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Diabetes self-management amid COVID-19 pandemic

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ABSTRACT

Background and aims: COVID-19 pandemic has challenged the physician-centered approach of diabetes care in India that is primarily based on routine clinic visits. We aim to review the various aspects of patient-centered care via diabetes self-management education based on available literature.

Methods: This is a narrative review using Pubmed, EMBASE and Google Scholar search till March 29, 2020. Search terms were “COVID-19”, “diabetes self-care”, “diabetes self-management education”, “DSME”, “diabetes self-management in India”, “diabetes self-care in India” and “DSME in India”.

Results: We have discussed an educational plan on diabetes self-management that can be adopted for people with diabetes mellitus in our country amid the ongoing pandemic. We have also identified the barriers to diabetes self-management in the current scenario and suggested possible solutions to overcome those.

Conclusions: We have reemphasized the need for a simultaneous patient-centered approach in routine diabetes care that has to be coordinated by a multidisciplinary team amid the ongoing COVID-19 pandemic.

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1. Introduction

Novel coronavirus disease (COVID-19) has emerged as a global pandemic, affecting more than 200 countries and claiming thousands of lives till date. Although the overall mortality rate is low [1], diabetes mellitus (DM) has emerged as a distinctive comorbidity that is associated with severe disease, acute respiratory distress syndrome and increased mortality in COVID-19 patients [2]. Infact, DM has emerged as an independent predictor of admission to intensive care unit or invasive ventilation or death in patient with COVID-19 even after adjustment for age [3]. Maintaining a good glycemic control would boost the innate immune system and help prevent the grave consequences [4]. However, as a result of nationwide lockdown imposed by the Government to curb the spread of the pandemic, comprehensive diabetes care and glycemic control has taken a back seat.

2. Challenges to diabetes self-care amid the COVID-19 pandemic

A recent study from China during the COVID-19 pandemic has shown that elderly subjects with type 2 diabetes mellitus experienced worsening of glycemic control manifesting as higher fasting blood glucose [5]. The impact of social distancing, quarantine and lockdown on lifestyles would have probably led to worsening of glucose control. Firstly, lockdown and social distancing meant for community containment would have limited the physical activities of the people with DM. Secondly, restriction in food supplies during the lockdown would have compelled people with DM to alter their dietary habits that were earlier associated with good glycemic control. Thirdly, procurement of anti-diabetic medications and glucose strips would have been difficult amid the ongoing restrictions. Lastly, people with diabetes mellitus would not have been able to visit their physicians for routine clinic follow-ups; hence, fine-tuning of anti-diabetic medications would not have been possible. This would have led to sustained periods of hyperglycemia (and probably frequent episodes of hypoglycemia that were not looked into in this study) which would have been left unaddressed in the absence of in-clinic consultations.

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3. Psychological health of people with diabetes mellitus amid the COVID-19 pandemic

The COVID-19 pandemic has adversely affected the psychological well being of people all over the globe. The constant anxiety of unknowingly contracting the virus, the stress of being locked down within rooms and not being able to meet their near and dear ones markedly affects the psychological health of the masses. Moreover, the sudden and near-constant stream of news reports about an outbreak can make anyone feel worried [6]. People with diabetes mellitus already tend to have varying degrees of negative emotions, such as depression and anxiety [7,8], which would naturally get aggravated during an epidemic. Unhealthy emotions would, in turn, affect the glycemic control in people with diabetes amid the COVID-19 pandemic [9,10].

Similar would be plight of people with DM in India. Thus, in the wake of the ongoing pandemic, optimum diabetes care can be achieved only by adopting a collaborative approach to diabetes self-management practices that involves a multidisciplinary team comprising of general physicians, endocrinologists, diabetes educators, nutritionists, ophthalmologists, podiatrists and psychiatrists. Above all, patients with diabetes need to play a major role in this didactic approach to diabetes self-care. Herein, we have reviewed the diabetes self-care practices that can be adopted by patients and reinforced by physicians amid the ongoing pandemic.

4. Search methodology

We systematically searched the PubMed, EMBASE and Google Scholar databases till March 29, 2020 using the keywords “COVID-19”, “diabetes self-care”, “diabetes self-management education”, “DSME”, “diabetes self-management in India”, “diabetes self-care in India” and “DSME in India”.

