A comparison between vaccinated and non-vaccinated student's towards COVID-19 vaccines; The adverse effects, awareness and acceptance

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is a sever acute respiratory disease. COVID-19 continues to have medical, economic, education and social consequences worldwide. Iraq used the following vaccines; Pfizer, AstraZeneca, Sinopharm and Moderna. The adverse effects of these vaccines and other unfounded rumors regarding the safety of these vaccines among our population, has affected the vaccination take up substantially in Duhok governorate.

Methods: This study was conducted using an online-based questionnaires distributed among the students at university of Duhok (UOD). A total of 1601 participants in this study,919 were vaccinated students and 682 were non-vaccinated students. In order to gain specific information from both vaccinated and non-vaccinated students, two different forms were developed. In general, vaccinated students' questionnaires involved 20 questions and consisted of four main parts while, the questionaries' for non-vaccinated students involved 17 questions and consisted of three main parts.

Results: Vaccinated UOD students showed a significant difference ($p \geq 0.01$) in their knowledge's and acceptance to COVID-19 vaccines, compared to non-vaccinated students. AstraZeneca it seems to be far less safe than other vaccines, with highest side effective ratio (94.6%) followed by Pfizer (78.5%) compared to Sinopharm vaccines (52%). The most common symptoms post vaccination were pain in injection (37.8%), muscle pain (34.9%) and fever (34.2%), after first dose.

Conclusion: Vaccinated students significantly shows better knowledge and acceptance than others. AstraZeneca was the most fear one and Sinopharm was the safest one. The most common symptoms post vaccination were pain in injection, muscle pain and fever.

Keywords: COVID-19, Vaccines, Acceptance, adverse effects, Iraq.

مقارنة بين الطلاب الملقحين وغير الملقحين تجاه لقاحات كوفيد-١٩؛ الآثار الجانبية ، الوعي والقبول

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الخلاصة

الخلفية : مرض فيروس كورونا ٢٠١٩ هو مرض تنفسي حاد وشديد. وهو مستمر بأحداث مترتبات طبية ، اقتصادية ، تعليمية واجتماعية في جميع أنحاء العالم. استخدم العراق اللقاحات العائدة للشركات التالية: فايزر، وأسترازينيكا، وسينوفارم، وموديرنا. الآثار الضارة لهذه اللقاحات اضافة الى الشائعات غير الصحيحة حول مدى امان هذه اللقاحات بين الناس أثرت على اخذ الناس لهذه اللقاحات بصورة مؤثرة في محافظة دهوك.

الطرق: أجريت هذه الدراسة باستخدام استبيان عن طريق الاتصال بين طلبة جامعة دهوك. شارك في هذه الدراسة ١٦٠١، ٩١٩ منهم ملقحين و٦٨٢ طالب من غير الملقحين. لغرض الحصول على معلومات محددة من الملقحين وغير الملقحين، استخدمت نموذجين من الاسئلة الاستبيانية بصورة عامة الاستبيان الخاص بالملقحين ضم ٢٠ سؤالاً ومكون من أربعة أجزاء ، فيما ضمن الاستبيان الخاص بغير الملقحين ١٧ سؤالاً ومكون من ثلاثة أجزاء.

النتائج: الملقحين من الطلبة لجامعة دهوك اظهروا اختلافا معنويا : في مستوى المعرفة والقبول للقاح الكورونا-٢٠١٩، بالمقارنة مع غير الملقحين من الطلبة.

لقاح استرازنكا ليس قريبا حتى في مستوى الامانة مع اللقاحات الأخرى، أعلى نسبة للأثار الجانبية كانت معه ، بعده كان لقاح فايزر (٧٨.٥%) بالمقارنة مع (٩٤.٦%) ، سينوفارم (٣٤.٩%) ، اكثر الاعراض تواترا بعد اخذ اللقاحات كانت الالم في مكان الحقن للقاح (٣٧.٨%)، والالم العضلي (٣٤.٩%)، والحمى (٣٤.٢%) ، بعد اخذ الجرعة الأولى.

