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Knowledge and Perception of COVID-19 Infection among the Diabetes Mellitus Patients in Nigeria: A Cross-Sectional Survey

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: This study aimed to assess the knowledge of coronavirus disease 2019 (COVID-19) and the perception of care among diabetes mellitus patients during the COVID-19 pandemic.
Methods: This was a cross-sectional study among 173 diabetes mellitus patients over 12 weeks in

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the endocrinology outpatient clinic. An interviewer-administered questionnaire was used to acquire data on socio-demographic and clinical characteristics, as well as questions to assess COVID-19 knowledge and perception of care. The data acquired were analyzed using SPSS, and a p-value less than 0.05 was considered significant.

Results: A total of 173 diabetes mellitus patients participated in the study, and there were more females than males (59% vs. 41%). The participants' mean age was 55.8 ± 14.9 years. The mean knowledge score was 12.42 ± 6.01, and the majority (51.4%) of the participants had poor knowledge of COVID-19 while 11.0% had good knowledge of COVID-19. Higher levels of education and monthly income were significantly associated with higher mean knowledge scores (P-value < 0.001). Increasing monthly income was the only significant predictor of higher knowledge scores (P-value < 0.001).

Conclusion: The majority of diabetes mellitus patients had poor overall knowledge of COVID-19. It is therefore imperative that patients with diabetes mellitus are well informed as new trends in COVID-19 unfold.

Keywords: COVID-19; diabetes mellitus; knowledge; Nigeria; perception.

1. INTRODUCTION

The coronavirus disease 2019 (COVID-19) was first detected in Wuhan, Hubei Province, in China. It is an emerging respiratory disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. COVID-19 is highly infectious and a multisystem disease with primary symptoms of dry cough, fever, myalgia, and breathlessness [2]. People with co-morbid conditions such as diabetes mellitus (DM), obesity, hypertension, chronic obstructive pulmonary disease, heart disease, and cancer are at higher risk of severe respiratory complications and systemic pathologies, such as sepsis and multi-organ dysfunction, which may lead to death [3,4]. The emergence of COVID-19 has had a significant impact on the level of care provided to individuals with different co-morbidities who need to access the hospital regularly. Several studies have shown that most patients with severe COVID-19 infection have co-morbidities, the most prevalent of which are DM, cardiovascular disease, and hypertension [5,6].

Diabetes Mellitus (DM), a chronic metabolic disorder that affects over 537 million people worldwide, is associated with an impaired immune response [7]. The emergence of the COVID-19 infection has led to unprecedented challenges in the management of DM. In COVID-19 patients, DM is a distinctive comorbidity that is associated with severe disease, acute respiratory distress syndrome, and higher mortality rates [8]. Furthermore, DM has emerged as an independent predictor of admission to the intensive care unit, invasive ventilation or death in patients with COVID-19, even after adjustment for age [9,10]. Maintaining good glycaemic control would boost the innate immune system and help prevent grave consequences [11].

Considering the association of reduced immunity with COVID-19, it is expedient to put into practice procedures and policies directed at mitigating the transmission of the infection without compromising the medical treatment of persons with DM. The protective measures put in place by governments and institutions all over the world have influenced service delivery to patients with DM. It is important to recognize that the COVID-19 pandemic may alter patients' perceptions of their medical condition, self-management practices, and expected treatment outcomes, as well as take a psychological toll on them [12]. Individuals with DM already tend to have varying degrees of negative emotions, such as depression and anxiety which would naturally get aggravated during an epidemic [13,14]. Restriction of movement during the lockdown may result in a shortage of food supply in a developing economy like Nigeria, which may compel people with DM to alter their dietary habits. In addition, the procurement of anti-diabetic medications and glucose strips may be difficult amid the ongoing restrictions. Furthermore, access to routine clinic consultations may be interrupted due to the deficiencies in our health service structure being saddled with the challenge to combat the pandemic. These multiple stressors can provoke unhealthy emotions that can affect glycaemic control in persons with diabetes during this pandemic [15,16]. It is therefore important to assess the psychosocial impact on their health-seeking behaviour, determine unmet needs, correct misconceptions, and myths, as well as

ultimately plan appropriate interventions to meet changing demands.

