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Knowledge, Attitude and Perceptions of Diabetic Patients Towards Covid-19 Infection in Two Healthcare Facilities in Lagos State, Southwest Nigeria.

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ABSTRACT

Background: People with Diabetes Mellitus (DM) have a higher overall risk of infection that results from multiple perturbations of innate immunity. This risk is higher for severe disease with COVID-19 infection. This study aims to assess the knowledge, attitudes, and perceptions (KAP) of diabetic patients regarding COVID-19 infection in two hospitals in Lagos State, South-West Nigeria.
Methods: A cross-sectional study using a structured, self-administered questionnaire, with consecutive sampling technique was conducted among diabetic patients attending endocrinology clinics at Lagos University Teaching Hospital (LUTH) and Randle General Hospital (RGH) from February to May, 2023to obtain participants sociodemographic dtails and their KAP towards COVID-19 infection. Data were analysed using descriptive statistics, Spearman's correlation and multinomial regression analysis. Level of significance was set at $p < 0.05$.
Results: A total of 290 participants took part in this study**.** Majority were males 153 (52.8%), aged between 46 and 65 years, 227 (78.3%), and not in health-related occupations, 270 (93.1%). The prevalence of good versus moderate knowledge, attitude and perceptions were 58.2 vs 35.9%, 22.1 vs 43.1% and 22.4 vs 40.7% respectively. Educational level and occupation were significantly correlated with the knowledge, attitude and perceptions of participants. Married participants had twice as good knowledge levels (OR 1.92, 95% CI (0.53 -6.94)), participants with tertiary education and a healthcare related occupation had twice as good attitudes (OR 1.62, 95% CI (0.56 - 4.66)) and (OR 1.60, 95% CI (0.52 - 4.91)) respectively, while those with no formal education had twice as good perception of infection (OR 2.00, 95% CI (0.50 - 7.93)) than others.
Conclusion: The study demonstrated good overall knowledge of COVID-19, but moderate attitudes and perceptions towards it among participants. Educational level and occupation were significantly correlated with the knowledge, attitude and perceptions of participants, underscoring the significance of promoting education among this population, thereby rectifying misconceptions, and fostering positive attitudes towards the disease.

1. NTRODUCTION

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2 virus, posed unprecedented health challenges to global health systems, economies, and societies[1]. The rapid spread of the virus and the severity of the disease it caused led to significant morbidity and mortality. The World Health Organization (WHO) declared COVID-19 a public health emergency of international concern by January 2020, and subsequently characterized it as a pandemic[2]. It further declared on May 5th, 2023, the abating but not the end of the infection as a global health threat, emphasizing that COVID-19 is here to stay and still causes severe global cases and deaths[3]. Once a person is infected, the severity of disease particularly affected older people and those who had pre-existing chronic health conditions such as diabetes mellitus, cardiovascular diseases and hypertension[1,4]. Diabetes mellitus (DM) is a chronic non-communicable disease characterized by elevated blood glucose levels. It is associated with increased susceptibility to infections as well as

microvascular and macrovascular complications which can result in severe disease. Thus, people living with diabetes are among the high-risk groups for severe outcomes if infected with COVID-19 due to their compromised immune systems and the potential for complications[5,6].

Several studies have highlighted that individuals with diabetes are more likely to experience severe symptoms, require hospitalization, and have higher mortality rates when infected with COVID-19 compared to non-diabetic patients[7-9]. The pathophysiological mechanisms underlying the increased susceptibility of diabetic patients to COVID-19 complications include chronic inflammation, hyperglycemia-induced immune dysfunction, and increased expression of angiotensin-converting enzyme 2 (ACE2), which serves as the entry receptor for SARS-CoV-2[10]. Understanding the knowledge, attitudes, and perceptions (KAP) of diabetic patients towards COVID-19 are important predictors of their knowledge and awareness of disease, susceptibility to infections, and adherence to health behaviors such as adherence to medications, infection prevention practices and vaccination uptake. This is crucial for developing effective public health strategies to mitigate the impact of the virus within this vulnerable population. In Nigeria, the prevalence of diabetes is rising, particularly in urban and densely populated areas such as Lagos, which is the most populous city and a significant epicenter for COVID-19 cases in the country[11,12]. The interplay between diabetes and COVID-19 in Lagos State [13] provides a unique context for assessing how diabetic patients perceive their risk, manage their condition, seek timely medical interventions, and adhere to public health guidelines during and after the pandemic.

Previous studies have also highlighted varying levels of knowledge and attitudes towards COVID-19 infection among different populations, influenced by factors such as education, socioeconomic status, and access to healthcare information[14-16]. However, specific data on COVID-19 in diabetic patients in Nigeria remains scarce, necessitating targeted research to inform policy and practice. This study thus aimed to assess the knowledge, attitudes, and perceptions of diabetic patients towards COVID-19 infection in Lagos State, South-West Nigeria as the pandemic was winding down, and to determine factors determining the KAP of participants towards the infection.

METHODS

Study Design and Setting: This study utilized a cross-sectional design to assess the knowledge, attitudes and perceptions of diabetic patients regarding COVID-19 infection. The study was carried out in Lagos State, South-West Nigeria. With a population of approximately 15 million people, Lagos State, the most populous city in Nigeria, and the second-largest metropolitan area in Africa, has notably recorded the highest number of reported COVID-19 cases in Nigeria[17], making it a significant location for this study. The study was carried out in two healthcare facilities: Lagos University Teaching Hospital (LUTH, a tertiary facility) in the Mushin Local Government Area, and Randle General Hospital (RGH, a secondary facility) in the Surulere Local Government Area of the state. Lagos University Teaching Hospital's endocrinology clinic, operating every Tuesday, attends to DM patients, with an average of 60 patients per clinic day. This is also similar for Randle General Hospital.

