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Exploring the Potential and Limitations of Medicinal Plants in COVID-19 Management: Insights from Algeria

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ABSTRACT

Background: The emergence of COVID-19 in December 2019 marked a global health crisis, originating from China and swiftly spreading worldwide. This pandemic prompted investigations into traditional medicines' potential in combating infectious diseases, aiming to alleviate severity, shorten duration, and prevent recurrence. The efficacy of traditional medicines relies on compounds optimizing immune system functioning and responsiveness.

Objective: The study's objective was to assess the perception and utilization of medicinal plants in alleviating COVID-19 symptoms among adult individuals in Algeria.

Patients and methods: The study involved 385 participants, predominantly with confirmed COVID-19 cases (88.05%), centered on Algerians' treatment preferences, juxtaposing traditional and modern medicine. Additionally, it sought to identify medicinal plants used for preventing and treating COVID-19 in Algeria.

Results: The survey included participants from various regions: 59.22% from Northern Provinces, 27.01% from Internal Provinces, and 13.76% from Southern Provinces. A median age of 42 years, with 32.46% below 35 years old. Predominantly educated, with 75.84% having attended university. The respondents were predominantly females (62.07%). Nearly half (48.31%) reported increased usage of medicinal plants during COVID-19, while 37.40% maintained usual consumption patterns. Most participants (44.93%) believed their knowledge of medicinal plants had expanded during the pandemic. Notably, 70.64% highly recommended medicinal plants for COVID-19 prevention, while 17.92% did not, with 11.42% expressing moderate recommendations. Top cited plants included *Syzygium aromaticum* (344), *Citrus limon* (315), *Verbena officinalis* (277), *Thymus algeriensis* (261), and *Zingiber officinalis* (239).

Conclusions: While concrete evidence supporting medicinal plants' efficacy against COVID-19 among Algerian patients remains elusive, their integration alongside prescribed medications showed promise in improving therapy within this study's parameters. Combining conventional medicine and phytotherapy might offer an alternative strategy in combatting COVID-19 in the future.

Keywords:COVID-19, Traditional medicines, Modern medicine, Global health, Algeria, Medicinal plants, Pandemic.

INTRODUCTION

The emergence of COVID-19, acknowledged as a 21st-century pandemic by the World Health Organization due to the zoonotic virus SARS-CoV-2 in late 2019, led to a global catastrophe with devastating repercussions. This virus triggers a spectrum of symptoms categorized by the WHO into common, less common and serious manifestations [1].

Throughout history, plants have played a vital role in sustaining human health, serving as sources of medicinal compounds derived from their complex secondary metabolisms and significantly contributing to drug discovery endeavors [2].

Presently, there is growing interest in the potential of medicinal plants, utilized in phytotherapy, an alternative medicine employing plant extracts and natural active principles, in addressing COVID-19. Multiple clinical findings emphasize the favorable effects of medicinal plants in treating COVID-19, while ongoing studies aim to assess their efficacy in both treatment and prevention [3, 4]. Investigating herbal remedies entrenched in traditional medicine and extracting key compounds from these plants presents an intriguing strategy to tackle the ongoing pandemic [5].

Algeria is incredibly rich in its diverse natural herbs due to its vast expanses and varied climates: Maritime, continental and desert, all of which benefit from warmth, sunshine, beautiful weather, and extremely fertile soil in most areas. Undoubtedly, these climates and soil types have a significant impact not only on the richness of plant diversity but also on the adaptations of the plants, giving them unique characteristics. There are plant forms that only appear in limited or very restricted areas in Algeria[6]. Moreover, there is still undiscovered plant species deeply rooted in nature despite the extensive literature on Algerian herbs. The economic value of this botanical

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wealth is undeniable and should not be overlooked or underestimated. Neglecting it would lead to significant losses. Thus, its conservation, development, and evaluation are crucial. Preserving nature equates to preserving life. The present study highlights the significance of herbs in inhibiting the SARS-CoV-2 virus and addresses the potential management of post-COVID-19 complications. This approach aimed to promote and ensure the safe utilization of medicinal plant resources, thereby reinforcing the healthcare system. The study's objective was to assess the perception and utilization of medicinal plants in alleviating COVID-19 symptoms among adult individuals in Algeria. To identify the specific medicinal plants utilized in alternative medicine for treating COVID-19 infections, a survey was conducted within Algeria.

PATIENTS & METHODS

Data collection: This study was conducted a face-to-face survey to gather data on the utilization of plants by the Algerian population between June 2021 and September 2021. A total of 385 respondents participated in the survey. The survey comprised two sections designed to collect information about the respondents and the plants employed by this population.

***Respondent Information:** This covered details such as age, gender, blood type, education level, marital status, occupation, socioeconomic status, geographic location, living area, date of infection, confirmation method, illness duration, perception of symptom intensity, and hospitalization.

***Information about the plants used:**

This section delved into aspects such as primary treatment mode, reasons for using medicinal plants, frequency of medicinal plant use, names of plant species, plant sources, dosage used, knowledge about medicinal plants, sources of information, reasons for herbal therapy, reasons for modern therapy, side effects, satisfaction rate, and recommendation of medicinal plants. The study computed the relative frequencies of citation (RFC) for the recorded medicinal plants in accordance with the methodology proposed by **Tardio and Pardo-de-Santayana**[8].

$RFC = \frac{FC}{N}$Where FC = number of respondents who mentioned the use of species; N = total number of respondents took part in a survey.

Ethical approval: Prior to their involvement, all respondents provided consent and were briefed about the study's objectives. The research adhered to the ethical guidelines outlined by the International Society of Ethnobiology [7].The Helsinki' Declaration was followed throughout the study's conduct. The study was approved by the Ethics Committee of the Faculty of Natural and Life Sciences at University of Adrar-Ahmed Draia.

Statistical Analysis

The results of this study were analyzed using the Chi² test as a pivotal method to assess the alignment between observed and expected values. Its application within this study was facilitated through the *Chi-Square Test* function within the R environment. A p-value≤0.05 denotes a notable difference between the observed and anticipated values, thus establishing statistical significance. Pearson's chi-square goodness of fit test, a variant of the Chi² test, serves to scrutinize the null hypothesis, assuming no distinction between observed and expected distributions.

RESULTS

To the best of our knowledge, our summary represents the initial attempt to compile this data comprehensively. The survey was specifically crafted to discern preferences in treatment methods, differentiating between conventional medicine and alternative medicine. Moreover, it aimed to identify the specific medicinal plant species that Algerians utilize for the treatment and prevention of COVID-19.

Classification of survey respondents: Gender:

Among385 respondents participated in the survey, the distribution of respondents according to gender showed a predominance of women (62.07%) compared to men (37.92%).The Chi² test showed a significant difference between the observed and the expected values ($\chi^2 = 22.465$, df = 1, p-value = 0.0001) (Fig.1).