Despite the successes recorded in curbing the pandemic in Nigeria, the battle against COVID-19 is continuing, as pockets of COVID-19 cases have been recorded in various regions of the country. To guarantee complete success, people's adherence to these control measures is essential and is largely affected by their knowledge and perception of COVID-19. The purpose of this study was to assess the knowledge of COVID-19 and the perception of care among DM patients attending a rural teaching hospital in South-South Nigeria.

2. METHODOLOGY

2.1 Study Design and Setting

This was a descriptive cross-sectional study conducted from June 29th to September 24th, 2020, at the endocrinology outpatient clinic of Irrua Specialist Teaching Hospital (ISTH). The hospital is a 434-bed-capacity tertiary institution in Irrua, Edo State in the South-South geopolitical zone of Nigeria. It serves as a major referral centre for neighbouring states (Ondo, Kogi, Delta, and beyond). It is also a centre for the diagnosis, management, and control of viral haemorrhagic fevers, and emergent pathogens.

2.2 Study Population

All adult patients (aged 18 years and older) with DM who presented to the endocrinology clinic during the study period were included in the study population. Patients with cognitive dysfunction or hearing impairment were excluded from the study."

2.3 Sample Size Estimation and Sampling Technique

The sample size was obtained using Fisher's statistical formula ($n = Z^2pq/d^2$). The sample size was calculated using a confidence interval (Z) of 1.96, which corresponds to a 95% confidence level, a tolerable sampling error (d) of 0.05, and a prevalence (p) of 90% obtained in a previous study by Zhong et al. [2]. q = (1- p) is the proportion of the sample population that is not included in this study, and n is the minimum sample size. A minimum sample size of 138 was obtained. However, 173 participants were recruited consecutively using the convenience sampling technique.

2.4 Data Collection

All consenting patients that met the eligibility criteria were recruited consecutively for the study. The data was collected using an interviewer - administered structured questionnaire. The questionnaire contained the following information: sociodemographic data, clinical data, questions to test the knowledge of COVID-19, changes in perception of care, and psychosocial effects of the COVID-19 pandemic. The questionnaire had 24 questions to assess knowledge of COVID-19. These questions were answered on a true/false basis with an additional "I don't know" option. A correct answer was assigned 1 point and an incorrect/unknown answer was assigned 0 points. The total knowledge score ranged from 0 to 24, with a higher score denoting a better knowledge of COVID-19. Using Bloom's cut-off point, respondents' overall knowledge was classified as good, moderate, or poor if their score was between 80% and 100% (19.2-24 points), 60% and 79% (14.4-19.1 points), or less than 60% (< 14.4points) [17].

2.5 Data Analysis

The collected data was analysed using IBM Statistical Package for the Social Sciences (SPSS®) version 25 for Windows. Continuous variables were summarized and presented as means and standard deviations, while categorical variables were summarized as frequencies and percentages. The association between variables was analysed using Pearson's chi-square and/or Fisher's exact test. Linear logistic regression was computed to assess factors associated with a poor knowledge score. A P-value less than 0.05 was considered statistically significant.

3. RESULTS

A total of 173 respondents participated in the study; there were more females than males (59% vs. 41%). The participants' mean age was 55.8 ±14.9 years. Almost half of the respondents (47.3%) had a tertiary level of education, while 9.8% had no formal education. The socio-demographic characteristics of the respondents are shown in Table 1.

Hypertension was reported in 62.4% of the respondents, while the presence of other comorbidities (history of stroke, heart failure) was reported in 27.7%. Chronic DM complications were seen in 38.7% of the participants. The

mean fasting plasma glucose of the participants in the preceding week before the interview using the self-glucose monitoring report was 139.7± 58.9 mg/dL, while their HbA1c was 9.3 ± 2.7%. A summary of the clinical characteristics of DM patients is shown in Table 2.

