https://doi.org/10.32394/pe.76.14

Karouche Saida, Benbott Amel, Rouar Salim Djouad Marwa, Hafiane Chaima

EPIDEMIOLOGICAL AND CLINICAL CHARACTERISTICS OF COVID-19 IN EASTERN ALGERIA

Faculty of Exact Sciences, Natural and Life Sciences, Universite of Larbi Ben Mhidi Oum El Bouaghi-Algeria

ABSTRACT

INTRODUCTION. COVID-19 is a highly transmissible and pathogenic viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Algeria was also affected by the COVID-19, it was considered the third most affected country in Africa.
AIM. The main aim of the study was to identify risk factors and the impact of risk factors on the incidence SARS-CoV-2 infection and the clinical course of the COVID-19, through a behavioral survey on a representative sample of the people who have been previously diagnosed with COVID-19.
MATERIALS AND METHODS. A partial cross-sectional study of 808 people from a population of both sexes, aged 1 to 90 years allowed the description of the epidemiological profile of patients in the city of Oum-El-Bouaghi in eastern Algeria.
RESULTS. The results of the study shows that the SASR-CoV-2 infection appears to be very strongly related to social and biological factor. The relationship between different BMI classes and the pandemic is confirmed by a significant difference ($p<0.001$). The results of the epidemiological profile of the SARS-CoV-2 infected population shows that COVID-19 particularly affects people aged 40-50 years. In was noted that there is a very highly significant difference ($p=0.000$) between age and COVID-19. Although no relationship between disease and gender of patients was observed ($p=0.110$). It was also noted that there is a very significant difference ($p=0.001$) between smoking and SARS-CoV-2 infection. And the survey data show that marriages predominate among patients.

Keywords: *Algeria, COVID-19, epidemiology, risk factors*

INTRODUCTION

The new coronavirus, which is called SARS-CoV-2 by the International Committee on Taxonomy of Viruses (1), can cause several diseases, ranging from the common cold to severe acute respiratory syndrome. Coronavirus disease (COVID-19) is a highly transmissible and pathogenic viral infection caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which emerged in Wuhan, China and spread around the world (2).

Algeria was also affected by the COVID-19; it was considered the third most affected country in Africa. As of November 01, 2020, the total number of COVID-19 cases confirmed by PCR in Algeria was 58 272 including 1 973 deaths, with an incidence rate of 132.74/100,000 inhabitants and a fatality rate of 3.39% (3). The Prime Minister, as part of the system adopted by the public authorities in the management of the health crisis, has adopted the following measures:

- Adaptation of 23-hour partial home confinement;
- Maintenance of the prohibition measure, throughout the national territory, of any type of gathering of people and family reunification, in particular the celebration of marriages and other events.

In order to better evaluate the spread of COVID-19 and allow a comparison of epidemiological data, facilitate surveillance, predict the future extent of this epidemic and assess the effectiveness of intervention strategies it is imperative to establish a database on all geographical areas of our country. Including information on disease incidence and the main drivers of transmission. Identified risk factors could form the basis for the development of preventive strategies. In this context, this study's main objective is the identification of risk factors and the impact of risk factors on the infection SARS-CoV-2 occurrence and the clinical course of the COVID-19, through a behavioral survey on a representative sample of the people who have

been previously diagnosed with COVID-19, through: positive antibody test from venous blood, or typical leasions on chest CT scan, or positive PCR at the time of the study, from an urban agglomeration located in the East of Algeria.

MATERIAL AND METHODS

Study population. We carried out a cross-sectional questionnaire study on a sample of 808 people, men and women combined, aged 1 to 90 years from the city of Oum-El-Bouaghi in the East of Algeria. No tests were offered during the study. Infectious status was established based on self-reported diagnosis with positive antibody tests from venous blood, typical leasions on chest CT scan, or positive PCR tests and fever, vomiting were the most frequent symptoms.

