Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Diabetes & Metabolic Syndrome: Clinical Research & Reviews 14 (2020) 1907–1912

Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews

journal homepage: www.elsevier.com/locate/dsx

Patient reported changes in metabolic health during lockdown: A cross sectional digital connect survey in people with type 2 diabetes

Rajiv Kovil [a,*], Tejas Shah [b], Manoj Chawla [c], Shefali Karkhanis [d], Dakshata Padhye [e], Ami Sanghvi [f], Mayura Choudhari Kale [g], Purvi Chawla [c], Nikhil Prabhu [h], Vinay Dhandhania [i], Kiran Shah [j], Manish Sachdev [k], Vinod Methil [l], Snehal Tanna [m], Kamlesh Nayak [n], Seema Bagri [o], Pratiksha Patil [p], Alka Gandhi [q], Sheetal Aversekar [r], Ragini Maheshwari [s], Akshay Kothari [t], Rahul Dhope [u], Anushree Mehta [v], RACE Indian Author group

[a] Dr. Kovil's Diabetes Care Centre, Mumbai, India
[b] IVA Diabetes Center, Mumbai, India
[c] Lina Diabetes Care Center, Mumbai, India
[d] Karkhanis Hospital, Mumbai, India
[e] Conquer Diabetes Center, Mumbai, India
[f] Sanghvi Eye and Diabetes Care Centre, Mumbai, India
[g] Dr.Kale's Diabetes and Psychiatry Clinic, Aurangabad, India
[h] Haut Diabetes Care Clinic, Mumbai, India
[i] Bombay Medical Hall, Ranchi, India
[j] Diabetes and Thyroid Care Center, Mumbai, India
[k] Advance Diabetes and Asthma Clinic, Mumbai, India
[l] Sweet Clinics, Mumbai, India
[m] Jupiter Hospital, Mumbai, India
[n] Dr Nayak's Diabetes Care Clinic, India
[o] Dr. Bagri Diabetes Care Centre, Mumbai, India
[p] Pratham Speciality Clinic, Mumbai, India
[q] Aayushi Clinic, Mumbai, India
[r] DiaBEAT - Center for Complete Diabetes Care, India
[s] Rohit Diabetes Center, Mumbai, India
[t] Dr Kothari's Diabetes Clinic, Mumbai, India
[u] Dhope Diabetes and Thyroid Clinic, Pune, India
[v] Kasturba Health Society, Mumbai, India

ARTICLE INFO

Article history:
Received 2 September 2020
Received in revised form
21 September 2020
Accepted 24 September 2020

1. Introduction

COVID-19 is a global pandemic affecting over 200 countries. The morbidity and mortality associated with COVID-19 has impacted the social, political, and cultural landscapes of the world. Several studies have shown type 2 diabetes as an important and commonly occurring comorbidity with COVID-19 [1–3]. In a study from USA across 1122 patients across 88 centres; it has been reported that diabetes in COVID-19 was associated with more than a fourfold increase in mortality [4].

* Corresponding author.
E-mail addresses: drrajivkovilmumbai@yahoo.com (R. Kovil), drtejas72@gmail.com (T. Shah), drmanojchawla@yahoo.com (M. Chawla), centre_diabetes@rediffmail.com (S. Karkhanis), drdakshatapadhye@gmail.com (D. Padhye), dramisanghvi@gmail.com (A. Sanghvi), kalediabetesclinic@gmail.com (M.C. Kale), linadiabetes@gmail.com (P. Chawla), dr.nikhilprabhu@gmail.com (N. Prabhu), vsudha72@yahoo.com (V. Dhandhania), drkiranshh@gmail.com (K. Shah), manishsachdev02@yahoo.in (M. Sachdev), vinod_methil@yahoo.com (V. Methil), docsnehal@yahoo.com (S. Tanna), dr.kamleshnayak@gmail.com (K. Nayak), sbagri2000@yahoo.com (S. Bagri), drpratikshadiab@gmail.com (P. Patil), dralkagandhi@gmail.com (A. Gandhi), sheetal.aversekar@gmail.com (S. Aversekar), raginimrohatgi@gmail.com (R. Maheshwari), akshaykothari1@hotmail.com (A. Kothari), rahuldhope@gmail.com (R. Dhope), mehta.aanu@gmail.com (A. Mehta).

https://doi.org/10.1016/j.dsx.2020.09.031
1871-4021/© 2020 Diabetes India. Published by Elsevier Ltd. All rights reserved.

