

Assessment of Awareness, Knowledge and Skills towards Diabetes Mellitus and Its Complications in Coastal South Indian Diabetic Population: A Cross Sectional Study

Shaheen B. Shaikh ^{a#}, S. A. Amina ^{a‡}, H. M. Ismail ^{b‡}, A. M. Ciraj ^{c†}
and M. Poornima ^{d*‡}

^a Department of Biochemistry, Yenepoya Medical College Hospital, Mangaluru, Karnataka, India.

^b Department of Critical Care Medicine, Yenepoya Medical College Hospital, Mangaluru, Karnataka, India.

^c Department of Microbiology, CCEID, MAHE-FAIMER, Karnataka, India.

^d Department of Data Science and Computer Application, Manipal Institute of Technology, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/87617>

Original Research Article

Received 14 March 2022

Accepted 28 May 2022

Published 02 June 2022

ABSTRACT

Background: Diabetes mellitus (DM), is a metabolic disorder with an escalating health problem in India. Diabetes is a growing health concern in India, with half of the population at risk of developing the disorder at certain stages of life. Awareness and knowledge towards diabetes mellitus and its complication is the key to better treatment and control.

Objective: The aim of this study was to assess the awareness, knowledge and skills of Insulin injection Technique towards diabetes mellitus and its complications in coastal south Indian diabetic population.

Materials and Methods: A hospital based cross-sectional study was conducted among 336 subjects. A structured questionnaire was prepared and filled by diabetic patients to assess their

Associate professor;

* Post Graduate;

‡ Professor;

† Deputy Director, MAHE and Course Director;

* Corresponding author: Email: poornima.girish@manipal.edu;

knowledge, awareness and skill of Insulin injection Technique. The contents of this questionnaire included general ideas about DM, the importance of Glycemic control, general awareness of diabetes complications, knowledge about insulin and insulin injection techniques, target blood sugar levels, glycemic control in pregnancy, the importance of a diet/diet plan, the importance of physical activity and significance of physician follow up, these were read to the participants in their language of preference.

Results: Nearly half of the population (42%) had poor knowledge, awareness and skill and only 8% of the population had excellent knowledge and awareness toward diabetes mellitus and its complications. Among the study group, 70% of the males had poor knowledge/awareness, 90% were illiterate and 84%, were unemployed had poor knowledge/awareness of diabetics, and among patients with a history of alcohol 88% of the males had poor knowledge/awareness.

Conclusion: The findings from this study revealed a poor knowledge level, awareness and skills towards diabetes mellitus and its complications among the respondents, thus emphasizing the need for awareness among diabetic subjects for better control of diabetes mellitus.

Keywords: Diabetes mellitus; awareness; knowledge; skill.

1. INTRODUCTION

Diabetes mellitus (DM), a significant and chronic disease is an escalating health problem in India [1]. In India, a country with a 1.39 billion (139 cores) population, the estimated number of diabetes patients is 74.2 million in 2021, for the 20-79 years age group and is predicted to increase to 134 million in 2045. According to estimations, approximately 422 million adults live with diabetes mellitus globally [2] and suggested, in 2040 the global prevalence of diabetes mellitus will be 642 million due to sedentary lifestyles, rapidly growing urbanization, and modified diets [3].

Diabetes Mellitus is the most common cause of non-traumatic lower-limb amputations and cardiovascular diseases [4] thus increasing the risk of various micro-vascular and macro-vascular diseases such as coronary artery disease, blindness, stroke, kidney failure, foot amputation leading to increased morbidity [5,6]. Thus diabetes is a growing health concern in India, with half the population at risk of developing the condition at certain stages of life.

Awareness and knowledge of diabetes mellitus and its complication is the key to better treatment and control. Studies have revealed that the proportion of good knowledge regarding diabetes mellitus is 49.9% in India [7] and 28.2% in Indian rural states [7]. Low levels of knowledge were associated with poor diabetes management and its risk factors [8]. The level of literacy, availability of information and training received is directly related to the level of knowledge on diabetes [9] but in India, there is a shortage of trained personnel to provide education about diabetes

and its associated complications [10]. Thus a new survey on knowledge, attitudes, and skill about diabetes mellitus is needed. This study was designed to assess the awareness, knowledge, and skill toward diabetes mellitus and its complication which may promote early detection and management of diabetes mellitus.