Sampling strategy. The sampling strategy was developed and carried out in collaboration with the National Statistics Office of Constantine. This is a two-stage random survey, at the first stage the sampling unit is the district and at the second stage the unit is the ordinary household regardless of its size. Thus, out of the 51 districts of the commune of Oum El Bouaghi (Coordinates 35° 52′ 39″ north, 7° 06′ 49″ east Altitude 891m). In each household 2 to 9 people were drawn. In total 300 households were included corresponding to 808 people surveyed.

Data collection:

- **Type and period of study.** The survey period was from March 02 to March 17, 2021. Data collection was carried out through an interview, based on a validated questionnaire. The interview based on simple questions that allow us information on profession, age, sex, BMI, marital status, symptoms of SARS-CoV-2: fever, cough, vomiting, diarrhea and fatigue, tests used to diagnose the coronavirus and the duration of recovery, the number of family members, as well as chronic diseases, medicinal plants used to treat SARS-CoV-2, stress, the notion of tobacco and alcohol.
- **Inclusion criteria.** We included subjects irrespective of sexes and age, residents of Oum-El-Bouaghi, living in households, of different age groups.
- **Exclusion criteria.** We excluded subjects residing outside the region, who did not respond to the questionnaire, absent on the day of the survey.

Statistical analysis. Data processing and analysis were performed using SPSS software version 25. Results were calculated as frequencies (%), means, and standard deviations. Bivariate statistical analysis was performed by applying classical parametric tests. The correlations between overweight/infection, sex and age, and the various categorical variables were studied using the Chi-square test. Pearson's correlation was used for comparison of percentages and the logistic regression of the risk of COVID-19 infection applied for our study data processing, in order to examine the role of different factors risk. $P<0.05$ was considered statistically significant.

RESULTS

Characteristics and description of the survey sample. A total of 808 patients were surveyed, of which 54.7% were men and 45.3% were women, with a 1.15 sex ratio.

Of the 808 individuals surveyed, only 12.13% individuals were infected in the past with SARS-CoV-2 during the survey period with predominance of men (62.24%) as compared to the percent of women 37.76%.

Characteristics of participants by infectious status. The present study has shown that the majority of patients with COVID-19 are adult males, with an average age of 45.41 years. The distribution of patients by sex and age, indicates that COVID-19 affects in particular individuals in the 40-50 age group for males (24.59%) and 51-61 years for females (21.62%). There is a very highly significant difference ($p<0.001$) between age and infection with COVID-19 but there is no significant difference between sex and frequency of SARS-CoV-2 infection ($p=1$).

The distribution by BMI, reported in Table 1, indicates that among COVID-19 cases the distribution overweight vs. non-overweight persons was 61.23% and 38.76% respectively. A highly significant correlation ($p<0.001$) is noted between BMI and the frequency of COVID-19. This study showed that the proportion of the individuals previously diagnosed with COVID-19 and having a BMI>35kg/m^{2}appears lower 3.06% in the case of the obesity classe 3.

The distribution of infected people according to professional situation shows that nearly 32% of patients are inactive and do not have a stable income. There is a very highly significant difference ($p<0.001$) between professional situation and the infection status.

The distribution of infected people according to professional situation and the number of household members (Fig. 1) shows that the class of unemployed patients who have more than 5 family members seems to be the most infected by COVID-19 compared to the others.

The survey data show that the frequency of patients seems very high, particularly among married couples. It is noted that there is a very highly significant difference in marital status and the infection status (Fig. 2).

