

Article

Perception and Knowledge of Algerian Students about Climate Change and Its Putative Relationship with the COVID-19 Pandemic: A Preliminary Cross-Sectional Survey

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Abstract: **Background:** Climate changes (CC) is one of the most important insidious crises affecting all countries in the world in the 21st century, including Algeria, and it is projected to affect many people in the future. Mitigation of the effects of this phenomenon will certainly involve environmental education, especially among university students. Therefore, evaluating their level of knowledge could help us understand to what extent they are prepared to contribute in the global efforts to fight against this catastrophe. **Objective:** The current study aims to investigate the perception and knowledge of Algerian students about climate change and its potential relationship with the COVID-19 pandemic. **Methods:** An online cross-sectional survey was conducted on a sample of 204 Algerian students by adopting snowball sampling during the academic year (2022/2023), with a questionnaire based on Google Forms. Data were analyzed using SPSS software. **Results:** The results obtained showed that 95.6% of the students asked had heard about this phenomenon and more than 90% perceived that it was really happening. The level of knowledge is significantly associated with age, where students aged between 20 and 30 years old had a lower level of knowledge than those over 30 years old ($OR = 0.22, p = 0.027$). Furthermore, students of the Humanities have shown the lowest level of knowledge compared to those of other domains. Regarding their attitude, only 31.8% of the asked students declared that they changed their attitude positively during the COVID-19 pandemic. The change in attitude and concern is statistically associated neither with the level of knowledge and perception nor COVID-19 affection, psychological impact, and uptake of the COVID-19 vaccine. **Conclusion:** The study concluded that there was a high level of awareness and a medium level of knowledge about CC among Algerian university students. However, most of them were either very worried or a little worried about this phenomenon. It was also suggested that the average level of knowledge about cause and effect and pandemic resistance could be attributed to the scientific study path of students from the study sample. The results of this study could be used as a baseline for future research into CC knowledge and perception in Algeria.

Keywords: climate change; COVID-19; knowledge; perception; survey



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1. Introduction

The world has suffered violent and dangerous waves of the COVID-19 pandemic since the end of 2019, which affected all aspects of social, economic, and environmental life. As a result, discussions of the problem of climate change (CC) as a fundamental environmental problem have gradually emerged [1].

This phenomenon is defined as long-term changes in temperature and weather patterns. These changes could be caused by natural processes, such as oscillations in the solar

cycle. However, since the 1800's, human activities—primarily the combustion of fossil fuels such as coal, oil, and gas—have been implicated as the primary cause of CC [2].

Consequently, CC has become one of the most significant environmental, social, and economic issue humanity is facing in the 21st century [3,4]. It is also predicted that this phenomenon will persist throughout this century and beyond, causing insidiously severe crises such as energy, water, and food shortages, as well as environmental deterioration. This will cause significant socioeconomic inequality and health problems across the globe [1,5–7].

In this way, it is commonly known that climate change poses a serious threat to public health. Its effects are subtle, but they slowly deteriorate human health [8]. Due to increasing interactions between humans and other animals, as well as altered geographic ranges of infectious disease vectors, CC is probably going to hasten the occurrence of future infectious disease outbreaks [9–12]. Additional negative effects include an increase in airborne allergens, a rise in severe weather events that raise the risk of injury, and widespread patterns of human movement brought on by environmental degradation that makes certain locations uninhabitable. Furthermore, it has been shown that CC could affect immune system behavior and increase susceptibility to respiratory diseases (through air pollution, and temperature. and precipitation variations). These effects have recently been acknowledged as having a role in the emergence and the progression of pandemics including influenza and COVID-19 [12–15].

In contrast, recent studies have shown that the COVID-19 pandemic could have either positive (decline in air pollution), or negative (increase in healthcare waste) effects on CC. Moreover, it has been reported that COVID-19 has indirectly shifted the perception and attitudes toward climate change [16–18]. Moreover, some studies have shown that the perception and attitude toward CC could be correlated with the perception of COVID-19 and the attitudes toward its vaccines [8,9]. Even more importantly, attitudes toward these two phenomenon have been shown to be similarly related to factors such as ideologies and conspiracy beliefs [4,19].