Study Population:

The study population comprised of diabetic patients attending Endocrinology Clinics in both hospitals between February and May, 2023.

Sample Size Determination:

A total of 290 participants who attended the clinics within the four-month study period were recruited into the study. A consecutive sampling approach was employed to recruit participants into the study. Response rate was 100%.

Eligibility criteria: The inclusion criteria for this study were patients diagnosed with DM attending either of the diabetic clinics during the study period, aged 18 years and above and willing to give informed consent while the exclusion criteria were patients with undiagnosed DM and hospitalized DM patients.

Study Procedure: Data were collected using a validated, self-administered structured questionnaire developed after extensive review of literature. The questionnaire consisted of four sections. Section A gathered information on socio-demographic characteristics such as age, gender, marital status, and occupation. Section B assessed participants' knowledge of COVID-19, with questions addressing transmission routes, symptoms, preventive measures, and treatment options. Section C assessed participants' attitudes towards COVID-19 (assessed using Likert scale items measuring perceived severity, susceptibility, and efficacy of preventive measures) and Section D investigated participants' perceptions towards COVID-19, encompassing questions about perceived barriers to accessing healthcare services, sources of information, and

compliance with public health guidelines. The questionnaire was subjected to reliabilty test, and returned a Cronbach alpha's value of 0.753. it was then pretested for clarity and comprehensibility among 10 diabetic patients from the same population prior to the commencement of the study, who were then subsequently excluded from the study. Responses to the questions about knowledge were measured with a yes, no or not sure while responses to attitude and perception questions were measured using a five-point Likert scale, ranging 1–5 from strongly agree to strongly disagree. Each correct answer in sections on knowledge received a one point, while incorrect response received a zero score. Scores were calculated as the sum of the correct answers and grouped into good, moderate or poor. The attitude and perception sections were assessed by adding total correct scores for the fifteen and eight questions respectively and calculating the percentage. Overall, knowledge, attitude and perception levels were rated as high if they were between 80 and 100%; moderate if they were between 60 and 79% and poor if they were less than 60%.

Ethical Considerations: Ethical approval for the study was obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital (LUTH). Assigned No: ADM/D5CST/HREC/APP/5071. Informed consent was obtained from all participants prior to their inclusion in the study, and confidentiality and anonymity of the collected data were ensured throughout the research process.

Data Analysis: The data collected from the study were collated and entered into Microsoft Excel spreadsheets, and exported to IBM SPSS version 28.0 for analysis. Data were analyzed using descriptive statistics for categorical variables such as demographics, and summarized by frequencies, percentages, mean and standard deviations. Spearman's rank correlation coefficient and multivariate logistic regression analyses were performed to identify correlation of variables with sociodemographic characteristics and associated factors of poor knowledge, attitude and perceptions. P-values < 0.05 were considered statistically significant.

RESULTS

Socio-demographics of respondents

A total of 290 DM patients were enrolled in this study. Majority of the participants were between the ages of 46 and 65 years (227; 78.3%), while 37 (12.8%) were older than 66 years and 25 (9.0%) were less than 45 years. The mean age of the study participants were 57±8 years (LUTH) and 57±9 years (RGH). More than half were males 153 (52.8%) and married 194 (66.9%). About a third, 107 (36.9%), had tertiary education and the majority, 270 (93.1%) had no health-related background. Almost all of the participants, 270 (93.1%), were self-employed, while 120 (41.4%) earned an income of more than N200, 000 monthly. There was no statistically significant difference in socio-demographic parameters between the two hospitals (p>0.05). (Table 1).

Table 1: Sociodemographic characteristics of diabetic patients

Basic Characteristics	Categories	LUTH n (%)	RANDLE n (%)	TOTAL n (%)	p-value
Age Group (years)	0 – 45	11 (7.8)	15 (10.1)	25 (9.0)	0.143
	46 – 65	117 (83.0)	110 (73.8)	227 (78.3)	
	≥ 66	13 (9.2)	24 (16.1)	37 (12.8)	
(Mean, SD)		57 (SD =8)	57 (SD=9)		
Gender	Male	69 (48.9)	84 (56.4)	153 (52.8)	0.205
	Female	72 (51.1)	65 (43.6)	137 (47.2)	
Marital Status	Single	2 (1.4)	5 (3.4)	7 (2.4)	0.254
	Married	95 (67.4)	99 (66.4)	194 (66.9)	
	Divorced	1 (0.7)	2 (1.3)	3 (1.0)	
	Widowed	35 (24.8)	31 (20.8)	66 (22.8)	
	Separated	8 (5.7)	12 (8.1)	20 (6.9)	

Religion	Christianity	71 (50.4)	72 (48.3)	143 (49.3)	0.729
	Islam	70 (49.6)	77 (51.7)	147 (50.7)	
Educational Level	No Formal Education	23 (16.3)	16 (10.7)	39 (13.4)	0.683
	Primary	23 (16.3)	26 (17.4)	49 (16.9)	
	Secondary	33 (23.4)	33 (22.1)	66 (22.8)	
	Tertiary	49 (34.8)	58 (38.9)	107 (36.9)	
	Postgraduate	13 (9.2)	16 (10.7)	29 (10.0)	
Occupation	Healthcare Related	11 (7.8)	9 (6.0)	20 (6.9)	0.554
	Non-Healthcare Related	130 (92.2)	140 (94.0)	270 (93.1)	
Employment	Civil Servant	17 (12.1)	15 (10.1)	32 (11.0)	0.207
	Self Employed	87 (61.7)	83 (55.7)	170 (58.6)	
	Private Sector	30 (21.3)	31 (20.8)	61 (21.0)	
	Retired	7 (5.0)	17 (11.4)	24 (8.3)	
	House Wife	0 (0.0)	0 (0.0)	0 (0.0)	
	Unemployed	0 (0.0)	2 (1.3)	2 (0.7)	
	Student	0 (0.0)	1 (0.7)	1 (0.3)	
Monthly Income (Naira)	Less than 50,000	5 (3.5)	12 (8.1)	17 (5.9)	0.570
	50,000 - 99,000	20 (14.2)	23 (15.4)	43 (14.8)	
	100,000 - 149,000	39 (27.7)	37 (24.8)	76 (26.2)	
	150,000 - 199,000	17 (12.1)	17 (11.4)	34 (11.7)	
	More than 200,000	60 (42.6)	60 (40.3)	120 (41.4)	