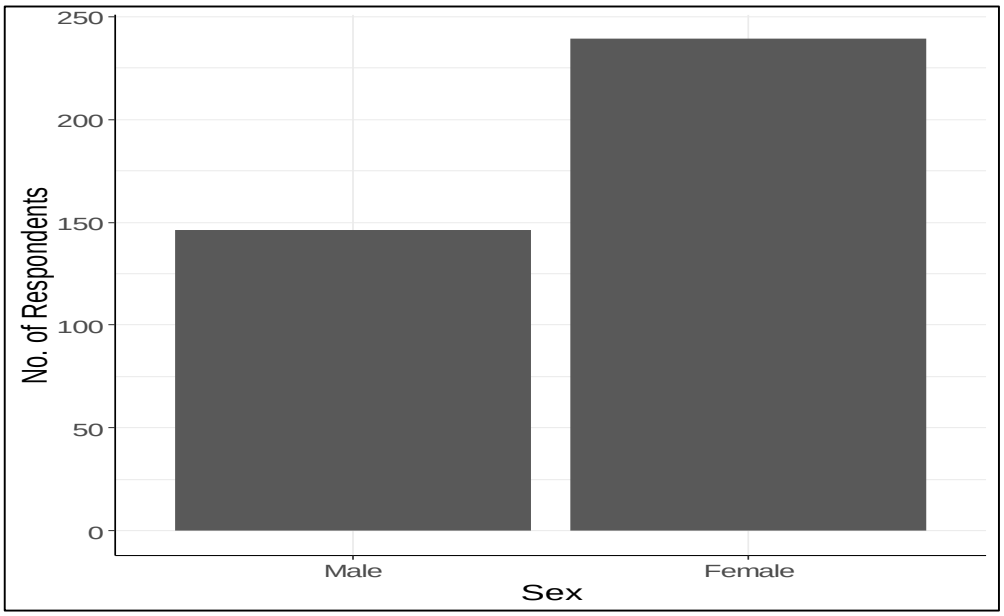

Figure (1): The distribution of survey respondents by gender.

Age groups: Individuals' ages were categorized into 7 groups, ranging from 18 to 85 years, with a median age of 42 years. The majority of respondents were aged 36 to 45 years (44.41%), followed by 26-35 years (24.41%), 46-55 years (17.66%), 15-25 years (8.05%), 56-65 years (4.41%), and over 66 years (1.03%) and the differences were statistically significant. (χ^2= 377.09, df = 8, *p*-value < 0.0001) (Fig.2). There were no registered cases under 14 years old.

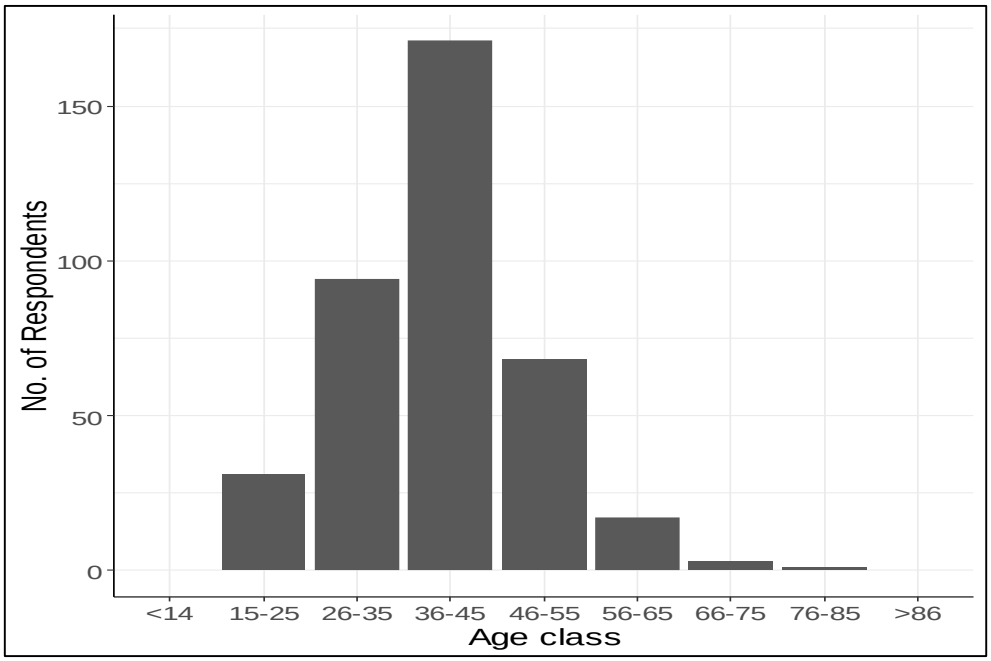

Figure (2): Profile of survey respondents according to their age group.

Blood type: The most prevalent blood types were A+ at 72.46%, O+ at 13.76%, AB+ at 8.83%, and B+ 4.41%. However, we observed only a 0.25% occurrence for A- and O-, with no instances of B- and AB-, which were statistically significant. (χ^2 = 681.27, df = 7, *p*-value < 0.0001) (Fig.3).

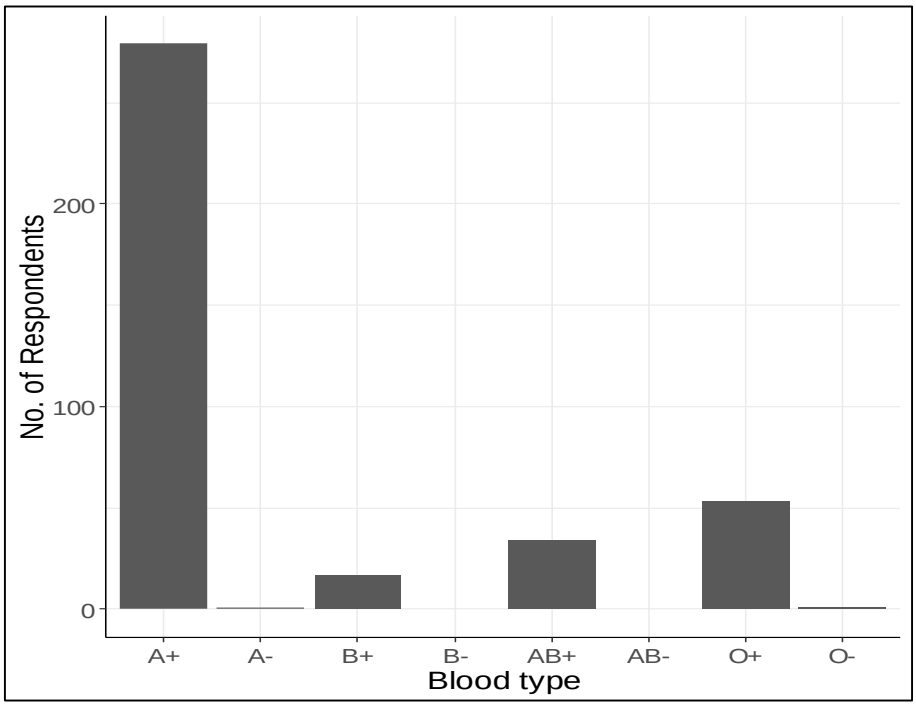

Figure (3): Classification of survey respondents according to blood type.

Education level: Most surveyed individuals (75.84%) had a university-level education with 2.33% wereilliterate and showed a significant difference ($\chi^2 = 575.01$, df = 3, *p*-value < 0.0001) (Fig.4).

