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Research Article

COVID-19 and Public Health in Algeria: The Mitigating Role of Physical Activity

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Abstract

Background: Coronavirus (COVID-19) is a respiratory illness with global spread and significant health risks, particularly for individuals with comorbidities or weakened immunity. ***Objectives***: This study evaluated the impact of COVID-19 on appetite, olfactory and gustatory functions, associated diseases, and the role of physical activity in health maintenance. ***Methods***: A cross-sectional retrospective survey was conducted among 323 Algerian adults previously infected with COVID-19 (43.74±17.48 years; 175 females, 148 males). The questionnaire collected data on demographics, anthropometrics, COVID-19 symptoms, comorbidities, and physical activity levels. ***Results***: Overweight and obesity were prevalent in 40.25% and 14.55% of participants, respectively, with significantly higher rates in those over 40 years (p=0.022). Sensory disturbances during infection were common: 84.21% experienced loss of smell, 75.54% loss of taste, and 37.46% appetite loss. A total of 21.98% reported COVID-19-related illnesses, primarily respiratory and cardiac complications. Notably, there was a strong inverse association between physical activity and disease occurrence (p<0.001; r=0.783), indicating that higher levels of physical activity are linked to a lower incidence of COVID-19-related illnesses. ***Conclusions***: COVID-19 significantly affects sensory functions and contributes to comorbid conditions, especially among overweight and obese individuals. Regular physical activity appears to be a protective factor associated with reduced risk of COVID-19-related illness.

Keywords: COVID-19; Exercise; Physical activity; Public health.

كوفيد-19 والصحة العامة في الجزائر: الدور المعتدل للنشاط البدني

الخلاصة

الخلفية: فيروس كورونا (COVID-19) هو مرض تنفسي منتشر عالميا وله مخاطر صحية كبيرة، خاصة للأشخاص الذين يعانون من أمراض مصاحبة أو ضعف في المناعة. **الأهداف**: تقييم تأثير كوفيد-19 على الشهية، ووظائف الشم والتذوق، والأمراض المرتبطة به، ودور النشاط البدني في الحفاظ على الصحة. **الطرائق**: أجري مسح مقطعي استعادي بين 323 بالغا جزائريا مصابين سابقا بكوفيد-19 (43.74±17.48 سنة؛ 175 أنثى، 148 ذكرا). تم جمع بيانات عن الديموغرافيا، والوزن القياسي، وأعراض كوفيد-19، والأمراض المصاحبة، ومستويات النشاط البدني. **النتائج**: كان الوزن الزائد والسمنة شائعين بين 40.25٪ و14.55٪ من المشاركين على التوالي، مع معدلات أعلى بشكل ملحوظ بين من هم فوق 40 عاما (p=0.022). كانت الاضطرابات الحسية أثناء العدوى شائعة: فقد فقد 84.21٪ حاسة الشم، و75.54٪ فقدان التذوق، و37.46٪ فقدان الشهية. بلغ إجمالي 21.98٪ عن أمراض مرتبطة بكوفيد-19، خاصة مضاعفات تنفسية وقلبية. ومن الجدير بالذكر وجود ارتباط عكسي قوي بين النشاط البدني وحدوث المرض (p<0.001؛ r=0.783)، مما يشير إلى أن مستويات النشاط البدني الأعلى مرتبطة بانخفاض معدل حدوث الأمراض المرتبطة بكوفيد-19. **الاستنتاجات**: يؤثر كوفيد-19 بشكل كبير على الوظائف الحسية ويساهم في حالات مصاحبة، خاصة بين الأشخاص الذين يعانون من زيادة الوزن والسمنة. يبدو أن النشاط البدني المنتظم عامل حماية مرتبط بتقليل خطر الإصابة بأمراض مرتبطة بكوفيد-19.