Knowledge of respondents on COVID-19

All the participants from LUTH, 141 (100%), and 147 (98.7%) from RGH confirmed that they had heard about the COVID-19 disease, and almost all in both hospitals knew the symtomps of COVID-19 infection (Table 2). However, 62 (44 0%) in LUTH and 70 (47.0%) in RGH agreed that people infected with coronavirus develop symptoms and feel unwell. In addition 125 (88.7%) in LUTH, and 136 (91.3%) in RGH believe that coronavirus infection spreads when the respiratory droplets that are coughed out or exhaled by an infected person is inhaled and that preventive practices can prevent the spread of infection. Also, 52 (36.9%) and 64 (43.0%) in LUTH and RGH respectively knew that people living with diabetes DM are more likely to develop more severe COVID-19 disease, and that the disease does not spread through the use of insulin injection needles at 46 (32.6%) and 47 (31.5%) from LUTH and RGH respectively. There was no statistically significant difference in the mean knowledge response between LUTH and RGH patients ($p>0.05$).

The prevalence of poor knowledge about COVID-19 among the study participants was 5.9% whereas the prevalence of good and moderate knowledge were 58.2% and 35.9%, respectively, together consisting about 94.1% of good knowledge of COVID-19 infection when compared to those with poor knowledge (Figure 1). The mean score for knowledge was 24.2±3.49.

Table 2: Percentage of correct responses of diabetic patients to knowledge questions

Variable	LUTH (n = 141) YES n (%)	RGH (n=149) YES n (%)	F	p-value
Have you ever heard of COVID-19 disease?	141(100.0)	147(98.7)	1.905	0.169
People with Coronavirus disease/COVID -19 have fever, tiredness, dry cough and shortness of breath	140 (99.3)	146(98.0)	0.902	0.343
All people infected with coronavirus develop symptoms and feel unwell	62 (44.0)	70(47.0)	0.047	0.828
People with diabetes mellitus are more likely to develop more severe COVID-19 disease and even die	52(36.9)	64(43.0)	0.276	0.600
All individual infected with coronavirus develop serious or severe COVID-19 disease	97 (68.8)	101(67.8)	0.142	0.707
People can contact the virus from people who have it	139 (98.6)	147(98.7)	0.003	0.956
The coronavirus spreads when you breathe in the respiratory droplets that are coughed out or exhaled by an infected person.	125 (88.7)	136(91.3)	0.551	0.459
Coronavirus in respiratory droplets can landon surrounding, surfaces and objects and can remain alive for a long time	104 (73.8)	100 (67.1)	1.213	0.272
You can contact the coronavirus if you touch your face, nose and mouth after touching objects and surfaces where coronavirus is present	122 (86.5)	136 (91.3)	1.432	0.232
People infected with coronavirus cannot spread the disease when they have no fever	64 (45.4)	56 (37.6)	1.230	0.268
The coronavirus does not spread through use of insulin injection needle	46 (32.6)	47 (31.5)	0.112	0.738
Regularly and thoroughly washing your hands with soap and water or cleaning them with an alcohol -based hand rub can protect against coronavirus	141(100.0)	148 (99.3)	0.946	0.332
Avoiding crowded places and maintaining a minimum distance of 1m from others can prevent spread of coronavirus	141(100.0)	149(100)	1.408	0.236
There has been the same variant of the COVID-19 till date	38 (27.0)	50 (33.6)	0.515	0.474
Several vaccines have been developed to curb the spread of COVID-19 disease	114 (80.9)	126 (84.6)	1.905	0.169

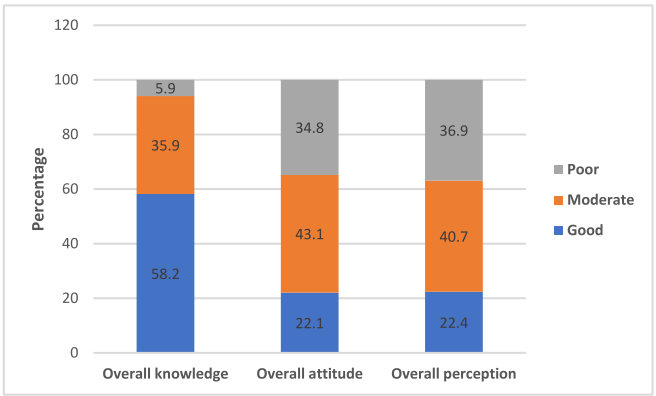

Figure 1: Overall level of knowledge, attitude and perception about COVID-19 among study participants.

Attitudes of Diabetic patients towards COVID-19

Over 90% (276) of patients at both hospitals agreed to wearing face masks in public during the active season of the pandemic. Also, 204 (70.4%) agreed that diabetic patients stood a higher risk of getting infected with COVID-19 disease, even as over 50% (154) of participants in both hospitals significantly disagreed that following the routine dietary advice would weaken their immune system and make them more prone to get infected with COVID-19 disease (p = 0.007). Only 193 (66.5%) believed that taking the COVID-19 vaccine was necessary to protect them from the disease with RGH having a slightly higher percentage (Table 3). There was a significant difference in participant's response from both facilities that following the routine dietary advice will weaken immune system and make them more prone to get infected with COVID-19 (p=0.007). The prevalence of poor attitude towards COVID-19 among the study participants was 34.8% while the prevalence of good and moderate attitude were 43.1% and 22.1% respectively, together consisting 65.2% of good attitude compared to those with poor attitude (Figure 1). The mean score for attitude was 22±3.