Table 1. Sociodemographic characteristics of the study participants

Variable	Frequency	Percentage
Age group (years)		
Less than 25	5	2.9
25 to 44	33	19.1
45 to 64	85	49.1
65 and above	50	28.9
Mean age ± SD	55.8 ± 14.9	
Gender		
Male	71	41.0
Female	102	59.0
Marital Status		
Single	18	10.4
Married	132	76.3
Widowed	23	13.3
Level of Education		
No formal education	17	9.8
Primary	46	26.6
Secondary	28	16.2
Tertiary	82	47.4
Occupation		
Civil servant	52	30.1
Trading	51	29.5
Retired	24	13.9
Farming	17	9.8
Student	6	3.5
Others	23	13.3
Monthly Income (Naira)		
Less than 10,000	38	22.0
10,000 to 50,000	43	24.9
50,001 to 100,000	38	22.0
100,001 to 200,000	25	14.5
Greater than 200,000	10	5.8
Undisclosed	19	11.0

Others = transporters, artisans, housewives, dependent, clergy, SD = standard deviation

Table 2. Clinical characteristics of the study participants

Clinical characteristics	Frequency	Percentage
Hypertension	108	62.4
Other co-morbidities	48	27.7
Chronic DM complication	67	38.7
	Mean ± SD	**Range**
Duration of DM (years)	6.94 ± 6.6	0.1 - 25
Duration of hypertension (years)	9.2 ± 9.6	0.3 - 58
Mean FBG in the preceding week (mg/dL)	139.7 ± 58.9	56 - 352
2 hours post prandial (mg/dL)	177.8 ± 74.5	79 - 453
HbA1c (%)	9.3 ± 2.7	4 -15

DM = diabetes mellitus, FBG = fasting blood glucose, HbA1c = glycated hemoglobin, SD = standard deviation

One hundred and thirty-three (76.9%) participants learned about COVID-19 from the media, 13 (7.5%) from health workers, 12 (6.9%) from family and friends, 8 (4.6%) from the internet, 5 (2.9%) from social media, and 1 (0.6%) from government officials. The mean knowledge score was 12.422 ± 6.01 with a range of 1–23. The proportion of correct answers given ranged from 13.9% to 98.8%. The majority (51.4%) of the respondents had low levels of knowledge of COVID-19, while 19 (11.0%) had good knowledge (Fig. 1).

Participants generally knew whom to contact if they had symptoms. They also knew that regular hand washing and social distancing can prevent COVID-19. Knowledge of other aspects of COVID-19 was, however, poor. Table 3 shows the frequency of correct responses to COVID-19 knowledge questions.

Participants with higher levels of education had higher mean knowledge scores, which was statistically significant (P-value < 0.001). Similarly, participants with higher levels of income were found to have higher knowledge scores (P-value < 0.001). Table 4 shows the distribution of the knowledge score of COVID-19 by sociodemographic characteristics among the participants.

Table 3. Frequency and percentage of participants' correct responses to COVID-19 knowledge questions

S/N	Questions	n (%)
1.	COVID-19 is caused by a virus	112 (64.7)
2.	COVID-19 virus originated from bats	25 (14.5)
3.	The Incubation period is 2-14 days	100 (57.8)
4.	The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, shortness of breath, sore throat and myalgia	130 (75.1)
5.	Coronavirus is spread from person to person by contact with airborne droplets via breathing, sneezing, and coughing	138 (79.8)
6.	Coronavirus is spread from person to person by kissing, hugging or other sexual contacts	79 (45.7)
7.	Coronavirus is spread from person to person by eating contaminated food and water	43 (24.9)
8.	Coronavirus is spread from person to person through 5G phone networks or masts	48 (27.7)
9.	Coronavirus is spread from person to person by using test kits or vaccine	37 (21.4)
10.	Coronavirus is spread from person to person by touching contaminated objects or surfaces	96 (55.5)
11.	Coronavirus is spread from person to person by mosquito bites	67 (38.7)
12.	COVID-19 can be prevented by the hot weather of Africa	42 (24.3)
13.	COVID-19 can be prevented by regular hand washing and social distancing	140 (80.9)
14.	COVID-19 can be prevented by avoiding touching the nose and mouth	129 (74.6)
15.	COVID-19 can be prevented by taking garlic	34 (19.7)
16.	COVID-19 can be prevented by taking chloroquine capsules and antibiotics	24 (13.9)
17.	COVID-19 can be prevented by disinfecting contaminated surfaces	113 (65.3)
18.	COVID-19 can be prevented by closing schools and canceling mass gatherings/events	108 (62.4)
19.	Whom do you contact if you have symptoms of COVID-19	171 (98.8)
20.	COVID-19 can be severe enough and lead to death	136 (78.6)
21.	Antivirals, and hydroxychloroquine have been used in the treatment of COVID-19	37 (21.4)
22.	Are DM patients more likely to get COVID-19	65 (37.6)
23.	DM is a risk for severe COVID-19 disease	84 (48.6)
24.	Health education is very important to prevent COVID-19	150 (86.7)

