

# Explore the risk perception and evaluate the effectiveness of competency-based intervention (CBI) on knowledge and lifestyle changes among type 2 diabetes mellitus patients

P. SIVAKUMAR<sup>1</sup>, R. RAMAIAH<sup>2</sup>, S.H. ALSHAHRANI<sup>2</sup>, E.L. SAMPAYAN<sup>3</sup>, S. VIJAYAKRISHNAN<sup>4</sup>, A. JOTHISHANMUGAM<sup>5</sup>, E.M. PAPPPIYA<sup>6</sup>, J. NATARAJAN<sup>7</sup>, J.M.V.F. XAVIER<sup>8</sup>, B.Y. ALSHAHRANI<sup>9</sup>, K. DURAISAMY<sup>2</sup>, S. JOTHIPRASAD<sup>10</sup>, R.E. AHMED<sup>11</sup>

<sup>1</sup>Kaloji Narayana Rao University of Health Sciences (KNRUHS), Vijaya Health Care Academic Society College of Nursing, Hyderabad, Telangana, India

<sup>2</sup>King Khalid University, College of Nursing, Kamish Mushrait, Asir Province, Saudi Arabia

<sup>3</sup>King Khalid University, College of Nursing, Khamis Mushit, Asir Province, Saudi Arabia

<sup>4</sup>Tamil Nadu. Dr. MGR Medical University, NPR College of Nursing and Research Institute, Natham, India

<sup>5</sup>Jazan University, University College at Aldair, Saudi Arabia

<sup>6</sup>Directorate of General Health Affairs, Ministry of Health, Najiran, Saudi Arabia

<sup>7</sup>Sultan Qaboos University, CON, Muscat, Oman

<sup>8</sup>York University, Keele Campus, Toronto, Ontario, Canada

<sup>9</sup>Supplies Warehouse Department Armed Forces Hospital Southern Region, Khamis Mushait, Saudi Arabia

<sup>10</sup>Tamil Nadu. Dr. MGR Medical University, Venkateswara Nursing College, Chennai, Tamil Nadu, India

<sup>11</sup>Tanta University, Egypt, College of Nursing, Khamis Mushit, King Khalid University, Asir Province, Saudi Arabia

**Abstract. – OBJECTIVE:** This is a study to explore the risk perception among T2DM patients and to compare the pre-test and post-test level of knowledge and lifestyle changes among T2DM patients at selected hospitals in Chennai. Most diabetics have type 2 diabetes, accounting for 85-90% of cases. Diabetes is a worldwide epidemic disease with distressing human, societal, and economic effects. It affects an estimated 382 million people worldwide in 2021.

**PATIENTS AND METHODS:** The research design used mixed-method research, such as Exploratory Sequential Design. The phenomenological approach, in that sequential exploratory design for the qualitative and true experimental design for the quantitative study, was chosen. 60 samples of T2DM patients were selected using a simple random sampling technique through the lottery method and divided into experimental and control groups for every 30 samples in quantitative. Five samples were selected using convenient sampling for qualitative.

**RESULTS:** In the quantitative study, the pre-test showed 4 (13.3%), and 5 (16.7%) adequate knowledge and lifestyle changes in both groups. Post-test experimental group showed that 23

(76.7%) had adequate knowledge and 23 (76.7%) changes in lifestyle found a drastic transformation from the pre-test as well as in the control group. The calculated Chi-square value showed a significant difference in the post-test level of lifestyle change among the T2DM patients between the groups at  $p < 0.001$  level.

**CONCLUSIONS:** This inferred that Competent Based Intervention (CBI) on knowledge and lifestyle changes administered to T2DM patients in the experimental group was found to be effective. Competent Based Intervention is a nursing intervention that is well accepted and adopted by patients and easily implemented by nurses. It can be included in the nursing curriculum. In-service education can be arranged once a month for staff nurses and faculty members regarding Competent Based Intervention. The Nurse educator should encourage the nurses to effectively utilize research evidence-based practice related to Competent Based Intervention for patients with type 2 diabetes mellitus.

*Key Words:*

Type 2 diabetes mellitus patients, Risk perception, Level of knowledge, Lifestyle changes, Competent Based Intervention, Mixed study.

## Introduction

Type 2 diabetes mellitus is one of the most dangerous diseases; if not treated properly, it causes more serious complications and finally leads to death. Approximately 6 to 7 patients' death per day take place in India. According to the World Health Organization (WHO), diabetes is the sixth leading cause of death worldwide and accounts for 60% of all deaths. Developing countries, in particular, suffer greatly due to type 2 diabetes mellitus (T2DM), which is becoming an epidemic. 8% of the world's population is affected by diabetes, and 7% by prediabetes. So, we need to focus on non-pharmacological factors as well as on the management of type 2 diabetes mellitus.