Table 3: Percentage of responses of diabetic patients to Attitude questions

Percentage of responses of diabetic patients to Attitude questions	Response	LUTH N (%)	RGH N (%)	Total N (%)	F	p-value
A diabetic patient is at a higher risk of getting infected with COVID-19.	Strongly agree	28 (19.9)	38 (25.5)	66 (22.8)	0.346	0.557
	Agree	75 (53.2)	63 (42.3)	138 (47.6)		
	Neither agree nor disagree	26 (18.4)	35 (23.5)	61 (21.0)		
	Disagree	12 (8.5)	13 (8.7)	25 (8.6)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		
Following routine dietary advice will weaken one's immune system and make one more prone to get infected with COVID-19.	Strongly agree	4 (3.0)	28 (18.5)	32 (11.0)	7.304	0.007*
	Agree	21 (15.6)	17 (11.4)	38 (13.1)		
	Neither agree nor disagree	26 (19.3)	34 (22.8)	60 (20.7)		
	Disagree	58 (43.0)	70 (47.0)	128 (44.1)		
	Strongly disagree	26 (19.3)	0 (0.0)	26 (9.0)		
Wearing a facemask in public prevents infection.	Strongly agree	51 (36.2)	57 (38.3)	108 (37.2)	0.021	0.884
	Agree	84 (89.6)	84 (56.4)	168 (57.9)		
	Neither agree nor disagree	0 (0.0)	0 (0.0)	0 (0.0)		
	Disagree	6 (4.3)	8 (5.4)	14 (4.8)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		
Regular hand washing, maintaining social distancing and use of masks can protect from COVID-19.	Strongly agree	59 (41.8)	66 (44.3)	125 (43.1)	0.673	0.413
	Agree	81 (57.4)	77 (51.7)	158 (54.5)		
	Neither agree nor disagree	1 (0.7)	5 (3.4)	6 (2.1)		
	Disagree	0 (0.0)	0 (0.0)	0 (0.0)		

	Strongly disagree	0 (0.0)	1 (0.7)	1 (0.3)		
I consciously made efforts to prevent touching my face when outside my home.	Strongly agree	22 (15.6)	28 (18.8)	50 (17.2)	0.055	0.815
	Agree	72 (51.1)	72 (48.3)	144 (49.7)		
	Neither agree nor disagree		43 (30.5)	45(30.2)	88 (30.3)	
	Disagree		4 (2.8)	4 (2.7)	8 (2.8)	
	Strongly disagree		0 (0.0)	0 (0.0)	0 (0.0)	
Following routine dietary advice to keep the infection off.	Strongly agree	46 (32.6)	54 (36.2)	100 (34.5)	0.000	0.996
	Agree	91 (64.5)	89 (59.7)	180 (62.1)		
	Neither agree nor disagree	4 (2.8)	6 (4.0)	10 (3.4)		
	Disagree	0 (0.0)	0 (0.0)	0 (0.0)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		
Consciously maintaining a distance of at least 1m from others in public prevents infection.	Strongly agree	35 (24.8)	37 (24.8)	72 (24.8)	1.100	0.295
	Agree	96 (68.1)	91 (61.1)	187 (64.5)		
	Neither agree nor disagree	8 (5.7)	12 (8.1)	20 (6.9)		
	Disagree	2 (1.4)	9 (6.0)	11 (3.8)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		
Taking the COVID-19 vaccine is necessary to protect from the disease.	Strongly agree	47 (33.3)	52 (34.9)	99 (34.1)	1.789	0.182
	Agree	41 (29.1)	53 (35.6)	94 (32.4)		
	Neither agree nor disagree	43 (30.5)	34 (22.8)	77 (26.6)		
	Disagree	10 (7.1)	10 (6.7)	20 (6.9)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		

Perceptions of Diabetic patients to COVID-19

According to Table 4, 182 (62.8%) and 233 (80.4%) of participants significantly admitted being scared, and feeling anxious, respectively, whenever they think of COVID-19 disease. Both hospitals had patients who expressed varying levels of confidence in the final control of COVID-19, both globally and within Nigeria and Lagos State with majority significantly believing that the disease will be controlled globally (p=0.027). About 65, (46.1%) of the participants in LUTH and 55, (36.9%) in RGH agreed that the government was not being transparent about COVID-19 related information, while over a quarter, while the pandemic was still active, believed that life will go back to normal when the pandemic ends. Similarly, about a quarter of the participants believed that the government had done enough against the spread of COVID-19 disease. The prevalence of poor perception towards COVID-19 was 36.9% while the prevalence of good and moderate perception were 40.7% and 22.4% respectively, together consisting 63.1% of good perception (Figure 1). The mean score for perception was 26.5±3.37.