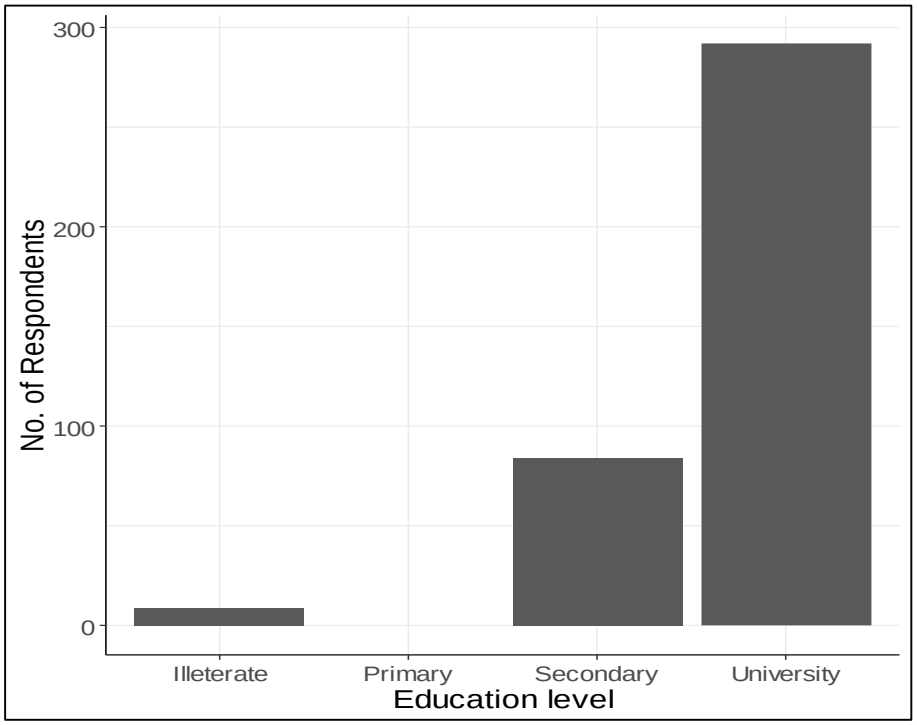

Figure (4): Educational level of the survey respondents

Geographic location: Participants were primarily from the Northern Province (Coastal) representing a significant proportion at 59.22%. Another substantial contingent, accounting for 27.01%, hailed from other internal regions. Meanwhile, the Southern Province constituted 13.76% of the surveyed population with a significant difference (χ^2 = 26.605, df = 2, *p*-value <0.0001) (Fig.5).

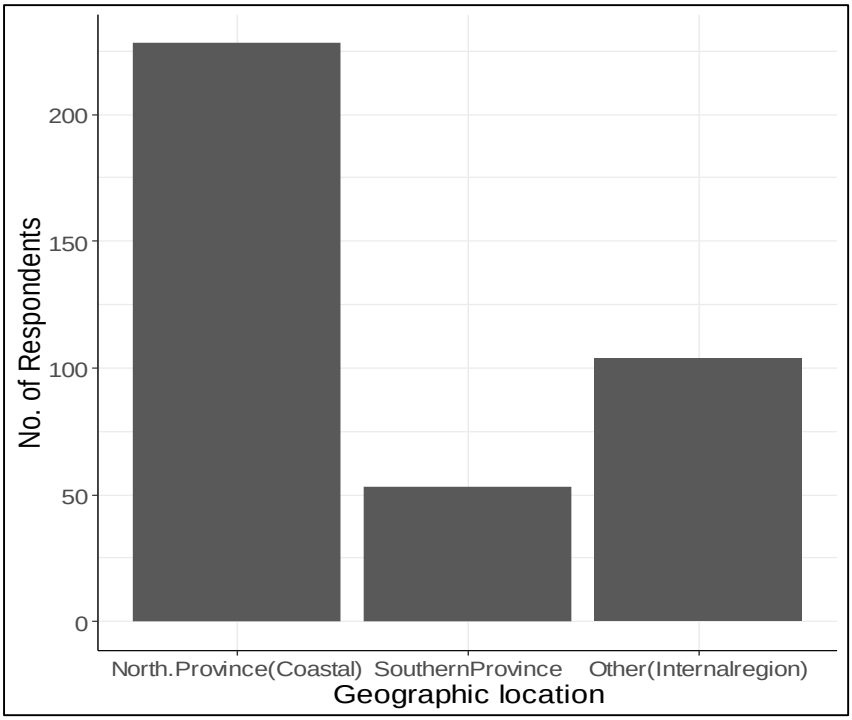

Figure 5: Geographiclocation of survey respondents.

Information on health status

Date of COVID-19 infection: The data on the dates of COVID-19 infection revealed intriguing insights. A significant majority, constituting 76.10%, reported contracting the virus within less than seven (07) days prior to the survey. Additionally, 20% of the respondents indicated their infection occurred between 8 to 15 days. However, a smaller percentage, 3.89%, reported being infected more than 16 days prior. (χ^2 = 319.27, df = 2, *p*-value < 0.0001). These statistics portray the dynamic nature of the pandemic's spread within different time frames (Fig.6).

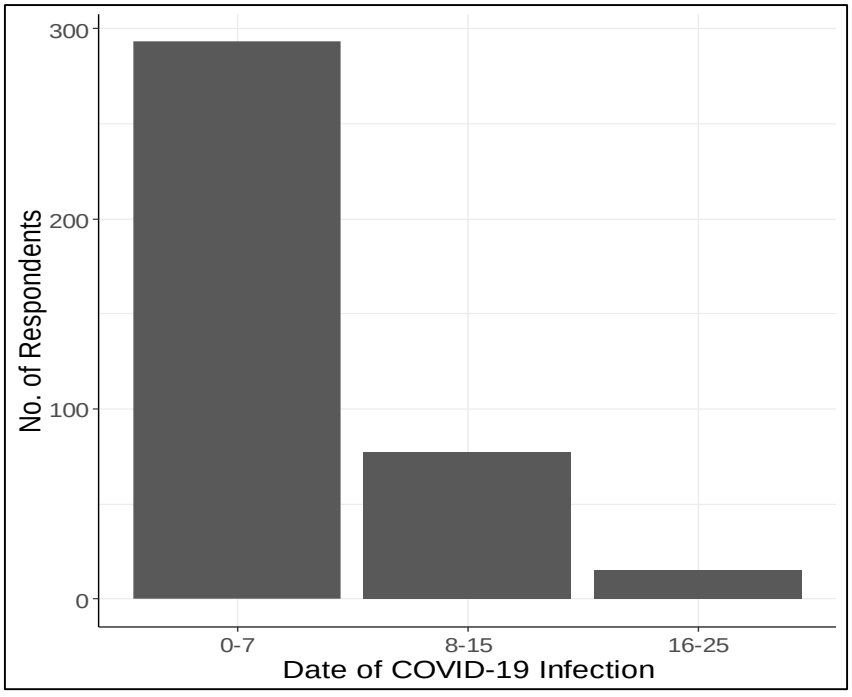

Figure (6): Date of COVID-19 infection.

