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Impact of the COVID-19 lockdown on diabetes patients in Jeddah, Saudi Arabia



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ABSTRACT

Aims: To explore the impact of the coronavirus disease lockdown on diabetes patients living in Jeddah, Saudi Arabia, in terms of their compliance with medication intake and lifestyle habits, and quality of life.

Methods: In this cross-sectional, qualitative prospective study, a questionnaire was administered over the telephone to diabetes patients who had attended National Guard primary care centers in Jeddah, Saudi Arabia. The survey included questions on demographic data, type of diabetes, medications used, comorbidities, medication compliance, and daily habits before and after the lockdown, and those assessing patients' psychological parameters during the past month by using the Kessler Psychological Distress Scale (K10). Data analysis was performed using SPSS program version 26.

Results: Totally, 394 patients participated. All of them had type 2 diabetes, and 37.6% had only one comorbidity. Antidiabetic monotherapy was used in 76.4% of the patients, while combination therapy was used in 23.6%. The compliance score before the lockdown was significantly higher (18.49 ± 3.05) than that after it (17.40 ± 3.25) (p -value < 0.001). The average psychological assessment score was 9.78 ± 4.14 (range 8–35). Male participants and smokers had a significantly better psychological status than female participants (p -value = 0.002) and non-smokers (p value < 0.001), respectively.

Conclusions: The patients' levels of compliance with medications and healthy lifestyle habits were significantly reduced after the lockdown. These findings highlight the need for healthcare professionals to encourage diabetes patients to adhere to healthy lifestyle habits and use telemedicine during lockdowns to ensure optimal blood glucose control and reduce the incidence of complications.

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1. Introduction

The first case of novel coronavirus disease (COVID-19) was reported in Wuhan city, China, in December 2019 [1]. Although several measures were taken to control the spread of the disease in that country, the viral transmission rate was extremely high, with the World Health Organization declaring COVID-19 a pandemic [2].

Several research centers the world over are currently focused on the formulation of vaccines and treatment agents for the control of COVID-19 [3], as there is currently no approved vaccine regimen for the same [4]. Meanwhile, health policymakers have implemented

various measures to control the spread of the virus, with priority given to the most vulnerable populations [5], predominantly comprising elderly individuals as well as people with chronic diseases such as hypertension, diabetes mellitus, and chronic respiratory conditions [6].

Diabetes mellitus exerts a significant healthcare burden, globally [7]. The proportion of people with diabetes mellitus has increased from 30 million a decade ago to 135 million patients currently [8]. This figure is estimated to further increase to about 300 million by 2025 [9]. In Saudi Arabia, the prevalence of diabetes is high (23.7%), with the incidence rates having increased in the last 20 years as a consequence of aggressive lifestyle changes [10,11]. Additionally, diabetes is among the top 10 chronic diseases that are associated with increased mortality values, globally [12].

People with diabetes are more vulnerable to COVID-19 development. The risk of complications and mortality is even higher among elderly people with diabetes. Furthermore, the incidence of

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diabetes in COVID-19 patients is approximately 10%, in association with a two-fold increase in the rate of intensive care unit admission compared to that in people without diabetes [13].

This study aimed to explore the influence of the COVID-19 lockdown on diabetes patients in Jeddah, Saudi Arabia, in terms of medication adherence, lifestyle, and quality of life.

2. Subjects, materials and methods

2.1. Study design

This cross-sectional, qualitative prospective study was conducted in King Faisal Residential City Clinic (Jeddah Housing), a specialized polyclinic in Jeddah, Saudi Arabia, among patients who attended National Guard primary care centers between May 2019 and May 2020. These centers serve as the first points of contact for all Ministry of National Guard Health Affairs service beneficiaries, and provide high-quality preventive and therapeutic services in Saudi Arabia. The survey was administered to diabetes patients over the telephone after the reception of informed consent for participation. Only Saudi type 2 diabetes patients aged 18–80 years were included. Patients with type 1 diabetes or gestational diabetes were excluded.

