

Awareness of Preparatory School Students Regarding COVID-19 and Its Variants

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Abstract

Background: The COVID-19 and its variants outbreak proved to be one of the most transformative events in the modern period and had a significant global impact, especially on educational sector. **Aim:** The aim was to assess awareness of preparatory school students regarding COVID-19 and its variants **Design:** A descriptive research design was used. **Setting:** This study was conducted at three preparatory schools were selected randomly in El-Masara, Helwan, Egypt. **Sample:** A multistage random sample of 210 students from 1st and 2nd preparatory grades. **Tool:** One tool was used a self-administered questionnaire sheet consists of five parts; students' demographic data, medical health history and COVID-19 related experiences, knowledge, attitudes and reported practices regarding COVID-19 and its variants. **Results:** More than three-fifths and about two-fifths of the studied preparatory school students had poor and average knowledge respectively, while none of them had good knowledge about COVID-19 and its variants. More than three-fifths of the students had negative attitudes, whereas less than two-fifths of them had positive attitudes towards COVID-19 and its variants. Less than three-quarters of them had unsatisfactory level of reported practices, while more than one-quarter of them had satisfactory level of reported practices regarding COVID-19 and its variants. **Conclusion:** more than three-fifths of the studied preparatory school students had poor knowledge and had negative attitudes toward COVID-19 and its variants, and less than three-quarters of them had unsatisfactory level of reported practices regarding COVID-19 and its variant. Also, there was a highly statistical significant positive correlation between students' total level of knowledge, attitudes & reported practices regarding COVID-19 and its variants ($P \leq 0.001$). **Recommendations:** Design and implement awareness programs for all preparatory school students to raise their awareness regarding COVID-19 & its variants and increasing students' health awareness about COVID-19 and its variants through mass media and school health education programs is essential.

Key words: Awareness, COVID-19 and its variants, Preparatory school students.

I. Introduction

The pandemic due to the coronavirus disease 19 (COVID-19) has a significant impact worldwide. This disease is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a virus of the coronaviridae family, which infects animals and humans. Since December 2020, variants of the original SARS-CoV-2 have been identified, which



have a significant public health impact, with changes the disease transmissibility and have potential risk to decrease the efficacy of the methods of prevention of infection especially the efficacy of vaccines. ^[21]

A variant of a virus is a new strain of the existing virus with a change in ribonucleic acid (RNA) structure and virus behavior. Slight mutations have little or no impact on the virus's characteristics, such as its ability to cause infection, but when the virus genome is muted and a new strain is formed, the virus's characteristics of spreading infection and severity of infection also change. Any such change can make a new variant less or more severe; it can change vaccine effectiveness on the virus; and it can also affect social measures taken for it. ^[3]

COVID-19 and its variants is a life-threatening disease with many devastating psychological, emotional, social, and sexual implications, especially for vulnerable people. One of the most vulnerable age groups who suffered greatly from this crisis is students. Although, preparatory school students are less likely to experience severe symptoms of COVID-19 and its variants, they contribute to the spread of the virus, as they are more likely to engage in risky health behaviors and possibly to risky practices related to COVID-19 and its variants. Students can also contract and transmit the virus through the close proximity in classrooms, shared spaces, and social interactions. It is important for schools and communities to implement preventive measures to reduce the risk of COVID-19 and its variants transmission among the students. ^[11]

Awareness about COVID-19 and its variants is important in controlling the spread of the disease. Knowing the cause of the disease, signs/symptoms, and the possible methods of prevention can facilitate the proactive application of preventive measures. Information about COVID 19 considers of significant value in providing the required strategies to be carried out. Moreover, these would enhance and evaluate the presently available programs as well as recognize possible interventions to improve the behavioral and attitudinal changes. Positive attitude and behavioral changes are driven by the level of knowledge and perceptions towards preventive practices. ^[17]

School health nurse plays an important role in preventing the spread of the disease through providing health education about COVID-19 and its variants prevention and control and encouraging students with adherence; which is influenced by the student's knowledge, attitudes, and practices regarding COVID-19 and its variants. Evidence shows that student knowledge is important in managing pandemics. Many facts about students' perceptions and practices can be gained by assessing students' awareness about coronavirus which helps to identify attributes that affect the students' adoption of healthy practices and behaviors. ^[6]

Significance of the Study

The virus that causes COVID-19 is continually evolving and producing new types of variants and sub-variants that spread quickly across the world because of its high transmission rate. This pandemic has resulted in more than 750 million reported cases and more than 6.5 million deaths worldwide. In Egypt, from January 2020 to January 2024 there have been 516,023 confirmed cases of COVID-19 with 24,613 deaths reported to the World Health Organization. ^[33] Education has been severely disrupted by this current global pandemic; 94% of students worldwide were affected, representing 1.58 billion students, from pre-primary to higher education, in 200 countries. ^[35]

The gap in knowledge, poor attitudes, and bad practices among students in relation to COVID-19 and its variants prevention and control have a contributing role in spreading the infection. Positive attitude and behavioral changes are driven by the level of knowledge and health beliefs towards preventive practices. ^[1] So, the current study aimed to assess awareness of preparatory school students regarding COVID-19 and its variants

Aim of the study

The aim of this study is to: Assess awareness of preparatory school students regarding COVID-19 and its variants through:

Assessing knowledge of preparatory school students about COVID-19 and its variants

Assessing attitudes of preparatory school students toward COVID-19 and its variants.

Assessing reported practices of preparatory school students regarding COVID-19 and its variants.

Research Questions:

Q 1 –Are preparatory school students having adequate knowledge about COVID-19 and its variants?

Q 2 –What are the attitudes of preparatory school students toward COVID-19 and its variants?

Q 3 –Are preparatory school students having satisfactory level of reported practices regarding COVID-19 and its variants?

Q 4 – Is there a relation between preparatory school students' total knowledge, attitudes and reported practices regarding COVID-19 and its variants?