Table 1. Characteristics and description of the survey sample

		Infected		Not infected		Total		p-value
		N	%	N	%	N	%	
Sex	Women	37	37.76%	329	46.33%	366	45.3 %	0.110
	Men	61	62.24%	381	53.66%	442	54.7 %	
Age group	1-18	5	5.10%	205	28.87%	210	26%	0.000
	18-28	18	18.40%	126	17.74%	144	17.90%	
	29-39	15	15.30%	154	21.69%	169	21%	
	40-50	22	22.40%	104	14.64%	126	15.60%	
	51-61	11	11.20%	60	8.45%	71	8.80%	
	62-72	18	18.40%	57	8.02%	75	9.30%	
	73-90	9	9.20%	9	1.26%	18	2.30%	
Professional situation	Unemployed	31	31.64%	260	36.61%	291	36.02%	0.000
	Retired	16	16.33%	51	7.18%	67	8.29%	
	Traders	8	8.16%	42	5.91%	50	6.19%	
	Employed	25	25.51%	124	17.46%	149	18.44%	
	Executive	6	6.12%	26	3.66%	32	3.96%	
	Schooled	12	12.24%	207	29.15%	219	27.10%	
Marital status	Single	15	15.30%	383	53.94%	398	49.30%	0.000
	Married	75	76.53%	306	43.09%	381	47.20%	
	Widowed	6	6.12%	14	1.97%	20	2.50%	
	Divorced	2	2.04%	6	0.84%	8	1%	
Number of household members	1 - 5	54	42.84%	309	43.52%	363	44.91%	
	>5	44	38.77%	401	56.47%	445	55.09%	
Smoking status	Never smoked	43	44.26%	617	86.90%	660	81.68%	0.001
	Past smoker	8	8.19%	15	2.11%	23	2.85%	
	Current smoker	30	31.15%	95	13.38%	125	15.47%	
BMI	Normal weight	38	38.76%	359	50.56%	397	49.10%	
	Overweight	42	42.86%	179	25.21%	221	27.40%	0.000
	Class I obesity	13	13.27%	61	8.59%	74	9.20%	
	Class II obesity	2	2.04%	11	1.54%	13	1.60%	
	Class III obesity	3	3.06%	6	0.84%	9	1.10%	
Chronic diseases	Arterial hypertension	22	22%	688	96.90%	710	87.87%	0.815
	Diabetes	19	20%	5	0.70%	24	2.97%	
	Allergies	20	21%	9	1.26%	29	3.58%	
	Asthma	17	17%	4	0.56%	21	2.59%	
	Rheumatic disease	8	8%	1	0.14%	9	1.11%	
	Cardiovascular disease	7	7%	2	0.28%	9	1.11%	
	Others	5	5%	1	0.14%	6	0.74%	
Stress		48	48.98%	251	35.35%	299	37%	1.000

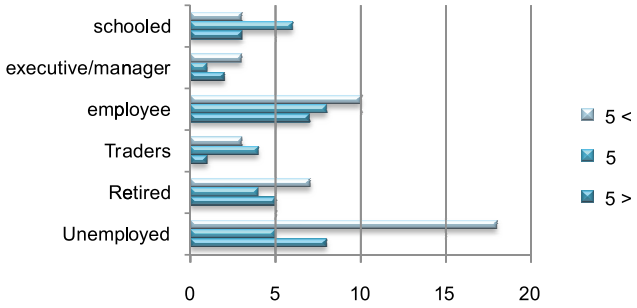

Fig. 1. Distribution of infected people according to their professional situation and number of household members

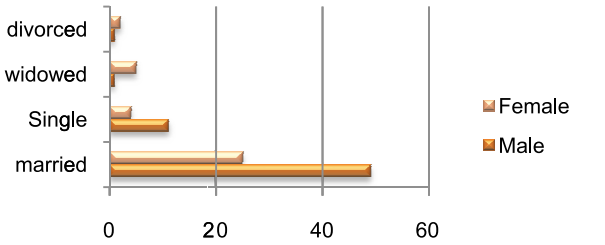

Fig. 2. Distribution of infected people by gender and marital status

Smoking is noted especially frequent among men, the data collected in Figure 3 also indicates that the age group most concerned by tobacco notion is that of 18 to 28 years with 14.75% infected people. It is noted that the proportion of smokers decreases to reach 6.56% for the two age groups 29-39 years and 40-50 years, 3.28% for 62-72 years. And it is zero for the elderly. Conversely, it is noted that smoking cessation begins from the age of 40 years.