2.2. Data collection

Patients were interviewed over the telephone. The questionnaire comprised four parts. The first part pertained to demographic and personal medical data, including those on age, sex, comorbidities, body mass index (BMI), and marital status. The second and third parts comprised eight questions on patients' medication compliance and daily habits before and after the lockdown. The fourth part comprised 10 questions aimed at psychological assessment, as measured using the Kessler Psychological Distress Scale (K10).

2.3. Statistical analyses

Data are presented as frequencies and valid percentages for categorical variables. Analysis of variance (ANOVA) was used for the comparison of means across the different groups. All *P* values < 0.05 were considered statistically significant. IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA), version 26 for Microsoft Windows was used for the performance of all the statistical calculations.

2.4. Ethical considerations

This study was initiated following the reception of approval from the IRB of King Abdullah International Medical Research Center. Participation was voluntary. Informed consent for participation was obtained before the interview, and each participant was provided a serial number.

3. Results

3.1. General characteristics of the responders

Overall, 394 participants responded to the online survey. Only participants who responded to all the questions were included. Of the 394 participants, 42.9% were women and 57.1% men. Age was categorized into five subgroups, starting from the 20–30 years group to the older than 60 years group. A majority of the responders (32.2%) were aged above 60 years. The 20–30 years group showed the lowest response rate (1.3%). Totally, 94.7% of the

participants in the total cohort were married, and 86.1% lived with their immediate family members.

BMI was categorized into four subgroups: underweight (BMI less than 18.5 kg/m²), normal (BMI of 18.5–24.9 kg/m²), overweight (BMI of 25–29.9 kg/m²), and obese (BMI of 30 kg/m² and above). Totally, 57.4% of the responders were obese, with 13.7% observing a change in their body weight during the lockdown. As for comorbidities, patients either had no comorbidities or up to four; 37.6% had only one comorbidity, with dyslipidemia the most commonly cited, followed by hypertension.

Additionally, 76.4% of the patients were non-smokers, and only 3% worked on the frontline for COVID-19. The demographic data of all the participants are shown in Table 1.

3.2. Type of antidiabetic medication

Patients were asked about the type of antidiabetic medication they took (either insulin or non-insulin injections or oral hypoglycemic agents). Oral hypoglycemic agents were used solely in 58.4% of the patients, while insulin monotherapy was used in 15.8%, and non-insulin injection in 2.2%. Combination therapy was employed in 23.6% of the patients.

3.3. Medication compliance before the lockdown

Patients were asked about their compliance with medications and healthy lifestyle habits before the lockdown, and instructed to choose a response (always, sometimes, rarely, never).

Totally, 89.6% of the diabetes patients used to take their

Table 1
Patient demographics.

	Count	Percent
Gender		
Female	169	42.9
Male	225	57.1
Age group (years)		
20 to 30	5	1.3
31 to 40	22	5.6
41 to 50	117	29.7
51 to 60	123	31.2
Older than 60	127	32.2
BMI (kg/m ²)		
Underweight	7	1.8
Healthy	53	13.5
Overweight	108	27.4
Obese	226	57.4
Marital status		
Single	4	1.0
Married	373	94.7
Divorced	2	0.5
Widow/Widower	15	3.8
Number of comorbidities		
None	120	30.5
One	148	37.6
Two	109	27.7
Three	14	3.6
Four	3	0.8
Smoking		
Currently Smoker	44	11.2
Ex-smoker	49	12.4
Non-smoker	301	76.4
Working on the frontline for COVID-19		
Yes	12	3.0
No	382	97.0

COVID-19, coronavirus disease; BMI, body mass index.

medications regularly and on time before the lockdown, and 45.9% regularly monitored their blood glucose levels. Additionally, more than half of the patients had not experienced any hypoglycemia (54.3%) or hyperglycemia symptoms (57.6%) before the lockdown.

As for lifestyle habits, 27.7% of the patients sometimes committed to a healthy diet, and 35.0% always committed to participation in physical activity, as shown in Table 2.

