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Knowledge and Awareness of Viral Diseases among University Students in Jordan: Spring 2020

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Abstract

Background: Little is known about Jordanian university students' knowledge of viral disease.
Aims: This study aimed to evaluate their knowledge of the nature of viruses and viral diseases among university students in Jordan.
Methods: A cross-sectional study was conducted from May–September 2020, focused on students attending eleven colleges from three universities in Jordan. Students were asked to answer an online survey comprising 48 closed-ended questions measuring knowledge of viruses and viral diseases.
Results: One thousand three hundred nine students responded to the questionnaire. Only 36.7% of the respondents said that they had studied viruses and viral diseases in university lectures. The findings revealed that 20.63% of the respondents thought that a virus is a living organism and 39.9% of the students correctly answered that viruses cannot reproduce on nonliving surfaces. On the other hand, more than one third of the participants thought that viruses are not sensitive to antibiotic treatment. Only 9.7% of the respondents could name the scientist who discovered the virus. Regarding viral diseases, 36.1% of the participants were aware that human papilloma virus causes cancer, while only 7.7% were aware that any of the viral hepatitis, herpes or human papilloma viruses can develop into cancer. Almost half of the students answered correctly that SARS-cov2 infects both humans and some animal species and that the HIV virus can be transmitted through sexual intercourse. Additionally, 54.7% of the students believe that vaccination is the best method of protecting humans from viral diseases. Lastly, 42.1% of the respondents were aware that viruses can be used in several scientific fields including genetics, immunology, molecular biology, and nanotechnology.
Conclusion: These university students in Jordan have a poor knowledge of viruses and viral diseases and have had limited exposure to virology education. It is strongly suggested that their knowledge of viral diseases is improved at all levels of education through increasing the number of virology courses and lectures in educational institutions, especially health colleges.

Keywords: Viral diseases, virus, Jordan, knowledge, university students.

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Introduction

Following the first case of COVID-19 in Jordan, the government quickly initiated a series of responses which allowed the country, in the first phase, to be less affected than other Middle East countries [1]. In addition, the government designated certain hospitals for the treatment of patients of COVID-19 and prepared several protocols to deal with the pandemic, suspended schools and universities, who were to start distance education, closed Jordan’s borders, and banned gatherings. However, the pandemic induced tremendous stress on the economy and the health facilities of the country concerning the possibility of variants to scape vaccine-induced antibodies [2] . The Ministry of Health also established vaccination centers, through which six types of vaccines have been provided throughout the country. So far, 38.6% of the population have received two doses, and 42.6% have received at least one dose. However, the Jordanian Ministry of Health has recorded 1,731549COVID-19 cases and 14,122 deaths as of September 27, 2022.

Some viral diseases, such as influenza, herpes, hepatitis, and acquired immunodeficiency syndrome (AIDS), are reported to be at different rates of infection in Jordan. Eleven cases of the Middle East respiratory syndrome corona virus (Mers-Cov) were reported in Jordan in 2013, five of whom died [3]. In addition, it was reported that the prevalence of AIDS is less than 0.02% [4]. Abuharfeil and Meqdam (2000), reported that the prevalence of herpes type 2 (HSV-2) and cytomegalovirus (CMV) was high among Jordanians due to the crowded living conditions and low socioeconomic status of the Jordan population [5].

The agriculture sector in Jordan also has contact with viral diseases, especially those that infect plants such as tomato, potato, cucumber and tobacco. The most well-known viruses are tomato mosaic, alfalfa mosaic, potato X, tobacco ring spot, and cucumber mosaic virus [6]. In addition, the apple mosaic virus and apple stem grooving virus are prevalent and well-known among farmers in Jordan [7].

The focus on learning about viral diseases has increased with the COVID-19 pandemic [8]. The major sources for information about viral diseases, for the layperson, are television, radio, and social media [9]. Jordanian universities students are educated about viruses and viral diseases within several selective and obligatory courses, including virology, microbiology, medical microbiology, pathology, and pharmacology courses.

The Jordanian Ministry of Higher Education and Scientific Research, in cooperation with the Ministry of Health, launched a vaccination campaign against COVID-19 in all Jordanian universities and colleges, and indeed universities have played an essential role in the national vaccination campaign against the virus. A large number of students from universities, especially those at health colleges (including students at the universities in the current study), participated in this campaign in the vaccination centers inside and outside universities. University students are future leaders, capable of understanding and dealing with modern technology and education skills. However, few studies have been carried out on the knowledge and attitudes of Jordanians regarding the COVID-19 pandemic [10–11]. To the best of our knowledge, there are no studies on the awareness of university students regarding viral diseases. The present study investigated students in three Jordanian universities in an attempt to determine the reality of their current knowledge of viral biology and viral diseases.