Table 4: Percentage of responses of diabetic patients to Perception questions

Percentage of responses of diabetic patients to Perception questions	Response	LUTH N (%)	RGH N (%)	Total N (%)	F	p-value
I am scared anytime I think of the COVID-19 disease	Strongly agree	39 (27.7)	29 (19.5)	68 (23.5)	0.767	0.027*
	Agree	60 (42.6)	54 (36.2)	114 (39.3)		
	Neither agree nor disagree	29 (20.6)	42 (28.3)	71 (24.5)		
	Disagree	11 (7.8)	21 (14.1)	32 (11.0)		
	Strongly disagree	2 (1.4)	3 (2.0)	5 (1.7)		
I feel anxious when I think of coronavirus disease/ COVID-19	Strongly agree	25 (17.7)	24 (16.1)	49 (16.9)	0.300	0.584
	Agree	94 (66.7)	90 (60.4)	184 (63.5)		
	Neither agree nor disagree	16 (11.3)	19 (12.8)	35 (12.1)		
	Disagree	5 (3.5)	16 (10.7)	21 (7.2)		
	Strongly disagree	1 (0.7)	0 (0.0)	1 (0.3)		
I have confidence that COVID-19 will be finally controlled in the world	Strongly agree	28 (19.9)	26 (17.4)	54 (18.6)	4.961	0.027*
	Agree	88 (62.4)	86 (57.7)	174 (60.0)		
	Neither agree nor disagree	18 (12.8)	18 (12.1)	36 (12.4)		
	Disagree	6 (4.3)	19 (12.8)	25 (8.6)		
	Strongly disagree	1 (0.7)	0 (0.0)	1 (0.3)		
I have confidence that COVID-19 will be finally controlled in Nigeria	Strongly agree	51 (36.2)	43 (28.9)	94 (32.4)	1.045	0.307
	Agree	84 (59.6)	89 (59.7)	173 (59.7)		
	Neither agree nor disagree	5 (3.5)	11 (7.4)	16 (5.5)		
	Disagree	1 (0.7)	3 (2.0)	4 (1.4)		
	Strongly disagree	0 (0.0)	3 (2.0)	3 (1.0)		
I have confidence that COVID-19 will be finally controlled in Lagos State	Strongly agree	46 (32.6)	42 (28.2)	88 (30.3)	0.649	0.421
	Agree	72 (51.1)	74 (49.7)	146 (50.3)		
	Neither agree nor disagree	19 (13.5)	23 (15.4)	42 (14.5)		
	Disagree	3 (2.1)	7 (4.7)	10 (3.5)		
	Strongly disagree	1 (0.7)	3 (2.0)	4 (1.4)		

I think the media's coverage of the COVID-19 disease is exaggerated	Strongly agree	50 (35.5)	45 (30.2)	95 (32.8)	1.807	0.180
	Agree	67 (47.5)	70 (47.0)	137 (47.2)		
	Neither agree nor disagree	20 (14.2)	22 (14.8)	42 (14.5)		
	Disagree	4 (2.8)	12 (8.1)	16 (5.5)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		
I think the government is not being transparent about COVID-19 related information	Strongly agree	20 (14.2)	21 (14.1)	41 (14.1)	0.061	0.806
	Agree	65 (46.1)	55 (36.9)	120 (41.4)		
	Neither agree nor disagree	33 (23.4)	40 (26.8)	73 (25.2)		
	Disagree	23 (16.3)	24 (16.1)	47 (16.2)		
	Strongly disagree	0 (0.0)	9 (6.0)	9 (3.1)		
I think the end of the COVID-19 pandemic is in sight	Strongly agree	17 (12.1)	18 (12.1)	35 (12.1)	0.468	0.494
	Agree	63 (44.7)	61 (40.9)	124 (42.8)		
	Neither agree nor disagree	45 (31.9)	48 (32.2)	93 (32.1)		
	Disagree	16 (11.3)	22 (14.8)	38 (13.1)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		
I believe life will go back to normal when the pandemic ends	Strongly agree	42 (30.0)	42 (28.2)	84 (29.0)	3.109	0.079
	Agree	74 (52.9)	75 (50.3)	149 (51.4)		
	Neither agree nor disagree	13 (9.3)	16 (10.7)	29 (10.0)		
	Disagree	11 (7.9)	16 (10.7)	27 (9.3)		
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)		
I think that the government has done enough against the spread of COVID-19 disease	Strongly agree	45 (31.9)	45 (30.2)	90 (31.0)	4.938	0.027*
	Agree	73 (51.8)	67 (45.0)	140 (48.3)		
	Neither agree nor disagree	12 (8.5)	24 (16.1)	36 (12.4)		
	Disagree	10 (7.1)	12 (8.1)	22 (7.6)		
	Strongly disagree	1 (0.7)	1 (0.7)	2.(0.7)		

Based on the spearman's correlation (r_s) analysis, the knowledge and attitude of participants towards COVID-19 was weakly negatively correlated with age, marital status and occupation but weakly positively correlated with gender, employment status and educational level (Table 5). Only occupation and educational level variables were statistically significant at $p<0.05$ across the three dependent variables.

Table 5: Correlation of general mean scores of Knowledge, Attitude and Perception with demographic characteristics

		r_s	p-value
Knowledge Score	Age (in years)	-0.196	< 0.001**
	Gender	0.040	0.501
	Marital Status	-0.095	0.108
	Religion	-0.017	0.779
	Educational Level	.249**	0.000**
	Occupation	-.189**	0.001**
	Employment	.139*	0.018*
	Attitude Score (mean)	.348**	0.000**
	Perception Score (mean)	0.097	0.100
Attitude Score	Age (in years)	-0.155	0.008**
	Gender	0.064	0.280
	Marital Status	-0.007	0.908
	Religion	0.020	0.733
	Educational Level	.205**	0.000**
	Occupation	-.177**	0.003**
	Employment	0.088	0.133
	Perception Score (mean)	.303**	0.000**
	Knowledge Score (mean)	.348**	0.000**
Perception Score	Age (in years)	0.050	0.396
	Gender	0.056	0.339
	Marital Status	0.026	0.665
	Religion	.151**	0.010
	Educational Level	-.206**	0.000**
	Occupation	.162**	0.006**
	Employment	-0.046	0.432
	Knowledge Score (mean)	0.097	0.100
	Attitude Score (mean)	.303**	0.000**

r_s= Spearman's correlation coefficient; ** significant at p< 0.01; * significant at p< 0.05

Participants with tertiary education and a healthcare related occupation had twice as good attitudes compared to others (OR 1.62, 95% CI (0.56 - 4.66)) and (OR 1.60, 95% CI (0.52 - 4.91)) respectively. Participants with no formal education also had twice a good perception of infection than others (OR 2.00, 95% CI (0.50 - 7.93)).

