The Use of Medicinal Plant to Prevent COVID-19 in Nepal

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Research

Keywords: Corona, COVID-19, Knowledge, Medicinal Plants, Pandemic, People, Prevent

Posted Date: October 9th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-88908/v1

Version of Record: A version of this preprint was published at Journal of Ethnobiology and Ethnomedicine on April 8th, 2021. See the published version at https://doi.org/10.1186/s13002-021-00449-w.

Abstract

Background:

Medicinal plants are the fundamental unit of traditional medicine system in Nepal. Nepalese people are rich in traditional medicine especially in folk medicine (ethnomedicine) and this system is gaining much attention after 1995. The use of medicinal plants have increased during COVID-19 pandemic as a private behavior (not under the control of government). Lot of misinterpretations of the use of medicinal plants to treat or prevent COVID-19 have been spreading throughout Nepal which need to be managed proactively. In this context, a research was needed to document medicinal plants used, their priority of use in society, cultivation status and source of information people follow to use them. This study aimed to document the present status of medicinal plant use and make important suggestion to the concern authorities.

Methods:

This study used a web-based survey to collect primary data related to medicinal plants used during COVID-19. A total of 774 respondents took part in the survey. The study calculated the relative frequencies of citation (RFC) for the recorded medicinal plants. The relationship between plants recorded and different covariates (age, gender education, occupation, living place, and treatment methods were assessed using Kruskal Wallis test and Wilcox test. The relationship between the information sources people follow and respondent characteristics, were assessed using chi-square test.

Results:

The study found that the use of medicinal plants has increased during COVID-19 and most of the respondents recommended medicinal plants to prevent COVID-19. This study recorded a total of 63 plants belonging to 42 families. The leaves of the plants were the most frequently used. The *Zingiber officinale* was the most cited species with the frequency of citation 0.398. Most of the people (45.61%), were getting medicinal plants from their home garden. The medicinal plants recorded were significantly associated with the education level, location of home, primary treatment mode, gender, and age class. The information source of plants was significantly associated with the education, gender, method of treatment, occupation, living with family, and location of home during lockdown caused by COVID-19.

Conclusions:

People were using more medicinal plants during COVID-19 claiming that they can prevent or cure COVID-19. This should be taken seriously by concerned authorities. The authorities should test the validity of these medicinal plants and control the flow of false information spread through research and awareness programs.

Background

The new Corona Virus diseases (COVID-19) pandemic has caused global socioeconomic disturbances with a worrisome number of deaths and health issues,the world has been struggling to find medicine to treat and prevent COVID-19 [1]. A number of combinations and trials have been done, but so far, they have not produced promising results [2–4]. The different types of misinformation related to COVID-19 have been spreading throughout the world through social media [5], including use of medicinal plant products to prevent or cure COVID-19. Due to this situation, ethnobiologists should collaborate with local people and document the medicinal plants used with caution to stop the inaccurate sharing of information [6].

There is a strong inter-relationship between people and plants according to needs [7–10]. People are dependent on plants for different purposes such as for food, medicine, and houses [11–13]. Plant species have always been a fundamental source for the discovery of drugs [14]. People had used medicinal plants to fight against pandemics in the past [15–17], and dependency of people on medicinal plants might have increased in these days around the world as medicinal plants can be an alternative option to prevent COVID-19 [18].

Different researchers have suggested herbal medicine as a potential option to cure or prevent COVID-19 [19, 20]. Countries like China and India are integrating their use with western medicine to boost the immunity power of COVID-19 patients [21, 22]. In China, traditional medicine showed encouraging results in improving symptom management and reducing the deterioration, mortality, and recurrence rates [23]. On the other hand, World Health Organization (WHO) (2020) claims medicinal plants might be good for health and supporting the immune system, but in not preventing or curing COVID-19. The WHO Africa (2020) claims unscientific products to treat COVID-19 can be unsafe for people, they may abandon self-hygienic practices, may increase self-medication and may be a risk to patient safety.

Lifestyle, diet, age, sex, medicinal conditions, and environmental factors have been playing an important role in the personal fate towards the severity of COVID-19 [24]. The source of information, such as social media, plays an important role to combat pandemics [25, 26]. People receive information regarding COVID-19 and other diseases from different sources including social media, local people, national health authorities, WHO, and is based on respondent characteristics such as age and gender [27] as well as occupation, state of their living and primary mode of diseases treatment method.

Nepal is rich in plant diversity, it hosts species of 5309 flowering plants, 41 gymnosperms, 1001 algae, 2182 fungi, 850 lichens, 1213 bryophytes, 550 pteridophytes [28–33]. Among them, 1614 species have been recognized as aromatic and medicinal plants [34].

In Nepal, the medicinal plants are often used in the traditional medicine system, which including Scholarly medical system (The Ayurveda, Homeopathy, the Unani, and the Tibetan medicine), Folk medicine (ethnomedicine, community medicine, household medicine and any other forms of local medicines) and Shamanistic (Dhami-jhankri, Jharphuke, Pundit-Lama-Pujari-Gubhaju and Jyotish). Among them, folk medicine system is using more medicinal plants in Nepal [35]. The first scientific research published in ethnobotany is dated back to 1955 [36]. More than 80% of the people in Nepal have been using medicinal plants in Nepal [37]. Medicinal plants are the primary source of healthcare for the people in Nepal and integral part of their culture [38, 39]. Most of the people in Nepal have been using medicinal plants as the alternative to allopathic or western medicine [40].

It has also been playing an important role in increasing the economic level of people [41] as Nepal exports medicinal plants to different countries in the world [42]. The elder people living in rural areas have more knowledge of traditional medicine [43].

In Nepal, COVID-19 cases are increasing daily but the health care system is fragile and has a lack of infrastructure [44]. In this context, the home remedies, like use of medicinal plants supported by the relevant authorities, can serve as an alternative option to combat COVID-19. The Nepal government has also valued medicinal plants as an immunity power booster used with prescriptions [45]. But, there a considerable amount of false information spread in Nepal regarding the use of medicinal plants and people are randomly using plants which can go against the traditional methodology and make it difficult to combat COVID-19. The present study has attempted to reveal the status of medicinal plant use in Nepal during COVID-19. Specifically, this study is aimed to address the following objectives in Nepal: (1) document the status and source of medicinal plants used to prevent COVID-19; (2) know the relationship between number of plants reported and covariates and (3) know the relationship between information sources respondent follow and respondent characteristics.