So, in order to lessen the effects of CC, it is crucial to implement measures that can be used to quickly resolve the issue and avoid further problems. One of the tactics would be to educate people about how their professional activities have a harmful impact on the climate [20]. Thus, understanding the level of awareness and knowledge could be very helpful attaining these objectives.

In this way, numerous studies have been conducted on global CC awareness and knowledge among different categories (i.e.: students, educators, school children, farmers, etc.) [21–24]. These studies have demonstrated the need to educate the local populace on the basics of CC [20,25]. University and school students were one of the most studied categories [3,26–30]. In fact, young individuals will be particularly affected by CC during their lives with respect to their families, communities, and workplaces [26]. Moreover, as future professionals, university students should be aware of the impact of their professions on the environment [31]. Thus, educating them about CC and its impact can make them sources of information and action on CC and key contributors to CC mitigation [26], directly or indirectly, through their knowledge, values, and attitudes [32,33]. Unfortunately, disparities in perception and knowledge of students about CC were observed in different studies [3,26,28,30]. Moreover, multiple gaps of knowledge were found in disciplines without an environmental dimension [34]; students of natural science have, in general, a better understanding of the process of CC than the other specialties [34,35].

To the best of our knowledge, no studies related to CC knowledge and perception have been conducted in Algeria, a country thought to be especially susceptible to CC. It is part of the Mediterranean Basin, and it is located between the Sahara and northern Europe, while the two arid and wet regions are considered to be a CC “hot spot” [36–38]. Studies also showed that CC will continue into future years [38]. Faced with this situation, Algeria has taken numerous climate adaptation measures covering all sectors, and it is still trying to strengthen its environmental legislative framework [37,39].

Through the current study, we aim to investigate the knowledge and perception of Algerian university students concerning the problem of CC. The possible changes in their attitudes towards this phenomenon during the COVID-19 pandemic were also evaluated.

2. Materials and Methods

Between 3rd December 2022 and 4th January 2023, a cross-sectional web-based survey was conducted among Algerian students during the current academic year (2022/2023). The students were contacted through social media platforms using Google Forms for the questionnaire. The questionnaire prepared in Arabic and in French was adopted from previous studies related to CC [3,8,9,20,40,41].

Participation and the response analysis in this survey have the following characteristics: participation was voluntary, and no financial incentives or compensations of any type were included to encourage students to participate; the analysis was conducted anonymously to control for Hawthorne's effect and information bias.

The final questionnaire is divided into multiple sections. After a first paragraph introducing the title and the objectives of the survey and requesting online consent, the first section was limited to demographic characteristics including age, sex, marital status, the area of residence, and the faculty and the level of education.

The second section related to the participants' awareness and concerns about CC, with six questions about their previous awareness of CC and their source of information, its origin, if it is really happening in Algeria and in the world, and their concern about CC and how this phenomenon is treated by the media.

The level of knowledge was evaluated in the third section using a 26-item (Yes/no/I do not know) scale regarding the origin of (7 items), the consequences of (11 items), and the fight (8 items) against CC (Supplementary File).

The last section was limited to the status of the participants with respect to COVID-19, its vaccine, its relationship with CC, and any possible change in their attitude and concern about CC during the COVID-19 pandemic.

The reliability of the 26 questions related to the level of knowledge was estimated with an alpha Cronbach = 0.792.

Statistical Analysis

Data analysis was performed using SPSS version 22.0 (SPSS Inc. Chicago, IL, USA, 2011). The descriptive analysis was presented as frequencies (*n*) and percentages (%) or mean $\pm$ SD for the score of knowledge. The score of knowledge about CC was calculated on a 26-point scale. A correct response was given 1 point while an incorrect response (No/I do not know) was given 0, with a total of 26 points.

To evaluate the association between dependent and independent variables Chi squared (χ^2) and Fisher tests were used and completed with multinomial logistic regression. A confidence level (CI) of 95% and a significance level $p \leq 0.05$ were used in all the performed statistical analyses.

3. Results

3.1. Demographic Characteristics of the Respondents

In the current study, 207 responses were obtained during the study period, 4 responses were deleted, and 204 responses were used for further analysis.