In China, a meta-analysis of nine studies including 1936 patients of COVID-19, found a significant correlation between severity of COVID-19 and diabetes [5], while another study in 44672 patients of COVID-19 in China reported a case fatality rate of 7.3% in patients with diabetes as opposed to 2.3% in those without diabetes [6]. Even though it appears that people with diabetes may not be more prone to acquiring COVID-19, the prognosis of the same is worse in these patients with a higher mortality.

The high prevalence of diabetes in India makes the population highly susceptible not just contracting the disease but also makes the T2DM population vulnerable to COVID 19 related complications with increased morbidity and mortality [7]. Therefore, it is important for the patients to be aware, disciplined, and sensitive to achieve glycemic control to as to mitigate the risks of COVID 19. This is even more important for patients with co-morbidity of hypertension and cardiovascular disease [8].

It is well postulated that it takes 21 days to formulate a new habit as it is a function of the formation of the new neurological pathways in the human brain. This principle is based on the findings of research by Maxwell Maltz way back in 1950's [9,10]. Hence, we hypothesise that COVID 19 imposed lockdown could be an unprecedented model to evaluate for the acute changes in the lifestyle that would affect the glycemic and the metabolic health.

2. Objectives

We evaluated the change in healthful behaviour patterns in people with T2DM and the impact of situational strategies developed by the patients by themselves, to cope with the nationwide lockdown on the metabolic parameters, including the self-reported glycemic measures. The aim of this survey was to map the overall short-term impact of the nationwide lockdown on the metabolic parameters in people with type 2 diabetes and explore the characteristics of the people with respect to gender and age. We evaluated the direct glycemic parameters and the indirect markers that would have affected the diabetes control. The survey was done to capture the short-term impact over three weeks on the metabolic health of people with diabetes as an assessment of acute changes due to COVID 19 pandemic imposed nationwide lockdown.

3. Methods

3.1. Participants

The survey was conducted and included people with T2DM who had visited their diabetologists for an in-person in-clinic consultation at least once during the last three months before initiation of nationwide lockdown (March 22, 2020) were randomly selected from the electronic patient database. The data was collected using the electronic form, created as a Google form and the responses were directly downloaded as an Excel file.

A cross sectional survey of patients from pooled practices of 23 diabetologists who are members of United Diabetes Forum (UDF) across the country was conducted for a period of one week from April 10 to April 16, encompassing the later part of the first phase of the nationwide lockdown (March 25th – April 14th) and the initial part of the second phase of the lockdown (April 15th – May 3rd).

3.2. Recruitment methodology

The people were informed for the objectives of the survey through a whatsapp message and were asked for the electronic consent through a reply to the initial whatsapp message. The people who consented were provided the online link of the Google form. A reminder was sent out on Whatsapp on the third day and sixth day, if the response was not recorded on the second day and fifth day, respectively.

3.3. Development of the questionnaire

The questionnaire was developed by UDF members, directly involved in the delivery of diabetes care. The questionnaire comprised a total of 30 questions designed to assess the current health status, perceived health status and the behaviour before the lockdown and the change observed in the health status after 21 days of lockdown. The questionnaire incorporated measures to assess the behaviour changes due to the COVID-19 pandemic-driven lockdown including changes in physical activity levels, medication adherence, food habit changes, glycemic monitoring, tobacco, alcohol consumption and duration of sleep.

3.4. Statistical methods

Results on continuous measurements are presented as mean ± SD and results on categorical measurements are presented in Number (%). Normality of data was tested by Shapiro-Wilk, Kolmogorov-Smirnoff test. Paired *t*-test was used to find the significance of study parameters within groups measured on two occasions. Chi-square/Fisher Exact test was used to find the significance of study parameters on categorical scale between two or more groups. Significance is assessed at a level of 5%.

4. Results

4.1. Patient characteristics

The span of the participants per diabetologist varied with five, three and single diabetologist accounted for 68.5% (235), 53% (181) and 27.4% (94) participants, respectively. All patients surveyed in this study were pooled from independent practices.

Table 1 shows the baseline sociodemographic characteristics of participants. The mean age of the 343 participants was 55 years ±13.0 (minimum 18, maximum 89, range 71, 95% CI 52 to 55). 16.9% (58), 83.1% (285) and 30.9% (106) were in the age range of 18–40 years, > 40 years, > 60 years, respectively. Almost every eight out of 10 participants were more than 40 years of age and three out of 10 were above 60 years. Almost two-thirds of the participants were male, were the primary-earning members of the household and less than 60 years of age. Approximately, half of the

Table 1
Sociodemographic characteristics of participants.

