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Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_269_20

Self-care practices and factors influencing self-care among type 2 diabetes mellitus patients in a rural health center in South India

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Abstract:

BACKGROUND: Self-care for diabetes is very important in preventing complications of diabetes and also improving quality of life. This study aims to find the various self-care practices of type 2 diabetes patients who are being treated at a rural health center of a medical college and the factors influencing self-care.

MATERIALS AND METHODS: This is a hospital-based cross-sectional study. Type 2 diabetes patients registered and receiving treatment from the noncommunicable disease clinic of a rural health center were administered a pretested questionnaire, developed based on different diabetes self-care questionnaires making changes as appropriate and including most aspects of self-care practices. The proportion of compliant was then cross-tabulated with background characteristics and their glycated hemoglobin (HbA1c) levels. SPSS version 16.0 was used for the analysis.

RESULTS: Among 390 patients with a mean age 56 years, 25.5% adhered to at least four dietary modifications, 46% were physically active, and 57% had good compliance to drugs; hypoglycemia prevention practices ranged from 21% to 51%. Except for avoiding barefoot walking (90%), other foot-care practices were followed by only a quarter of them. Among ever users, 69.2%, 64.3%, and 29.4% have quit smoking, alcohol, and tobacco use, respectively. Adherence to dietary modifications and drug compliance were associated with a lower HbA1c level of ≤ 7 g% ($P < 0.05$).

CONCLUSION: In this study, the compliance to physical activity or medications is much better than dietary changes and foot-care practices. Focused education programs and monitoring during follow-up visits will improve self-care in the less adhered to aspects. Those who are adherent to dietary modifications and drugs have better glycemic control.

Keywords:

Dietary modifications, drug compliance, rural center, self-care practices, type 2 diabetes

Introduction

Type 2 diabetes is increasing in epidemic proportions across the globe. The increase in prevalence is marked in developing countries including India, and unlike previously believed, it is no more a problem of cities and towns alone, but the upsurge is felt in rural population as well.^[1-3] The responsibility of provision of

preventive and therapeutic health-care services naturally falls on the doctors in the primary health centers and rural health centers of medical colleges, as there is not much private or tertiary level hospitals to care for the health demands of the diabetic patients in the village areas.^[4-6]

The management of type 2 diabetes requires a multipronged team approach to test, treat,

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How to cite this article: Durai V, Samya V, Akila GV, Shriram V, Jasmine A, Muthuthandavan AR, *et al.* Self-care practices and factors influencing self-care among type 2 diabetes mellitus patients in a rural health center in South India. *J Edu Health Promot* 2021;10:151.

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Received: 27-03-2020

Accepted: 20-04-2020

Published: 20-05-2021

follow up, educate, screen for complications, and counsel the patients who are diagnosed with the condition.^[7,8] These being the role of the health-care personnel, it is wrong to underestimate the role of the patients in terms of dietary modifications, lifestyle changes, compliance to medications, foot care, self-monitoring of blood sugars, etc., Self-care for diabetes is very important in preventing complications in diabetes and better quality of life.^[9,10] Simple measures taken at the right time such as reporting hypoglycemic episodes to the physician can potentially avert lot of morbidity and even mortality. Furthermore, early care seeking will cut down on the health expenditure that occurs if left untreated.^[11]

Even if patients are imparted with (having) a reasonable level of knowledge about the risk factors of diabetes, treatment, target blood values, ways of self-care, importance of compliance to drugs, frequent checking of blood sugars, etc., many times, it is not translated into a change in behavior.^[12-14] Self-care for diabetes is met with a lot of challenges and barriers including unclear advices from medical practitioners, family cooperation, cost of care, distance from medical centers, and cultural differences between families and the health-care provider.^[15-18]

Assessing the self-care practices through questionnaires in any center will help the health providers to know the level of compliance to different aspects of self-care among the treated people and also be an eye-opener on the gaps in communication, the barriers in adopting the advices of doctors, and clarifying doubts if any. Various measures such as education program, counseling sessions, and periodical monitoring may be adopted to improve the adherence to self-care practices so that the complications associated are brought down to a great extent and also better glycemic control achieved.

