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Knowledge, attitude and practice towards COVID-19 vaccination among Iraqi adults

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Abstract

Background: COVID-19 vaccines are critical to containing the pandemic and preventing severe infections with the novel coronavirus (SARS-CoV-2). Newly developed and marketed vaccines, along with concerns about their safety and long-term side effects, have raised significant anxiety among the general population, often resulting in slow vaccination rates.

Objectives: To assess the knowledge, attitudes, and perceptions of the Iraqi population regarding COVID-19.

Methods: A community-based cross-sectional study was conducted among 189 participants during the period extended between 1st October to 31st November, 2024. Demographic information was gathered, and knowledge, attitudes, and perceptions of COVID-19 vaccinations were assessed. Statistical analysis was undertaken to determine the parameters that determine the perception of COVID-19 vaccinations.

Results: The results demonstrated that totally about half of the participants had a high level of COVID-19 knowledge. According to the survey, 98.4% of participants were aware of the COVID-19 vaccine, and the media accounted for 60.8% of their knowledge. Also, 76.7% of participants had favorable views toward COVID-19 vaccination. A statistically significant association was observed between good knowledge and attitudes toward the COVID-19 vaccine ($P < 0.001$), indicating that higher knowledge levels are strongly linked to more positive attitudes. Vaccine uptake was strongly correlated with knowledge and attitude levels. Participants with excellent knowledge were more likely to have received the vaccine (49.7%). Similarly, those with a positive attitude toward vaccination were significantly more likely to be vaccinated (72.5%).

Conclusion: This study provides valuable insights for policymakers and public health officials to improve vaccine uptake in Iraq. By focusing on education, accessibility, and trust-building, it is possible to increase vaccination rates and reduce the impact of COVID-19.

Keywords: Practice COVID-19 vaccine; vaccine hesitancy; knowledge; attitude; perception

1. Introduction:

The coronavirus disease 2019 (COVID-19), first identified in Wuhan, China, in December 2019, is an infectious disease caused by the severe acute respiratory syndrome - coronavirus 2 (SARS-CoV-2) (Al-Zalfawi, *et al*. 2021). SARS-CoV-2, the causative virus is a novel β-coronavirus (Lu *et al*., 2020), belongs to the Coronaviridae family, whose members characterize by their ability to cause various diseases, from common colds to severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) (Ishrath *et al*., 2021).

The rapid spread and high infection rate prompted the World Health Organization (WHO) to declare the disease a worldwide pandemic in March 2020, less than three months after the first case diagnosis (Wong *et al*., 2020; Guidry *et al*., 2021). Despite the many measures that have been taken to curb the increase in infection rate, such as lockdowns, social distancing, community use of face masks, travel restrictions, and self-isolation strategies, the spread of the epidemic has not diminished (Koh, 2020; Dey *et al*., 2020). The WHO has reported, up to the date of conducting this study, 777,112,363 confirmed cases of coronavirus disease 2019 (COVID-19), with 7,079,587 fatalities, illustrating the enormous impact of COVID-19 on the global population (WHO, 2024). According to the WHO, vaccination-based herd immunity development is currently the most effective way to stop the spread of this disease (Al-Zalfawi *et al*., 2021).

The rapid development and distribution of COVID-19 vaccines was an important turning point in the fight against the pandemic (Excler *et al*., 2023). The WHO has recommended several vaccines for COVID-19. However, misconceptions and inaccurate information regarding certain aspects of the pandemic and the efficacies of the vaccines have been startlingly pervasive among the general population. Furthermore, concerns have been raised about the immediate use of recently developed and marketed vaccines along with concerns about vaccine safety in terms of short-term testing and long-term side effects, which has caused vaccine hesitancy and hampered herd immunity (Harrison & Wu, 2020; Dubé & MacDonald, 2022; Hannah *et al*., 2023). Numerous studies repeatedly demonstrate that knowledge and attitudes can predict vaccination uptake (Sookaromdee & Wiwanitkit, 2022; Badi *et al*., 2023).

The first case of COVID-19 in Iraq was reported on 24 February 2020 in Najaf, Iraq, by a person who had recently arrived from Iran (WHO, 2020). By 13 April 2024, Iraq had reported 2,465,545 cases with 25,375 deaths. (worldometers, 2024). Vaccination against COVID-19 began in January 2021. As of August 2022, an estimated 19.4% of the population is fully immunized using one of the three vaccines available: Pfizer-BioNTech, AstraZeneca, or Sinopharm (Johns Hopkins University, 2020). When tracking stopped in March 2023, an estimated 28.2% of Iraqis had been immunized. Widespread distrust of the government, fear of

adverse reactions, and lack of knowledge related to the vaccine have been reported (World Bank Group, 2020).