Variable	Parameter	No. of participants (%)
Age (years)	18–40	58 (16.9)
	41–60	179 (52.1)
	>60	106 (30.9)
Gender	Male	233 (67.9)
	Female	110 (32)
Financial Status	Primary earning member	233 (67.9)
	Dependent	110 (32)
Duration of Diabetes	<1 year	25 (7.28)
	1–5 years	78 (22.7)
	5–10 years	82 (23.9)
	>10 years	158 (46)
Type of therapy	Insulin	116 (33.8)
	Oral medications	202 (58.8)
	Lifestyle Management	25 (7.2)
Hypertension duration	Non hypertensive	185 (53.9)
	<5 years	50(14.5)
	5–10 years	39(11.3)
	>10 years	69 (20.1)

participants surveyed had diabetes for over 10 years while one-third of the studied participants were on insulin therapy.

Almost half of the participants (n = 158) were hypertensives, with almost all (n = 151) were strictly compliant to the prescribed anti-hypertensive therapy. There were 54 (15.7%) participants who had both the co-morbidities of hypertension and diabetes.

4.2. Change during the lockdown

Table 2 shows the change in the parameters during the lockdown. Even before the lockdown, almost half of the participants had adequate sleep of more than 8 h, with substantially higher number of people; more than double the number of people reporting adequate sleep, during the lockdown. The tobacco consumption decreased by almost one-third. Almost, half of the participants, even before the lockdown, during recall for last one week reported to be fully compliant, to the anti-diabetic drugs with compliance, to the therapy further increased marginally. Fasting glucose reported by SMBG of more than 140 mg/dl, was reported by almost one-third of the participants before the lockdown, was reported by less than one fifth of participants, during the lockdown. Post prandial glucose of more than 180 mg/dl initially reported by almost one-third of the participants changed to almost 6% during the lockdown. Before the lockdown, there were less than 5% people who were not regularly monitoring their fasting and post prandial glucose, which increased substantially by almost five times during the lockdown. The participants who reported decrease in the weight were marginally more than those who reported increase in the weight. However, more than half reported that the body weight almost remained the same during lockdown. This was despite the finding that there was 7.7% (22) less participants reporting daily physical exercise during the lockdown.

Table 3 shows association between the sociodemographic characteristics of participants and the age. Almost half of the participants were in the age group of 41–60 years followed by almost one-third in the age group of more than 60 years. The participants in the age group 18–60 years were more often the primary earning members as compared to the people in the age group more than 60 years (OR 2.48, 95% CI 1.53 to 4.02; $p < 0.0003$) and also the participants in the same age group were less likely to have duration of diabetes which was more than 10 years (OR 0.10 95% CI 0.06 to 0.17, $p < 0.0001$). Almost three-fourth of the participants were less than 60 years of age with duration of diabetes less than 10 years. Almost half of the participants were non-hypertensives between the age group of 18–60 years (OR 5.46 95% CI 3.28 to 9.06, $p < 0.0001$). There was not much change in the number of participants in the age group more than 60 years, that had adequate sleep duration even during the lockdown (OR 0.32 95% CI 0.17 to 0.62, $p < 0.0009$), whereas almost one-fourth of the participants who had adequate sleep duration during the lockdown was between the age group 18–60 years.

Table 4 shows association between the sociodemographic characteristics of participants and the gender. There were a greater number of males (68%) as compared to 32% of the participants were female. Men more often than women are the primary earning members (OR 9.72 95% CI 5.81 to 16.47, $p < 0.0001$). There were relatively less proportion of males who were on insulin as compared to females. (OR 0.44 95% CI 0.28 to 0.71, $p < 0.0009$). There was a dramatic drop in females ordering food from eatery as compared to males (OR 0.34 95% CI 0.14 to 0.9). The increase in the adequate sleep by a greater number of participants during the lockdown was not statistically different between the males and females. However, there were numerically higher number of males as compared to females who achieved adequate sleep during lockdown.