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INTRODUCTION

The COVID-19 virus has spread globally, infecting over 600 million individuals and resulting in more than 6.5 million deaths [1]. Declared a global pandemic, the coronavirus outbreak has profoundly impacted healthcare systems, economies, education, transportation, and numerous other sectors [2]. Coronaviruses, a large family of viruses first identified in 1965, include COVID-19, which has recently emerged as a significant pathogen affecting humans. These viruses are classified into three genotypes: alpha, beta, and gamma [3]. The COVID-19 pandemic has had a considerable impact on Arab nations in the Middle East and North Africa. By February 15, 2022, these countries reported approximately 12.4 million cases and 162,500 fatalities. Algeria, alongside Egypt and South Africa, was identified as one of the three African nations at the highest risk of reporting COVID-19 cases [4]. Algeria had confirmed 218,432 COVID-19 cases and 6,284 deaths by the end of December 2021 [5]. Pregnant women, older adults, and people who

already have health problems like cancer, lung disease, immune suppression, or obesity are more likely to get COVID-19 [6]. Patients who tested positive for COVID-19 most often reported having a cough, fever, and tiredness. The median age of cases was 54.4 years, with 61% being over 50. Biological abnormalities frequently observed included elevated sedimentation rates, LDH, CRP, ALT/AST levels, and reduced lymphocyte counts [7]. Additionally, data reveal that approximately 75% of hospitalized COVID-19 patients have at least one underlying condition. Hypertension, diabetes, cancer, neurodegenerative disorders, cardiovascular diseases, obesity, and kidney disorders are the most common of these [8]. Physical activity plays a crucial role in promoting both physical and mental health. Engaging in regular physical activity helps prevent and manage various chronic diseases, enhances overall well-being, and contributes positively to communities and societies [9]. However, globally, 23% of adults and 81% of adolescents (aged 11–17 years) fail to meet recommended levels of physical activity. Rates of inactivity vary widely both within and across countries, reaching up to 80% in certain adult populations. Economic development contributes to rising inactivity levels due to shifts in transportation habits, increased reliance on technology, urbanization, and evolving cultural norms, which can lead to a more sedentary lifestyle and reduced opportunities for physical activity. Significant disparities exist, with girls, women, older adults, marginalized groups, low-income individuals, people with disabilities or chronic illnesses, and rural residents facing greater barriers to accessing safe, affordable, and suitable environments for physical activity [10]. This study aimed, first, to assess the impact of COVID-19 on olfactory and gustatory functions as well as appetite among the Algerian population. Second, to evaluate the diseases associated with COVID-19, comorbidities, and the role of physical activity in maintaining health.

METHODS

Participants and study design

A cross-sectional retrospective randomized study was conducted in Algeria from April to July 2024 and involved various regions of the Algerian country. A questionnaire survey was distributed to Algerian individuals (> 18 years) affected by COVID-19, with data collected through social networks like Facebook and Instagram, as well as face-to-face interviews using a formal questionnaire. The electronic version of the questionnaire was created using Google Forms. This survey consisted of five sections covering the following topics: 1) Demographic and general information (region, sex, age, education level, and occupation); 2) Anthropometric data (weight and height); 3) COVID-19 detection and related diseases (chronic diseases, year of infection, variant type, doctor consultations, methods of virus detection); 4) Health consequences of COVID-19 (duration of loss of taste, appetite, smell, and emergence of other diseases post-infection); and 5) Physical activities practiced during COVID-19 (types, frequency, and duration of exercise). The questionnaire was developed by researchers with extensive experience in conducting interviews. For clarity, reliability, and validity, it was pretested with twenty-five participants. The research team collected, entered, corrected, and validated the data, ensuring all responses remained anonymous and confidential. A total of 356 individuals affected by COVID-19 participated in the study. Twenty-two responses were eliminated due to minor participation, and eleven responses were discarded due to non-infected individuals or incomplete answers. In total, 323 responses were retained for analysis. Participation was voluntary, and all individuals provided information willingly.

Anthropometry

The anthropometry data were provided by participants via electronic or formal questionnaire. Height and weight were used for the body mass index (BMI) calculation according to WHO [11] by dividing weight in kilograms by height in meters squared. According to BMI values, corpulence was defined as underweight (BMI < 18.0 kg/m²), normal (BMI = 18.5–24.9 kg/m²), overweight (BMI = 25.0–29.9 kg/m²), and obese (BMI ≥ 30.0 kg/m²).

