

# Knowledge, attitudes and practices about Coronavirus disease (COVID-19) among Birzeit University students: A cross-sectional study

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## Research Article

**Keywords:** Coronavirus disease 19, COVID-19, Knowledge, Awareness, Attitudes, Practices, Palestine, Birzeit University.

**Posted Date:** September 29th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-83268/v1>

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**Version of Record:** A version of this preprint was published at Journal of Public Health on November 8th, 2021. See the published version at <https://doi.org/10.1007/s10389-021-01665-0>.

# Abstract

**Aim:** COVID-19 the novel corona virus that has been characterized as a pandemic; as it spreads all over the world and has so far infected more than 20 million worldwide. In Palestine, the first seven cases were documented on March 5<sup>th</sup>, 2020 followed by the declaration of the state of emergency. This study aimed to assess knowledge, attitudes and practices toward COVID-19 among Birzeit University students.

**Subject and methods:** A cross sectional study was carried out, a questionnaire was developed based on the WHO, CDC, ECDC recommendations. The questionnaire was distributed online and filled by Birzeit University students. Chi-square testing was performed to check for significant association between KAP and different sociodemographic variables. Binary logistic regression performed to identify and control the confounding factors. Data were analyzed using SPSS (version 22).

**Results:** A total of 665 students have completed the online questionnaire. The mean age was (20.55±3.069) years. Multivariate analysis revealed that males, students from health professions and scientific faculties and those with highly educated parents had manifested a good knowledge level (GKL) about Covid -19. Regarding students' practices, less negative practices were prompted by students from health professions faculty and the students living at the middle governorate of Palestine compared to north, south and Jerusalem dwellers. With regards to the practices, the vast majority of the participants held a positive and very cautious practice towards the COVID-19 epidemic.

**Conclusion:** Our results revealed that students had variable knowledge regarding Covid-19 and the vast majority depended on the official media briefs in Palestine as a source of information. With regards to practices, positive and cautious practices towards the COVID-19 epidemic were carried out by the vast majority of participants.

## 1. Introduction

Coronaviruses are a large family of viruses, which have been known to cause respiratory infections such as the Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS) and the corona virus disease 19 (COVID-19)(WHO 2020; Novel Coronavirus Pneumonia Emergency Response Epidemiology Team 2020). COVID-19 was first discovered during an outbreak in Wuhan, China, in December 2019, which led to thousands of deaths. Consequently, it widely spread throughout the world with especially large outbreaks occurring in South Korea, Italy, Iran, United States of America and many other countries(World Health Organization). By July 8, 2020, the virus had reached more than 150 countries, resulting in approximately twelve million infected people, among which five million recovered and 548.998 had died (WHO 2020a). These alarming levels of spread and severity of the disease have therefore raised the bar for the entire world to manage this stressful crisis and urged the World health organization to officially characterize COVID-19 as a pandemic (WHO/Europe)

Concerning the symptoms of COVID-19, some infected people may not experience any symptoms, whereas others may have mild symptoms. Around 80% of patients recover without needing any special

treatment while one out of six patients develop more severe symptoms, including but not limited to difficulty breathing, these patients are most likely to be elderly or with underlying medical conditions, such as high blood pressure, heart problems or diabetes (Ecdc; Wang et al. 2020; Zhang et al. 2020b) Additionally, young people are not invincible against coronavirus; world data have shown that a large number of the patients were young, among which many needed hospitalization (Chen et al. 2020; Bialek et al. 2020; Escalera-Antezana et al. 2020).

On March 5th, 2020, the Palestinian authorities announced the first seven cases in the city of Bethlehem which led to the declaration of a 30-day state of emergency. During this period, further preventative precautions such as quarantine and testing any suspected carriers were undertaken in an attempt to control this pandemic crisis without overwhelming the country's limited financial and healthcare resources. The unavailability of a definitive treatment or vaccine for COVID-19 emphasizes the importance of the non-pharmaceutical protective and preventive measures as the only means of combating this disease.

Knowledge, attitudes, and practices towards COVID-19 among the Palestinian community of immense importance and is critical for the community prevention/control of this Pandemic. The main objectives of this study were to evaluate the knowledge, attitude and practices (KAP) regarding COVID-19 among students (undergraduate and postgraduate) at Birzeit University in Palestine.

This study aims to assess the relationship between students' different sociodemographic characteristics and its effects on their knowledge level, practices and attitudes towards COVID-19. Moreover, this study evaluates the participants' opinions regarding the performance of the local authorities and their trusted source of information during this pandemic.

Evidence-based data from such studies could have an impact on policy decision-makers in the healthcare systems and perhaps help in designing appropriate strategies to improve the awareness and attitudes towards the COVID-19 in order to facilitate managing the outbreak in Palestine.

## **2. Material And Methods**

### *2.1. Study Design and sample:*

An observational descriptive cross-sectional study was conducted among students (undergraduate and postgraduate) at Birzeit University in the occupied Palestinian territories, between March and April 2020. The targeted respondents were all registered students from different majors (health and non-health professions) at the period of conducting the study, having an ID number and internet services. Any duplication or fabricated in the inserted ID number were excluded.

The data were collected through an online distributed questionnaire starting from the 31<sup>th</sup> March until the 10<sup>th</sup> April 2020, as it is considered the only feasible way for distributing the questionnaire during the forced lockdown. The questionnaire was designed and provided by the Google Forms (Google Inc., USA)

under the supervision of an IT department personnel. The total population presented was 14500 students, which is the total number of students registered at Birzeit University. The sample size was 375 as calculated online([CSL STYLE ERROR: reference with no printed form.]) with 95% confidence level and 5% error margin. About 665 students participated in this study. The study was approved by the IRB committee at Faculty of Pharmacy, Nursing and Health Professions, Birzeit University with reference number BZU-PNH-2006.

