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Diversity of medicinal plant uses and epidemiological analysis during the COVID-19 pandemic in Biskra (south-eastern of Algeria)

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Abstract. In this study we examined data on COVID-19 patients recorded in 2020 at the Hakim Sadanne Hospital in the Biskra, Algeria and applied various tests: statistical, epidemiological, etc. In addition, we conducted interviews with herbalists and an ethnobotanical on-line survey of medicinal plants used during the COVID-19 pandemic. A total of 2108 cases of this disease, including 931 deaths, were analysed to link various factors, such as air temperature, age, and sex, with mortality rate. Our results demonstrate that the appearance of symptoms of infection was often associated with pre-existing chronic diseases, particularly diabetes, cardiovascular heart disease, and high blood pressure. As for medicinal plants, *Melissa officinalis* and *Zingiber officinale* were the most used during the pandemic, whereas *Eucalyptus globulus* and *Syzygium aromaticum* had 100% fidelity levels. In conclusion, primarily the above-mentioned chronic diseases were associated with reduced immunity to COVID-19. Furthermore, traditional medicine has been an accommodating alternative to conventional medical treatment of COVID-19 within Biskra region.

Key words: COVID-19, chronic disease, traditional medicine, medicinal plants, ethnopharmacology, mortality, Biskra

1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), or COVID-19, has caused over 6.9 million stated deaths worldwide since December 2019 according to the World Health Organization (last updated on 9 August 2023). Algeria has also been affected by this virus, with 272 010 confirmed cases and 6881 deaths reported as of 19 December 2023 (WHO 2023). Although the country controlled to maintaining the numbers within such low rates, compared to other neighbouring countries (e.g. Morocco, Tunisia) or even France, there are still significant slighter. The population under study included individuals with chronic illnesses, who are considered to be the most vulnerable group. Our interest in this matter and the way this virus can impact such individuals prompted us to conduct a survey and carry out this study (Hemidi & Dehimat 2021).

On the other hand, the utilization of medicinal plants is a crucial strategy to combat infections caused by microorganisms and viruses. Some plants contain various bioactive compounds with potent antimicrobial properties that can target various pathogens. In the context of the coronavirus, medicinal plants have shown promising antiviral activity, potentially inhibiting viral replication and reducing the severity

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of the infection (Al-Jamal *et al*. 2024). Additionally, using medicinal plants aligns with traditional medicine and holistic healthcare principles, providing natural and accessible remedies to communities worldwide. Embracing the wealth of medicinal plant resources not only enhances our pharmacological arsenal but also fosters sustainable healthcare practices, promoting resilience against infectious diseases. Over the last 5 years, the influence of multiple herbal treatments could not be neglected, so it was necessary to include such an essential segment (Leonti & Casu 2013).

The purpose of this study is to conduct a full scan of field-collected data on COVID-19 patients in the region of Biskra at the Hakim Sadanne Hospital, with a total of 2108 cases in the year 2020, including 931 deaths. Several statistical tests were conducted to link factors such as monthly air temperature, patient's age, and sex with mortality rate. Furthermore, interviews with herbalists and an ethnobotanical survey of medicinal plants used during the COVID-19 pandemic were carried out.

2. Material and methods

2.1. Data collection

Data was collected the pandemic between 2020-2021 by the Hakim Sadanne Hospital in Biskra and shared with us. The obtained data was classified according to the studied parameters and processed using various statistical tests (ANOVA, *t*-test, chi-square test) and epidemiological parameters (effective reproduction number, case mortality rate, gender mortality rate, etc.). Five age classes were distinguished: children, teenagers, adults 20-44 years and 45-64 years old, and the elderly 65+ years old, because different physiological factors might influence the viral spread during different phases of life.

2.2. Dynamics of the pandemic

Daily and monthly numbers of admitted, recovered, and deceased patients were assessed throughout the year 2020 in order to determine the periods in which the chosen parameters reached their highest and lowest values.

2.3. Mortality rates

Estimating the mortality rates enabled us to assess the proportion of deaths attributed to COVID-19 in the overall population of each commune in the Biskra region. These rates were calculated monthly, both as an aggregate for the entire region and separately for each studied commune, providing a comprehensive understanding of the disease's impact at the local level.

$$\text{Case mortality rate} = \frac{\text{Number of deceased patients}}{\text{Number of total admitted patients}}$$

In order to investigate the relationship between gender and the case mortality rate calculated before, we assessed the gender mortality rate (GMR):

$$\text{GMR} = \frac{\text{Total Mortality within Males}}{\text{Total Mortality within Females}}$$

2.4. Positive sensitivity of SARS-CoV-2 tests

To validate the sensitivity of COVID-19 tests, positive sensitivity was evaluated (Asai 2020):

$$\text{Positive sensitivity} = \frac{\text{Number of results the test showed positive}}{\text{Number of actually positive people}}$$

2.5. Effective reproduction number (R_t)

The reproduction number R_t is crucial for understanding the infectious disease dynamics. Defined as the average number of secondary cases per primary case at time *t*, it varies with control measures (Nishiura & Chowell 2009). In our study, we used Cori Anne's SIR model to evaluate SARS-CoV-2 in Biskra for 236 days in 2020. Daily case numbers were used as the incidence data. To improve accuracy, we adjusted the posterior coefficient to 0.1, while maintaining the other parameters from Cori's model unchanged.

2.6. Statistical analysis

Statistical analysis was performed using SPSS version 25 software package. One-way analysis of variance (ANOVA) was used to determine statistical significance of differences in mortality rate between age classes in June and July 2020 and the influence of air temperature on mortality. In addition, the *t*-test was used to study the relationship between gender and mortality rate in the same period.

