Original Article

COVID 19 quarantine and its impact on lifestyle of diabetic patients and on their follow up in Madinah, KSA

Abdulaziz Ahmed Alahmadi[1], Abdulmalek Ehab Azzouni[1], Abdullelah Mohammed Mahrous[1], Abdullah suleiman alhazmi[1], Basem Younis Burhan Aldeen Al-Turkistany[1], Hatim Nafa Almukhalfi[1], Majed Abdulaziz M Kareem Abdullah[1], Majed Najeh Alanizy[1*], Khalid Gaffer Mohamed[2]

[1]Intern, Taibah University, Medina, Kingdom of Saudi Arabia.

[2]Assistant professor of family and community medicine, Taibah University, Medina, Kingdom of Saudi Arabia.

DOI: 10.47750/pnr.2022.13.S06.360

Abstract

Objectives: This article aims to discover the impact of the coronavirus pandemic lockdown on diabetes patients living in Almadina, Saudi Arabia, in terms of their lifestyle and on their follow-up. Methods: This is a cross-sectional, qualitative prospective study, a questionnaire was done to diabetic patients who underwent the quarantine period in Madinah, Saudi Arabia through an online questionnaire after getting informed consent to participation. The survey included personal, medical data, patient's compliance to treatment and overall lifestyle manner before and during lockdown period and psychological assessment using 10 questions of the (K10) Kessler psychological distress scale. Data analysis was performed using SPSS program version 26. Results: A total of patients 350 participated in the study. 56.6% of them were females(n;198), and 43.4% were males(n:152), their ages ranged from 18 years to more than 60 years. The vast majority 96.3% of participated were of Saudi nationality, while 3.7% are non-Saudi. Participants-with types 2 Diabetes represent 31.4% while 26% suffer from type 1 diabetes and the rest they don't which type they have. Results showed no significant differences in: (symptoms of low or high blood sugar, the extent to which a healthy diet is followed, the frequency of home blood sugar measurement) before and during the quarantine period. The rest of the variables shows a significant difference ($P<0.05$) Conclusions: The study showed a difference in the extent of adherence to medication during the quarantine period compared to before. A reduction constructive in lifestyle habits is detected.

1. INTRODUCTION

On March 11th, 2020, the world health organization announced that Covid-19 is pandemic.[1] On March 23rd, 2020, the Saudi government announced there will be a lockdown form seven in the evening until six in the morning until June 21st, 2020.[2][3][4] And there were 24 hours lockdown from April 02nd, 2020 till April 26, 2020.[5][6]

Diabetes mellitus is a disease caused by insulin resistance or deficiency, either relative or absolute deficiency. There are many risk factors for diabetes mellitus such as age, overweight and sedentary lifestyle.[7]

Diabetes mellitus exerts a significant healthcare burden, globally [8]. The proportion of people with diabetes mellitus has increased from 30 million a decade ago to 135 million patients currently [9]. This figure is estimated to further increase to about 300 million by 2025 [10]. 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 a huge lifestyle changes [11,12]. Additionally, diabetes is among the top 10 chronic diseases that are associated with increased mortality values, globally [13].

People with diabetes are more vulnerable to COVID-19 infection. The risk of complications and mortality is higher among elderly people with diabetes.

This study aims to explore perceived lifestyle changes associated with Covid-19 lockdown and its impact on diabetes follow up for diabetic patients in Madinah, KSA.

2. Subjects, materials, and methods

A cross sectional study look at the relevance between disease and other variables of interest as they exist in a defined population at single point in time or over a short period of time. It is used to assess the burden of a disease in a defined population.

2.1. Study area

Al Madinah, the city of the Prophet. It is located in the Hejaz region of Western Saudi Arabia and has a population of 2,239,923 [14] the percentage of diabetes in Madinah including Saudi and non-Saudi patients is 8.5% [15] and the total number of diabetic patients in Madinah are 190,393 of the population. The city undergone lockdown between March 23rd, 2020, till April 26th, 2020, during this time patients were not allowed to d o their usual activities outside home.