The average score for compliance with medical treatment and lifestyle habits before the lockdown was calculated for the whole cohort, and the total was found to be 18.49 ± 3.05 (range 9–26). The score was calculated through giving five points for every “always” answer, four points for “most of the times”, three points for “sometimes”, two points for “rarely” and 1 point for “never”, except for the questions related symptoms of hypo or hyperglycemia questions, the score was reversed (never answers got 5 points). The total score was then calculated for every patient and the average score was calculated for the whole cohort. Similar calculation was performed for the compliance after the lockdown.

3.4. Medication compliance after the lockdown

Patients were administered the same set of questions after the lockdown, and asked to choose responses based on the same five-point scale used in the questionnaire before the lockdown.

Totally, 88.3% of the diabetes patients took their medication regularly and on time after the lockdown, with 46.2% regularly monitoring their blood glucose levels. Additionally, 48.7% and 55.8% of the patients did not experience any hypoglycemia and hyperglycemia symptoms, respectively.

As for lifestyle habits, a quarter of the included cohort (25.1%) of patients never committed to a healthy diet after the lockdown, and 31% never committed to participation in physical activity, as shown in Table 3. Notably, there were decreases of 14.9% and 1.3% in the proportions of patients who regularly participated in physical activity and committed to a specific diet, respectively, after the lockdown.

The average score for compliance with medical treatment and lifestyle habits after the lockdown was calculated for the whole cohort, and was found to be 17.40 ± 3.25 (range 8–28).

3.5. Psychological assessment using the Kessler Psychological Distress Scale (K10)

The psychological status of all the participants during the last four weeks was evaluated using the K10 scale, which uses a five-point system with the following responses: all the time, most of the time, sometimes, rarely, and never. The score was calculated through giving five points for every “all the time” answer, four points for “most of the times”, three points for “sometimes”, two points for “rarely” and 1 point for “never”. The total score was then calculated for every patient and the average score was calculated for the whole cohort. Similar calculation was performed for the compliance after the lockdown.

More than half of the included participants never: experienced

fatigue for no apparent reason (65%), felt nervous (68.3%), felt nervous that nothing could calm them down (84.5%), felt hopeless (89.3%), felt restless (81.2%), felt depressed (77.7%), felt sad (90.4%) or felt worthless (94.2%) (Table 4).

The average psychological assessment score was 9.78 ± 4.14 (range 8–35).

3.6. Comparison of total scores across different variables

The average scores for compliance with medications and lifestyle habits before and after the lockdown were compared using a paired *t*-test, with a *p*-value <0.05 considered significant. The level of compliance before the lockdown was significantly higher (18.49 ± 3.05) than that after the lockdown (17.40 ± 3.25) (*p*-value <0.001).

Furthermore, the average scores for compliance before and after the lockdown, and the psychological assessment scores were compared across different variables for the exploration of the factors affecting compliance levels, using one way ANOVA; a *p*-value <0.05 considered significant.

The factors examined were gender, age group, type of diabetes, BMI category, number of comorbidities, weight change, smoking habits, working on the frontline, and work changes after the lockdown.

None of the factors significantly affected the level of compliance to medications or lifestyle habits before or after the lockdown. However, gender and smoking habits significantly affected the psychological assessment scores of the patients, with the men and smokers showing a significantly better psychological status than the women (*p*-value = 0.002) and non-smokers (*p*-value <0.001), respectively (Table 5).

4. Discussion

In the present study, the diabetes patients' levels of compliance with their medicine intake and lifestyle habits were found to be significantly reduced due to the COVID-19 lockdown. However, the lockdown had a minimal effect on the psychological status of most of the patients.

Diabetes mellitus is a chronic disease that imposes a significant burden on both patients and the healthcare system [14]. Uncontrolled blood glucose levels can significantly increase the incidence of complications as well as mortality [15]. Hence, patients' compliance with their medical treatment and a healthy lifestyle is essential. However, it remains unclear if the current COVID-19 pandemic has an effect on the compliance levels of diabetes patients [16].

The levels of compliance among diabetes patients during lockdowns have been evaluated in a different setting. Ghosal et al. [17] developed a predictive model for the exploration of the impact of lockdowns on diabetes patients and the incidence of diabetes-related complications, and demonstrated the presence of a direct relationship between the lockdown length and non-compliance, in association with an increase in the incidence of diabetes-related

Table 2
Medication and lifestyle compliance before the lockdown.