Methods

Methods of Data Collection

A set of questionnaire forms were prepared by google form developer. The google form was initially tested to validate and understand the response rate from respondents. The google form was circulated through social media (such as Facebook), emails in different groups, and social circles asking to circulate the survey form as much as possible. A total of 774 people participated in the survey from different parts of Nepal and provided information about the different variables (Table 1) used for the study.

Data Analysis

Demography (age, sex, and education) of all the respondents were tabulated. The Status of medicinal plants use during COVID-19 (increase, decrease, same and never used) and recommendation of medicinal plants (strong, moderate, low, and never) were calculated and shown in the bar graph using Microsoft Excel 2013.

The medicinal plants recorded were tabulated in the table with respective scientific, local, and English names with their family and parts (root, stem, leaves, rhizome, roots) used. The scientific names from local name identification followed Singh et. al (1979), and the family assignation in this paper followed the TROPICOS [46]. For all the species frequency of citation (FC) and relative frequency of citation (RFC) were calculated following Tardio and Pardo-de-Santayana (2008) [47].

$$RFC = \frac{FC}{N}$$

Where,

FC = Number of respondents who mentioned the use of species

N= Total number of respondents took part in a survey

The results of the RFC and the top 10 medicinal plants used are presented in the radar diagram using Microsoft Excel 2013.

The Shapiro test, Kruskal Wallis test, Wilcox test, chi-square test and related diagrams were drawn using R [48]. The Shapiro test was performed to test the normality of the data. As the data of plant number was not normally distributed, the Kruskal Wallis test was performed to test the relationship between several plants with an occupation, education level, primary treatment mode and age class. The Wilcox test was performed to see the differences in plants reported number with gender and place of living during COVID-19 pandemic.

The relationship between information sources with respondent characteristics was shown in the graph and statistically analyzed using the chi-square test.

Results

Demographics of the respondents

A total of 774 respondents participated in the survey, of whom 407 (52.58%) were from the urban area, and 367 (47.42%) were from the rural area. The age of the respondent varied from 16 to 76 years. Among them, 65.51% were in below 30 years age, all of the respondents were literate and most of them (69.5%) had attended University. There were more male respondents (60.85%) than female (Table 2).

Table 2: Demographic of Profile of Respondent

Demographic parameter	Description	Total respondents	Frequency (%)
Age	>20	31	4.01
	20-29	476	61.5
	30-39	121	15.63
	40-49	64	8.27
	50-59	50	6.46
	60-69	23	2.98
	70-79	9	1.16
Sex	Male	471	60.85
	Female	303	39.15
Education	Primary	36	4.65
	Secondary	200	25.84
	University	538	69.5

Status of Medicinal Plant Use

Out of 774 respondents, 323 (42%) respondents agreed that the use of the medicinal plant has increased during COVID-19, whereas 313 (40.44%) agreed the use of medicinal plants during COVID-19 is the same as that of normal condition (Figure 1).

Most of the respondents 349 (45.09%) believed that information/knowledge of medicinal plants has increased during COVID-19, 333 (43.02%) believed it is the same as usual, and 93 (11.89%) considered that they are confused about the use of medicinal plants (Figure 2).

A total of 670 (86.5%) of the respondents had recommended medicinal plants to prevent COVID-19, whereas 104 (13.4%) had not recommended. Most of them had made a moderate recommendation (Figure 3)

Medicinal Plants Recorded

A total of 63 species of medicinal plants from 42 families and 57 genera were documented as being used. Among them, the most common families were Zingiberaceae, Lamiaceae, and Apiaceae. The habit analysis showed that the medicinal plants belonging to herb, shrub, climber, and tree species were 66.67%, 7.94%, 3.17%, and 22.22% respectively (Table 3). Leaves (39.68%) were the most predominantly used parts, followed by seeds (22.22%), fruits (20.63%), roots (12.69%), rhizomes (11.11%), whole plant (7.9%), bark (6.3%) stem (0.16%) and bulb (0.16%) (Figure 4). The most commonly used method of preparations were grind the parts and boil with hot water or milk and drink.

Relative Frequency of Citation

The relative frequencies of citations ranged from 0.001 to 0.398 and for ten most cited species value ranged from 0.03 to 0.398. The most cited species was *Zingiber officinale* (308 times cited and frequency of citation was 0.398) followed by *Curcuma caesia* (264 times cited and frequency of citation was 0.341) (Figure 5).

Source and Cultivating Conditions of Medicinal Plants

The respondents had mentioned that they were getting medicinal plants from the home gardens (45.61%), markets (32.03%), jungles (10.73%), and remaining respondents were getting medicinal plants from all of the above three sources from the home market and Jungle. Most of the respondents (47%) reported that they are cultivating more medicinal plants during COVID-19 than before, and few respondents have reported just starting to plant (3%) (Figure 6).

Number of Plant Reported and Covariates

The reported plant number used by individual respondents ranged from 0 to 12 (Figure 7). In the occupational category, people who were engaged in agriculture and those with jobs used comparatively more medicinal plants than others, but the difference was not significant (Kruskal-Wallis, χ^2= 7.921, df = 5, p = 0.1606). The people with University level education were using more plant species compared to people with secondary level and primary level education, and the differences were statistically significant (Kruskal-Wallis, χ^2 = 50.736, df = 2, p = $9.612e^{-12}$). The people living in the city were using more plants than people living in the village, which was statistically significant (W = 85818, p = 0.0002427). The people whose primary method of treatment was Allopathic were using a statistically significant low number of plants (Kruskal-Wallis, χ^2 = 32.524, df = 3, p = $4.057e^{-07}$) compared to the respondents whose primary method of treatments were Ayurvedic and homeopathic. The female respondents were using more plants than males, the difference in the use of plants by males and females was statistically significant (W = 77489, p = 0.03864). Age group of 20-29 and below (<20) reported more number of species being used. The number of medicinal plant species reported was statistically significantly different among the age groups (Kruskal-Wallis, χ^2 = 25.484, df = 6, p = 0.0002777).