2.7. Survey on the effect of preexisting comorbidities on COVID-19 patients

Our previous work (Hemidi & Dehimat 2021) brought to light the potential impact the virus could have on chronically ill patients. A comprehensive questionnaire was administered to explore potential connections between preexisting comorbidities and COVID-19. The survey included participation from over 300 Algerian citizens.

2.8. Questionnaire surveys

2.8.1. Interviews with herbalists

This questionnaire was conducted in the Biskra region (Fig. 1). As of April 19, 2021, a total of 1,352 COVID-19 positive cases had been reported.

Fig. 1. Geographical location of the study area (Biskra region) in south-eastern of Algeria

A questionnaire was designed to collect information from herbalists regarding the use of herbs for anti-COVID-19 purposes. Data were gathered through face-to-face interviews, each lasting 10-20 min. The herbalists differ from one commune to another nevertheless are usually males. Their profession is acquired through inheritance from parents or special training for a few years. Most of the 8 herbalists consulted in this study were old, experienced men aged 39-67 years, with at least 7 years of experience.

2.8.2. International survey

To follow up with the results we could obtain from the above-mentioned interviews, a questionnaire survey was launched also online through the Google Forms platform. Thus, comparing results obtained from the worldwide communities on the application of various medicinal plants against SARS-CoV-2, the frequency of use, and the reasons why those herbs were specifically used, a total of 99 responses were generated.

2.8.3. Data analysis

Next, the data collected during the interviews and the on-line survey were subjected to a few tests (Table 1).

Table 1. Ethnopharmacological indices chosen for analysis of medicinal plant use for COVID-19 treatment

Index	Formula	Use	Reference
Relative frequency of citation (RFC)	$\mathbf{RFC} = F_C/N$ F_C = number of citations of plant *i* N = number of respondents	Reflects local importance of each medicinal plant species used by individuals in a given area	Appiah *et al.* 2017
Use value (UV)	$\mathbf{UV} = \sum U_i/N$ U_i = number of use reports on plant *i* N = number of respondents	Indicates highly used plants for various health problems, also less known medicinal plants	Dossou-Yovo *et al.* 2022; Appiah *et al.* 2017
Fidelity level (FL)	**FL = IP/IU × 100%** IP = number of informants who suggested use of plant *i* against a certain disease or symptom or for a body part IU = number of informants who listed plant *i* for any medical purpose	Indicates high or low efficacy of plants in treating a certain disease	Appiah *et al.* 2017

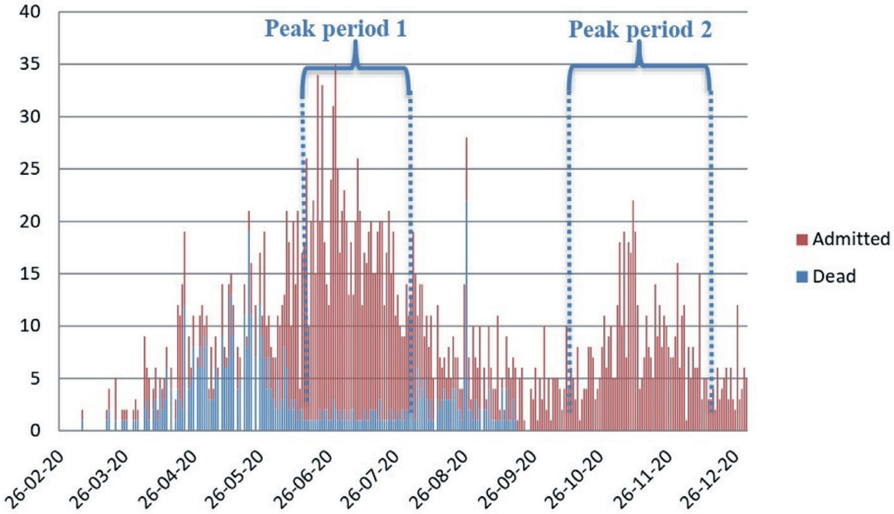

Fig. 2. Records of daily admissions and deaths caused by COVID-19 in 2020 in Biskra Region. Data on deaths were available only till September

3. Results and discussion

3.1. Dynamics of the pandemic

The cumulative daily numbers of admitted patients for each month were compared with the corresponding daily death counts. Our analysis revealed two significant peaks in hospital admissions: one during June-July and another in October-November. However, the number of deaths remained notably low during the summer months (Fig. 2).

3.2. Numbers of admitted patients according to gender and age

Effects of age class and gender on the number of admitted patients are presented in Figure 3. The first emerging case of SARS-CoV-2 infection in Biskra region was confirmed on 26th February 2020, and since then the number of cases gradually increased till June. Only 35 patients aged 0-19 years were admitted. However, for the age class 20-44 years, the admission rates were 19.80% and 31.90% for males and females, respectively. For patients aged 45-65 years the admission percentage reached 42.57% for men and 37.29% for women, compared to 36.71% and 30.05% for the oldest males and females, respectively.

Thus, the youngest age classes (0-19 years) were very slightly affected, while patients aged 45-64 years were the most susceptible to the infection. In addition, our results indicated that males numerically surpassed females starting from the age of 45 years.