Objectives

This study aims to find the various self-care practices of type 2 diabetes patients who are being treated at a rural health center of a medical college and the factors influencing self-care.

Materials and Methods

Study setting

This is a hospital-based cross-sectional study. It is a part of an institutionally funded project done at a rural health and training center (RHTC) at Vayalanallur, Thiruvallur district, under community medicine department of a medical college hospital in Tamil Nadu, South India. Data were collected from patients who attended the outpatient department (OPD) between January and March 2017.

Inclusion criteria

Type 2 diabetes patients registered and receiving treatment from the noncommunicable disease (NCD)

clinic of the center who were diagnosed at least 6 months ago were included in the study. Around 800 patients have been registered under the NCD clinic. Three hundred patients with hypertension alone and another 100 patients on irregular follow-up were excluded from the study. Of the remaining patients, those who consented were included in this study.

Background details on demography and disease were collected using a questionnaire and also laboratory investigations were performed to assess their glucose parameters. Self-care practices were assessed based on a pretested questionnaire, and the patients were assessed on adherence to medications, physical activity, dietary practices, foot care, and other life style practices. This was developed after verifying other diabetic self-care questionnaires and various studies on self-care practices in India and around the world.^[19-21] For example, in the summary of diabetes self-care activities measure questionnaire, we found the diet and glucose monitoring in this to be not very relevant for this population.^[20] Furthermore, questions on quitting of smokeless tobacco or alcohol which are prevalent practices have not been included. Necessary additions, deletions, and modifications of the variables were made that would be applicable to the study population. A team of endocrinologists, physicians, and the diabetic caregivers examined the face and content validity of the questionnaire. A pilot study was done among 25 diabetics at the endocrine OPD of the medical college hospital to check the comprehension and reproducibility of the questionnaire.

Ethical considerations

Informed consent was obtained from all the participants after explaining the study. Institutional ethics committee approval was obtained before the start of the study (Ref no. IEC-NI/16/NOV/56/81). After data collection, the patients were gathered in small groups and health education on self-care practices was given with specific focus on the areas where there was an identified gap in self-care and their doubts if any were clarified.

Adherence is the extent to which the patient follows the advice to the medication, diet, and life style changes as proposed by the medical practitioner.^[22] Data on their dietary practices, namely intake and frequency of intake of high fat food, fruits, vegetables, wheat/millet-based diet, roots and tubers, and sweets/sugary drinks were collected. The following were considered for dietary adherence: low intake of high fat food, at least 3–4 servings of fruits and vegetables per day, intake of wheat/millet-based diet at least thrice a week, low intake of roots and tubers (never or fortnightly intake), and low intake of sugars and sugary drinks (never or fortnightly intake).

Patients were considered to be physically active if they exercised for ½ h or more for at least 3 days a week. Medication adherence among type 2 diabetes mellitus patients was assessed by a questionnaire developed using Morisky Medication Adherence Scale, Hill-Bone Compliance to High Blood Pressure Therapy Scale, and Adherence to Refills and Medications Scale after making minor changes.^[23] There were a total of 10 questions in the final questionnaire. Using 4-point Likert scale for each question, total score was calculated. A total score of more than 27 was considered as good adherence.

Compliance on cessation of smoking and alcohol consumption after diagnosis of diabetes was also collected. Patients' knowledge of the target fasting blood sugar (FBS) and postprandial blood sugar (PPBS) values and their latest (current) FBS and PPBS values were assessed, as this one is closely linked with their glucose monitoring, hypoglycemia care as well as drug adherence. Self-care practices for hypoglycemic symptoms were also collected. Details regarding their foot care such as regular inspection of feet, constant wearing of footwears while going outside, washing feet with warm water and applying lotion, and wearing footwear with soft-sole (MCR) were collected.

Statistical analysis

Proportion was calculated for descriptive statistics. Chi square test was used as the test of significance for proportions and a p-value less than 0.05 was considered statistically significant.