Perception of symptom intensity: Perception of symptom intensity showed a significant difference and varied among respondents: 4.15% were asymptomatic, 54.80% experienced mild symptoms, 15.84% had moderate symptoms, and 25.19% reported strong symptoms. ($\chi^2 = 216.63$, df = 3, *p*-value < 0.0001) (Fig.7).

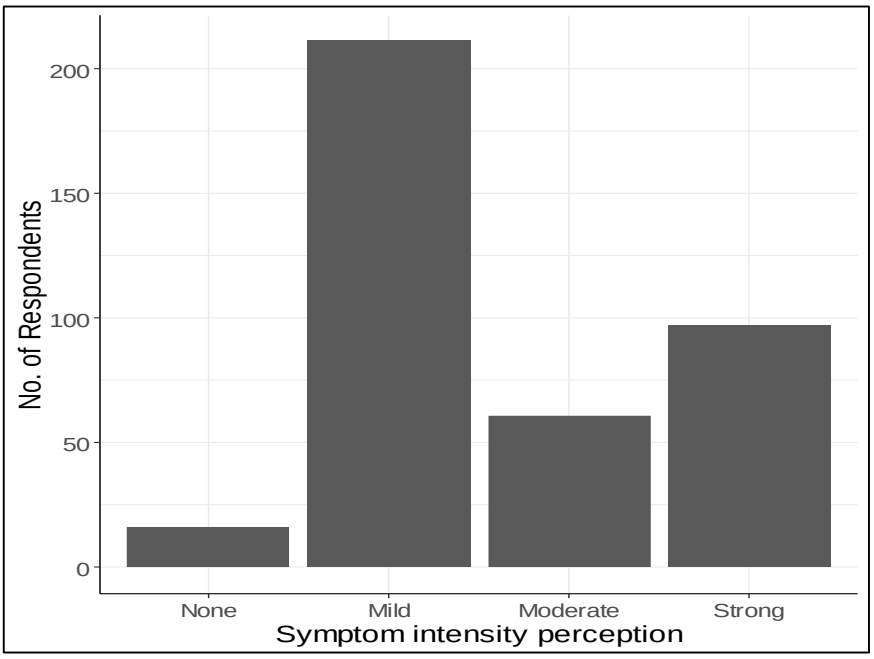

Figure 7: Perception of symptom intensity

Information about the treatment methods

Modern/traditional medicine: Among the respondents in the primary treatment mode category, 52.46% utilize Traditional Medicine, while 25.45% opt for Modern Medicine. Additionally, 22.07% use both forms of treatment. ($\chi^2 = 176.25$, df = 2, *p*-value < 0.0001) (Fig.8).

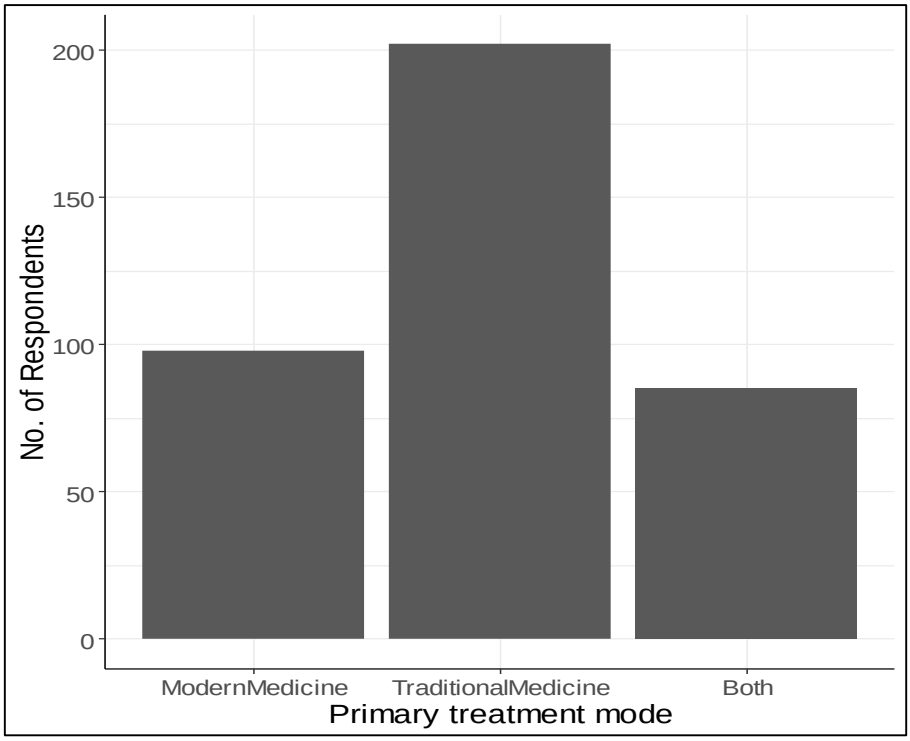

Figure (8): Primary treatment mode

Utilizations of Medicinal Plants in Treating COVID-19: Understanding the motivations behind the use of medicinal plants was multifaceted among participants. For the 'Why use medicinal plants?' segment, participants cited curative purposes as the primary reason, accounting for a significant 83.11%. They widely used phytotherapy to improve COVID-19 symptoms, enhance laboratory indicators, and increase the rate of clinical recovery. Preventive purposes followed with 4.15%, while a notable 12.72% expressed concerns about vaccine side effects, driving their inclination toward medicinal plants. ($\chi^2 = 418.19$, df = 2, *p*-value < 0.0001) (Fig.9).

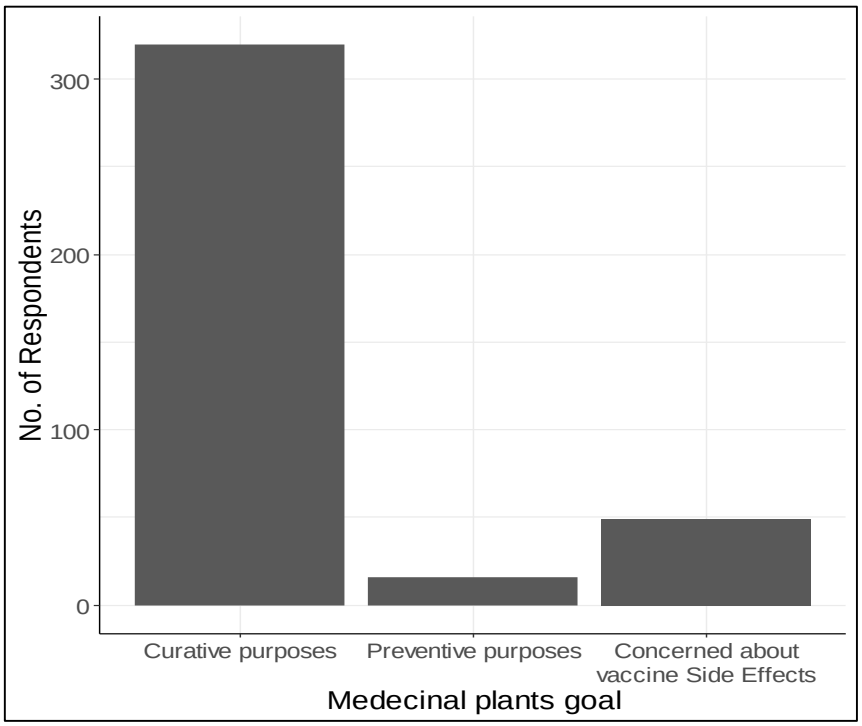

Figure (9): Reasons behind the utilization of medicinal plants.