3.3. Male and female admission rates according to months

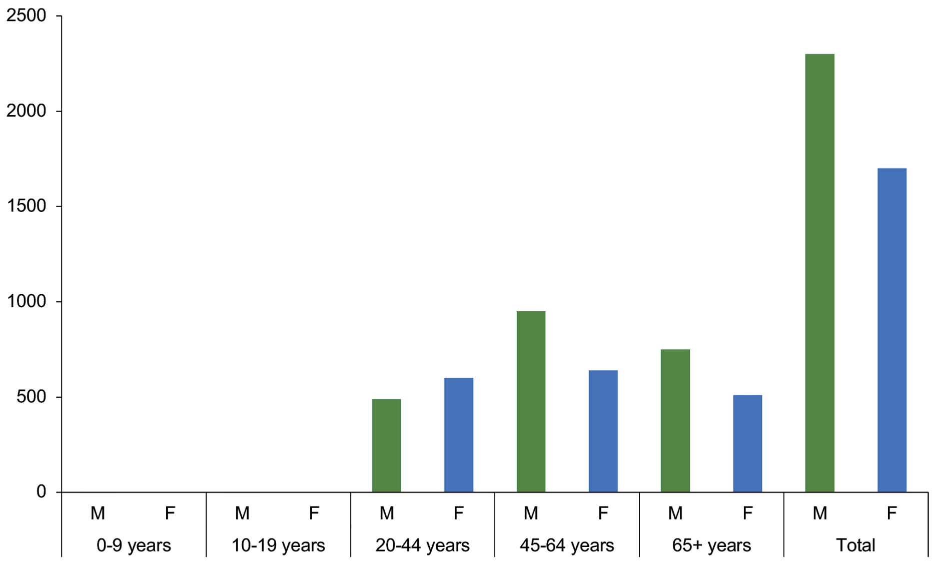

Fig. 3. Numbers of admitted male and female COVID-19 patients (by age and gender) in the Hakim Sadanne Hospital in Biskra in 2020-2021

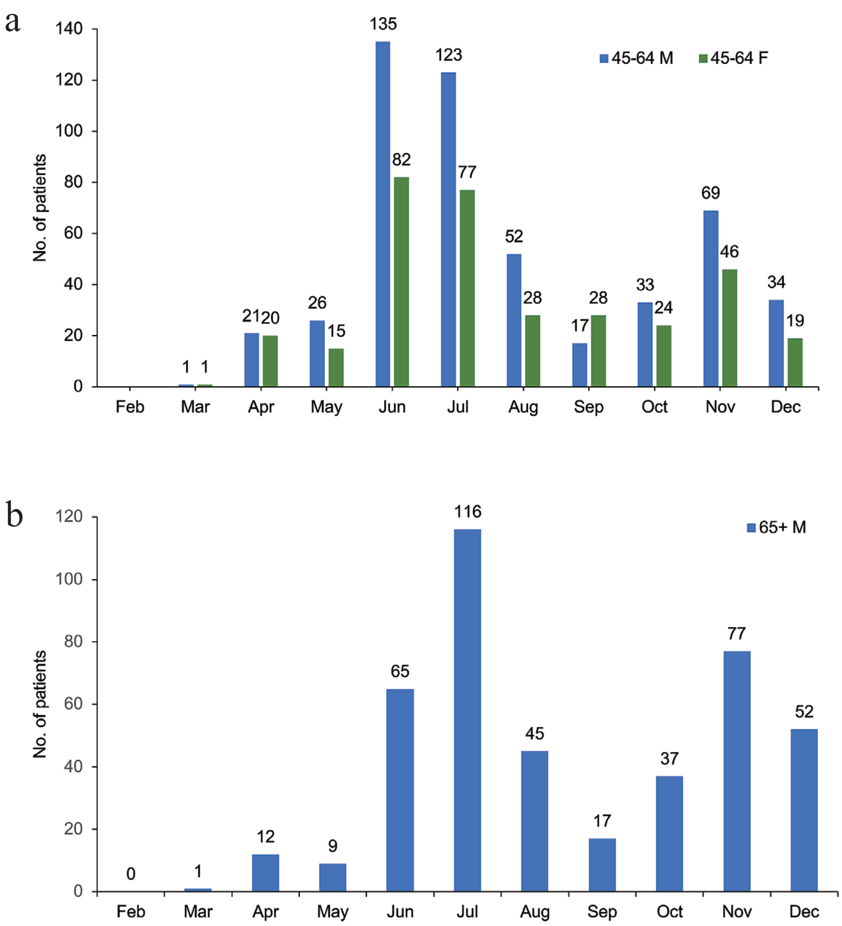

Fig. 4. Monthly admissions of COVID-19 patients by age and gender in Biskra in 2020

Explanations: a – males aged 45-64 years (most admitted group, blue), compared to females (red); b – males aged 65+ years (second most admitted group)

Monthly male and female rates of admission are presented for males and females aged 45-64 years (Fig. 4a) and for males aged 65+ years (Fig. 4b). According to our results, the most affected age class within the male gender (45-64 years) peaked in June, accounting for 26% of admissions, whereas the lowest values were recorded in March, September, and May: 0.1%, 3%, and 4%, respectively. It is quite obvious that from April until August the males aged 65+ years old had the upper hand in the number of admissions, whereas in October, November, and December the males aged 45-64 years old prevailed. For females aged 45-64 years (Fig. 4a), the highest percentage of admissions was recorded in June and July (about 23% each). Meanwhile, March, May and April showcased the lowest levels of admissions (0.3-5.9%).

The observed differences between genders could be partly due to genetic and immunological factors. According to Bwire (2020), angiotensin-converting enzyme 2 (ACE2) is more expressed in male genes than in female ones. In addition, differences between the male and female immune system could explain the divergent risks. Karnam *et al*. (2012) showed that the inhibitory CD200 receptor (CD200R) has a primordial role in balancing the immune system during a viral infection. The lack of signalling enhances the immune response within females. The concept of hormones coming side to side by immune response has also been pointed out. Blocking of oestrogen receptors seems to increase the rate of infection with SARS-CoV-2 in female mice (Bwire 2020).