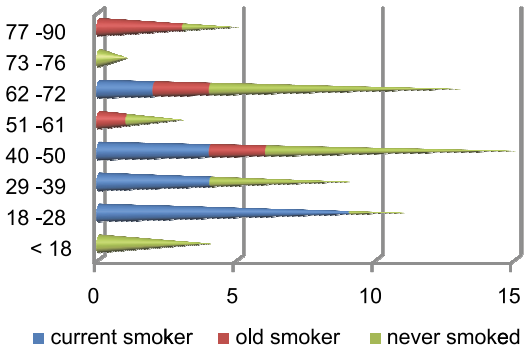

Fig. 3. Smoking status of infected people according to age groups

According to the obtained results; on average, 22% of infected individuals have arterial hypertension, 21% show different types of allergies, 20% of patients are diabetic, 17% of patients suffer from asthma, 8% have osteoarthritis or rheumatic disease, 7% have cardiovascular disease, 4% and 1% show thyroid disease and kidney problems respectively. It is noted that there is no significant relationship between chronic diseases and patient gender ($p>0.05$).

Symptoms. The distribution of people who were diagnosed with COVID-19 in the past according to the type of symptoms is reported in Figure 4. It shows that fever was the most frequent symptom with a total of 75 patients. This symptom is one of the most common symptoms according to the WHO. In contrast, vomiting was the less common symptom which is also confirmed by WHO.

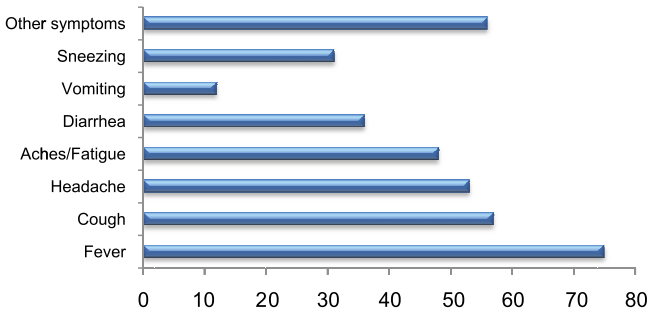

Fig. 4. Distribution of patients by the symptoms they have had

Distribution of individuals according to the medicinal plants they take. The infected people took any supporting medicinal plants (natural supplements) after falling ill. Data recorded in Figure 5 reveals that ginger is the most used plant by most of the individuals surveyed. While *Artemisia* ranks first among infected individuals.

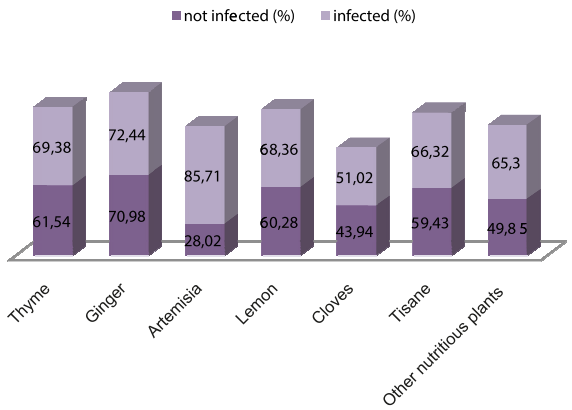

Fig. 5. Distribution of the study sample according to the medicinal plants taken and SARS-CoV-2 infection

Distribution of patients by diagnosis types. The distribution of people who have been previously diagnosed with COVID-19, through: positive PCR, or positive antibody test from venous blood, or typical leasions on chest CT scan shows that nearly half of the patients were diagnosed by positive antibody test which

allow the detection of specific antibodies produced by the body and directed against SARS-CoV-2. These tests are performed on blood samples. 46 individuals were noted for this type of tests; on the other hand, 27 patients surveyed have recourse to chest scan and 11 of the infected people diagnosed with positive PCR which appears to be the least used test.