5. Diabetes self-management education: Definition

Diabetes self-management education refers to the ongoing process of facilitating the knowledge, skill, and ability necessary to successfully manage the disease on their own. It is a critical element of care for all people with diabetes and has been shown to improve patient outcomes [11]. American Association of Diabetes Educators (AADE) has described seven self-care behaviors of a patient as reliable outcome measures of diabetes self-management education, namely, being active, healthy eating, taking medication, monitoring, solving problems, reducing risks and healthy coping [12].

6. Mode of communication between healthcare providers and people with diabetes mellitus amid the COVID-19 pandemic

With nationwide lockdown being imposed in the country, people with DM will not be able to visit their treating physicians in person. Herein comes the pivotal role of teleconsultations. With smartphones being a norm in most households, there seems to be no dearth of scope for teleconsultation in the present era. Patients can keep in touch with their routine physicians via teleconsultations. Details regarding applicability of telemedicine amid the ongoing pandemic have been dealt in another article in this special issue.

7. Diabetes self-management education: Relevant issues

Although the US National Taskforce has established national standards for diabetes self-management education and support [13], the same set of guidelines might not be applicable to the

Indian patients. Hence, diabetic self-management practices should cater to the Indian population and address their routine habits. Taking cues from Indian data [14–17], diabetes self-care practices should center on the following components for homebound people unable to comply with routine clinic visits during this period.

1. **Diet:** Indian diet is already rich in carbohydrates. A study conducted among 796 people with type 2 diabetes mellitus had shown that carbohydrates constituted 64.1% of total energy from diet, higher than that recommended in India [18]. The consumption of carbohydrates is expected to increase amid the lockdown due to limited availability of fresh vegetables and fruits. Indians also happen to be one of largest consumers of sweetened food items [19]. Since sweetened food items can be stored for long (even without refrigeration), the consumption of such items would be expected to increase during times of lockdown. However, certain simple advices can help people with DM maintain a healthy diet.
 - Any dietary advice should begin with calculation of an approximate required total daily calorie intake. Required total daily calorie intake of obese and non-obese patient on sedentary lifestyle is 20 kcal/kg and 22–25 kcal/kg ideal body weight, respectively. As a simple example, an average Indian man of height 165 cm should ideally weigh 62 kg and would require 1850 kcal to maintain a healthy weight assuming that the person is leading a sedentary lifestyle [14].
 - As per the prevalent Indian norms, the total daily calorie intake has to be distributed over three major meals (breakfast, lunch and dinner) and an evening snack.
 - The daily carbohydrate intake should be approximately 50–60% of the total calorie intake; e.g. for an average Indian man leading a sedentary lifestyle, carbohydrates should be 225–270 g/day [14].
 - Complex carbohydrates should be preferred over refined carbohydrates and its products (e.g., whole grain bread [roti] over white [maida] bread). Millets (bajra, ragi, jowar) can be consumed. The total dietary fiber in daily diet should be 25–40 g/day. Whole grains, cereals, pulses, vegetables, and fruits contain high dietary fiber.
 - Intake of sugar-sweetened food items like fruit juice, aerated beverages and sugar syrups should be strictly avoided [19].
 - Fats should provide not more than 30% of total calorie/day and saturated fat (vanaspati, dalda, ghee) intake should be minimum [14]. Emphasis should be placed on low fat milk (double toned).
 - Ideally three teaspoons of oil per day should be used in cooking. Preferred cooking oil would be a combination of two or more vegetable oils (one being groundnut/sesame/riced bran/cottonseed/palmolein/olive oil and the other being mustard/canola/soybean/sunflower/safflower oil) [14].
 - Protein intake should be 1 g/kg/day, considering the quality of protein in a usual Indian vegetarian diet. However, protein intake needs to be reduced in those with diabetic nephropathy and macroalbuminuria (0.8 g/kg/day) [20]. Recommended protein sources for a vegetarian would be soya, pulses and low fat dairy products while in a non-vegetarian would be egg white and, if available, fresh water fish and lean poultry. Red meat should be avoided.
 - Salt intake should be less than 5 g of sodium chloride/day and the age-old Indian practice of adding extra salt at the dining table should be avoided.
 - Diabetes plate method is a simple yet effective way to provide a visual guide to portion calories in a food plate keeping the total calorie intake/day and the routine Indian diet in mind. Half of the plate should consist of vegetable curry (e.g.

cauliflower, brinjal etc). One quarter of plates should consist of proteins in form of dal/soya/egg white and if available fresh fish/lean poultry. Remaining quarter of plate should consist of complex carbohydrates in form of cereals (roti made from whole wheat/bajra/ragi, brown rice, etc.).