According to the latest data from the International Diabetes Federation, estimated 463 million adults worldwide live with diabetes in 2019. The number of diabetics worldwide was estimated at 445 million in 2017, up from 425 million in 2016. It is predicted that number will raise to 578 million almost double by 2030<sup>1</sup>. More factors contribute to the prevalence of diabetes than previously thought, specifically longer lifespan and being overweight or obese. In patients aged 61-65 years, type 2 diabetes was more prevalent than other risk factors. Furthermore, those who have a family history of diabetes, overweight, or obese are more likely to develop diabetes. Risk communication should be targeted at the population level and centered on primary care to implement effective diabetes prevention strategies<sup>2</sup>.

Prevention and management of diabetes require consideration of nutrition and diet. It is essential for rational advice regarding calorie recommendations to have an understanding of the glycemic index (GI) of foods consumed and to consider their quality rather than quantity when choosing macronutrients. According to data from prospective observational studies, clinical trials, and experimental findings<sup>3</sup>, diet appears to play an important role in diabetes management. Studies in Africa<sup>4</sup> found that diabetic patients are less likely than their European counterparts to follow dietary recommendations. Premorbid diabetes perception of risk was low among diabetic patients, who engaged in risky behaviors related to diabetes. Diabetes patients used both biomedical and local remedies for the management of their disease, finding them difficult to adhere to lifestyle changes<sup>5</sup>.

Health-promoting lifestyles can be developed when people are aware of diabetes and their risk perceptions. The results of a study<sup>6</sup> show

that individualized diet counseling, circuit-type resistance training, and increased physical activity help individuals to lose weight and reduce diabetes risk. People with diabetes can improve their insulin sensitivity and control their blood sugar levels by losing moderate weight and exercising regularly. Participating in weight loss sessions with a small group is necessary for diabetes prevention. An intervention in the form of diet and exercise can reduce the incidence of diabetes by 5-28%.

Researchers found that lifestyle interventions were more effective than diabetes medications. Compared to metformin, which only prevents diabetes by 31%, effective use of lifestyle programs can prevent diabetes by 58%. Hence, a healthy lifestyle is better than anti-diabetic medications in terms of cost, safety, and effectiveness. Regular exercise has a variety of benefits, such as enhancing body functions and reducing the risk of diabetes. Diabetes type 2 lower extremity complications can be reduced with improved foot care interventions incorporating knowledge and practices. Diabetes foot care programs must include programs for preventing complications<sup>7</sup>, identifying risk factors, and managing them outside the clinical setting. Therefore, Competent Based Intervention (CBI) related to exercise, foot care, nutrition, lifestyle changes, and knowledge seem to have a greater impact compared to non-pharmacological therapy, in the treatment of type 2 diabetes mellitus and prevention of its complications. The present study was conducted to address the impact of Competent Based Intervention in diabetic patients.

## Patients and Methods

The research design used was a mixed method research such as Exploratory Sequential Design, which includes phenomenological design followed by true-experimental design. In this research design, the sequential order of qualitative and quantitative approaches was used: qualitative – phenomenological design; quantitative – true experimental research design.

In quantitative, the experimental study was conducted at OPD of JIP Multispecialty Hospital, Chennai, a 100 bedded hospital; approximately 30 types 2 diabetic patients attend the diabetic outpatient department (OPD) daily. The diabetic outpatient department (OPD) functions from Monday to Saturday between 9 am and 8 pm. The control study was performed at OPD of

Sneha General Surgical Clinic, Chennai, a 50 bedded hospital, approximately 25 type-2 diabetic patients attend diabetic outpatient department (OPD) every day. The diabetic outpatient department (OPD) functions from Monday to Saturday between 9 am and 6 pm. Patients medically diagnosed with type 2 Diabetes mellitus for more than three months, aged between 35-55 years of both gender and who adhered to the interventions were included in the study. The researcher excluded the patients with type 2 diabetes mellitus for more than 5 years, cognitive impairment, severe depression, blind and mute, foot ulcer, lesions, and edema, severely ill, or who were undergoing any other complementary therapy.

After receiving approval from the ethical committee of the study hospital (IEC letter No. 17/MSN-10/2021), samples who were allowed to join the study were divided into groups. The data collection proforma consists of four sections.