الخاتمة: الطلبة الملقحين كانت لديهم مستوى اعلى من المعرفة والقبول بالمقارنة مع غير الملقحين لقاح استرازنكا اظهر اعلى مستوى من التخوف وسينوفورم الأكثر اماناً بين اللقاحات . وكان الالم في مكان اخذ اللقاح والالم العضلي والحمى اكثر الاعراض تواترا بعد اخذ اللقاح .

الكلمات المفتاحية: كوفيد-١٩، اللقاحات، القبول، التأثيرات الضارة، العراق.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a severe acute respiratory disease caused by the novel coronavirus (SARS-CO-2) [1]. The World Health Organization declared the COVID-19 epidemic as pandemic on March 11th,2020.

Up to date (the time this study is being conducted), the COVID-19 cases approximately have reached 486,276,597 cases and more than 6 million deaths worldwide, while Iraq has recorded approximately 2.3 million positive cases and 25,173 death cases [2].

Statistically, COVID-19 continues to impact the medical, economic, educational and societal fields of life worldwide [3]. As no curative treatment exists for this disease, developing a vaccine was urgently needed. Currently, various vaccines have been developed and tested clinically to prevent the spread of COVID-19 disease [4] .

The first vaccine was issued by U. S Food and Drug Administration on December 11th ,2020, while in the European Union, the first vaccine, BNT162b2 by BioNTech/Pfizer, was authorized for use on December 21th, 2020, followed by mRNA-1273 by Moderna and AZD1222 by Oxford/ AstraZeneca which were approved on the 7th and 29th January 2021 respectively [5,6].

In order to decrease hospitalization and death, and to alleviate the burden that the widespread COVID-19 infections has caused, an increase of population immunity was required. Therefore, many countries spent billions of dollars to provide extensive vaccination programs. The first administered vaccines in Iraq were in February 2021, while in the Duhok governorate region, the first vaccines were received on March 26th, 2021.The vaccines used in Iraq and Duhok city were Pfizer, AstraZeneca, Sinopharm and Moderna due to their availability and high efficacy against COV-19 [7,8].

Generally, the adverse effects following vaccination were mild to moderate. According to the CDC headache, chills/fever, nausea, localized pain/redness/swelling at injection site, tiredness, muscle/joint pain are the most common side effects experienced within 1-2 days after getting the vaccines [8]. However, the moderate and severe vaccines side effects and other unfounded safety rumors among this population [9] affected the vaccination take up in Duhok governorate. These concerns raised the need for the study of the acceptance of and awareness about COVID vaccinations among students at UOD, and to establish with which types of vaccine they were vaccinated and determine whether there was any difference reported in the side effects of each type of these vaccines.

MATERIALS AND METHODS

This study was conducted using online-based questionnaires that were distributed to the students at UOD, which is the oldest university in Duhok City- Northern Iraq; it consists of 19 colleges (Medicine, Agriculture Engineering Science, Engineering, Dentistry, Veterinary Medicine, Science, Physical Education and Sport Science, Nursing, Health Science, Language, Law, Humanities, Pharmacy, Administration and Economics, Basic Education, and Spatial Planning) with about 22942 enrolled students in 2021-2022 academic year [10]. The survey was distributed via emails from January 02,2022 to January 20,2022. The online Google - based questionnaire was in Kurdish language as it is the mother language of most of the students. The questionnaire was designed after reviewing relevant literature and reviewed by experts from the University of Duhok who are experienced in running large scale questionnaire-based studies.

During the survey, four COVID vaccines had already been authorized and used in Iraq (BNT162b2 by BioNTech/Pfizer, mRNA-1273 by Moderna, AZD1222 by Oxford/ AstraZeneca and Sinopharm). At that time, the vaccination process was totally optional (elective) for Duhok-Iraq population. Later, the process of vaccination became involuntary for the Ministry of Higher Education and Ministry of Health staffs. UOD has

established a vaccine center on campus for the students willing to get the vaccine.

The inclusion criteria for the study were to be a student at the UOD (male and female), aged ≥18 and >25 of any college/department and in any province in Kurdistan (Duhok, Erbil, Sulaymaniyah, and others). Students from other universities, visitors, as well as incomplete replies from the students of the UOD to all questionnaire items, were excluded from the analysis. At the time of the study, UOD students has two-day in-person presence on campus and thus had the opportunity to receive the questionnaire through their department via email. A total of 1601 participants from both vaccinated (919) and non-vaccinated (682) students answered the questionnaire fully. The fully answered questionnaires were also received via email.