Statistical Package for Social Sciences (SPSS) version 16 (IBM Corporation, Somers, New York, USA) software was used for the statistical analysis.

Results

There were 390 type 2 diabetes patients who participated in this study. The mean age of the participants was 56.17 (10.4) years. Of them, 73.3% were female. More than half the patients were in the overweight/obese category. Most of the participants took oral hypoglycemic agents, whereas only 18 (4.6%) took insulin. Background characteristics are given in Table 1.

Dietary modifications

Wheat- or millet-based diet was consumed by 209 (53.5%) patients on a daily basis. Three-fourth of the patients consumed vegetables only once daily (lunch). The number of times was understood better than serves which was very misleading. The fruit intake was very low – daily by 31 (8%) patients. Three-fourth (76%) of the population have cut down on roots and tubers. Close to 27% (among whom, 90% were nonvegetarians previously) have stopped consuming nonvegetarian food after diagnosed

to have diabetes or after developing some complication. Details of dietary modifications are given in Table 2.

Table 1: Background characteristics (n=390)

Variables	n (%)
Age (years)	
<60	252 (64.6)
60 and above	138 (35.4)
Sex	
Males	104 (26.7)
Females	286 (73.3)
Education	
Uneducated	135 (34.6)
Primary school	117 (30)
High school and above	137 (35.1)
Working status	
Unemployed	260 (66.7)
Employed	126 (32.3)
Duration of DM (years)	
<5	224 (57.4)
5-10	100 (25.6)
>10	55 (14.1)
BMI	
Normal (18.5- 24.99)	159 (40.8)
Overweight (25.00- 29.99)	147 (37.7)
Obese (≥ 30)	80 (20.5)
HbA1c levels (g%) (n=376)	
≤7	236 (62.8)
>7	140 (37.2)
Medications	
OHA	372 (95.4)
Insulin + OHA	18 (4.6)

OHA=Oral hypoglycemic agent, DM=Diabetes mellitus, BMI=Body mass index, HbA1c=Glycated hemoglobin

Table 2: Diet modifications by the study participants

Modifications in diet (n=390)	n (%)
Wheat/millet-based diet	
Daily	209 (53.5)
Weekly thrice or more	66 (17)
Intake of vegetables	
Daily	331 (84.9)
Weekly	48 (12.3)
Intake of roots/tubers	
Monthly/rarely	297 (76.2)
Intake of fruits	
Daily	31 (7.9)
Weekly thrice or more	21 (5.4)
Less frequently	338 (86.7)
Intake of nonvegetarian food	
Weekly	222 (56.9)
Monthly	51 (13.1)
Rarely/stopped	104 (26.7)
Intake of sweets/sugary drinks	
Rarely/never	310 (79.5)
Sugar in coffee/tea	
Decreased to half levels	183 (47)
Stopped	74 (19)

An individual was considered to be adherent to dietary modifications if he/she follows these, namely rare or fortnightly intake of sugary substances, roots/tubers, and intake of wheat- or millet-based diet daily or at least thrice a week; fruit or vegetable intake 3–4 times a day; and low intake of high fat diet. Only 99 (25.4%) had dietary adherence to any four practices and 176 (45.1%) were adherent to any three dietary practices.

A higher proportion of participants who were adherent to four or more dietary practices had lower glycated hemoglobin (HbA1c) level of $\leq 7\%$ compared to those who were less adherent. This difference in proportion was found to be statistically significant ($P = 0.006$) [Table 3].

Physical activity

Walking or yoga for at-least ½ h for 3 or more days in a week was followed by 178 (46%) of the study participants [Figure 1]. Of these, only 6 people performed yoga and the rest did walking. On cross-tabulation, males were more physically active (65%) compared to females (39%), and this difference was statistically significant ($P = 0.000$) (not shown in table). However, there was no statistically significant difference between physically active population and the less active ones on the level of HbA1c ($P = 0.702$) [Table 3].