## *2.2. Study tool:*

The questionnaire was formed through a standardized methodology which includes the review of the literature information, group discussion, experts' evaluation, pilot study and the validation of the final components of the questionnaire (Ishii et al. 2012; Arora et al. 2017). However, due to the lack of worldwide published literature regarding the evaluation of knowledge, attitudes and practice (KAP) toward COVID 19 among various society districts, the information was obtained from a comprehensive literature review regarding the evaluation of KAP toward MERS and SARS (Mbroh; Lau et al. 2003; Bener and Al-Khal 2004; Kim et al. 2016; Yang and Cho 2017; Al-Hazmi et al. 2018; Asaad et al. 2019; Goni et al. 2019), WHO (WHO Corona-viruses), centers for disease control and prevention (CDC , (COVID-19)) and European center for disease prevention and control (ECDC) websites.

The questionnaire components were reviewed and evaluated by the researchers' team on different meetings. The questionnaire was validated by four multidisciplinary experts panel with proven experience in epidemiology and research field in order to receive their input and their critical appraisals regarding the questionnaire's content relevance and appropriateness. Thence, based on experts' feedback, some sectors of the questionnaire were excluded and re-phrasing of certain questions was being considered. Furthermore, a pilot study was distributed among students of different faculties, in order to reveal any drawbacks presented in the questionnaire, where students were requested to fill the questionnaire and give their feedback regarding its clarity, construction, and relevance. Thence, based on students' assessment, some adjustments were made and the final draft was formed in Arabic, then translated into English and was finally reviewed.

The final questionnaire was composed of 4 sections to assess the socio-demographics, knowledge, attitudes and practices of the participants. 45 questions were structured as both open and close-ended multiple choice questions. The sociodemographic section consisted of 13 questions regarding gender, age, marital status, major, study year, current place of residence, number of family members, whether any were aged over 60, parents' educational attainment and nature of their work. The second section assessed the participants' knowledge of COVID 19 by asking 14 questions about the etiology, host, incubation period, transmission, prevention and control approaches, symptoms, risk group, mortality rate and information sources. The answers were on the basis of yes/ no and an additional option of "I don't know". The third section assessed the students' attitudes towards COVID 19 using a set of 10 questions with I agree/I don't agree and I don't know as answer options. This section measured the agreement with

the following: invincibility against COVID-19, worry that a family member would get the disease, willingness to seek advice as needed and preventive measures applied by the local authorities. The fourth section consisted of 10 questions; 9 of which assessed the students' practice towards COVID 19 and the tenth assessed their smoking habits. The questions evaluated the preventive measures taken at the individual level including: self-hygiene, proper coughing or sneezing methods, wearing face masks, keeping a safe distance, limiting presence at public places, limiting travelling between different governorates and whether they supplied their houses with antipyretics, necessary medications, vitamins and nutritional supplements. The answers were in a frequent manner; always, often, rarely and never.

#### *2.4. Statistical analysis:*

Descriptive statistics were performed to present data; a knowledge scale was developed from the thirteen questions that identify the participants' knowledge about the virus, its symptoms and how to prevent it with internal consistency (Cronbach  $\alpha=0.577$ ). Recoding for questions with more than one answer was done, then counting for the correct answers was performed within 32 items, one score was given for each. A scale was developed and recoded into acceptable knowledge level (AKL) scoring less than 26 and good knowledge level (GKL) scoring 26 to 32. Another scale was developed for participants' practices; recoding for negative items performed, a count for the positive statements within 10 items was done, scored and recoded into more positive practices (8 to 10 positives) or less positive ones (less than 8).

Chi-square testing with 95% confidence interval was performed to identify the sociodemographic variables associated with the knowledge and practice scales. Then a third Chi-square testing with 95% confidence interval was performed to assess the association between the knowledge level of respondents and their attitudes.

Binary logistic regression analysis was performed to establish the association between knowledge level and more positive practices with the variables that were identified as significant in the bivariate analysis and to identify and control the confounding factors. All data were analyzed using the Statistical Package for Social Sciences, (IBM SPSS Statistics 22).

## **3. Results**

### *3.1. socio-demographic characteristics:*

A total of 665 students completed the online questionnaire. The mean age was (20.55±3.069) years and 488 (73.4%) were females. 176 (26.5%) of students were from the pharmacy, nursing and health professions faculty and the remainder were from non-medical majors. 379 (59.7%) of the students resided in the middle of the west bank with 333 (50.1%) being city residents. More than half of the students (n=357, 53.7%) were part of a big family consisting of more than 6 members and 126 (18.9%) included members over the age of 60. Additionally, 455 (68.5%) of the students had at least one parent

who completed a diploma or higher education with less than 5% of them working in the health sector.  
(Table 1)

**Table 1:** Socio-demographic characteristics of study participants (N = 655).

Socio-demographic characteristics			No. n (%)
Gender	Male		177 (26.6)
	Female		488 (73.4)
Marital status	Single		622 (93.5)
	Married		43 (6.5)
Major	Arts		109 (16.4)
	Business and Economics		112 (16.8)
	Science		53 (8.0)
	Law and Public Administration		33 (5.0)
	Pharmacy, Nursing and Health Professions		176 (26.5)
	Education		12 (1.8)
	Engineering		167 (25.1)
	Arts, Music and Design.		3 (0.5)
Study Year	First		174 (26.2)
	Second		169 (25.4)
	Third		141 (21.2)
	Fourth or more		146 (22.0)
	Postgraduate		35 (5.3)
Governorate	Jerusalem and the occupied Palestinian territory		140 (21.1)
	North of the WB		71 (10.7)
	Middle of the WB		397 (59.7)
	South of the WB		57 (8.6)