Information Sources

People are using different sources to prevent COVID-19, such as social media like Facebook twitter, official information of the World Health Organization, National health authorities, and local communities. The information adopted from social media is risky but in significant proportion, more than 25% of secondary education respondents and female respondents are using social media information, and there was a statistically significant relationship between information source and Gender (χ^2 = 8.0304, p = 0.04598). The relationship between information source and education was statistically significant (χ^2 = 34.714, p = 0.0004998). The jobless people were following the local community for obtaining information (more than 50%), and the relationship between the source of information and occupation was marginally significant (χ^2 = 23.863, p = 0.06997). The people living with their families were depending more on local communities and social media for plant use information (more than 50% and 25% respectively), and the relationship between the source of information and living with the family was statistically significant (χ^2 = 7.9621, p = 0.04448). The people who using Ayurvedic as the primary treatment were mainly following information provided by the communities (more than 50%), and there was a statistically significant association between the information source and the primary treatment method (χ^2 = 17.406, p = 0.009495). The people living in the city and village during the lockdown of COVID-19 both followed similar sources of information, and there is no significant association between source of information and people living in lockdown (χ^2 = 4.6375, p = 0.2054).

Discussion

Status and Sources of Medicinal Plant

Medicinal plants have attracted the attention of several stakeholders around the world [49]. They have chemical diversity and can play a significant role in new drug development [50]. In this study, the majority of respondents in Nepal reported that the use of medicinal plants has increased during COVID-19, they also believed that information about the medicinal plants has increased, and most of them recommend medicinal plants to prevent COVID-19. Researchers such as Rastogi et al. (2020) and Vellingiri et al. (2020) have claimed that the medicinal plant based treatment should be beneficial to treat and prevent COVID-19 [20, 51]. Yang et al. (2020) reported that plant species traditionally used as food can help to enhance the immune system of the body and help to prevent the manifestation of COVID-19 [52]. In the past, the medicinal plants were combined with western medicine to treat a similar disease, severe acute respiratory syndrome (SARS) [53].

There is no effective medicine available so far for the treatment of COVID-19, medicinal plants are being used globally that might have increased the demand for medicinal plants [54]. Some plants are useful to treat viral disease, but COVID-19 is a new disease, and the effectiveness of the medicinal plants to cure it has not been tested yet. Therefore, the excessive use of medicinal plants, however, could be problematic and is a matter of concern. Easy access to social media which often publish unreliable advertisements might have a role to play in the increasing use of medicinal plants. Moreover, local availability of, medicinal plants, and an incorrect belief that medicinal plants have no side effects among the people might also be responsible for the same. All the stakeholders including the ethnobotanist, community leaders and other stakeholders to come together to educate people about the proper use of medicinal plants.

Medicinal plants recorded and Frequency of Citation

Most of the species reported in this study are locally available, home garden species and used for daily food at home. The leaves were the most used parts of the plants corroborating the findings of other related studies in Asia [55, 56]. The use of leaves is mainly due to the presence of active secondary metabolites [57]. Underground parts roots and rhizomes, that are rich in bioactive constituents [58, 59]. However, indiscriminate

use of underground parts might lead to conservation threats particularly to the wild species [60]. Similarly, the use of bark in an excessive amount and the whole plant use, particularly implied for her [61], might create problems in conservation.

The citation of species might have been influenced from the social media along with the cultural, religious and community leaders within Nepal and neighbouring India. For instance, the famous Hindu Swami Ramdev of India has suggested that *Tinospora cordifolia* boiled in water *Curcuma caesia,Zanthoxylum piperitum* powder and *Ocimum tenuiflorum* leaves can prevent COVID-19 (written in India TV News of 14 March 2020).The most cited species in this study are also the most commonly used species in Nepal, such as *Z.ingiber officinale*, *C. caesia*, and *Allium sativum*.These species are planted in almost every household of rural Nepal and these species are also listed by Nepal Ministry of Health & Population Department of Ayurveda & Alternative Medicine, Teku, Kathmandu, as an alternative medicine to boost immunity power of people [62]. The plants like *Curcuma caesia*, *Cuminum cyminum*, *A.llium sativum*, *Terminalia bellirica*, *Z. officinale*, *O. tenuiflorum*, *Cinnamomum verum*, *Piper nigrum*, *Vitis vinifera* and *Citrus spp.* were also recommended by the Indian Government to boost immunity power but doesn not claim that can cure or treat COVID-19 [63].

The medicinal plants reported in the study have different chemical compounds and constituents that have been proved in treating different diseases and ailments. *T bellirica,Cinnamomum verum*, *Piper nigrum*, dry *Z. officinale* and raisin contain phytonutrients chlorophyll, vitamins, minerals eugenol and a bioactive compound, *Z. officinale* contains sesquiterpenes [64].

Chemical constituents 8-Gingerol, 10-Gingerol from *Z. officinale* were active against COVID-19 [65]. COVID-19 patients might have cytokine storm [66, 67] and *Curcumacaesia* has capacity to block cytokine release [68]. *Allium sativum contain* sulphoxide, proteins and polyphenols like bioactive sulphur containing compound which are antiviral with immunostimulatory potential [69, 70]. *Tinospora cordifolia* has alkaloids, glycosides, lactones and steroids with immunomodulatory roles and can treat fever, chronic diarrhea asthuma [71, 72]. Citrus species contain polysaccharides and polyphenolic compounds which improve immunity of body [73]. *Ocimum tenuiflorum* extraxt contains Tulsinol (A, B, C, D, E, F, G) and dihydrodieuginol that possess immunomodulatory and Angiotensin-converting enzyme 2 (ACE II) blocking properties to inhibit replication of Corona Virus [74]. *Phyllanthus emblica* has antioxidative and anti-inflammatory and its extract Phyllaemblicin G7 has potential to treat COVID-19 [75]. *Azardirachta indica* extracts *Nimbolin A,* Nimocin and Cycloartanols (24-Methylenecycloartanol and 24-Methylenecycloartan-3-one) have shown potential to inhibit COVID-19 [76]. *Mentha arvensis* posses eugenol, terpenes, and flavonoids which are good antioxidants and modulators of xenobiotic enzymeshelp to inhibit COVID-19 [77]. *Cinnamom unverum* contains compounds like eugenol, cinnamic acid, caryophyllene which are antioxidant and antiviral which might help to inbhit COVID-19 [78].