Materials and Methods

Study design and survey questionnaire

This was a cross-sectional study conducted among students from different cities in Jordan. Eligible participants were students at three universities: Jerash, Isra, and Al-Zaytoonah. Eligible students had to be 18 years of age or older and enrolled in at least one semester course. The target population included students from different colleges, such as medical, basic scientific, economics, and the humanities. The questionnaire was distributed to the university students via a web link to the questionnaire page (https://julms.com/ survey/index.php/ 232298). The response to the questionnaire was opened between May 15 to September 15, 2020. Informed consent was obtained from each participant before they completed the questionnaire. At the beginning of the questionnaire, there was an introductory section describing the study objectives. The questionnaire itself consisted of 48 closed-ended questions in four categories: demographic data; exposure to viral knowledge; knowledge of the nature of viruses, the history of viruses, viral diseases, viral infection and diseases; and, the application of virology in human life. The students were asked to complete the online questionnaire. The study protocol was approved by the Ethics Committee of Jerash University (Id:16-05-2020). Before the questionnaire was sent to students, a pilot study was conducted with 60 students to identify misunderstood questions, if any. The Cronbach's alpha of the used questions was 0.8.

The sample size was calculated according to the Daniel formula [12], with a significance level of $\alpha = 0.05$. The expected prevalence in the sample with a characteristic of interest was 0.5. The total number of students in the three Jordanian universities was 16,150. We estimated that a sample size of 377 would represent the student population within these three universities. We thus recruited a sample size of 1,309 students to increase the statistical power of this study. Variables among the participants concerning their knowledge of virology and viral diseases were expressed as frequencies. Statistical analyses were carried out using SPSS v25 (IBM, Armonk, NY, USA).

Results

Demographic data of the participants

One thousand three hundred and nine students responded to the online questionnaire, 631 (48.2%) of which were from females and 530 (40.4%) of which were from males; the remaining (11.4%) had missing data. Regarding the academic program, 72.2% of the respondents were from the paramedical fields (pharmacy and nursing), 18.5% from the sciences, and 9.3% from other colleges. The remaining percentage had missing data. Concerning the age groups, 226 (17.29%) were aged 18–20, 501 (38.28%) were aged 21–23, 177 (13.54%) were aged 24–26, 92 (7.04%) were aged 27–29, and 312 (23.85%) were >29. On the other hand, the respondents were distributed across the academic years as follows: first year, 125 (9.50%), second year, 202 (15.45%), third year, 436 (33.32%), fourth year, 319 (24.40%), fifth year, 186 (14.24%), and sixth year, 40 (3.02%). The student responses revealed that 945 (72.18%) of the respondents were single, 346 (26.44%) were married, and 18 (1.40%) were divorced. On the other hand, the number of family members was as follows: one, 26 (1.99%), two, 62 (4.74%), three 95 (7.24%), four, 142 (10.86%), five, 227 (17.33%), and >5, 757 (57.83%). The percentage of respondents according to academic school, age, sex, and academic year is shown in Table 1.

Table 1. The demographic data of the respondent students

Demographic parameter	**Frequency (%)**
Sex	
Female	48.2%
Male	40.4%*
College	
Paramedical	72.2%
Science	18.5%
Other colleges	9.3%
Age	
18–20	17.29%
21–23	38.28%
24–26	13.54%
27–29	7.04%
>29	23.85%
Academic year	
First	9.5%
Second	15.5%
Third	33.3%
Fourth	24.4%
Fifth	14.3%
Sixth	3%
Marital status	
Single	72.2%
Married	26.4%
Divorced	1.4%
Number of family members	
1	2%
2	4.7%
3	7.2%
4	10.9%
5	17.3%
>5	57.8%

*11.4% had missing data with respect to gender

Exposure to viral knowledge

Table 2 shows the exposure of the students to virology education in the universities in this study. Only 481 (36.7%) said that they had studied viruses and viral diseases during university lectures, while 324 (24.8%) were not involved in any such educational activities.

Six hundred ninety respondents (52.7%)

agreed that there is a strong need to include curricula on viruses and viral epidemics, with 3.5% not approving of this. In addition, 43.8% of students were unable to decide on this question.