Knowledge about medicinal plants: Our survey shed light on the extensive knowledge and sources of information regarding medicinal plants among participants. In terms of knowledge, a substantial 44.93% reported an increase, with none indicating a decrease. Surprisingly, 42.07% stated that their level of knowledge remained the same, while 12.98% expressed being confused about their understanding of medicinal plants, showing a significant difference ($\chi^2 = 224.59$, df = 3, *p*-value <0.0001)(Fig.10).

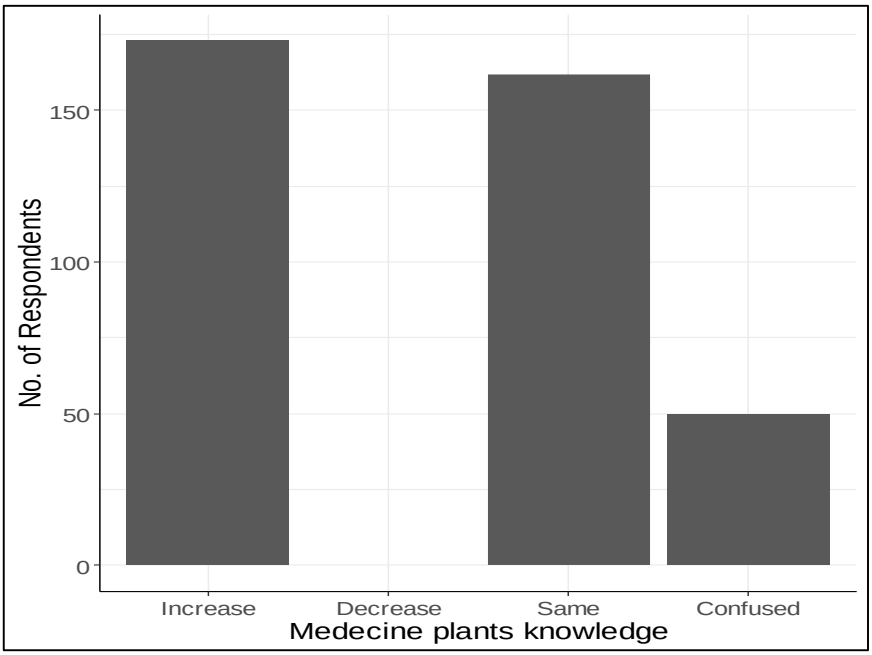

Figure (10): Medicinal plants knowledge.

It was evident that media and social media platforms played a dominant role influencing 57.66% of the respondents. Contrarily, national health authorities accounted for only 3.89%, whereas the herbalists, local community, and ancestral experiences were significant sources for 16.10%, 14.54%, and 5.45% respectively. Intriguingly, a smaller percentage (1.55%) relied solely on self-experience, and an even smaller 0.77% relied on reading materials for their knowledge about medicinal plants. The differences were statistically significantly ($\chi^2 = 557.76$, df = 6, p-value < 0.0001) (Fig.11).

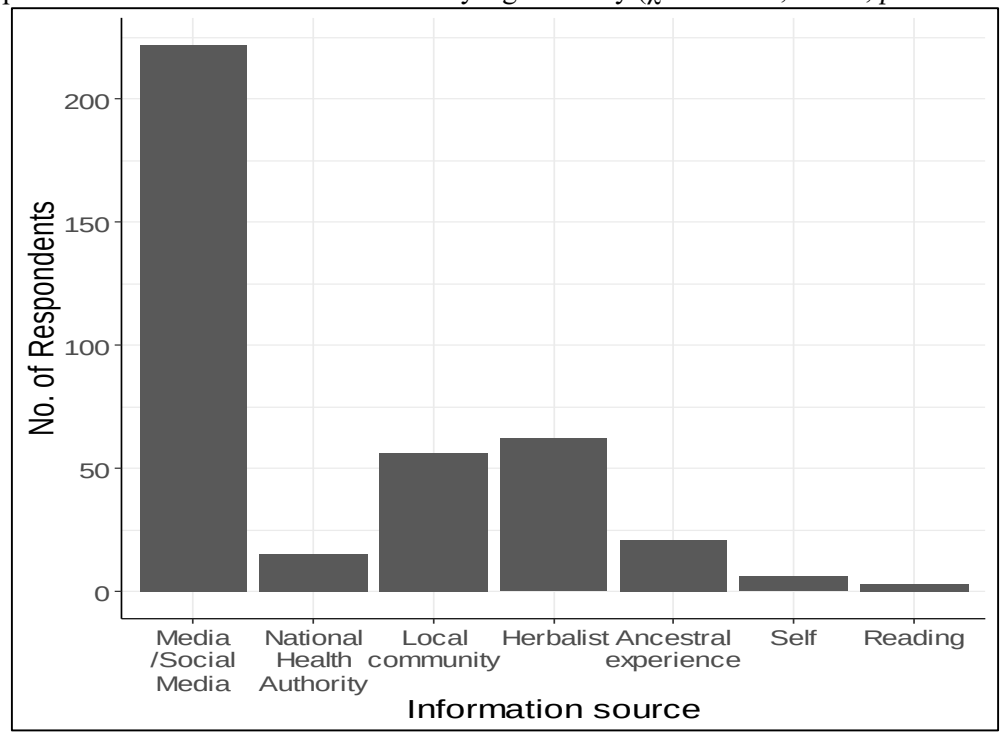

Figure (11): Source of Information about medicinal plants.

Side Effects of Traditional Therapy: The statistical differences were significant when considering herbal therapy as 11.42% respondents acknowledged experiencing side effects, while 7.27% reported experiencing none, and a larger group of 81,29% was uncertain about the existence of side effects. ($\chi^2 = 384.84$, df = 2, p-value < 0.0001) (Fig.12).