- The incessant desire of Indians (specially while at home) to consume tea (with added sugar) should be curbed. Tea intake should be limited and that too, without added sugar. Artificial sweeteners, if available, could be used in moderation [14]. Likewise, the habit of consuming snacks (like fritters) every time tea is taken should be strongly discouraged.
 - Patients will additionally benefit by keeping in regular touch with a nutritionists via online consultations. Telehealth-delivered dietary interventions targeting dietary patterns has been shown to improve diet quality, fruit and vegetable intake and dietary sodium intake [21].
 - Unhealthy habits of smoking, drinking and betel chewing should be avoided.
- 2. Physical activity:** Physical activity is a part and parcel of routine diabetes self-care; however, lockdown would restrict the outdoor physical activities of people with DM. Hence, they should be informed about alternative physical activity programs that can be undertaken within the safe confines of home.
- A total of 60 min of physical activity/day would be ideal that could be divided between aerobic activity, work-related activity and muscle-strengthening activity [15].
 - Aerobic activity of at least moderate-intensity for a minimum of 30 min/day would be the goal. This could include brisk walking (walking at an intensity wherein an individual finds speaking difficult but not impossible) in rooftop or lawn. If available, treadmills could be used. Other means of aerobic activity like stationary jogging, stationary cycling and gardening could be resorted to. The total duration of aerobic activity could be accumulated in small 10–15 min periods, two or three times a day.
 - Work-related physical activity, like climbing stairs, performing household chores, would comprise about 15 min/day.
 - Lastly, 15 min/day should be dedicated for muscle-strengthening activities that could include bodyweight exercises (like push-ups, squats, sit-ups, crunches and forward flexes) and resistance exercise in the form of lifting light-weights. In absence of home fitness accessories, readily available household stuffs like buckets half filled with water or even small bags filled with objects could be used.
 - Joint mobility and stretching exercises like yoga could be part of the regimen.
 - Intensity and type of physical activity should be tailored to an individual's ability and fitness level. Caution must be exercised for patients with co-existing heart diseases and history of hypoglycemia. Physicians could help patients choose the type and nature of physical activity, guide them by sharing sample exercise videos and reinforce the need to remain physically active at each online interaction.
- 3. Medication adherence:**
- Through teleconsultations, physicians could ensure drug compliance. Diabetes educators could help patients procure anti-diabetic medications via online stores which might otherwise be difficult to obtain amid the lockdown.
 - In addition, physicians/diabetes educators should make patients aware of contraindications of hydroxychloroquine (diabetic retinopathy or seizure history) to prevent injudicious use of the drug as an anti-diabetic amid the COVID 19 pandemic.
- 4. Self-monitoring of blood glucose (SMBG):**

- SMBG of capillary blood is an acceptable alternative to plasma glucose estimation in present scenario.
- For patients on insulin with poor glycemic control or recurrent hypoglycemia, SMBG is advised at least 4 times/day, i.e., at fasting, before lunch, before dinner and at bedtime. Each value is to be recorded over a span of at least 3 days to avoid multiple pricks a day. In addition, capillary glucose should be checked at any clinical suspicion of hypoglycemia. For patients on oral hypoglycemic agents with acceptable control, measuring fasting and post-prandial capillary blood glucose once or twice a week is acceptable.
- Availability of glucose strips could be a challenge in the current scenario. Taking help of online pharmacy stores and placing orders well before existing stocks dwindle could be the best solution in this regard.

5. Coping with hypoglycemia: Hypoglycemia could become a major deterrent to comprehensive diabetes care amid the ongoing pandemic. In the absence of physician's advice, hypoglycemia could recur, perpetuating hypoglycemic unawareness and leading to a vicious cycle of *hypoglycemia begetting further hypoglycemic episodes*. In addition to the usual causes, stressful situations have also been shown to precipitate hypoglycemic episodes in people with type 1 and type 2 diabetes mellitus [22]. Apart from the life-threatening neuroglucopenic symptoms, recurrent episodes of hypoglycemia result in diminished psychological wellbeing and quality of life. Hence, hypoglycemia needs to be prevented at all costs. Use of telemedicine has been shown to reduce the risk of moderate hypoglycemia in diabetic patients [23].