The aim of this study was to assess the awareness knowledge and skills of diabetes mellitus and its complications in the coastal south Indian diabetic population.

2. MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted among three hundred thirty-six subjects aged 18 years and above, who visited for consultation at the Diabetic Out Patient Department. The survey was conducted from January 2021 to June 2021. Those diabetic patients who were critically ill during the data collection period were excluded from the study. A data collection tool was designed based on the study objective. A structured questionnaire was prepared and filled out by diabetic patients to assess their knowledge, awareness, and skill. The contents of this questionnaire included general ideas about DM, the importance of Glycemic control, general awareness of diabetes complications, knowledge about insulin and insulin injection techniques, target blood sugar levels, glycemic control in pregnancy, the importance of a diet/diet plan, the importance of physical activity and significance of physician follow up, these were read to the participants in their language of preference and were marked as "aware"/ "unaware". The socio-demographic information included age, sex, marital status,

education level, occupation, family history of DM, and history of smoking.

The questionnaire was validated for content and reliability by adopting a systematic, seven-step process [11]. A diabetes awareness questionnaire was validated by three diabetologists and suggestions were incorporated.

1. Conduct a literature review- to ensure that the construct definition aligns with relevant prior research and theory and to identify existing questionnaires or items that might be used or adapted. 2. Conduct interviews and/or focus groups- to learn how the population of interest conceptualizes and describes the construct of interest. 3. Synthesize the literature review and interviews/focus groups- to ensure that the conceptualization of the construct makes theoretical sense to scholars in the field and uses language that the population of interest understands. 4. Develop items/questionnaires - to ensure items are clear, understandable, and written in accordance with current best practices in survey design. 5. Conduct expert validation - to assess how clear and relevant the items are with respect to the construct of interest. 6. Conduct cognitive interviews- to ensure that respondents interpret items in the manner that the survey designer intends. 7. Conduct pilot testing - to check for adequate item variance, reliability, and convergent/ discriminate validity with respect to other measures.

2.1 Statistical Analysis

Data analysis was performed using the statistical package for social science (SPSS) version 23.0. Respondent's socio-demographic characteristics were stated using descriptive statistics. Frequency and percentage were used for the categorical variables.

3. RESULTS

Among 336 diabetic patients enrolled, 196 (58.3%) were males and 140 (41.7%) were females with a mean age of 55 ± 10 years. Among the participants, 24 (7.1%) were illiterate, 330 (98.2%) were married; 68 (20.2%) were unemployed and half of the participants (58.6%) were private employers. 210 (62.5%) of the patients had a positive family history of diabetes; nearly half of the male patients (47.6%) had a history of smoking and 41.07% of them had a history of alcohol consumption 58.9% had 5-10

years of diabetes duration. Sociodemographic characteristics of Diabetic Population are shown in Table 1.

While assessing the awareness about diabetes mellitus and complications, more than half of the patients lack knowledge on general ideas of DM, the importance of glycemic control, general awareness of diabetes complications, knowledge about insulin and insulin injection techniques, target blood sugar level, glycemic control in pregnancy, the importance of diet/diet plan, the importance of physical activity and significance of physician follow up. Participant's awareness about diabetes mellitus and complications are shown in Table 2 and in Fig. 1.

Among the study group, 70% of the males had poor knowledge/awareness, 90% were illiterate and 84%, were unemployed had poor knowledge/awareness of diabetics, and among patients with a history of alcohol 88% of the males had poor knowledge/awareness. Knowledge/ awareness of diabetes mellitus in the study population is tabulated in Table 3. It is clear that the majority of the population lack knowledge, awareness, and skill regarding diabetes mellitus, Fig. 2; nearly half of the population (42%) had poor knowledge, awareness, and skill and only 8% of the population had excellent knowledge and awareness toward diabetes mellitus and its complications.