Section 1 has 2 parts: demographic data considered to be part (age, gender, education, occupation, family monthly income, history of smoking and alcohol), and part 2 related to medical data (duration of diabetes mellitus, family history of diabetes mellitus, dietary pattern, BMI, comorbid illness and chronicity of illness).

Section 2 includes the Standardized Revised Michigan Diabetes Knowledge Scale, which consists of 20 statements about diabetes. The highest score denotes adequate knowledge.

Section 3 entails of Modified Minneapolis American Indian Center Lifestyle survey questionnaire to assess lifestyle changes, containing 20 questions under 6 categories as follows: a healthy diet, exercises, follow-up, management stress, smoking and alcohol, and foot care. The scoring of section 3 goes from 20 to 60: the highest conveys adequate lifestyle changes.

The study was validated with the expert's opinion for the external peer-review process in the following field of expertise: 2 medical experts, 4 medical surgical nursing experts, 1 statistician. To determine the reliability of the tool, the test-retest method was found to be reliable. The reliability of the tool was given by a test-retest method ( $r=0.793, 0.895$  for knowledge and lifestyle) and the tool was considered suitable for proceedings based on the results of 3 sample data from the pilot study. A brief explanation was given regarding the risk and benefits of the study in detail. Oral and written informed consent was obtained from the samples. The data were collected for 4 weeks from 04.04.2021 to 31.04.2021.

For the qualitative study, 5 samples were selected using convenient sampling techniques. An in-depth interview was conducted with five individuals until theoretical saturation was reached. An interview was conducted at JIP Specialty Hospital. Pre-tested semi-structured open-ended questionnaires were used for data collection. Time spent for each sample was 30 min in a day under six categories – age, obesity, hypertension, family history of DM, diet, and social habits to know the perception of risk factors of type 2 diabetic mellitus. After reviewing the literature and expert opinion, questionnaires were developed. Written agreement - informed consent was obtained, and interviews were audio recorded. At the end of the interview, the key points were debriefed to the participants for validation.

For the quantitative study, 60 samples who fulfilled the inclusion criteria were selected using a simple random sampling technique – the lottery method. The investigator selected 30 samples in the experimental group and 30 samples in the control group. The researcher assessed the pre-test knowledge using the Standardized Revised Michigan Diabetes Knowledge Scale, which consists of 20 statements about diabetes scoring and lifestyle changes, and it was administered to the type 2 diabetes mellitus patients in both groups. After the pre-test, the researcher educated a group of 8-10 patients about diabetes, nutrition, exercise, foot care, and changes in lifestyle through a PowerPoint presentation (PPT) for 15-20 minutes. In addition, they explained how to perform chair-based exercises and foot care to all study participants individually and advised them to follow these two demonstrated interventions at home continuously for 2 weeks, twice daily for the experimental group. For the control group, only hospital routines were followed. Post-test of knowledge was collected on the 7<sup>th</sup> day, and lifestyle changes on the 15<sup>th</sup> day.

### **Statistical Analysis**

The data was analyzed for qualitative and quantitative study using the Statistical Package for the Social Sciences SPSS version 21 (IBM Corp., Armonk, NY, USA). Descriptive statistics  $\chi^2$  tests (for categorical variables), Paired  $t$ -tests were used to compare the post-test degree of CBI on knowledge and lifestyle changes in the study and control group. Independent  $t$ -test and paired  $t$ -tests were used to determine the effectiveness of CBI on knowledge and lifestyle changes among type 2 diabetes mellitus patients

in the experimental group and the Chi-square test was used to associate the post-test level of knowledge and lifestyle changes among type 2 diabetes mellitus patients with selected demographic variables.  $p < 0.05$  were considered significant in this study.

## Results

The results of qualitative data show that the perception of risk and lifestyle are important issues in diabetes prevention. Also, an individual's ability to cope with the condition by adhering to medication, exercises, and dietary requirements will reduce complications and deaths among people with type 2 diabetes mellitus and would help nurses to design their care plan. Based on a better understanding of those 5 patients who were selected for the phenomenological approach, their risk factors perception was audio taped and the words were accurately evaluated by the researcher. After analyzing statements, the perception of age, obesity, hypertension, family history, diet, and social habits have emerged and the risk perceptions were analyzed.

This qualitative study points to a greater need to effectively address people's low-risk awareness, and how to raise the awareness and understanding of type 2 diabetes and its risk factors in the general population to influence early detection and healthy lifestyle changes.