Therefore, we aimed to explore the knowledge, attitude, and practice of adults toward COVID-19 vaccines among Iraqi population, examining factors influencing vaccine acceptance.

2. Methods:

2.1.Study design, setting, and data collection:

A community-based cross-sectional study was conducted during the period extended between 1st October to 31st November, 2024. Adults aged 18 years and older regardless of gender, employment status, and income from various Iraqi provinces were eligible to be part of this study.

Data were obtained using a standardized structured self-administered questionnaire adapted from previously published studies (Al-Zalfawi et al., 2021; Endriyas et al., 2023) and slightly modified by the supervisor and researcher. The questionnaire was designed using Google forms and distributed electronically to voluntary participants using social media applications including Facebook, Telegram, and WhatsApp.

2.2. Measures:

The survey consists of 37 questions divided into four sections:

1. **Sociodemographic:** the first section contains 7 questions about the participant include age, gender, residence (rural or urban), education level, occupation, history of COVID-19 and diagnosis status.
2. **Knowledge**: the second section contain 7 questions about the Covid-19 vaccine (existence, safety, efficiency, target, infectivity, doses and sources of information).
3. **Attitude**: the third section evaluated attitude including 5 items that was assessed on a three-point Likert scale (yes, no and neutral).
4. **Practice**: the fourth section covered 5 items toward COVID-19 vaccine.

2.3. Scoring criteria:

In this study, two scores were calculated, one for knowledge and one for attitude. For the knowledge score, each correct answer scored 1 point, and each wrong answer scored 0 point. The maximum knowledge score was 10 and the minimum was 0. After calculating the knowledge scores, participants were categorized into three groups: poor knowledge (≤ 3), moderate knowledge (4-6), and excellent knowledge (≥ 7). For attitude score each correct attitude =5, uncertain= 3 and incorrect attitude=1. The maximum attitude score was 21 and the minimum was 5. A score of 13 was taken as a cutoff point, participants that scored 13 or less were considered to have a negative attitude, whereas participants that scored more than 13 were considered to have a positive attitude towards the vaccine.

2.4. Statistical analysis:

Utilizing the statistical software IBM SPSS V 29 (SPSS Inc., Chicago, IL, USA), the data was described and analyzed. Categorical variables were analyzed using frequency, percentage, Cross tabs and Pearson Chi-square test. While continuous variables like scores of both (knowledge and attitude) was performed using Anova test. $P < 0.05$ was considered to indicate statistical significance.

3. Results:

3.1. Sociodemographic characteristics of participants:

A total of 189 individuals were recruited in this study. Of these 127 (67.2%) fall with the age range of 18–37 years, with a female predominance 143 (75.7%). Most of them, 130 (68.8%) holding a bachelor's degree. Moreover, 172 (91%) of respondents lived in urban areas. Half of the respondents 96 (50.8%) were government employees. Finally, over half of the respondents 112 (59.3%) reported having contracted COVID-19, though only 77 (40.7%) were subjected to confirmation by laboratory diagnosis, table (1).

Table 1: Frequency of demographic characteristics of study participants

		Count	%
Age group	18-37	127	67.2%
	38-57	55	29.1%
	> 57	7	3.7%
Sex	Male	46	24.3%
	Female	143	75.7%
Education level	Pre-university education	14	7.4%
	University (undergraduate)	130	68.8%
	Postgraduate	45	23.8%
Residence	Urban	172	91.0%
	Rural	17	9.0%
Occupation	Unemployed	6	3.2%
	Private work	7	3.7%
	Student	77	40.7%
	Housewife	3	1.6%
	Government employee	96	50.8%
Have you had COVID-19?	Yes	112	59.3%
	No	77	40.7%
If you are infected, has it been diagnosed in a laboratory?	Yes	77	40.7%
	No	112	59.3%

3.2. Analysis of the knowledge of study participants about COVID-19 vaccination:

The results shown in table (2) highlight the respondents' knowledge towards COVID-19 vaccine. A significant majority, 186 (98.4%), of participants were aware of the vaccine. Most of them reported that the primary source of information was the media 115 (60.8%), while government agencies ranked second with 54 (28.6%).

When asked about vaccine safety, 113 (59.8%) believed the vaccine was safe, 29 (15.3%) thought it was unsafe, and 47 (24.9%) were uncertain.