4. DISCUSSION

Diabetes mellitus is results from absolute or relative insulin deficiency. Studies from both developed and developing countries have reported that the knowledge about DM is generally poor among diabetic patients [12,13]. Awareness, knowledge, and skills regarding diabetes vary depending on socioeconomic conditions, cultural beliefs, and habits. Public knowledge about diabetes helps to combat not only the disease but also its complications, and medical and socioeconomic consequences [13]. The current study showed that 65.47% of the study population was unaware of the general ideas of Diabetes Mellitus and 62.5% lacked knowledge about its complications. This result is similar to a study done by Minhat et al and Hamedon et al who reported, that only 41.9% of the population were aware and 58.1% had a poor level of understanding related to Diabetes Mellitus, which indicates knowledge and awareness regarding diabetes needs to be improved upon [14].

Table 1. Sociodemographic characteristics of diabetic population

Variables	Category	N=336	Percentage %	
Age (mean \pm SD)			55 \pm 10years	
Sex	Male	196	58.3%	
	Female	140	41.7%	
Educational status	Illiterate	24	7.1%	
	Primary school	30	8.9%	
	Secondary school	30	8.9%	
	Pre-university	60	17.8%	
	Undergraduate	152	45%	
	Post graduate	40	11.9%	
Marital status	Married	330	98.2%	
	Single	6	1.78%	
Occupation	Unemployment	68	20.2%	
	Housewife	36	10.7%	
	Government employer	35	10.4%	
	Private employer	197	58.6%	
Family history of Diabetes Mellitus.	Yes	210	62.5%	
	No	126	37.5%	
History of smoking	Male	Yes	160	47.6%
		No	36	10.7%
	Female	Yes	0	0%
		No	140	41.6%
History of alcohol	Male	Yes	138	41.07%
		No	58	17.26%
	Female	Yes	0	0%
		No	14	4.16%
Duration of diabetes	1-5 year	86	25.59%	
	5-10 year	198	58.9%	
	10-15 year	52	15.4%	

Table 2. Participants awareness about diabetes mellitus and complication

Variables	Aware	Unaware
General ideas of DM	116 (34.5%)	220 (65.47%)
Importance of glycemetic control	104 (30.9%)	232 (69.04%)
General awareness of diabetes complication	126 (37.5%)	210 (62.5%)
Knowledge about insulin and insulin injection techniques.	96 (28.57%)	240 (71.42%)
Target blood sugar levels	62 (18.45%)	274 (81.54%)
Glycemetic control in pregnancy	126 (37.5%)	210 (62.5%)
Importance of diet/diet plan	157 (46.7%)	185 (55.05%)
Importance of physical activity	144 (42.8%)	192 (57.14%)
Significance of physician follow up	117 (34.8%)	219 (57.14%)

Table 3. Knowledge/awareness of diabetes mellitus in study population

Variables	Category		Knowledge/awareness	
			Good knowledge	Poor Knowledge
Sex	Male		30%	70%
	Female		40%	60%
Educational status	Illiterate		10%	90%
	Primary school		20%	80%
	Secondary school		25%	75%
	Pre-university		30%	70%
	Undergraduate		36%	64%
	Post graduate		60%	40%
Marital status	Married		24%	76%
	Single		28%	72%
Occupation	Unemployment		16%	84%
	Housewife		22%	78%
	Government employer		25%	75%
	Private employer		30%	70%
Family history of DM	Yes		60%	40%
	No		22%	78%
History of smoking	Male	Yes	18%	82%
		No	16%	84%
	Female	Yes	20%	80%
		No	22%	78%
History of alcohol	Male	Yes	12%	88%
		No	14%	86%
	Female	Yes	18%	82%
		No	20%	80%
Duration of diabetes	1-5 year		18%	82%
	5-10 year		24%	76%
	10-15 year		27%	78%

In our study, 81.54% of diabetic patients lack knowledge about the target blood sugar levels. Studies have consistently shown that complications of DM can be reduced by improved glycemic control [15]. If blood glucose levels are not managed appropriately it could impair cellular function and may be lethal [16]. Adopting lifestyle interventions such as diet modifications and physical activity are important to maintain blood glucose levels and reduce long-term problems [17]. Regular exercise, limiting alcohol and smoking and healthy eating is the key to managing Diabetes Mellitus and achieving proper quality of life. 55.05% of our diabetic patients were unaware of a diet plan and 57.14% were unaware of the importance of physical activity. One of the barriers to this is a lack of knowledge and awareness regarding self-care activities [18].