2.2. Study design

This is a cross-sectional, qualitative prospective study, a questionnaire was done to diabetic patients who underwent the quarantine period in Madinah, Saudi Arabia between March 23rd ,2020 till April 26th, 2020, through an online questionnaire after getting informed consent to participation it the beginning of the questionnaire.

2.3. Study population

The survey was done to diabetic patients who undergone the quarantine period in Madinah through online questionnaire after getting an informed consent to participate. The total number of patients who participated in the research were 350 participants. All diabetic patients from age 18-80 who undergone quarantine in Madinah were encouraged to participate.

2.4. Data collection

Data was collected through an online questionnaire due to covid-19 restrictions. The questionnaire was composed of 3 parts: First part was personal and medical data including age, sex, nationality, educational level, weight, height, marital state, type of diabetes, medications, other comorbid diseases, smoking status, and weight change over lockdown period. Second part was patient's compliance to diabetes treatment and overall lifestyle manner before and during lockdown period, which included 10 identical comparison questions for the two periods. Third part was a psychological assessment using 10 questions of the (K10) Kessler psychological distress scale.

2.5. Statistical Analysis

Data is presented as frequencies and valid percentages for categorical variables. Independent samples t-test was used to test the differences in the extent of adherence to medications before and during the quarantine period due to gender, while the one-way ANOVA was used to test the differences in the extent of adherence to medications before and during the quarantine period due to the variables (age, BMI, weight changes smoking). IBM SPSS statistics version 26.0 Microsoft Windows (Statistical package, IBM Corp, Armonk, NY, USA) was used for the implementation of all statistical calculations.

2.6. Ethical and privacy approval

This study was done after the approval from "Research Ethics committee" of Taibah University Medical research center. participation was optional, and an informed consent for participation was provided before starting the questionnaire.

3. Result

Among the 350 participants in the study, there are (198) 56.6% of them were females, and (152) 43.4% were males, their ages ranged from 18 years to more than 60 years.

The vast majority 96.3% of patients are of Saudi nationality, while 3.7% are non-Saudi.

Finally, for their distribution by Body Mass Index (BMI), only 35.1% are considered healthy weight.

Table (1) Patient demographics

		Frequency	Percent
Gender	Male	152	43.4
	Female	198	56.6
Age	18-29	122	34.9
	30-39	37	10.6
	40-49	65	18.6
	50-59	74	21.1
	60 or more	52	14.9
Nationality	Saudi	337	96.3
	Non-Saudi	13	3.7
Educational level	Uneducated	12	3.4
	Primary	16	4.6
	Middle	14	4.0
	Secondary	75	21.4
	University	218	62.3
	Postgraduate	14	4.0
	Other	1	.3
Marital status	Single	134	38.3
	married	216	61.7
BMI	Underweight (Below 18.5)	9	2.6
	Healthy weight (18.5 to 24.9)	123	35.1
	Overweight (25.0 to 29.9)	121	34.6
	Obesity (30 or higher)	97	27.7
Total		350	100.0

Table (2) shows the distribution of patients by type of diabetes, medications used, the patient's possession of a glucose meter at home, smoking, chronic diseases, and weight change during the quarantine period.

Patients who do not know their type of diabetes represented 42.6% of participants, 31.4% suffer from type 2 diabetes, and 26% suffer from type 1 diabetes. 42% of patients use oral diabetes pills, 36% use insulin needles, and 6.3% use both diabetes pills and insulin needles. And 75.4% of patients have a glucometer at home. As for their distribution by smoking: 75.4% are non-smokers, 18% are smokers, and 6.6% are former smokers. In terms of their distribution according to their suffering from chronic diseases, 25.7% suffer from high blood pressure, 17.1% suffer from high fats, 5.1% suffer from heart diseases, 9.9% suffer from asthma, and 59.7% have no chronic diseases. 38.9% of the patients noticed an increase in their weight during the quarantine period, and 21.4% noticed a decrease in their weight during the quarantine, while 39.7% had no change in their weight during the quarantine period.