Regarding effectiveness, 95 (50.3%) rated it as moderately effective, 54 (28.6%) as highly effective, 22 (11.6%) as low effective, 13 (6.9%) as very highly effective, and 5 (2.6%) as not effective at all. Most respondents 168 (88.9%) correctly stated that the vaccine is suitable for everyone, while smaller groups believed it was only for healthy individuals 12 (6.3%), elderly people 5 (2.6%), or infected individuals 4 (2.1%). None thought it was only for young people.

Regarding misconceptions, 75 (39.7%) believed the vaccine could cause COVID-19, while 67 (35.4%) disagreed, and 47 (24.9%) were unsure. On the question of acquiring immunity after the first dose, 69 (36.5%) believed it was possible, 75 (39.7%) disagreed, and 45 (23.8%) were unsure.

Table 2: Knowledge of study respondents towards COVID-19 vaccines

Characteristics		**N**	**%**
Do you know about the existence of a Covid-19 vaccine?	Yes	186	98.4%
	No	0	0.0%
	I don't know	3	1.6%
Where did you learn about the vaccine?	Media	115	60.8%
	Family and friends	13	6.9%
	Government agencies	54	28.6%
	Other	7	3.7%
Do you think the Corona vaccine is safe?	Yes	113	59.8%
	No	29	15.3%
	I don't know	47	24.9%
How effective do you think vaccines are?	Not effective at all	5	2.6%
	Low effective	22	11.6%
	Moderately effective	95	50.3%
	High effective	54	28.6%
	Very high effective	13	6.9%
Do you know who is eligible to receive the vaccine?	Only infected people	4	2.1%
	Only elderly people	5	2.6%
	Only young people	0	0.0%
	Only healthy people	12	6.3%
	The vaccine covers everyone	168	88.9%
Can you get COVID from the vaccine?	Yes	75	39.7%
	No	67	35.4%
	I don't know	47	24.9%
Can protective immunity against Covid-19 be acquired after the first dose of the vaccine?	Yes	69	36.5%
	No	75	39.7%
	I don't know	45	23.8%

The participants' knowledge levels were assessed as (poor, moderate, excellent) in relation to their demographic characteristics, table (3). Generally, half of the respondents (97, 51.3%) demonstrated excellent level of knowledge regarding COVID-19 vaccine. Obviously, participants fall within 18-37 age group has the highest level of knowledge since they were predominant in the excellent knowledge group (69, 36.5%), and in the moderate level of knowledge group (54, 28.6%), while those aged >57 years constituted the smallest proportion in all categories. Although, respondents aged between 18-30 showed a higher cognitive level than the rest of the age group, there was no significant difference (P=0.8).

In terms of sex, females formed the majority across all knowledge levels, representing 40.7% (**77**) in the excellent level of knowledge group and (31.8% **60**) in the moderate level of knowledge group. Again there was no significant difference between both sexes (P=0.395).

Educational attainment showed that undergraduates comprised the largest segment of both the moderate and excellent levels of knowledge, (31.8%, **60**) and (35.4%, **67**), respectively, however, the difference was statistically insignificant (P=0.144).

In the same context, there was insignificant increase in cognitive level of urban compared to rural residents, although they were dominated across all knowledge levels, including (46.5%, **88**) in the excellent level group and (41.3%, **78**) in the moderate level group, (P=0.696).

Regarding occupation, students accounted for a significant portion of the excellent level of knowledge group (48.5%, **47**), however, the difference again was statistically insignificant (P=0.310), table (3).

Table (3): distribution of participants' knowledge levels (poor, moderate, excellent) in relation to their demographic characteristics

		Poor knowledge		Average knowledge		Excellent knowledge		P value
		N	%	N	%	N	N %	
Age group	18-37	4	2.1%	54	28.6%	69	36.5%	0.227
	38-57	3	1.6%	27	14.3%	25	13.2%	
	> 57	0	0.0%	4	2.1%	3	1.6%	
Total		7	3.7%	85	45%	97	51.3%	
Sex	Male	1	0.5%	25	13.2%	20	10.6%	0.395
	Female	6	3.2%	60	31.8%	77	40.7%	
Total		7	3.7%	85	45%	97	51.3%	
Education level	Pre-university education	0	0.0%	5	2.6%	9	4.8%	0.144
	Undergraduate	3	1.6%	60	31.8%	67	35.4%	
	Postgraduate	4	2.1%	20	10.6%	21	11.1%	
Total		7	3.7%	85	45%	97	51.3%	
Residence	Urban	6	3.2%	78	41.3%	88	46.5%	0.696
	Rural	1	0.5%	7	3.7%	9	4.8%	
Total		7	3.7%	85	45%	97	51.3%	
Occupation	Unemployed	0	0.0%	3	1.6%	3	1.6%	0.310
	Private work	0	0.0%	4	2.1%	3	1.6%	
	Student	0	0.0%	30	15.9%	47	24.9%	
	Housewife	0	0.0%	2	1.1%	1	0.5%	
	Government employee	7	3.7%	46	24.3%	43	22.7%	
Total		7	3.7%	85	45%	97	51.3%	

