Site and setting

We conducted the study in Kole district, Lango sub-region, Northern Uganda. The district is divided into five sub-counties (see map Figure 1). Participants were selected from each sub-county. The residents of the district are largely subsistence farmers of beans, maize, soya beans, cowpeas, and cassava.

Design

We employed a cross-sectional quantitative ethnobotanical survey design.

Sampling and selection

The study employed a total sample size of 250 adult participants. We disproportionately divided the participants into the five sub-counties also referred to as strata [34]. Each stratum (sub-county) had 50 participants. Thereafter, convenient sampling technique was used to select the study participants who were adult household members of the Kole district to enable the generalization of the findings. In this study, only considered adults of 18 years and

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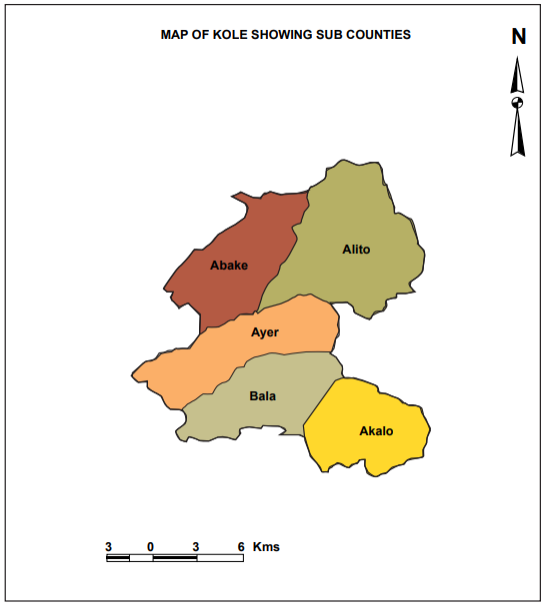

Figure 1 Map of Kole District showing the sub-counties

http://www.ucc.co.ug/files/downloads/KOLE.pdf/30/01/2021

above, who had have lived in Kole district for the last six months were included while metally disabled and ill persons were excluded.

Study procedure

In each of the sub-county, we interviewed the 50 participants using a semi-structured interviewer-administered questionnaire. Before administering the questionnaires, we first explained the study aims to the participants, after which we obtained their consent to participate. The questionnaire was designed to collect: participant bio-data as well as traditional medicines used to treat flu, cough, sore throat, and breathing difficulty in the region. The participants reported about the plant used for each of the symptoms, and how they used it (plant name and part, preparation and administration). We thoroughly checked the questionnaires for completeness at the end of each day.

Data management and analysis

We entered the collected data into SPSS V.20 software and later performed descriptive analysis for frequencies and percentages. We presented the findings in form of figures and tables. In addition, we determined the informant consensus factor (ICF) and fidelity level (FL) for five of the plants with high frequencies of mention for each symptom. The calculated ICF enabled us to describe the effectiveness for each symptom [35,36]. We used the formula: ICF= (n-nt)/(n-1), where n is the number of individual reports of a plant used for a particular illness while nt is the total number of species used by all informants for this illness. Furthermore, the fidelity level FL was also calculated as follows: FL=(Ip/Iu) × 100%, where: Ip is the number of informants who submitted the use of a species for the same major use (therapeutic) and Iu is the total number of informants who mentioned the plant species for any other use [36].

Ethics

The study was conducted following international ethical codes of conduct. The study aims and procedures were thoroughly explained to the participants and they were requested to participate without coercion. They signed a consent form as an indication of free will participation.

Results

Participant Bio-data

Almost half of the participants (47.2%) were adults of 56 years and above. 62% were females, most (98.4%) of whom were of the Langi ethnic group, while half 47.2% were Roman Catholics and a significant proportion (38.4%) were Anglicans. In addition, (53.2%) had attained a primary level of education, with most of them (92.8%) being farmers (**Table 1**).

Traditional Plants used to treat COVID-19 related symptoms

Traditional plants used in the treatment of Flu Clematis hirsute Perr. & Guill (68.0%), was the most mentioned plant for treating flue, followed by Citrus limon burm.f., (30.8%) (**Table 2**).

Traditional plants used in the treatment of cough

Analysis of the reports indicated Eucalyptus grandis M. (49.2%), as the most used plant in treating cough. This was followed by Zingibar officinalis, (28.0%) (**Table 3**).