Table (2) Patient medical history

Variable	Category	Frequency	Percent
Diabetes type	Type I	91	26.0
	Type II	110	31.4
	I do not know	149	42.6
Diabetes Medicines	Non	42	12.0
	Insulin needle	126	36.0
	Oral diabetes pills	147	42.0
	Insulin needle& Oral diabetes pills	22	6.3
	Other	13	3.7
Do you have a glucose meter at home	Yes	264	75.4

	No		86	24.6
Smoking	Smoker		63	18.0
	Non smoker		264	75.4
	Quit smoking		23	6.6
	If quit smoking, what duration?	≤ 1 year	8	34.8
		>1 to 2 year	5	21.7
		>2 year	10	43.5
Chronic diseases	Pressure		90	25.7
	Heart disease		18	5.1
	High fat		60	17.1
	Asthma		32	9.1
	Nothing		209	59.7
	Other		21	6.0
Did you notice any change in weight during the quarantine period	Increase		136	38.9
	Decrease		75	21.4
	There is no change		139	39.7
Total			350	100.0

Table (3) shows the extent of commitment to medications and lifestyle before and during the quarantine period, and the following can be noted:

- The results did not show significant differences in: (symptoms of low or high blood sugar, the extent to which a healthy diet is followed, the extent of regular blood sugar measurement at home) before and during the quarantine period.

- The rest of the variables shows significant difference ($P<0.05$).

Table (3) comparison of different variables before and during quarantine

No	Question		Never	Rarely	Sometimes	Often	Always	M	SD	RII	T-test	P-value
1	Do you take medication on time?	Before	28 (8.0)	19 (5.4)	56 (16.0)	118 (33.7)	129 (36.9)	3.86	1.20	77 %	4.34	0.00*
		During	35 (10.0)	27 (7.7)	63 (18.0)	119 (34.0)	106 (30.3)	3.67	1.26	73 %		
2	Have you experienced symptoms of low blood sugar (1)	Before	89 (25.4)	78 (22.3)	136 (38.9)	37 (10.6)	10 (2.9)	2.43	1.07	49 %	-0.84	0.40/
		During	80 (22.9)	88 (25.1)	127 (36.3)	48 (13.7)	7 (2.0)	2.47	1.05	49 %		
3	Have you experienced symptoms of high blood sugar (2)	Before	87 (24.9)	71 (20.3)	138 (39.4)	51 (14.6)	3 (.9)	2.46	1.04	49 %	-1.51	0.13/
		During	81 (23.1)	77 (22.0)	123 (35.1)	61 (17.4)	8 (2.3)	2.54	1.10	51 %		
4	How well do you follow a healthy diet?	Before	60 (17.1)	74 (21.1)	144 (41.1)	52 (14.9)	20 (5.7)	2.71	1.09	54 %	0.46	0.65/
		During	65 (18.6)	75 (21.4)	132 (37.7)	61 (17.4)	17 (4.9)	2.69	1.11	54 %		
5	How regularly do you measure your blood sugar level at home?	Before	71 (20.3)	49 (14.0)	104 (29.7)	68 (19.4)	58 (16.6)	2.98	1.35	60 %	1.26	0.21/
		During	77 (22.0)	56 (16.0)	88 (25.1)	77 (22.0)	52 (14.9)	2.92	1.36	58 %		

([1]) such as: sweating, extreme hunger, irritability, lack of concentration or headache.
([2]) such as: excessive thirst, dry mouth, lethargy, frequent urination or blurred eyes.

6	How much do you follow up on diabetes with a specialist doctor?	Before	73 (20.9)	54 (15.4)	91 (26.0)	73 (20.9)	59 (16.9)	2.97	1.37	59 %	5.66	0.00*
		During	86 (24.6)	92 (26.3)	73 (20.9)	64 (18.3)	35 (10.0)	2.63	1.30	53 %		
7	How easy is it to get an appointment with a doctor?	Before	53 (15.1)	54 (15.4)	104 (29.7)	69 (19.7)	70 (20.0)	3.14	1.32	63 %	6.02	0.00*
		During	80 (22.9)	77 (22.0)	95 (27.1)	53 (15.1)	45 (12.9)	2.73	1.32	55 %		
8	How easy is it to get medication when needed?	Before	47 (13.4)	44 (12.6)	76 (21.7)	58 (16.6)	125 (35.7)	3.49	1.42	70 %	5.01	0.00*
		During	49 (14.0)	66 (18.9)	78 (22.3)	79 (22.6)	78 (22.3)	3.20	1.35	64 %		
ALL		**Before**						**3.01**	**0.82**	60 %	**5.92**	**0.00***
		During						**2.86**	**0.80**	57 %		