4.3. Changes in the diabetes management due to lockdown imposed by COVID-19

The compliance to therapy, SMBG fasting and post prandial glucose control, SMBG monitoring did not differ significantly neither in the age groups, nor in the gender groups. However, there was a superior change in the glycemic variables in the male participants. The change in the body weight was not significant between the genders. However, there were more males reporting decrease in body weight, and vice versa by the females.

5. Discussion

This study across 343 patients from 23 diabetologists demonstrated that the short-term impact of the lockdown on the metabolic health of the patients by virtue of the adoption to the new lifestyle and the constrained resources. The fear of death which has perhaps created a panic in T2DM community raising the awareness for the COVID-19 related complications including mortality,

Table 2
Changes reported during lockdown.

Variable	Change with reference to Lockdown	No. of participants (%)
Adequate sleep > 8 h	Before	54 (15.7)
	During	127 (37)
Tobacco	Before	42 (12.2)
	During	29 (8.4)
Compliance to Therapy	Before	176 (51.3)
100% compliance in last one week	During	188 (54.8)
SMBG Fasting Glucose > 140 mg/dl	Before	112 (32.6)
	During	62 (18)
SMBG Postprandial Glucose > 180 mg/dl	Before	104 (30.3)
	During	20 (5.8)
SMBG Fasting Glucose – Did not check	Before	12 (3.4)
	During Lockdown	66 (19.2)
SMBG Postprandial Glucose – Did not check	Before	17 (4.9)
	During	67 (19.5)
Habitual Food from Eatery	Before	310 (90.3)
	During	33 (9.6)
Daily Physical Exercise	Before	285 (83)
	During	263 (76.6)
Body weight – Change during lockdown	Decreased	56 (16.3)
	Increased	51 (14.8)
	Same no change	178 (51.8)

Table 3
Association between the sociodemographic characteristics of participants and changes during lockdown with the age.

Variables	Age (n = 343)			
	18–60 years (n = 237)	>60 years (n = 106)	p value	Odds Ratio (OR) 95% CI
No of Participants (%)				
Earning Status			<0.0003	2.48 (1.53–4.02)
Primary earning member 233 (67.9)	176 (51.3)	57 (16.6)	***	
Dependant 110 (32)	61 (17.7)	49 (14.2)		
Duration of Diabetes			<0.0001 ****	0.10 (0.06–0.17)
>10 years 158 (46)	80 (23.3)	78 (22.7)		
≤10 years 185 (53.9)	263 (76.6)	28 (8.1)		
Pharmacotherapy			0.32 ns	0.77 (0.48–0.1.27)
Insulin 116 (33.8)	76 (22.1)	40 (11.6)		
Oral/Lifestyle modification 227 (66.1)	161 (46.9)	66 (19.2)		
Hypertension status			<0.0001 ****	5.46 (3.28–9.06)
No Hypertension 185 (53.9)	157 (45.7)	28 (8.16)		
Hypertensive 158 (46)	80 (23.3)	78 (22.7)		
Change in Bodyweight during Lockdown			0.82 ns	1.12 (0.46–2.73)
Decreased 56 (16.3)	44 (12.8)	12 (3.4)		
Increased 51 (14.8)	39 (11.3)	12 (3.4)		
Changes during Lockdown				
Sleep Duration > 8 h			0.0009	0.32 (0.17–0.62)
Before 60 (17.4)	28 (8.16)	32 (9.3)	***	
During 121 (35.5)	88 (25.6)	33 (9.6)		
Habitual Food from Eatery			0.70 ns	1.21 (0.60–2.58)
Before 310 (90.3)	202 (58.8)	108 (31.4)		
During 33 (9.6)	20 (5.8)	13 (3.7)		
Daily Physical Exercise			0.85 ns	0.96 (0.66–1.38)
Before 285 (83)	196 (57.1)	89 (25.9)		
During 263 (76.6)	183 (53.3)	80 (23.3)		
Tobacco Consumption			0.70 ns	1.52 (0.40–5.58)
Before 63 (18.3)	51 (14.8)	12 (3.4)		
During 8 (2.3)	4 (1.1)	4 (1.1)		
Total Compliance to Therapy			0.07 ns	4.25 (1.08–15.91)
Before 176 (51.3)	111 (32.3)	65 (18.6)		
During 188 (54.8)	122 (39.3)	66 (15.4)		
SMBG Fasting Glucose > 140 mg/dl			>0.87 ns	1.06 (0.58–1.95)
Before 112 (32.6)	56 (16.3)	56 (16.3)		
During 62 (18)	30 (8.7)	32 (9.3)		
SMBG Post Prandial Glucose > 180 mg/dl			0.60 ns	1.43 (0.52–3.85)
Before 104 (30.3)	71(20.1)	33 (10.2)		
During 20 (5.8)	12 (3.49)	8 (2.3)		
Not checking FPG at all			>0.99 ns	1.25 (0.26–6.25)
Before 12 (3.4)	10 (2.9)	2 (0.58)		
During 66 (5.8)	53 (15.4)	13 (3.7)		