Table 1 Bio-data of participants (n=250)

Age range	Frequency	Percent
18-35years	34	13.6
36-45years	57	22.8
46-55years	41	16.4
56 and above	118	47.2
Gender		
Female	155	62.0
Male	95	38.0
Tribe		
Lango	246	98.4
Acholi	4	1.6
Religious affiliation		
Anglican	96	38.4
Roman Catholic	118	47.2
Moslem	2	8
Pentecostal	24	9.6
Others	10	4.0
Education level		
Informal	74	29.6
Primary	133	53.2
Secondary	28	11.2
Tertiary	15	6.0
Source of income		
Farming	232	92.8
Business	8	3.2
Formal employment	10	4.0

Traditional plants used to treat sore throat

Generally, sore throat received the least number of responses compared to other symptoms. About one-quarter of respondents mentioned Conyza floribunda H.B.K. (26.4%) and Allium sativum A. (23.6%), as being medicinal in treating sore throat (**Table 4**).

Traditional plants used to treat difficulty in breathing

Breathing difficulty was commonly treated using Capparis tomentosa Lam., (19.4%), followed by Acacia hockii De Wild, (17.4%) (**Table 5**).

Plants' parts used, mode of preparation and administration

Different parts of the different plant species were used for the different symptoms. For flu, the flowers of *Clematis hirsuta Perr. & Guill* was crushed between the palms and sniffed while the fruits of *Citrus limon burm.f.*, were either chewed raw while swallowing the juice or crushed, boiled, and drunk. For cough, mostly leaves were used especially for *Eucalyptus grandis M.* which could either be chewed raw (a handful) or boiled and the decoction drunk. The leaves of *Conyza floribunda H.B.K* were crushed fresh and juice swallowed used for sore throat. For breathing difficulty, the roots of *Capparis tomentosa Lam* were chewed raw and the liquid swallowed whereas the roots of *Acacia hockii De Wild* and crushed (pounded), sundried, burnt, and the smoke inhaled.

Informant Consensus Factor (ICF) and Fidelity level (FL)

The highest ICF values determined were 0.82 (*Clematis hirsute Perr. & Guill)*, 0.42 (*Eucalyptus grandis M.*), 0.29 (*Conyza floribunda H.B.K*) for flu, cough, and sore throat respectively. However, the ICF values were less than zero for plants used to treat breathing difficulties. On the other hand, the highest FL values were 533 (*Securidaca longipendiculata Fres.*), 878 (*Eucalyptus grandis M.*), 440 (*Conyza*

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floribunda H.B.K.), and 600 (*Capparis tomentosa Lam*); for Flu, cough, sore throat, and breathing difficulties respectively (Table 6).

Table 2 Plants for treating flu

Local, Scientific, & Family name	counts	percent	Plant part
Adwe, *Clematis hirsuta Perr. & Guill*, Ranunculaceae	170	68.0	F-121, L-48, R-01
Limun, *Citrus limon burm.f.*, Rutaceae	77	30.8	Fr-58, L-5, R01
Ilila, *Securidaca longipendiculata Fres*, Polygaceae	32	12.8	R-27, L-5
Ogudu, *Asparagus africanus*, Liliaceae	22	8.8	L-15, S-07
Tangawizi, *Zingibar officinalis*, Zingiberaceae	20	8.0	R-20

Key: L-Leaves; R-Roots, Fr-Fruits; Fl-Flowers; S-Seeds, St- Stem; B-Bark; Bu-Bulb.

Table 3 Plants used in the treatment of cough

Local, Scientific & Family name	counts	percent	Part used
Kaltuc, *Eucalyptus grandis M.*, Myrtaceae	123	49.2%	L-123
Tangawizi, *Zingibar officinalis*, Zingiberaceae	70	28.0%	R-65, L-05
Limon, Citrus *limon burm.f.*, Rutaceae	50	20.0%	Fr-42, L-08
Okutu, *Acacia hockii De Wild*, Mimosaceae	49	19.6%	L-38, R-10, B-01
Adwe, Clematis hirsuta Perr. &Guill, Ranunculaceae	31	12.4%	L-01, R-28, St-02

Key: L-Leaves; R-Roots, Fr-Fruits; Fl-Flowers; S-Seeds, St- Stem; B-Bark; Bu-Bulb.