3.3. Analysis of the attitude of study participants about COVID-19 vaccination:

The results shown in table (4) revealed that the majority 119 (63.0%) identified as supporters of vaccination, while 15 (7.9%) opposed it, and 55 (29.1%) were neutral. Regarding their views on vaccination, 105 (55.6%) believed it is very important, 66 (34.9%) considered it unnecessary but still worth receiving, and 18 (9.5%) thought it should only be taken based on infection severity. The most significant factor preventing vaccination was a lack of sufficient information 115 (60.8%), followed by concerns about vaccination centers being crowded or poorly managed 39 (20.6%) and fear of vaccines 35 (18.5%). When asked whether natural immunity after infection negates the need for vaccination, 55 (29.1%) agreed, while 134 (70.9%) disagreed, emphasizing the importance of vaccination. Lastly, 142 (75.1%) opposed halting healthy habits like mask-wearing, hand hygiene, and social distancing after vaccination, while 47 (24.9%) supported stopping such practices.

Table (4): Attitude of study respondents towards COVID-19 vaccine.

Characteristics		**N**	**%**
Were you a supporter or opponent of vaccination?	Supporter	119	63.0%
	I don't support	15	7.9%
	Neutral	55	29.1%
What do you think of the Covid-19 vaccine?	It is very important to get vaccinated	105	55.6%
	It is not necessary, but in any case, we should get vaccinated	66	34.9%
	The vaccine is taken according to the infection and severity of the disease only	18	9.5%
What is the most important factor that prevents you from getting vaccinated?	Fear of vaccines	35	18.5%
	There is not enough information about vaccine	115	60.8%
	Vaccination centers are bad and crowded	39	20.6%
Do you think that the vaccine is not necessary because immunity will be acquired naturally after infection?	Yes	55	29.1%
	No/Must be vaccinated	134	70.9%
Do you support stopping healthy habits such as wearing masks, hand hygiene, and social distancing after receiving the COVID-19 vaccine?	Yes, I support	47	24.9%
	No	142	75.1%

According to results in table (5), which shows participants' characteristics in relation to their attitude toward the COVID-19 vaccine, the attitudes were categorized as either negative or positive. The majority (76.7%, **145**) of participants demonstrated positive attitude toward the COVID-19 vaccine. Most of them (53.4%, **101**) fall within 18-37 age group, followed by (21.2%, 40) within the 38-57 age group. Participants aged >57 years were least represented in both attitude groups, with only (1.6%, 3) and (2.1%, 4) in the negative and positive attitude categories, respectively. However, the difference failed to reach the statistical significance (P=0.077).

Females were better represented within both positive and negative attitude categories with (59.8%, 113) and (15.9%, 30) compared to males (16.9%, 32) and (7.4%, 14), respectively. Again, the difference was statistically insignificant (P=0.304).

Regarding education, categories showed a significant difference (P=0.018) in their attitudes, where participants with an undergraduate degree comprising (54%, 102) with positive attitude compared to other educational categories. However, they also were predominant in negative attitude groups (14.8%, 28), followed by postgraduates (16.4%, 31) and (7.4%, 14) within the positive and negative attitude categories, respectively.

Urban residents showed a stronger association with positive attitudes (71.4%, 135) compared to rural residents (5.3%, 10), and this pattern was consistent in the negative attitude group, where urban residents accounted for (19.6%, 37) and rural residents for (3.7%, 7).

By occupation, government employees had a larger representation in both positive (36.5%, 69) and negative (14.3%, 27) attitude groups compared to other categories, followed by students (33.9%, 64) and (6.9%, 13), respectively.