Place of residency	City	333 (50.1)
	Village	307 (46.2)
	Refugee camps	25 (3.8)
Parents completed diploma or higher educational level	None	210 (31.5)
	One of them	186 (28.0)
	Both	269 (40.5)
Mother's work	Health sector	25 (3.8)
	Education sector	138 (20.8)
	Office jobs	30 (4.5)
	Housewife	426 (64.1)
	Other	46 (6.9)
Father's work	Health sector	34 (5.1)
	Education sector	88 (13.2)
	Office jobs	101 (15.2)
	Unemployed	39 (5.9)
	Other	403 (60.6)
Number of family members	Six or less	308 (46.3)
	More than six	357 (53.7)
Including a family member over the age of 60	Yes	126 (18.9)
	No	539 (81.1)
Smoking habits	Smoker	106 (15.9)
	Non- smoker	559

		(84.1)
Students' rating their knowledge regarding COVID-19	Very good	173 (26.0)
	Good	322 (48.4)
	Acceptable	149 (22.4)
	Weak	18 (2.8)
	Do not care	3 (0.5)

### 3.2. Knowledge:

Out of 665 respondents, 495(74.4%) rated their own knowledge level regarding COVID-19 as good to very good, however, data analysis revealed that only 275 (41.4%) actually have good knowledge level (GKL) whereas 390 (58.6%) have acceptable knowledge level (AKL).

97.6% of respondents knew that COVID-19 is a viral infection that affects the respiratory tract system, 95.8% acknowledged that the median incubation period is between 2-14 days and 92.3% responded that it's a curable disease. However, only 46.6% recognized that bats are considered the original host for COVID-19.

Respondents' answers towards COVID-19 transmission approaches revealed acknowledging that sneezing or coughing respiratory droplets, touching face, eyes, nose and mouth with contaminated hands, direct contact with patients, and contact with contaminated surfaces as methods of transmission with percentages of 92.3%, 89.6%, 87.2% and 78.5% respectively. Furthermore, 91.6% of respondents knew that approaching pets is not a method for COVID-19 transmission.

Concerning COVID-19 symptoms, fever and dry cough were stated in more than 90% of participants' responses, whereas only 56.5% recognized general fatigue as a symptom and 30.4% believed improperly that like flu symptoms and nasal congestion were symptoms.

When asked about COVID-19 high risk groups, over 90% of respondents mentioned elderly, patients with chronic diseases and immune-compromised patients, while only 12% acknowledged that severe obesity is also considered a high risk category.

As for COVID-19 prevention methods, drinking hot beverages and eating garlic, onions and pickles were wrongly believed to be the optimal preventive approaches by 44.2% and 15.3% of the answers, respectively. (Table 2) Furthermore, 12.9% of participants believed that antibiotics is an optimal method for preventing COVID-19 infection, which is not proven at the time of conducting the study. On the other

hand, the majority of the participants (91.1%) believed that personal hygiene is an optimal method for preventing COVID-19 infection.

The official media outlets in Palestine, Ministry of Health website and government spokesperson, were the major sources of information about COVID 19 by (79.1%) of the participants. A noticeable percentage (69.6%) of the respondents reported the scientific resources as a source of information followed by media and the social media. (65.1%, 46.8% respectively) (Fig. 1)

**Table 2:** Students' knowledge toward COVID-19.

<b>Statement</b>	<b>Yes n(%)</b>	<b>No n(%)</b>	<b>don't know n(%)</b>
COVID-19 is an infectious viral disease that affects the respiratory system?	649 (97.6)	7 (1.1)	9 (1.4)
Bats are considered the original host of COVID-19 infections?	310 (46.6)	144 (21.7)	211 (31.7)
Does COVID-19 transmitted by touching and approaching pets	56 (8.4)	609 (91.6)	
Does COVID-19 transmitted by direct contact with patients	580 (87.2)	85 (12.8)	
Does COVID-19 transmitted by airborne	142 (21.4)	523 (78.6)	
Does COVID-19 transmitted through respiratory droplets from sneezing or coughing.	614 (92.3)	51 (7.7)	
Does COVID-19 transmitted by contact with contaminated surfaces.	522 (78.5)	143 (21.5)	
Does COVID-19 transmitted by touching the face, eyes, nose, and mouth with contaminated hands.	596 (89.6)	69 (10.4)	
The median of incubation period for COVID-19 is (2-14) days?	637 (95.8)	14 (2.1)	14 (2.1)
Sore throat is a symptom of COVID-19.	454 (68.3)	211 (31.7)	
Fever is a symptom of COVID-19.	602 (90.5)	63 (9.5)	
Productive cough is a symptom of COVID-19.	77 (11.6)	588 (88.4)	
Dry cough is a symptom of COVID-19.	605 (91.0)	60 (9.0)	
General fatigue is a symptom of COVID-19.	376 (56.5)	289 (43.5)	
Flu and nasal congestion is a symptom of COVID-19.	202 (30.4)	463 (69.6)	
All people infected will develop symptoms of COVID-19	69 (10.4)	538 (80.9)	58 (8.7)
A negative primary examination test result of a person suspected of having COVID-19 eliminates the need for quarantine for that person.	51 (7.7)	604 (90.8)	10 (1.5)
Elderly are at high risk to develop COVID-19 complications.	631 (94.9)	34 (5.1)	