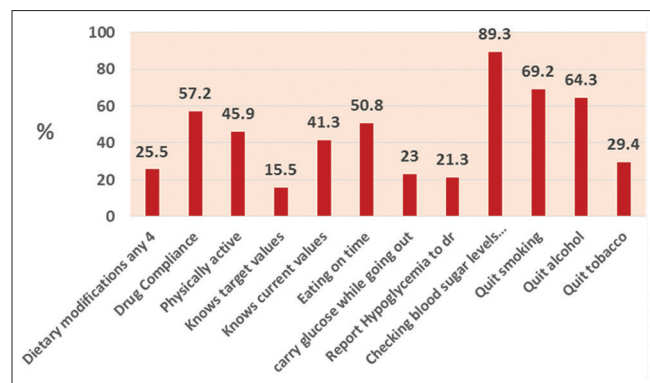


Figure 1: Bar chart showing self-care practices followed by the study participants

Compliance to medications

Among the diabetics, 57.2% were found to be highly compliant with their medications [Figure 1]. The compliance was not associated with sex, age, or their education status, but those with good compliance had a lower HbA1c level $<7\%$ (68%) compared to the less compliant (55.6%) ($P = 0.016$) [Table 3].

Foot care

Most diabetics followed walking outdoors with footwears (90%). A quarter of them inspected their feet regularly [Figure 2]. Just 1.5% checked feet at the clinic in the last month. However, this gap can be attributed to the care provision at the health center during that visit.

Self-care to prevent hypoglycemia

Half of the patients (51.2%) reported taking timely meals to avoid episodes of hypoglycemia. However, just only 21.3% reported symptoms of hypoglycemia to the physician [Figure 1].

Blood glucose monitoring

Although insulin was taken by 4.6% of the study subjects, none of them had a self-glucose monitoring device. However, 90% of them regularly checked their blood glucose levels (FBS and postprandial) once in 3 months at the RHTC [Figure 1]. However, 5% of them checked

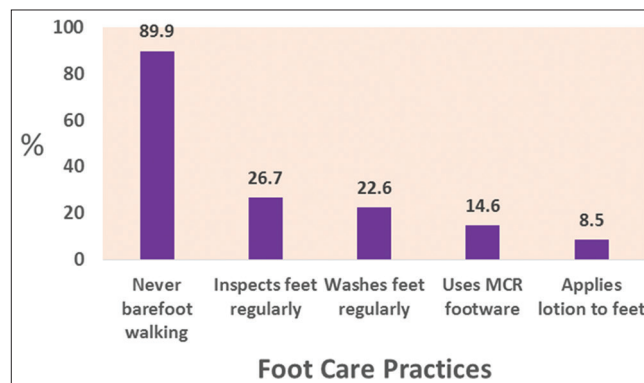


Figure 2: Diabetic foot-care practices among the study participants

Table 3: Association of self-care practices with glycated hemoglobin depicting diabetic control

Self-care practices	n (%)	HbA1c levels, n (%)		P
		≤ 7	> 7	
Adherence to drugs				
Good	214 (57.2)	145 (67.8)	69 (32.2)	0.016*
Poor	160 (42.8)	89 (55.6)	71 (44.4)	
Adherence to at least four dietary practices				
Yes	96 (25.5)	49 (51)	47 (49)	0.006*
No	280 (74.5)	187 (66.8)	93 (33.2)	
Physically active				
Yes	172 (45.9)	106 (61.6)	66 (38.4)	0.702
No	203 (54.1)	129 (63.5)	1. (36.5)	

* $P < 0.05$. HbA1c=Glycated hemoglobin

their levels very infrequently and the remaining 5% more frequently.

The awareness on current (most recent) FBS and PPBS values was higher 161 (41.3%) compared to that of target values 60 (15.5%) [Figure 1]. The awareness on target levels was higher among males, those with higher educational levels and those with duration of diabetes more than 5 years. ($P < 0.05$) However, these differences were not significant with the knowledge of current values where the distribution was almost similar. However, this difference in awareness did not have any effect on the HbA1c levels [Table 4].