The majority of the population are students aged between 20 and 30 years (64.5%), and they are most represented by singles (88.2%), females (68%), and those living in urban areas (84.2%).

Regarding their education, most of the students were from Natural and Life Sciences (36%) and Human and Social Sciences (30%), and they were nearly equally distributed among Bachelor's (45.8%) and Master's degrees (44.8%) (Table 1).

Table 1. Demographic characteristics of the study population.

Variable		Number	Frequency (%)
Age	18–19 years	37	18.2
	20–30 years	131	64.5
	More than 30 years	35	17.2
Sex	Female	138	68.0
	Male	65	32.0
Marital status	Married	24	11.8
	Single	179	88.2
Living areas	Rural	32	15.8
	Urban	171	84.2
Faculty	Economics	12	5.9
	Health Sciences	19	9.4
	Humanities	61	30.0
	Natural and Life Sciences	73	36.0
	Sciences and Technology	38	18.7
Educational level	Bachelor	93	45.8
	Master	91	44.8
	Postgraduates	19	9.4

3.2. Perception and Concern about CC

Concerning the overall perception, 195 students (95.6%) declared that they heard about CC before the current survey. Among them, 55.6% considered that CC originated from both nature and human activities, while 44.1% related it only to human activities. Furthermore, 93.3% and 91.3% of the students asked believed that CC is currently happening in the world and in Algeria, respectively.

Regarding their concern, most of the asked students were very (42.6%) or a little (40%) concerned about CC, while 72.3% thought that this phenomenon was under-publicized (Table 2).

Table 2. Perception and concern about CC.

Item	Responses	Number	Frequency
Origin of CC	Both humans and nature	109	55.9
	Humans	81	41.5
	Nature	5	2.6
CC is really happening	Yes	182	93.3
	No	3	1.5
	I do not know	10	5.1
CC is happening in Algeria	Yes	178	91.3
	No	6	3.1
	I do not know	11	5.6
Concern about CC	Little concerned	83	42.6
	Neutral	18	9.2
	Not concerned	16	8.2
	Very concerned	78	40.0
Media coverage of CC	Highly publicized	6	3.1
	Normal	48	24.6
	Under publicized	141	72.3

3.3. Sources of Information about CC

When asked about their sources of information about CC, the asked students reported that the internet/social media platforms (76.4%) and the media (70.8%) were their most

used sources. Discussions with friends/family members (40%), university courses (40%), and awareness campaigns (23.6%) were also cited (Figure 1).