The quantitative results disclosed that the experimental and control groups were homogeneous and did not reveal statistically significant differences in terms of age, age, gender, education, occupation, family monthly income, history of smoking and alcohol, duration of diabetes mellitus, family history of diabetes mellitus, dietary pattern, BMI, comorbid illness and chronicity of

illness. Both the experimental and control group conveyed inadequate knowledge and lifestyle changes before Competency Based Intervention (CBI). In terms of the knowledge and lifestyle changes within the groups, [the mean (SD) 7.73 (3.91) and 32.63 (8.58) in the experimental and 6.63 (4.17) and 33.23 (9.93) in the control group], there was no statistical significance in both the groups. However, after the explanation through PPT, chair-based exercises, and foot care, the data revealed statistical significance in the experimental and the control group with inadequate knowledge and lifestyle changes (Table I).

Between-group comparisons using an independent t-test revealed that before the CBI, there was no significant difference in the mean score between the knowledge and lifestyle changes ( $p = 0.297, 0.803$ ). Despite implementing CBI continuously for 2 weeks twice daily, the mean score of knowledge and lifestyle changes was low in the experimental group compared to the control group ( $p = 0.000$ ) (Figures 1 and 2). The correlation between the knowledge and lifestyle changes were statistically correlated i.e., ( $r = 0.793, 0.895$ ) at  $p < 0.001$ .

Only one demographic variable, BMI ( $\chi^2 = 9.080, p = 0.028$ ), showed a statistically significant association with the post-test level of knowledge among type 2 diabetes mellitus at  $p < 0.05$  level.

## Discussion

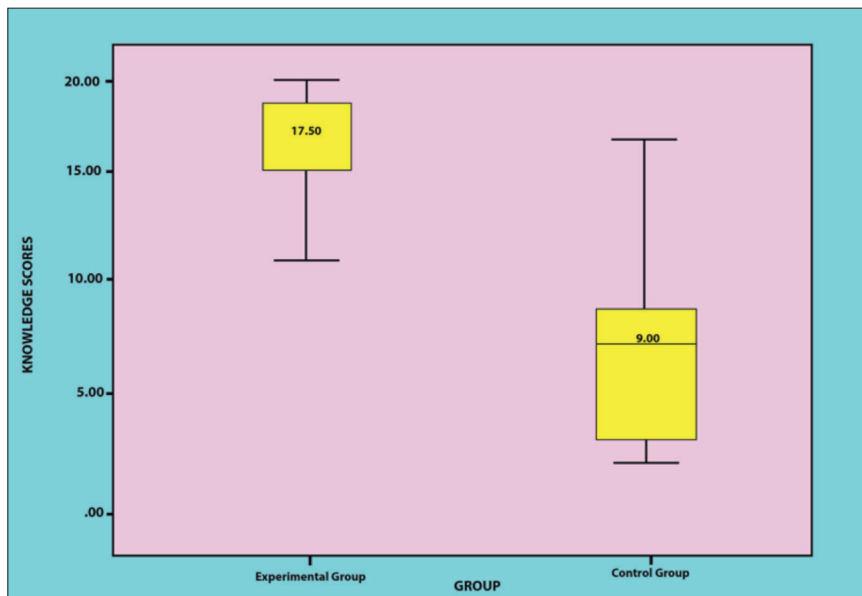
### Demographic Analysis

Among 30 patients, the majority of the samples were between the age group of 51-55 years and 43.3% were males, while 56.7% were females. Studies<sup>8</sup> in the past reported participants with similar age groups. A meta-analysis<sup>9</sup> study reveals that despite the relatively lower risk for T2DM, obesity is a formidable independent risk factor to

**Table I.** Effectiveness of Competency-Based Intervention (CBI) on knowledge and lifestyle changes among type 2 diabetes mellitus patients in the experimental and control group.

Groups	Variable	Test	Mean (SD)	Paired t-test value
Experimental	Knowledge	Pretest	7.73 (3.91)	$p = 0.0001^*$
		Posttest	16.63 (3.41)	
Control	Life style changes	Pretest	32.63 (8.58)	$p = 0.0001^*$
		Posttest	50.70 (8.13)	
	Knowledge	Pretest	6.63 (4.17)	$p = 0.489$
		Posttest	6.70 (4.11)	
Life style changes	Pretest	33.23 (9.93)	$p = 0.053$	
	Posttest	35.53 (9.27)		

\* $p < 0.01$ : statistically significant.