Almost half of the participants (49.7%) agreed with the necessity of offering compulsory university courses on viruses and viral epidemics, with 6.7% rejecting the idea. On the other hand, 43.6% of the students were unable to express an opinion on this.

Table 2. Exposure of the students to virology education

The statement	Agree (%)	Do not know (%)	Disagree (%)
I got the chance to study about viruses and viral diseases during university lectures	36.7%	38.5%	24.8%
There is a strong need to include curricula on viruses and viral epidemics	52.7%	43.8%	3.5%
It is necessary to offer compulsory university courses on viruses and viral epidemics	49.7%	43.6%	6.7%

The knowledge of the students about the nature of viruses

A total of 270 (20.63%) of the respondents believed that the virus is a living organism, 247 (18.87%) said they are infectious particles, 255 (19.48%) said they are non-living materials, and 504 (38.5%) said they had no knowledge of the nature of viruses. The percentage of students who gave the correct answer for the Latin meaning of virus of ‘poisonous’ was 15.1%, but 38.5% incorrectly answered that it means ‘tiny’. In addition, 7.7% of the students thought that virus might have a different meaning, and 38.7% of the students were unable to decide on this question.

Most of the participants (48.2%) answered correctly that the virus can be seen only with an electron microscope. On the other hand, 9.63% of the students thought that it can be seen by a light microscope, with 2.4% thinking the correct answer was ‘telescope’; surprisingly, 1.2% believed it can be seen with the naked eye.

While 27.2% of the respondents were aware that the correct name for the widespread outbreak of a viral disease is a pandemic, 33% answered wrongly by choosing ‘epidemic’, and 39.1% did not know the name of the outbreak of a virus. However, few students (0.8%) selected ‘dangerous disease’.

Most of the participants 547 (41.8%) were aware that a virus is an intracellular parasitic life, but 15.4% thought wrongly that a virus can live outside and inside a cell. However, 4.1% of the respondents believed that a virus can live freely.

While 40% of the respondents appeared to have no background knowledge of virus behavior, almost the same percentage (39.9%) correctly answered that viruses cannot reproduce on nonliving surfaces. However, 14.1% of the participants answered the question wrongly.

The majority of responders (38%) answered correctly that a virus can move, reproduce and metabolize, but some chose other answers, including: reproduction only (17%), movement only (4.7%) and metabolism only (1.5%).

Three hundred and thirty-four students (25.5%) correctly stated that viruses reproduce by commandeering the host cell’s metabolism. A further 21.6% of respondents believed wrongly that viruses multiply by fission, while 52.9% were unable to answer the question correctly.

Only 37.7% of the participants were correctly aware of the time viruses stay inactive inside host cells, and 62.3% of the students were unable to answer the question correctly.

Three hundred and seventy-six students (28.7%) correctly answered that a viral genome can be either DNA or RNA. However, 20.3% and 11.7% of the participants named RNA and DNA respectively as the viral genome, while the rest of the respondents gave no answer.

Four hundred and thirty (32.9%) students were aware that viruses cannot synthesize proteins as they lack ribosomes, but the majority (67.2%) of the participants failed to answer the question correctly.

Just 22.8% of the participants were aware that the relative size of bacteria to viruses is at least 1000x. About 31.5% of the students gave the wrong answer and 39.5% were unable to decide on this question.

Lastly, more than one third of the participants (34%) correctly stated that viruses are not sensitive to antibiotic treatment. A further 26.7% of the students were not aware of this while the rest of students answered the question wrongly.