Quit smoking, tobacco, and alcohol

Among the participants, 26 (6.7%) were ever smokers, 28 (7.2%) were ever consumers of alcohol, and 17 (4.4%) were tobacco users. All the smokers and alcohol consumers were males, whereas among tobacco consumers, 11 (65%) were females. After having been diagnosed with diabetes, 69.2%, 64.3%, and 29.4% had quit smoking, alcohol, and tobacco use, respectively [Figure 1]. More females (4 [36.3%]) compared to males (1 [17%]) quit tobacco.

Discussion

This cross-sectional study was done among 390 type 2 diabetic patients at the diabetic clinic of a RHTC attached to a medical college to assess the self-care practices adopted by diabetes patients to maintain good blood sugar control and to prevent the different complications using a pretested questionnaire.

With respect to dietary modifications, cessation or reduction in intake of foods such as sugary or fatty foods, roots and tubers, and nonvegetarian foods was practiced by a higher proportion of diabetics

compared to addition or increase in intake such as more fruits and vegetable servings per day. However, 54% included wheat- or millet-based food everyday. Almost 70%–80% had cut down on the intake of sugar in coffee/tea as well as sweets and sugary drinks. Increasing the number of servings was reported to be difficult for them due to cost and partaking by all the family members.^[15,24] Furthermore, millets is reported to be culturally more acceptable among south Indians compared to wheat-based foods.^[15] Moreover, it is evident from this study that adherence to dietary modifications is associated with a lower HbA1c (≤ 7 g%) as reported in other studies.^[25,26]

Regular physical activity was practiced by 46% of the patients, but more males than females were physically active which was expected. Many females have perceived joint pain and fear of giddiness or fall as barrier to walking in another study,^[15,27] whereas a study from Eastern India quotes lack of time and unwillingness as main barriers.^[28] However, physical activity was not associated with lower HbA1c levels which is in contrast with other studies.^[18,26]

Close to 60% of the study participants were highly compliant to their medications. In other studies in India, it shows a wide range from 55% to 92.5%.^[29-31] Compliance to medications will help in maintaining better blood glucose control which is reported from many studies and the same is evident from this study too.^[32] Not only drugs but compliance to cessation of smoking and alcohol was also present in two-third of the participants, although tobacco quitting was less common (30%). However, very few studies have looked for these practices.^[29,33] However, one study in a nearby area shows high knowledge about a role of smoking and alcohol in the disease causation among rural diabetics.^[34]

Table 4: Association of awareness of target and current fasting blood sugar and postprandial blood sugar values with the background characteristics

Background characteristics	n	Knowledge of target FBS or PPBS values		P	Knowledge of current FBS or PPBS values		P
		n (%)	n (%)		n (%)	n (%)	
Sex							
Male	104	23 (23.3)	79 (76.7)	0.011*	46 (44.2)	58 (55.8)	0.476
Female	286	36 (12.7)	248 (87.3)		115 (40.2)	171 (59.8)	
Education							
Primary or less	252	23 (9.2)	227 (90.8)	0.000*	97 (38.5)	155 (61.5)	0.116
Greater than primary education	137	37 (37.2)	99 (72.8)		64 (46.7)	73 (53.3)	
Duration of diabetes (years)							
Up to 5	224	26 (11.6)	198 (88.4)	0.032*	98 (38.5)	126 (43.8)	0.138
>5	155	30 (19.6)	123 (80.4)		56 (36.1)	99 (63.9)	
HbA1c (g%)							
≤ 7	236	33 (14)	202 (86)	0.323	100 (57.6)	136 (42.4)	0.557
>7	140	25 (17.9)	115 (82.1)		55 (39.3)	85 (60.7)	

* $P < 0.05$. FBS=Fasting blood sugar, PPBS=Postprandial blood sugar

Except for constant wearing of footwear (90%), the other foot-care practices were followed by less than a quarter of the patients. Foot-care practices are typically low in most Indian studies.^[34-36] Foot examination at the clinic during the last month has been reported by only 1.5% which represents the gap at the health provider level more than the patients themselves. The health care providers at the rural centre have been instructed to perform a detailed foot examination of every diabetic patient at-least once in a year and also the patients have been educated on the importance of foot care and the measures to be taken.