Table 6: Multinomial logistic regression predicting factors associated with good levels of Knowledge, Attitude and Perception

		OR (95% CI)	*p*-value
KNOWLEDGE			
Gender	Male	0.82 (0.46 1.44)	0.48
	Female[R]		
Marital Status	Single	0.79 (0.08 - 7.46)	0.84
	Married	1.92 (0.53 -6.94)	0.32
	Divorced	1.53 (0.09 - 27.27)	0.77
	Widowed	1.69 (0.43 - 6.73)	0.46
	Separated[R]		
Educational Level	No Formal Education	0.00	0.99
	Primary	0.00	0.99
	Secondary	0.00	0.99
	Tertiary	0.00	0.99
	Postgraduate[R]		
Occupation	Healthcare Related	H	0.99
	Non-Healthcare Related[R]		
Employment	Civil Servant	0.00	1.00
	Self Employed	0.00	1.00
	Private Sector	0.00	1.00
	Retired	0.00	1.00
	Unemployed	0.00	0.99
	Student[R]		
ATTITUDE			
Gender	Male	1.02 (0.53 - 1.96)	0.95
	Female[R]		
Marital Status	Single	0.00	1.00
	Married	1.35 (0.31 - 5.87)	0.69
	Divorced	0.00	1.00
	Widowed	1.41 (0.29 - 6.91)	0.67
	Separated[R]		
Educational Level	No Formal Education	0.78 (0.17 - 3.50)	0.74
	Primary	0.88 (0.23 - 3.33)	0.85
	Secondary	0.95 (0.28 - 3.26)	0.93
	Tertiary	1.62 (0.56 - 4.66)	0.37
	Postgraduate[R]		
Occupation	Healthcare Related	1.60 (0.52 - 4.91)	0.41
	Non-Healthcare Related[R]		
Employment	Civil Servant	0.00	1.00
	Self Employed	0.00	1.00
	Private Sector	0.00	1.00
	Retired	0.00	1.00
	Unemployed	24.04	1.00
	Student[R]		

PERCEPTION			
Gender	Male	0.72 (0.37 - 1.42)	0.35
	Female[R]		
Marital Status	Single	1.80	1.00
	Married	0.99 (0.26 - 3.81)	0.99
	Divorced	H	1.00
	Widowed	0.80 (0.18 - 3.54)	0.77
	Seperated[R]		
Educational Level	No Formal Education	2.00 (0.50 - 7.93)	0.33
	Primary	0.95 (0.27 - 3.36)	0.94
	Secondary	0.45 (0.13 - 1.58)	0.21
	Tertiary	0.34 (0.10 - 1.18)	0.09
	Postgraduate[R]		
Occupation	Healthcare Related	0.00	0.99
	Non-Healthcare Related[R]		
Employment	Civil Servant	0.20	1.00
	Self Employed	1.38	1.00
	Private Sector	1.12	1.00
	Retired	0.17	1.00
	Unemployed	0.00	NA
	Student[R]		

[R] reference category H- high odd ratio NA not available * significant p<0.05

DISCUSSION

In the midst of global pandemics, a critical aspect of effective healthcare provision involves understanding the awareness, attitudes, and perceptions of vulnerable populations towards the pandemic. This study undertook a comprehensive examination of diabetic patients' knowledge, attitude, and perceptions towards COVID-19, focusing on two endocrinology clinics. In this study, more than half of the participants, six, and three out of ten, showed good and moderate knowledge of COVID-19 infection respectively. Conversely, four out every ten participants showed moderate attitudes and perceptions towards the infection. Similar proportions of four out of every ten participants additionally showed poor attitudes and perceptions towards the infection. This brings to bear some unanswered questions and misconceptions, especially about the increased risk of serious illness for diabetic patients.

Younger participants demonstrated heightened knowledge of DM and COVID-19 infection, likely stemming from their greater access to information and digital resources, as well as their higher health literacy levels. This correlation echoed findings from research in Ethiopia[15] and emphasize the importance of leveraging educational and professional networks for effective health communication. The study by Apicella et al.[10] confirms the necessity for focused education for diabetic patients by highlighting how immune dysfunction and chronic inflammation in diabetes increase the severity of COVID-19. Additionally, educational level displayed a positive correlation with knowledge, while occupation showed a negative correlation. These outcomes underscore the pivotal role of education in enhancing understanding, alongside the potential efficacy of occupation-specific education campaigns. Consistent with our study findings are studies conducted in Sudan[18] and India[19]. These similarities could

be due to the uniformity of the study population as both types of research focused on patients with DM. Also in agreement with our findings was a study conducted in Northern Nigeria which reported 99.5% knowledge of COVID-19 among study participants[20].

Findings from this study also revealed that only four in every ten participants were aware of the danger of more severe illness, exhibited by the observed poor attitudes and perceptions. This highlights the necessity of focused educational initiatives to raise health literacy in this demographic group. It also reflects that less than half of participants knew that people living with diabetes are more likely to develop more severe COVID-19 disease, however, slightly more than half of the participants agreed that following routine dietary advice will strengthen their immune system and make them less prone to getting infected with COVID-19 virus. This, as a component of diabetes self-management education (DSME) is essential in routine diabetes care during pandemics.[21,22]