The species with a lower frequency of citation are also useful in some way; *Camellia sinensis* has immunomodulatory properties due to the presence of epigallocatechin gallate, quercetin and gallic acid in its leaves [79]. E*uphorbia thymifolia* has antioxidant and antiviral activities [80]. Functional food such as *Allium cepa*, *Nigella sativa*, *Carica papayas* and other species are functional food they possess immunomodulatory properties in several way and help in effective health management if taken in an adequate manner [52]. However, there is no proper reearch and scientific evidence supporting that medicinal plants can prevent or cure COVID-19. The use of medicinal plants is traditional and has a long history with its own theory, like traditional Chinese medicines whose composition is typical and complicated. A creative evaluation system should be developed before its used to prevent or treat COVID-19 [81]. Some researchers have suggested natural products obtained from plants might be an alternative option to treat COVID-19 [82, 83].

But at present, the use of different, unproven medicine, as well as herbal medicine has been the only way to protect vulnerable patients and such medicines should not be overlooked, or taken without the prescription from health personnel [52]. The effectiveness of above-mentioned medicinal plants should be tested scientifically then added to the discovery of drugs used to treat COVID-19.

Source and Growing Conditions of Medicinal Plants

Most of the respondents obtained medicinal plants from home gardens or farms. It is interesting to find that people are cultivating more medicinal plants during COVID-19, which is a positive sign for the development of gardening or farming practices in the country. This type of activity will support the sustainable conservation of medicinal plants. However, collecting medicinal plants from the jungle will cause several issues in the conservation of plants [84]. Different types of actions can be taken to conserve and sustainable use of such species, including assessing the conditions of plant use and presence as well as policy formation [85]. Some people have also just started to plant medicinal plants which is a good sign for the sustainable livelihood in Nepal.

Number of Plants Reported and Covariates

The use of medicinal plants depends on several covariates, such as occupation, education level, age, class, living condition, and treatment methods that people usually follow. The sociocultural acceptance of people vary within different places and communities [86]. People living in villages most live with their families in Nepal, and studies have found that the use of medicinal plants usually comes from families [87]. During COVID-19, well-educated people used more medicinal plants in Nepal, contrary to the results of other studies, which found that well-educated people often rely on modern medicine for treatment [88]. Females reported more medicinal plants than males, similar to other studies [89], probably because women are more involved in household work, invest more time in the kitchen and caring for their family in food and health, as

well as in farm work such as cutting grasses and collecting fodder. People adopting agriculture reported a higher number of medicinal plants, which may be because they have easier access to medicinal plants. In Nepal, people with agricultural occupations and living in rural areas used more traditional methods to stay healthy [90]. The job holders also reported comparatively more number of plants.

Interestingly the youths (age groups below 30) have reported using more medicinal plants, probably because they lived with their families and learned more about the medicinal plants from the elders. This group is also the most active group on social media. Most respondents also claimed that they were more aware of the medicinal plants during COVID-19, which is a good sign as the research by Tiwari et al. (2020) has mentioned that young people are forgetting the use of medicinal plants. However, the misunderstanding of medicinal plants is also dangerous, and the stakeholders need to think about and provide accurate information to the young people [91]. Young people should follow a reliable source to obtain information about medicinal plants. People who primarily use Ayurvedic and homeopathy remedies reported more number of medicinal plants. The use of plants and the acquisition of knowledge usually depends on the culture and primary health care system [92].

Information Sources and Respondent Characteristics

The source of information is the key to using medicinal plants, and it is not good to follow the social website and rely on it, as the usefulness and accuracy of messages regarded COVID-19 provided from social media such as youtube have not been tested [93]. However, in this study, a large number of respondents were found to be engaged in social media to obtain information regarding COVID-19. Most of the people were not relying on WHO and National Health authorities, similar to the study of Bhagavathula et al. (2020) [94]. The most well-educated people, female, job holders, people living with families, people who are following allopathy as a primary treatment, and people who live in the village are all following social media to obtain knowledge of prevention methods, and using medicinal plant-based on the source which might be incorrect and thus harmful. This is because the frequent use of social media and the practices of using several sources of social media has caused an overload and increased people's concerns [95].

This study recommends the use of official websites of WHO and national health authorities to gain information regarding COVID-19. Most people also rely on the communities for the use of medicinal plants which might cause traditional malfunction. Therefore, it is unwise to adopt unscientific sources of information and use medicinal plants privately. The correct use of medicinal plants passes from generation to generation, which is usually applicable to old diseases. No valid medicine has been developed to prevent or cure COVID-19 so far. The COVID-19 pandemic has created a large crisis, and it needs large scale behavior changes [96]. For instance, we need to change our behavior and follow the valid information to use the different preventive measures to be free from COVID-19. The collaboration between diverse stakeholders such as government, volunteers, people, and other sectors is deemed necessary to transmit information and respond to crisis through improving information flow [97]. Different studies on herbal remedies are deemed necessary which would be helpful to prepare an antiviral drug against COVID-19 as well as to help prevent going against traditional methodology related to the use of medicinal plants [98]. There is an urgent need to dissiminate high level of public awareness to prevent misinformation regarding treatment and prevention mesures of COVID-19 [99].

Conclusion

This study found that medicinal plants used and beliefs related to them, have increased during COVID-19. A total of 63 medicinal plant species used to prevent COVID-19 were investigated and recorded. The frequently used plants in the home were recorded more in comparison to other plants. The plants cultivation status have increased during COVID-19. The medicinal plants were associated with social and demographic variables. Likewise, the source of medicinal plants also varied with the demographic social factors of the respondents. This study recommends undertaking studies of medicinal plants used during COVID-19. The validity and reliability of such medicinal plants should be tested further by phytochemical and pharmacological research and invalid information should be monitored and controlled in different social media platforms and communties. It is recommended that people follow information from authentic sources related to COVID-19 pandemic.

Declarations

Acknowledgments

We are highly indebted to all respondents who took part in the survey. We are also thankful to Heather Whitefield for editing English of our manuscript.

Authors' contributions

DK, MKD, PRM, SS, FFL and DFC designed the study. DK, MKD, PRM, SB MST, PCA and AB conducted data collection. DK and PCA analyzed the data. DK, MKD, SS, DFC, MST, SB, AB and PRM confirmed the plants. DK and SS wrote the manuscript. MKD, PCA, FFL, SB and DFC review the manuscript. All authors read and approved the final manuscript.

Funding

This work was supported by the National Traditional Chinese Medicine Resources Survey of the State Administration of Traditional Chinese Medicine (GZYKJS-2018-004).