Children are at high risk to develop COVID-19 complications.	189 (28.4)	476 (71.6)	
People with chronic diseases (Hypertension, diabetes, heart disease and respiratory system) are at high risk to develop COVID-19 complications.	614 (92.3)	51 (7.7)	
Pregnant women are at high risk to develop COVID-19 complications.	189 (27.7)	481 (72.3)	
People who are immunocompromised (patients receiving chemotherapy, kidneys and organ transplant recipients) are at high risk to develop COVID-19 complications.	605 (91.0)	60 (9.0)	
People with severe obese are at high risk to develop COVID-19 complications.	80 (12.0)	585 (88.0)	
Drinking hot beverages is an optimal method for preventing COVID-19 infection.	294 (44.2)	371 (55.8)	
Non-pharmacological precautions for personal hygiene is an optimal method for preventing COVID-19 infection.	606 (91.1)	59 (8.9)	
Wearing protective masks by healthy people who are not in contact with infected individuals is an optimal method for preventing COVID-19 infection.	263 (39.5)	402 (60.5)	
Washing the nose and gargling with water is an optimal method for preventing COVID-19 infection.	369 (55.5)	296 (44.5)	
Eating garlic, onions and pickles is an optimal method for preventing COVID-19 infection.	102 (15.3)	563 (84.7)	
Taking antibiotics is an optimal method for preventing COVID-19 infection.	86 (12.9)	579 (87.1)	
A vaccine for COVID-19 has been developed and is currently available in global markets?	22 (3.3)	533 (80.2)	110 (16.5)
COVID -19 is a curable disease?	614 (92.3)	14 (2.1)	37 (5.6)
Globally, the total mortality rate from COVID-19 infections is less than 5%?	386 (58)	147 (22.1)	132 (19.8)
What resources do you rely on to obtain information about COVID-19 and how to prevent it?	<b>Fig 1</b>		

As depicted in (Table 3), logistic regression analysis results affirmed that students' extent of knowledge regarding COVID-19 is significantly related to their gender where females manifested lower knowledge levels compared to males (OR= 0.588, P=0.01). Regarding major specialty, a higher knowledge level of COVID-19 was manifested in scientific faculties (OR=1.841, P=0.004) and health professions faculties (OR=3.462, P<0.001) with comparison to literary faculties. Additionally, significant results were obtained with year progression; where students at their fourth year of studying or more were more likely to have GKL (OR=5.562, P<0.001), then second year students (OR= 2.717, P<0.001) and third year (OR= 2.249, p=0.003) compared to first year students. As for place of residency, results showed that refugee camps

residents were the least to have GKL (OR=0.235, P= 0.016) compared to city citizens. With regards to parental factors; students with both parents having higher educational attainment were more likely to have GKL (OR= 1.931, P=0.013) compared to their counterparts. Whilst students whose mothers worked in non-health related jobs or were unemployed were less likely to have GKL, (OR=0.332, p=0.03), (OR=0.345, P=0.04) respectively compared to health sector employees.

**Table 3:** Effect of different significant variables on the level of respondents' knowledge obtained by binary logistic regression (odds ratios and 95% confidence intervals).

Independent variable		Acceptable KL	Good KL	p-value	Regression coefficient B	OR (95%CI)
Gender	Male	92 (52)	85 (48)	Reference		
	Female	298 (61.1)	190 (38.9)	0.01	0.53	0.588 (0.393-0.882)
Marital status	Single	363 (58.4)	259 (41.6)	0.568 not significant, no regression had done		
	Married	27 (62.8)	16 (37.2)			
Major	Literary faculties	195 (72.5)	74 (27.5)	Reference		
	Scientific faculties	120 (54.5)	100 (45.5)	0.004	0.610	1.841 (1.215-2.791)
	Health professions faculties	75 (42.6)	101 (57.4)	p-value <0.001	1.242	3.462 (2.230-5.375)
Study year	First	136 (78.2)	38 (21.8)	Reference		
	Second	92 (54.4)	77 (45.6)	p-value <0.001	1.0	2.717 (1.640-4.501)
	Third	85 (60.3)	56 (39.7)	0.003	0.811	2.249 (1.321-3.831)
	Fourth or more	56 (38.4)	90 (61.6)	p-value <0.001	1.716	5.562 (3.275-9.448)
	Postgraduate	21 (60.0)	14 (40.0)	0.166	0.602	1.826 (0.779-4.284)
Governorate	Jerusalem and the Pt	86 (61.4)	54 (38.6)	Reference		
	North of the WB	48 (67.6)	23 (42.4)	0.122	-0.534	0.586 (0.298-1.154)
	Middle of the WB	231 (58.2)	166 (41.8)	0.245	0.269	1.308 (0.832-2.058)
	South of the	25 (43.9)	32	0.244	0.419	1.520