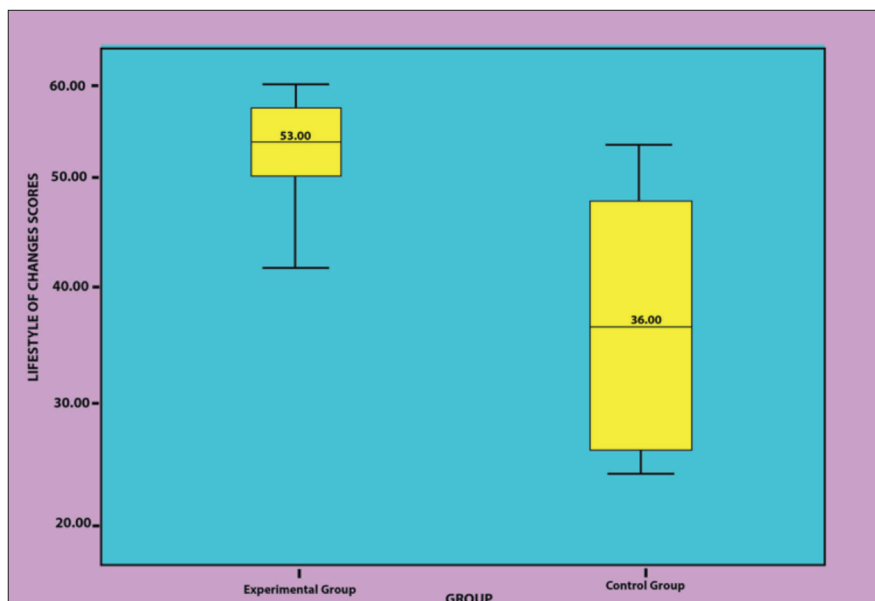
**Figure 1.** Boxplot showing the comparison of pretest and posttest knowledge among type 2 diabetes mellitus patients between the experimental and control group.

mitigate in India. India has experienced increased obesity due to industrialization and urbanization, making it imperative to concentrate on preventing these NCDs. We find only a moderate association between obesity and type 2 DM. The results of our study showed contrarily 30% of participants were obese. According to clinical trials<sup>10</sup> involving individuals with type 2 DM, low-fat vegan diets

are more effective than conventional diabetic diets in reducing blood glucose levels, but in this study, 70% of participants remained with vegan diets.

#### **Qualitative Analysis**

An overview of the quantitative study reveals that the CBI implemented for 4 weeks on type 2 DM patients under the age group of 30-55 years



**Figure 2.** Boxplot showing the comparison of pretest and posttest lifestyle changes among type 2 diabetes mellitus patients between the experimental and control group.

who have inadequate knowledge and low lifestyle changes was improved positively in both aspects.

***Risk Perception of Age, Obesity, Hypertension, Family History of DM, Diet, and Social Habits***

The study participants' perception regarding obesity and hypertension was high risk for type 2 DM. This result is supported by Giridhara, who assessed that the association between obesity and hypertension was strongly positive and T2DM was moderately positive compared with healthy non-obese adults in India. The perception of participants in this study regarding smoking and alcohol is that there is no connection with type 2 DM. However, as per the 2014 Surgeon general report<sup>11</sup>, active smokers have a 30-40% higher risk of type 2 DM than non-smokers, which suggests that tobacco cessation should be emphasized as a vital component of public health strategies to counteract the global epidemic of diabetes. Currently, intervention strategies targeted at reducing obesity and promoting physical activity are being used in the prevention of type 2 diabetes mellitus. To greatly decrease both micro vascular and macro vascular complications, it is essential to be aware of risk factors for type 2 diabetes so that screening, early detection, and treatment can be implemented in high-risk populations.

The findings of the qualitative study regarding risk perception from type 2 DM patients indicate that most dimensions of the risk perception measures display low-risk awareness and that optimistic bias was present. These results were supported by the systematic review<sup>12</sup> of 18 studies from 9 electronic databases reporting lay perceptions of the risk of complications in type 2 DM populations. In general, perceptions would be biased depending on which risk dimension was measured, the subgroup concerned, and what complications they considered. It is necessary to identify practical methods to correct for biased risk perceptions to increase self-care behaviors and treatment adherence in future research.

***Quantitative Analysis***

***Specifies related to knowledge perseverance among type 2 DM***

The study established that 76.7% of the sample had adequate knowledge after the PowerPoint presentation in a group. These findings were similar to the results of an interventional study<sup>13</sup>

carried out on 100 DM patients attending Primary Health Center units who were subjected to 3 health education sessions regarding information about diabetes. Overall knowledge score after 3 months increased from  $2.69 \pm 1.44$  on the first visit to  $5.30 \pm 1.36$  on the second visit, indicating a significant improvement in the patients' awareness of diabetes, and there was noticeable development in the patients' awareness regarding different aspects of diabetes.