Availability of data and materials

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1: Description of the variables used in this study

SN	Variable	Type	Symbol	Categories	Remarks/ Details
1	Plant Number	Numeric	Plants	NA	Number of plant species used
2	Education	Ordinal	Education	Primary, Secondary, University	Formal education of respondents
3	Occupation	Nominal	Occupation	Agriculture, Business, Job, Jobless, Wage earner, Remittance	The main source of livelihood of the respondents
4	Age	Ordinal	Age	>20 20-29 30-39 40-49 50-59 60-69 70-79	Age of the respondents
5.	Gender	Nominal	Sex	Male (M) Female (F)	Gender of the respondents
6.	Primary treatment mode	Nominal	Primary treatment mode	Allopathy, Ayurvedic, Homeopathy	Mode treatment normally people follow
7	Source of Information	Nominal	Source of Information	WHO, National Health Authorities, Social Media, Local Community	Source of information people follow to use medicinal plant
8	Medicinal Plant Use	Ordinal	Medicinal Plant Use Status	Increase, Decrease, same Never used	The medicinal plants use status during COVID-19 compare to before COVID-19
9	Recommendation of Medicinal	Ordinal	Recommendation	Strong, Moderate, Low, Never	Respondents recommendations level were recorded
10	Living Conditions during Lockdown	Nominal	Living Conditions	Urban, Rural	The place of living during lockdown was recorded
11	Living with Family	Nominal	Living with Family	Yes No	The respondents living with family or not is recorded
12	Plant Growing Conditions	Ordinal	Medicinal Plant Growing Condition	Less, Same, More, Started, Never	Plants growing conditions during COVID-19 pandemic
13	Knowledge about medicinal Plant	Ordinal	Knowledge of Medicinal Plant	Increase, Decrease, Same, Confuse	The respondents Knowledge level on the use of medicinal plant
14	Habit Analysis	Nominal	Habit	Herb, Shrub, Climber,	Types of plant mentioned by the respondents

						Tree

Table 3: Medicinal plants recorded with scientific name, habit, parts used, mode of use, frequency of citations (FC), and relative frequency of citation (RFC).

S.N	Family	Scientific name	English Name	Local Name	Habit	Parts Used	Mode of Use	FC	RFC %
1	Acanthaceae	*Adhatoda vasica* Nees	Adhato davasica	Asuro	Shrub	Leaves	Raw, powder	11	1.4
2	Acanthaceae	*Barleria prionitos* L.	Barleria	Vajrad0anti	Herb	Root, Leaves and seed	Boil with water	1	0.1
3	Acoraceae	*Acorus calamus* L.	Sweet Flag	Bojho	Herb	Rhizome	Raw	17	2.2
4	Amaranthaceae	*Oxalis corniculata* L.	Yellow wood sorrel	Chariamilo	Herb	Leaves	Raw	1	0.1
5	Amaryllidaceae	*Allium cepa* L.	Onion	Pyaaj	Herb	Rhizome	Raw, boil with water	20	2.6
6	Amaryllidaceae	*Allium sativum* L.	Garlic	Lasun	Herb	Bulb	Dried, boil with water	217	0.28
7	Amaryllidaceae	*Allium hypsistum* Stearn	Jimboo	Jimmu	Herb	Leaves	Powder	1	0.1
8	Amaryllidaceae	*Crinum latifolium* L.	Milk and wine lily	Sudarsana	Herb	Root, Leaves	Dry powder	3	0. 4
9	Apiaceae	*Centella asiatica* (L.) Urb.	Asiatic Pennywort	Ghortapre	Herb	Rhizome	Raw	3	0. 4
10	Apiaceae	*Coriandrum sativum* L.	Coriander	Dhaniya	Herb	Seed, Leaves	Boil with water, powder	7	0. 9
11	Apiaceae	*Cuminum cyminum* L.	Cumin seed	Jeera	Herb	Seed	Raw	13	1.7
12	Apiaceae	*Foeniculum vulgare* L.	Aniseed	Sauf	Herb	Root, seed	Raw, boil with water, powder	3	0. 4
13	Apiaceae	*Trachyspermum ammi* (L.) Sprague	Carom seed	Aawjain	Herb	Seed	Dry powder	5	0. 6
14	Asphodelaceae	*Aloe vera* (L.) Burm. f.	Aloevera	Ghiukumari	Herb	Whole plant	Raw paste with water	15	1.9
15	Asteraceae	*Artemisia vulgaris* L.	Common Mugwort	Titepati	Herb	Leaves	Powder	1	0.1
16	Cannabaceae	*Cannabis* L.	Marijuana	Ganja	Herb	Leaves	Raw, powder, boil with water	5	0. 6
17	Caricaceae.	*Carica papaya* L.	Papaya	Mewa	Shrub	Fruit	Powder drink with water or milk, dry, boil with water	1	0.1
18	Combretaceaea	*Terminalia bellirica* (Gaertn.) Roxb.	Holy basil	Barro	Tree	Fruit	powder	5	0.6
19	Combretaceae.	*Terminalia chebula* Retz.	Black Myrobalan	Harro	Tree	Fruit, Bark	Powder, boilwith water	18	2.3
20	Euphorbiaceae	*Euphorbia thymifolia* L.	Asthma Plant	Dudhijhar	Herb	Leaves	Dried, soaked	1	0.1
21	Fabaceae	*Butea monosperma* Kuntze	Flame of the forest	Laharo	Tree	Leaves	Dried powder	1	0.1
22	Fabaceae	*Glycyrrhiza glabra* L.	Licorice	Mulethi	Herb	Root, Rhizome	Raw paste	1	0.1