Proper insulin injection and regular blood tests are indispensable for adequate control of diabetes mellitus [19]. More than 3.2 million

Indians with diabetes injecting insulin lack knowledge and skill about the insulin injection technique [20]. In our study, 71.42% of diabetic patients reported a lack of knowledge about insulin and insulin injection techniques. Studies conducted by sweidan et al., poudel et al., and pozzuoli et al. evaluated the knowledge and skills of diabetic patients regarding insulin technique. Of the examined participants nearly 75% had poor knowledge of the insulin technique [21]. 43 patients scrutinized showed substantial gaps concerning proper insulin injection technique [22] and among 352 Italian patients with Diabetes Mellitus, a high prevalence of lipodystrophy was reported due to errors in insulin injection technique [23]. Ji et al. conducted a national survey in China and highlighted practical errors in insulin injection among diabetic patients, 35.3% had lip hypertrophy, and more than half of the patients 58.7% had injection-related complications such as bleeding and bruising [24]. Studies conducted by Tumminia et al. [25] and Snyder et al. [26] showed that there is a positive

correlation between poor insulin injection knowledge and poor glucose control. This indicates there is a high need to enhance the knowledge and skill of insulin injection practices specifically among diabetic patients.

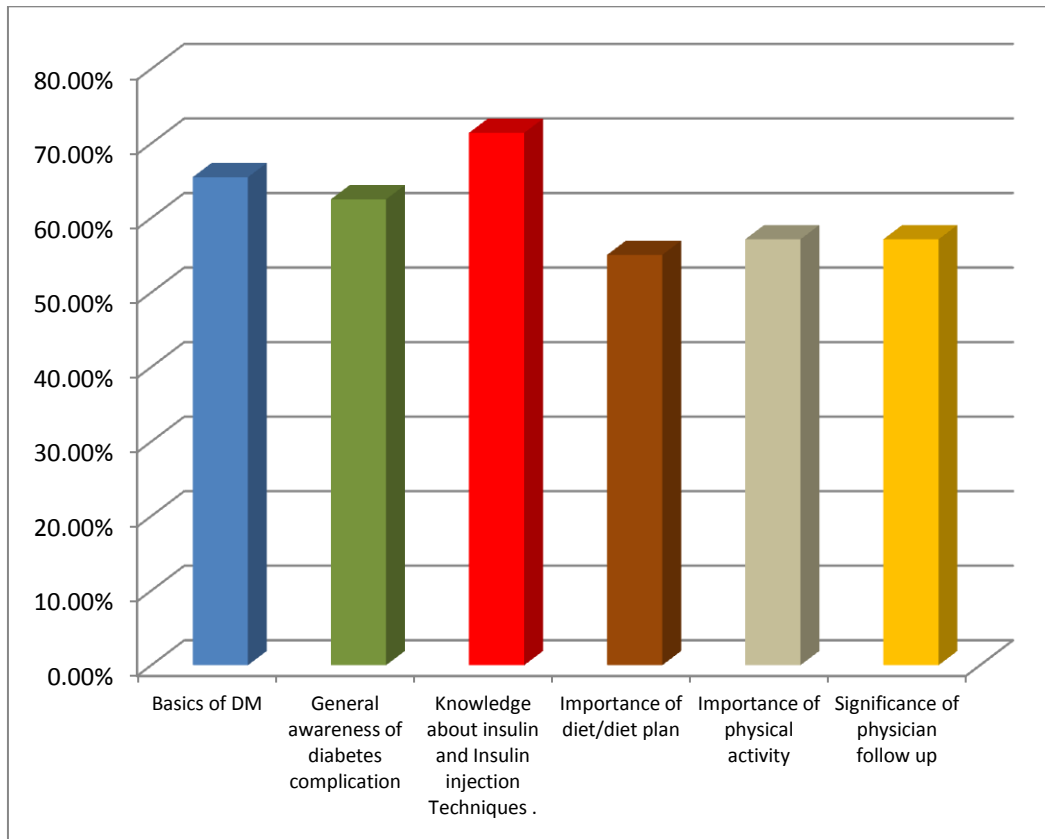


Fig. 1. Bar graph showing poor participants awareness about diabetes mellitus and complication