In order to gain specific information from both vaccinated and non-vaccinated students, two different forms were developed.

Vaccinated Student's Questionnaires

The vaccinated student's questionnaires involved 20 questions and consisted of four main parts; the first part contained 7 questions regarding the students' demographics (College, department, age, gender, marital status and residential location). The second part covered 4 questions in regard to the vaccination: types of vaccines taken, and the number of shots (boosters). The last two questions sought the type of side effects or complications they experienced after each shot. Part three contained questions about their knowledge and awareness regarding the vaccines and consisted of four questions. Part four contained 3 questions regarding their attitude towards the vaccines. As for part 3 and 4, participants were given three options and different computed score (during analysis) according to their answer: Yes= 3 point, No= 2 and Do not know=1.

Finally, two extra questions were added to this questionnaire to find out the main reason behind students' rationale for taking the vaccine and their source of knowledge regarding their decision.

Non-Vaccinated Students' Questionnaires

The questionaries for non-vaccinated students involved 17 questions and consisted of three main parts; the first part involved 7 questions regarding the students' demographics (College, departments, age, gender, marital status and residence). The second part sought students' knowledge and awareness regarding the vaccines and consisted of 4 questions. Part three involved 3 questions regarding their acceptance toward the vaccines. As for part 2 and 3, the participants were given three options: participants were given three options and

different computed score according to their answer: Yes= 3 point, No= 2 and Do not know=1.

Finally, three extra questions were added to this questionnaire to find out the main reason behind their decision for not wanting to take the vaccine.

The Study Variables

The dependent variables included knowledge and awareness about COVID-19, attitude towards COVID-19 vaccine, and the COVID-19 vaccine side effects (in the 1st dose or 2nd dose).

Independent Variables included age, gender, marital status and residence.

Ethical Considerations

All procedures involving human participants were accomplished in this study and complied with the institutional ethical standards after they were approved by the Collage of Science, University of Duhok (Approval No.13). Students were introduced to their rights as participants, and their consent was taken to willing participants without imposing any pressure.

Statistical Analysis.

The Statistical Packages of Social Science (SPSS) version 27.0 was used to analyze the data. Descriptive statistics, frequencies, percentages, cumulative percentages, means, and standard deviations were generated for all study variables, both independent and dependent variables. Mean, Frequency and percentage were used as descriptive statistics, while independent-sample t-test and two-way analysis of variances ANOVA was implemented with independent and dependent variables to quantify the description analysis and validate the description of the statistical inferences. Duncan Multiple range test were used to compare the demographic data analysis between both groups (vaccinated and non-vaccinated). Two-way ANOVA with replications was used since there were several data points for each combination of factors: knowledge and acceptance value equal or less than 0.05 was considered statistically significant. The histogram was used to check for the normal distribution of data in this study regarding the reasons behind willing or not willing to be vaccinated.

RESULTS

A total of 1601 participants were assessed in this study; their demographic description is summarized below.

Vaccinated and non-vaccinated UOD students' demographic data.

A total of 919 vaccinated students completed the survey questionnaires, 605 were females and 314 were males. The majority of respondents were within the age group 18-21 years (68%), single (94.8%) and from Duhok city (72.8%). On the other hand, a total of 682 non- vaccinated students completed the survey questionnaires, 452 were females and 230 were males. The majority of respondents were within the age group 18-21 years (67.4%), single (94%) and from Duhok city (72.8%). Both vaccinated and non-vaccinated students shown similar distribution in term of their gender (Male and Female), age (18-21, 22-25 and >25). marital status (single and married) and location (Duhok, Erbil, Sulaymaniyah and other) within the same group. However, comparing both groups (vaccinated and non-vaccinated student), there was a significant difference between them at $p < 0.05$ in term of their gender, Age, Marital status and Location, according to Duncan multiple range test (means with different characters for each factor has a significant difference at $p \leq 0.05$), as shown in table 1.

Table (1). Vaccinated and non-vaccinated student's demographic data analysis using Duncan multiple range test.