TABLE 5: Participants' characteristics compared with Attitude categories						
		Negative attitude		Positive attitude		P value
		N	%	N	%	
Age group	18-37	26	13.8%	101	53.4%	٠.٠٧٧
	38-57	15	7.9%	40	21.2%	
	> 57	3	1.6%	4	2.1%	
Total		44	23.3%	145	**76.7%**	
Sex	Male	14	7.4%	32	16.9%	0.304
	Female	30	15.9%	113	59.8%	
Total		44	23.3%	145	**76.7%**	
Education level	Pre-university education	2	1.1%	12	6.3%	0.018
	Undergraduate	28	14.8%	102	54%	
	Postgraduate	14	7.4%	31	16.4%	
Total		44	23.3%	145	**76.7%**	
Residence	Urban	37	19.6%	135	71.4%	0.280
	Rural	7	3.7%	10	5.3%	
Total		44	23.3%	145	**76.7%**	
Occupation	Unemployed	2	1.05%	4	2.1%	٠.٥٩٧
	Private work	2	1.05%	5	2.6%	
	Student	13	6.9%	64	33.9%	
	Housewife	0	0.0%	3	1.6%	
	Government employee	27	14.3%	69	36.5%	
Total		44	23.3%	145	**76.7%**	

3.4. Relationship between knowledge, attitude towards the COVID-19 vaccine:

Figure (1) compares knowledge categories of participants (poor, moderate, and excellent) with their attitudes toward COVID-19 vaccine; (positive or negative). Among those with poor knowledge, (2.1%, 4) exhibited a negative attitude, while (1.6%, 3) had a positive attitude, accounting for a total of 3.7% of participants. Those with moderate knowledge constituted (15.3%, 29) of those with a negative attitude and (29.6%, 56) of those with a positive attitude, making up (45.0%, 85) of the total sample. Participants with excellent knowledge were primarily associated with a positive attitude, representing (45.5%, 86) of the group, compared to 5.8% (11) in the negative attitude category, accounting for (51.3%, 97) of the overall sample.

Overall, 76.7% (145) of participants exhibited a positive attitude toward the vaccine, while 23.3% (44) had a negative attitude. A statistically significant association was observed between knowledge categories and attitudes toward the COVID-19 vaccine ($P < 0.001$), indicating that higher knowledge levels are strongly linked to more positive attitudes.

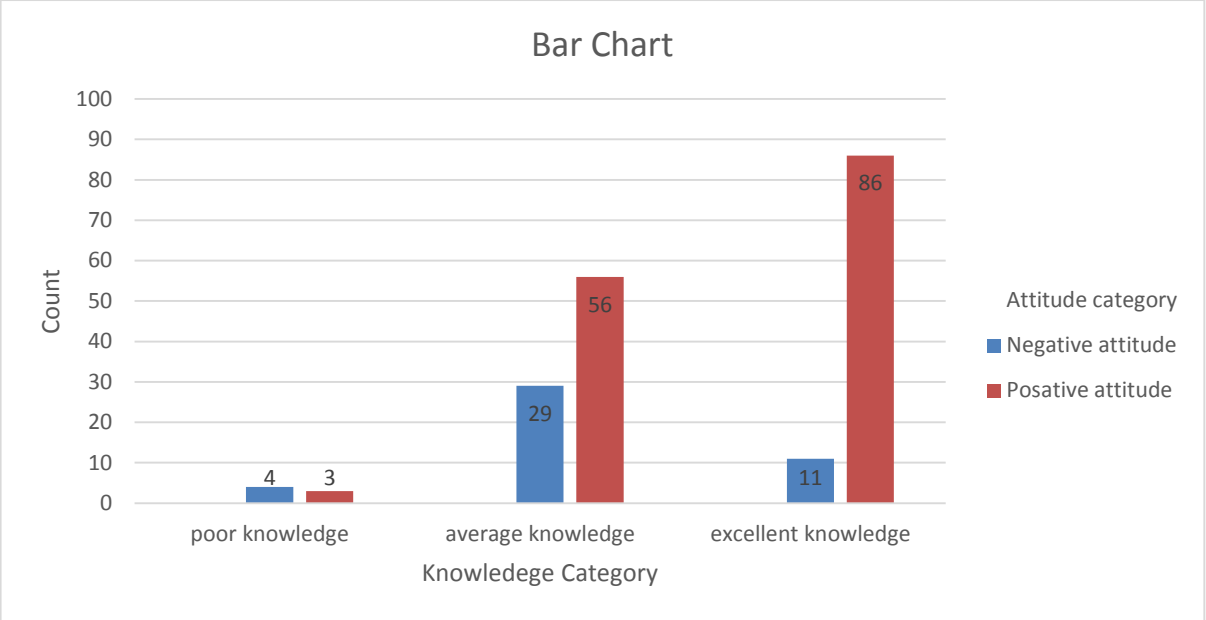


Figure (1): Vaccine knowledge compared to attitude.