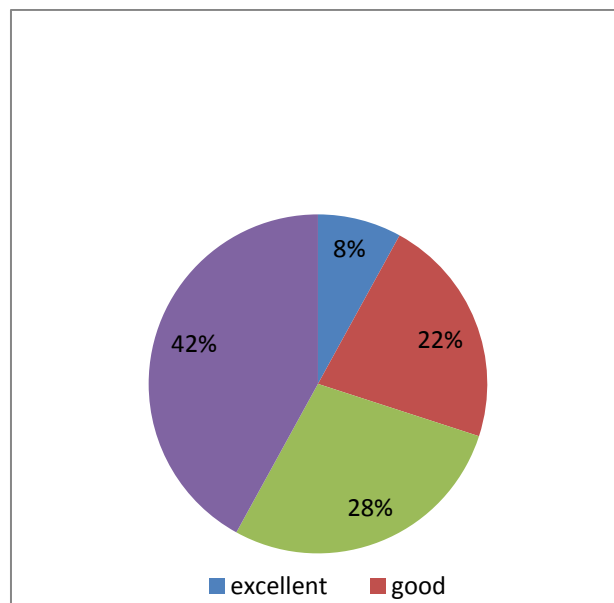


Fig. 2. Pie chart showing knowledge, awareness and skill of diabetes mellitus in study population

The follow-up and treatment of diabetic patients are complex and require cooperation between both patients and health care professionals. In our study 57.14% were unaware of the significance of physician follow up, thus reflecting the poor understanding related to the importance of controlling the blood sugar and a study by W S Shiferew et al. reported, that people have barriers to regular follow up and despite their levels of knowledge and awareness it is important to identify interventions to reduce people's perceived barriers of Diabetes Mellitus [1].

The follow-up and treatment of diabetic patients is complex and requires cooperation between both patient and Health professionals. It is evident from our study that the difference in the knowledge about diabetes mellitus is directly related to the level of literacy and educational status. 90% of the people who had poor knowledge were illiterates and 80% of them had poor knowledge about diabetes mellitus were of primary school education than those whose educational status was college and above. This might reflect that respondents who had higher education would have the chance to obtain different information and is more likely able to communicate with health care professional [1]. Low levels of knowledge were associated with poor diabetes management, as reported by the KAP survey conducted by Islam et al. Among the general population of rural Bangladesh [27]. Thus the higher their knowledge the better their attitude towards diabetes. Another study conducted by Baghianimoghadam and Afkhami-ardekani reported that the face-to-face and group teaching health education intervention performed in their study had remarkably improved the quality of life of diabetic patients [28].

Family history is a predictor of assess susceptibility to disease. An individual with a positive family history of Diabetes Mellitus. is 2.5 times more often at risk than non-diabetic family history [29]. Among 336 diabetic populations enrolled in this study, 210 (62.5%) patients had a family history of Diabetes Mellitus and 60% had good knowledge of diabetes mellitus, which is similar to findings by Al Shafae ma et al. [30] Asmamaw an et al. [31] and Kassahun t et al. [32]. In this study, of 58.3% (169) males, 47.6% and 41.07% had a history of smoking and alcohol respectively, whereas among 41.7% (140) female diabetic population enrolled in this study, none of them had a history of smoking and alcohol and thus it was found that smoking is

independently associated with diabetes [33] were as in a study conducted by Eric b Rimm et al. Cigarette smoking may be an independent, modifiable risk factor for diabetes mellitus and men who consumed a higher amount of alcohol had a reduced risk of diabetes, compared with men who drank 30.0 – 49.9g of alcohol daily [34].

We found that the awareness and knowledge were low for patients with a history of cigarette smoking and alcohol consumption, this is consistent with a prior cross-sectional study conducted by Chang Wang et al. [35]. Therefore, there is a need for increased public concern regarding diabetes mellitus.