Table 3. Knowledge of the students on the nature of viruses

The statement	Answer A (%)*	Answer B (%)	Answer C (%)	Answer D (%)	Answer E (%)	Missing
The virus is:	Living particle (20.6%)	Infectious particle(18.8%)	Non-living material(19.5%)	Do not know (38.5%)	-	2.5%
The Latin meaning of virus is:	Poisonous (15.1%)	Tiny (38.5%)	Different meaning (7.7%)	Do not know (38.7%)	-	0
The virus can be seen only by:	Electron microscope (48.2%)	Light microscope (9.63%)	Telescope (2.4%)	Naked eye (1.2%)	Do not know (38.7%)	0
The correct name for the outbreak spread of a viral disease is:	Pandemic (27.2%)	Epidemic(33%)	Dangerous disease (0.8%)	Do not know (39%)	-	0
The virus can live:	Intracellular (41.8%)	Outside and inside the cell (15.4%)	Freely (4.1%)	Do not know (38.7%)	-	0
Viruses cannot reproduce on nonliving surfaces:	True (39.9%)	False (14.1%)	Do not know (40%)	-	-	6%
The virus can perform:	Movement, reproduction and metabolism (38%)	Reproduction only (17%)	Movement Only (4.7%)	Metabolism only (1.5%)	Do not know (38.8%)	0
Viruses reproduce by:	Commandeering the host cell's metabolism (25.5%)	Viruses multiply by fission (21.6%)	Do not know (52.9%)	-	-	0
Viruses stay inactive inside the host cells	Unidentified(37.7%)	For hours(4.7%)	For days(13.6%)	For months(3.9%)	Do not know (40.1%)	0
The viral genome is:	Either DNA or RNA (28.7%)	RNA only (20.3%)	DNA only (11.7%)	Do not know (39.3%)	-	0
Viruses can synthesize their proteins:	False(32.9%)	True(27.6%)	Do not know (39.5%)	-	-	0
The relative size of bacteria to viruses:	At least 1000x (22.8%)	100x(18.2%)	10x(13.3%)	2x(6.3%)	Do not know (39.5%)	0
Viruses are sensitive to antibacterial drug treatment:	Disagree(34%)	Agree(17.1%)	Do not know (48.9%)	-	-	0

* represents the correct answer

Knowledge about the history of viruses and viral diseases

Considering the first known virus, 23% of the participants were able to name the virus as the tobacco mosaic virus. The most frequent incorrect answer provided was 'poxvirus' (26%). On the other hand, 8% of students identified the first known virus as 'HIV', while only 5% of students mentioned the corona virus. However, 38.7% of respondents did not provide any answer.

About 28.7% of students gave the correct answer as the first discovery of viruses was carried out in 1887. However, 32.1% of the participants were unable to identify this date and others did not answer this question.

Regarding the first scientist who discovered the viruses, the most frequent incorrect answer provided was ‘Thomas Weller’ with only 9.7% of the respondents being able to name ‘Paul Frosch’ as the scientist who discovered viruses for the first time. However, about 90.3% of the students were unable to answer this question correctly.

Five hundred and two respondents (38.4%) correctly answered that the Spanish influenza in 1918 caused the death of 20–40 million people. A further 19.6% of the students were not aware of the real number of deaths resulting from this pandemic, while the rest of the participants gave no answer to this question.

While only 22% of the students were correctly able to name the smallpox virus as being responsible for the death of 70% of the indigenous people of the Americas, 40% of the participants gave no answer, and a further 15.5% wrongly incriminated the corona and AIDS viruses. The knowledge of the students regarding the history of viruses and viral diseases is presented in Table 4.

Table 4. The knowledge of the students regarding the history of viruses and viral diseases

The statement	Answer A (%)*	Answer B (%)	Answer C (%)	Answer D (%)	Answer E (%)	Missing %
The first known virus is:	Tobacco mosaic virus (23%)	Poxvirus (26%)	HIV(8%)	Corona virus (5%)	Do not know (38%)	0
The first discovery of viruses was in 1887:	True (28.7%)	False (32.1%)	Do not know (39.2%)	-	-	0
The first scientist who discovered the viruses is:	Paul Frosch (9.7%)	Thomas Weller (28.7%)	Charles Chamberland (16.9%)	Magdi Yacoub (4.1%)	Do not know (40.6%)	0
The number of death cases caused by the Spanish influenza in 1918 was:	20–40 million (38.4%)	20–40 thousand (19.6%)	0 (2.2%)	Do not know (39.8 %)		0
The virus responsible for the death of 70% of the indigenous people of the Americas was:	Smallpox (22%)	Corona (9.5%)	HIV (6%)	Ebola (22.5%)	Do not know (40%)	0

* presents the correct answer

Viral infection and diseases

Table 5 shows the questions and the frequency of the responses regarding the knowledge of the students toward the basics of viral infections and diseases and their impact on human life. Regarding the knowledge of the students of the basics of viral infection, 58% of the participants answered correctly that viruses can infect all living organisms. However, 39% did not answer this question.

While 14.5% of the students failed to answer the question correctly, 292 participants (22.3%) were aware that bacteriophages infect bacteria. Further participants wrongly identified human cells (7.1%) and plant cells (7.4%), with 63.2% appearing not to know.

Almost half of the students answered correctly that SARS-cov2 infects both humans and some animal species. However, 10.9% of the participants believed that SARS-cov2 infects humans only, while 39% appeared to have no knowledge on this.

About 26.4% of the participants correctly answered that poxviruses do infect humans, animals, and plants. However, almost one-third (33.1%) of the respondents wrongly answered that poxviruses infect humans only, whereas 39.3% of students were unable to answer the question correctly.