Physical activity data

The physical data questionnaire for adults was prepared according to the Centers for Disease Control and Prevention (CDC) guidelines [12]. The assessment of physical activity was based on a modified self-report methodology for adults. The questionnaire consists of 9 items measured on a 5-point scale, assessing physical activity levels over one week. This includes sports engagement and physical activity, like walking and sitting time.

Ethical considerations

The research protocol was authorized by the Ethical Committee of the Faculty of Natural and Life Sciences at Relizane University (Algeria) and the Data Protection Board (DPB) on February 19th, 2024, under the code D04N01UN480120230001.

Statistical analysis

The results are expressed as mean ± standard deviation (SD). To compare means and percentages, Student's t-test and Pearson's chi-square test were applied, respectively. Spearman's correlation coefficient was used to evaluate the associations between physical activity and disease. Statistical significance was defined as $p < 0.05$, with all analyses conducted using SPSS Statistics software (IBM SPSS Statistics, Version 23.0, Armonk, NY, USA).

RESULTS

In this study, 323 participants were included. The number of females was 175, representing 54.18%, while the number of males was 148, accounting for 45.82%. Significant differences between the sexes

were observed for height, body weight, and BMI (Table 1).

Table 1: Anthropometry of participants

General anthropometry	Total (n=323)	Male (n=148)	Female (n=175)	*p*-value
Age (year)	43.74±17.48	44.65±16.99	42.97±17.9	NS
Body weight (kg)	73.44±11.58	75.84±10.61	71.42±11.99	0.001
Height (m)	1.68±0.88	1.73±0.08	1.64±0.08	<0.001
BMI (kg/m^2)	26.10±4.17	25.46±3.4	26.65±4.67	0.009
18>age<40 years	Total (n=144)	Male (n=60)	Female (n=84)	*p*-value
Body weight (kg)	71.53±12.13	73.71±11.47	69.98±12.42	NS
Height (m)	1.68±0.08	1.73±0.09	1.64±0.06	<0.001
BMI (kg/m^2)	25.39±4.08	24.66±0.11	25.91±4.59	NS
≥40 years	Total (n=179)	Male (n=88)	Female (n=91)	*p*-value
Body weight (kg)	74.98±10.9	77.28±9.8	72.76±11.49	0.005
Height (m)	1.68±0.09	1.73±0.07	1.64±0.9	<0.001
BMI (kg/m^2)	26.67±4.17	26±3.49	27.32±4.66	0.033

Values are expressed as mean±SD. NS: non-significant (p> 0.05).

There were 144 participants under 40 years old (44.58%), while 179 participants were aged 40 years or more (55.42%). Height significantly differed between the sexes for participants under 40 years. For participants aged 40 years or older, body weight, height, and BMI (body mass index) also differed between the sexes (Table 1). Overweight was the most prevalent condition, with a rate of 40.25%, followed by obesity at 14.55% (Table 2).

Table 2: BMI categories among study participants

BMI Categories	Total (n=323)	Male (n=148)	Female (n=175)	*p*-value
Underweight	8(2.48)	4(2.7)	4(2.28)	
Normal weight	138(42.72)	71(47.97)	67(38.29)	0.022
Overweight	130(40.25)	61(41.22)	69(39.43)	
Obese	47(14.55)	12(8.11)	35(20)	
18>age<40 years	Total (n=144)	Male (n=60)	Female (n=84)	*p*-value
Underweight	7(4.86)	4(6.67)	3(3.57)	
Normal weight	68(47.22)	30(50)	38(45.24)	0.026
Overweight	50(34.72)	24(40)	26(30.95)	
Obese	19(13.2)	2(3.33)	17(20.24)	
≥40 years	Total (n=179)	Male (n=88)	Female (n=91)	*p*-value
Underweight	1.0(0.56)	0	1.0(1.1)	
Normal weight	70(39.11)	41(46.59)	29(31.87)	NS
Overweight	80(44.69)	37(42.05)	43(47.25)	
Obese	28(15.64)	10(11.36)	18(19.78)	

Values are expressed as frequency and percentage. No significant p> 0.05. Significant difference between male and female (Pearson Chi-squared test, p< 0.05).