There was no gender gap in knowledge, awareness, and skill toward diabetes mellitus in the study population .where a wide gender gap in knowledge, attitude, and practice regarding diabetes was reported in a study by brown S A et al. [36].In our study, the knowledge levels about diabetes mellitus and its complication are not satisfactory among diabetic patients. This study result emphasizes the need for better education and awareness even among diabetic patients. This is in line with the findings of m. Deepa et al. [37] and Anjana et al. [38]. Thus imparting knowledge and awareness about Diabetes Mellitus to the community is the first step in the prevention and early detection of the disease and its complications [39].

Surveys conducted in Chennai in 2005 [40] and 2007 [41] reported that only 25% and 10% of the participants respectively were unaware of diabetes mellitus. This higher rate of awareness and knowledge could be due to the prevention, awareness, counseling, and evaluation (pace) diabetes project. Indeed, the pacing project showed the need for replicating such models in other parts of the country as it was possible to increase awareness of diabetes in the whole of large cities like Chennai with a population of nearly 6 million people [42].

Of 336 diabetic patients enrolled in our study, only 8% had excellent knowledge and awareness of DM. Thus it is clear if prevention is to be effective, education about DM must reach those who are not still enrolled in or engaged with a health care center.

5. CONCLUSION

The findings from this study revealed a poor knowledge level, awareness, and skills towards

diabetes mellitus and its complications among the respondents. This study provides a snapshot of the current knowledge and awareness of the diabetic population in the coastal southern part of India, thus emphasizing the need for awareness among diabetic subjects for better control of diabetes and its complications. The diabetic educators should also be well-trained to ensure effective delivery of information and the programs or else diabetes is unlikely to become feasible in India.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Shiferaw Ws, Gatew A, Afessa G, Asebu T, Petrucka Pm, Aynalem Ya. Assessment of knowledge and perceptions towards diabetes mellitus and its associated factors among people in debre berhan town, northeast ethiopia. *Plos One*. 2020 oct 19;15(10):e0240850.
2. World health organization. Global diffusion of ehealth: making universal health coverage achievable: report of the third global survey on ehealth. World health organization; 2017 mar 27.
3. Cho N, Whiting D, Guariguata L, Montoya Pa, Forouhi N, Hambleton I. International diabetes federation atlas report: Global burden of diabetes. Belgium, Brussels; 2013.
4. Sharma T, Prajapati H. Knowledge and awareness of diabetes in diabetic patients: A cross-sectional study.
5. Sharma T, Prajapati H. Knowledge and awareness of diabetes in diabetic patients: A cross-sectional study.
6. Stratton Im, Adler Ai, Neil Ha, Matthews Dr, Manley Se, Cull Ca, Hadden D, Turner Rc, Holman Rr. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (Ukpds 35): prospective observational study. *BMJ*. 2000 aug 12;321(7258):405-12.
7. Rani Pk, Raman R, Subramani S, Perumal G, Kumaramanickavel G, Sharma T. Knowledge of diabetes and diabetic retinopathy among rural populations in india, and the influence of knowledge of diabetic retinopathy on attitude and practice. *Rural and Remote Health*. 2008 jul 1;8(3):1-9.
8. Sristi S, Sheeladevi S, Rani Pk. Knowledge, attitude and practices on diabetes and diabetic retinopathy of rural population from an indian state. *International Journal of Diabetes in Developing Countries*. 2015 mar;35(1):33-8.
9. Upadhyay Dk, Palaian S, Shankar Pr, Mishra P, Pokhara N. Knowledge, attitude and practice about diabetes among diabetes patients in Western Nepal. *Rawal Med J*. 2008;33(1):8-11.
10. Chowdhury R, Mukherjee A, Lahiri Sk. A study on distribution and determinants of indian diabetic risk score (idrs) among rural population of west bengal. *Natl J Med Res*. 2012 jul;2(3):282-6.
11. Ballouk R, Mansour V, Dalziel B, Hegazi I. The development and validation of a questionnaire to explore medical students' learning in a blended learning environment. *BMC Medical Education*. 2022 Dec;22(1):1-9.
12. Al-maskari F, El-Sadig M, Al-Kaabi Jm, Afandi B, Nagelkerke N, Yeatts Kb. Knowledge, attitude and practices of diabetic patients in the united arab emirates. *Plos One*. 2013 jan 14;8(1):e52857.
13. Murugesan N, Snehalatha C, Shobhana R, Roglic G, Ramachandran A. Awareness about diabetes and its complications in the general and diabetic population in a city in southern india. *Diabetes Research and Clinical Practice*. 2007 sep 1;77(3):433-7.
14. Minhat hs, hamedon tr. Understanding towards diabetes mellitus among rural adult community in malaysia. *World J Med Sci*. 2014;11(2):217-.
15. Al-maskari f, el-sadig m, al-kaabi jm, afandi b, nagelkerke n, yeatts kb. Knowledge, attitude and practices of diabetic patients in the united arab emirates. *Plos One*. 2013 jan 14;8(1):e52857.