***Adaptation and maintenance of chair-based exercises***

Chair-based exercises like shoulder circle, reach forward, out, up, chest fly, quad extension, knee rise, abdomen twist, and shoulder shrugs were used as a self-care program for each diabetes patient for 30 minutes and found an effect in changing their lifestyles. These results will line with a study<sup>14</sup> conducted by the Diabetes Prevention Program focused on lifestyle modifications along with dietary changes and increased physical activity. Observational studies<sup>15</sup> have shown that more fitness is associated with a lower risk of developing type 2 diabetes, even when the exercise is of moderate intensity. The results of a meta-analysis<sup>16</sup> indicate that exercise intensity predicts greater improvements in overall blood glucose (BG) control than exercise volume, thus, those who exercise at moderate intensity may want to opt for some vigorous exercise to obtain additional blood glucose [and likely cardiovascular (CV)] health benefits. For type 2 diabetics, increasing unstructured, total physical activity (PA) daily is recommended. To prevent excessive weight gain, non-exercise activity thermogenesis (i.e., burning calories for daily activities) can create a large caloric deficit daily. It is crucial for individuals, with type-2 diabetes to include an exercise program or another method of increasing their overall physical activity. Patients with T2DM who exercised both resistance and aerobically had more significant benefits from physical activity<sup>17</sup>. Engagement in regular physical activity has been shown<sup>18</sup> to significantly attenuate non-communicable diseases, including type-2 diabetes. However, the overall rate of physical inactivity among Saudi Arabia adults is currently 80.5%, owing to time pressure, heavy traffic, cold climate, lack of time, and environmental factors. Our present study findings were similar to the protocol of Sinclair<sup>19</sup>. Home-based exercises and chair-based exercises are very useful to type-2 diabetes mellitus pa-

tients, especially for those who are very busy with their time schedule. Present study results revealed that there was good control of blood glucose levels after practicing chair-based exercise for half an hour a day.

### ***Specifications of Foot Care***

Most of the type 2 diabetes mellitus patients are not strictly following a low-glycemic index diet which leads to many complications especially diabetic foot ulcers. Complicated diabetic foot ulcers are mostly treated with surgery. The overall rate of major foot limb amputation is 11.6% due to poor glycemic control and lack of knowledge of foot care<sup>20</sup>. The foot examination is the least satisfactory factor of diabetic care, with only 38% of diabetics having the process completed. Comparatively, better compliance with diet and lifestyle advice was observed with regular blood glucose monitoring to improve the lifestyle changes in our study. Earlier studies<sup>21</sup> conducted in Nigeria and Saudi Arabia found similar practices to our study. Diabetes foot ulcers are likely to be reduced with better foot care practices, as well as morbidity and medical costs. Several studies<sup>22,23</sup> have demonstrated that education has a significant impact on improving the knowledge and attitude of patients toward all aspects of diabetes, including the diabetic foot. Diabetic foot care requires a multidisciplinary approach. Ninety-four percent (31/33) of studies<sup>24</sup> reported a reduction in major amputations after the institution of a multidisciplinary team. Regular foot care practices by type 2 DM patients would greatly influence the reduction of blood glucose levels, lifestyle changes, and reduction rate of limb amputation to lead to a good quality of life.

The present study proved that there was effectiveness in competency-based interventions on knowledge and lifestyle changes among type 2 diabetes mellitus patients.

### ***Limitations of the Study***

Two different settings were used for the study and control groups.

### ***Implications for Nursing and/or Health Policy***

Nurses must act as proactive members to support such patients by empowering them to use self-management methods to improve their knowledge and lifestyle changes, as well as their quality of life. Nurses can give health education to the patient on diet and walking and how diabetes

mellitus can be treated. Application of Competent Based Intervention would provide a reference framework to be taught in basic and continuing education programs as a practice for health professionals. The nurse administrator should raise awareness of the importance and benefits of nutrition, foot care, and chair-based exercise and the changes in lifestyle among patients and their family members. The nurse administrator can arrange for various sessions on Competent Based Intervention since it is one of the cost-effective interventions. Nurse administrators can instruct and encourage their subordinates to utilize this as a nursing intervention in their clinical setting. Nurse administrators can arrange and conduct workshops, conferences, and seminars on type 2 diabetes mellitus and its management. The findings of this study can be taken as a baseline for further research. Especially, nurses should be encouraged to conduct the study in clinical settings. This study may provide a practice framework for the future development of other evidence-based nursing practices.