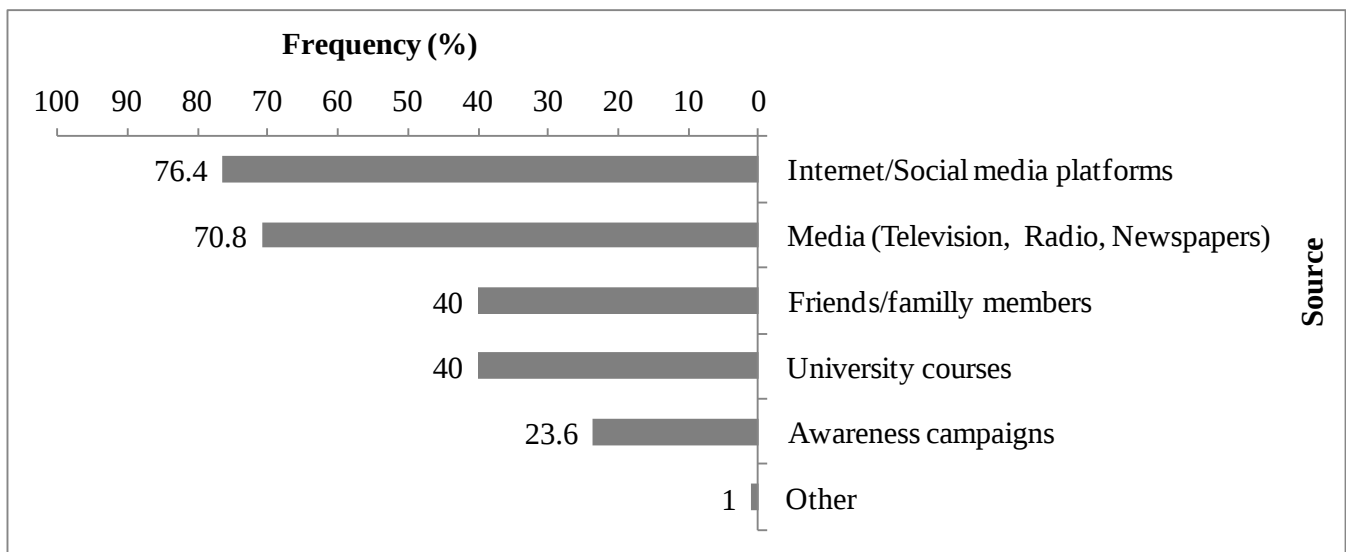


Figure 1. Sources of information about CC of the students asked.

3.4. Level of Knowledge about CC

The results show that the mean of correct response is estimated at 74.4%. Regarding the score of knowledge, it is estimated at 20.1 ± 3.8 .

This score is estimated at 5.1 ± 1.3 (from 7 possible points) for the origin of CC, 8 ± 2.3 (from 11 possible points) for the consequences, and 7.1 ± 1.3 (from 8 possible points) for the fighting against CC (Table 3).

Table 3. Score of knowledge about CC of the study population.

Score	Mean	SD	Median	Maximum	Average Correct Answers (%)
Cause of CC	5.05	1.255	5	7	71.7
Consequence of CC	7.99	2.264	8	11	72.7
Fight against CC	7.06	1.319	8	8	88.3
Total knowledge	20.09	3.787	21	26	74.4

The mean level of knowledge is estimated to qualify the level of knowledge as high or low.

Factors Associated with the High Level of Knowledge

The results indicate that the level of knowledge is higher among students aged more than 30 years (62.9%) than those aged between 20 and 30 years (47.6%) and those younger than 20 years old (52.9%). This difference, however, is not statistically significant.

In the same way, sex, marital status, and living area have not shown a statistically significant impact on knowledge. In contrast, students of Humanities have a lower level of knowledge (30.4%, $p = 0.0002$) than students of Natural and Life Sciences (61.6%, $p = 0.025$), with a significant difference. Postgraduate students have also shown a high level of knowledge, but it was not statistically significant (Table 4).

The multiple logistic regression results show that students of 20 to 30 years old were associated with a lower level of knowledge than those aged more than 30 years (OR = 0.22, CI 95% = 0.58–0.84, $p = 0.027$).

Compared with students of Humanities, those studying in the Health Sciences (OR = 10.08, CI 95% = 2.25–45.12, $p = 0.003$), Natural and Life Sciences (OR = 6.09, CI 95% = 2.48–14.94, $p < 0.01$), and Sciences and Technology (OR = 5.87, CI 95% = 1.97–17.56, $p = 0.002$) faculties have the highest levels of knowledge about CC (Table 5).

Table 4. Factors associated with the level of knowledge of the study population.

Variable		Low Score Number (%)	High Score Number (%)	p Value
Age	18–19 years	16 (47.1)	18 (52.9)	0.831
	20–30 years	66 (52.4)	60 (47.6)	0.167
	31–50 years	13 (37.1)	22 (62.9)	0.13
Sex	Female	66 (48.5)	70 (51.5)	0.936
	Male	29 (49.2)	30 (50.8)	
Marital status	Married	10 (41.7)	14 (58.3)	0.461
	Single	85 (49.7)	86 (50.3)	
Living areas	Rural	17 (56.7)	13 (43.3)	0.344
	Urban	78 (47.3)	87 (52.7)	
Faculty	Economics	8 (66.7)	4 (33.3)	0.242 *
	Health Sciences	6 (33.3)	12 (66.7)	0.218 *
	Humanities	39 (69.6)	17 (30.4)	0.0002
	Natural and Life Sciences	28 (38.4)	45 (61.6)	0.025
	Sciences and Technology	14 (38.9)	22 (61.1)	0.191
Educational level	Bachelor	46 (52.9)	41 (47.1)	0.297
	Master	44 (49.4)	45 (50.6)	0.853
	Postgraduate	5 (26.3)	14 (73.7)	0.053 *

Chi squared and Fisher (*) tests were used. Bold characters indicate results with significant difference ($p < 0.05$).