Table 4 Plants used in the treatment of sore throat

Local, Scientific & Family name	Freq	percent	Part used
Adiltong, *Conyza floribunda H.B.K.*, Asteraceae	66	26.4%	L-54, R-12
Tungulucumu, *Allium sativum A.*, Alliaceae	59	23.6%	Bu-59
Adwe, *Clematis hirsuta Perr. &Guill*, Ranunculaceae	30	12.0%	L-5, R-25
Limon, *Citrus limon burm.f.*, Rutaceae	30	12.0%	L-03, Fr-27
Aleovera, *Aloe volkensii Engl.*, Asphodeloideae	29	11.6%	L-29

Key: L-Leaves; R-Roots, Fr-Fruits; Fl-Flowers; S-Seeds, St- Stem; B-Bark; Bu-Bulb.

Table 5 Plants used in the treatment of breathing difficulties

Local, Scientific & Family name	counts	percent	Part used
Ogodman, *Capparis tomentosa Lam.*, Capparaceae	30	19.4	R-29, L-01
Okutu, *Acacia hockii De Wild*, Mimosaceae	27	17.4	L-3, R-24
Ocukulac, *Indigofera garkeana*, Fabaceae	26	16.8	R-26
Adwe, *Clematis hirsuta Perr. &Guill*, Ranunculaceae	21	13.5	L-08, R-12, Fl-01
Kaltuc, *Eucalyptus grandis M.*, Myrtaceae	14	09.0	L-13, R-01

Key: L-Leaves; R-Roots, Fr-Fruits; Fl-Flowers; S-Seeds, St- Stem; B-Bark; Bu-Bulb.

Table 6 ICF and FL of the 5 most frequently mentioned plants for each symptom

Local, Scientific, & Family name	counts	ICF	FL
Flu (nt=31)			
Adwe, *Clematis hirsute Perr. & Guill*, Ranunculaceae	170	0.82	204.82
Limun, *Citrus limon burm.f.*, Rutaceae	77	0.61	81.91
Ilila, *Securidaca longipendiculata Fres*, Polygaceae	32	0.03	533.33
Ogudu, *Asparagus africanus*, Liliaceae	22	-0.43	169.23
Tangawizi, *Zingibar officinalis*, Zingiberaceae	20	-0.58	22.47
Cough (nt=72)			
Kaltuc, *Eucalyptus grandis M.,* Myrtaceae	123	0.42	878.57
Tangawizi, *Zingibar officinalis*, Zingiberaceae	70	-0.03	179.49
Limon, Citrus *limon burm.f.,* Rutaceae	50	-0.45	48.08
Okutu, *Acacia hockii De Wild*, Mimosaceae	49	-0.48	163.33
Adwe, *Clematis hirsuta Perr. &Guill*, Ranunculaceae	31	-1.37	14.16
Sore throat (nt=47)			
Adiltong, *Conyza floribunda H.B.K.,* Asteraceae	66	0.29	440
Tungulucumu, *Allium sativum A.,* Alliaceae	59	0.21	*No other use
Adwe, *Clematis hirsuta Perr. &Guill*, Ranunculaceae	30	-0.59	25
Limon, *Citrus limon burm.f.*, Rutaceae	30	-0.59	21.28
Aloe vera, *Aloe volkensii Engl.,* Asphodeloideae	29	-0.64	76.32
Breathing difficulty (nt=43)			
Ogodman, *Capparis tomentosa Lam.,* Capparaceae	30	-0.45	600
Okutu, *Acacia hockii De Wild*, Mimosaceae	27	-0.62	51.92
Ocukulac, *Indigofera garkeana*, Fabaceae	26	-0.68	325
Adwe, *Clematis hirsuta Perr. &Guill*, Ranunculaceae	21	-1.1	9.13
Kaltuc, *Eucalyptus grandis M.*, Myrtaceae	14	-2.2	11.38