- Through teleconsultations, physicians/diabetes educators should make patients aware of the common symptoms of hypoglycemia, especially those on insulin and sulfonylureas. Skipping of meals should be discouraged.
- The need for monitoring capillary blood glucose at bedtime for patients on basal-bolus regimen should be repeatedly emphasized, as it might prevent them from unknowingly slipping into nocturnal hypoglycemia while being asleep.
- Anti-diabetic regimens should be promptly reconsidered following a hypoglycemic episode via online consultations.
- In addition, patients and their caregivers should be educated about the measures that could be readily instituted at home in an unfortunate situation of hypoglycemia. Patients could be advised to keep a stock of glucose (like Glucon D) at home. Often overlooked is the need to take a regular meal following termination of an episode of hypoglycemia with oral carbohydrate [22]; the same should be re-emphasized during teleconsultations.

6. Coping with other complications:

- Patients, especially people with type 1 diabetes mellitus, should be made aware of the common symptoms of diabetic ketoacidosis (DKA) and when to call for help.
- Measures to prevent DKA and following sick-day guidelines including non-omission of insulin should be reiterated.
- Patients with retinopathy on intravitreal injections or prior history of retinal photocoagulation should be educated regarding the red flags of retinopathy and when to consult an ophthalmologist urgently.
- Routine foot care practices should be continued.

7. Psychosocial issues:

- Patients should feel free to discuss psychological issues with their routine physicians via telecommunication medium. In addition, physicians should also routinely enquire about the status of mental health of the diabetic patients.
- Physicians/diabetes educators can in turn coordinate teleconsultations with practicing psychiatrists to help patients

cope with psychological problems amid the ongoing pandemic.

- A simple way to help patients cope with psychological stress is to voluntarily give up the feeling of being locked up in home and in return spend quality time with their near and dear ones. Another mean of avoiding undue stress is to intentionally minimize watching, reading or listening to news about COVID-19 [6].

8. Diabetes self-management education in India: barriers and solutions

1. Attitude barrier: Many individuals lack confidence in the importance of home-based care in diabetes management. Counseling requires individualized approach depending on patient's needs.
2. Communication barrier: Good reference books, educational videos and other scientific information could be provided to patients having internet access using mHealth technology and telemedicine.
3. Cultural barrier: As has already been narrated, consumption of high carbohydrate meals and 'ghee' (saturated fats) is a norm in India. 'Three major meals' diet is more popular over small frequent meals. Therefore, meal plans must be individualized to meet the total calorie goals.
4. Socioeconomic barrier: Poor access to patient-centered care, internet and lack of affordability in maintaining a good balanced diet remains a concern for poor patients like laborers during country wide lockdown. Government can find a way to provide them with free high quality generic drugs and educational pamphlets.
5. Social distancing: Government directives ensuring continued supply of medications and provision of essential investigations for patients are highly welcome.
6. Legal barrier: Physicians always have been skeptical about using telemedicine in their practice owing to lack of definite legislation in India. Recent Government guidelines issued by the Ministry of Health and Family Welfare on teleconsultations have enabled physicians to facilitate self-management via teleconsultations after overcoming this barrier [24].

9. Conclusions

A team based diabetes self-management education and support system comprising of general physicians, endocrinologists, diabetes educators, nutritionists, ophthalmologists, podiatrists and psychiatrists have a pivotal role to play in diabetes care amid the ongoing COVID-19 pandemic. A close coordination between patients and physicians is required to meet the desired success.

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Declaration of competing interest

The authors declare that they have no conflicts of interest.