	WB		(56.1)			(0.751-3.076)
Place of residency	City	193 (58)	140 (42)	Reference		
	Village	176 (57.3)	131 (42.7)	0.331	0.190	1.210 (0.824-1.776)
	Refugee camps	84 (21)	4 (16)	0.016	-1.448	0.235 (0.072-0.765)
Parents completed diploma or higher educational level	None	143 (68.1)	67 (31.9)	Reference		
	One of them	109 (58.6)	77 (41.4)	0.132	0.365	1.440 (0.896-2.315)
	Both	138 (51.3)	131 (48.7)	0.013	0.658	1.931 (1.147-3.252)
Mother's work	Health sector	7 (28)	18 (72)	Reference		
	Other sectors	122 (57.0)	92 (43.0)	0.03	-1.104	0.332 (0.123-0.896)
	Housewife	261 (61.3)	165 (38.7)	0.04	-1.063	0.345 (0.125-0.950)
Father's work	Health sector	17 (50.0)	17 (50.0)	0.145 not significant, no regression had done		
	Other sectors	345 (58.3)	247 (41.7)			
	Unemployed	28 (71.8)	11 (28.2)			
Number of family members	Six or less	167 (54.2)	141 (45.8)	Reference		
	More than six	223 (62.5)	134 (37.5)	0.128	-0.279	0.757 (0.529-1.084)
Including a family members over the age of 60	Yes	64 (50.8)	62 (49.2)	Reference		
	No	326 (60.5)	213 (39.5)	0.68	-0.409	0.664 (0.428-1.030)

### 3.3. Attitudes

As seen in (Table 4), a higher percentage of respondents (90.7%) were worried that a family member would get COVID-19. 84.1% of them remarkably thought that COVID-19 preventative measures should be applied by everyone regardless of their status. In addition, 96.2% of the participants would seek assistance from the authorities' responsible if the person or a family member develops symptoms of COVID-19. As for the practices applied by the government, 96.5% of respondents considered that the preventative measures taken by the Palestinian government at the beginning were sufficient and on timely manner.

**Table 4:** Students' attitudes toward COVID- 19:

Statement	Agree n(%)	Don't agree n(%)	Don't know n(%)
Are you worried that a family member might get COVID-19?	603 (90.7)	42 (6.3)	20 (3.0)
Do you think that COVID-19 prevention measures should only be applied by older adults and groups most at risk?	101 (15.2)	559 (84.1)	5 (0.8)
In the event that I or a family member develop symptoms of COVID-19 infection, I will seek advice and assistance from the authorities responsible for providing health services.	640 (96.2)	8 (1.2)	17 (2.6)
My perception of someone will change if they contract COVID-19.	54 (8.1)	571 (85.9)	40 (6.0)
Do you think that the practice of limiting the movement of individuals between countries and imposing strict quarantine on travelers will limit the transmission and spread of COVID-19 between individuals?	642 (96.5)	13 (2.0)	10 (1.5)
Do you think that the attempts of the local authorities at your place of residence will succeed in curbing the spread of COVID-19?	442 (66.5)	102 (15.3)	121 (18.2)
Do you think that the local authorities have sufficient tools to deal with confirmed and suspected cases of (Covid-19)?	118 (17.7)	397 (59.7)	150 (22.6)
Do you think that the preventative measures that were taken by the Palestinian government were early?	267 (40.2)	355 (53.4)	43 (6.5)
Do you think that the preventative measures taken by the Palestinian government in the beginning were sufficient?	348 (52.3)	235 (35.3)	82 (12.3)
Do you think you are invincible from COVID-19?	180 (27.1)	290 (43.6)	195 (29.3)

Table 5 shows that although more than 90% of respondents were worried that a family member might get COVID-19, students with GKL were found to be significantly less likely to be worried (8.7%,  $p=0.007$ ). They believed that preventative measures should not be practiced solely by older adults and groups most at risk (91.3%,  $p < 0.001$ ) in comparison to students with AKL (4.6%, 79.0% respectively). Likewise,

participants with GKL were less likely to find themselves invincible from COVID-19 (56.7%,  $p < 0.001$ ) as to those with AKL (34.4%). Students with GKL were significantly more likely to believe that the attempts of the local authorities will not succeed in curbing the spread of COVID 19 (19.3%) and they did not have sufficient tools to deal with the pandemic (66.5%) as compared to students with AKL (12.6 % and 54.9% respectively). In addition, students with GKL were significantly more likely to believe that the preventive measures taken by the Palestinian government were neither early nor sufficient (54.9% and 38.2%) in comparison to students with AKL (52.3% and 33.3% respectively).

**Table 5:** Distribution of different students' attitudes measures with their KL toward COVID-19

Statement		Acceptable KL n(%)	Good KL n(%)	P- value
Are you worried that a family member might get COVID-19?	Yes	355 (91.0)	248 (90.2)	0.007
	No	18 (4.6)	24 (8.7)	
	Don't know	17 (4.4)	3 (1.1)	
Do you think that COVID-19 prevention measures should only be applied by older adults and groups most at risk?	Yes	78 (20.0)	23 (8.4)	p- value <0.001
	No	308 (79.0)	251 (91.3)	
	Don't know	4 (1.0)	1 (0.4)	
In the event that I or a family member develop symptoms of COVID-19 infection, I will seek advice and assistance from the authorities responsible for providing health services.	Yes	376 (96.4)	264 (96.0)	0.099
	No	2 (0.5)	6 (2.2)	
	Don't know	12 (3.1)	5 (1.8)	
My perception of someone will change if they contract COVID-19.	Yes	41 (10.5)	13 (4.7)	0.006
	No	321 (82.3)	250 (90.9)	
	Don't know	28 (7.2)	12 (4.4)	
Do you think that the practice of limiting the movement of individuals between countries and imposing strict quarantine on travelers will limit the transmission and spread of COVID-19 between individuals?	Yes	373 (95.6)	269 (97.8)	0.301
	No	10 (2.6)	3 (1.1)	
	Don't know	7 (1.8)	3 (1.1)	
Do you think that the attempts of the local authorities at your place of residence will succeed in curbing the spread of COVID-19?	Yes	258 (66.2)	184 (66.9)	0.008
	No	49 (12.6)	53 (19.3)	
	Don't know	83 (21.3)	38 (13.8)	