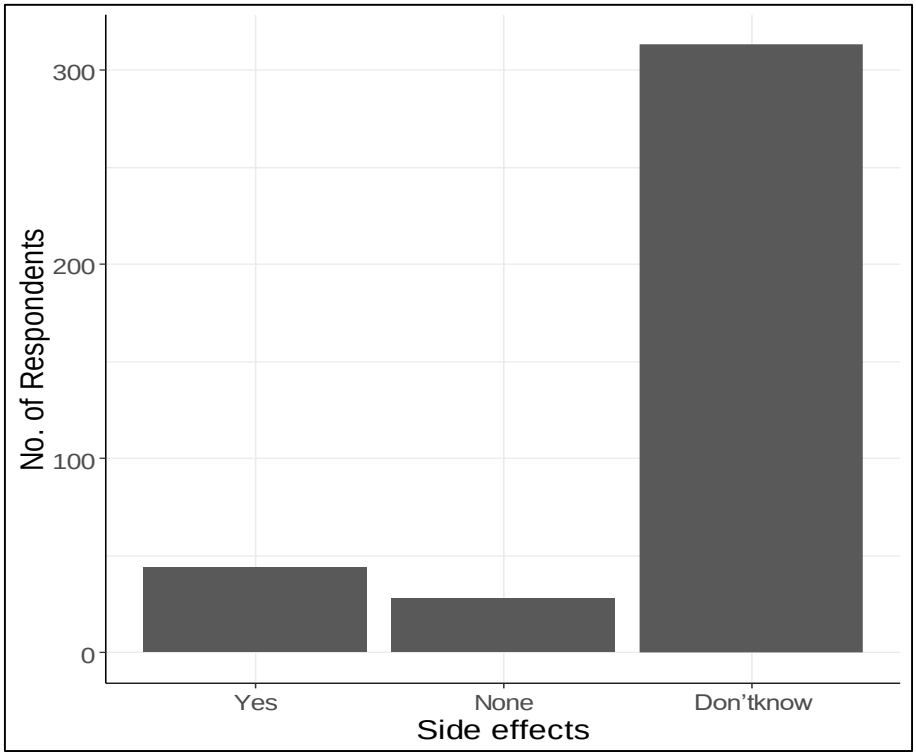

Figure (12): Sideeffects of traditional cure.

Rate of Recommendations for Medicinal Plants: The survey conducted on the usage of folkloric medicines during the past COVID-19 period yielded insights into user satisfaction and recommendations regarding medicinal plants. Regarding the recommendation of medicinal plants, a significant majority of 70.64% respondents actively recommended their usage. However, a smaller subset of 11.42% individuals expressed moderate levels of recommendation, while 17.92% respondents explicitly stated that they would not recommend the usage of these medicinal plants. ($\chi^2 = 232.91$, df = 2, *p*-value < 0.0001). This diverse range of opinions regarding the efficacy and recommendation of folkloric medicines during the COVID-19 period signifies a spectrum of experiences and perceptions among the surveyed population (Fig.13).

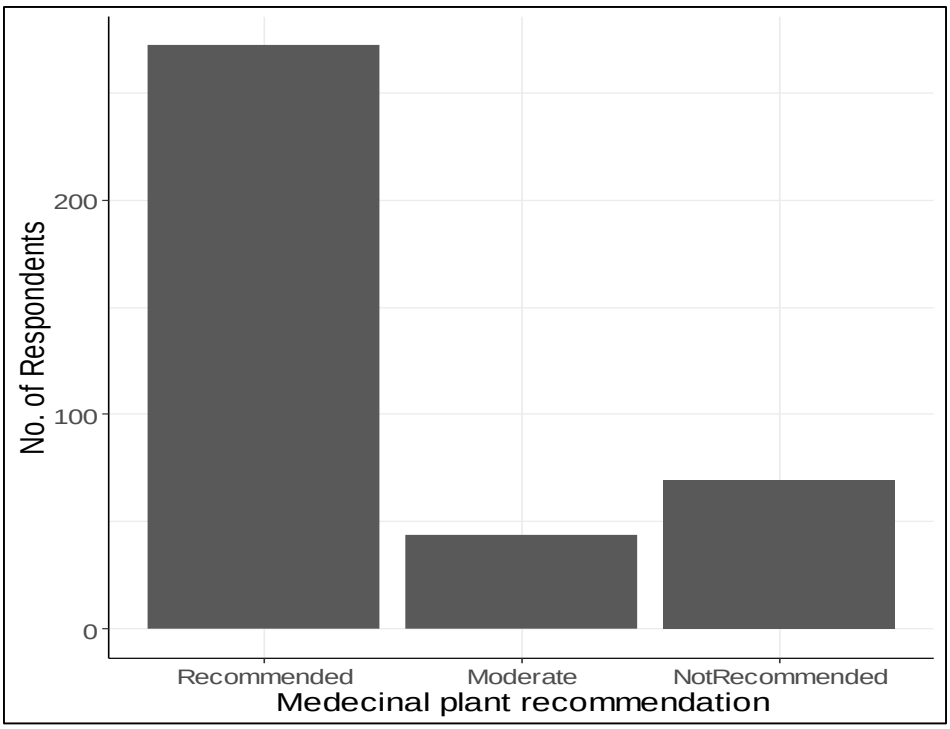

Figure (13): Recommendation of Medicinal Plants.

Relative frequency of citation:

The relative frequencies of citations of the present study ranged from 0,029 to 1,000 and for ten most cited species value ranged from 0,1424 to 1,000. The most cited species was *Syzygium aromaticum* (344 times cited and frequency of citation was (1,000), *Citrus limon* (315 times cited and frequency of citation was (0,9157) and *Verbena officinalis* (277 times cited and frequency of citation was (0,8052) (**Table 1**). The present survey documented a total of 48 species of medicinal plants belonging to 27 families. Among them, the most common families were *Lamiaceae* (8 species), *Apiaceae* (6 species), *Asteraceae* (5 species), *Myrtaceae* (4 species), *Zingiberaceae* & *Boraginaceae* (2 species). Likewise, the most perceived species was: *Syzygium aromaticum* (344), *Citrus limon* (315), *Verbena officinalis* (277), *Thymus Algeriensis* (261), *Zingiber officinalis* (239), *Rosmarinus Officinalis* (208), *Eucalyptus globules* (136), *Mentha spicata* (91), *Coriandrum sativum* (67), *Curcuma angustifolia* (49), *Cinnamomum cassia* (43), *Artemisia herba-alba Asso* (24) *Allium sativum* (22), *Pimpinella anisum* (19) *Juniperus Phoenicia* (09) *Cuminum cyminum* (13) *Nigella sativa* (12) *Origanum majorana* (09) *Chamaemelum nobile* (09) *Myrtus communis* (07) *Visnagadaucoides*(07) *Glycyrrhiza glabra* (04) *Salvia officinalis* (04) *Lavandula stoechas* (03) *Carum carvi* (03) *Papaver rhoeas* (03) *Aristolochia rotunda* (02) *Mentha pulegium* (02) *Artemisia arborescens* (02) *Ricinus communis* (02) *Ammivisnaga*(01) *Marrubium vulgare* (01) *Allium ampeloprasum* (01) *Althoea officinalis* (01) *Pinus maritime* (01) *Polypodium vulgare* (01) *Adiantum capillus-veneris*(01) *Hypericum perforatum* (01) *Iris germanica* (01) *Anchusa officinalis* (01) *Borrago officinalis* (01) *Ephedra alata* (01) *Sambucusnigra* (01) *Anthemis pyrethrum* (01) *Anacyclus valentinus* (01) *Verbascumthapsus* (01) *Lycium arabicum* (01) *Zygophyllum album* (01). The results of the RFC and the 48 medicinal plants used are presented in the radar diagram (Fig.14).