Age also influences greatly the immune system. Two major ways, namely immune senescence and inflammation, might explain why older people are more susceptible of catching the virus than the younger community. The unexpectedly higher admission rates of men aged 45-64 years in the first half of the year, compared to those over 65 (except for September) can be attributed to 2 factors. First, older men were more cautious and stayed indoors, reducing their exposure. Second, many of those over 65 were retired, limiting their need to go out. However, their reduced activity may have weakened their immune systems. In the second half of the year, easing restrictions and reopening mosques and cafes increased the exposure of elderly men, leading to higher admissions.

Our results demonstrated a higher proportion of admissions during the summer (June and July) probably because the activity of citizens increased with summer

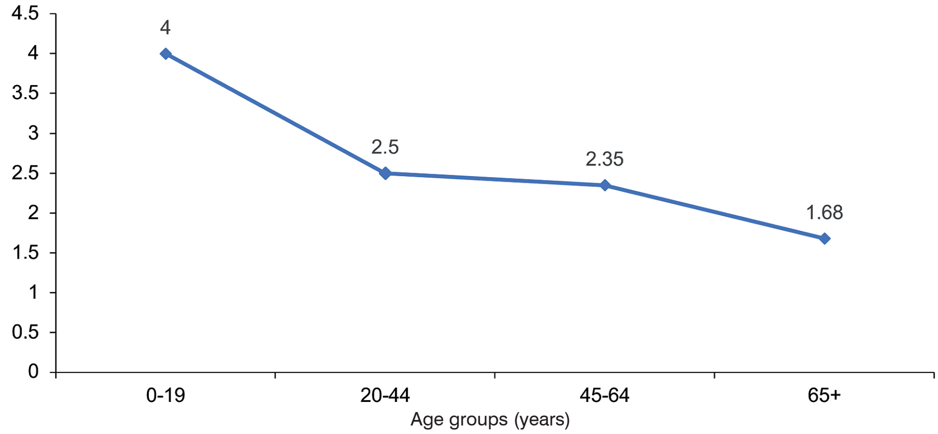

Fig. 5. Gender mortality rate due to COVID-19 in Biskra region

vacations, seasonal weddings, and other celebrations. Our results are in accordance with those reported by Jamshidi *et al*. (2020).

3.4. Mortality rates in relation to gender, age, and temperature

Our first hypothesis was that gender affects mortality rates. The result of the *t*-test ($p = 0.013$) indicates that gender has an impact on mortality.

The second hypothesis was that the influence of age on mortality is non-significant. After a descriptive analysis and Levene test for equality of variances, we performed one-way ANOVA. The results ($F = 7.158$, $p < 0.0001$) show that age indeed has a highly significant effect on mortality rates. The third hypothesis was that air temperature has a significant effect on mortality, but results of ANOVA ($F = 3.886$, $p = 0.219$) indicate that there is no significant effect of temperature on mortality caused by the virus. In addition, we calculated gender mortality rate (GMR) for individual age classes (Fig. 5). Both males and females' mortality rates are used to estimate this parameter. The results show a strong gender-age correlation. The high GMR in the age class 0-19 years is due to the very low death rate of females of that age, which enlarges the gap between genders. The later decrease in GMR is due to the aging factor influencing more strongly the female category, which shrinks the gap between mortality rates of both genders.

Several variables may influence the GMR, but habits are the key factors – particularly smoking, which is far more common among males. This makes smoking a significant contributor to the disparity between young males and females. The higher prevalence of smoking among men increases their vulnerability to severe outcomes, which could explain the large gap in GMR between the genders.

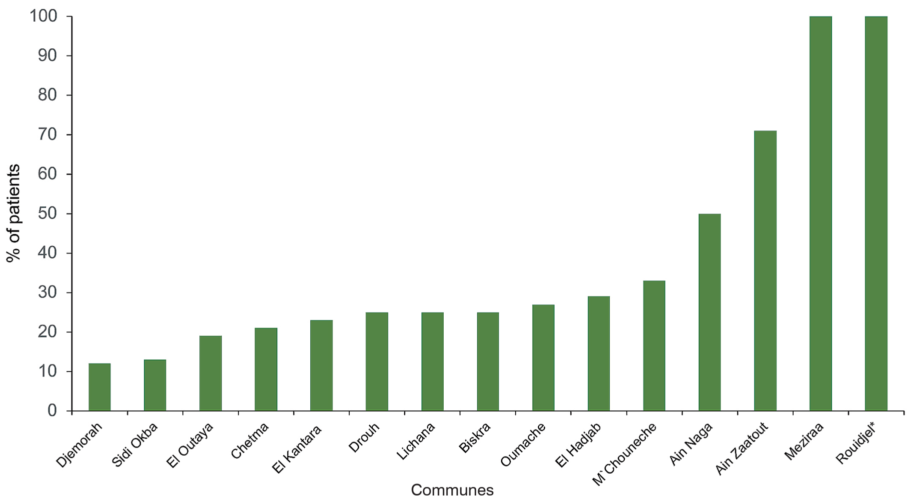

Fig. 6. Mortality rates of COVID-19 patients from various locations in 2020 (only single patients from Meziraa and Zeribet El Oued were admitted)

Explanation: * – Rouidjel is not a commune but a village in Zeribet El Oued commune. The location of Drouh was not identified