Hint: M=Mean of answers (Never =1, Rarely =2, Sometimes =3, Often =4, Always =5), RII=Relative Importance Index ((Mean/5) *100%), SD=Standard Deviation, R=Rank.

Paired Samples Test: *Statistically significant at 0.01 / Not statistically significant

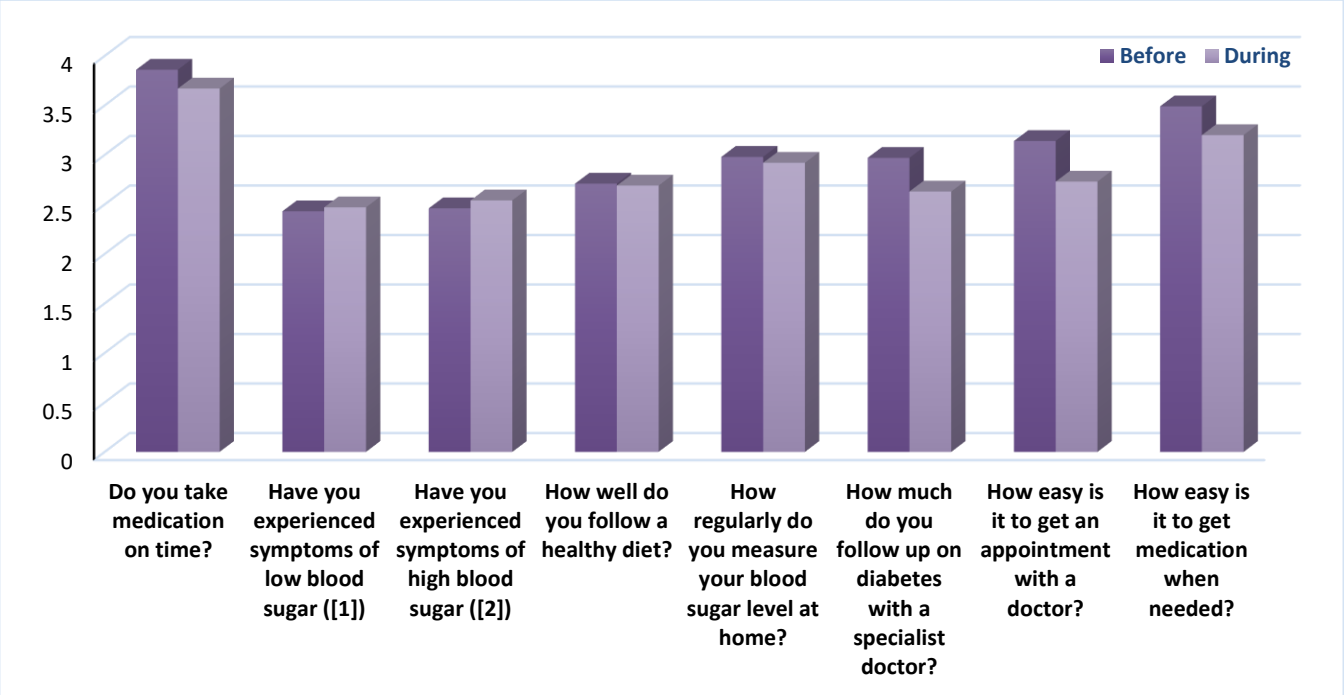

Figure (1) comparison of different variables before and during quarantine

Figure (2) compares the number of times of exercise for at least half an hour per day, before and during the quarantine period, where the rate of exercise before the quarantine period was 51.3%, and during the quarantine 47.3%, and the result of the T-test showed significant differences (P<0.05). in the average number of times to exercise for at least half an hour per day, before and during the quarantine period.