II. Subjects and Method

Research design:

A descriptive study was applied to achieve the aim of the current study.

Research setting:

The study was conducted at preparatory schools in El-Masara district in Helwan, Cairo Governorate, Egypt. El-Masara district contains 17 preparatory schools, selected randomly (25 January preparatory school, Khadija Bent Khowayled preparatory school, and El-Shaheed Ahmed Marzok preparatory school). Each school has six classes for 1st and 2nd preparatory grades and the total number of students in each class recruited through the academic year 2021-2022 was 32–35.

Subjects:

A multistage random sample of 210 students from the first and second preparatory grades was included in this study from the selected preparatory schools in El-Masara district.

Sampling technique:

A multi-stage random sampling technique was used for the selection of preparatory school students according to the following stages:

First stage: the total number of governmental preparatory schools at El-Masara is 17; three schools were chosen randomly to conduct this study by using numbers that were written on closed paper and assigned to each school. The researcher then closed his eyes and randomly picked up a subset of three numbers that represent three schools from the 17 schools in El-Masara district.

Second stage: two classes from first and second preparatory grades were selected randomly from each school. The total number of classes included in the study was six.

Third stage: all school students in selected classrooms were included in the study (210).

Tools of data collection

The data were collected through using the following tool:

A Self-Administered Questionnaire: This tool was developed by the researcher after a comprehensive literature search and based on the most recent available information from the World Health Organization, the Center for Disease Control and Prevention and the Egyptian Ministry of Health. It composed of five parts:

Part I: Concerned with demographic characteristics of the students related to age, sex, place of residence, preparatory school grade, father's education, mother's education, family members whose work in the health sector, family income, number of family members, and number of household rooms. This part consists of 10 items (Q1- Q10).

Part II: Concerned with the students' medical history and COVID-19 related experience, which included: Do you have an existing chronic disease, how do you rate your overall health, how worried do you about coronavirus, previous infection with COVID-19 or its variants, know someone who had been infected with COVID-19 or its variants, know someone who died from COVID-19 or its variants and primary sources of COVID-19 pandemic. This part consists of 7 items (Q11- Q17).

Part III: Concerned with students' knowledge about COVID-19 & its variants which included: knowledge regarding meaning, causes, routes of transmission, incubation period, common symptoms, vulnerable groups, diagnosis, and available treatment of the disease, complications, prognosis, general preventive measures and knowledge regarding variants of COVID-19. This part consists of 60 items (Q18- Q77).

Scoring system for students' knowledge items:

This part contained 60 closed ended questions; they were answered on "yes, "no," and "I don't know" options. A correct answer was assigned a score of 1 and zero for an incorrect answer, or I don't know. The total knowledge score ranged from zero to 60; scores were converted into percentages, with high scores indicating good knowledge about COVID-19 and its variants. Items were evaluated for internal reliability using Cronbach's alpha coefficient of 0.82, indicating internal reliability.

The total scores of students' knowledge were divided into three levels:

- Good knowledge ($\geq 75\%$ -100%) (≥ 45 -60 scores).
- Average knowledge ($50\% < 75\%$) (30- <45 scores).
- Poor knowledge ($< 50\%$) (0<30 scores).

Part IV: Concerned with students' attitudes toward COVID-19 and its variants, for example: feel anxious when you think of COVID-19 and its variants, think that you are a potential source of infection for your family, and think that keeping a safe physical distance is the duty of all people. This part consists of 20 items (Q78- Q97).

Scoring system for students' attitudes items:

This part contained 20 questions; in this section, scores were calculated based on the students' answers to each attitudinal statement using three-point Likert scale, which was rated from 1-3: 1 = disagree, 2 = neutral, and 3 = agree. Total scores ranged from 20 to 60; scores were converted into percentages, with high scores indicating positive attitudes. The Likert scale was assessed for internal reliability using Cronbach's alpha. Cronbach's α coefficient was 0.84, indicating internal reliability.

The total scores of students' attitudes were divided into two levels:

- Positive attitude $\geq 60\%$ (≥ 36 - 60 scores).
- Negative attitude $< 60\%$ (20 - < 36 scores).



Part V: Concerned with reported practices about COVID-19 and its variants to assess the adherence to preventive measures like: covering mouth and nose with a tissue or elbow when sneezing & coughing, disposing of used tissues in the bin & washing hands in regular manner with soap and water or with disinfectants, and sanitize the surfaces which are suspected of infection exposure. This part 20 items (Q98-Q117).

Scoring system for students' reported practices items:

This part contained 20 questions; in this section, scores were calculated based on the students' answers to each statement using three-point Likert scale, which was rated from 0-2, zero = never, 1 = sometimes, and 2 = always. Total scores ranged from 0 to 40; scores were converted into percentages, with high scores indicating satisfactory reported practices. The Likert scale was assessed for internal reliability using Cronbach's alpha. Cronbach's α coefficient was 0.87, indicating internal reliability.

The total scores of students' reported practices were divided into two levels:

- Satisfactory reported practice $\geq 60\%$ (≥ 24 - 40 scores).
- Unsatisfactory reported practice $<60\%$ (0-< 24 scores).

Validity:

The tools validity was done by five of Faculty's staff nursing experts in the field of experts in medical surgical and community health nursing, Faculty of Nursing, Helwan University, specialties reviewed the tools for clarity, relevance, comprehensiveness, applicability, and reliability.

Reliability

Reliability coefficients were calculated for the questionnaires of awareness regarding COVID-19 and its variants, preparatory among preparatory school students, Cronbach's Alpha for their knowledge was 0.82, for their attitudes was 0.84, and for their reported practices was 0.87.

Ethical considerations:

An official permission to conduct the proposed study obtained from the Scientific Research Ethics Committee Faculty of Nursing, Helwan University. Participation in the study was voluntary and subjects were given complete full information about the study which included explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of the information where it not be accessed by any other party without taking permission of the participants. Ethics, values, culture and beliefs were respected.

