ORIGINAL RESEARCH

COVID-19 Vaccine Acceptance and its Predictors among College Students in Addis Ababa, Ethiopia, 2021: A Cross-Sectional Survey

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Background: The coronavirus disease pandemic disrupted the normal social and economic activities of the people resulting in over 3 million deaths worldwide. Piece of literature depicted that predictors of vaccine acceptance are complex, multiple, and vary depending on the type of vaccine involved.

Objective: The study aimed at assessing the COVID-19 acceptance and its predictors among college students in Addis Ababa, Ethiopia, 2021.

Methods: A multi-center-institutional-based cross-sectional study was conducted among 407 participants from three institutions in Addis Ababa selected based on a simple random sampling method from May 01 to July 30, 2021. A self-administered structured questionnaire was used for the collection of data, after which informed consent was obtained from all the included study participants. Descriptive statistics was used for the summarization of the data. Binary (bivariate and multivariate) logistic regression was applied for the identification predictors of vaccine acceptance with their respective 95% confidence interval and less than 5% p-value for the ascertainment of presence of association.

Results: The level of vaccine acceptance was 39.8% (95% CI: 35.0–44.7%). Being male (AOR: 0.463, 95% CI: 0.284–0.755, $P < 0.001$), living with children under the age of five (AOR: 2.295; 95% CI: 1.416–3.721, $P < 0.05$), living with an elderly (AOR: 1.609, 95% CI: 1.016–2.548, $P < 0.05$) and having had poor knowledge (AOR: 2.187, 95% CI: 1.391–3.438, $P < 0.001$) were predictors significantly associated with an increased level of vaccine acceptance.

Conclusion and Recommendation: The level of vaccine acceptance among college students in Ethiopia was lower than necessary to achieve herd immunity. Sex, living with under-five children, and elderly, and knowledge were predictors of COVID-19 acceptance. Concerned bodies were suggested to work over the identified predictors of vaccine acceptance in the study settings.

Keywords: COVID-19, vaccine acceptance, predictors, college students

Introduction

The Coronavirus disease (COVID-19) pandemic disrupted the normal social and economic activities of the world[1–5] and continued to havoc the globe.[5] However, the African continent recorded fewer proportion of the COVID-19 infection; the disease caused over 3 million deaths worldwide.[6]

Numerous biologic and chemotherapeutic therapies such as convalescent plasma, tocilizumab, remdesivir and hydroxylchloroquine were applied for the treatment of COVID-19 patients[7,8] with no conclusive evidence on its cure rate.

Nevertheless, it was a recent experience that most of the world practiced different public health measures, such as social distancing, lockdowns, respiratory hygiene, and hand hygiene for the prevention of COVID-19 disease, a little role was recorded;[9] rather, an effective vaccine as a standing solution was recommended during the crises.[10,11]

Vaccine hesitancy is a delay in acceptance or refusal of vaccine despite the availability of vaccination service.[12] When safe and efficacious vaccines become available, governors could ensure a successful, large-scale uptake of COVID-19 vaccines to the attainment of community immunization.

255

Existing studies on COVID-19 vaccine uptake revealed that a considerable proportion of people are careless of taking the vaccine. A representative study from 19 countries revealed, 71.5% were likely to take the COVID-19 vaccine.[13] Perhaps; the evidence from 20 nations representative studies revealed the level of COVID-19 acceptance to be under 67%.[14]

The predictors of vaccine acceptance are complex, multiple, and vary depending on the type of vaccine involved.[15–17] The level of trustworthiness of the source information determines the likelihood of vaccine acceptance,[18] but trust in COVID-19 vaccination varies widely between different groups of people.[19] It is reasonable to think more people trust vaccines, the more they will take the COVID-19 vaccine. However, the infodemic that inundated the world during the COVID-19 has changed vaccine acceptance,[20–23] – which directly shows that media sensationalism is linked to distrust in COVID and COVID-19 vaccines appear to have different predictors of acceptance than previous vaccine.[24]

To the best knowledge of the researchers, there was a limited evidence regarding the acceptance of COVID-19 vaccine by college students in Ethiopia. Informed by the above statement, this study assessed the acceptance and predictors of COVID-19 vaccine by college students in Addis Ababa, Ethiopia.