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References

- [1] Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, et al. Clinical characteristics of coronavirus disease 2019 in China [Internet] *N Engl J Med* 2020 [cited 2020 Mar 20]; Available from: <http://www.nejm.org/doi/10.1056/NEJMoa2002032>.
- [2] Gupta R, Ghosh A, Singh AK, Misra A. Clinical considerations for patients with diabetes in times of COVID-19 epidemic. *Diabetes Metab Syndr Clin Res Rev* 2020;14:211–2.
- [3] Guan W, Liang W, Zhao Y, Liang H, Chen Z, Li Y, et al. Comorbidity and its impact on 1590 patients with covid-19 in China: a nationwide analysis. *Eur Respir J* 2020;2000547.
- [4] Pal R, Bhansali A. COVID-19, diabetes mellitus and ACE2: the conundrum. *Diabetes Res Clin Pract* 2020;108132.
- [5] Xue T, Li Q, Zhang Q, Lin W, Wen J, Li L, et al. Blood glucose levels in elderly subjects with type 2 diabetes during COVID-19 outbreak: a retrospective study in a single center [Internet]. *Endocrinology (including Diabetes Mellitus and Metabolic Disease)*, [cited 2020 Apr 8]. Available from: <http://medrxiv.org/lookup/doi/10.1101/2020.03.31.20048579>; 2020.
- [6] Mental health and psychosocial considerations during the COVID-19 outbreak. Accessed April 9, 2020. [Internet]. Available from: <https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf>.
- [7] Roy T, Lloyd CE. Epidemiology of depression and diabetes: a systematic review. *J Affect Disord* 2012;142:58–21.
- [8] Raval A, Dhanaraj E, Bhansali A, Grover S, Tiwari P. Prevalence and determinants of depression in type 2 diabetes patients in a tertiary care centre. *Indian J Med Res* 2010;132:195–200.
- [9] Yang Y, Shang W, Rao X. Facing the COVID-19 outbreak: what should we know and what could we do? [Internet] *J Med Virol* 2020 [cited 2020 Apr 9]; Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1002/jmv.25720>.
- [10] American Diabetes Association. 5. Facilitating behavior change and well-being to improve health outcomes: *Standards of medical Care in diabetes—2020*. *Diabetes Care* 2020;43:S48–65.
- [11] Funnell MM, Brown TL, Childs BP, Haas LB, Hoseney GM, Jensen B, et al. National standards for diabetes self-management education. *Diabetes Care* 2010;33: S89–96.
- [12] Glasgow RE, Peeples M, Skovlund SE. Where Is the Patient in Diabetes Performance Measures?: the case for including patient-centered and self-management measures. *Diabetes Care* 2008;31:1046–50.
- [13] Haas L, Maryniuk M, Beck J, Cox CE, Duker P, Edwards L, et al. National standards for diabetes self-management education and support. *Diabetes Care* 2012 Nov 1;35:2393–401.
- [14] Misra A, Sharma R, Gulati S, Joshi SR, Sharma V, Ghaffoorunissa, et al. Consensus dietary guidelines for healthy living and prevention of obesity, the metabolic syndrome, diabetes, and related disorders in asian Indians. *Diabetes Technol Therapeut* 2011;13:683–94.
- [15] Misra A, Nigam P, Hills AP, Chadha DS, Sharma V, Deepak KK, et al. Consensus physical activity guidelines for asian Indians. *Diabetes Technol Therapeut* 2012;14:83–98.
- [16] Kaur R. Diabetes self-management education programs: current scenario and relevance in India. *Epidemiol Int* 2017;2:4–8.
- [17] Basu S, Sharma N. Diabetes self-care in primary health facilities in India - challenges and the way forward. *World J Diabetes* 2019;10:341–9.
- [18] Joshi SR, Bhansali A, Bajaj S, Banzal SS, Dharmalingam M, Gupta S, et al. Results from a dietary survey in an Indian T2DM population: a STARCH study. *BMJ Open* 2014;4:e005138.
- [19] Gulati S, Misra A. Sugar intake, obesity, and diabetes in India. *Nutrients* 2014;6:5955–74.
- [20] Ko G, Kalantar-Zadeh K, Goldstein-Fuchs J, Rhee C. Dietary approaches in the management of diabetic patients with kidney disease. *Nutrients* 2017;9:824.
- [21] Kelly JT, Reidlinger DP, Hoffmann TC, Campbell KL. Telehealth methods to deliver dietary interventions in adults with chronic disease: a systematic review and meta-analysis. *Am J Clin Nutr* 2016;104:1693–702.
- [22] Kalra S, Mukherjee J, Ramachandran A, Saboo B, Shaikh S, Venkataraman S, et al. Hypoglycemia: the neglected complication. *Indian J Endocrinol Metab* 2013;17:819.
- [23] Hu Y, Wen X, Wang F, Yang D, Liu S, Li P, et al. Effect of telemedicine intervention on hypoglycaemia in diabetes patients: a systematic review and meta-analysis of randomised controlled trials. *J Telemed Telecare* 2019;25: 402–13.
- [24] Telemedicine practice guidelines. Accessed March 27, 2020. Available from: <https://www.mohfw.gov.in/pdf/Telemedicine.pdf>.