Pilot study:

The simplicity, clarity, and applicability of the tool was evaluated in a pilot study involving 10% of the entire sample (21 students). The time required to collect the questionnaire was determined as well as any problems during data collection were identified. Since no modifications were made, pilot study participants were included within the total sample size.

Fieldwork

Official permission was obtained from the directors of the schools before conducting the study. The researcher met the students and the aim of the study was explained to them. Their informed verbal consent was secured before collecting data. Data was collected during two semesters of the 2021–2022 academic year, from the beginning of November to the end of May, and the researcher was available two days per week (Tuesday and Wednesday) from 9:00 a.m.–1:00 p.m. in the study setting until the completion of the questionnaire. The study was carried out by interviewing the students in the

previously mentioned settings. The time required for each student to fill out the questionnaire was about 15–20 minutes. The researcher re-checked each sheet after the student completed it to make sure no data was missing.

Statistical analysis:

Data entry and analysis were performed using SPSS statistical package version 25. Categorical variables were expressed as number and percentage while continuous variables were expressed as (mean \pm SD). Chi-Square (χ^2) was used to test the association between row and column variable of qualitative data. Comparison of quantitative variables between the study groups was carried out using the student t-test for independent samples to compare two groups when normally distributed. Pearson correlation was done to measure correlation between quantitative variables.

Pearson correlation was done to measure correlation between quantitative variables. Degrees of the significance of results were considered as follows: P-value > 0.05 not significant (NS), p-value ≤ 0.05 statistically significant (S) and p-value ≤ 0.001 highly statistically significant (HS).

III. Results

Table 1 shows that 90.0% of the studied students were in the age group 11-13 years old, with mean and standard deviation values of age were 12.18 ± 1.82 years, 65.2% of them were females, 75.2% of them live in urban residence and 60.0% of them were in the 1st preparatory grade. Regarding level of parent's education, 27.6% of their fathers had secondary education, with 21.9% of their mothers were not read and write and had technical diploma equally. 51.0% of their parents don't work in the health sector and 62.4% of them hadn't enough income.

Table 2 illustrates that 87.1% of the studied students had not chronic diseases, 34.8% perceived that their health status was very good and 49.0% were very worried about coronavirus. 75.2% of them hadn't been infected with COVID-19, while 24.8% of them had been infected. 63.5% of the infected subjects reported that the infection was mild and 78.8% of them hadn't been confirmed to have been infected by a test. Moreover, 51.9% of them didn't know people who were or had been infected with COVID-19 (suspected or confirmed), and 80.0% of them reported that the infected people they knew weren't died from COVID-19.

Fig. 1 reveals that 60% of the studied students used social media (e.g., Facebook, Twitter, etc.) as a primary source of information to know about COVID-19 and its variants, followed by 40% of them using television. On the other hand, 12.9% of the studied students' primary sources of information were health care professionals, while 12.4% of them were used radio.

Fig. 2 clarifies that 60.5% and 39.5% of the studied students had poor and average knowledge about COVID-19 and its variants respectively, while none of them had good knowledge about COVID-19 and its variants.

Table 3 reveals that there 61.4% of studied students had negative attitudes toward COVID-19 and its variants, while 38.6% of them had positive attitudes toward COVID-19 and its variants.

Table 4 represents that, 72.4% of the studied preparatory school students had unsatisfactory practices regarding COVID-19 and its variants, while 27.6% of them had satisfactory practices post- awareness program.

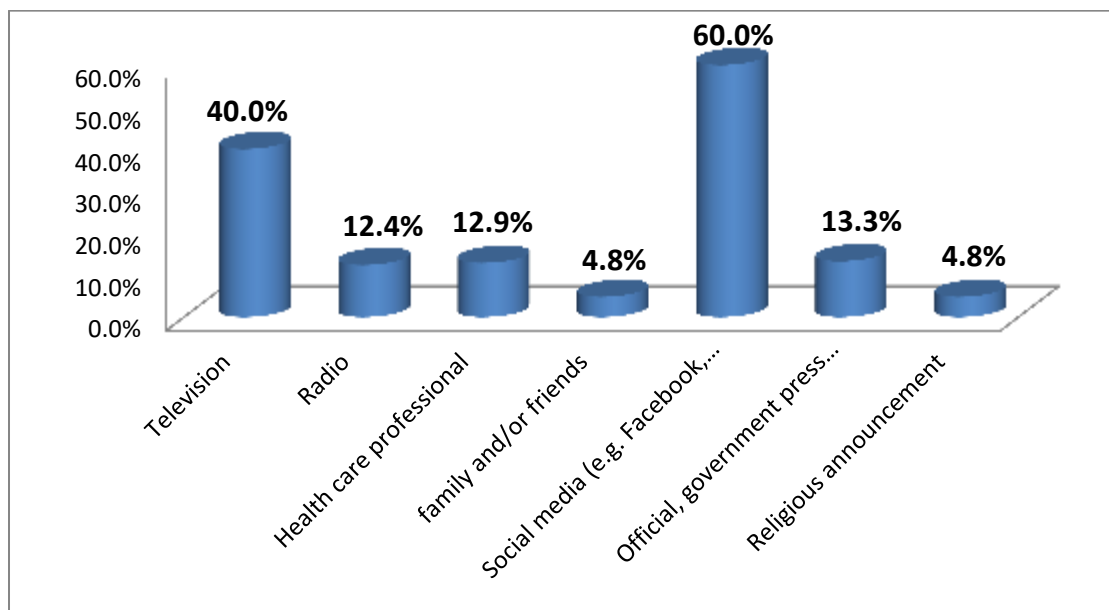
Table 5 displays that there was a highly statistically significant positive correlation between the studied students' total level of knowledge, attitudes, and reported practices regarding COVID-19 and its variants ($P \leq 0.001$).