*p ≤ 0.10, **p < 0.05, ***p < 0.01, ****p < 0.0001, ns Non Significant.

through consistent television and social media driven communications, could be attributed as one of the important reasons for enhanced compliance to the ant-diabetic therapy. Moreover, the restrictions imposed by the health authorities because of the higher risk of being infected and to experience more severe symptoms of the contract COVID 19, reinforced the awareness to maintain social distancing, hand hygiene and restrain to the home [11]. Although, there was a minimal change for the enhanced compliance to therapy, but is nothing less than a remarkable drift in habit, since despite several logistics and financial constraints, there has been a social and behavioral change, to be adherent to the therapy, in a short span of time. The panic buying of the chronic medications has been well reported, just as the lockdown was announced. This could also have been an important factor to improve the compliance of the therapy [12] The decreased SMBG during lockdown could be attributed to the difficulty in the access to the glucometer strips, the increase in the price of the glucometers, unavailability of the battery, would have limited the utilisation of SMBG, even in highly disciplined and complaint patients [13].

In a study from Italy, there were no significant changes in the ambulatory glucose profile of insulin treated people during the initial 14 days of lockdown [14]. There are emerging evidences from India, that glycemic characteristics have indeed improved during the lockdown [13,15]. However, our results contrast with a simulation modelling study that theoretically suggests that the duration of the lockdown is linked with worsened glycemic control [16].

The highly motivated patients continued their physical activity despite being indoors in the houses or with limited walk with the limited geography such as residential compound or terraces. The compromised continuity of the physical activity was a paradox for the perceived decrease in the body weight. The change in the body weight although reported to decrease in a small number of participants has been shown to decrease in a small-time frame of 21 days. The weight reduction in short period of time could be the

Table 4
Association between the sociodemographic characteristics of participants and changes during lockdown with the gender.

Variables	Gender (n = 343)			
	Males (n = 233)	Females (n = 110)	p value	Odds Ratio (OR) 95% CI
No of Participants (%)				
Earning Status			<0.0001	9.72 (5.81–16.47)
Primary earning member 233 (67.9)	195 (56.8)	38 (11)	****	
Dependant 110 (32)	38 (11)	72 (20.9)		
Duration of Diabetes			0.56 ns	1.15 (0.73–1.84)
>10 years 158 (46)	110 (32)	48 (13.9)		
≤10 years 185 (53.9)	123 (35.8)	62 (18)		
Pharmacotherapy			0.0009	0.44 (0.28–0.71)
Insulin 116 (33.8)	65 (18.9)	51 (14.8)	***	
Oral/Lifestyle modification 227 (66.1)	168 (48.9)	59 (17.2)		
Hypertension status			0.41 ns	0.82 (0.52–1.29)
No Hypertension 185 (53.9)	122 (35.5)	63 (18.3)		
Hypertensive 158 (46)	111 (32.3)	47 (13.7)		
Change in Bodyweight during Lockdown			0.22	1.75 (0.76–3.83)
Decreased 56 (16.3)	40 (11.6)	16 (4.6)		
Increased 51 (14.8)	30 (8.7)	21 (6.1)		
Changes during Lockdown				
Sleep Duration > 8 h			0.08 ns	0.55 (0.28–1.05)
Before 60 (17.4)	37 (10.7)	23 (6.7)		
During 121 (35.5)	90 (26.2)	31 (9)		
Food from Eatery			0.03 *	0.34 (0.14–0.9)
Before 310 (90.3)	205 (59.7)	105 (30.6)		
During 33 (9.6)	28 (8.16)	5 (1.4)		
Daily Physical Exercise			0.71 ns	0.93 (0.65–1.33)
Before 285 (83)	193 (56.2)	92 (26.8)		
During 263 (76.6)	182 (53)	81 (23.6)		
Tobacco Consumption			0.70 ns	1.52 (0.40–5.58)
Before 63 (18.3)	38 (11)	25 (7.2)		
During 8 (2.3)	4 (1.1)	4 (1.1)		
Total Compliance to Therapy			0.64 ns	0.88 (0.56–1.39)
Before 176 (51.3)	122 (35.5)	54 (15.7)		
During 188 (54.8)	135 (39.3)	53 (15.4)		
SMBG FPG > 140 mg/dl			>0.99 ns	1.04 (0.53–2.05)
Before 112 (32.6)	77 (22.4)	35 (10.2)		
During 62 (18)	42 (12.2)	20 (5.8)		
SMBG PPG > 180 mg/dl			0.081 ns	2.41 (0.88–6.02
Before 104 (30.3)	69 (20.1)	35 (10.2)		
During 20 (5.8)	9 (2.62)	11 (3.2)		
Not checking FPG at all			0.72 ns	0.69 (0.19–2.29)
Before 12 (3.4)	8 (2.3)	4 (1.1)		
During 66 (5.8)	49 (14.2)	17 4.9)		