Discussion

Based on the current study findings regarding the management of COVID-19 related symptoms in Kole district, Northern Uganda: Clematis hirsute Perr. & Guill and Citrus limon burm. f were the major herbs used in the treatment of Flu. Clematis hirsuta Perr. & Guill was also found to be used for flu in Kabale district, [37] and Ngai, Uganda [38]. The plant also has anti-inflammatory effects [37] which could be responsible for the anti-flu actions and treatment of breathing difficulty since inflammatory processes contribute to the pathogenesis. This result mirrors the findings of a meta-analysis that reported that traditional herbal medicine reduced the infection rate [39]. The use of Clematis hirsute Perr&Guill, in the management of cough and sore throat is justified by its antibacterial effects [40] supported by the findings of Namukobe et al in Kabale [37]. However, these findings contradict some of the previous studies which indicated that Clematis hirsute Perr. & Guill is used to treat rheumatoid arthritis, sexually transmitted infection, bone disorders, and chronic skin diseases [41] as well as Trachoma, Elephantiasis, wounds, and Hemorrhoids in Ethiopia [42]. Citrus limon burm.f., was used in the current study for the treatment of flu in agreement with the findings of Papp et al [43] but contrasted with the findings of Tugume et al where the plant was used to treat bad breath [44]. Since the use of Citrus limon burm. f. to treat bad breath suggests that the plant has antibacterial properties, this supports its use currently to treat sore throat. In addition, the plant was also previously found to treat high blood pressure, scurvy, irregular menstruation, sore throat, and rheumatism [45-47]. Previous studies indicated that Zingiber officinalis is an immune stimulant used to treat flue and cold and has expectorant and anti-inflammatory properties [48,49]. These properties of

Zingibar officinalis [48,49] support its current use for cough and flu treatment. However, other previous records indicate that the plant is used against nausea and vomiting of different causes such as drug or pregnancy-induced as well as an anticancer, antidiabetic, and antimicrobial [50,51]. Securidaca longipendiculata Fres, and Asparagus africanus, have anti-inflammatory activity [52,53] which too supports the findings of the current study. Securidaca longipendiculata Fres was also found in previous studies to treat fungal infections, sexual importance, and epilepsy contrary to the present findings [54]. Eucalyptus grandis M. is well known for treating cough and has antibacterial activity [55,56], hence supporting the current use for cough and breathing difficulty. Previous studies indicated Acacia hockii De Wild, to be used to treat athletes' foot disease and tuberculosis in Uganda [37,49,57]. In Benin, the plant is used to treat malaria and abscesses [58]. However, in the current study, it was used to treat cough. In the present study, Conyza floribunda H.B.K., was found to be used in the treatment of sore throat but other studies showed it to be used for epilepsy and HIV/AIDS symptoms in Ngai, (Uganda) and in Tanzania [38,59]. Allium sativum A., has anti-inflammatory, antioxidant and wound healing properties [60] coupled to broad-spectrum antimicrobial activity [61]. These reports support its current use for treating sore throat. Aloe volkensii Engl., was found by Paul and John in Sangobay to treat fever, mouth ulcers and malaria [62]. Its use for mouth ulcers agrees with its current use in the treatment of sore throat. In the current study, Capparis tomentosa Lam., was used for breathing difficulty in correspondence to its use for pneumonia and chest pain reported by Sibhatu and Krishina [63]. The antispasmodic properties of Indigofera garckeana [64] justify its use for breathing difficulty in the present study.

The highest ICF values determined were 0.82 (Clematis hirsute Perr. & Guill), 0.42 (Eucalyptus grandis M.), 0.29 (Conyza floribunda H.B.K) for flu, cough, and sore throat respectively. However, the ICF values were less than zero for plants used to treat breathing difficulties. The ICF values were determined by the number of species used for a particular symptom. The higher the number, the lower the value. This value (ICF is used to determine the effectiveness of a plant species in the treatment of a disease signified by the number of individual reports of a particular plant species. If there are so many alternative species for a particular ailment, its ICF value is lowered. This is evident in the section for cough, sore throat, and breathing difficulties. The high ICF value for Clematis hirsute Perr. & Guill is supported by the findings of previous studies in Ngai (Northern Uganda) and Kabale (western Uganda). On the other hand, the highest FL values were 533 (Securidaca longipendiculata Fres.), 878 (Eucalyptus grandis M.), 440 (Conyza floribunda H.B.K.), and 600 (Capparis tomentosa Lam); for Flu, cough, sore throat, and breathing difficulties respectively. If a plant species has several other medicinal uses, its FL value lowers and vice versa. The values are quite high due to the limited medicinal uses of these species. It's an indication of the high importance attached to these species by the community for the conditions managed.

Conclusion

Kole district possesses a multitude of herbs with the potential of treating COVID-19 symptoms. There is a need for further pharmacological investigations to validate their activity and possible development for clinical use in the management of COVID-19.

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