Hypoglycemic symptoms were reported by 57% of the study participants and were precipitated by missing or delayed meal in 90% of the participants in this study.^[37] However, only half of the patients reported having timely meals which was much lower compared to another study done in a tertiary care setup.^[13] Moreover, less than a quarter of them practiced carrying glucose packets while going out and reporting symptoms to the physician. A study done from a similar background shows that the knowledge among the diabetics on the symptoms, precipitating factors, and timely foods for prevention was high to the order of 70%–90%.^[12] However, a qualitative study shows that the cooperation of family members plays a significant role in choice and timing of food.^[15]

Although self-monitoring of blood glucose (SMBG) has been shown to help in better glycemic control, it is not routinely prescribed for type 2 diabetics. Moreover, this is a rural setup with patients from a poor affordability. Hence, the physicians do not recommend SMBG routinely to patients. However, most patients were compliant in their three monthly laboratory checkups similar to other studies.^[13,34] This is closely linked with the awareness levels on target and current blood sugar values. More people knew their current blood sugar levels (41%), but very less people knew their target levels (15%). Although in this study, there is no statistically significant difference in the awareness about the current levels, more men than women, those with a higher educational status and longer duration of disease, knew the target level sugar values. There are charts at RHTC depicting these values at the laboratory which is not being observed by the beneficiaries. Knowledge of both current and target levels let them know how far they are from the control values. This in itself might motivate them to adopt better self-care practices.

The strength of this study is that it has not only included all the aspects of diabetic self-care but also made it applicable to the study population. This study sheds light on the gaps in self-care practices, especially in dietary practices which shows that discontinuation of a dietary item is more easily adopted compared

to addition – doctors must suggest diet that is easily accessible, culturally appropriate, or may be easy to prepare. Lower proportion of people quitting tobacco in comparison to smoking or alcohol – maybe tobacco (smokeless) – was not much inquired into by the health professional. The target levels must be informed to them every time since diagnosis by the laboratory technician and the doctor to motivate them. Importance of timely meals to be emphasized frequently and doctors must actively inquire about hypoglycemic symptoms to improve reporting of such episodes. Foot-care practices are one of the least, demanding more frequent examinations by the doctors and targeted health education by the nurses and other caregivers.

The limitations of this study is that only a fourth of the participants were males and two-third were unemployed or retired. This does not overlap with the diabetes prevalence in the population. This is because the study was done in the rural center and not as a population-based study. However, evidence shows that even population-based studies do have this limitation.^[34,38,39]

Conclusion

Self-care by the diabetics on various aspects plays the vital role in better glycemic control and prevention of vascular complications and sudden death. In this study, the compliance to physical activity or medications is much better than dietary changes and foot-care practices. Those who are adherent to dietary modifications and drugs have better glycemic control. Periodic education sessions and one-on-one counseling sessions along with follow-up monitoring with brief questionnaires may help to improve the areas of self-care among diabetics.

Financial support and sponsorship

Financial Assistance was provided by GATE, SRIHER – 2016-17; Rs. 100,000/-.

Conflicts of interest

There are no conflicts of interest.

References

1. Nanditha A, Snehalatha C, Sathesh K, Priscilla S, Mary S, Lakshminarayanan V, *et al.* Secular trends in diabetes in India (STRiDE-I): Change in prevalence in 10 years among urban and rural populations in Tamil Nadu. *Diabetes Care* 2019;42:476-85.
2. Little M, Humphries S, Patel K, Dewey C. Decoding the Type 2 diabetes epidemic in Rural India. *Med Anthropol* 2017;36:96-110.
3. Misra P, Upadhyay RP, Misra A, Anand K. A review of the epidemiology of diabetes in Rural India. *Diabetes Res Clin Pract* 2011;92:303-11.
4. Tripathy JP, Sagili KD, Kathirvel S, Trivedi A, Nagaraja SB, Bera OP, *et al.* Diabetes care in public health facilities in India:

- A situational analysis using a mixed methods approach. *Diabetes Metab Syndr Obes* 2019;12:1189-99.
5. Rao MB, Manja P, Željko M. Organization of diabetes health care in Indian rural areas. *Diabetol Croat* 2002;31:161-71.
 6. Lall D, Engel N, Devadasan N, Horstman K, Criel B. Challenges in primary care for diabetes and hypertension: An observational study of the Kolar district in rural India. *BMC Health Serv Res* 2019;19:44.
 7. McGill M, Blonde L, Chan JC, Khunti K, Lavalley FJ, Bailey CJ *et al.* The interdisciplinary team in Type 2 diabetes management: Challenges and best practice solutions from real-world scenarios. *Clin Transl Endocrinol* 2016;7:21-7.
 8. Linda S. Team Care the preferred approach to diabetes treatment. *US Endocrinol* 2015;11:75-6.
 9. Zhao FF, Suhonen R, Katajisto J, Stolt M, Leino-Kilpi H. Association between diabetes-related self-care activities and positive health: A cross sectional study. *BMJ Open* 2019;9:e023878.
 10. Shrivastava SR, Shrivastava PS, Jegadeesh R. Role of self-care in management of diabetes mellitus. *J Diabetes Metab Disord* 2013;12:14.
 11. Yesudian CA, Grepstad M, Visintin E, Ferrario A. The economic burden of diabetes in India: A review of the literature. *Global Health* 2014;10:80.
 12. Shriram V, Mahadevan S, Anitharani M, Jagadeesh NS, Kurup SB, Vidya TA, *et al.* Knowledge of hypoglycemia and its associated factors among Type 2 diabetes mellitus patients in a Tertiary Care Hospital in South India. *Indian J Endocrinol Metab* 2015;19:37882.
 13. Shriram V, Mahadevan S, Anitharani M, Jagadeesh NS, Kurup SB, Vidya TA, *et al.* Reported hypoglycemia in type 2 diabetes mellitus patients: Prevalence and practices-a hospital-based study. *Indian J Endocrinol Metab* 2017;21:148-53.
 14. Hood KK, Hilliard M, Piatt G, Ievers-Landis CE. Effective strategies for encouraging behavior change in people with diabetes. *Diabetes Manag (Lond)* 2015;5:499-510.
 15. Rani MA, Shriram V. Are patients with Type 2 diabetes not aware or are they unable to practice self-care? A qualitative study in rural South India. *J Prim Care Community Health* 2019;10:2150132719865820.
 16. Glasgow RE, Toobert DJ, Gillette CD. Psychosocial barriers to diabetes self-management and quality of life. *Diabetes Spectr* 2001;14:33-41.
 17. Adu MD, Malabu UH, Malau-Aduli AE, Malau-Aduli BS. Enablers and barriers to effective diabetes self-management: A multi-national investigation. *PLoS One* 2019;14:e0217771.
 18. Ayele AA, Emiru YK, Tiruneh SA, Ayele BA, Gebremariam AD, Tegegn HG. Level of adherence to dietary recommendations and barriers among Type 2 diabetic patients: A cross-sectional study in an Ethiopian hospital. *Clin Diabetes Endocrinol* 2018;4:21.
 19. Jannoo Z, Khan NM. Summary of diabetes self-care activities: A confirmatory factor analytic approach. *Prim Care Diabetes* 2018;12:425-31.
 20. Schmitt A, Gahr A, Hermanns N, Kulzer B, Huber J, Haak T. The diabetes self management questionnaire (DSMQ): Development and evaluation of an instrument to assess diabetes self-care activities associated with glycaemic control. *Health Qual Life Outcomes* 2013;11:138.
 21. Shrivastava SR, Shrivastava PS, Ramasamy J. Role of self-care in management of diabetes mellitus. *J Diabetes Metab Disord* 2013;12:14. doi: 10.1186/2251-6581-12-14.
 22. García-Pérez LE, Alvarez M, Dilla T, Gil-Guillén V, Orozco-Beltrán D. Adherence to therapies in patients with Type 2 diabetes. *Diabetes Ther* 2013;4:175-94.