Variables	groups	levels	Frequency	%	means and test	non-vaccinated means
Gender	Vaccinated	M	314	34.17	1.65b	1.97a
		F	605	65.83	1.55b	
	Non-vaccinated	M	230	33.72	1.97a	1.64b
		F	452	66.28	1.95a	
Age	Vaccinated	18-21	631	68.66	1.64bc	1.65b
		22-25	264	28.73	1.69bc	
		>25	24	2.61	1.45c	
	Non-vaccinated	18-21	460	67.45	1.98a	1.97 a
		22-25	205	30.06	1.97a	
		>25	17	2.49	1.88ab	
Marital Status	Vaccinated	Single	872	94.89	1.65b	1.97a
		Married	47	5.11	1.55b	
	Non-vaccinated	Single	641	93.99	1.97a	1.65b
		Married	41	6.01	1.95a	
Location	Vaccinated	Duhok	669	72.8	1.63b	1.47b
		Erbil	6	0.65	1.50bc	
		Sulaymaniyah	4	0.44	1.57bc	
		Other	240	26.12	1.01c	
	Non-vaccinated	Duhok	669	72.8	2.30a	2.21a
		Erbil	6	0.65	1.88ab	
		Sulaymaniyah	4	0.44	2.00ab	
		Other	240	26.12	1.99ab	

mean with different characters for each factor has a significant difference at $p \leq 0.05$.

Assessment of knowledge among the vaccinated and non-vaccinated UOD students about COV-19 vaccines

Table (2) illustrates the respondents' acceptance of and knowledge about COVID-19 vaccines. Generally, the vaccinated students showed positive attitude towards and knowledge about the vaccines as compared to non-vaccinated students. The attitude score (mean±SD) of the vaccinated students showed that vaccines were believed to be effective (1.53±1.081) compared to non-vaccinated students (1.41±0.631) with a significant difference ($p \geq 0.001$). Furthermore, positive attitude and knowledge was recorded among vaccinated students with the correct answers 81.2%, 46.8% and 56.1% compared to non-vaccinated students with 44.9%, 23.2% and 29.6% by choosing the "yes" regarding the following questions; importance of vaccines for the public health, the ability to develop the protection against the virus after the second shot and the vaccines' ability to boost the immunity without getting the illness, respectively, with statistically significant differences (p>0.0001).

Table 2: Knowledge level of vaccinated and non-vaccinated UOD students (n=1601) towards COVID-19 Vaccines.

Variable	The vaccines are effective			The vaccine are important for the public health			Full vaccinated person build protection after two weeks of second shot			COV-19 vaccines develop immunity to COV-19 virus without getting the illness		
	Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure
Vaccinated students (n.)	544	75	300	746	21	152	430	45	444	516	89	314
%	59.2%	8.2%	32.6%	81.2%	2.3%	16.5%	46.8%	4.9%	48.3%	56.1%	9.7%	34.2%
mean±SD	1.53±1.081			1.93±0.906			7.55±3.596			1.89±0.469		
Non-vaccinated students (n.)	311	90	281	306	115	261	158	120	404	202	165	315
%	45%	13.2%	41.2%	44.9%	16.9%	38.3%	23.2%	17.6%	59.2%	29.6%	24.2%	46.2%
mean±SD	1.41±0.631			1.37±0.763			1.70±0.458			1.77±0.421		
P value	0.014*			0.0001***			0.0001***			0.0001***		

Value expressed as mean±SD, *=(P<0.05), **= (P>0.01), ***=(P<0.001) foe comparison between both group.

Assessment of acceptance among vaccinated and non-vaccinated UOD students (n=1601) of COVID-19 vaccines

Significant differences were observed in the vaccine acceptance between vaccinated and non-vaccinated students (Table 3). The results show that the vaccinated students agreed that the vaccines are safe with a score of 2.36±0.835. Only 16% of those students were concerned about the side effects of the vaccines compared to 66.3% of non-vaccinated ones.

Out of 919 vaccinated students, 736 encourage their family and friends to get the vaccine compared to 478 (out of 682) non-vaccinated students who never tried to encourage anybody to get the vaccine. Finally, 35.6% and 21.8% of non-vaccinated students were not sure or would reject to get the vaccine in case they got forced by the university, respectively.