*p ≤ 0.10, **p < 0.05, ***p < 0.01, ****p < 0.0001, ns Non Significant.

function of enhanced mobility due to the increased demand of the household chores, due to the lack of the domestic help, which otherwise has not been consciously been attributed to the increase in the physical activity. The dramatic decrease in the consumption of the outside eatery food along with the travel restrictions with predominantly the home cooked food resulted in a dietary calorie discipline, which could have further added to the perceived decrease in the weight, by the participants. Also, the lack and the ease of availability of the non-vegetarian food would also have resulted in the direct perception of decrease in the weight. Since, many of the participants were from Mumbai, the work from home eliminated the long, stressful commute time, slowed down the hectic routine, enabling more time to rest, relax and have an adequate sleep of more than 8 h daily. Perhaps, this enabled enhanced time to cope with the challenges of diabetes management. The impact of the behavioral change would need more time to be assessed by a difficult to achieve point parameter. Our results provide insights that people with T2DM may be able to face the ongoing restrictions, in a safe manner, which is important as diabetes itself may worsen the prognosis of COVID 19.

The strengths of the study include the timeliness of the study, which was initiated appropriately overlapping the end of first phase of lockdown and the beginning of the second, during which the participants had well adapted and learned to cope with the new normal for the self-management of diabetes. The predominant representation of the patients from the western part of the country which has been the hot bed of the COVID 19 pandemic in India could be the representative picture for the rest of the country, for how the patients with T2DM would be coping as the disease has spread across the country.

5.1. Limitations of the study

The variability for the participants that responded per

diabetologist in the study was a function of the motivation of the individual participant to timely respond to the questionnaire. This could be accounted to be driven by the external variables driven by the diabetologist-patient relationship and the current situation under which the participant would have desired to respond. The results represent the patient reported parameters which need to corroborated post lockdown with regular in person-in clinic monitoring of FPG, PPG and HbA1c and compare with the investigations conducted before the lockdown. We did not categorically investigate the reasons to decline the study invitation. The parameters reported are based on the perception mapping capabilities of the individual participant.

6. Conclusions

The lockdown imposed as a measure to combat the spread of COVID 19 resulted in improved metabolic health in people with T2DM. The enhanced compliance to the therapy is attributed to greater societal awareness about association for the risk of COVID 19 in patients with diabetes and hypertension. This contrasts with the decrease in the SMBG due to the unavailability of the point of care resources. Our study highlights the dynamic impact of the lockdown which enabled situational, self-automated patient empowerment despite the limited resources, to take control of their diabetes. Self-imposed adoption towards healthful modifications in the short term may be self-adapted in long term that would be sustainable. The results need corroboration with a longer follow up to evaluate the changes with the evolving COVID 19 situation.

References

[1] Ye C, Zhang S, Zhang X, et al. Impact of comorbidities on patients with COVID-19: a large retrospective study in Zhejiang, China [published online ahead of print, 2020 Jun 16]. J Med Virol 2020. https://doi.org/10.1002/jmv.26183. 10.1002/jmv.26183.

[2] Selvin E, Juraschek SP. Diabetes Epidemiology in the COVID-19 Pandemic [published online ahead of print, 2020 Jun 15]. Diabetes Care 2020:dc201295.

[3] Li J, He X, Yuanyuan, et al. Meta-analysis investigating the relationship between clinical features, outcomes, and severity of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pneumonia [published online ahead of print, 2020 Jun 12]. Am J Infect Contr 2020;S0196–6553(20). https://doi.org/10.1016/j.ajic.2020.06.008. 30369-2.