COVID-19 = coronavirus disease, DM = diabetes mellitus

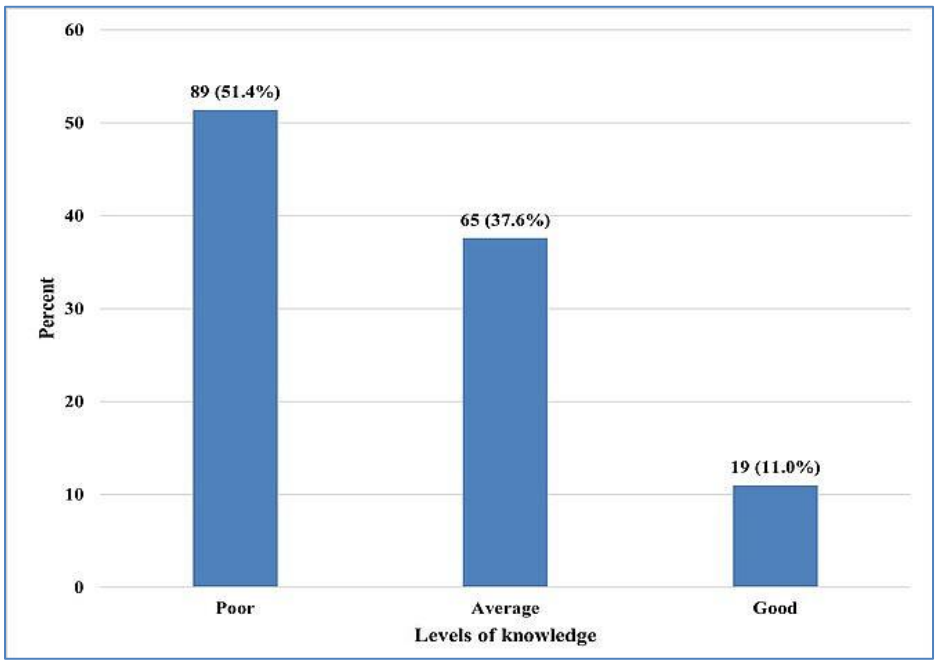

Fig. 1. Participants' level of COVID-19 knowledge

Table 4. Distribution of knowledge score of COVID-19 by socio-demographic characteristics of the participants

Characteristics	Knowledge score (mean ± S.D.)	t-test	P-value
Gender			
Male	12.87± 6.21	0.823	0.412
Female	12.11 ± 5.89		
Age group (years)			
Less than 25	12.60 ±3.36	0.498	0.684
25 to 44	11.64 ± 5.78		
45 to 64	12.96 ± 6.08		
65 and above	12.00 ± 6.31		
Marital status			
Single	12.22 ± 5.09	0.030	0.970
Married	12.48± 6.19		
Widowed	12.22 ± 5.88		
Level of education			
No formal education	8.71 ± 5.96	7.443	< 0.001*
Primary	10.67 ± 5.76		
Secondary	11.64 ± 6.90		
Tertiary	14.44 ± 5.15		
Monthly income (Naira) (N=154)			
Less than 10,000	9.13 ± 6.33	6.765	< 0.001*
10,000 to 50,000	12.35 ±5.79		
50,001 to 100,000	13.61 ± 4.66		
100,001 to 200,000	15.52 ±4.92		
Greater than 200,000	15.80 ±4.78		

** = Significant P–value, SD = standard deviation*

After adjusting for age, marital status, level of education, and monthly income, the mean knowledge scores were found to increase with increasing income (P-value < 0.001). This finding was statistically significant. There was also strong evidence to support an increase in

knowledge scores with higher levels of education. Table 5 displays the results of multiple linear regression for participant knowledge scores.