23	Fabaceae	*Trigonella foenum-graecum* L.	Fenugreek leaf	Methi	Herb	Seed, Leaves	Raw, fresh, paste	6	0.8
24	Gentianaceae	*Swertia chirayita* H. Karst.	Chireeta	Chiraito	Herb	Whole plant	Raw, paste, powder, boil with water	2	0.3
25	Grossulariaceae	*Ribesuva-crispa*	Indian Gooseerry	Daakh	Herb	Leaves	Dried, boil with water	1	0.1
26	Lamiaceae	*Mentha arvensis* L.	Mint	Pudina	Herb	Whole plant	Powder, boil with waterl, paste	36	4.4
27	Lamiaceae	*Ocimum basilicum* L.	Mint	Babari	Herb	Seed	Dried, boil powder with water or milk,	2	0.3
28	Lamiaceae	*Ocimum tenuiflorum* L.	Tulsi	Tulsi	Herb	Leaves, Seed	Dried, boil with water or milk	142	18.3
29	Lamiaceae	*Thymus vulgaris* L.	Thyme seed	Jwano	Herb	Flower, Leaves	Raw, paste	12	1.6
30	Lamiaceae	*Mentha x piperita* L.	Peppermint	Pudina	Herb	Leaves	Raw, juice	1	0.1
31	Lamiaceae	*Salvia Rosmarinus* Spenn.	Rosemary	Dauni	Herb	Flower	Boil, paste	2	0.3
32	Lauraceae	*Cinnamomum verum* J. Presl	Cinnamon	Dalchini	Tree	Bark	Boil with water, powder	23	3
33	Lauraceae	*Laurus nobilis* L.	Bay leaf	Tejpatta	Tree	Leaves	Paste, raw	1	0.1
34	Marantaceae	Maranta dichotoma (Roxb.) Wall.	Cool mat	shitalpati	Herb	Leaves	Dried, raw	4	0.5
35	Melanthiaceae	*Paris polyphylla* Sm.	Love apple	Satuwa	Herb	Rhizome	powder, paste	1	0.1
36	Meliaceae	*Azadirachta indica* A. Juss.	Azadirachtaindica	Neem	Tree	Leaves, Bark	Boil with water, dried	73	9.4
37	Menispermaceae	*Tinospora cordifolia* (Willd.) Miers	Gulanchatinospara	Gurjo	Herb	Stem	Boil with water or milk	74	9.6
38	Moraceae	*Ficus religiosa* L.	Pipal	Pipal		Leaves	Raw	2	0.3
39	Myristicaceae	*Myristica fragrans* Houtt.	Fragrant nutmeg	Jifal	Herb	Seed	Raw	2	0.3
40	Myrtaceae	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	Clove	Lwang	Tree	Flower	Raw, paste	12	1.6
41	Myrtaceae	*Syzygium cumini* (L.) Skeels	Java Plum	Jamun	Tree	Fruit, Leaves	Raw	2	0.3
42	Myrtaceae	*Psidium guajava* L.	Gauva	Amba	Tree	Leaves	Powder boil with water or milk	3	0.4
43	Oleaceae	*Nyctanthes arbor-tristis* L.	Jasmine	Parijaat	Tree	Leaves	Paste	4	0.5
44	Orchidaceae	*Dactylorhiza hatagirea* (D. Don) Soó	Marsh orchid	Panchaule	Herb	Tuber, root	Powder, paste	2	0.3
45	Oxalidaceae	*Averrhoa*	Star fruit		Tree	Fruit	Powder, boil	1	0.1

		carambola L.					with water or milk		
46	Pedaliaceae	*Sesamum indicum* L.	Seasame	Sesame seeds	Herb	Seed	Raw, juice	1	0.1
47	Piperaceae	*Piper nigrum* L.	Black pepper	Marich	Climber	Fruit	Boil with water	15	1.9
48	Phyllanthaceae	*Phyllanthus emblica* L.	Amala	Amala	Tree	Fruit	Paste, soaked	23	3
49	Plantaginaceae	*Bacopa monnieri* (L.) Wettst.	Thyme leaved graticula	Brahmi	Climber	Whole plant	Raw, paste, dried, soaked	1	0.1
50	Poaceae	*Cymbopogon* Spreng.	Citron grass	Lemon grass	Herb	Whole plant	Raw	4	0.5
51	Ranunculaceae	*Nigella sativa* L.	Black cumin	Kalojira	Herb	Seed	Raw	2	0.3
52	Ranunculaceae	*Delphinium denudatum* Wall. ex Hook. f. & Thomson	Jadwar	Nirmasi	Herb	Root	Dried,boil with water	1	0.1
53	Rosaceae	*Rosa* sp.	Rose	Gulab	Shrub	Petals	Raw, dried	2	0.3
54	Rutaceae	*Aegle marmelos* (L.) Corrêa	Stone apple	Bel	Tree	Leaves,Bark, Root, Fruit, Seed	Boil with water	1	0.1
55	Rutaceae	*Citrus x limon* (L.) Osbeck	Lemon	Kagati	Tree	Fruit	Raw, juice, boil with water	116	15
56	Rutaceae	*Zanthoxylum piperitum* DC.	Red pepper	Timur	Shrub	Fruit	Raw	13	1.7
57	Solanaceae	*Withania somnifera* (L.) Dunal	Winter cherry	Ashwagandha	Herb	Root, Seed, Leaves	Boil with waterl, powder, paste	1	0.1
58	Solanaceae	*Capsicum frutescens* L.	Green chilly	Khursani	Herbs	Fruit	Dried, boil with water	2	0.3
59	Theaceae	*Camellia sinensis* (L.) Kuntze	Green tea	Chiya	Shrub	Leaves	Paste, raw	2	0.3
60	Zingiberaceae	*Curcuma caesia* Roxb.	Turmeric	Besaar	Herb	Rhizome	Boil with water or milk, raw, powder taken with water or milk	264	34.1
61	Zingiberaceae	*Amomum subulatum* Roxb.	Black Cardamom	Alaichi	Herb	Fruits	Boil with water or milk, powder boil with water or milk	4	0.5
62	Zingiberaceae	*Elettaria cardamomum* (L.) Maton	Green cardamom	Sukhmel	Herbs	Seed	Boil with water, powdertaken with water or milk	1	0.1
63	Zingiberaceae	*Zingiber officinale* Roscoe	Ginger	Ginger	Herb	Rhizome	Boil with water, paste, powder	308	39.8