Distribution of infected people according to duration of illness/symptoms. The distribution of infected people according to duration of symptoms reported in Figure 6 shows that most patients recovered in two weeks with a total of 31 patients. Questionnaires analysis revealed two men deaths.

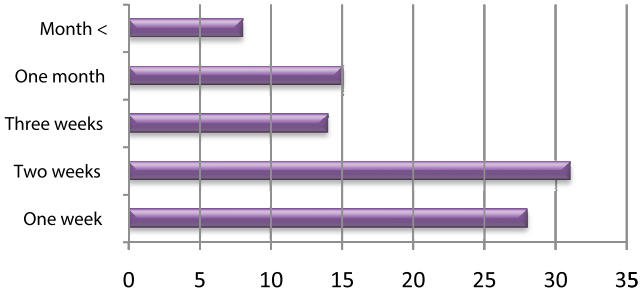

Fig. 6. Distribution of infected people according to attack and recovery duration

DISCUSSION

Our results are consistent with those of studies conducted in Wuhan where they have shown that the majority of patients with COVID-19 are adult men, their average ages were 55.5 years (4-6). There is uncertainty regarding the role of different age groups in propagating the SARS-CoV-2 epidemics in different countries. While disease is most severe in older age groups, a sizeable share of COVID-19-related hospitalisations in the United States and other countries occurs in individuals aged 20-55 years. A study of close contacts of COVID-19 cases in China found comparable rates of infection with SARS-CoV-2 in different age groups. South Korea adopted one of the most inclusive testing practices for SARS-CoV-2 in the world, and the rate of detected cases in South Korea is highest in persons aged 20-29 years (7).

In our survey, a highly significant correlation ($p<0.001$) is noted between BMI and the frequency of COVID-19. The same results have been proven by the study of Masson et al. (8), in which being overweight is a risk factor associated with severe forms of coronavirus.

The distribution of infected people according to the number of household members in our study shows that higher infection rates are associated with unemployment and living in collective households who have more than 5 family members. Collective forms of housing lead to the spread of epidemics. The Somali Medical Association in Sweden has suggested that the co-presence of "several living in the same apartment" is a factor that affects COVID-19 spread. From the 1980s, sociologist Annie Thébaud-Mony identified the occupancy rate per room as a factor accelerating contagion by tuberculosis. The poorest neighborhoods of Stockholm and France have many more cases and excess mortality than the rest of the city. This first appears as a consequence of housing conditions, and in particular of overcrowding (9).

We observed a very significant association between the tobacco use and infection with SARS-CoV-2. Indeed, it was suggested in a recent study that smoking may increase the expression of angiotensin converting enzyme 2 in lung tissue (10) which has been suggested as the SARS-CoV-2 receptor (11).

22% of infected people in our study have arterial hypertension, the same results were reported by the study of Ryu et al. (12), in which hypertension was detected in 23.2% (n=255), followed by diabetes mellitus (14.9%). Chen et al., also showed that 50.5% (n=51) of patients suffered from chronic medical conditions (4).

The survey data shows that the infected people took any supporting medicinal plants (natural supplements) after falling ill where medicinal plants help the immune system to better resist diseases. In China, *Artemisia annua* has played a special role fighting against the coronavirus because it is given on its own and not mixed with other plants. It is used to resolve symptoms of moderate breathing difficulty, and it is consider as safe and effective plant (13). In West Africa, many plant species are used in the management of respiratory diseases, which may offer the opportunity for possible use against respiratory manifestations linked to COVID-19 (14).

A limitation of our study is that different methods were used to establish infection status, instead of just PCR considered a gold standard. However, our study is retrospective in nature and the distribution of the diagnostic methods used reflect the way COVID-19 is diagnosed in our country. Moreover, a retrospective Chinese study carried out on 1,014 patients with COVID-19, aimed to compare the sensitivity and specificity of RT-PCR and the chest CT scan, revealed that the sensitivity of the chest CT scan is estimated at 97%, and the specificity at 25%, against a sensitivity of 65% and a specificity of 83% for RT-PCR (15).