Table (1): Frequency Distribution of Demographic Characteristics of Preparatory School Students regarding COVID-19 and Its Variants (n=210).

Demographic characteristics	The studied sample (n=210)	
	No.	%
• Age		
- 11 – 13	189	90.0
- >13 – 15	21	10.0
Mean \pm SD 12.18 \pm 1.82		
• Gender		
- Male	73	34.8
- Female	137	65.2
• Place of residence		
- Rural	52	24.8
- Urban	158	75.2
• Preparatory grade level		
- Grade 1 st	126	60.0
- Grade 2 nd	84	40.0
• Father education		
- No read and write	27	12.9
- Read and write	36	17.1
- Basic education	16	7.6
- Secondary	58	27.6
- Technical diploma	37	17.7
- University and above	36	17.1
• Mother education		
- No read and write	26	12.4
- Read and write	46	21.9
- Basic education	36	17.1
- Secondary	23	11.0
- Technical diploma	46	21.9
- University and above	33	15.7
• Any of family members work in the health sector		
- Yes	103	49.0
- No	107	51.0
• Family Income		
- Not enough	131	62.4
- Enough but no saving	58	27.6
- Enough and saving	21	10.0
• Number of family members	4.6857 \pm 0.70966	
• Number of household rooms	3.3048 \pm 0.90320	

Table (2): Frequency Distribution of the Preparatory School Students regarding Medical Health History and COVID-19 & its Variants Related-Experiences (n=210).

Items	No.	%
Having an existing chronic disease		
• Yes	11	5.2
• No	199	94.8
Rating your overall health		
• Very poor	27	12.9
• Poor	26	12.4
• Fair	38	18.0
• Good	46	21.9
• Very good	73	34.8
Worried about coronavirus		
• Very worried	103	49.0
• To some extent	60	28.6
• Not worried at all	47	22.4
Infected with COVID-19 or its variants		
• Yes	52	24.8
• No	158	75.2
If “yes”: Was the infection?		
• Mild	33	63.5
• Severe	19	36.5
Was the infection		
• Confirmed by a test	11	21.2
• Not confirmed by a test	41	78.8
Know people who are or have been infected with COVID-19 or its variants (suspected or confirmed)		
• Yes	101	48.1
• No	109	51.9
If “yes”: know someone who died from COVID-19		
• Yes	20	19.8
• No	81	80.2



*more than one answer is possible

Figure (1): Percentage Distribution of Primary Sources of Information regarding COVID-19 and its variants among Preparatory School Students (n=210).

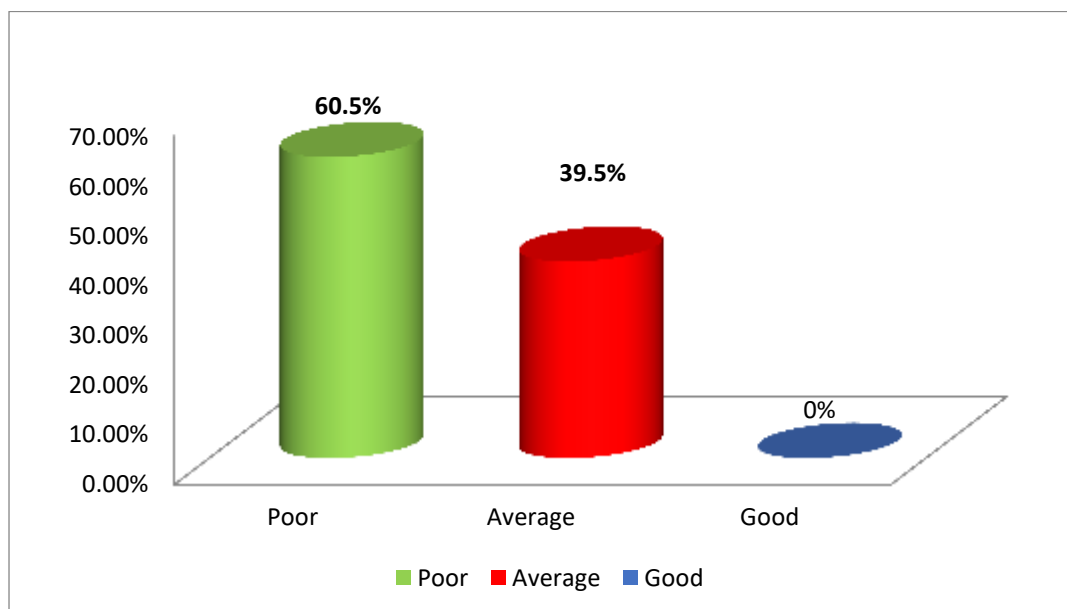


Figure (2): Percentage Distribution of Total Knowledge among Preparatory School Students regarding COVID-19 and Its Variants (n=210).

Table (3): Frequency Distribution of Total Attitudes among Preparatory School Students regarding COVID-19 and Its Variants (n=210).

Total attitudes	Negative		Positive		χ^2	P Value
	No.	%	No.	%		
	129	61.4	81	38.6		
Mean score of total attitudes:						
Range	26					
Mean \pm SD	57.79 \pm 5.803					

*Significant at $p \leq 0.05$ **Highly significant at $p \leq 0.001$ Not significant at $p > 0.05$

Table (4): Percentage Distribution of Total Reported Practices among Preparatory School Students regarding COVID-19 and Its Variants (n=210)

Total reported practices	Unsatisfactory		Satisfactory		χ^2	P Value
	No.	%	No.	%		
	152	72.4	58	27.6		
Mean score of total reported practices						
Range	15					
Mean \pm SD	32.785 \pm 4.477					

*Significant at $p \leq 0.05$ **Highly significant at $p \leq 0.001$ Not significant at $p > 0.05$

Table (5): Correlation between the Studied Preparatory School Students' Total Knowledge, Attitudes, and Reported Practices regarding COVID-19 and Its Variants (n=210).