16. Mathew Tk, Tadi P. Blood glucose monitoring. Instatpearls [internet]; 2020 aug 14. Statpearls publishing.
17. Galaviz Ki, Narayan Kv, Lobelo F, Weber Mb. Lifestyle and the prevention of type 2 diabetes: a status report. *American Journal of Lifestyle Medicine*. 2018 jan;12(1):4-20.
18. Fenwick Ek, Xie J, Rees G, Finger Rp, Lamoureux El. Factors associated with knowledge of diabetes in patients with type 2 diabetes using the diabetes knowledge test validated with rasch analysis. *Plos One*. 2013 dec 3;8(12):e80593.
19. Alhazmi Ga, Balubaid Rn, Sajiny S, Alsabbah R. Assessment of insulin injection technique among diabetic patients in makkah region in saudi arabia. *Cureus*. 2020 sep 27;12(9).
20. Kalra S, Mithal A, Sahay R, John M, Unnikrishnan Ag, et al. Indian injection technique study: population characteristics and injection practices. *Diabetes Therapy*. 2017 jun;8(3):637-57.
21. Sweidan Ba, Al Ajlouni Mm, Robert Aa, Alzaid Aa. Competency of prefilled insulin pen usage among diabetes patients in saudi arabia: a cross-sectional study. *Current Diabetes Reviews*. 2019 jun 1;15(3):240-6.
22. Poudel Rs, Shrestha S, Piryani Rm, Basyal B, Kaucha K, Adhikari S. Assessment of insulin injection practice among diabetes patients in a tertiary healthcare centre in nepal: a preliminary study. *Journal of Diabetes Research*. 2017 jan 1;2017.
23. Pozzuoli Gm, Laudato M, Barone M, Crisci F, Pozzuoli B. Errors in insulin treatment management and risk of lipohypertrophy. *Acta Diabetologica*. 2018 jan;55(1):67-73.
24. Ji J, Lou Q. Insulin pen injection technique survey in patients with type 2 diabetes in mainland china in 2010. *Current medical Research and Opinion*. 2014 jun 1;30(6):1087-93.
25. Tumminia A, Crimi S, Sciacca L, Buscema M, Frittitta L, Squatrito S, Vigneri R, Tomaselli L. Efficacy of real-time continuous glucose monitoring on glycaemic control and glucose variability in type 1 diabetic patients treated with either insulin pumps or multiple insulin injection therapy: a randomized controlled crossover trial. *Diabetes/Metabolism Research and Reviews*. 2015 jan;31(1):61-8.
26. Snyder Ll, Stafford Jm, Dabelea D, Divers J, Imperatore G, Law J, Lawrence Jm, Pihoker C, Mayer-Davis Ej. Socio-economic, demographic, and clinical correlates of poor glycaemic control within insulin regimens among children with type 1 diabetes: the search for diabetes in youth study. *Diabetic Medicine*. 2019 aug;36(8):1028-36.
27. Islam Fm, Chakrabarti R, Dirani M, Islam Mt, Ormsby G, Wahab M, Critchley C, Finger Rp. Knowledge, attitudes and practice of diabetes in rural bangladesh: the bangladesh population based diabetes and eye study (bpdes). *Plos One*. 2014 oct 14;9(10):e1110368.
28. Hossien Bm, Mohammad Aa. Effect of education on improvement of quality of life by sf-20 in type 2 diabetic patients. *Middle-east journal of scientific Research*. 2008;3(2):67-72.
29. Interact consortium robert. Scott@ mrc-epid. Cam. Ac. Uk. The link between family history and risk of type 2 diabetes is not explained by anthropometric, lifestyle or genetic risk factors: the epic-interact study. *Diabetologia*. 2013 jan;56:60-9.
30. Al shafae Ma, Al-Shukaili S, Rizvi Sg, Al Farsi Y, Khan Ma, Ganguly Ss, Afifi M, Al Adawi S. Knowledge and perceptions of diabetes in a semi-urban omani population. *Bmc Public Health*. 2008 dec;8(1):1-8.
31. Asmamaw A, Asres G, Negese D, Fekadu A, Assefa G. Knowledge and attitude about diabetes mellitus and its associated factors among people in debre tabor town, northwest ethiopia: cross sectional study. *Science*. 2015 feb 16;3(2):199-209.
32. Kassahun T, Gesesew H, Mwanri L, Eshetie T. Diabetes related knowledge, self-care behaviours and adherence to medications among diabetic patients in southwest ethiopia: A cross-sectional survey. *Bmc Endocrine Disorders*. 2016 dec;16(1):1-1.
33. Sairenchi T, Iso H, Nishimura A, Hosoda T, Irie F, Saito Y, Murakami A, Fukutomi H. Cigarette smoking and risk of type 2 diabetes mellitus among middle-aged and elderly japanese men and women. *American Journal of Epidemiology*. 2004 jul 15;160(2):158-62.
34. Rimm Eb, Chan J, Stampfer Mj, Colditz Ga, Willett Wc. Prospective study of cigarette smoking, alcohol use, and the risk of diabetes in men. *BMJ*. 1995 mar 4;310(6979):555-9.
35. Wang C, Yu Y, Zhang X, Li Y, Kou C, Li B, Tao Y, Zhen Q, He H, Kanu Js, Huang X.