Methods
Participants and Study Design
A multi-center-institutional-based cross-sectional study design was conducted among 407 participants from the selected colleges in Addis Ababa from May 01 to July 30, 2021. The study received ethical approval from Universal Medical and Business College, a research review ethics committee and applied to the respective colleges. All the participants were provided written informed consent. The source population was all regular students of the selected colleges; namely, Universal Medical and Business College, Kea Med Medical and Business College, and Africa Health Science College. The study population was all the 407 participants from the selected colleges available during the study period. Students who registered in the stated colleges, available during data collection, and those free from severe medical conditions were included in the study. A simple random sampling technique was employed to select the participants after their lists were once identified from the registrar of the respective colleges.

The sample size was determined based on a single population proportion, with the premise that the magnitude of vaccine acceptance among college students taken at 50%, since there was no prior study among the particular study group, 95% confidence interval 1.96 and 5% margin of error. The final sample was 422 inclusive of a 10% non-response rate.

Data were gathered with a pre-tested self-administered questionnaire. The questionnaire was developed by reviewing related pieces of literature[25–29] then given to three senior researchers working in academic institutions, and their inputs were incorporated in the final tool.

Definitions of Concepts
The outcome variable (COVID-19 vaccine acceptance) was measured as yes and no question.[1,27] Knowledge was measured as true and false questions and categorized as poor versus good knowledge based on median score after constructs forming knowledge were once computed.

Statistical Analysis
Descriptive statistics were used for the summarization of data. For the identification predictors of COVID-19 acceptance, binary (bi-variable and multivariable) logistic regression was used, with their respective 95% Confidence Interval (CI) and p-value of less than 0.05 as a statistically significant level.

Result
Socio-Demographic Characteristics
Of 422 students approached, 407 respondents completed the questionnaire, with a response rate of 96%. The majority (82.8%) and (68%) of the participants were single and females consecutively. The mean age of the participants was 21.9 years with a standard deviation of ±3.43. Most (63.4%) of the study participants had children living with them (Table 1).

Table 1 Socio-Demographic Characteristics of Participants in Selected Colleges of Addis Ababa, Ethiopia, May, 2021

Characteristics	Categories	Frequency	Percent
Sex	Female	277	68.1
	Male	130	31.9
Religion	Orthodox	265	65.1
	Protestant	67	16.5
	Muslim	57	14.0
	Catholic	18	4.4
Marital status	Single	337	82.8
	Married	48	11.8
	Others *	22	5.4
Source of Income	Family	343	84.5
	Work	44	10.8
	Others **	20	4.9
Department	Pharmacy	160	39.3
	Nursing	118	29.0
	Health Officer	86	21.1
	Medical doctor	16	3.9
	Radiology	16	3.9
	Lab. Technician	11	2.7
Academic year	Freshman	92	22.6
	Second Year	77	18.9
	Third Year	127	31.2
	Fourth year and seniors	66	16.2
	Graduate	45	11.1
Presence of Children in the family	Yes	258	63.4
	No	149	36.6
Live with elders (>50 years)	Yes	247	60.7
	No	160	39.3

Notes: Others*- Widowed, Separate, in relationship or divorced, others**- Relatives, and Friends.

Knowledge About COVID-19 Vaccination

This study reported that about 57.5% (95% CI: 52.5–62.3%) of the study participants had poor knowledge regarding COVID-19 disease. More than half (53%) of the study participants had heard of COVID-19 disease at first from social media. From all the WHO-recommended preventive protocols, most (80.6%), (81.8%), and (74.2%) of the study participants practiced hand washing, used antibiotics, and wore face masks consecutively. Most (69%) of the study participants knew that only AstraZeneca was given in Ethiopia (Table 2).