The rates of overweight and obesity were higher among individuals aged 40 years or more compared to those under 40 years. Statistical analysis revealed significant differences between the sexes for all participants and for those under 40 years. According to the provided data, out of 323 people affected by the COVID-19 virus, 27 did not know its type. Among the remaining 296 participants, 168 (56.76%) were affected by virus type A. The numbers of people affected by virus types Beta, Delta, and Omicron were 77 (26.01%), 3 (1.01%), and 48 (16.22%), respectively. The results indicated that the majority of people infected with the COVID-19 virus had lost their sense of smell and taste, with rates of 84.21% and 75.54%, respectively. The rate of individuals who lost their appetite during SARS infection was 37.46%. No significant differences were observed between sexes. Of the 272 individuals who lost their sense of smell, 16 did not know the type of virus they had. According to Table 3, the duration of this loss was more than 8 days but less than 15 days for the majority of participants, at a rate of 57.03%. A comparable observation was recorded regarding the loss of taste, impacting 50.74% of participants, with 17 individuals uncertain about the specific virus involved. The relationship between the duration of sensory loss and the type of virus was statistically significant (p< 0.001). The duration of appetite loss was also significantly different depending on the virus type (p= 0.035). According to participants' reports, the duration of loss ranged from more than 8 days to less than 30 days for most individuals (p= 0.035) (Table 3). The number of individuals who reported not knowing the type of virus was 16. Of the 323 participants affected by the SARS virus, 71 (21.98%) had illnesses linked to their infection. Respiratory complications were the most common, occurring in 46.48% of these cases, followed by heart disease at a rate of 23.94% (Figure 1A). There was no significant difference between sexes concerning these diseases according to the Pearson chi-squared test. Of the 71 patients with COVID-19-related illness, 2 were unaware of the specific virus variant. Additionally, most participants were affected by the Alpha variant of the virus (Figure 1B).

Table 3: The type of COVID-19 virus and the duration of olfactory and gustatory sense loss

Smell loss duration* (day)						
Virus type	≤8 days	8>days≤15	15>days≤21	21>days≤30	> 30 days	*p*-value
Alpha	1	78	60	3	2	<0.001
Beta	1	45	16	6	0	
Delta	2	1	0	0	0	
Omicron	1	22	11	3	4	
Total 256(100)	5	146	87	12	6	
Taste loss duration* (day)						
Virus type	≤8 days	8>days≤15	15>days≤21	21>days≤30	> 30 days	*p*-value
Alpha	0	76	51	3	0	<0.001
Beta	1	42	13	2	0	
Delta	1	1	0	0	0	
Omicron	2	19	11	3	2	
Total 227(100)	4	138	75	8	2	
Appetite loss duration* (day)						
Virus type	≤8 days	8>days≤15	15>days≤21	21>days≤30	> 30 days	*p*-value
Alpha	1	25	21	13	1	0.035
Beta	1	7	7	5	0	
Delta	1	1	0	0	0	
Omicron	3	9	3	4	3	
Total 105 (100)	6	42	31	22	4	

* Results expressed by number of participants. No significant $p > 0.05$. Significant difference between virus type and olfactory and gustative senses loss duration (Pearson Chi-squared test, $p < 0.05$).