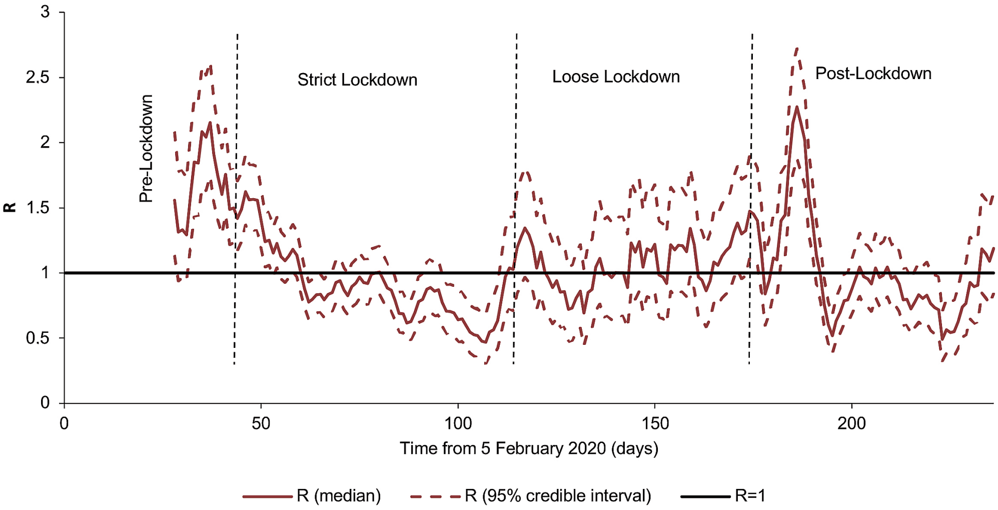

Fig. 7. Effective reproduction number (R_t) averaged over time periods in Biskra (posterior median and 95% confidence intervals)

3.5. Mortality rates in relation to patients' place of origin

According to our results (Fig. 6), admitted patients from Ain Naga, Ain Zaatout, Meziraa, and Zeribet El Oued had high mortality rates of 50%, 71.4%, 100%, and 100%, respectively, while in Biskra the mortality was much lower, only 25%. The lowest mortality (below 15%) was recorded for patients from Djemorah and Sidi Okba. Many reasons for these differences can be discussed; however, estimation of mean age helps to understand the relationship between mortality rates and location (obviously, locations with just one admission and death were omitted: Zeribet El Oued, Meziraa). The highest mean of 66.9 years was recorded in Ain Zaatout, while the lowest of 49.9 years, in Sidi Okba.

3.6. SARS-CoV-2 tests sensitivity

Four types of SARS-CoV-2 tests were performed for the hospital's patients during in 2020-2021. The nasopharyngeal (NSP) test, based on PCR, accounted for 83.01% of the total number of 2608 tests. In contrast, CT scanning for 11.31%, the antigenic test for 5.64%, and the rapid test was used only once (0.01%).

Regarding accuracy, CT scanning and rapid tests displayed 100% positive sensitivity, while the antigenic test 98% and the NSP test 73%. Their sensitivity does not have to do with the number of tests being performed (although that might increase a negligible error value) but it reflects the test's ability to detect a true positive/negative result for the actual positive or negative patients. The use of a NSP test is required, hence the possibility of having false negatives/positives and the requirement to enhance the test's accuracy by its combination with another test. A study performed by Fang *et al*. (2020) shows that a CT scan is more sensitive than the NSP test, so a combination of both tests is preferable. A serological test can also be empowered by a simultaneous use of another test. Although the Hakim Sadanne Hospital in Biskra performs tests according to their availability, it is advisable to improve disease monitoring by using the more sensitive tests and combining them.

3.7. Effective reproduction number (R_t)

Our results demonstrated the presence of 2 main peaks: on day 37 (corresponding to the second week of June) and on day 187 (the first week of November). The maximum value of R_t was 2.7 and the lowest was 0.53 (Fig. 7). R_t increased mostly after the authorities decided to lighten the burden on merchants and business owners by re-opening and allowing the activities to take place from 26 April. Once the lockdown was set again after Ramadhan, R_t decreased significantly (to less than 1) for more than 2 months. R_T started to increase again after lifting the traffic ban on 14 July and re-authorizing public transportation on 3 August. The second peak was related to the beginning of the new academic year, with workers and students coming back to Biskra region. The local authorities then lost the control for a while. With the decreasing number of susceptible patients, R_t values depended on the level of control and awareness of the authorities and citizens of Biskra.

3.8. Questionnaire survey on chronic diseases and COVID-19

The survey responses were combined to get a maximum accuracy of answers. Our results indicated that hypertension patients were the most numerous, accounting for about 73, followed by diabetes with

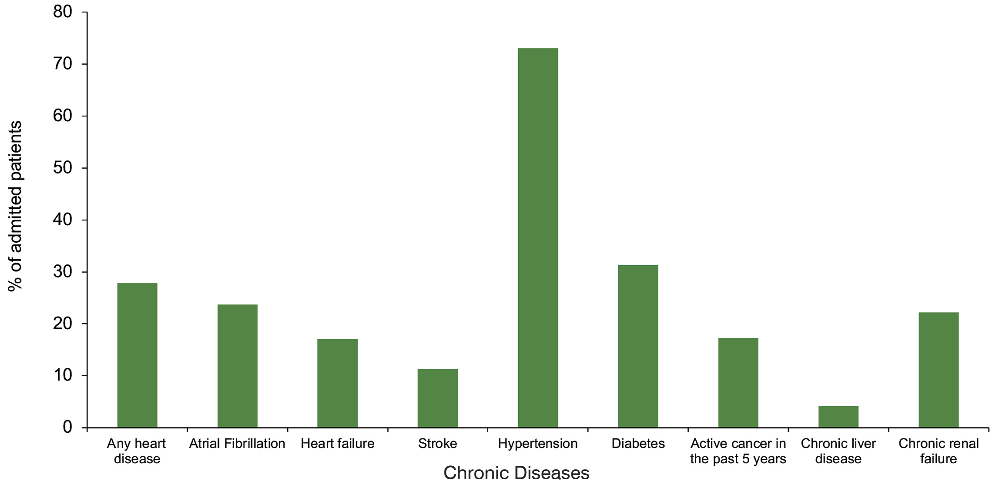

Fig. 8. Chronic diseases of COVID-19 patients admitted to the Hakim Sadanne Hospital in Biskra in 2020

31.3%. In contrast, chronic liver disease represented only 4.1% (Fig. 8).