About three-quarters of participants reportedly agreed that diabetic patients stood a higher risk of getting infected with COVID-19 disease. However, only about a third strongly agreed that taking the COVID-19 vaccine was necessary to protect them from the infection, similar to reports by Reuben et al.[20] The relatively low acceptance of COVID-19 vaccination mirrors global trends and underscores the need to address vaccine misinformation and cultural beliefs through transparent and evidence-based public health campaigns. A higher report of diabetics being at more risk of the infection was obtained in Sudan[18]. The overall level of good and moderate attitude was lower to reports from Sudan among patients with type 2 diabetes but similar to that from north west Nigeria in the general population.[18,20] The results are consistent with international research showing that people with diabetes frequently misjudge how vulnerable they are regarding severe infections such as COVID-19[21]. Also in this study, about three-quarters of our study participants in both study centers significantly believed that the government had done enough by putting in efforts to contain the spread of the virus, and that COVID-19 will eventually be controlled globally. This report is similar to studies carried out by Addis et al. and Alzoubi et al. in Ethiopia and Jordan respectively.[23,24] This could be as a result of their seeing the efforts the government put in place to curb the spread of the virus, and the information being constantly given on the numbers of infections reported within the state during the pandemic, as well as management and cure rates of infections[17,25] and this has has come to be by the WHO declaration.[3]

Crucial correlations surfaced between sociodemographic variables and the scores for knowledge, attitude, and perceptions. Remarkably, attitude scores demonstrated a significant positive correlation with knowledge scores. This alignment highlights those participants with a stronger knowledge base also exhibited more positive attitudes. The majority of participants concurred on the elevated risk of COVID-19 for diabetic patients and endorsed preventive measures and vaccination. Yet, nuanced variations were evident in attitudes concerning dietary advice and vaccine perceptions. These findings resonated with insights from Chinese studies, emphasizing the presence of universal attitudes within diabetic patient populations.[15,26]

The COVID-19 perceptions among diabetic patients were further influenced by demographic factors. A substantial number of patients reported feelings of fear and anxiety in relation to the disease, echoing sentiments reported in various studies during the pandemic[27]. Education level, occupation, and being married demonstrated correlations with KAP scores, suggesting their joint influence on shaping individual outlooks. Multinomial logistic regression analysis yielded deeper insights into the factors molding knowledge, attitude, and perception levels. Education emerged as a robust influencer across all dimensions. Married participants, those having tertiary education and working in healthcare related occupations, and those lacking formal education exhibited twice as good knowledge, attitudes, and perceptions compared to other participants. This underscores the pivotal role of education and lifestyle in shaping perspectives and underscores the significance of promoting education and positive lifestyle choices among this population.

This study had some limitations. The study was conducted in only two healthcare facilities, which may not be representative of the broader diabetic population across different regions, socioeconomic backgrounds, or healthcare settings. Participants were required to recall past behaviors and knowledge, which may have affected the accuracy of the responses, particularly regarding adherence to COVID-19 guidelines or changes in health practices during the pandemic. And, the reliance on self-administered questionnaires also may have introduced reporting bias, where participants could have provided

responses they believe are expected or acceptable.

CONCLUSION

This study found that participants had a good overall knowledge of COVID-19, but moderate overall attitudes and perceptions towards COVID-19 infection. Educational level and occupation were significantly correlated with the knowledge, attitude and perceptions of participants. Participants with tertiary education and working in health-related occupations were twice as likely to have positive attitudes toward COVID-19 infection. By addressing gaps in attitude, rectifying misconceptions, and fostering positive attitudes, healthcare providers and policymakers can play a pivotal role in empowering diabetic patients to navigate the challenges of the pandemics effectively.

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REFERENCES

1. Pollard CA, Morran MP, Nestor-Kalinoski AL (2020) The COVID-19 pandemic: a global health crisis. *Physiological Genomics*, *52*(11), 549–557. https://doi.org/10.1152/physiolgenomics.00089.2020
2. World Health Organization (2020) Coronavirus disease 2019 (COVID-19): situation report, 116, World Health Organization. Switzerland. Retrieved from https://policycommons.net/artifacts/537998/coronavirus-disease-2019-covid-19/1514551/ https://iris.who.int/handle/10665/332151 Accessed June 2024.
3. World Health Organization (2023) Statement on the Fifteenth Meeting of the IHR (2005) Emergency Committee on the COVID-19 Pandemic. WHO News, 5 May 2023. Available online: https://www.who.int/news/item/05-05-2023-statement-on-the-fifteenth-meeting-of-the-international-health-regulations-%282005%29-emergency-committee-regarding-the-coronavirus-disease-%28covid-19%29-pandemic (accessed on 12 March, 2025).
4. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, Xiang J, Wang Y, Song B, Gu X, Guan L (2020) Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The Lancet*, 28: 395 (10229):1054-62. https://doi.org/10.1016/S0140-6736(20)30566-3
5. Verdecchia P, Cavallini C, Spanevello A. Angeli F (2020) The pivotal link between ACE2 deficiency and SARS-CoV-2 infection. *European Journal of Internal Medicine*, 76:14-20. https://doi.org/10.1016/j.ejim.2020.04.037
6. Abu-Farha M, Al-Mulla F, Thanaraj TA, Kavalakatt S, Ali H, Abdul Ghani M, Abubaker J (2020) Impact of diabetes in patients diagnosed with COVID-19. *Frontiers in Immunology,* 11:576818. https://doi.org/10.3389/fimmu.2020.576818
7. Rajpal A, Rahimi L. Ismail-Beigi F (2020) Factors leading to high morbidity and mortality of COVID-19 in patients with type 2 diabetes. *Journal of diabetes*, 12(12), 895-908. https://doi.org/10.1111/1753-0407.13085
8. Hussain A, Bhowmik B. do Vale Moreira, NC (2020) COVID-19 and diabetes: Knowledge in progress. *Diabetes Research and Clinical Practice*, 162:108142. https://doi.org/10.1016/j.diabres.2020.108142
9. Singh AK, Gupta R, Ghosh A. Misra A (2020) Diabetes in COVID-19: Prevalence, pathophysiology, prognosis, and practical considerations. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(4):303-310. https://doi.org/10.1016/j.dsx.2020.04.004
10. Apicella M, Campopiano MC, Mantuano M, Mazoni L, Coppelli A, Del Prato S (2020) COVID-19 in people with diabetes: understanding the reasons for worse outcomes. *The Lancet Diabetes & Endocrinology,* 8(9):782-792.