Do you think that the local authorities have sufficient tools to deal with confirmed and suspected cases of (Covid-19)?	Yes	75 (19.2)	43 (15.6)	0.009
	No	214 (54.9)	183 (66.5)	
	Don't know	101 (25.9)	49 (17.8)	
Do you think that the preventive measures that were taken by the Palestinian government were early?	Yes	152 (39.0)	115 (41.8)	0.019
	No	204 (52.3)	151 (54.9)	
	Don't know	34 (8.7)	9 (3.3)	
Do you think that the preventive measures taken by the Palestinian government in the beginning were sufficient?	Yes	200 (51.3)	148 (53.8)	0.015
	No	130 (33.3)	105 (38.2)	
	Don't know	60 (15.4)	22 (8.0)	
Do you think you are invincible from COVID-19?	Yes	124 (31.8)	56 (20.4)	p-value <0.001
	No	134 (34.4)	156 (56.7)	
	Don't know	132 (33.8)	63 (22.9)	

### 3.4. Practices

With regard to the ten positive practices (PP) abided by the individuals for self and others' safety, table 6 shows that adherence with at least eight practices was observed in 511 (76.8%) of the respondents, these include: washing hands and using proper hygiene (97.0%), practicing cough etiquette (95.9%), avoiding public places and maintaining a safe distance between individuals with percentages of 93.5% and 79.1%. Whereas, 154 (23.2%) displayed implementation for at least three negative practices. Concerning smoking habits, respondents reported smoking; less frequently (5.3%), same frequency (6.5%), more frequently (2.4%) and cessation (1.8%). (**Fig. 2**).

**Table 6:** Students' practices toward COVID-19

Statement	Often or more n(%)	Rarely or less n(%)
After the Palestinian government declared a state of emergency, were you committed to washing your hands with soap and water and using disinfectants on a regular basis? (Positive practice)	645 (97.0)	20 (3.0)
After the Palestinian government declared a state of emergency, did you practice the proper methods of coughing and sneezing etiquette? (Positive practice)	638 (95.9)	27 (4.1)
After the Palestinian government declared a state of emergency, did you wear a face mask when you left the house? (Negative practice)	204 (30.7)	461 (69.3)
After the Palestinian government declared a state of emergency, were you in places where people gathered? negative practice)	38 (5.7)	627 (94.3)
After the Palestinian government declared a state of emergency, did you travel between governorates? (negative practice)	23 (3.5)	642 (96.5)
After the Palestinian government declared a state of emergency, did you reduce your presence in public places and adhere to the state of emergency? (Positive practice)	622 (93.5)	43 (6.5)
After the Palestinian government declared a state of emergency, did you maintain a safe distance between you and the individuals around you? (Positive practice)	526 (79.1)	139 (20.9)
After the Palestinian government declared a state of emergency, did you supply your home with antipyretics and necessary medications? (Positive practice)	363 (54.6)	302 (45.4)
After the Palestinian government declared a state of emergency, did you supply your home with vitamins and nutritional supplements? (Positive practice)	365 (54.9)	300 (45.1)
After the Palestinian government declared a state of emergency, were your smoking habits affected by the emerging Corona virus (Covid-19)?	Fig. 2	

Regarding the different variables affecting practices towards COVID-19, and based on data obtained by binary logistic regression as presented in (table 7), numbers showed that females had less negative practices compared to males (OR= 0.323, P<0.001). Other factors influencing the respondents' practices were found to be their major and study year. Negative practices were less promoted by health professions faculty participants (OR= 0.631, P=0.083) compared to students from Literary faculties, whereas postgraduates tended to have less positive practices (OR= 3.362, P=0.004) compared with students at their first year, while no significant differences in practices were found between undergraduates at their different studying years. Moreover, among the variables having an impact on practices was the governorate to which the respondents belong, where middle of the WB revealed the lowest adherence with negative practices (OR= 0.512, p=0.006) compared with students from Jerusalem and the OPT.

**Table 7:** Effect of different significant variables on positive practices of respondents obtained by binary logistic regression (odds ratios and 95% confidence intervals).

Independent variable		More PP n(%)	Less PP n(%)	p-value	Regression coefficient B	OR (95%CI)
Gender	Male	107 (60.5)	70 (39.5)	Reference		
	Female	404 (82.8)	84 (17.2)	p-value <0.001	-1.130	0.323 (0.212-0.491)
Major	Literary faculties	201 (74.7)	68 (25.3)	Reference		
	Scientific faculties	163 (74.1)	57 (25.9)	0.834	-0.048	0.953 (0.607-1.497)
	Health professions faculties	147 (83.5)	29 (16.5)	0.083	-0.461	0.631 (0.375-1.062)
Study year	First	136 (78.2)	38 (21.8)	Reference		
	Second	135 (79.9)	34 (20.1)	0.567	-0.162	0.850 (0.488-1.481)
	Third	105 (74.5)	36 (25.5)	0.754	0.089	1.094 (0.625-1.912)
	Fourth or more	117 (80.1)	29 (19.9)	0.378	-0.259	0.771 (0.433-1.374)
	Postgraduate	18 (51.4)	17 (48.6)	0.004	1.213	3.362 (1.458-7.755)
Governorate	Jerusalem and the oPt	99 (70.7)	41 (29.3)	Reference		
	North of the WB	47 (66.2)	24 (33.8)	0.849	-0.065	0.937 (0.480-1.830)
	Middle of the WB	322 (81.1)	75 (18.9)	0.006	-0.669	0.512 (0.317-0.828)
	South of the WB	43 (75.4)	14 (24.6)	0.144	-0.583	0.558 (0.255-1.221)
Place of residency	City	257 (77.2)	76 (22.8)	0.298 not significant, no regression had done		