Figures

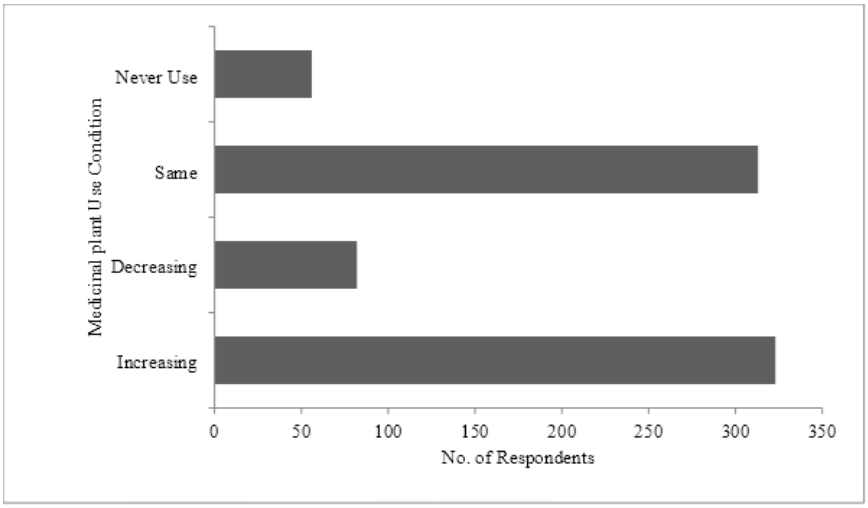

Figure 1

Trend of medicinal plant use during COVID-19

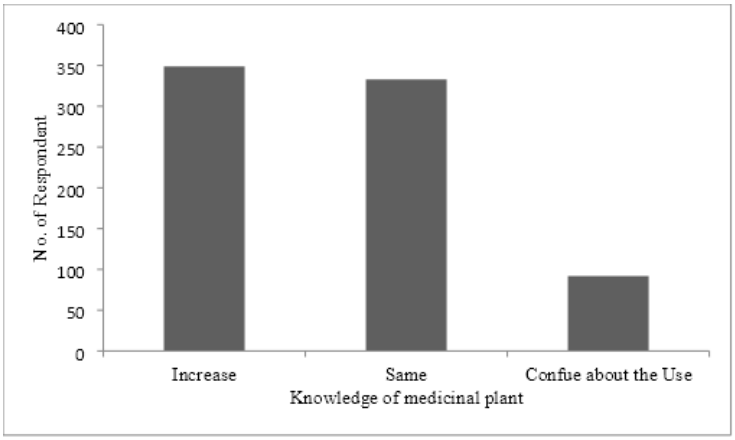

Figure 2

The perception knowledge level conditions of people on the use of medicinal plants.

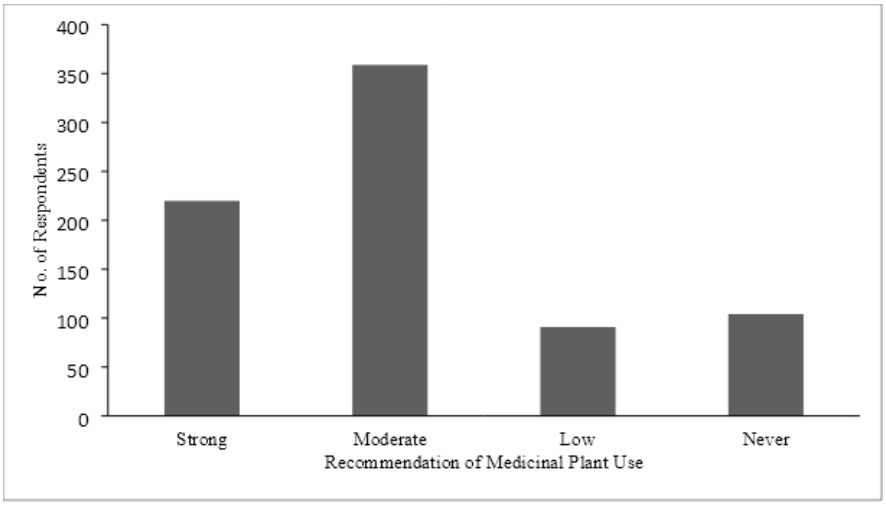

Figure 3

Recommendation of a medicinal plant to prevent and cure COVID-19

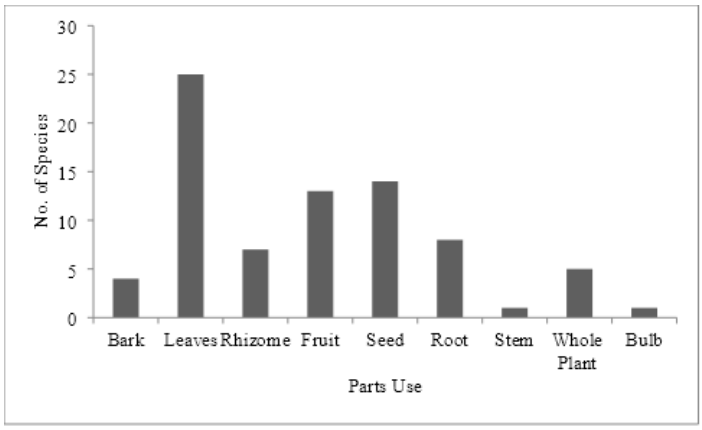

Figure 4

Parts of plants used for medicinal purpose to prevent COVID-19

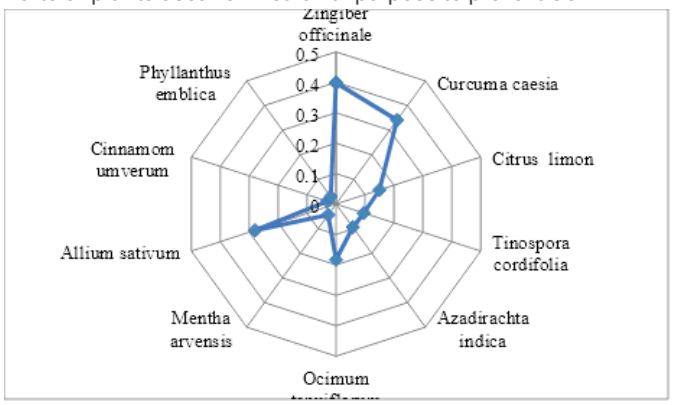

Figure 5

List of top ten ranked plant species reported by respondents shown the frequency of citation