Five hundred and twenty students (39.7%) were aware that the foot and mouth virus infects livestock, with an roughly similar percentage (39.9%) being unable to answer. However, 20.4% of the respondents thought wrongly that this virus could infect humans, tobacco plant and bacteria.

About 20.7% of students were aware that the number of living people infected with the AIDS virus is 35–40 million. A further 30% of the participants acknowledged their ignorance on this.

Four hundred and forty-three participants (33.8%) were aware that mosquitoes are the vector for the dengue virus. Some of the respondents wrongly thought that this virus can be transmitted by bats (4.8%) and cats (8.2%), while others (13%) thought wrongly that it can be transmitted by sneezing droplets. However, the remaining students (40.6%) appeared to have no knowledge about the dengue virus and were unable to answer this question correctly.

Regarding the impact of viral infection on human life, only 35.5% of the students were aware that the hepatitis C, measles and AIDS viruses can be transmitted by a pregnant women to her fetus. Others recognized only one of the mentioned viruses, either hepatitis C (6.1%), measles (7.3%) or AIDS (11.1%). Moreover, 40% of the participants were unable to answer the question.

Seven hundred and sixty-five students (58.4%) were correctly aware of the transmission methods of viral disease to humans. However, 41.6% were unable to answer the question correctly. On the other hand, the majority of the participants (54.7%) believed that vaccination is the best method of protecting humans from viral diseases. A considerable percentage (39%) of the students were unable to answer this question at all.

A fair percentage of the participants (39.4%) appeared to have no knowledge about viral hepatitis transmission. However, 41.8% of the students correctly recognized that this viral disease can be transmitted by sexual intercourse, alongside contaminated blood and injected needles. Surprisingly, only 0.8% of the students answered that viral hepatitis can be transmitted by sexual intercourse. In addition, seven hundred and seventy-nine (54.5%) of the participants answered correctly that AIDS can be transmitted to humans through sexual intercourse. A further 45.5% of the responders gave the incorrect answer to this question.

Four hundred and seventy-three students (36%) were correctly aware that the human papilloma virus causes cancer, while 23.8% were unable to recognize the correct answer. On the other hand, few participants (7.7%) were aware that hepatitis, herpes or human papilloma viruses can develop into cancer. However, 29.9% named human papilloma and 4.6% herpes, while 40% of the students had no idea.

Relatively, a high percentage of the respondents (45.2%) were aware that no symptoms of the viral disease can be seen during the incubation period. However, 54.8% of the respondents did not answer this question correctly.

About 26.7% of the participants correctly named the Borna virus as being responsible for psychiatric disease. However, 32.7% of the students wrongly incriminated smallpox, avian influenza and Ebola.

The majority of the participants (51.6%) were aware that vaccination succeeds in lowering fatal cases of the mentioned viral diseases. In addition, some respondents named only measles (2.1%), rubella (2.2%), poliomyelitis (3.4%), and mumps (1%). However, 30.7% of the students were unable to answer the question correctly.

Table 5. The knowledge of the students regarding the basics of viral infection and their impact on human life