Results of the chi-square test (Table 2) show that the virus has a significant effect on patients with pre-existing comorbidities after infecting them.

This finding is reliable with earlier results. The association between the renin-angiotensin aldosterone system's (RAAS) master regulator ACE2 and susceptibility to COVID-19 has disadvantages, such as uncontrolled hypertension and cardiac function deterioration (Hemidi & Dehimat 2021). The binding of SARS-CoV-2 to ACE2 can result in alteration of ACE2 signalling pathways, leading to acute myocardial and lung injury. Pre-existing cardiovascular disease increases the risk of death in patients with COVID-19, whereas COVID-19 itself can also induce myocardial injury, arrhythmia, and acute coronary syndrome (Hemidi & Dehimat 2021). In a previous study, Guo *et al*. (2020) reported that the SARS-CoV genome was positively detected in the heart. In addition, the virus was reported to damage cardiomyocytes directly.

In diabetic patients' pancreatic cysts damage already exists. With its ability to bind to ACE2 receptors, the virus can be linked to pancreatic tissue and β-cells, leading to an acute loss of insulin secretory capacity along with a stress condition and the cytokine storm. As a consequence, a rapid metabolic deterioration with development of diabetic ketoacidosis or hyperglycaemic hyperosmolar syndrome appears (Hemidi & Dehimat 2021).

A simple explanatory diagram sums up the whole concept of the influence of pre-existing comorbidities on COVID-19 (Fig. 9).

Those results are logical with our explanation about the alteration of ACE2 in tissues in multiple organs. In fact, within the Hakim Sadanne Hospital of Biskra, patients with no previous history of comorbidities developed a type of complexity in some organs after being severely affected by SARS-CoV-2.

3.9. Questionnaire surveys on medicinal plants used for COVID-19 treatment

3.9.1. Ethnopharmacological indices

A total of 6 plants belonging to 4 families were reported in interviews with herbalists in Biskra region (Fig. 10). Considering, the relative frequency of citation (RFC), *Melissa officinalis* L. was the most used herb during the pandemic, as it was mentioned by 87.5% of respondents, compared to 50% for *Eucalyptus globulus* Labill. and 25% for *Syzygium aromaticum* (L.) Merr. & L.M. Perry and *Artemisia vulgaris* L.

In the international survey, the most cited plant was *Zingiber officinale* Roscoe, commonly known as ginger, with 56.6%. It was followed by *Mentha*, mentioned by 43.4%. In contrast, for *Matricaria chamomilla* L.,

Table 2. Chi-square test results on comorbidity survey data

	Value	df	Asymptotic significance (bilateral)
Chi-square (Pearson)	16.584[a]	6	0.011
Likelihood report	18.675	6	0.005
Number of valid observations	215		

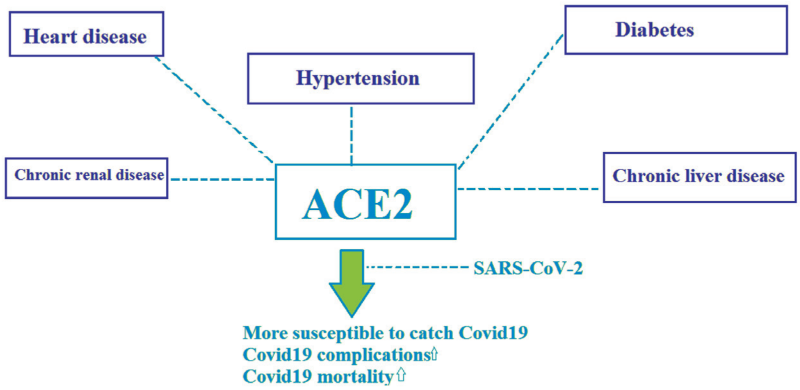

Fig. 9. Scheme of the impact of comorbidities on the consequences of infection with SARS-CoV-2 (Hemidi & Dehimat 2021)