CONLCUSIONS

Our research indicates that the SARS-CoV-2 diagnosis was not related to gender, chronic diseases or stress. On the other hand the infection risk is mainly

linked to age, BMI, professional situation, tobacco notion and marital status.

Regarding prevention, it was noted that the majority of people surveyed take medicinal plants in order to strengthen their immune systems. Our survey results indicate that socio-demographic characteristics of COVID-19 epidemic in Algeria are in line with observed in other countries. Larger then – for example – noted in Europe household sizes may contribute to infection spread in our country. We note that similarily to countries in Asia and Africa a multiplicity of plant medicines were used to self-treat COVID-19 infection. Their effectiveness should be evaluated. According to the results obtained during the survey, we suggested to use the medicinal plants to treat the COVID-19 infection.

Acknowledgments.
We would like to thank everyone who took the time to respond to our survey.

Conflict of Interest.
The authors declare that they have no conflict of interest.

REFERENCES

1. Gorbalenya AE, Baker SC, Baric RS, et al. Severe acute respiratory syndrome-related coronavirus: The species and its viruses – a statement of the Coronavirus Study Group. BioRxiv 2020.
2. Dae-Gyun A, Hye-Jin S, Mi-Hwa K, et al. Current Status of Epidemiology, Diagnosis, Therapeutics, and Vaccines for Novel Coronavirus Disease 2019 (COVID-19). J Microbiol Biotechnol 2020;30(3):313-24.
3. Algerian health and hospital reform minister: Carte épidémiologique. Available at: https://www.covid19. gov.dz/carte/ (Accessed: April 18, 2020).
4. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. The Lancet; 2020;395(10223):507-13.
5. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet 2020;395(10223):497-506.
6. Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus–Infected Pneumonia in Wuhan, China. JAMA 2020;323(11):1061.
7. Goldstein E, Lipsitch M. Temporal rise in the proportion of younger adults and older adolescents among coronavirus disease (COVID-19) cases following the introduction of physical distancing measures, Germany, March to April 2020. Eurosurveillance 2020;25(17):2000596.
8. Masson M, Gaillard R. La psychiatrie française confrontée à l'inédit : la crise de la COVID-19. L'Encéphale 2020;46(3):S1-2.
9. Bessiere C, Biland E, Gollac S, et al. Penser la famille aux temps du Covid-19. 2020;22.
10. Cai G. Bulk and single-cell transcriptomics identify tobacco-use disparity in lung gene expression of ACE2, the receptor of 2019-nCov. 2020;15.
11. Xu X, Chen P, Wang J, et al. Evolution of the novel coronavirus from the ongoing Wuhan outbreak and modeling of its spike protein for risk of human transmission. Sci China Life Sci 2020;63(3):457-60.
12. Ryu S, Chun BC. An interim review of the epidemiological characteristics of 2019 novel coronavirus. Epidemiol Health 2020;42 e2020006.
13. van der Kooy F, Sullivan SE. The com:lexity of medicinal plants: The traditional Artemisia annua formulation, current status and future perspectives. J Ethnopharmacol 2013;150(1):1-13.
14. Haidara M, Diarra ML, Doumbia S, et al. Plantes médicinales de l'Afrique de l'Ouest pour la prise en charge des affections respiratoires pouvant se manifester au cours de la Covid-19. Int J Biol Chem Sci 2020;14(8):2941-50.
15. Li Y, Yao L, Li J, et al. Stability issues of RT-PCR testing of SARS-CoV-2 for hospitalized patients clinically diagnosed with COVID-19. J Med Virol 2020;92(7):903-8.

Received: 08.10.2021
Accepted for publication: 11.07.2022
Address for correspondence:
Karouche Saida
Faculty of Exact Sciences,
Natural and Life Sciences,
Universite of Larbi Ben Mhidi Oum El Bouaghi-Algeria
e-mail: saidabmc86@yahoo.fr