3.5. Knowledge and attitude compared with practice of COVID-19 vaccine:

The relationship between vaccine knowledge and attitudes with vaccine receipt status was assessed. Participants with poor knowledge showed low vaccination rates, with 3.2% (6 participants) reporting receiving the vaccine compared to 0.5% (1 participant) who did not. Those with moderate knowledge demonstrated moderate vaccine uptake, with 40.2% (76 participants) vaccinated and 4.8% (9 participants) unvaccinated. In contrast, participants with excellent knowledge had the highest vaccination rates, with 49.7% (94 participants) receiving the vaccine compared to only 1.6% (3 participants) who did not. Similarly, vaccination rates varied by attitude. Among participants with a negative attitude, 20.6% (39 participants) had received the vaccine, while 2.6% (5 participants) had not. Those with a positive attitude showed a higher vaccination rates, with 72.5% (137 participants) vaccinated and only 4.2% (8 participants) **unvaccinated**. These findings suggest that higher levels of vaccine knowledge and positive attitudes are associated with increased vaccine uptake.

The association between vaccine knowledge and attitudes with delayed vaccination until it became mandatory was analyzed. Among participants with poor knowledge**,** 2.1% **(**4 participants**)** delayed vaccination, while 1.6% (3 participants) did not. Participants with moderate knowledge demonstrated a more balanced distribution, with 20.6% (**39** participants) reported delaying vaccination compared to 24.3% (46 participants) who did not. For those with **excellent knowledge**, 19.6% (**37 participants**) delaying vaccination and 31.7% (**60 participants**) opting not to delay. Regarding attitudes, 12.7% (**24 participants**) of those with a **negative attitude** delayed getting vaccinated until it became mandatory, while 10.6% (**20 participants**) did not delay. Among participants with a **positive attitude**, 29.6% (**56 participants**) delayed vaccination, whereas a larger proportion, 47.1% (**89 participants**), did not delay. Although higher knowledge and positive attitudes were associated with fewer delays, the differences failed to reach statistical significance (P=0.061).

The association between participants' vaccine knowledge, attitudes, and their determination of the vaccine manufacturer was analyzed. Among participants with **poor knowledge**, 3.2% (**6 participants**) determined the vaccine type, while 0.5% (**1 participant**) did not. For those with **moderate knowledge**, 36.0% (**68 participants**) determined the vaccine type, compared to 9.0% (**17 participants**) who did not. Participants with **excellent knowledge** were the most informed, with 46.0% (**87 participants**) determining the vaccine type, while 5.3% (**10 participants**) did not. However, the differences in knowledge categories were not statistically significant (**P = 0.18**). Regarding attitudes, 17.5% (**33 participants**) with a **negative attitude** determined the vaccine manufacturer, compared to 5.8% (**11 participants**) who did not. Among those with a **positive attitude**, a significantly higher proportion of 67.7% (**128 participants**) determined the vaccine type, while 9.0% (**17 participants**) did not. This difference in attitudes was statistically significant (**P = 0.03**), indicating that positive attitudes were strongly associated with determining the vaccine manufacturer

The relationship between participants' vaccine knowledge, attitudes, and the number of doses received was analyzed. Among participants with poor knowledge, 0.5% (1 participant) were not vaccinated, 0.5% (1 participant) received only one dose, and 2.6% (5 participants) received two doses. None received more than two doses. Participants with moderate knowledge had a distribution of 4.8% (9 participants) not vaccinated, 10.6% (20 participants) receiving one dose, 27.5% (52 participants) receiving two doses, and 2.1% (4 participants) receiving more than two doses. Among those with excellent knowledge, 1.6% (3 participants) were unvaccinated, 7.9% (15 participants) received one dose, 38.1% (72 participants) received two doses, and 3.7% (7 participants) received more than two doses. The differences across knowledge categories were not statistically significant (P = 0.2). In terms of attitude, 2.6% (5 participants) with a negative attitude were not vaccinated, 6.3% (12 participants) received one dose, and 14.3% (27 participants) received two doses, with no participants receiving more than two doses. Conversely, among participants with a positive attitude, 4.2% (8 participants) were unvaccinated, 12.7% (24 participants) received one dose, 54.0% (102

participants) received two doses, and 5.8% (11 participants) received more than two doses. While differences were observed, they did not reach statistical significance (P = 0.059). This analysis suggests that both vaccine knowledge and attitude may influence vaccination status, though not at statistically significant levels in this sample.