Table 5. Regression analysis of the demographic factors associated with high levels of knowledge.

Factors	B	SE	Wald	p Value	OR	CI 95% OR	
						Lower	Upper
Age: 18–19 years (vs. more than 30 years)	−1.68	0.89	3.566	0.059	0.186	0.033	1.066
Age: 20–30 years (vs. more than 30 years)	−1.513	0.685	4.877	0.027	0.22	0.058	0.843
Sex: Females (vs. Males)	−0.093	0.352	0.07	0.791	0.911	0.457	1.817
Marital: Married (vs. single)	−0.354	0.705	0.252	0.616	0.702	0.176	2.795
Living areas: Rural (vs. urban)	0.141	0.449	0.099	0.753	1.151	0.478	2.776
Faculty: Economics (vs. Humanities)	0.659	0.733	0.809	0.368	1.934	0.46	8.135
Faculty: MS (vs. Humanities)	2.31	0.765	9.12	0.003	10.075	2.25	45.118
Faculty: NLS (vs. Humanities)	1.806	0.458	15.562	0	6.088	2.482	14.938
Faculty: ST (vs. Humanities)	1.771	0.559	10.049	0.002	5.874	1.966	17.556
Educational: Bachelor (vs. Postgraduates)	−0.253	0.694	0.133	0.715	0.776	0.199	3.025
Educational: Master (vs. Postgraduates)	−0.009	0.665	0	0.989	0.991	0.269	3.645

MS: Medical Sciences; NLS: Medical and Life Sciences; ST: Science and Technology. Bold characters indicate results with significant difference ($p < 0.05$).

3.5. COVID-19 Status, Beliefs, and Effect on Attitude toward CC

Results show that 54.9% of the participants have been affected by COVID-19 while 70.3% have suffered psychologically from the pandemic. Moreover, 23.6% have taken the COVID-19 vaccine.

On the other hand, only 14.9% considered COVID-19 as one of the results of CC, and 70.9% believed that COVID-19 had an effect on CC.

Regarding their attitude, about one third of the participants (31.8%) declared that COVID-19 has positively changed their attitude and concern about CC. Additionally, 33.8% and 27.7% of the participants considered thinking about reducing energy consumption and recycling, respectively.

The results of the statistical analysis show that the change in attitude and concern is not statistically associated with the level of knowledge and perception, COVID-19 affection and psychological impact, and COVID-19 vaccine uptake.

4. Discussion

The objective of this study is to evaluate the level of knowledge of Algerian university students about CC and their possible changes of attitude toward this phenomenon during the COVID-19 pandemic. To the best of our knowledge, this is the first study dealing with this subject in Algeria.

The results show a high level of awareness and a medium level of knowledge about CC among Algerian university students. Additionally, and like other studies involving students [2,31,34], the ambiguous belief of an anthropogenic origin of CC is frequent in Algeria (41.5%), although more than half opted for both a natural and a human origin. These convictions are not surprising, due to the universal acceptance by the population that human activities are the primary cause of CC [42], who mainly cite deforestation, pollution, and excessive use of natural resources, among other activities. Furthermore, almost all participants believed that CC is happening in the world (93.3%) and that Algeria is also affected (91.3%). These results are in accordance with the results of multiple studies in Europe and the USA [23,30,31]. However, they are higher than those reported in Mozambique, where nearly 90% of the asked students did not believe in the occurrence of CC, and 50% of the remaining portion expressed their doubt [3]. Asked about the best strategy to promote better communication about CC, students from 166 universities in 43 different countries agree (28%) or strongly agree (58%) that emphasizing university courses is the best one [31].

Regarding their concern, most of the Algerian students were either very (42.6%) or a little (40%) concerned about CC. These results go generally in the same way as other studies evaluating the concerns of students about CC in different states in the USA [43], or in the other Northern Mediterranean countries [29,41,44–46]. Interestingly, Graham et al. [47] reported that public concern about CC and its health impact is significantly associated with prior exposure to floods and air pollution.