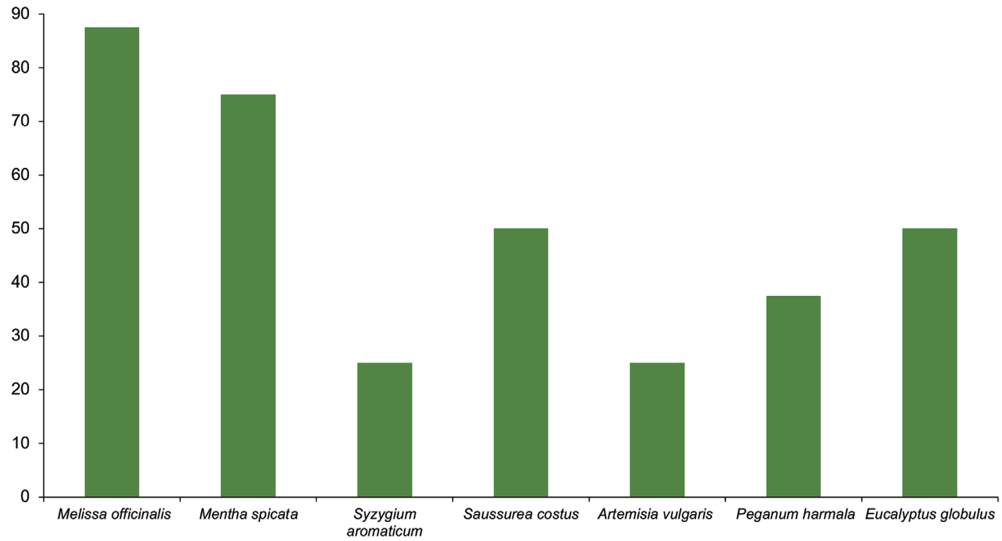

Fig. 10. Relative frequency of citation of medicinal plants used by Algerian herbalists in Biskra region for COVID-19 treatment

commonly known as chamomile, citation frequency reached only 2.0% (Fig. 11).

RFC depends on public awareness, old traditions or habits, and on the availability of a certain plant in the area. The plants with a high RFC both locally and internationally are very common in the area. Some species are applied due to the traditional background they have within the community for being well known to

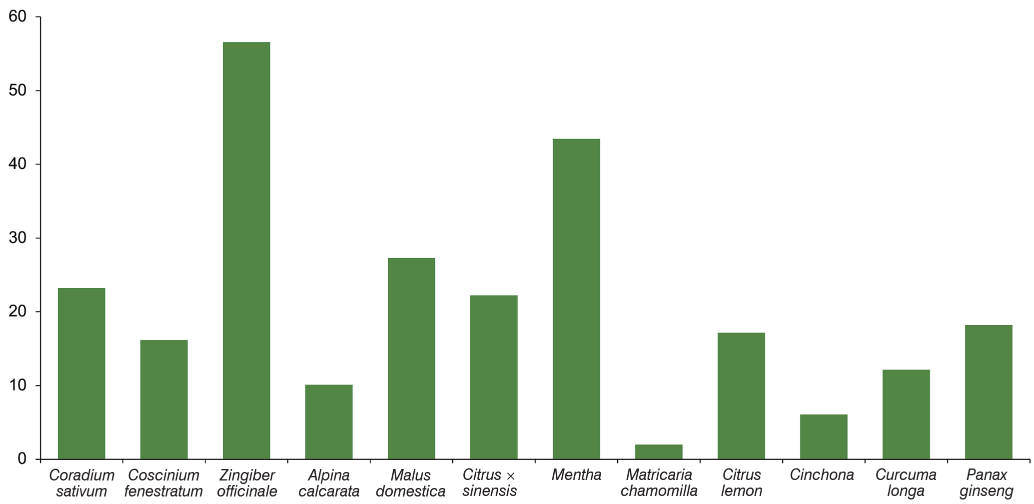

Fig. 11. Frequency of citation in the international survey of plants used for COVID-19 treatment

Table 3. List of plant species used to treat COVID-19 in Biskra region, Algeria

Family	Species & vernacular name	Parts involved, preparation	Bioactive compounds	Bioactivity
Asteraceae	*Artemisia vulgaris* L.; Shih شيح	leaves, infusion	eudesmane-type sesquiterpene, morin, luteolin, triterpenes, coumarin, flavonoids, eriodyctol (Kumar *et al*. 2021)	antioxidant, hepatoprotective, antispasmolytic, antiviral against SARS-CoV-2 (Ekiert *et al*. 2020; Kshirsagar & Rao 2021)
	Saussurea costus (Falc.) Lipsch.; Al Quist Al hindi القسط الهندي	roots, ground and infused in water	terpenes, flavonoids, anthraquinones, alkaloids, tannins, sesquiterpene lactones, inulin (Bagheri *et al*. 2018)	anti-ulcer, antiangiogenic, plant growth regulator, antimicrobial (Zhao *et al*. 2017)
Lamiaceae	*Mentha spicata* L.; Na'na' نعناع	leaves, infusion	carvone, limonene, dihydrocarveol (Ay Kee *et al*. 2017; Ali-Shtayeh *et al*. 2019)	antioxidant, anti-inflammatory, antimicrobial, sedative (Ali-Shtayeh *et al*. 2019)
	Melissa officinalis L.; Na'na' soufi النعناع الصوفي	leaves, infusion	terpenes: α-pinene, cis-p-meth-2 en-7-ol, 2-pinen-4-one, nerol acetate; phenolic compounds: patchoulene 1R-α-pinene, isogeraniol, geraniol (Miraj *et al*. 2017)	antioxidant, digestive, carminative, antispasmodic, sedative, analgesic, tonic, diuretic (Miraj *et al*. 2017)
	Syzygium aromaticum (L.) Merr. & L.M.Perry; Tib الطيب	flowers, maceration	2-phenyl ethanol, benzyl alcohol, eugenol, chavicol, 4-hydroxy, 3-methoxy-benzeneacetic acid, hexadecanoic acid (Chaachouay *et al*. 2021)	anti-inflammatory, antimicrobial, antioxidant (Chaachouay *et al*. 2021)
Myrtaceae	*Eucalyptus globulus* Labill.; Kalitous الكاليتوس	leaves, infusion	myricetin, linalool, urosolic acid, apigenin (Chaachouay *et al*. 2021)	antiviral: SARS-CoV, hepatitis B and C virus (Chaachouay *et al*. 2021)

treat common colds and strengthen the immune system, while in the international community *Panax ginseng* C.A. Mey. is used for its therapeutic properties since ancient times. Recent research has proved its antiviral effects (Lee & Rhee 2021). Our results concerning plant species used to treat COVID-19 in Biskra rgeion are presented in Table 3.