Items		Total knowledge	Total attitudes	Total reported practice
Total knowledge	R	---	0.720	0.715
	p-value	---	0.000**	0.000**
Total attitudes	R	0.720	---	0.824
	p-value	0.000**	---	0.000**
Total reported practices	R	0.715	0.824	---
	p-value	0.000**	0.000**	---

*Significant at $p \leq 0.05$ **Highly significant at $p \leq 0.001$ Not significant at $p > 0.05$

IV. Discussion

The world is now facing a COVID-19 pandemic, which is considered highly infectious. Several preventive measures have been mentioned to prevent its spread among students. However, for these preventive measures to be effective, the students require appropriate and sufficient knowledge. ^[19] Improving health awareness is crucial to preventing and controlling the disease. Health care teams include school health nurses are responsible for providing knowledge, delivering good quality management, and protecting students from illness during the epidemic prevalence period. ^[29] Therefore, this study aimed to assess awareness regarding COVID-19 and its variants among preparatory school students.

Regarding demographic characteristics of the studied students, the current study results revealed that most of the studied students' ages ranged from 11 to 13 years, with a mean \pm SD of 12.18 ± 1.82 years. This result was supported by **Radwan et al.** ^[24] in Palestine, who reported that 55.8% of the studied students aged between 11 and 14 years. Although, this result disagreed with **Subedi et al.** ^[30] in South Asia, who found that the mean age of the studied school students was 14.8 years (range 13–17 years). From the researcher's point of view, this finding might be due to the fact that the ages of the students at the 1st and 2nd preparatory grades in Egypt range from 11 to 13 years.

Related to sex, the current study represented that about two-thirds of the studied subjects were females. This finding was in line with **Souli and Dilucca** ^[28] in Italy, who revealed that 59.3% were females and 40.7% were males. However, this finding was contradictory to **Waghmare et al.** ^[31] in India, who reported that 57.7% of the studied students were male. From the researcher's point of view, this finding might be due to the number of girls in preparatory schools affiliated with Al-Masara educational administration was higher than that of boys and mixed schools.

Considering the place of residence, the present study showed that slightly more than three-quarters of the studied students lived in an urban area. This result was in agreement with **Wen** ^[32] in China, who found that 64.5% lived in urban areas. From the researcher's point of view, this finding might be due to the selected schools are affiliated to Al-Masara district, which is considered an urban area, and usually parents prefer to live nearby their children's schools.

Concerning preparatory school grade level, the current study clarified that less than two-thirds of the studied students were in 1st preparatory grade. This result was in discrepancy with **Dardas** ^[9] in Jordan, who stated that 16.0% of the studied participants were in 1st preparatory grade. From the researcher's point of view, this finding might be due to the high attendance rate of students' enrolled in the 1st grade and their interest in becoming more knowledgeable about COVID-19 and its variants.

Regarding father's and mother's education, the present study results showed that more than one quarter of their fathers had secondary education, while more than one fifth of their mothers read and wrote and had technical diplomas equally. From the researcher's point of view, this finding might be due to living in slum areas and a lack of interest in being highly educated.

With regards to whether any of their family members work in the health sector, the present study illustrated that more than half of their family members didn't work in the health sector. This finding was dissimilar to the result of **Radwan et al.** ^[24] who reported that more than half (52.7%) of students' family members worked in the health sector.

In relation to family income, the present study clarified that more than three-fifths of the studied students did not have enough income. This result was in disparity with **Radwan et al.** ^[25] in Palestine, who found that about 65.0% confirmed that the economic level of their family is moderate. From the researcher's point of view, this finding might be due to the nature of their parents' occupation, which does not earn enough money based on their educational level.

Concerning to Students' medical history, the finding of the present study explicated that the majority of the studied students weren't suffering from chronic diseases. This result was similar to **Mudenda et al.** ^[18] in Zambia, who reported that 89.0% of the study participants weren't suffering from chronic diseases. From the researcher's point of view, such a result can be explained by the fact that chronic diseases are not usually common in the youngest age group.

Regarding students' perception of their overall health status, the current study indicated that slightly more than one-third of the studied students perceived that their health status was very good while slightly more than one-fifth perceived it as good. This result was inconsistent with **Machado et al.** ^[16] in Portugal, who showed that 59.5% perceived their health as excellent or very good while 31.0% perceived it as good. From the researcher's point of view, this finding might be due to the way people perceive their health is influenced by a complex set of factors such as their view of health, level of education, beliefs, among others environmental, cultural and socioeconomic conditions.



With respect to worrying about coronavirus, the current study results represented that about half of the studied students were very worried about coronavirus. In the same context, **Xue et al.** ^[34] in China, who stated that 37.2% of the studied school students were very worried about being infected with COVID 19. From the researcher's point of view, this finding might be due to coronavirus is a highly infectious virus that might infect any age group.

In relation to previous infection with COVID-19 or its variants, the present study revealed that slightly more than three-quarters of the studied students hadn't been infected with COVID-19, less than two-thirds of the infected students reported that the infection was mild, and more than three-quarters of them hadn't been confirmed to have been infected by a test. Furthermore, more than half of them didn't know people in their immediate social environment who were or had been infected with COVID-19 (suspected or confirmed), and less than one-fifth of them didn't die from COVID-19. Similarly, this result was supported by **Mudenda et al.** ^[16] who reported that 85.7% of the participants had not suffered from COVID-19, but among these, 46.8% knew a friend or relative who had previously suffered from COVID-19 and 73.5% of them reported not knowing a relative or friend who had died of COVID-19. From the researcher's point of view, this result might be due to COVID-19 and its variants infection has been reported in all age groups, including infants, children and young adults. Even so, studies consistently indicate that children under the age of 18 years old are less frequently infected with SARS-CoV-2. They are mostly asymptomatic or experience much milder symptoms than the adults.