	Village	238 (77.5)	69 (22.5)	
	Refugee camps	16 (64.0)	9 (36.0)	
Parents completed diploma or higher educational level	None	160 (76.2)	50 (23.8)	0.577 not significant, no regression had done
	One of them	139 (74.7)	47 (25.3)	
	Both	212 (78.8)	57 (21.2)	
Mother's work	Health sector	19 (76.0)	6 (24.0)	0.329 not significant, no regression had done
	Other sectors	172 (80.4)	42 (19.6)	
	Housewife	320 (75.1)	106 (24.9)	
Father's work	Health sector	27 (79.4)	7 (20.6)	0.146 not significant, no regression had done
	Other sectors	459 (77.5)	133 (22.5)	
	Unemployed	25 (64.1)	14 (35.9)	
Number of family members	Six or less	234 (76.0)	74 (24.0)	0.622 not significant, no regression had done
	More than six	277 (77.6)	80 (22.4)	
Including a family members over the age of 60	Yes	91 (72.2)	35 (27.8)	0.172 not significant, no regression had done
	No	420 (77.9)	119 (22.1)	
Knowledge level	Acceptable	294 (75.4)	96 (24.6)	0.289 not significant, no regression had done
	Good	217 (78.9)	58 (21.1)	

## 4. Discussion

Our findings indicate that although less than half of the participants have a good knowledge level regarding COVID-19, none of the participants was totally unaware of the disease. This could be attributed

to conducting the study early on the outbreak in Palestine and the diverse media coverage of COVID-19 in concurrence with the state of emergency in the country. The relatively low percentage of participants with a good knowledge level in this study is in line with findings of a study conducted among health care workers which reported that Knowledge and perceptions of COVID-19 varied across different categories of health care workers but in general the participants had a poor knowledge level (Bhagavathula et al. 2020a). Nevertheless, the percentage of participants with a good knowledge level is lower when compared to studies conducted among different segments of the society against MERS (Kharmah et al. 2015; Elrggal et al. 2018) and against COVID 19 (Zhong et al. 2020; Wolf et al. 2020; 2020; Zhang et al. 2020a) where the participants have claimed good knowledge regarding transmission, symptoms and treatment of COVID-19.

The level of knowledge varied depending on the type of question. For example; almost all of respondents knew that COVID-19 is a viral infection that affects the respiratory tract system and majority of them knew the methods of transmission and believed that personal hygiene is the optimal method of preventing COVID-19. However, some practices such as drinking hot beverages, gargling with water and washing the nose were wrongly believed to be preventative. In addition, around eighth of the participants believed that antibiotics were an optimal method of prevention; more than half of these participants were from literary faculties.

The students from health professions faculties achieved a knowledge level higher than their counterparts'. This could be attributed to these students taking various health related courses, as well as their involvement in public health campaigns which in turn enable them to have a better understanding of potentially epidemic infectious diseases such as COVID 19. These findings are consistent with previous studies which reported that students from Health Colleges had significantly better knowledge than others (Alzoubi et al. 2020; White et al. 2020), and oppose what was concluded in a study conducted in Jordan where no significant difference between the mean of Knowledge, Attitude and Practice level was found among medical and non-medical students (Alzoubi et al. 2020). In accordance with a study conducted in Uganda (Olum et al. 2020), this study reported that females manifested lower knowledge levels compared to males. Our results are inconsistent with prior studies which reported that females had a significantly higher score than males (Al-Hazmi et al. 2018; Zhong et al. 2020; 2020) and one study which reported no significant correlation of gender and specialty with both knowledge and attitude (MQ et al. 2020).

It's noteworthy that despite Facebook being the most social media application used by students in Palestine, official media including; The Ministry of Health's website, Government spokesperson and the scientific resources were found to be the most important sources of information amongst students. This is attributed to the extremely active media coverage regarding COVID 19 in Palestine, where the official government spokesman and the Minister of Health held two press conferences each day on national TV channels concerning the latest updates about COVID 19 in Palestine, as well as relatable information regarding this disease, such as; modes of transmission and preventive instructions during the outbreak. These results are in line with the findings of former studies, which revealed that the mass media is the

major source of information about COVID19 and SARS epidemics(Lau et al. 2003; Motta Zanin et al. 2020). Whereas, other previous studies reported that the majority of participants referred to social media in order to obtain information concerning COVID-19 which is relatively inconsistent with our finding(Giao et al. 2020; Bhagavathula et al. 2020b; Abdelhafiz et al. 2020; Saqlain et al. 2020; Aker and Midik 2020). Moreover, 69.6% of the students reported scientific resources as their source of information, which is due to their easy access to highly recommended medical articles and journals available at the university's library.

Notwithstanding that official media and scientific resources were seen to be the main sources of information in 83.6% and 81.5% of students with a good knowledge level, respectively, 57.5% and 40.7% of these students considered media and social media as well a source of information. On the other hand, 75.9% and 70.7 % students with poor knowledge level relied on official media and media, respectively, as a source of information, furthermore, 61.3% and 51% of these students used scientific resources and social media. The difference in information sources contributed to the variety of knowledge levels. Moreover, besides the presented correct and accurate information, unconfirmed information intended to misinform the people can as well be rapidly disseminated via the media and social media.