## **Conclusions**

The results of this study indicate that early detection of risk perception leads to raising awareness in diabetic populations. The study findings indicate that the amount of information the person with type 2 diabetes mellitus possesses on diabetes, nutrition, foot care, exercise and lifestyle changes can have a significant improvement in the management of diabetes mellitus. The mixed method research approach with Exploratory Sequential Design with the help of the Revised Michigan Diabetes Knowledge Scale helped in bringing out the importance of Competent Based Intervention in the non-therapeutic management of diabetes mellitus.

---

### **Conflict of Interest**

The authors have no conflict of interest to declare.

---

### **Ethics Approval**

After approval from the Institute Ethical Committee, permission was obtained from the Institute of Ethical Committee (IEC) of Venkateshwara Nursing College letter No. VNC/TH/47/2021 and approved on 11.02.2021.

**Informed Consent**

Informed consent was obtained orally and in writing from every participant after a brief explanation regarding the study by the investigator. Confidentiality of the data, the right to leave the study, and the secrecy of the participant were explained before data collection.

**Acknowledgments**

The authors thank the Principal, Venkateswara Nursing College, who agreed to guide study participants, and staff nurses of the hospital for extending their cooperation. The authors are also very thankful to the Deanship of Scientific Research, King Khalid University, for supporting this work.

**Funding**

This research was funded by the Deanship of Scientific Research at King Khalid University; Grant number "RGP 1/57/43".

**Authors' Contributions**

Study design; PS, RR, BYA.  
Data collection; SJ, S.  
Data analysis; SHA, ELS, EMP.  
Study supervision; AJ, JRN.  
Manuscript writing; PS, JRN, REA.  
Statistical expertise; JMVFX, KD.

**Data Availability**

The data presented in this study are available on request from the corresponding author.

**ORCID ID**

Prathiba Sivakumar: 0000-0002-4766-0749  
Rama Ramaiah: 0000-0003-3196-0605  
Shadia Alshahrani: 0000-0002-1428-787X  
Eva Lobelle Sampayan: 0000-0002-5139-9280  
Sowmya Vijayakrishnan: 0000-0002-8123-7602  
Aruna Swaminathan: 0000-0002-2730-7403  
Ester Mary Pappiya: 0000-0003-1188-8845  
Jansirani Natarajan: 0000-0002-9686-7543  
Josephine Mary Violet Francis Xavier: 0000-0002-7248-8506  
Kalaiselvi Duraisamy: 0009-0002-1685-7642  
Samundeeswari Jothiprasad: 0000-0002-8591-1211  
Rasha Salem: 0000-0002-8627-3442  
Bader Yahya Alshahrani: 0009-0002-0265-0616

**References**

- 1) Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, Colagiuri S, Guariguata L, Motala AA, Ogurtsova K, Shaw JE, Bright D, Williams R, IDF Diabetes Atlas Committee. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Res Clin Pract* 2019; 157: 107843.
- 2) Debrah A, Godfrey OM, Ritah K. Prevalence and Risk Factors Associated with Type 2 Diabetes in Elderly Patients Aged 45-80 Years at Kanungu District. *J Diabetes Res* 2020; 2020: 1-5.
- 3) Heidemann C, Paprott R, Stühmann LM, Baumert J, Mühlenbruch K, Hansen S, Schiborn C, Zahn D, Gellert P, Scheidt-Nave C. Perceived diabetes risk and related determinants in individuals with high actual diabetes risk: results from a nationwide population-based survey. *BMJ Open Diabetes Res Care* 2019; 7: e000680.
- 4) Nwawuba S, Nwozo SO, Mohammed KA. Dietary Management of Diabetes Mellitus with Focus on Nigeria. *Int J Diabetes Res* 2019; 2: 26-32.
- 5) McMacken M, Shah S. A plant-based diet for the prevention and treatment of type 2 diabetes. *J Geriatr Cardiol* 2017; 14: 342-354.
- 6) Philip TNT, Vitalis B, Doris ND, Joseph MK, Tolgou Y. Premorbid risk perception, lifestyle, adherence and coping strategies of people with diabetes mellitus: A phenomenological study in the Brong Ahafo Region Ghana. *PLoS One* 2018; 13: e0198915.
- 7) Agyemang C, Addo J, Bhopal R, Aikins ADG, Stronks K. Cardiovascular disease, diabetes and established risk factors among populations of sub-Saharan African descent in Europe: a literature review. *Global Health* 2009; 5: 7.
- 8) Lindstrom J, Louheranta A, Mannelin M, Rastas M, Salminen V, Eriksson J, Uusitupa M, Tuomilehto J. The Finnish Diabetes Prevention Study (DPS): Lifestyle intervention and 3-year results on diet and physical activity. *Diabetes Care* 2003; 26: 3230-3236.
- 9) Giridhara RB, Murthy GVS, Yamuna A, Prital P, Deepa A, Sara EBN, Saniay K, Srinath K. Association of obesity with hypertension and type 2 diabetes mellitus in India: A meta-analysis of observational studies. *World J Diabetes* 2018; 9: 40-52.
- 10) Neal D, Barnard ND, Cohen J, Jenkins DJA, Mc-Grievy GT, Gloede L, Green A, Ferdowsian H. A low-fat vegan diet and a conventional diabetes diet in the treatment of type 2 diabetes: a randomized, controlled, 74-wk clinical trial. *Am J Clin Nutr* 2009; 89: 1588S-1596S.
- 11) Maddatu J, Baucum EA, Molina CE. Smoking and the Risk of Type 2 Diabetes. *Transl Res* 2017; 184: 101-107.
- 12) Rouyard T, Kent S, Baskerville R, Leal J, Gray A. Perceptions of risks for diabetes-related complications in Type 2 diabetes populations: A systematic review. *Diabetic Medicine* 2016; 34: 467-470.
- 13) Chawla SPS, Kaur S, Bharti A, Garg R, Kaur M, Soin D, Ghosh A, Pal R. Impact of health education on knowledge, attitude, practices and glycemic control in type 2 diabetes mellitus. *J Family Med Prim Care* 2019; 8: 261-268.
- 14) Diabetes Prevention Program (DPP) Research Group. The Diabetes Prevention Program (DPP):