The majority of participants (75.7%) felt doctors had adequate personal protective equipment (PPEs), and 82.7% were comfortable with temperature screening done before entry into the hospital; however, less than half (42.2%) of the participants felt they did not have sufficient PPEs. Forty (23.1%) patients found it difficult to get their prescribed medications due to a lack of funds. Most patients (85.5%) were pleased with the care they received at the hospital during the pandemic. Most respondents (73.4%) did not agree that telemedicine consultation was a good alternative to physical (in-person) medical consultation; 72.8% felt diagnosis and treatment would not be properly made via telemedicine. While 92 (53.2%) participants expressed that telemedicine consultations would be expensive for them, only 62 (35.8%) would be willing to use telemedicine consultations in the future. Table 6 depicts the respondent's perception of care received during the COVID-19 pandemic.

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One hundred and twenty-one (70%) respondents expressed fear of contracting COVID-19, and 17 (9.8%) felt they were discriminated against by the public as they were referred to as "high-risk" people. Job insecurity was reported by 94 (54.4%) respondents. The respondents' self-reported psychological effect of COVID-19 is represented in Fig. 2.

4. DISCUSSION

The global health burden of the COVID-19 pandemic was overwhelming. Middle- and low-income countries were the worst hit due to severe constraints in the health service sector and the economic impact of the pandemic. Individuals with chronic medical conditions are more liable to complications from COVID-19, as depicted by an earlier World Health Organisation survey. Diabetes, hypertension, and COPD were most adversely affected by the COVID-19 pandemic [18]. This study assessed the COVID-19 knowledge among DM patients as well as their perception of the care they received.

The mean age of respondents in this study (55.8 ± 14.9 years) is comparable to that of a similar study carried out by Ahuja et al. [19] and Akalu et al. [20] among individuals with chronic medical conditions in Central Appalachia, the United States, and Northwest Ethiopia, respectively. The female preponderance observed in this study (59%) was also reported by some other studies [2,19].

Table 5. Multiple linear regression for knowledge score of participants

Variables	Coefficient	Standard error	T	P-value
Gender (male v/s female)	-0.360	1.006	-0.358	0.721
Age group (less than 25 vs 65 and above)	3.596	3.434	1.047	0.297
Age group (25 to 44 vs 65 and above)	-0.583	1.406	-0.415	0.679
Age group (45 to 64 vs 65 and above)	-0.678	1.134	-0.598	0.551
Marital status (single vs married)	-0.747	1.778	-0.420	0.675
Marital status (widowed vs married)	1.240	1.431	0.866	0.388
Level of education (primary vs no formal education)	3.118	1.687	1.848	0.067
Level of education (secondary vs no formal education)	3.555	1.889	1.882	0.062
Level of education (tertiary vs no formal education)	4.597	1.770	2.597	0.010*
Monthly income (10,000 to 50,000 vs less than 10,000)	3.488	1.329	2.624	0.010*
Monthly income (50,001 to 100,000 vs less than 10,000)	3.817	1.447	2.638	0.009*
Monthly income (100,001 to 200,000 vs less than 10,000)	5.494	1.737	3.163	0.002*
Monthly income (greater than 200,000 vs less than 10,000)	5.798	2.322	2.497	0.014*