The statement	Answer A (%)	Answer B (%)	Answer C (%)	Answer D (%)	Answer E (%)	Answer F (%)	Missing %
Basics of Viral Infection							
Viruses can infect all living organisms:	True (58%)	False (39%)	Do not know (3%)	-	-	-	0
Bacteriophages infect:	Bacteria (22.3%)	Human cells (7.1%)	Plant cells (7.4%)	Do not know (63.2%)	-	-	0
SARS-cov2 can infect:	Both humans and some animal species (50.1%)	Only human (10.9%)	Do not know (39%)	-	-	-	0
Poxviruses do infect:	Humans, animals and plants. (26.4%)	Only humans (33.1%)	Only animals (1.2%)	Do not know (39.3%)	-	-	0
Foot and mouth virus infects:	Livestock (39.7%)	Humans (15%)	Tobacco plants (3.2%)	Bacteria (2.2%)	Do not know (39.9%)	-	0
The number of living people infected with AIDS:	35–50 million (20.7%)	35–50 thousand (7.6%)	3.5–5 thousand (1.8%)	Do not know (69.8%)	-	-	0.1%
Vector for dengue virus:	Mosquitoes (33.4%)	Bats (4.8%)	Cats (8.2%)	Sneezing droplets (13%)	Do not know (40.6%)	-	0
The Impact of Viral Infection on Human Life							
The viruses that can be transmitted from a pregnant woman to her fetus is/are:	Hepatitis C, measles and AIDS (35.5%)	Hepatitis C (6.1%)	Measles (7.3%)	AIDS (11.1%)	Do not know (40%)	-	0
HIV virus can be transmitted to humans through	Sexual intercourse (59.5%)	Contaminated food (0.8%)	Contaminated drinks (0.6%)	Do not know (39.1%)	-	-	0
Hepatitis is transmitted by:	Sexual intercourse, contaminated blood, and injected needles (41.8%)	Only sexual intercourse (0.8%)	Only contaminated blood in injected needles (18%)	Do not know (39.4%)	-	-	0
Human papilloma virus causes cancer:	Yes (36%)	No (23.8%)	Do not know (40.2%)	-	-	-	0
Symptoms of viral diseases cannot be seen during the incubation period:	Agree (45.2%)	Disagree (15.1%)	Do not know (39.7%)	-	-	-	0
Responsible for for psychiatric disease:	Borna virus (26.7%)	Smallpox virus (15%)	Influenza virus (15%)	Ebola virus (2.8%)	Do not know (40.5%)	-	0
Viruses can develop cancers:	Viral hepatitis, herpes simplex and human papilloma (17.6%)	Human papilloma (29.9%)	Viral hepatitis (7.7%)	Herpes (4.6%)	Do not know (40%)	-	0.2%
Is vaccination the best method of protecting humans from viral diseases?	Yes (54.7%)	No (6.3%)	Do not know (39%)	-	-	-	0
Vaccination could decrease the death cases of:	Measles, rubella, poliomyelitis, and mumps (51.6%)	Only measles (2.1%)	Only rubella (2.2%)	Only poliomyelitis (3.4%)	Only mumps (1%)	Do not know (30.7%)	9%

Application of viruses in human life

A considerable percentage of the participants (42.1%) were aware that viruses can be invested in several scientific fields, including genetics, immunology, molecular biology, and nanotechnology. Other respondents (18.9%) appeared to have knowledge of the use of viruses in scientific research. The frequency of the responses to this question are presented in Figure 1.

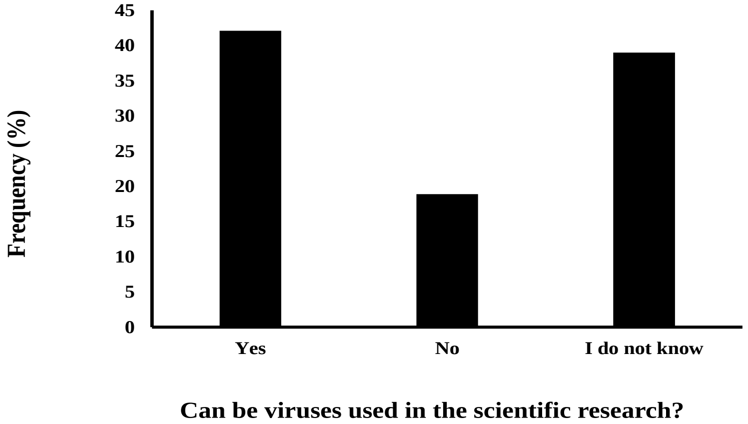

Figure 1. The knowledge of the students regarding the question "Can viruses be used in scientific research?"

Five hundred and sixty-eight respondents (43.4%) agreed that viruses have been used as biological weapons, while 5.1% did not believe so. However, 51.5% said they had no idea (Figure 2).

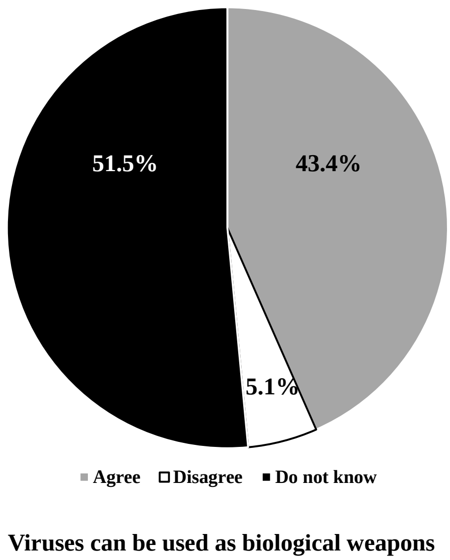

Figure 2. The knowledge of the students regarding the use of viruses as biological weapons

Discussion

The COVID-19 pandemic increased the need for the world to pay more attention to knowledge of viruses and viral diseases [13]. Much research has been conducted to evaluate current knowledge of the COVID-19 pandemic in different countries, including Jordan [11]. However, little is known about the knowledge of university students in Jordan regarding viruses and viral diseases. The findings of the present study indicate that these students have a poor knowledge of the nature of viruses and viral diseases, even though most of the participants (39.4%) were from paramedical schools. This might be due to their limited exposure to virology courses. We found in this study that only 36.7% of the students responded that they had the chance to attend virology courses.