- description of lifestyle intervention. *Diabetes Care* 2002; 25: 2165-2171.
- 15) Nawaf JS, Nabil AAZ, Hassan MH, Yousef SK, Khaled G, Hussein AH. Predictors of major lower limb amputation in type 2 diabetic patients referred for hospital care with diabetic foot syndrome. *Diabetes Metab Syndr Obes* 2018; 11: 313-319.
  - 16) John P, Jessica S, Stephan N. The essential role of exercise in the management of type 2 diabetes. *Cleve Clin J Med* 2017; 84: 15-21.
  - 17) Amirah M, Maria J, Aliff AL, Haidzir M. Home-Based Physical Activity in Patients With Type 2 Diabetes Mellitus: A Scoping Review. *Ann Rehabil Med* 2021; 45: 345-358.
  - 18) Saqib ZA, Dai J, Menhas R, Mahmood S, Karim M, Sang X, Weng Y. Physical Activity is a Medicine for Non-Communicable Diseases: A Survey Study Regarding the Perception of Physical Activity Impact on Health Wellbeing. *Risk Manag Health Policy* 2020; 13: 2949-2962.
  - 19) Sinclair J, Ageely H, Mahfouz MS, Hummadi AA, Darraj H, Solan Y, Allan R, Bottoms L. Effects of a Home-Based Physical Activity Programme on Blood Biomarkers and Health-Related Quality of Life Indices in Saudi Arabian Type-2 Diabetic Mellitus Patients: Protocol for a Randomised Controlled Trial. *Int J Environ Res Public Health* 2022; 19: 4468.
  - 20) Doğruel H, Aydemir M, Kemal Balci MK. Management of diabetic foot ulcers and the challenging points: An endocrine view. *World J Diabetes* 2022; 13: 27-36.
  - 21) Zainab JA, Leila AA, Parameaswari PJ, Abrar AA. Attitude and knowledge about foot care among diabetic patients in Riyadh, Saudi Arabia. *J Family Med Prim Care* 2019; 8: 2089-2094.
  - 22) Maram A, Hassan A, Ana F, Khalid A, Wid A, Rozan A. Knowledge of Diabetic Foot among nurses at a Tertiary hospital in Saudi Arabia. *Med Arch* 2022; 76: 190-197.
  - 23) Sultan A, Hesham A, Reema A, Omar A, Ghadah A, Nasser A, Abdulmajeed A. Diabetic foot care: A screening on primary care providers' attitude and practice in Riyadh, Saudi Arabia. *MDPI Medicina* 2023; 59: 1-12.
  - 24) Musuuza J, Sutherland BL, Kurter S, Balasubramanian P, Bartels CM, Brennan MB. A systematic review of multidisciplinary teams to reduce major amputations for patients with diabetic foot ulcers. *J Vasc Surg* 2020; 71: 1433-1446.