Concerning students' primary source of information, the present study indicated that of less than two-thirds of the studied students used social media as a primary source of information to know about COVID-19 and its variants, followed by two-fifths of them using television. These results go in line with **Singh et al.** ^[26] in India, who found that social media (81.4%) and television (75.3%) were the main sources of receiving COVID-19-related information. As well, these results were matched with **Padmanaban et al.** ^[20] in India, who showed that the majority of students (81.0%) used social media as a vital source of information to know about COVID-19, followed by TV (79.0%).

Contrariwise, these results were incongruent with **Getawa et al.** ^[12] in Ethiopia, who indicated that 78.7% of the studied student use television and radio as source of information about COVID-19 while 13,2% of them use social media. From the researcher's point of view, this may be due to ease of access to readily updated information to most students via the internet and social media. This indicates the importance of the Internet in health promotion, especially during the occurrence of pandemics; even though it highlights that social media can be a fertile area for the dissemination of misinformation about COVID-19.

In relation to students' the total level of knowledge regarding COVID-19 and its variants, the current study clarified that more than three-fifths and about two-fifths of the studied preparatory school students had poor and average knowledge respectively, while none of them had good knowledge about COVID-19 and its variants. This result was supported by **Adli et al.** ^[2] in Indonesia, who reported that 29.8% of the studied students had adequate knowledge about COVID-19. Also, this result agreed with **Ferdous et al.** ^[10] in Bangladesh, who showed that 51.7% of the studied participants had inaccurate knowledge about COVID-19. Similarly, **Amin et al.** ^[4] in Egypt, who stated that more than half (52.6%) and less than one –fifth (19.8%) of the students had poor and fair knowledge concerning Omicron variant, while only more than one-quarter (27.6%) of them had good knowledge. From the researcher's point of view, poor knowledge of the studied students might because students don't follow COVID-19 situations and updates as much as adults, as COVID-19-related knowledge is public knowledge; it is not knowledge in the academic curriculum, and students usually focus more on academic information. In addition this might attributed to three-fifths of the studied students reported that the main source of the student's information regarding COVID-19 and its variants was social media that may mislead students by spreading fabricated and unverified information.

In contrast to **Wen et al.** ^[32] in china, who found that 74.1% of the studied students had high level of knowledge about COVID-19. As well, this result was disagreed with **Li et al.** ^[14] in china, who illustrated that 24.11% of the studied students had poor knowledge awareness regarding COVID-19. The reason for this difference might be as their study was conducted in China, where COVID-19 outbreak was emerged and they had all resources necessary to improve awareness of their people and the entire world about the disease and its prevention.

Concerning students' total attitudes toward COVID-19 and its variants, the current study revealed that more than three-fifths of the students had negative attitudes, whereas less than two-fifths of them had positive attitudes towards COVID-19 and its variants. This result was similar to **Radwan et al.** ^[25] in Palestine, who found that 68.6% of the students possessed negative attitudes toward COVID-19. Also, this finding was in the same context with **Lincango-Naranjo et al.** ^[15] in Spain, who clarified that more than one-half of respondents had negative attitudes toward COVID-19. Contrary to this finding, it was contradicted by **Adli et al.** ^[2] in Indonesia, who found that 51.5% of the studied students had a positive attitude. In addition, this result was disagreed with **Peng et al.** ^[22] in China, who reported that 73.81% of the studied students had positive attitudes. From the researcher's point of view, this might be due to the association between the students' knowledge and attitudes, which indicates that students' poor knowledge reflects their negative attitudes towards COVID-19 and its variants.

With regards to students' total reported practices regarding COVID-19 and its variants, the current study proved that less than three-quarters of them had unsatisfactory level of reported practices, while more than one-quarter of them had satisfactory level of reported practices regarding COVID-19 and its variants. This result was in accordance with **Hassan et al.** ^[13] in Yemen, who clarified that only minority of participants followed any preventative measures since the beginning of the pandemic. As well, this result was in line with **Sirat et al.** ^[27] in Afghanistan, who revealed that 71.8 % of the studied students had poor practices regarding COVID-19. Furthermore, this finding was similar to **Aynalem et al.** ^[7] in Ethiopia, who indicated that most of the studied participants had poor practices regarding COVID-19 preventive measures. Conversely, this finding was different from the result of the study done by **Ganaprakasam et al.** ^[11] in Malaysia, who reported that most of the respondents scored average and followed the preventive practices. From the researcher's point of view, unsatisfactory reported practices of the studied students might be due to a variety of reasons including poor knowledge, negative attitudes, the high expense of protective equipment such as face masks, and hand sanitizers. Moreover, this might be rationalized by the age of the participants, as young people often think that the occurrence of COVID-19, its variants, and its complications are related to the elderly or people with underlying diseases only.

As regards correlation between the studied students' total knowledge, attitudes, and reported practices regarding COVID-19 and its variants, the present study represented that there was a highly statistically significant positive correlation between the studied students' total level of knowledge, attitudes, and reported practices regarding COVID-19 and its variants ($P \leq 0.001$). These findings were supported by **Poddar et al.** ^[23] in India, who showed that there was a positive correlation between knowledge, attitude, and practice. Also, these results were in agreement with **Anaam** ^[5] in Yemen, who revealed that there was a statistically significant association between practice and knowledge and between practice and attitude. On the contrary, this finding was inconsistent with **Canti et al.** ^[8] in Malaysia, who showed that there was no statistically significant correlation between knowledge on COVID-19 and the practice towards prevention of COVID-19 ($r = 0.031$, $p = 0.615$). From the researcher's point of view, this could be due to students with poor knowledge had more negative attitudes regarding the COVID-19 and its variants thus they practiced less preventive behaviors and vice versa; good knowledge regarding the COVID-19 and its variants reflects positive attitudes and adoption of healthy practices and behaviors.