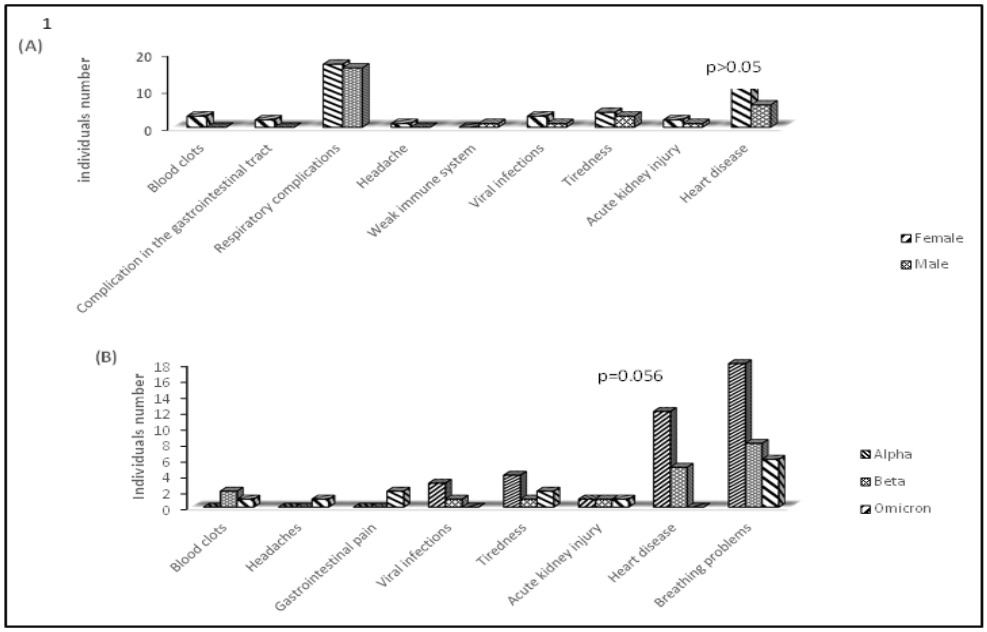

Figure 1: Diseases of participants. (A) Diseases linked to COVID-19; (B) Diseases linked to virus type.

Statistical analysis using the Pearson chi-square test revealed a trend ($p = 0.056$) suggesting a potential difference in disease severity based on the variant type. The number of participants practicing physical activities was 78, representing 23.15%. There were 70 males and 8 females, with no significant differences between sexes in terms of frequency and duration (Table 4). The most commonly practiced activities were football and swimming, with rates of 62.82% and 16.67%, respectively. Karate and basketball were each practiced at a rate of 6.41%, followed by walking at 3.85%. Finally, both aerobics and jogging had a rate of 1.28%. The results presented in Table 4 indicated a significant difference between physical activity and the incidence of COVID-19-related illnesses ($p < 0.001$). Among the participants engaged in physical activity, only 16 developed COVID-19-related illnesses, whereas 55 individuals who did not practice physical activity experienced illness associated with COVID-19. A strong positive correlation was observed between physical activity and the absence of COVID-19-related illnesses ($p < 0.001$; $r = 0.783$).

Table 4: Physical activity levels and their impact on COVID-19-related illnesses

Physical activity				
Variables		Male (n=70)	Female (n=8)	*p*-value
Frequency (Session/week)		2.14± 0.8	2.37±0.92	NS
Duration (hour/session)		1.36±0.48	1.38±0.52	NS
COVID-19-related illnesses		No	Yes	*p*-value
Physical activity (n)	Nonpracticing	0	55	<0.001*
	Practicing	62	16	

n: number of individuals, NS: No significant difference $p > 0.05$ (Student's t-test). *Significant difference (Pearson Chi-square test; $p < 0.05$).