With regards to practices, positive and cautious practices towards the COVID-19 epidemic were carried out by the vast majority of participants, where (76.8%) of the respondents adhered with at least eight practices out of 10, while only (23.2%) displayed implementation for at least three negative practices. Our findings revealed that more than 90% of students avoided crowded places, practiced the appropriate methods of coughing and sneezing, washed their hands with soap and water, did not travel between governorates and reduced their presence in public places during the rapid rise period of the COVID-19 outbreak. Furthermore, a high percentage of the students (79.1%) maintained a safe distance between them and other people. This is attributed to the good knowledge level about the mode of transmission and the belief that personal hygiene is optimal for prevention from the disease, in addition to strict prevention and control measures implemented by the Palestinian government. We found our results encouraging since good hygiene practices, behavioral commitment and social distancing aids in decreasing the transmission rate of COVID 19. These results are comparable with a study performed in China, where the vast majority of the participants held an optimistic attitude towards the COVID-19 epidemic(Zhong et al. 2020), and with other studies, where the participants revealed generally adequate positive practices towards the COVID-19 disease ([CSL STYLE ERROR: reference with no printed form.]; MQ et al. 2020; Al Nsour et al. 2020).

Throughout COVID-19 outbreak, results have shown that two-third of participants didn't wear face masks when out in public, whereas fifth did not maintain physical distancing. Compliance with the pandemic restrictions is essential and crucial in this phase, and failure to adhere to preventive measures – even if by a minority- would only lead to uncontrolled spreading of the disease. Positive practices towards COVID-19 pandemic were found to be significantly associated with the gender and major of the precipitant. Females were found to have less negative practices when compared to males; mainly by avoiding crowded places, practicing coughing and sneezing etiquette, maintaining proper hand hygiene

and avoiding traveling between governorates during the rapid rise of the disease. These findings are in line with other studies; which reported association between gender and some positive practices toward COVID 19([CSL STYLE ERROR: reference with no printed form.]; Zhong et al. 2020; Khader et al. 2020). Results have also shown that health care professions students were more compliant with COVID19 restrictions when compared to students of other faculties. Which is comparable to previous studies which investigated KAP towards COVID 19 among participants from a medical and non-medical study group([CSL STYLE ERROR: reference with no printed form.]; Hussain et al. 2020).

Regarding the attitudes towards COVID-19, the majority of participants were found to be worried that a family member would get COVID-19 and believed that the prevention measures should be applied by the whole population. This is analogue with multiple previous studies in Egypt(Abdelhafiz et al. 2020) and Pakistan(Mirza et al. 2020). Although many studies reported that a significant percentage of the infected people were young(Chen et al. 2020; Bialek et al. 2020; Escalera-Antezana et al. 2020), our study has shown that less than half of the participants – who are considered young- thought that they can be infected with COVID-19, and nearly one third thought they were invincible from the disease. Based on the results of the study, a molding of knowledge about COVID 19 into a positive attitude was clearly observed. Interesting differences were noted when comparing students with GKL and AKL, where GKL students tended to be less worried that a family member might get COVID-19, and believed that preventative measures should not be practiced solely by older adults and high risk groups, as compared with AKL students. Furthermore, findings showed that participants with GKL were less likely to find themselves invincible from COVID-19 when compared to those with AKL.

Concerning the performance of the local authorities, two thirds of participants considered the authorities' attempts successful in controlling the spread of COVID-19, and around half of them thought that the preventative measures were sufficient. Furthermore, less than a quarter of the participants believed that local authorities have sufficient tools to deal with the confirmed and suspected cases of COVID-19. These findings disagree with other studies among different communities(Zhong et al. 2020; Rugarabamu et al. 2020; Azlan et al. 2020), that might be due to the lack of economic and medical resources and the shortage within the health system compared to developed countries.

## 5. Conclusion

Our results revealed that students had variable knowledge regarding Covid-19 and majority depended on the official media briefs in Palestine as a source of information thus reflecting the need of collaborative efforts between the ministry of health and the media to implement more effective tools that increase the community knowledge level about COVID-19 and the needed preventive measures to be followed, especially that the protective measures were more adhered by health profession students, that may revealed that increase the community knowledge increase they commitment with the preventive measures. With regards to practices, positive and cautious practices towards the COVID-19 epidemic were carried out by the vast majority of participants. Positive practices towards COVID-19 pandemic were found to be significantly associated with the gender where females were found to have less negative

practices when compared to males. Furthermore, majority of respondents were worried that a family member might get infected with the virus and considered the preventative measures taken by the Palestinian government at the beginning were sufficient and on timely manner.

## 6. Limitations

The study has potential limitations to be noted. Above all, the participants of the study were students, and this sample of participants is unlikely to be a representative of the general Palestinian population. Also, the study participants volunteered to participate in the study (self-selection bias), thus limiting the generalizability of the study findings. Moreover, the collected data was self-reported and depended on the participants' integrity and recall ability; thus, might be subjected to recall bias. Taking all the above mentioned limitations into consideration, more studies should be conducted in the future to evaluate the knowledge, practices and attitudes toward COVID-19 among different groups of society.

## Declarations

### DATA AVAILABILITY:

The data used to support the findings of this study are available from the corresponding author upon request

### CONFLICT OF INTEREST:

The authors state that they do not present any conflict of interests in the present research.

### FUNDING:

No funding sources.

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