Table 3: Acceptance level of vaccinated and non-vaccinated UOD students (n=1601) towards COV-19 Vaccines.

Variable	Generally, the vaccines are safe			Are you concerned about COV-19 vaccines side effects?			Do you encourage your family, friend and students to get the vaccines			Are you going to get the vaccine, if you have been forced by the university?		
	Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure
Vaccinated students n.(%)	635 (69.1%)	19 (2.1)	265 (28.8%)	150 (16.3%)	712 (77.5%)	57 (6.2%)	736 (80%)	183 (19.9%)	0 (0%)			
mean±SD	2.36±0.835			1.87±0.456			1.70±0.458					
Non-vaccinated students (n.)%	166 (24.3%)	143 (21%)	373 (54.7%)	452 (66.3%)	175 (25.7%)	55 (8.1%)	204 (29.9%)	478 (70.1%)	0 (0%)	290 (42.6%)	148 (21.8%)	242 (35.6%)
mean±SD	1.60±0.908			1.41±0.631			1.23±0.664					
P value	0.0001***			0.0001***			0.0001***					

Value expressed as mean±SD, *=(P<0.05), **= (P>0.01), ***=(P<0.001) foe comparison between both group.

COVID-19 vaccine; their types, doses and adverse effects in vaccinated UOD students.

Table (4) shows the number of doses, the type of vaccines and the adverse effects post vaccination among students. It shows that 275 (29.9%) participants were infected by COVID-19 before getting the vaccines, while 466 (50.7%) of them were not infected by the virus. The majority of those students 77.4% have taken both shots the time this study was carried out; among them 751(81.7%) have taken Pfizer vaccine, followed by AstraZeneca (8.2%) and Sinopharm (7.9%). As per our data, none of our participants had received the Moderna vaccine.

Furthermore, the most common post-vaccination adverse effects after the first dose were pain at the site of injection N= 347, muscle pain N=321 and fever N=314; the less likely side effects were blood clotting N=4 and diarrhea N=7. However, 239 students claimed that they did not have any symptoms at all. On the other hand, the most common post - vaccination side effects after the second shot were fever N=259, pain at the site of injection N=247 and muscle pain N=228. Blood clotting and diarrhea were still the less reported side effects. No symptoms after the second shot were recorded amongst 266 students.

Table 4: COVID-19 vaccine; their types, doses and adverse effects in vaccinated UOD students

		Frequency (n.)	Percentage (%)
Have you been infected with COVID-19?	Yes	275	29.9%
	No	466	50.7%
	Not sure	178	19.4%
How many doses of vaccine have you taken	1	208	22.6%
	2	711	77.4%
Which Type of vaccine you have taken	Pfizer	751	81.7%
	AstraZeneca	75	8.2%
	Sinopharm	73	7.9%
	Moderna	0	0%
	Not sure	19	2.1%
Adverse effects after first Dose	Fever	314	34.2%
	Headache	198	21.5%
	Muscle pain	321	34.9%
	Pain at injection	347	37.8%
	Fatigue	64	7%
	Chill	37	4%
	Diarrhea	7	0.8%
	Blood clotting	4	0.4%
	No symptoms at all	239	26%
	others	30	3.3%
Adverse effects after second dose	Fever	259	28.3%
	Headache	177	19.3%
	Muscle pain	228	24.9%
	Pain at injection	247	27%
	Fatigue	60	6.6%
	Chill	39	4.3%
	Diarrhea	10	1.1%
	Blood clotting	3	0.3%
	No symptoms at all	266	29%
	others	136	14.8%

Correlation between the type of Vaccine and the Adverse Effects

Table (5) shows the significant association between different types of vaccines and their adverse effects. The data showed that AstraZeneca vaccines had the highest adverse effects on vaccinated participants after the first shot (94.6%) compared to both Pfizer (78.5%) and Sinopharm (56%), while Pfizer showed the highest percentage of side effects (76.6%) after the second dose followed by AstraZeneca (70%).

The Sinopharm vaccine made no side effects or symptoms in the participants after both shots (numbers 32 and 35 respectively) compared to AstraZeneca and Pfizer. Interestingly, the Sinopharm vaccine showed less symptoms with both shots together.

Table 5: Correlation between the type of vaccine and the adverse effects.