Table (1): Medicinal &aromatic plants (48) recorded with frequency of citations (FC), and relative frequency of citation (RFC)

N°	Family	Scientific name	FC	RFC
1	*Adoxaceae*	*Sambucusnigra*	1	0,0029
2	*Amaryllidaceae*	*Allium sativum*	22	0,0640
3	*Apiaceae*	*Carum carvi*	3	0,0087
4	*Apiaceae*	*Cuminum cyminum*	13	0,0378
5	*Apiaceae*	*Ammivisnaga*	1	0,0029
6	*Apiaceae*	*Pimpinella anisum*	19	0,0552
7	*Apiaceae*	*Coriandrum sativum*	67	0,1948
8	*Apiaceae*	*Visnagadaucoides Gaertn*	7	0,0203
9	*Aristolochiaceae*	*Aristolochia rotunda*	2	0,0058
10	*Asteraceae*	*Anthemis pyrethrum*	1	0,0029
11	*Asteraceae*	*Anacyclus valentinus*	1	0,0029
12	*Asteraceae*	*Chamaemelum nobile*	9	0,0262
13	*Asteraceae*	*Artemisia herba-alba Asso*	24	0,0698
14	*Asteraceae*	*Artemisia arborescens*	2	0,0058
15	*Boraginaceae*	*Anchusa officinalis*	1	0,0029
16	*Boraginaceae.*	*Borrago officinalis*	1	0,0029
17	*Cupressaceae*	*Juniperus phoenicia*	9	0,0262
18	*Ephedraceae*	*Ephedra alata altissima*	1	0,0029
19	*Euphorbiaceae*	*Ricinus communis*	2	0,0058
20	*Fabaceae*	*Glycyrrhiza glabra*	4	0,0116
21	*Hypericaceae*	*Hypericum perforatum*	1	0,0029
22	*Iriaceae*	*Iris germanica*	1	0,0029
23	*Lamiaceae*	*Lavandula stoechas*	3	0,0087
24	*Lamiaceae*	*Mentha pulegium*	2	0,0058
25	*Lamiaceae*	*Mentha spicata*	91	0,2645
26	*Lamiaceae*	*Origanum majorana*	9	0,0262
27	*Lamiaceae*	*Rosmarinus officinalis*	208	0,6047
28	*Lamiaceae*	*Salvia officinalis*	4	0,0116
29	*Lamiaceae*	*Thymus algeriensis*	261	0,7587
30	*Lamiaceae*	*Marrubium vulgare*	1	0,0029
31	*Lauraceae*	*Cinnamomum cassia*	43	0,1250
32	*Liliaceae*	*Allium ampeloprasum*	1	0,0029
33	*Malvaceae*	*Althoea officinalis*	1	0,0029
34	*Myrtaceae*	*Myrtus communis*	7	0,0203
35	*Myrtaceae*	*Syzygium aromaticum*	344	1,0000
36	*Myrtaceae*	*Eucalyptus globules*	136	0,3953
37	*Papaveraceae*	*Papaver rhoeas*	3	0,0087
38	*Pinaceae*	*Pinus maritima*	1	0,0029
39	*Polypodiaceae*	*Polypodium vulgare*	1	0,0029
40	*Pteridaceae*	*Adiantum capillus- veneris*	1	0,0029
41	*Ranunculaceae*	*Nigella sativa*	12	0,0349
42	*Rutaceae*	*Citrus limon*	315	0,9157
43	*Scrophulariaceae*	*Verbascumthapsus*	1	0,0029
44	*Solanaceae*	*Lycium arabicum*	1	0,0029
45	*Verbenaceae*	*Verbena officinalis*	277	0,8052
46	*Zingiberaceae*	*Zingiber officinalis*	239	0,6948
47	*Zingiberaceae*	*Curcuma angustifolia*	49	0,1424
48	*Zygophylaceae*	*Zygophyllum album*	1	0,0029

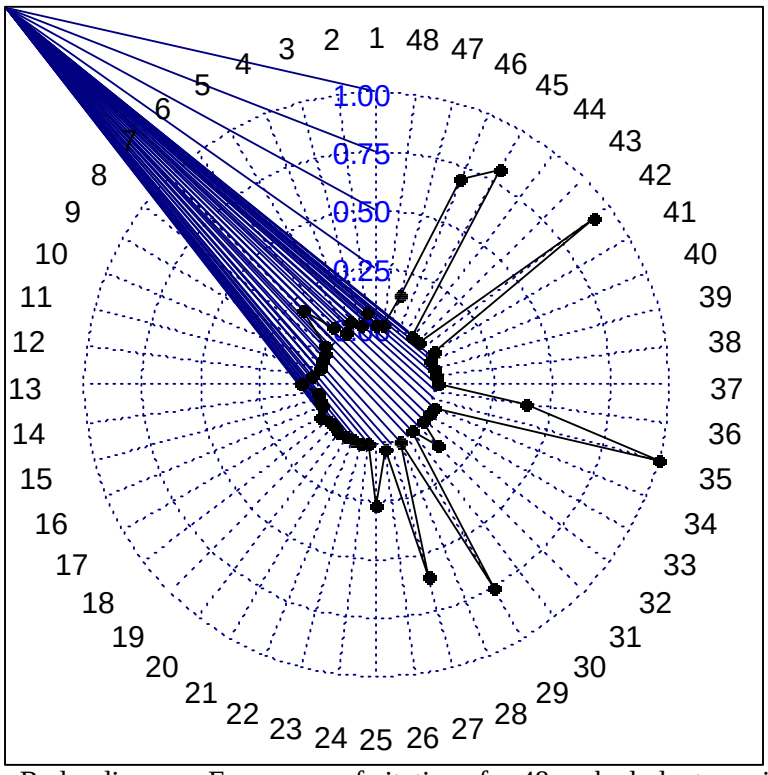

Figure (14): Radar diagram: Frequency of citations for 48 ranked plant species reported by respondents.

DISCUSSION

Men have been observed to be more vulnerable to COVID-19 compared to women, owing to several factors. Notably, men tend to engage in behaviors such as higher rates of smoking and alcohol consumption, which can weaken the immune system and exacerbate the severity of the virus. Additionally, women often exhibit a more conscientious attitude toward the pandemic, showing greater adherence to precautionary measures like frequent sanitation practices, consistent use of face coverings, and following directives to remain at home. This difference in behavior plays a crucial role in the varying vulnerability levels between genders, with women showcasing a more proactive approach in reducing exposure and the spread of the virus. Consequently, this proactive stance contributes to their relatively lower susceptibility to severe COVID-19 outcomes. Our conclusions are highly supported by **Bwire**[9].This predominance of women can be explained also by their responsibility towards the family in caring for the health of family members, particularly children [10].

Younger age groups, specifically those under 35, often involve active individuals who engage in frequent movement, activities, and travel associated with education, work, as well as visits to sports clubs and entertainment spots with less inclination to preventive health measures. In contrast, those aged over 55 represent the elderly, individuals with compromised immune systems, or those managing chronic diseases or health complications.

Studies indicated a higher susceptibility to SARS-CoV-2 infection and the potential for severe COVID-19 outcomes among individuals with blood group A, while blood group O may offer a certain level of protection against infection [11].