DISCUSSION

This study evaluated the impact of COVID-19 on the health of the Algerian population. A comprehensive analysis was conducted, including anthropometric measurements, the effects of COVID-19 on sensory organs (smell and taste) and appetite, methods of virus screening, illnesses associated with the virus, and physical activity level. Our findings showed that the prevalence of overweight was 40.25%, followed by obesity at 14.55%. The rates of overweight and obesity were higher in the population aged 40 years or more. A recent study published by Japanese researchers found that under the COVID-19 infections, 24.1% of participants declared weight gain. The increase of body weight was associated with the decrease of physical activity [13]. In Germany, obesity affects 47.8% of individuals whose body weight remained unchanged and 39.1% of those who reported weight gain since the beginning of the COVID-19 pandemic [14]. It was also reported that the likelihood of COVID-19 hospitalization increased progressively with higher BMI [15]. A positive correlation was observed between obesity and the spread of infection of COVID-19, according to a comment published by de la Rosa-Zamboni *et al*. 2022 [16]. Our study highlighted smell and taste dysfunction, revealing that 84.21% of individuals infected with the virus lost their sense of smell, and 75.54% lost their sense of taste. The duration of smell and taste dysfunction ranged from less than 8 days to over one month. The Alpha variant was linked to the most significant loss of smell, which was consistent with the study published by Sharetts *et al*., 2024 [17]. In 2023, a study by Nguyen and colleagues found that COVID-19 was associated with a 47% reduction in smell and a 21% reduction in taste [18]. Moreover, among Brazilian individuals who self-reported olfactory and taste disorders, 69% experienced both olfactory and taste impairments, 13% had olfactory issues only, and 17% had taste issues only [19]. Furthermore, patients recovered their sense of smell and taste within 8 days to two months [20,21]. Additionally, the prevalence of smell and/or taste loss occurring after other COVID-19 symptoms has been reported in 27% to 48.6% of patients [22,23]. Although these symptoms were observed in the patients included in this study, the underlying physiological mechanisms remain unclear, particularly in differentiating between temporary and permanent effects, as previously reported in the literature [24]. Moreover, the Alpha variant (> 50%) has the greatest impact on the loss of smell, taste, and appetite compared to other variants. Studies have shown that patients infected with the Omicron variant are less likely to experience long-term complications from COVID-19 than those infected with earlier variants, with the risk being three times lower than that associated with the Alpha variant [25]. In the Polish population, post-COVID-19 patients struggled most with identifying the smell of lemon. When comparing scores across the Delta, Omicron, and Wild Type variants, a statistically significant difference was found between the Delta and Wild Type waves (p= 0.006) [26]. Our results revealed that more than 21% of participants developed illnesses linked to COVID-19 infections. Of the 9 illnesses reported, respiratory conditions affected the majority of participants, followed by heart diseases. It is important to note that COVID-19 had an impact on health, including infections, stress, death, burnout, and other mental disorders [27]. Moreover, it has been reported that after SARS-CoV-2 infection, cardiovascular problems, including myocardial inflammation, myocarditis, cardiac arrhythmias, and respiratory dysfunction, have appeared [28,29]. Regarding physical activity, about 23% of individuals affected by the virus engaged in physical activity, with a strong correlation observed between healthy persons (the absence of COVID-19-related diseases) and the practice of physical activity. The literature indicates that physical activity plays a role in preventing and treating COVID-19, aids in the recovery of physical function, and helps alleviate post-acute COVID-19 syndrome [30]. A study of 48,440 adult patients diagnosed with COVID-19 found that physical activity was significantly linked to a lower risk of severe outcomes in infected adults [31]. Physical activity benefits the respiratory system by enhancing the strength of respiratory muscles, boosting the immune response to respiratory viral antigens, and reducing the risk of death from COVID-19 [32]. The duration and frequency of physical activity are important for health, especially for individuals infected with COVID-19. According to a report published by the Centers for Disease Control and Prevention, researchers found a relationship between decreased physical activity and an increased risk of hospitalization and mortality due to COVID-19 infection [33]. For adults, regular physical activity plays a key role in preventing and managing noncommunicable diseases such as heart disease, cancer, and diabetes. It also helps with depression and anxiety, keeps the brain healthy, and makes people feel better overall [34]. Additionally, the risk of acute respiratory infections is lower in groups who engage in adequate levels of moderate-to-vigorous physical activity [35].

Study limitations

This study provides valuable insights, but we should acknowledge certain limitations. The lack of detailed information on specific diseases, either due to privacy concerns or uncertainty about the disease type, limits the understanding of the relationship between the disease and specific virus variants. The high cost of virus screening in private laboratories and the shortage of screening materials in public hospitals, due to the large number of suspected cases, have led doctors to rely on clinical signs to determine the presence of viral infection.

Conclusions

Findings from this study highlight the high rates of overweight and obesity among individuals affected by COVID-19. Olfactory and gustatory senses were impacted during the infection period, with recovery times varying among individuals. Additionally,

cardiorespiratory complications were the primary health issues caused by the Alpha, Beta, and Omicron variants, which can lead to long-term health consequences such as reduced lung function and increased risk of cardiovascular diseases. Moreover, physical activity plays a preventive and protective role against viral infections and aids the body's recovery from diseases linked to COVID-19. In this context, we recommend that both public and private health agencies prioritize efforts to promote physical activity and integrate it into routine medical care. They should also educate the public about the dangers of obesity and the benefits of exercise.

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Conflict of interests

The authors declared no conflict of interest.

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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