 23. Culig J, Leppée M. From Morisky to Hill-bone; self-reports scales for measuring adherence to medication. *Coll Antropol* 2014;38:55-62.
 24. Tewahido D, Berhane Y. Self-care practices among diabetes patients in Addis Ababa: A qualitative study. *PLoS One* 2017;12:e0169062.
 25. Alhariri A, Daud F, Almaiman A, Saghir SA. Factors associated with adherence to diet and exercise among Type 2 diabetes patients in Hodeidah city, Yemen. *Diabetes Manag* 2017;7:264-71.
 26. Marinho FS, Moram CB, Rodrigues PC, Leite NC, Salles GF, Cardoso CR. Treatment Adherence and its associated factors in patients with Type 2 diabetes: Results from the Rio de Janeiro Type 2 diabetes cohort study. *J Diabetes Res* 2018;2018:8970196.
 27. Sohal T, Sohal P, King-Shier KM, Khan NA. Barriers and facilitators for Type-2 diabetes management in South Asians: A systematic review. *PLoS One* 2015;10:e0136202.
 28. Pati S, Lobo E, Pati S, Desaraju S, Mahapatra P. Type 2 diabetes and physical activity: Barriers and enablers to diabetes control in Eastern India ERRATUM. *Prim Health Care Res Dev* 2019;20:e126.
 29. Srinath KM, Basavegowda M, Tharuni NS. Diabetic self care practices in rural Mysuru, Southern Karnataka, India a need for diabetes self management educational (DSME) program. *Diabetes Metab Syndr* 2016;11:S181-6.
 30. Venkatesan M, Dongre AR, Ganapathy K. A community-based study on diabetes medication nonadherence and its risk factors in rural Tamil Nadu. *Indian J Community Med* 2018;43:72-76.
 31. Dinesh PV, Kulkarni AG, Gangadhar NK. Knowledge and self-care practices regarding diabetes among patients with Type 2 diabetes in Rural Sullia, Karnataka: A community-based, cross-sectional study. *J Family Med Prim Care* 2016;5:847-52.
 32. Huang YM, Shiyanbola OO, Smith PD. Association of health literacy and medication self-efficacy with medication adherence and diabetes control. *Patient Prefer Adherence* 2018;12:793-802.
 33. Mohandas A, Bhasin S, Upadhyay M, Madhu S. Diabetes self care activities among adults 20 years and above residing in a resettlement colony in East Delhi. *Indian J Public Health* 2018;62:104.
 34. Shrivastava PS, Shrivastava SR, Ramasamy J. An epidemiological study to assess the knowledge and self care practices among Type 2 diabetes mellitus patients residing in rural areas of Tamil Nadu. *Biol Med* 2015;S3:2-4.
 35. Raithatha SJ, Shankar SU, Dinesh K. Self-care practices among diabetic patients in Anand district of Gujarat. *ISRN Family Med* 2014;2014:743791.
 36. Deepa LN, Murty P, Reddy M, Muninarayan C, Shetty S. Assessment of awareness and practice of foot care and physical activity among people with Type 2 diabetes attending a tertiary care teaching hospital. *Int J Community Med Public Health* 2017;4:3218-23.
 37. Samya V, Shriram V, Jasmine A, Akila GV, Rani MA, Durai V, *et al.* Prevalence of hypoglycemia among patients with Type 2 diabetes mellitus in a rural health center in South India. *J Prim Care Community Health* 2019;10:2150132719880638.
 38. Kushwaha AS, Kumari S, Kushwaha N. Self care in diabetes: A study amongst diabetics in an urban community. *Int J Community Med Public Health* 2016;3:293-8.
 39. Gopichandran V, Lyndon S, Angel MK, Manayalil BP, Blessy KR, Alex RG, *et al.* Diabetes self-care activities: A community-based survey in urban Southern India. *Natl Med J India* 2012;25:14-8.