V. Conclusion

On the light of results of the current study and answers of the research questions, it could be concluded that; more than three-fifths and about two-fifths of the studied preparatory school students had poor and average knowledge respectively, while none of them had good knowledge about COVID-19 and its variants. More than three-fifths of the students had negative attitudes, whereas less than two-fifths of them had positive attitudes towards COVID-19 and its variants, and less than three-quarters of them had unsatisfactory level of reported practices, while more than one-quarter of them had satisfactory level of reported practices regarding COVID-19 and its variants. Also, there was a highly statistical significant positive correlation between students' total level of knowledge, attitudes & reported practices regarding COVID-19 and its variants.

VI. Recommendations

On the light of the current study findings the following recommendations are suggested:

Students:

- 1- Design and implement awareness programs for all preparatory school students to raise their awareness about COVID-19 & its variants.
- 2- Increasing students' health awareness regarding COVID-19 and its variants through mass media and school health education programs is essential.
- 3- Developing appropriate and engaging hygiene and social distancing awareness campaigns targeting school students.
- 4- Schools Policy makers should put strict rules regarding the students commitment with preventive practices regarding COVID-19 and its variants.

Community

- 5- Conducting community mobilization campaigns to boost community awareness about COVID-19 and its variants infection, especially in the rural population.
- 6- Creating social media-based campaigns by concerned public health authorities to lessen the dissemination of falsifying information and misconceptions about COVID- 19 and its variants.

Further research:

- 7- Further researches are needed for school students regarding limitation of COVID 19 & its variants to reduce and prevent this infection and apply it on large sample selected from all schools in Egypt.
- 8- More investigations about impact of COVID pandemic on bio-psychosocial wellbeing of school students.

References

- 1- Abdeldaim, D. E., & Elghazally, N. (2021). An outcome of COVID-19 awareness educational program towards Schools' Students and Staff Knowledge in Tanta City, Egypt. The Egyptian Family Medicine Journal, 5(2), pp.49-63.
- 2- Adli, I., Widyahening, I. S., Lazarus, G., Phowira, J., Baihaqi, L. A., Ariffandi, B., ... & Findyartini, A. (2022). Knowledge, attitude, and practice related to the COVID-19 pandemic among undergraduate medical students in Indonesia: A nationwide cross-sectional study. PloS one, 17(1), e0262827.
- 3- Aleem, A., AB, A. S., & Slenker, A. K. (2021): Emerging variants of SARS-CoV-2 and novel therapeutics against coronavirus (COVID-19). Available at: <https://europepmc.org/article/nbk/nbk570580>. Accessed date 11 February 2023, 12:15 am.
- 4- Amin, M, S., Elzohairy, W, N., & Elbially, A, A. (2022). Knowledge, Anxiety, and Protective Behaviors Regarding Omicron among Secondary School Students. International Egyptian Journal of Nursing Sciences and Research, 3(1), pp.303-317.
- 5- Anaam, S., M. (2023): Assessment of knowledge, attitude, and practice towards COVID-19 among undergraduate students and its psychological impact on their life: Across-sectional study. Pharmacy Education 23 (1), pp.18-29.
- 6- Ayed, M., M., Mohamed, A., A., Mahmoud, T., M., & Abdelaziz, S., M. (2021). Effect of Educational intervention on secondary School Students' knowledge, Practices and Attitudes regarding COVID-19. Egyptian Journal of Health Care, 12(2), pp.58-74.
- 7- Aynalem, Y. A., Akalu, T. Y., Gebresellassie Gebregiorgis, B., Sharew, N. T., Assefa, H. K., & Shiferaw, W. S. (2021). Assessment of undergraduate student knowledge, attitude, and practices towards COVID-19 in Debre Berhan University, Ethiopia. PloS one, 16(5), e0250444.
- 8- Canti, N. A. N., Zain, N. M., & Embong, H. (2022). Knowledge on Coronavirus Disease (COVID-19) and Practice of COVID-19 Prevention among Students in the Health Campus. International Journal of Care Scholars, 5(2), pp.75-86.
- 9- Dardas, L. A., Khalaf, I., Nabolsi, M., Nassar, O., & Halasa, S. (2020). Developing an understanding of adolescents' knowledge, attitudes, and practices toward COVID-19. The Journal of School Nursing, 36(6), pp.430-441.