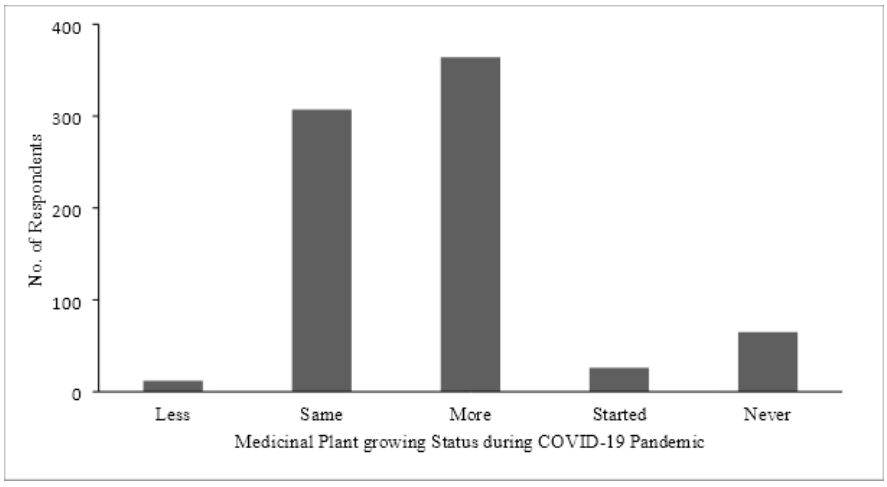

Figure 6

The medicinal plant cultivation status during COVID-19.

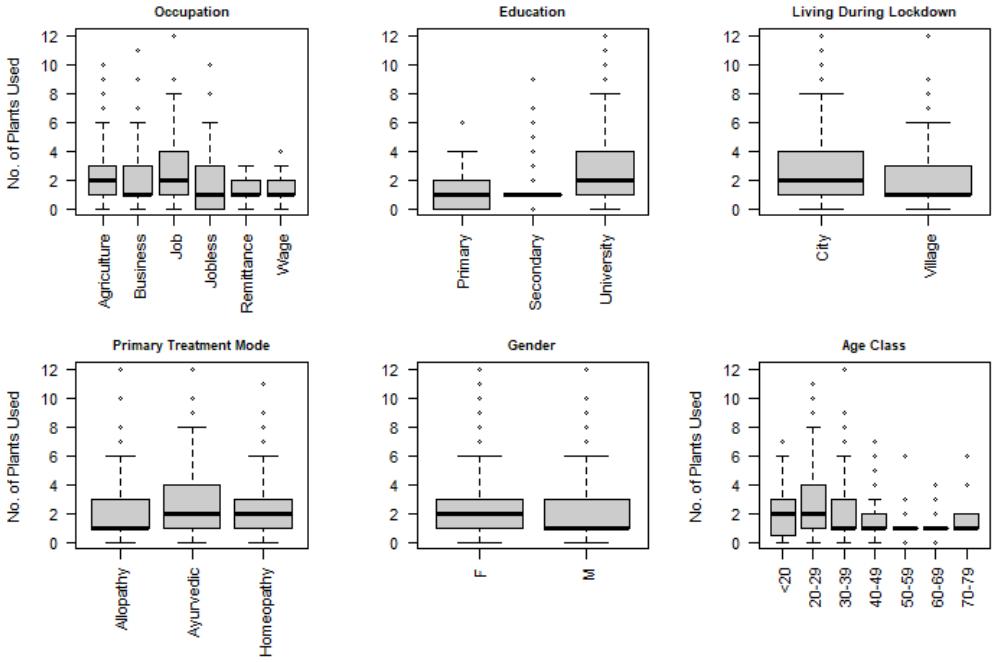

Figure 7

Graphical representation of plant use as a preventive method against COVID-19 by respondents.

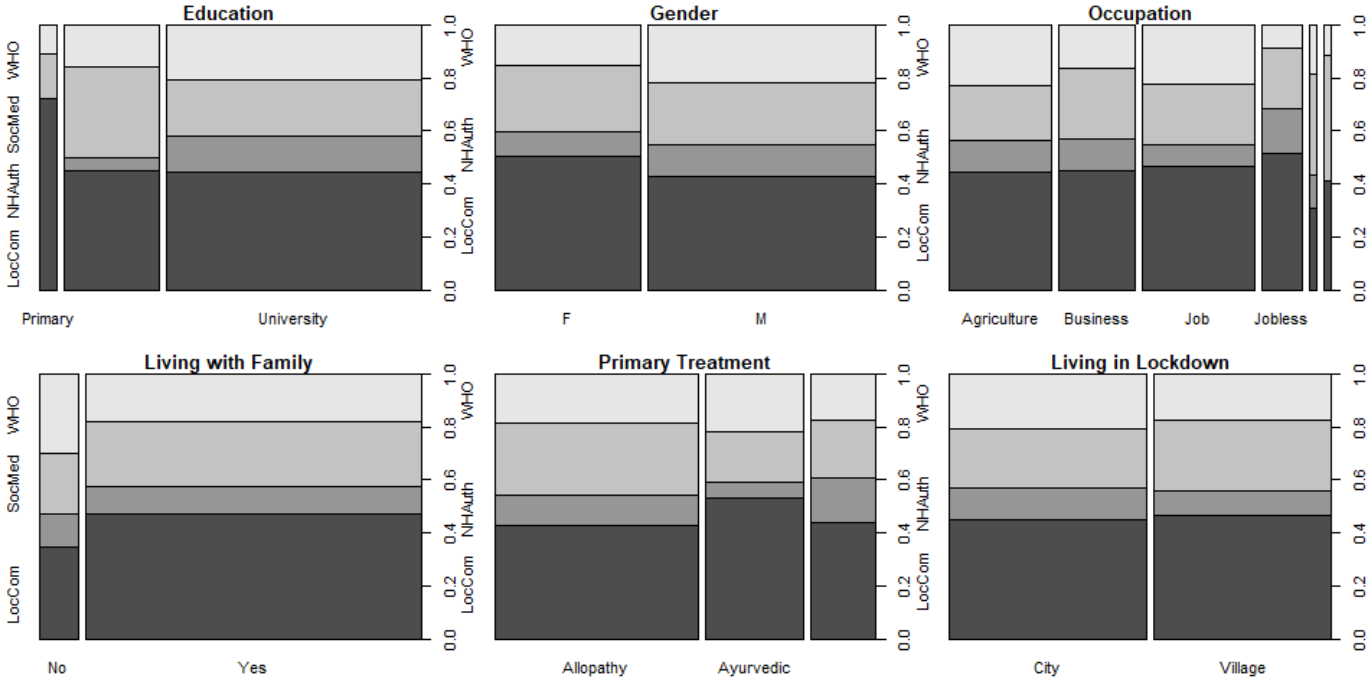

Figure 8

Graphical representation of information sources with respondent characteristics.