Type of vaccine / Side Effects	Pfizer Total (751)		AstraZeneca Total (75)		Sinopharm Total (73)		P value
	First Shot	Second Shot	First Shot	Second Shot	First Shot	Second Shot	
with adverse effect n. (%)	590 (78.5%)	576 (76.6%)	71 (94.6%)	53 (70%)	41 (56%)	38 (52.05%)	0.0001
No symptoms n. (%)	161 (21%)	175 (23.3%)	4 (5.3%)	22 (29.3%)	32 (43.8%)	35 (47.9%)	

Reasons for getting and not getting the vaccine in vaccinated and non-vaccinated students.

The results of the part of questionnaire about the reasons why the vaccinated students got the vaccine are summarized in Figure (1). More than half of the UOD students (55%) decided to get the vaccines because they believed that the vaccines will save their lives from COVID-19. Furthermore, a number (11.9%) were encouraged by their families and friends to get the vaccines. Students also reported fear of infecting other students or the presence of COVID related death experiences in their family as major reason for getting the vaccines (6.3% and 4.6%, respectively).
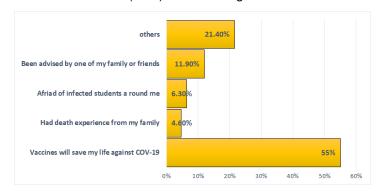

Figure (1): The percentage of reasons for the decisions of UOD students to get the vaccine

Regarding the non-vaccinated students, more than 244 (36%) preferred not to state their reasons regarding the vaccination rejection; there could be many other reasons which have not been listed in the study such as reinfection by COVID-19 after vaccination, the variety of vacc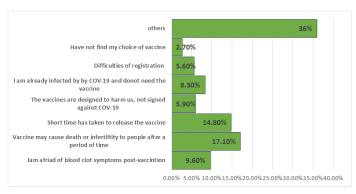ines available and the conflicted news about their side effects, and the fear of post vaccination side effect. However, 17.10% of the students refused to get the vaccines because they thought that the vaccines might lead to death or infertility. One hundred students (14.8%) stated that the short time involved in the development and release of the vaccines made them potentially unsafe and only 9.6% of the students were afraid of the blood clot symptoms they might suffer post vaccination. The numbers and percentage of each reason were shown in figure (2).

Figure (2): The percentage reasons for UOD students to reject the vaccine.

DISCUSSION

Knowledge and acceptance studies can be used to identify gaps in knowledge and reveal specific misbeliefs among the population, which can be helpful and lead to plan for better actions. In the context of the COVID-19 vaccine, lack of accurate knowledge, specific misconceptions regarding the vaccines safety and effectiveness possibly affected the vaccination acceptance as well as vaccination rate, as many studies claimed that the higher education sector displayed better knowledge and acceptance to COVID-19 [11,12].

Therefore, this study is designed to [1] access the awareness and acceptance level of UOD students (vaccinated and non-vaccinated) on the current available vaccines in Duhok city at the time of the study, [2] identify the possible adverse effects of those vaccines among the vaccinated students.

In this study, out of 1601 participant, 919 were students who have taken the vaccines, while 682 are those who have not agreed to get the vaccines. It clearly showed the significance differences among both groups (vaccinated and non-vaccinated) in their knowledge and acceptances regarding COVID-19 vaccines. Half of non-vaccinated students believed that vaccines are not effective, not important for the public health, and not sure about the time needed to get the full immunization or if the vaccines will boss the immunity persons. Among those, only 24.3% agreed that the vaccines are safe, 66.3% were concerned about the vaccines side effects, 70% seemed they never encouraged their families and friends to get the vaccines as compared to the vaccinated students who showed good acceptance to the vaccines. This finding can be summarized that good awareness can lead to better acceptance and vice versa; same results have been suggested by other studies from different countries [13-17].

Notably, 11.90% of the vaccinated participants accepted the vaccination as a result of families and friend's encouragement; this has been supported when the results showed that 23.6% of those students have friends and relatives as a main source of gaining their knowledge. In contrast, a study conducted in UK showed that 20% of the public were discouraged to get the vaccines through family and friends massages [18].