	Always	Most of the time	Sometimes	Rarely	Never
Do you take your medications on time?	89.6	7.1	2.5	0.3	0.5
Do you monitor your own blood glucose level?	45.9	25.6	17.0	4.8	6.6
Do you experience symptoms of hypoglycemia?	0.8	1.3	14.0	29.2	54.3
Do you experience symptoms of hyperglycemia?	1	7.9	14.7	18.8	57.6
Do you commit to a specific diet?	16.0	13.5	27.7	21.1	21.8
Do you commit to participation in physical activity?	35.0	11.9	23.6	17	12.4

Table 3
Medication and lifestyle compliance after the lockdown.

	Always	Most of the time	Sometimes	Rarely	Never
Do you take your medications on time?	88.3	6.1	4.6	0.5	0.5
Do you monitor your own blood glucose level?	46.2	21.8	16.8	6.9	8.4
Do you experience symptoms of hypoglycemia?	0.5	1.3	14.5	35.0	48.7
Do you experience symptoms of hyperglycemia?	0.5	7.1	15.5	21.3	55.8
Do you commit to a specific diet?	14.7	12.7	22.6	24.9	25.1
Do you commit to a physical activity?	20.1	5.3	17.0	26.6	31

Table 4
Psychological assessment using the Kessler Psychological Distress Scale (K10).

	All the time	Most of the time	Sometimes	Rarely	Never
In the past 4 weeks, how often did you feel tired for no good reason?	1.5	4.6	8.1	20.8	65
In the past 4 weeks, how often did you feel nervous?	2.8	4.3	11.2	13.5	68.3
In the past 4 weeks, how often did you feel so nervous that nothing could calm you down?	0.3	2.8	3.3	9.1	84.5
In the past 4 weeks, how often did you feel hopeless?	0.3	0.8	3.3	6.3	89.3
In the past 4 weeks, how often did you feel restless or fidgety?	0.8	2.3	4.1	11.7	81.2
In the past 4 weeks, how often did you feel so restless you could not sit still?	0.3	0.8	2	8.4	88.6
In the past 4 weeks, how often did you feel depressed?	1	3	6.9	11.4	77.7
In the past 4 weeks, how often did you feel that everything was an effort?	0.8	1.3	3	4.6	90.4
In the past 4 weeks, how often did you feel so sad that nothing could cheer you up?	0.3	1	3.3	5.1	90.4
In the past 4 weeks, how often did you feel worthless?	0	0	2.3	3.6	94.2

Table 5
Comparison of scores across different variables using one-way analysis of variance.

		Medication compliance before lockdown			Medication compliance after lockdown			Psychological assessment		
		Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value
Gender	Female	18.47	2.93	0.915	17.37	3.19	0.836	9.03	2.88	0.002*
	Male	18.51	3.14		17.44	3.31		10.35	4.81	
Age group (years)	20 to 30	18.60	2.88	0.492	19.40	3.21	0.412	8.80	1.10	0.299
	31 to 40	19.41	3.28		18.23	3.68		9.41	3.96	
	41 to 50	18.30	3.18		17.24	3.42		10.44	5.01	
	51 to 60	18.69	2.84		17.50	3.08		9.73	4.23	
	Older than 60	18.31	3.10		17.25	3.19		9.33	3.13	
Body mass index (kg/m ²)	Underweight	18.86	3.08	0.843	19.14	1.57	0.564	8.43	0.79	0.3
	Healthy	18.34	3.41		17.32	3.88		10.04	4.60	
	Overweight	18.32	3.14		17.37	3.37		10.24	4.77	
	Obese	18.60	2.93		17.39	3.07		9.54	3.75	
Number of comorbidities	None	18.61	2.94	0.778	17.47	3.32	0.760	9.57	3.24	0.378
	One	18.32	3.19		17.26	3.19		10.18	4.99	
	Two	18.48	3.02		17.50	3.26		9.46	3.63	
	Three	18.94	2.86		17.35	3.18		11.06	5.81	
Weight change	Four	20.00	3.61	0.282	19.67	4.04	0.241	8.33	0.58	0.140
	No	18.43	3.08		17.33	3.26		9.66	3.87	
Smoking habits	Yes	18.91	2.83	0.906	17.89	3.21	0.199	10.56	5.54	<0.001*
	Currently Smoker	18.48	3.98		16.68	4.39		13.52	7.04	
Working on the frontline	Ex-smoker	18.67	3.22	0.695	17.88	3.17	0.275	9.94	3.83	0.345
	No	18.47	2.87		17.44	3.07		9.21	3.27	
Work changes after lockdown	Yes	18.83	2.12	0.269	18.42	2.27	0.852	8.67	1.50	0.574
	No	18.36	3.01		17.38	3.17		9.88	4.23	
	Yes	18.71	3.10		17.44	3.40		9.63	4.02	