** = Significant P-value*

Table 6. Participants' perception of care

Variables	Yes n (%)	No n (%)
I think my doctors use adequate PPE when attending to me	131 (75.7)	42 (24.3)
I think I am given adequate PPE at the hospital	73 (42.2)	100 (57.8)
I am comfortable with temperature screening done before entry into the hospital	143 (82.7)	30 (17.3)
I think I have access to enough educational pamphlets and posters on COVID-19 at the hospital	98 (56.6)	75 (43.4)
I think I have access to enough educational pamphlets and posters on DM at the hospital	87 (50.3)	86 (49.7)
I feel satisfied with the level of sanitation activities being carried out at the hospital	127 (73.4)	46 (26.6)
I find it hard to access the hospital to get care for DM	36 (20.8)	137 (79.2)
I have found it hard getting my prescribed drugs because of COVID-19	40 (23.1)	133 (76.9)
I am satisfied with the care I am receiving at the hospital during this pandemic	147 (85.0)	26 (15.0)
I think telemedicine is a good alternative to face-to-face visits with my doctor	46 (26.6)	127 (73.4)
I think telemedicine will be financially tasking for me	92 (53.2)	81 (46.8)
I think doctors can properly diagnose and treat via telemedicine	47 (27.2)	126 (72.8)
I am likely to use telemedicine consultation in the future	62 (35.8)	111 (64.2)

DM = diabetes mellitus; PPE = personal protective equipment

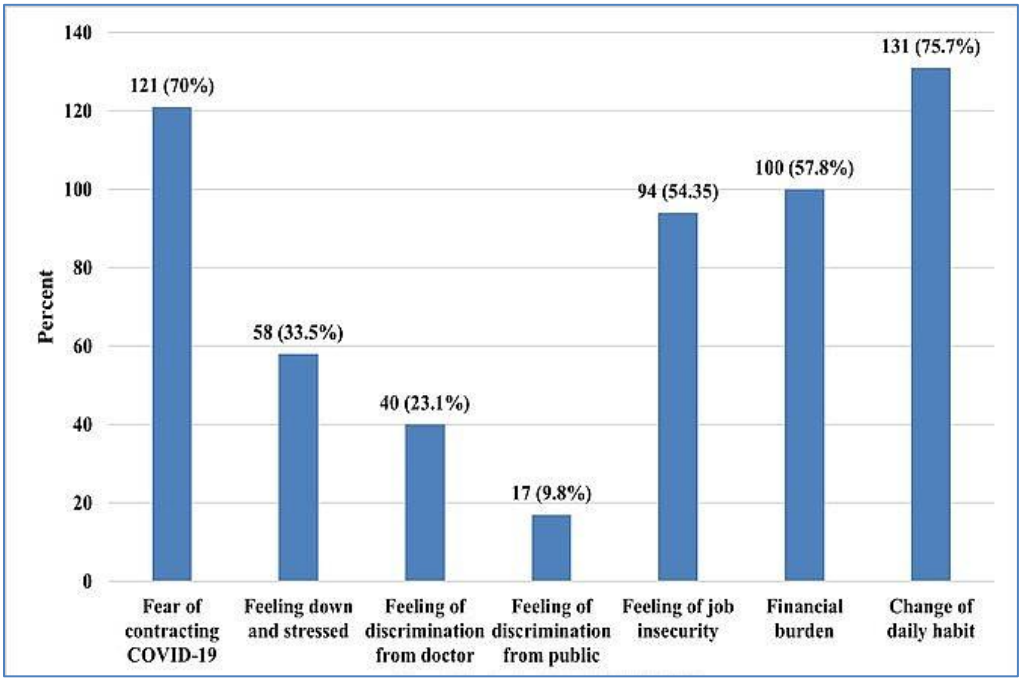

Fig. 2. Psychological effects of COVID-19

The majority of the respondents had correct knowledge of the cause, symptoms, incubation period, and general precautions to be applied in the prevention of COVID-19. This can be explained by the influence of mass media on public education about the prevention of the disease. However, a substantial population expressed false beliefs that the vaccines or test kits, mosquito bites, and 5G phone networks and masts (21.4%, 38.7%, and 27.7%, respectively) could spread the disease. This indicates that more sensitization and education of the general public have to be carried out to debunk the false beliefs about the modes of disease

transmission and the benefits of vaccination in COVID-19.