The response rate was 50.43%, which is comparable with what was reported in other studies done during the COVI-19 pandemic [14–15]. Most studies on the evaluation of students' knowledge of virology and the COVID-19 pandemic have used questionnaires distributed online, and it is reported that the response rate for online studies is lower than those of face-to-face survey-based questionnaires [16–17].

It was noticed that there were missing data in the response to some questions in this survey. The design of the questionnaire did not force respondents to answer all the questions and the students were aware that they had the right to skip questions.

The findings of the current work demonstrated that the situation in Jordan is not exceptionally different from other countries, as a poor knowledge of viruses and viral diseases is also reported among students in Ghana [18] and the United Arab of Emirates [19]. On the other hand, some studies have reported that university students in Iran [20] have a moderate to high knowledge of viruses and viral diseases. This different level of knowledge in virology among these university students might not only be correlated to the level of exposure to virology courses in universities but also to exposure in public media, such as on television, radio, and the internet. Therefore, the findings of the present study suggest improving knowledge of viral diseases by increasing the number of virology classes and lectures in educational institutes and in the public media.

It has been reported in other countries that medical students in different Middle Eastern countries, including Egypt [21] and Saudi Arabia [14], have a good knowledge of the COVID-19 pandemic. However, it was reported in a study published from Jordan that only 34.8% of the sampled pharmacy students mentioned that transmission of SARS-cov2 from animals to humans is unlikely [11]. In this study, it was found that half of the participant students, from medical and non-medical backgrounds, answered that SARS-cov2 could infect humans and animals. This might indicate that the sampled university students in Jordan have a fair knowledge regarding the transmission of SARS-cov2, the virus responsible for the COVID-19 pandemic.

Al-Hussami et al. (2020) evaluated the general knowledge of Jordanians [22] and Olaimat et al. (2020) assessed the knowledge of university students in Jordan toward COVID-19 [23]. These studies focused only on knowledge of COVID-19, while the present study has covered different aspects of knowledge of viral infections, including COVID-19.

The prevalence of AIDS is relatively low in

Jordan. The findings of the current study demonstrate that only 20.7% of the respondents were aware of the number of living people infected with AIDS, and only 35% were aware that HIV can be transmitted from a pregnant woman to her fetus. However, it was reported that undergraduate students in Ghana, where the prevalence of AIDS is higher than in Jordan, demonstrated poor knowledge of AIDS disease [18]. Additionally, it was found that the knowledge score on AIDS was not high for undergraduate students in the United Arab Emirates [19].

Strong knowledge and awareness of viruses and viral diseases can help with the management of viral pandemics, such as the COVID-19 pandemic, in protection from viral diseases and in the development of antiviral drugs and vaccines [24]. Although the prevalence of COVID-19 infection was low in Jordan at the beginning of the pandemic, the prevalence of COVID-19 infections increased after a year (January to March 2021) and demonstrated high prevalence relative to the Jordanian population (25). This might be due to limited knowledge of the nature and transmission of viral diseases, which is a barrier to controlling viral transmissions, or due to the great hesitancy among the Jordanian population toward receiving a COVID-19 vaccination [26].

It was reported by Ikhmais et al. [27] that the readiness of researchers in Jordan to participate in viral research is low, due to barriers including the limited facilities and well- equipped laboratories for viral research and limited knowledge of virology [28].

Education on viral diseases and viral biology is of pivotal interest, with a need to raise public awareness concerning the means of viral disease transmission and prevention, to reduce the potential risk of neglect relating to viral diseases. Thousands of students from the health colleges of all Jordanian universities, including students at universities in the current study, have participated in the national vaccination campaign against COVID-19. The findings of the present study demonstrate poor and fragmented viral disease knowledge among these university students. This suggests the need to increase awareness of virus biology and viral disease, and to encourage and support the efforts of researchers in Jordan to participate in this field.