Perceptions About COVID-19 Vaccination

Less than half (43%) of the study participants were afraid the first time they heard about COVID-19 disease. Less than half (44.2%) of the study participants perceived the importance of taking COVID-19 vaccination. Most (64%) of the study participants perceived that they would not get infected with COVID-19 (Table 3).

COVID-19 Vaccine Acceptance

The level of COVID-19 vaccine acceptance was 39.8% (95% CI: 35.0–44.7%). A quarter (25%) of the study participants thought it was the best preventive mechanism to prevent COVID-19. One-tenth (11%) of the study participants did not want to take the vaccine, worrying about the possible side effects (Table 4).

Table 2 Knowledge of the Study Participants About COVID-19 Vaccination in Selected Colleges of Addis Ababa, Ethiopia, May, 2021

Questions	Categories	Frequency	%
Heard COVID-19 diseases at first from	Social media	215	52.8
	News	97	23.8
	Books/Journals	3	0.7
	TV/Radio	92	22.6
Do you say you have enough Knowledge about COVID-19 disease?	Yes	264	64.9
	I know some	134	32.9
	I do not know	9	2.2
What caused COVID-19 disease?	Fungus	4	1.0
	Bacteria	5	1.2
	Virus	385	94.6
	Others*	13	3.2
Symptoms of COVID-19	Cough	288	70.8
	Sneezing	187	45.9
	Fever	246	60.4
	Shortness of breath	289	71.0
	Smell/test Loss	176	43.2
	Diarrhea	79	19.4
A sick person can transmit COVID-19 disease	True	354	87.0
Asymptomatic person can transmit COVID-19 disease	True	183	45.0
Elderly people are the most susceptible groups for COVID-19	True	320	78.6
Children are the most susceptible groups for COVID-19	True	95	23.3
Disabled people are most susceptible groups for COVID-19	True	47	11.5
Chronically ill people are susceptible groups for COVID-19	True	215	52.8
Health workers are the most susceptible groups for COVID-19	True	219	53.8
Pneumonia is the common complications of COVID-19	True	186	45.7
Death is the common complications of coronavirus disease	True	305	74.9
WHO Recommended preventive methods	Hand washing	328	80.6
	Alcohol rub	243	59.7
	Face mask	302	74.2
	Quarantine	184	45.2
	Antibiotics	74	18.2
	Vaccination	193	47.4
	Balanced diet	163	40.0
	Avoiding crowded places	199	48.9
Have you heard about COVID-19 vaccination?	Yes	379	93.1
The COVID-19 vaccination type currently given in Ethiopia?	AstraZeneca	282	69.3
	Novavax	114	28.0
	Moderna	11	2.7

Note: Others*- protozoa, evil spirit.

Predictors of COVID-19 Vaccine Acceptance

The bivariate logistic regression identified candidate variables for the multivariate logistic regression, at the p-value of 0.25 set as a cut-off point. Accordingly, nine variables fulfilled the candidacy for the multivariate logistic regression. After-effects of confounders were controlled in multivariate logistic regression, sex, living with an elderly person who was elder than 50 years old, and knowledge about the COVID-19 vaccine was statistically associated with COVID-19 vaccine acceptance.

Table 3 Attitude About COVID-19 Disease and Vaccination Among Participants in Selected Colleges of Addis Ababa, Ethiopia, May, 2021

Questions	Categories	Frequency	%
How did you feel when you first heard about COVID-19 disease?	Not concerned	72	17.7
	Concerned	114	28.0
	Afraid	175	43.0
	Anxious	46	11.3
Do you say you have been protecting yourself from COVID-19 disease?	Yes absolutely	162	39.8
	Medium	206	50.6
	Not really	39	9.6
What do you think about COVID-19 vaccination?	It is very important for prevention	180	44.2
	I do not know much about it	173	42.5
	I do not really care about it	54	13.3
Do you think you will get infected in the future?	Yes	146	35.9
	No	261	64.1

The odds of vaccine acceptance was 53.7% higher among male participants as compared to the females (AOR: 0.463, 95% CI: 0.284–0.755, $P<0.001$). The odds of having had vaccine acceptance was 2.295 times higher among participants who lived with under-five years old children (AOR: 2.295; 95CI:1.416–3.721, $P<0.05$) and was 1.609 times higher among participants who lived with an elderly person (AOR: 1.609, 95% CI: 1.016–2.548, $P<0.05$). Similarly, the odds of vaccine acceptance was two folds higher among those participants with poor knowledge of COVID-19 compared to those with good knowledge (AOR: 2.187, 95% CI: 1.391–3.438, $P < 0.001$) (Table 5).