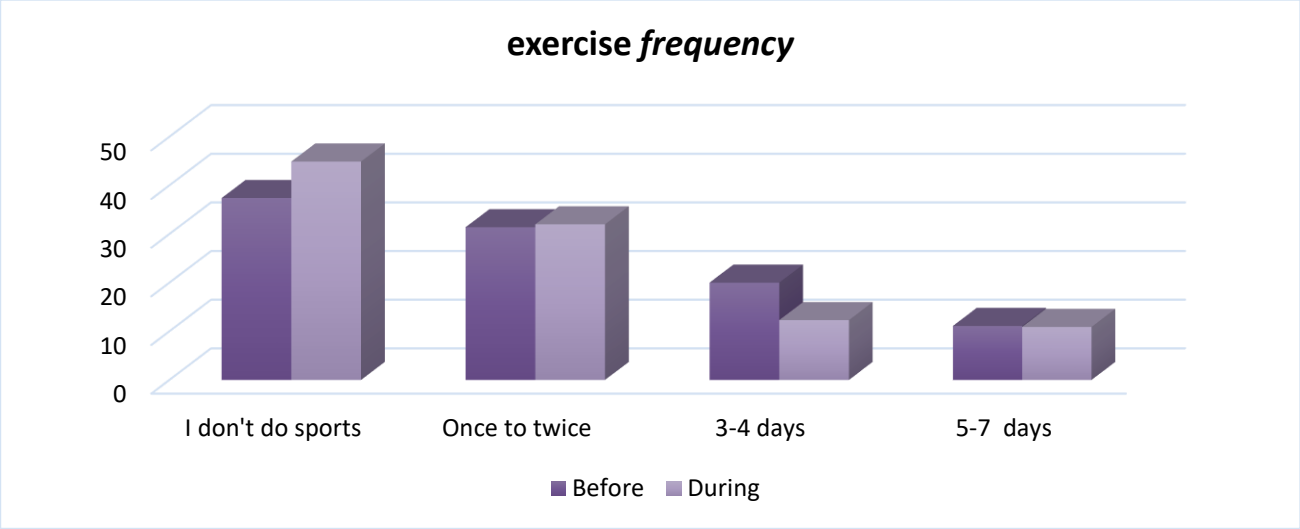

Figure (2) exercise frequency

Table (4) compares the average number of cigarettes per day before and during the quarantine period. The smoking rate of diabetic patients before the quarantine period was 11.87 cigarettes/day, and during the quarantine period 15.11 cigarettes/day, and the T-test result showed significant differences (P<0.05) in the number of cigarettes per day, before and during the quarantine period.

Table (4) Daily smoking rate

		Number of smokers	Mean	Std. Deviation	T-test	P-value
If you smoke, how many cigarettes do you smoke a day	Before	63	11.87	8.644	3.19	0.00*
	During	63	15.11	12.447		

Paired Samples Test: *Statistically significant at 0.01 / Not statistically significant

Independent samples t-test was used to test the differences in the extent of adherence to medications during the quarantine period due to gender, while the one-way ANOVA was used to test the differences in the extent of adherence to medications during the quarantine period due to the variables (age, BMI, weight changes smoking). (Table 5)

Table 5 adherence to medications during the quarantine period due to different variables

Variable	**Category**	**N**	**Mean**	**SD**	**Test value**	**P-value**
Gender	Male	152	2.80	.797	1.198	0.232/
	Female	198	2.90	.794		
Age	18-29	122	2.82	.846	3.780	0.005*
	30-39	37	2.64	.811		
	40-49	65	2.74	.816		