The analysis of whether participants would recommend the COVID-19 vaccine to their family and friends revealed significant differences based on both their knowledge and attitudes. For those with poor knowledge, none recommended the vaccine, while 3.2% expressed opposition, and 0.5% were unsure. Among those with moderate knowledge, 25.9% recommended the vaccine, 10.1% did not, and 9.0% were uncertain. In contrast, participants with excellent knowledge overwhelmingly supported the vaccine, with 48.1% recommending it, only 1.6% opposing it, and 1.6% uncertain. The differences in recommendations based on knowledge were statistically significant ($P < 0.001$). Regarding attitudes, participants with a negative attitude towards the vaccine showed mixed responses: 9.5% recommended it, 8.5% opposed it, and 5.3% were uncertain. In contrast, those with a positive attitude were much more likely to recommend the vaccine, with 64.6% endorsing it, 6.3% opposing it, and 5.8% uncertain. The association between attitude and the likelihood of recommending vaccination was also statistically significant ($P < 0.001$).

These findings suggest that participants with higher knowledge and more positive attitudes toward vaccination were significantly more likely to recommend it to others, demonstrating the importance of both knowledge and attitude in vaccine advocacy.

Table (6): Knowledge and attitude compared with practice toward COVID-19 vaccine					
Q1/ Have you received the vaccine?					
			Yes	No	P Value
Knowledge	Poor knowledge	N (%)	6 (3.2%)	1 (0.5%)	0.1
	Moderate knowledge	N (%)	76 (40.2%)	9 (4.8%)	
	Excellent knowledge	N (%)	94 (49.7%)	3 (1.6%)	
Attitude	Negative attitude	N (%)	39 (20.6%)	5 (2.6%)	0.1
	Positive attitude	N (%)	137 (72.5%)	8 (4.2%)	
Q2/ If you were vaccinated, did you delay getting the vaccine until it became mandatory?					
			Yes	No	P Value
Knowledge	Poor knowledge	N (%)	4 (2.1%)	3 (1.6%)	0.4
	Moderate knowledge	N (%)	39 (20.6%)	46 (24.3%)	
	Excellent knowledge	N (%)	37 (19.6%)	60 (31.7%)	
Attitude	Negative attitude	N (%)	24 (12.7%)	20 (10.6%)	0.061
	Positive attitude	N (%)	56 (29.6%)	89 (47.1%)	
Q3/ Have you determined the type of vaccine (the vaccine manufacturer)?					
			Yes	No	P Value
Knowledge	Poor knowledge	N (%)	6 (3.2%)	1 (0.5%)	0.18
	Moderate knowledge	N (%)	68 (36.0%)	17 (9.0%)	
	Excellent knowledge	N (%)	87 (46.0%)	10 (5.3%)	
Attitude	Negative attitude	N (%)	33 (17.5%)	11 (5.8%)	0.03
	Positive attitude	N (%)	128 (67.7%)	17 (9.0%)	
Q4/ How many doses did you receive?							
			0 dose	1 dose	2 doses	> 2	P Value
Knowledge	Poor knowledge	N (%)	1 (0.5%)	1 (0.5%)	5 (2.6%)	0 (0.0%)	0.2
	Moderate knowledge	N (%)	9 (4.8%)	20(10.6%)	52 (27.5%)	4 (2.1%)	
	Excellent knowledge	N (%)	3 (1.6%)	15 (7.9%)	72 (38.1%)	7 (3.7%)	
Attitude	Negative attitude	N (%)	5 (2.6%)	12 (6.3%)	27 (14.3%)	0 (0.0%)	0.059
	Positive attitude	N (%)	8 (4.2%)	24 (12.7%)	102 (54.0%)	11 (5.8%)	
Q5/ Would you recommend that your family and friends get vaccinated?						
			Yes	No	I don't know	P Value
Knowledge	Poor knowledge	N (%)	0 (0.0%)	6 (3.2%)	1(0.5%)	< 0.001
	Moderate knowledge	N (%)	49 (25.9%)	19 (10.1%)	17 (9.0%)	
	Excellent knowledge	N (%)	91 (48.1%)	3 (1.6%)	3 (1.6%)	
Attitude	Negative attitude	N (%)	18 (9.5%)	16 (8.5%)	10 (5.3%)	< 0.001
	Positive attitude	N (%)	122 (64.6%)	12 (6.3%)	11 (5.8%)	

Discussion:

Continued efforts have been undertaken by the Iraqi Ministry of Health to stop the spread of COVID-19, a challenging global pandemic. The Iraqi Ministry of Health established COVID-19 vaccination campaigns to guarantee public immunization coverage as one of its disease-control and preventive initiatives. The present study assessed the knowledge, attitudes, and practices (KAP) toward COVID-19 vaccination among Iraqi adults, aiming to identify factors influencing vaccine acceptance.