Discussions

In this study, the level of vaccine acceptance was 39.8%, which was consistent with the findings from 37.3% in Uganda,[27] 37.4% in Jordan,[28] 47% in Bangladesh[30] and 47% in France.[31]

The current finding was lower than the reports of 54.8% in Russia,[13] 88.6% in China,[13] 64.7% in Saudi Arabia,[32] 67% in Indonesia,[11] 75% in US[24] and 83% in Denmark.[31] Such variations might be attributed to the variations in the type of vaccine across the different countries and perception differences across the communities. Thus, the lower acceptance level in Ethiopia might be due to a limited option was available at the time of the investigation.

The level of vaccine acceptance in this study was higher than the finding from Republic of Congo that was 27.7%.[33] This variation might be linked to differences in study participant type across the studies.

In this study, being a male had a higher level of vaccine acceptance. The same was reported by a study from Uganda that being a male was associated with an increased level of vaccine acceptance.[27] A study from US college students reported that worrying about unknown side effects and unforeseen problems, vaccine cynicism, under evaluation for safety and political conservativeness to be predictors of vaccine hesitancy.[34]

In this study, the level of vaccine acceptance was higher among participants who lived with the elderly and children of under-five years old. This was supported by another study.[35]

The likelihood of vaccine acceptance was two folds higher among participants with poor knowledge about the COVID-19. Probably, participants with good knowledge of COVID-19 might have fear associated with vaccine type, efficacy, and fear associated with AstraZeneca. However, source of the information matters, participants with good knowledge had a higher tendency to vaccine acceptance.[36,37]

Conclusion and Recommendation

The level of vaccine acceptance among college students in Ethiopia was lower than necessary to achieve herd immunity. Sex, living with under-five children and elderly, knowledge were predictors of vaccine acceptance in the study settings.

Table 4 COVID-19 Vaccination Acceptance of Participants in Selected Medical Colleges of Addis Ababa, Ethiopia, May, 2021

Questions	Categories	Frequency	%
Willing to take the COVID-19 vaccination	Yes	162	39.8
	I do not know	78	19.2
	No	167	41.0
Reasons for wanting to take COVID-19 vaccination	It is best preventive mechanism	100	24.6
	I am afraid that I might get infected	33	8.1
	I am afraid for the children in my home	7	1.7
	I am afraid that I might transmit the virus to elderly people at home	16	3.9
	It is WHO recommended preventive	3	0.7
	I saw famous people taking it	2	0.5
	Someone I know had taken the vaccine	2	0.5
Reasons for not wanting to take COVID-19 vaccination	Afraid of the possible side effects	47	11.5
	Believe it is biological weapon	30	7.4
	Have doubt about the vaccine	18	4.4
	Unreliable due to short time for development	30	7.4
	Do not have enough information	23	5.7
	Prefer other ways of protection	9	2.2
	The vaccine itself can cause COVID-19 disease	6	1.5
	Its ineffective	1	0.2
	COVID-19 is overrated, no vaccine needed	3	0.7
	Others*	1	0.2
If a doctor or the government recommended you to take the vaccine, would you take it?	Yes	30	7.4
	No	122	30.0
	I do not know	16	3.9
If it was other vaccine like a vaccination like Human Papilloma Virus (for women), or a vaccination for influenza, would you take it	Yes	90	22.1
	No	53	13.0
	I do not know	24	5.9
Have you been infected with COVID-19 virus?	Yes	42	10.3
	I do not know	135	33.2
	No	230	56.5
Have you ever been tested for COVID-19?	Yes	106	26.0
	No	301	74.0
Do you know anyone who died, been sick and had been admitted to hospital or anyone who had been in quarantine before?	Yes	281	69.0
	No	107	26.3
	Nothing to say	19	4.7

Note: Others*- pregnancy, heart disease.