	50-59	74	2.89	.586		
	60 or more	52	3.20	.814		
BMI	Underweight (Below 18.5)	9	2.99	.764	0.185	0.907/
	Healthy weight (18.5 to 24.9)	123	2.82	.930		
	Overweight (25.0 to 29.9)	121	2.86	.758		
	Obesity (30 or higher)	97	2.88	.657		
weight changes	Increase	136	2.82	.731	0.804	0.448/
	Decrease	75	2.96	.790		
	There is no change.	139	2.84	.859		
Smoking	Smoker	63	2.72	.826	1.102	0.333/
	Quit smoking	23	2.88	.905		
	Non smoker	264	2.88	.778		

*Statistically significant at 0.01 / Not statistically significant

It is clear from the previous table that:

There is a difference in the extent of adherence to medications during the quarantine period only due to age, where the value of ($F=3.780$, $P<0.05$).

Table (6) shows the psychological impact on diabetic patients during the quarantine period, where the feeling of fatigue without a real reason, and the feeling of tension, ranked first according to the relative weight of 54.5%, ranked third: feeling the need for effort to do the slightest thing, according to the relative weight 49.3%, ranked fourth: feeling tired and restless, according to relative weight 46.1%, fifth place: feeling very sad, relative weight 44.5%, sixth place: feeling depressed, according to relative weight 44.2%, seventh place: feeling bored and severe disorder, according to relative weight 41.8 %, ranked eighth: feeling very nervous, according to relative weight 41.1%, ninth place: feeling hopeless, according to relative weight 40.6%, and ranked tenth and last, feeling of loss of value, according to relative weight 37.1%.

Table (6) Psychological assessment using the Kessler Psychological Distress Scale (K10).

#	Question	Never	Rarely	Sometimes	Often	Always	M	SD	RII
1	Tired for no real reason	68 (19.4)	71 (20.3)	130 (37.1)	52 (14.9)	29 (8.3)	2.72	1.18	54.5%
2	Nervous	61 (17.4)	75 (21.4)	134 (38.3)	60 ()17.1	20 (5.7)	2.72	1.11	54.5%
3	So nervous that nothing calms you down	147 (42.0)	92 (26.3)	64 (18.3)	38 (10.9)	9 (2.6)	2.06	1.13	41.1%
4	Desperate	155 (44.3)	81 (23.1)	75 (21.4)	26 (7.4)	13 (3.7)	2.03	1.14	40.6%

5	Tired and upset	112 (32.0)	81 (23.1)	107 (30.6)	39 (11.1)	11 (3.1)	2.30	1.13	46.1%
6	So bored and restless that you can't even sit down	147 (42.0)	76 (21.7)	84 (24.0)	34 (9.7)	9 (2.6)	2.09	1.13	41.8%
7	Depressed	142 (40.6)	68 (19.4)	80 (22.9)	45 (12.9)	15 (4.3)	2.21	1.22	44.2%
8	That you need an effort to do the slightest thing	104 (29.7)	78 (22.3)	95 (27.1)	47 (13.4)	26 (7.4)	2.47	1.25	49.3%
9	That you are so sad that nothing makes you happy anymore	144 (41.1)	67 (19.1)	77 (22.0)	41 (11.7)	21 (6.0)	2.22	1.26	44.5%
10	That you are worthless	201 (57.4)	57 (16.3)	47 (13.4)	31 (8.9)	14 (4.0)	1.86	1.19	37.1%
ALL							2.27	0.94	45.4%

Hint: M=Mean of answers, RII=Relative Importance Index ((Mean/5) *100%), SD=Standard Deviation

Table (7) shows the relationship between weight changes and exercising (before-after) quarantine.

To test this hypothesis, the chi-squared test was used as follows:

Table 7 Relationship between weight changes and exercising (before-after) quarantine.

Exercising	Category	weight changes			Total	Chi^2	P-value
		Increase	Decrease	There is no change.			
Before quarantine	I don't do sports	54	13	64	131	19.70	.003*
	Once to twice	42	31	37	110		
	3-4	27	17	26	70		
	5-7 days	13	14	12	39		
During quarantine	I don't do sports	72	17	68	157	23.86	.001*
	Once to twice	42	29	41	112		
	3-4	10	17	16	43		
	5-7 days	12	12	14	38		

*Statistically significant at 0.01

It is clear from the previous table that:

- There is a relationship between weight changes and exercising before quarantine (Chi2=19.70, P<0.05).
- There is a relationship between weight changes and exercising during quarantine (Chi2=23.86, P<0.05).