We calculated also other ethnopharmacological indices: use value (UV) and fidelity level (FL). Results of the interviews with herbalists indicate that *Melissa officinalis* and *Mentha spicata* L. had the highest UVs of 3.0 and 2.5, respectively, compared to *Eucalyptus globulus, Saussurea costus* (Falc.) Lipsch., *Syzygium aromaticum*, *Peganum harmala* L., and *Artemisia vulgaris* with 1.7, 1.5, 1.3, 1.2, and 1.1, respectively. Considering fidelity, both *Eucalyptus globulus* and *Syzygium aromaticum* reached FL of 100%, in contrast to *Artemisia vulgaris* and *Peganum harmala*, with FL of only 50% each (Fig. 12).

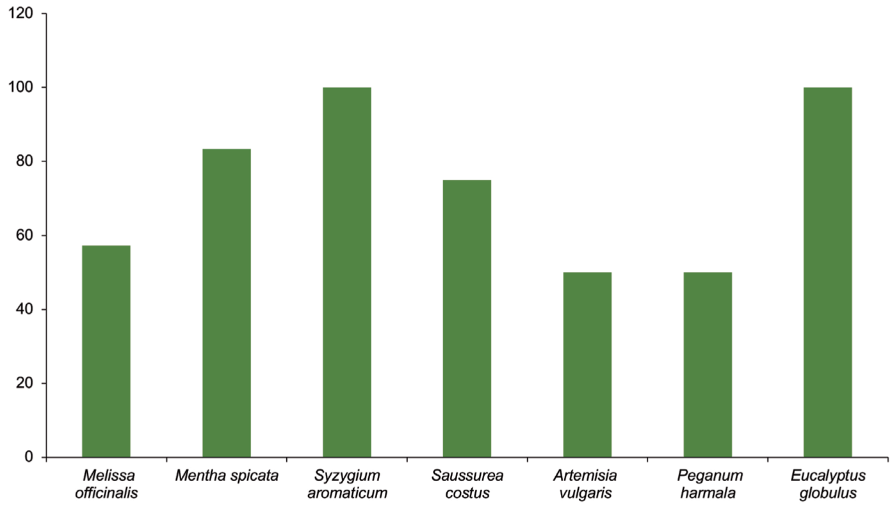

Fig. 12. Fidelity levels of plants mentioned by herbalists as used for curing COVID-19 in Biskra region

This approach was specifically employed to find differences between the common use of a certain species against whatever diseases, and between the specific use of this certain species against COVID-19 itself. For instance, *Syzygium aromaticum* is a species that has a lower UV and RFC but has a high FL, indicating that the herbalists use this plant specifically to fight COVID-19, unlike *Melissa officinalis*, which is used for a wide range of health problems and healing from the virus is only one of them.

3.9.2. Comparison between the traditional and conventional treatment

The difference in use of each plant strongly relies on indigenous people's strong belief that it has the beneficial components to cure an illness they are facing, so some irrational values may be spotted.The typical pharmacological treatment prescribed for COVID-19 in the Hakim Sadanne Hospital is: Orocal 200 mg (calcium and vitamin D), Zomax 500 mg (a complex supplement composed of *Tagetes erecta* L. extract, lutein, zeaxanthin, vitamins B2, E, and A, zinc, and selenium), zinc, vitamin C, Lovenox 0.4-0.8 ml (enoxaparin), and Doliprane 500 mg (paracetamol). Orocal is used for antimicrobial treatment with Cefixime (cephalosporin), mainly to treat infections caused by bacteria, such as bronchitis (Quintiliani 1996). However, antimicrobial properties are found in many plants, for example in *Saussurea costus* (Asteraceae), efficient especially against respiratory bacteria *Pseudomonas aeruginosa* and *Klebsiella pneumonia* (Othman 2013).

According to Butler *et al*. (2021), Zomax 500 mg works with azithromycin as an anti-inflammatory and antiviral agent increasingly used in the period of COVID-19 infections even within the United Kingdom. Algerian indigenous people saw similar effects in the use of *Melissa officinalis* and *Syzygium aromaticum* for their pre-existing antiviral activity against viruses such as herpes virus 1 and 2, aside from their antimicrobial effect (Cortés-Rojas *et al.* 2014). People in the area of Biskra are not really aware that by consuming *Artemisia* they obtain very high zinc amounts, higher than any other vegetable they consume (Wang *et al.* 2020). We can conclude that the consumption of herbs within Biskra region does not discredit the inhabitants of the area. However, the belief that a plant has a stronger curative effect than another is solely built on presumptions and has to do with the presence of that herb in the area or the influence one individual has on the rest of the community in convincing them of its efficacy. Still, most of these plants are gradually proven to be helpful in either fighting the virus or just minimizing the interval of COVID-19 symptoms, which is thought to be beneficial for the patient.

4. Conclusions

Data from the Hakim Sadanne Hospital in Biskra show that gender, age, and mortality caused by COVID-19 are analysed and related. Our results indicate that patients with pre-existing comorbidities (like heart disease, high blood pressure, and diabetes) are at a higher risk of contracting the virus and experiencing severe complications. The ethnopharmacological investigations indicated that most of people prefer alternative treatments over pharmaceutical ones due to belief in their safety, efficacy, and accessibility. This preference was particularly strong during the period when authorities were struggling to meet the high demand for medical care.

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