Our study also revealed some reasons behind the students' rejection; 17.10% and 14.8% of them stated that vaccines may cause death or infertility to people after a period of time and the short time taken to release the vaccine, respectively. Surprisingly, 36% of non-vaccinated students have chosen not to interpret their reasons behind not getting the vaccines. This finding can be explained that lack of knowledge, false claim and the fear of the adverse effects post vaccination led to vaccination hesitance and acceptance [11,17-19] and many others. Surveys supported similar findings that the adverse effects such as blood clotting made 45% of the participants reject the vaccine and 14% were concerned about the short time taken to release the vaccines [14]. The good knowledge of the UOD students as shown previously [12] increased the rate of acceptance as proved in the results: 55% of students got the vaccines because they did believe that vaccines would save their life against the COVID-19.

The current study also covered the types of vaccines and their adverse effects after each shot; 77.4% of our vaccinated participants have received both doses; the majority have taken Pfizer vaccine (81.7%) while only 8.2% and 7.9% were injected with AstraZeneca and Sinopharm vaccine, respectively.

The most common symptoms post vaccination were pain in injection site (37.8%) muscle pain (34.9%) and fever (34.2%) after the first dose, while fever (28.3%), pain in the injection site (27%) and muscle pain (24.9%) were the most common side effects after the second dose. Our finding is similar to some extent to another local study which showed that local injection site reactions (58 %) and fever (57.8%) were the most distinguished side effects post vaccination. However, the same study showed that fatigue (58.1%) and headache (40.4%) affected those who have taken the vaccines. This finding is not in agreement with our finding as we found that only a low number of our participants had suffered from headache (21.5% , 19.3% after first and second dose, respectively) and chill (4% ,4.3% after first and second dose, respectively) [9]. This contrast could be linked to the sample differences age and their association [19], or numbers of doses taken, as we only covered the UOD students with an age range of ≤25, while the other study had covered ages up to 70 years old and our study also covered the adverse effects after both doses. [9].

Although some studies showed that Pfizer vaccines had more side effects on young people [19], and AstraZeneca affected more old adults [20], our finding suggested that AstraZeneca seems to be far less safe than other vaccines, with the highest side effect ratio (94.6%) followed by Pfizer (78.5%) compared to Sinopharm vaccines (52%). This finding is in parallel with the findings of many studies which reported thromboembolic events among people who had received this vaccine [21].

Sinopharm, on the other hand, significantly has the least adverse effect vaccine among the other vaccines investigated in this current research.

The finding of this study highlighted the role of public awareness and acceptance on vaccination

process; our government should take advantages from such study to make better plan in their future vaccination process campaign; professionals and expert scientists should be involved in increasing public awareness and transfering the scientific information among people regarding the types of vaccines and their expected side effects. This can be done by educational programes to be given to students in schools, colleges, government institutions and private sectors. Radio, TV and newspapers can also be used to spread the right information among the public. As we previously showed the role of social media on people`s awareness, government should focus on this area and should be used to prevent the spread of misconceptions regarding COV-19 vaccines and future pandemic diseases.

Limitations

Although the study highlighted the many different aspects regarding the COVID-19 vaccines, it has some limitations. The non-vaccinated students were not keen to fill the form because they thought that their information might affect the university future decision (force them to get the vaccine). Furthermore, this study only covers limited age group which may not reflect the accurate figure in terms of the vaccines side effects.

Duncan's Multiple Range Test (DMRT):

This test was suggested by Duncan (1955) as attempt to avoid disadvantages of other tests, and as possible as, to test all comparisons among treatment means at the same precision (Efficiency) and at the same significant level. Therefore, he putted especial table to gotten **SSR** values **(Shortest Significant Range)**, which needed to calculate **LSR (Least Significant Range).** These values (LSR) are need for comparisons between means. Therefore, this test is depending on number of statistical values (LSR) no on one value as previous testes (Dunnett, lsd,…..etc.). So that, it is the best test and more efficient and precision than other testes, and many researchers was used after they know the disadvantages of other tests.
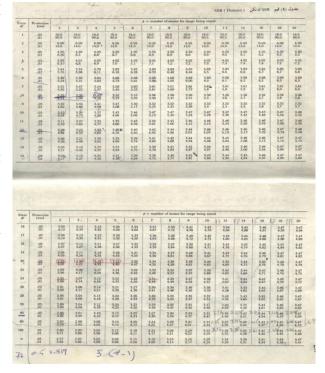
Steps of Test:

1- Calculate the standard deviation of any treatment mean:

$$S\tilde{y}i. = \sqrt{\frac{MSe}{r}}$$

2- Find out the SSR value (Shortest Significant Range) from Duncan's table by know: a- Number of means for range being tested (2, 3, 4,...etc.).

b- Error d.f.

c-Level of significant or probability level.