4. Discussion

Diabetes mellitus is a chronic disease that has a significant burden on the healthcare system and the patient [14]. Its management is affected by several factors, if not taken into account that can cause deterioration in the patient's condition. So proper control of risk factors and adequate compliance of medication and follow up is the corner stone for the best outcomes.

This study shows that the lockdown contributed in developing unhealthier lifestyle such as the decrease in physical activity which could be due to closed gyms and unavailability of e out doors training. People were under psychological stress due to Covid-19, the lock down made them feel bored, that might have increased their smoking rates. There is also a reduction of diabetic patients' compliance to their medication. There is non-significant increase incidence in both hypoglycemic and hyperglycemic incidences due to Covid-19 lockdown.

A Spanish study investigated the effect of the lockdown on the dietary intake of diabetic patients which showed an improvement in the intake of fruits and vegetables, however there was an increase in the number of snack and sugary food. Regarding physical activity, the Spanish study also showed a marked decline in activities and an increase in sitting time [15]. In another study, there was increase in weight due to boredom and psychological effects [16]. A study among collage students in the USA that was performed between February 2019 and July 2020 to track their physical activity. So, they were given Fitbit to keep track and over this period there was a decline in daily steps from 10000 to 4600 steps. Sleep time increased by an average of 30 minutes per night, adding to that there was an increase in screen on time more than 5 hours excluding classes or work [17]. In a similar study, there was a reduction in the level of compliance to their medical treatment and lifestyle habi.[18]

A study conducted at King Abdulaziz University Hospital in Jeddah, Saudi Arabia showed reduction in physical activity in 66.1% of patients and unhealthy diet. [19]

According to (Table 3) the incidence of hyperglycemic and hypoglycemic symptoms was non-significant increased during the lockdown in our study non-significant, in contrast, a study from Italy [20], showed more control levels during the lockdown period.[20]

In Jeddah, Saudi Arabia [19] a study evaluated the psychological impact of the lockdown on the diabetic patients using the Kessler Psychological Distress Scale (K10), it revealed non-significant difference [19] which is on line with our study.

This study had limitation, there was a challenge in finding cases and in visiting hospitals to find more spectrum of cases.

5.Conclusion

The study findings indicate that taking medication on time, following up on diabetes with a specialist doctor, getting an appointment with a doctor, getting medication when needed, average number of times to exercise for at least half an hour per day and in extent of adherence to medications regarding the age were significantly reduced during the quarantine period. While the number of cigarettes per day were significantly increased during the quarantine period. Also, we found that there is a relationship between weight changes and exercising before and during quarantine. In addition, there was a little effect on the psychological states of the diabetic patients.

All these findings indicate the need for doing special strategies by the primary health care's doctors and with the help of ministry of health to facilitate everything needed for patients regarding their disease during quarantine period.

REFERENCES

1. Archived: WHO Timeline - COVID-19 [Internet]. Who.int. 2020 [cited 1 December 2020]. Available from: https://www.who.int/news/item/27-04-2020-who-timeline---covid-19
2. Official Source at Ministry of Interior: Clarification of Curfews' Exceptions The official Saudi Press Agency [Internet]. Spa.gov.sa. 2020 [cited 1 December 2020]. Available from: https://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=2050408
3. Ministry of Interior: Change to the times allowed during the curfew in all regions, except Makkah The official Saudi Press Agency [Internet]. Spa.gov.sa. 2020 [cited 1 December 2020]. Available from: https://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=2091629%232091629
4. An Approval Issued to fully Lift the Curfew from 06 am on Sunday, Ban on Umrah, Visit, Int'l Flights to Continue [السعودية الأنباء وكالة Internet]. Spa.gov.sa. 2020 [cited 1 December 2020]. Available from: https://www.spa.gov.sa/2100088
5. Ministry of Interior: Curfew in All Makkah and Madinah for 24 Hours Effective from Today until Further Notice The official Saudi Press Agency [Internet]. Spa.gov.sa. 2020 [cited 9 December 2020]. Available from: https://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=2054196
6. Custodian of the Two Holy Mosques Orders to Lift the Curfew Partially in all Regions of the Kingdom, Except Makkah and Isolated Districts The official Saudi Press Agency [Internet]. Spa.gov.sa. 2020 [cited 9 December 2020]. Available from: https://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=2078975
7. Murtagh J, Rosenblatt J, Coleman J, Murtagh C. John Murtagh's general practice. McGraw-Hill Education (Australia) Pty Ltd; 2018.