Policymakers, stakeholders, and concerned bodies were recommended to work on the identified predictors of COVID-19 vaccine acceptance.

Limitation of the Study

The study was a cross-sectional study, which had a nature of point observation and difficult to establish the temporal association between variables. The other limitation was difficulty of inferring to the community at large, as it was an institution-based study.

Table 5 Predictors of COVID-19 Vaccine Acceptance of in Selected Colleges Students of Addis Ababa, Ethiopia 2021

Characteristics	Categories	Vaccine Acceptance status		COR (95% CI)	AOR (95% CI)
		Yes	No		
Age	20 or less	46	78	I	I
	21–23	79	138	1.030(0.652–1.628)	1.113(0.636–1.947)
	24–26	17	22	0.763(0.368–1.584)	1.230(0.473–3.198)
	27 and older	20	7	0.206(0.081–0.526)**	0.465(0.133–1.621)
Sex	Female	91	186	1.00	1.00
	Male	71	59	0.407(0.265–0.623)**	0.463(0.284–0.755)**
Religion	Protestant	28	39	I	I
	Orthodox	95	170	1.285(0.744–2.219)	1.033(0.559–1.908)
	Muslim	26	31	0.856(0.420–1.745)	0.784(0.361–1.704))
	Catholic	13	5	0.276(0.088–0.863)	0.326(0.92–1.160)
Marital Status	Single	131	206	I	I
	Married	25	23	0.585(0.319–1.074)	1.030(0.472–2.246))
	Others	6	16	1.696(0.647–4.444)	1.648(0.587–4.627)
Source of income	Family	129	214	I	I
	Work	22	22	0.603(0.321–1.132)	0.829(0.368–1.865)
	Other	11	9	0.493(0.199–1.222)	0.676(0.240–1.906)
Academic year	Freshman	35	57	I	I
	Second year	25	52	1.277(0.676–2.413)	1.061(0.529–2.126)
	Third	53	74	0.857(0.495–1.485)	0.603(0.314–1.155)
	Senior	26	40	0.945(0.494–1.207)	0.947(0.423–0.2.118)
	Graduate	23	22	0.587(0.286–1.207)	0.563(0.224–1.408)
Are there children in your home	Yes	108	150	I	I
	No	54	95	1.267(0.836–1.919)	2.295(1.416–3.721))*
Is there elderly person who is > 50 of age in your home	Yes	97	150	I	I
	No	65	95	0.945(0.630–1.418)	1.753(1.095–2.807)*
Knowledge about COVID-19 Vaccination	Poor knowledge	112	122	I	I
	Good knowledge	50	123	2.258(1.488–3.427)**	2.187(1.391–3.438)**

Notes: *p<0.05, **p<0.001.

Abbreviations

AOR, adjusted odds ratio; COR, crude odds ratio; COVID-19, coronavirus disease 2019; WHO, World Health Organization.

Data Sharing Statement

A finding of this study was generated from the data collected and analyzed on the basis of stated methods and materials, hence all data were already available in the manuscript.

Ethics Approval and Consent to Participate

The study protocol was performed in accordance with the ethical principle. Ethical approval was obtained from ethics review Committee of Universal Medical and Business College. The ethics approval was given in accordance with the Declaration of Helsinki. The data collectors obtained written informed consent from all participants.

Consent for Publication

Consent for publication of the manuscript was not applicable due to the fact that there were no participant's individual data videos or images.

Acknowledgments

The authors thank study participants for their willingness in taking part in the study.

Author Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article was submitted, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

Funding

The authors received no specific funding for this work.

Disclosure

The authors declare no conflicts of interest for this work.

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