SD, standard deviation.

complications and uncontrolled glycemia [17].

Although the present study did not show correlations between compliance and the duration of the lockdown, we found that the level of compliance of patients with their medical treatment and lifestyle habits was significantly reduced after the lockdown (p value < 0.001), suggesting an increase in the incidence of complications with prolongations in the duration of the lockdown.

In Italy, Bonora et al. [18] examined the level of blood glucose control in diabetes patients during the COVID-19 lockdown. Using retrospective data collected from 33 patients with type 1 diabetes, they showed that the patients' level of glycemic control improved

during the lockdown when they stopped working, which reduced their levels of stress and allowed them to comply to a greater degree with healthy lifestyle habits [18].

Furthermore, Beato-Vibora [19] evaluated the impact of the lockdown on diabetes patients' level of control through the analysis of data on 147 patients with type 1 diabetes. Through a follow-up of patients' glycated hemoglobin and random blood sugar values, it was demonstrated that the glucose levels were not significantly affected by the lockdown [19].

The Saudi patients in the present study showed significantly lower compliance levels during the lockdown than before the

lockdown; however, it should be noted that, while the studies by Bonora et al. [18] and Beato-Víborá [19] comprised type 1 diabetes patients, the present cohort included type 2 diabetes patients. Additionally, the incidence of hypoglycemia or hyperglycemia did not significantly differ between the pre- and post-lockdown phase, as shown in Tables 2 and 3

The present study has some limitations. The answers to the included questions depended predominantly on the patients' honesty and subjective opinions; this may have affected the outcome validity.

However, this study is the first in Saudi Arabia to have assessed the impact of the COVID-19 lockdown on the compliance of diabetes patients in terms of their management care plans.

4.1. Limitations

The present study had one important limitation, that is common with most of the survey studies. The answers to the included questions depended predominantly on the patients' honesty and subjective opinions; this may have affected the outcome validity.

However, this study is the first in Saudi Arabia to have assessed the impact of the COVID-19 lockdown on the compliance of diabetes patients in terms of their management care plans.

5. Conclusion

Our findings indicate that Saudi diabetes patients' levels of compliance with their medical treatment and lifestyle habits were significantly reduced as a consequence of the COVID-19 lockdown. However, the lockdown had only a minimal effect on the psychological status of most patients. These findings highlight the need for endocrinologists and clinicians to formulate compliance monitoring strategies for diabetes patients, which may, in turn, help in the decision-making on whether changes need to be made to patients' antidiabetic medications during lockdowns in the case of uncontrolled blood glucose levels.

Further studies in other areas in Saudi Arabia are required to establish the national compliance values.

5.1. Recommendation

The findings of the present study indicate the need for health-care professionals to encourage diabetes patients to adhere to healthy lifestyle habits (including participation in physical activity and smoking cessation) and use telemedicine during the lockdown in order to ensure optimal blood glucose control and reduce the incidence of complications. Additionally, clinicians should perform a full assessment during diabetes patients' first visit to the hospital.

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Declaration of competing interest

The authors have no conflict of interest to disclose.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.dsx.2020.07.051>.

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