[4] Bode B, Garrett V, Messler J, et al. Glycemic characteristics and clinical outcomes of COVID-19 patients hospitalized in the United States [published online ahead of print, 2020 may 9] [published correction appears in J diabetes sci technol. 2020 jun 10;:1932296820932678]. J Diabetes Sci Technol 2020. https://doi.org/10.1177/1932296820924469. 1932296820924469.

[5] Chen Y, Gong X, Wang L, Guo J. Effects of hypertension, diabetes and coronary heart disease on COVID-19 diseases severity: a systematic review and meta-analysis medRxiv. 2020. 03.25.20043133) published online March 30.

[6] Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese center for disease control and prevention [published online ahead of print, 2020 feb 24]. J Am Med Assoc 2020. https://doi.org/10.1001/jama.2020.2648. 10.1001/jama.2020.2648.

[7] Clark A, Jit M, Warren-Gash C, et al. Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study [published online ahead of print, 2020 Jun 15]. Lancet Glob Health 2020;S2214–109X(20). https://doi.org/10.1016/S2214-109X(20)30264-3. 30264-3.

[8] Calderón JM, Zerón HM, Padmanabhan S. Treatment with Hydroxychloroquine vs Hydroxychloroquine + Nitazoxanide in COVID-19 patients with risk factors for poor prognosis: a structured summary of a study protocol for a randomised controlled trial. Trials 2020;21(1):504. https://doi.org/10.1186/s13063-020-04448-2. Published 2020 Jun 8.

[9] Morselli PG. Maxwell Maltz, psychocybernetic plastic surgeon, and personal reflections on dysmorphopathology. Aesthetic Plast Surg 2008;32(3):485–95. https://doi.org/10.1007/s00266-007-9006-9.

[10] Wang M, Guo Y, Zhang Y, et al. Promoting healthy lifestyle in Chinese college students: evaluation of a social media-based intervention applying the RE-AIM framework [published online ahead of print, 2020 May 4]. Eur J Clin Nutr 2020. https://doi.org/10.1038/s41430-020-0643-2. ;10.1038/s41430-020-0643-2.

[11] Katulanda P, Dissanayake HA, Ranathunga I, et al. Prevention and management of COVID-19 among patients with diabetes: an appraisal of the literature [published online ahead of print, 2020 May 14]. Diabetologia 2020:1–13. https://doi.org/10.1007/s00125-020-05164-x.

[12] Arafat SMY, Kar SK, Marthoenis M, Sharma P, Hoque Apu E, Kabir R. Psychological underpinning of panic buying during pandemic (COVID-19) [published online ahead of print, 2020 May 6]. Psychiatr Res 2020;289:113061. https://doi.org/10.1016/j.psychres.2020.113061.

[13] Nachimuthu S, Vijayalakshmi R, Sudha M, Viswanathan V. Coping with diabetes during the COVID - 19 lockdown in India: results of an online pilot survey [published online ahead of print, 2020 May 11]. Diabetes Metab Syndr 2020;14(4):579–82. https://doi.org/10.1016/j.dsx.2020.04.053.

[14] Maddaloni E, Coraggio L, Pieralice S, Carlone A, Pozzilli P, Buzzetti R. Effects of COVID-19 lockdown on glucose control: continuous glucose monitoring data from people with diabetes on intensive insulin therapy [published online ahead of print, 2020 jun 5]. Diabetes Care 2020. https://doi.org/10.2337/dc20-0954. dc200954.

[15] Anjana RM, Pradeepa R, Deepa M, et al. Acceptability and utilisation of newer technologies and effects on glycemic control in type 2 diabetes - lessons learnt from lockdown [published online ahead of print, 2020 Jun 10]. Diabetes Technol Therapeut 2020. https://doi.org/10.1089/dia.2020.0240. 10.1089/dia.2020.0240.

[16] Ghosal S, Sinha B, Majumder M, Misra A. Estimation of effects of nationwide lockdown for containing coronavirus infection on worsening of glycosylated haemoglobin and increase in diabetes-related complications: a simulation model using multivariate regression analysis. Diabetes Metab Syndr 2020;14(4):319–23. https://doi.org/10.1016/j.dsx.2020.03.014 [published online ahead of print, 2020 Apr 10].