8. Ma RCW, Holt RIG. COVID-19 and diabetes. Diabet Med. 2020 May 3;37(5):723–5.
9. Cao X. COVID-19: immunopathology and its implications for therapy. Nat Rev Immunol. 2020 May 9;20(5):269–70.
10. Pal R, Bhansali A. COVID-19, diabetes mellitus and ACE2: The conundrum. Diabetes Res Clin Pract. 2020;162:108132.
11. Abdulaziz Al Dawish M, Alwin Robert A, Braham R, Abdallah Al Hayek A, Al Saeed A, Ahmed Ahmed R, et al. Diabetes Mellitus in Saudi Arabia: A Review of the Recent Literature. Curr Diabetes Rev. 2016 Oct 26;12(4):359–68.
12. Al Odhayani AA, Al Sayed Tayel S, Al-Madi F. Foot care practices of diabetic patients in Saudi Arabia. Saudi J Biol Sci. 2017 Nov;24(7):1667–71.
13. Sami W, Ansari T, Butt NS, Hamid MRA. Effect of diet on type 2 diabetes mellitus: A review. Int J Health Sci (Qassim). 11(2):65–71.
14. Stats.gov.sa. 2018. Household Health Survey 2018. [online] Available at: <https://www.stats.gov.sa/sites/default/files/Table%201-4.xlsx> [Accessed 5 June 2022].
15. https://www.stats.gov.sa/sites/default/files/household_health_survey_2018.pdf page 39
16. Nachimuthu S, Vijayalakshmi R, Sudha M, Viswanathan V. Coping with diabetes during the COVID - 19 lockdown in India: Results of an online pilot survey. Diabetes Metab Syndr. 2020;14(4):579–82. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7211739/
17. Ruiz-Roso MB, Knott-Torcal C, Matilla-Escalante DC, Garcimartín A, Sampedro-Nuñez MA, Dávalos A, et al. COVID-19 lockdown and changes of the dietary pattern and physical activity habits in a cohort of patients with Type DiabetesMellitus.Nutrients.2020;12(8):2327. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7468739/
18. Pellegrini M, Ponzo V, Rosato R, Scumaci E, Goitre I, Benso A, et al. Changes in weight and nutritional habits in adults with obesity during the "lockdown" period caused by the COVID-19 virus emergency. Nutrients. 2020;12(7):2016. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7400808/
19. Giuntella O, Hyde K, Saccardo S, Sadoff S. Lifestyle and mental health disruptions during COVID-19. Proc Natl Acad Sci U S A. 2021;118(9):e2016632118.https://www.pnas.org/content/118/9/e2016632118#sec-10
20. Alshareef R, Al Zahrani A, Alzahrani A, Ghandoura L. Impact of the COVID-19 lockdown on diabetes patients in Jeddah, Saudi Arabia. Diabetes Metab Syndr.2020;14(5):1583–7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7422800/#bib15
21. Al Agha AE, Alharbi RS, Almohammadi OA, Yousef SY, Sulimani AE, Alaama RA. Impact of COVID-19 lockdown on glycemic control in children and adolescents. Audi Med J.2021;42(1):44–8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7989327/
22. Bonora BM, Boscari F, Avogaro A, Bruttomesso D, Fadini GP. Glycaemic control among people with type 1 diabetes during lockdown for the SARS-CoV-2 outbreak in Italy. Diabetes Ther. 2020;1–1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7213551/