https://doi.org/10.1016/S2213-8587(20)30238-2
11. International Diabetes Federation (2019) *IDF Diabetes Atlas* (9th ed.). International Diabetes Federation. https://diabetesatlas.org/en/
12. Ekeke N, Ukwaja KN, Chukwu JN, Nwafor CC, Meka AO, Egbagbe EE, Soyinka FO, Alobu I, Agujiobi I, Akingbesote S, Igbinigie O (2017) Screening for diabetes mellitus among tuberculosis patients in Southern Nigeria: a multi-centre implementation study under programme settings. *Scientific reports*, 7(1):44205. https://doi.org/10.1038/srep44205
13. Osikomaiya B, Erinoso O, Wright KO, Odusola AO, Thomas B, Adeyemi O, Bowale A, Adejumo O, Falana A, Abdus-Salam I, Ogboye O (2021) 'Long COVID': persistent COVID-19 symptoms in survivors managed in Lagos State, Nigeria. *BMC Infectious Diseases*, 21:1-7. https://doi.org/10.1186/s12879-020-05716-x
14. Alenbalu M, Egenasi CK, Steinberg WJ, Aluko O (2024) Diabetes Knowledge, Attitudes, and Practices in adults with type 2 diabetes at primary health care clinics in Kimberley South Africa. *South African family practice: official Journal of the South African Academy of Family Practice/Primary Care*, 66(1), e1–e9. https://doi.org/10.4102/safp.v66i1.5838
15. Melesie Taye G, Bose L, Beressa TB, Tefera GM, Mosisa B, Dinsa H, Birhanu A, Umeta G (2020). COVID-19 Knowledge, Attitudes, and Prevention Practices Among People with Hypertension and Diabetes Mellitus Attending Public Health Facilities in Ambo, Ethiopia. *Infection and Drug Resistance*, 13: 4203–4214. https://doi.org/10.2147/IDR.S283999
16. Bao Y, Dong C, Liang Q, Zhang X, Gu Z, Cheng C (2023) The Difference of COVID-19 Vaccination Attitude, Preventive Measures and Knowledge of SARS-COV-2 Between Diabetic Patients and Healthy Citizens in China. *Journal of Multidisciplinary Healthcare*, 16:493-502. https://doi.org/10.2147/JMDH.S394790
17. Okoroiwu HU, Ogar CO, Nja GME, Abunimye DA, Ejemot-Nwadiaro RI. (2021) COVID-19 in Nigeria: account of epidemiological events, response, management, preventions and lessons learned. *Germs*, 11(3), 391.
18. Ahmed YS, Mohamed MI, Hasabo EA, Omer AT, Abdelgadir II, Bashir SN (2022) Knowledge, attitude and practices regarding COVID-19 and their associated factors in patients with type 2 diabetes attending Abdullah-Khalil diabetes center, Omdurman: A cross-sectional study. Medicine (Baltimore). 101(52):e32561. https://doi.org/10.1097/MD.0000000000032561
19. Pal R, Yadav U, Grover S, Saboo B, Verma A, Bhadada SK (2020) Knowledge, attitudes and practices towards COVID-19 among young adults with Type 1 Diabetes Mellitus amid the nationwide lockdown in India: A cross-sectional survey. Diabetes Research and Clinical Practice,166:108344. https://doi.org/10.1016/j.diabres.2020.108344
20. Reuben RC, Danladi MMA, Saleh DA, Ejembi PE (2021) Knowledge, Attitudes and Practices Towards COVID-19: An Epidemiological Survey in North-Central Nigeria. *Journal of Community Health*, 46(3):457-470. https://doi.org/10.1007/s10900-020-00881-1. 21. Banerjee M, Chakraborty S, Pal R (2020) Diabetes self-management amid COVID-19 pandemic. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(4), 351-354. https://doi.org/10.1016/j.dsx.2020.04.013
22. American Diabetes Association. (2020) Facilitating behavior change and well-being to improve health outcomes: Standards of Medical Care in Diabetes—2020. *Diabetes Care*, *43*(Supplement_1): S48-S65.
23. Addis SG, Nega AD, Miretu DG (2021) Knowledge, attitude and practice of patients with chronic diseases towards COVID-19 pandemic in Dessie town hospitals, Northeast Ethiopia. *Diabetology and Metabolic Syndrome*, 15(3):847-856. https://doi.org/10.1016/j.dsx.2021.03.033
24. Alzoubi H, Alnawaiseh N, Al-Mnayyis A, Abu-Lubada M, Aqel, Al-Shagahin H (2020) COVID-19 – Knowledge, Attitude and Practice among Medical and Non-Medical University Students in Jordan. *Journal of Pure Applied Microbiology*, 14(1): 17-24 https://doi.org/10.22207/JPAM.14.1.04
25. Dan-Nwafor C, Ochu CL, Elimian K, Oladejo J, Ilori E, Umeokonkwo C, Steinh (2020) Nigeria's public health response to the COVID-19 pandemic: January to May 2020. *Journal of Global Health*, 10(2). https://doi.org/10.7189/jogh.10.020399

26. Wang Y, Duan L, Li M, Wang J, Yang J, Song C (2022) COVID-19 Vaccine Hesitancy and Associated Factors among Diabetes Patients: A Cross-Sectional Survey in Changzhi, Shanxi, China. *Vaccines*, 10(1):129. https://doi.org/10.3390/vaccines10010129

27. Wang J, Jing R, Lai X, Zhang H, Lyu Y, Knoll MD (2020) Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. *Vaccines*, 8(3):482. https://doi.org/10.3390/vaccines8030482