Overall levels of knowledge of COVID-19 in this study were 51.4%, 37.6%, and 11% which represented poor, average, and good knowledge levels respectively. Less than half of the respondents (48.6%) had average and good COVID-19 knowledge overall. In contrast, studies in Ethiopia, reported a prevalence of 66.1% and 68.66% for respondents with moderate and good knowledge, respectively [17,20]. The majority of respondents (51.4%) in this study had poor knowledge of COVID-19, which was similar to the 50% reported by Subyani et al. in Saudi Arabia [21]. This contrasts with the 31.44% of poor knowledge levels reported by Taye et al. in Ethiopia [17]. These discrepancies could be the result of differences in the study population, geographical region, and the content of the questionnaire used to assess knowledge. Zhang et al. [22] in China and Saqlain et al. [23] in Pakistan, in their studies to assess the knowledge of healthcare workers about COVID-19 knowledge, recorded a prevalence of 89% and 92.3%, respectively. The reported higher knowledge rate in these studies may be due to the fact that these studies were conducted among health professionals, unlike our study, which was conducted among the general population with various educational backgrounds.

This study noted that the knowledge scores of respondents were significantly higher among those with a higher educational level and those with a higher monthly income. This finding was similar to that of Al-Hanawi et al. in Saudi Arabia [24]. The Saudi Arabian study also reported that older age groups and the married population had significantly higher knowledge scores. A study carried out in Bangladesh observed a contrasting finding that younger individuals expressed higher knowledge about COVID-19 than older individuals [25].

The only predictors of respondents' knowledge from our study were educational level and income level. This contrasts with the findings of other studies that observed age, gender, and employment status as additional predictors [2,24,25]. These differences could be due to variations in population type. Our study was carried out among individuals with DM, while other studies were carried out among an apparently healthy general population [2,24,25]. The majority of our study participants were older (45 to 64 years), while the majority of the participants in the aforementioned studies were younger (less than 40 years). However, the bottom line from our study is that higher levels of education and income guarantee better access to information about health.

In our study, the majority of the participants (74.2%) did not agree that telemedicine consultation was a good alternative to physical (in-person) medical consultation. Furthermore, they also felt diagnosis and treatment would not be properly made with telemedicine. Only 35.8% of the respondents were willing to use telemedicine platforms. This is in contrast with an earlier report in which a higher number (72.6%) of respondents were willing to have teleconsultation [26]. The difference may be attributed to the timing of the study, the satisfaction of the respondents with the care they were being given, and the level of education of the respondents. More than 70% of our respondents did not find it difficult to access a hospital for care, received prescribed medications, and were happy with the care they were receiving despite the pandemic. Thus, they may have felt reluctant to explore other methods of receiving care. Individuals with a higher level of education and digital literacy are more likely to embrace the changes that come with the COVID-19 pandemic, while those with lower incomes may increase the hardships suffered during COVID-19, like the inability to assess DM care or difficulty getting medications.

In seeking innovative solutions to improve the interest of our patients, integrating interpreters for non-English-speaking patients will go a long way. Transportation fares can be diverted to the purchase of airtime or data, with the resultant reduction in exposure by coming to the hospital and reduced waiting time at the clinics. There is increasing evidence that telemedicine consultation has a remarkable impact on DM prevention and DM self-management, as well as a reduction in the number of care dropouts with improved metabolic control [27].

The fear of contracting COVID-19 was the most frequent psychosocial effect experienced by the respondents. The low level of access to resources for stress management observed in this study may amplify this fear among them. Hence, reassurance and psychological support would be necessary components of their care, as the majority of them had adopted non-pharmaceutical methods of COVID-19 prevention.

This study is not without limitations. This study was a single-centre study; hence findings may not be generalised. There is also the issue of recall bias among the participants.

5. CONCLUSION

The majority of our population had poor COVID-19 knowledge overall, and knowledge scores were significantly higher among patients with higher income and educational levels. Despite the overwhelming global burden of the COVID-19 pandemic, it is important for middle- and low-income countries to keep their populations, especially those with chronic medical illnesses like DM, informed as new trends in COVID-19 unfold. Psychosocial factors associated with the disease, in addition to medical care should be addressed in patients with diabetes. Improvements in the healthcare system's preparedness will facilitate better healthcare delivery.

CONSENT

All authors declare that written informed consent was obtained from the participants for publication of this study.

ETHICAL APPROVAL

All authors hereby declare that the study was examined and approved by the institutional ethics committee with protocol number ISTH/HREC/20202005/071 and therefore has been performed following the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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