CONCLUSIONS

In the present study, vaccinated UOD students showed significant differences on their knowledge and acceptance to COVID-19 vaccines as compared to the non-vaccinated students. More than the half of the vaccinated students agreed to get the vaccines because they believed that vaccines would save their lives against the virus and because they were advised by their families and friends, while fear of death and infertility was the main reason for those who rejected to get the vaccine. The most common adverse effect post vaccination was pain in the injection site, muscle pain and fever. Among the three available vaccines, AstraZeneca was the riskiest one and Sinopharm was the safest one in regard to their adverse effects. It is recommended to set up a series of campaigns within the university and among the public to increase knowledge regarding the available vaccines, which will reflect on the public acceptance, correct those misconception facts gained through the social media, and increase the vaccination rate.

3- Calculate the Least Significant Range (LSR):
   LSR = Sỹi. * SSR

4-Arrange the treatment means (Ascending or Descending).

5-Compare the differences among treatments means with LSR values to
 limiting the significance by letters. If the difference between
 treatment means is greater than L.S.R, then the treatments are
 significantly different from each other (The letters are different) and
 vice versa. Or if the difference between treatment means is less than
 L.S.R, then the treatments are not significantly different from each
 other (The letters are similar).

6- Conclusion:

Exercise -3:
  The following table shows the effect of four different treatments (level of NPK=0, 5, 10 and 15 g/pot) on growth of peach seedlings (Single Leaf Area). Each treatment was replicated 5 times and CRD was used.

The Demand:
1- Do ANOVA table.
2- Compare all treatment means with other, by Duncan's test ?

Ti	r1	r2	r3	r4	r5	Yi.	ỹi.
T1							
T2	22.2	17.3	21.2	25.2	16.1	102	20.4
	24.1	30.3	27.4	26.4	34.8	143	28.6
T3	25.9	18.4	23.2	21.9	22.6	112	22.4
	23.9	21.7	24.8	28.2	26.4	125	25
T4							
						Y..= 482	ỹ..= 24.1

ANOVA table after statistical analysis:

S.O.V	d.f	S.S	M.S	F.cal.	F.tab. 0.05
Treatment	3	188.2	62.7	5.7[*]	3.24
Error	16	176.4	11		
Total	19	364.6			

1- Sỹi. = $\sqrt{\frac{MSe}{r}}$ = $\sqrt{\frac{11}{5}}$ = **1.48**

2- SSR value $_{(16, 0.05)}$ = $\begin{matrix}2 & 3 & 4\\3.00 & 3.15 & 3.23\end{matrix}$

3- LSR = Sỹi. * SSR =

Number of means for range being tested			
	2	3	4
SSR values	3.00	3.15	3.23
Sỹi. value	1.48		
LSR values = Sỹi. * SSR	2 **4.44**	3 **4.66**	4 **4.78**

4-Means are sort ascending and indicate statistical significance by letters:

Ti	Means
T2	28.6
T4	25
T3	22.4
T1	20.4

5-Compare the differences among treatments mean with LSR value to

limiting the significance by letters.

Ti	Means	*
T2	28.6	a
T4	25	ab
T3	22.4	b
T1	20.4	b

6-The Decision: The superior treatment is…T2…., however it does not significant differ with T4 , but it is significant variance with other treatments.

Abbreviations: WHO: World Health Organization, UOD: University of Duhok

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Author Contribution
Noor A. Mohammed: Supervision, Formal analysis, Investigation, Methodology, Writing—original draft, review & editing, **Zerin Fouad Hassan**: Investigation, Methodology. **Gulistan Mostafa Sabri:** Investigation and data analysis. **Arin Amin Zuber**, Writing, Investigation, Methodology.

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