There are some limitations to this work. First, the choice ‘I do not know’ was chosen relatively often. This did not help with the interpretation of the findings rather than being a limitation to the conduction of the study. Studies show that questionnaire design choices, such as handling ‘I do not know’ may impact the level of non-response answers [27]. In addition, it is reported that forcing all questions to be answered affects the level of non-response and thus it is advised to avoid this; likewise, offering an explicit option is also not recommended as these options strongly increase non-response. However, some reports suggest skipping, allowing the design to be more reasonable. The second limitation of the present study is the inclusion of students from just three universities in Jordan; other universities in different districts of the country, especially those with medical schools, could have been included.

Conclusion

The present study found that the sampled university students in Jordan had a poor knowledge of viruses and viral diseases, and had low exposure to virology education. It is recommended to improve knowledge of viruses and viral diseases by increasing the number of virology courses, lectures, and workshops in educational institutions and the public media.

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Conflict of interest

The authors report no conflicts of interest of any kind.

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المعرفة والوعي بطبيعة الفيروسات والأمراض الفيروسية لدى طلبة الجامعات في الأردن

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الملخص

الخلفية العلمية: لا تتوافر المعرفة حول مدى إلمام طلبة الجامعات في الأردن بطبيعة الفيروسات والأمراض الفيروسية، وأهمية ذلك في ظل ما خلفته جائحة كورونا من ضغوط صحية واقتصادية.

الأهداف: هدفت الدراسة الحالية إلى تقويم المعرفة حول طبيعة الفيروسات والأمراض الفيروسية لدى شرائح طلبة بعض الجامعات في الأردن.

المنهجية: أجريت دراسة مقطعية خلال الفترة من بداية أيار حتى نهاية أيلول لعام(2020م) باكورة جائحة كورونا، وقد شملت الدراسة شريحة من الطلبة الملتحقين بإحدى عشرة كلية من ثلاث جامعات في الأردن (جامعة جرش، جامعة الزيتونة وجامعة الإسراء)، وطُلب منهم الإجابة عن استطلاع عبر الإنترنت يتألف من (48) سؤالًا لغرض تقييم المعرفة بما يخص الفيروسات والأمراض الفيروسية لدى طلبة الجامعات .

النتائج: أجاب ألف وثلاثمئة وتسعة طالبًا(1309) على الاستبيان حيث أفاد(36.7٪) فقط منهم أنه توافرت لديهم فرصة لدراسة الفيروسات والأمراض الفيروسية خلال المحاضرات الجامعية. واعتقد(20.63٪) ممن شملتهم الدراسة أن الفيروس كائن حي وأجاب(39.9٪) منهم بشكل صحيح بأن الفيروسات لا تتكاثر على الأسطح غير الحية، ووافق أكثر من ثلث المشاركين على أن الفيروسات ليست حساسة للعلاج بالمضادات الحيوية بينما لم يتمكن سوى(9.7٪) منهم من تسمية العالم الذي اكتشف الفيروس لأول مرة، وأفادت النتائج أن(36.1٪) من المشاركين على علم بأن فيروس الورم الحليمي البشري يسبب السرطان، بينما أدرك(7.7٪) منهم فقط أن أيًا من فيروسات التهاب الكبد الفيروسي أو الهربس أو الورم الحليمي البشري يمكن أن يتطور إلى سرطان، وأجاب ما يقرب من نصف المشمولين بالدراسة بشكل صحيح أن سارس–كوف (2) يصيب كلًّا من البشر وبعض أنواع الحيوانات، ويمكن أن ينتقل فيروس نقص المناعة البشرية من خلال العلاقة الجنسية، إضافة إلى ذلك، اعتقد(54.7٪) من الطلبة أن التطعيم هو أفضل وسيلة لحماية الإنسان من الأمراض الفيروسية، وأظهر(42.1٪) ممن شاركوا بالدراسة علمهم بإمكانية استثمار الفيروسات في العديد من المجالات العلمية.

الخلاصة: يمكن الاستنتاج من الدراسة الحالية أن لدى طلبة الجامعات في الأردن معرفة ضعيفة بالفيروسات والأمراض الفيروسية، وأنهم لا يتلقون التعليم الكافي في مجال علم الفيروسات والأمراض الفيروسية، وعليه، توصي هذه الدراسة بالعمل على تحسين المعرفة لدى طلبة الجامعات وشرائح المجتمع كافة، وفي جميع مستويات التعليم من خلال تجويد وتكثيف الدورات والورش العلمية والمحاضرات الخاصة والعامة في علم الفيروسات والأوبئة الفيروسية.

الكلمات الدالة: الأمراض الفيروسية، الأردن، الفيروسات، طلبة الجامعة.