The survey data revealed that well-educated people tended to use alternative medicines more frequently during the pandemic in Algeria. The same observation was registered in Nepal [12].Contrary to the results of other studies, which found that well-educated people often rely on modern medicine for treatment [13]. Previous research has noted that individuals with higher education levels usually preferred modern medicine. However, during the COVID-19 period, educated individuals displayed an awareness of medicinal plants as potential alternative medicine [14,15]. Contrary to prior research, this alteration in conduct among educated individuals leads to an enhanced recognition and consideration of medicinal plants. An investigation involving 30 herbalists was conducted to explore the utilization of plants during the coronavirus pandemic. The findings revealed a significant interest in herbal medicines across various genders and age groups. An analysis of educational backgrounds indicated that over half of the herbalists (53.3%) had completed secondary education, while 26.7% had finished primary education. Additionally, 16.7% were categorized as illiterate, and merely 3.3% had attained graduate-level education [16].

The survey depicted a diverse representation across geographic locations shedding light on the varied impacts and perspectives concerning the pandemic within these different settings. A total of 774 respondents participated in the survey of **Khadka *et al.***[12], of whom (60.85%) were males. The age of the respondents varied from 16 to 76 years. Among them,

65.51% were below 30 years of age; all of the respondents were literate, and most of them (69.5%) had attended University. The people with university-level education were using more plant species compared to people with secondary-level and primary-level education. Individuals residing in villages or internal provinces demonstrated higher usage of plants compared to those living in cities or larger Northern Provinces, highlighting this discrepancy.

COVID-19 manifests through a diverse array of symptoms, with commonly reported signs encompassing fever, cough, and shortness of breath, contributing to the escalating number of cases observed daily. Beyond these, individuals may experience a wide spectrum of indications, such as sore throat, runny nose, body aches, headaches, chills, fatigue, gastrointestinal issues like diarrhea and nausea, loss of smell and taste, and even sweating. This breadth of symptoms underscores the multifaceted nature of COVID-19, with its presentation varying across affected individuals[17,18].

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 that the use of medicinal plants during COVID-19 was the same as that of normal condition[12].

Participants used various information sources to prevent COVID-19, including media, social media, national health authorities, and local communities. This study revealed that a considerable proportion of respondents turned to social media platforms to acquire information about COVID-19. Surprisingly, the majority of individuals did not rely on national health authorities or the World Health Organization for information, mirroring the results observed in other research[19]. The jobless people were following the local community for obtaining information (more than 50%). Respondents in Nepal reported that the use of medicinal plants has increased during COVID-19 and also believed that information about the medicinal plants has increased, and most of them recommend medicinal plants to prevent COVID-19 [12].Nevertheless, it is advisable for younger individuals to seek information about medicinal plants from credible and reliable sources. A high-risk index is apparent Moreover, a substantial portion of participants, totaling 30.64%, obtained information about COVID-19 and medicinal plants from herbalists and the local community. This proportion cannot be disregarded, particularly when considering the level of knowledge among herbalists. Their precision in determining the exact classification of species used is crucial, given the existence of numerous chemotypes and sub-species within the same species.

In terms of safety, studies indicated that the extended intake (up to three months) of 3g/day of *Nigella sativa* seeds in humans did not show any notable side effects on liver and kidney functions[20,21]. Due to conflicting data on the effectiveness of specific medicinal plants, it is prudent to refrain from using herbal supplements for COVID-19 prevention without direct healthcare provider supervision. Physicians need to proceed cautiously when prescribing herbal medicines for COVID-19 treatment, avoiding such prescriptions if their efficacy remains unproven [22,23]. For many individuals, herbal remedies serve as the primary, and sometimes sole, source of medical care, owing to their territorial accessibility and financial feasibility. Moreover, amid the COVID-19 pandemic, the affordability and accessibility of most herbal remedies have amplified their appeal compared to conventional medicines [24]. **Fan *et al.*** [25] in their review of seven clinical trials involving 736 COVID-19 patients, collectively demonstrated that the use of Chinese herbal medicine as adjunctive therapy alongside standard care improved treatment outcomes in COVID-19 cases.

The study led by **Chaachouay *et al.*** [16]identified a total of 20 plant speciescommonlyrecorded for the prevention and treatment of COVID-19. The *Lamiaceae* family exhibited the highest representation in terms of the number of plant species used, followed by *Apiaceae*, *Asteraceae*, *Fabaceae*, and *Myrtaceae*[16].The most perceived species during another research was *Zingiber officinale* at 39.79% (308 times cited and frequency of citation was 0.398) followed by *Curcuma angustifolia* at 34.11% (264 times cited and frequency of citation was 0.341)[12]. Ethnomedicines include medicinal herbs known for their use in preventing or treating coronavirus disease, particularly due to their ability to bolster respiratory immunity. They can also demonstrate the potential to maintain the membrane integrity, thereby hindering viral entry by binding to envelope proteins, regulating ion channels, and modulating enzymes [26].

Syzygium aromaticum L. (cloves) is one of the most significant medicinal plants due to its long-standing use as a food preservative and for various medicinal purposes [27].

Clove's therapeutic use in traditional medicine has been experimentally observed against different types of COVID-19. Its properties, including anti-inflammatory effects, immune system enhancement, and prevention of clot formation or blood coagulation, significantly contribute to its role as a medicinal plant used against COVID-19[28].*Thyme*, due to the biological activities of phytochemical compounds present in its oils like thymol and carvacrol has shown properties that render it a beneficial tonic for the immune system, especially in cases of chronic infections and pulmonary ailments. This quality positions it as a priority plant for alleviating COVID-19 symptoms [29].The use of spices such as *Cuminum cyminum* L., and *Coriandrum sativum* L., is recommended for daily use to improve the immunity in COVID-19 patients[30].Additional study suggests that *Alium sativum* worked as a protective agent against HIV infection and then may be used in COVID-19 as a supportive agent due to its antiviral properties [31].*Nigella sativa* seed was among one of the

medicinal plants with most published positive evidence. It demonstrated immunomodulatory and antiviral properties by decreasing viral load, alpha fetoprotein, and improved liver function parameters among hepatitis C infected patients [32].Furthermore, the essential oils from *Pimpinella anisum* L., *Eucalyptus globules* Labill, and *Citrus limon Losbeck* with antiviral activities were well documented by several researchers [33, 34, 35].

CONCLUSION

The present study represented the initial survey documenting indigenous knowledge related to the use of medicinal plants in Algeria amid the COVID-19 outbreak. The findings indicated a growing reliance on medicinal plants during this period, as people believed in their potential to prevent or treat COVID-19. The study also revealed the abundance and diversity of medicinal plants in Algeria. Additionally, local inhabitants possess a wealth of knowledge, as evidenced by the extensive list of species mentioned, along with their respective preparation methods and the various plant parts utilized for diverse therapeutic purposes. Thus, this study emphasized the critical need to preserve local knowledge and indigenous practices, facilitating their transmission to other communities and researchers. Consequently, collaboration between the pharmaceutical industry and indigenous traditional communities is crucial. By leveraging their collective knowledge of alternative medicine, the pharmaceutical industry can potentially discover new drugs from these sources.

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