The findings indicate that while the majority of participants demonstrated good knowledge regarding the COVID-19 vaccine, some misconceptions and hesitancy still persist. The poll found that 98.4% of respondents knew about the COVID-19 vaccination, with the media accounting for 60.8% of their knowledge and government agencies coming in second at 28.6%. This result aligns with previous studies that shown that media plays a dominant role in shaping public knowledge about COVID-19 vaccinations (Al-Zalfawi et al., 2021; Al-Marshoudi et al.,2021). Even though, the results also revealed the effect of misinformation on vaccine acceptance, as 39.7% of respondents believed that the vaccine could cause COVID-19. Other research has documented similar beliefs, indicating that vaccination reluctance is highly influenced by misinformation (Dubé & MacDonald, 2022).

Our results showed that 51.3% of participants had good knowledge, 76.7% with positive attitudes and 63% perception towards COVID 19 vaccinations. There was a significant association between excellent level of knowledge and positive attitudes ($P < 0.001$), indicating that higher knowledge levels are strongly linked to more positive attitudes.

Many factors played a key role in knowledge level, such as age, gender, residency and graduation level. Since, those aged between 18-37 showed a higher level of knowledge towards COVID-19 vaccine. The reason for this knowledge gap might potentially is the under-representation of age groups over 30 years old due to their unfamiliarity with participating in online surveys. It may also be due to the frequent use of social media by younger age groups and their constant access to most recent news and information. Furthermore, education level played a key role in knowledge levels, with university graduates having higher knowledge scores compared to those with lower educational attainment. This supports previous research indicating that higher education is associated with better health literacy and vaccine awareness (Badi et al., 2023).

According to an attitude survey, 63% of participants were in favor of vaccination, compared to 7.9% who were against it and 29.1% who were neutral. This indicates a comparatively high acceptance rate but also highlights the presence of vaccine hesitancy. The most common reason for reluctance was insufficient information (60.8%), followed by the efficiency of vaccination centers and concerns about vaccine safety. This is in line with global research that highlights the necessity of transparent communication in order to allay concerns about vaccines (Harrison & Wu, 2020).

The study found a significant association between education level and vaccine attitudes ($P = 0.018$), suggesting that higher education fosters a more positive stance toward vaccination. However, no significant

differences were observed regarding age (P = 0.077) or gender (P = 0.304). These findings suggest that while education plays a role in shaping attitudes, other demographic factors may not be as influential in the Iraqi population.

Vaccine uptake was strongly correlated with knowledge and attitude levels. Participants with excellent knowledge were more likely to have received the vaccine (49.7%) compared to those with poor knowledge (3.2%). Similarly, those with a positive attitude toward vaccination were significantly more likely to be vaccinated (72.5%) than those with a negative attitude (20.6%). These findings reinforce the notion that knowledge and attitude are key determinants of vaccine acceptance (Sookaromdee & Wiwanitkit, 2022).

Furthermore, while many participants determined their vaccine manufacturer, a significant proportion did not, indicating gaps in informed decision-making. Additionally, while knowledge and attitude influenced whether individuals received the vaccine, the number of doses taken did not significantly differ across groups (P = 0.2). This suggests that while initial vaccine acceptance is driven by knowledge and attitude, factors such as access and policy mandates may play a role in subsequent doses. These findings have important public health implications. The high levels of vaccine awareness indicate the success of informational campaigns, but the persistence of misconceptions highlights the need for targeted interventions. Health authorities should focus on countering misinformation, particularly through trusted channels like government sources and healthcare professionals.

Moreover, improving vaccine confidence requires addressing concerns about safety and side effects. Efforts should be made to increase transparency in vaccine development and regulatory processes to alleviate public fears (Excler et al., 2023). Additionally, policies promoting ease of access, such as mobile vaccination units and workplace vaccination drives, may further improve uptake.

Conclusion:

The study demonstrated that Iraqi adults had generally a decent degree of awareness and positive attitude regarding the COVID-19 vaccine. However, owing to false information and safety concerns, vaccination reluctance remains a challenge. Crucial strategies for boosting vaccine uptake include strengthening public awareness campaigns, utilizing reliable information sources, and enhancing vaccine accessibility. Future research should explore interventions to bridge knowledge gaps and mitigate hesitancy to strengthen public health responses in Iraq.

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