- 10- Ferdous, M. Z., Islam, M. S., Sikder, M. T., Mosaddek, A. S. M., Zegarra-Valdivia, J. A., & Gozal, D. (2020). Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: An online-based cross-sectional study. *PloS one*, 15(10), e0239254.
- 11- Ganaprakasam, C., Humayra, S., Ganasegaran, K., Kuppusamy, E., & Karikalan, B. (2021). Knowledge, Attitude, and Practice Regarding Covid-19 among primary school students in Kedah, Malaysia: A cross-sectional study. *Malaysian Journal of Public Health Medicine*, 21(3), pp.49-59.
- 12- Getawa, S., Aynalem, M., Bayleyegn, B., & Adane, T. (2022). Knowledge, attitude and practice towards COVID-19 among secondary school students in Gondar town, Northwest Ethiopia. *PloS one*, 17(5), e0268084.
- 13- Hassan, O. E. H., Al-Aghbari, A. A. A., McGowan, M., Iang, M. D., Basaleem, H. O., Al-Sakkaf, K. A., ... & Dureab, F. (2023). Knowledge, attitudes, and practices toward COVID-19 prevention in Yemen: a community-based cross-sectional study. *Frontiers in Public Health*, 11.
- 14- Li, Y. H., Wen, T., Cui, Y. S., Huang, Z. H., & Liu, Y. Q. (2023). Knowledge, attitudes, and practices regarding COVID-19 and mental health status among college students in China: a cross-sectional study. *Frontiers in Public Health*, 11.
- 15- Lincango-Naranjo, E., Espinoza-Suarez, N., Solis-Pazmino, P., Vinueza-Moreano, P., Rodriguez-Villafuerte, S., Lincango-Naranjo, J., ... & Ortiz-Prado, E. (2021). Paradigms about the COVID-19 pandemic: knowledge, attitudes and practices from medical students. *BMC medical education*, 21(1), pp.1-10.
- 16- Machado, B. C., Pinto, E., Silva, M., Veiga, E., Sá, C., Kuhz, S., ... & Correia, M. (2023). Impact of the COVID-19 pandemic on the mental and physical health and overall wellbeing of university students in Portugal. *Plos one*, 18(5), e0285317.
- 17- Mohammed, A. S. E. (2021): knowledge, Attitudes, and Practices towards COVID-19 among Health Care Workers in Primary Health Care Units Dar El Salam, Suhag, Egypt. *Sohag Medical Journal*, 25(1), pp.50-58.
- 18- Mudenda, S., Mukosha, M., Godman, B., Fadare, J. O., Ogunleye, O. O., Meyer, J. C., ... & Witika, B. A. (2022). Knowledge, Attitudes, and Acceptance of COVID-19 Vaccines among Secondary School Pupils in Zambia: Implications for Future Educational and Sensitisation Programmes. *Vaccines*, 10(12), 2141.
- 19- Osman, B. M., Abdelrheem, S. S., El Sabaa, R. M., Yousef, F. K., Hussein, A. A. M., Abuelkassem, N. M., & Atlam, S. A. (2023). COVID-19 pandemic: perception, attitude, and practices of university students from health sector faculties. *The Egyptian Journal of Bronchology*, 17(1), 4.
- 20- Padmanaban, S., Rajendran, P., Davis, P., & Velayutham, P. (2022). Knowledge, attitude and practices towards COVID-19 among higher education students in India: a cross sectional study. *Journal of Public Health*, 30(7), pp.1661-1673.
- 21- Parra-Lucare, A., Segura, P., Rojas, V., Pumarino, C., Saint-Pierre, G., & Toro, L. (2022). Emergence of SARS-CoV-2 variants in the world: how could this happen? *Life*, 12(2), 194.
- 22- Peng, Y., Pei, C., Zheng, Y., Wang, J., Zhang, K., Zheng, Z., & Zhu, P. (2020). A cross-sectional survey of knowledge, attitude and practice associated with COVID-19 among undergraduate students in China. *BMC public health*, 20(1), pp.1-8.
- 23- Poddar, P., Maheshwari, A., Shylasree, T. S., Yadav, S., Kannan, S., Ghosh, J., ... & Gupta, S. (2022). Knowledge, attitudes and practices towards COVID-19: a cross-sectional survey. *Indian Journal of Gynecologic Oncology*, 20(2), 23.
- 24- Radwan, E., Alattar, E., Radwan, A., Radwan, W., Alaje, M., Pandey, D., & Jebreen, K. (2023). Knowledge, attitudes, and practices of Palestinian students toward COVID-19: a cross-sectional study during the first wave of the COVID-19 pandemic. *Human Arenas*, pp.1-22.
- 25- Radwan, E., Radwan, A., Radwan, W., & Pandey, D. (2021). Prevalence of depression, anxiety and stress during the COVID-19 pandemic: a cross-sectional study among Palestinian students (10–18 years). *BMC psychology*, 9(1), pp.1-12.
- 26- Singh, P. J., Sewda, A., & Gupta, S. D. (2020). Assessing the knowledge, attitude and practices of students regarding the COVID-19 pandemic. *Journal of Health Management*, 22(2), pp.281-290.
- 27- Sirat, R., Sahrai, M. S., Rahimi, B. A., Asady, A., & Wasiq, A. W. (2023). Knowledge, attitudes and practices of university students toward COVID-19 in Southern region, Afghanistan: a cross-sectional study. *BMC Medical Education*, 23(1), pp.1-12.
- 28- Souli, D., & Dilucca, M. (2020). Knowledge, attitude and practice of secondary school students toward COVID-19 epidemic in Italy: a cross sectional study. *BioRxiv*, pp.2020-05.
- 29- Ssebuufu, R., Sikakulya, F. K., Mambo, S. B., Wasingya, L., Nganza, S. K., Ibrahim, B., & Kyamanywa, P. (2020). Knowledge, attitude, and self-reported practice toward measures for prevention of the spread of COVID-19 among Ugandans: a nationwide online cross-sectional survey. *Frontiers in public health*, 8, 890.
- 30- Subedi, D., Bhandari, S., Gaire, A., Kandel, M., Subedi, S., & Karki, S. (2020). Knowledge, attitude, and practices associated with COVID-19 among school students in Bharatpur, Chitwan District of Nepal. *International Journal of Medical Students*, 8(3), pp.231-237.
- 31- Waghmare, P., Humane, S., & Shaikh, T. (2023). Knowledge and attitude of school students Regarding the COVID-19 pandemic. Available at: <https://www.researchsquare.com/article/rs-2505374/v1>.



- 32- Wen, F., Meng, Y., Cao, H., Xia, J., Li, H., Qi, H., ... & Zhang, L. (2020). Knowledge, attitudes, practices of primary and middle school students at the outbreak of COVID-19 in Beijing: A cross-sectional online study. MedRxiv, pp.2020-06.
- 33- World Health Organization (2024). WHO COVID-19 dashboard. Available at: <https://covid19.who.int>. Accessed date 19 January 2024, 09:45 P.m.
- 34- Xue, Q., Xie, X., Liu, Q., Zhou, Y., Zhu, K., Wu, H., ... & Song, R. (2021). Knowledge, attitudes, and practices towards COVID-19 among primary school students in Hubei Province, China. Children and youth services review, 120, 105735.
- 35- Yuan, P., Aruffo, E., Gatov, E., Tan, Y., Li, Q., Ogden, N., ... & Zhu, H. (2022). School and community reopening during the COVID-19 pandemic: a mathematical modelling study. Royal Society open science, 9(2), 211883.