In this study, the medium level of knowledge (correct answers) about causes, consequences, and the fighting of CC is estimated at 74.4%. This level varied between 16.4% to 97.4% between the different items. This level is in accordance with the self-reported knowledge of Greek students (of Social Sciences and Humanities) [41]. A high level is also reported among college students in the Philippines [48]. However, multiple other studies conducted in different countries showed that students generally have limited and superficial knowledge about CC [3,27,44,46]. The high level of knowledge obtained in this study could be related to the fact that about half of the respondents were from Life and Health faculties, and the fact that a high number of them declared that university courses are the main source of knowledge about CC. In this vein, a study conducted among university graduates in Nigeria in 2016 has shown that students who attend environmental courses have generally better knowledge about CC [49]. In our study, the highest level of knowledge is reported among students of Natural and Life Sciences and Health Sciences, while the lowest level was reported among students of Humanities. In addition to the field of study, age was the only factor associated with a high level of knowledge. The same observation was reported by Filho et al. among international students; they demonstrated that older students are more knowledgeable about CC [33].

Regarding sex, even though the International Union for Conservation of Nature (IUCN) supports the conclusion that women are more knowledgeable about CC since they are highly vulnerable and affected immensely by CC [48], the results of this study found no statistical difference between males and females. In the same vein, contrasting results have been provided by different surveys regarding knowledge of CC the two sexes [3,24,50].

The possible impact of CC on the emergence of multiple infectious and non-infectious diseases has been reported in different studies [14,51,52]. COVID-19 is the most recent and the most important outbreak which was related to this phenomenon. In the present study, only 14.9% of the participants considered the possibility that COVID-19 could be a result of CC. On the other hand, attitudes toward these two phenomena have been shown to be associated with similar factors including ideologies and conspiracy beliefs [4]. Additionally, COVID-19 is said to have indirectly changed people's perceptions and attitudes concerning CC, and views regarding CC and COVID-19 and its vaccines may be connected [8,9,16,17]. Inversely, Richardson et al. [53] revealed that the Australian people most concerned about CC tended to be more enthusiastic about the COVID-19 vaccine.

In our study, 70.9% of the respondents considered COVID-19 to have had an effect on CC, only about one third demonstrated that COVID-19 has positively changed their attitude, and, surprisingly, none of the studied factors (knowledge level, perception, COVID-19 effects and psychological impact, and COVID-19 vaccine uptake) were associated with a positive change of attitude and concern concerning CC. In the same vein, Di Giusto et al. [54] reported that no relationship between knowledge and concern exists. More surprisingly, they found a negative relationship between knowledge and behavioral change. Inversely, Yu et al. [30] showed that students with a low level of knowledge represent a greater obstacle to adopting pro-environmental behavior.

Finally, the limitations of this study make it difficult to generalize the findings to all Algerian students. In fact, the methodology of this survey may over- or under-represent some categories, which could have a direct impact on respondents' levels of awareness and knowledge. These types of surveys tend to over-represent students living in urban areas with high internet coverage and under-represent those without internet access. These biases in selection are primarily attributable to the survey's use of social media platforms and the lack of publication from any formal organizations or websites. The small number of respondents who responded to the survey represents another flaw of this study.

5. Conclusions

This study has shown a high level of awareness and an acceptable level of knowledge about CC for most items, especially among Natural and Life Sciences and Health Sciences students. In addition to the major, age was the only factor associated with high levels of knowledge. The level of knowledge and the COVID-19 pandemic had no effect on positive changes of attitudes about CC. Obviously, the present study is limited by its subject, the sample, and the number of respondents questionnaire. Its results could, however, be used as a baseline for future studies into students' knowledge and perception concerning CC in Algeria. Future studies with a larger sample size and a representative sample could be helpful in understanding CC knowledge among Algerian university students; targeting the categories with low levels of knowledge will be necessary in future CC awareness campaigns and helpful to CC mitigation strategies in Algeria.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/cli11040090/s1>, Table S1: percentage of correct and incorrect answers of the study population.

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