- Awareness, treatment, control of diabetes mellitus and the risk factors: survey results from northeast china. Plos One. 2014 jul 28;9(7):e103594.
36. Brown Sa, Harrist Rb, Villagomez Et, Segura M, Barton Sa, Hanis Cl. Gender and treatment differences in knowledge, health beliefs, and metabolic control in mexican americans with type 2 diabetes. The Diabetes Educator. 2000 may;26(3):425-38.
37. Deepa M, Bhansali A, Anjana Rm, Pradeepa R, Joshi Sr, Joshi Pp, et al. Knowledge and awareness of diabetes in urban and rural india: the indian council of medical research india diabetes study (phase i): indian council of medical research india diabetes 4. Indian Journal of Endocrinology and Metabolism. 2014 may;18(3):379.
38. Anjana Rm, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural india: phase i results of the indian council of medical research-india diabetes (icmr-indiab) study. Diabetologia 2011;54:3
39. Deshpande Ad, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. Physical therapy. 2008 nov 1;88 (11):1254-64.
40. Deepa M, Deepa R, Shanthirani Cs, Manjula D, Unwin Nc, Kapur A, Mohan V. Awareness and knowledge of diabetes in chennai--the chennai urban rural epidemiology study [cures-9]. The Journal of the Association of Physicians of India. 2005 apr 1;53(4):283-7.
41. Murugesan N, Snehalatha C, Shobhana R, Roglic G, Ramachandran A. Awareness about diabetes and its complications in the general and diabetic population in a city in southern india. Diabetes Research and Clinical Practice. 2007 sep 1;77(3): 433-7.
42. Somannavar S, Lanthorn H, Deepa M, Pradeepa R, Rema M, Mohan V. Increased awareness about diabetes and its complications in a whole city: effectiveness of the prevention, awareness, counselling and evaluation [pace] diabetes project [pace-6]. Journal of the Association of Physicians of India. 2008;56: 497-502.

© 2022 Shaikh et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/87617>