International Journal of Medical Science and Clinical Research Studies

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 03 Issue 12 December 2023

Page No: 3215-3223

DOI: https://doi.org/10.47191/ijmscrs/v3-i12-52, Impact Factor: 6.597

Self-Care Management Interventions for Type 2 Diabetes Mellitus in Saudi Arabia: A Systematic Review

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ABSTRACT

Aim of the study: To assess the self-care management interventions for type 2 diabetes mellitus in Saudi Arabia through a systematic review.

Methods: A systematic review was conducted by searching for articles from three online journal collection sites – PubMed Central (PMC), CINAHL Open Access and Directory of Open Access Journals (DOAJ). Other articles were obtained from the Google scholar and the Google advanced search engine. The resultant articles were subjected to a thorough scrutiny within the inclusion criteria and quality assessment. An abstraction table was then used to summarize the outcomes.

Results: Initial search gave a yield of 2410 articles, which were finally reduced to nine articles. One type of intervention program was identified across the articles – the educational intervention. Across the studies, education program had a significant positive impact on patients' self-management of type 2 diabetes mellitus and patients' clinical outcomes, with notable impacts on self-care knowledge, behaviors and attitude towards desired practices. There was also a significant impact of the intervention programs on glycemic level and risks of cardiovascular diseases, such as lipid profile. However, the impact of the educational programs depended on smoking and marital status.

Conclusion and Recommendations: educational programs are effective in improving the self-management of type 2 diabetes mellitus in Saudi Arabia. However, there is a need to focus on the large-scale application of the education, especially in the clinical setup to come up a sustainable culture of patients' education.

ARTICLE DETAILS

Published On:
27 December 2023

KEYWORDS: type 2 diabetes mellitus; self-management, patient education; intervention programs; Saudi Arabia.

Available on:
https://ijmscr.org/

BACKGROUND

Type 2 diabetes mellitus (T2DM) is metabolic disorder that arises from a combination of two factors – the production of defective insulin and insensitivity to the produced insulin by the tissues (Roden & Shulman, 2019). This condition has been linked to several risk factors, mainly dyslipidemia, hereditary and environmental factors, age, obesity, sedentary lifestyle and ethnicity (Wu et al., 2014; Fletcher et al., 2002; Weisman et al., 2018). When not treated well, T2DM can progress to macro and microvascular complications, affecting the eyes, feet and heart (Dal Canto et al, 2019). In severe cases, these patients are rendered totally dependent on social support to meet their daily living activities, which is economically liable (Seuring, Archangelidi & Suhrcke, 2015).

The global prevalence of T2DM is rising. In 2021, the International Diabetes Federation (IDF) reported that 540 million people have diabetes, 90% of who suffer from T2DM (IDF, 2021). The same report predicted that the number of people suffering from this disease may rise to over 640 million by the year 2030. Surprisingly, three out of four individuals with this condition reside in the low- and middle-income countries (IDF, 2021). Nevertheless, every country is affected, and studies conducted in Saudi Arabia have shown a fluctuation in the incidence of T2DM. For example, in 2011, Alqurashi et al. (2011) reported a prevalence of 30%. Later in 2014, a prevalence rate ranging between 23% and 37% were reported by Al-Rubeaan et al. (2014). The high incidence of T2DM in Saudi Arabia has been linked to the high cases of obesity and aging population (Alotaibi, 2020).

While there no documented cure for T2DM, the management has been reliant on insulin injections and management of secondary symptoms and complications (Pfeiffer, & Klein, 2014). Among the key management practices is self-care, which encompasses a range of self-directed behaviors (da Rocha et al., 2020). Cooper defined diabetes self-care as "an evolutionary process of development of knowledge or awareness by learning to survive with the complex nature of the diabetes in a social context" (Cooper et al., 2003). According to this definition, the survival behaviors depend on a range of empirically proven practices, including self-monitoring of blood glucose (SMBG), managing weight, taking regular or structured physical activity, eating a healthy diet with more fiber and less calories, adhering to the prescribed medicines, and consulting consultation physician regularly for any changes (Ghoreishi et al., 2019).

Despite the weighty pieces of empirical evidence supporting the significance of self-care practices in managing T2DM, studies conducted Saudi Arabia have indicated inadequate practices and behaviors towards management of T2DM (Al-Qahtani, 2020; Saad et al., 2018). The low levels of self-care practices have elicited a need to investigate adaptive mitigation measures, and indeed, many studies have examined the efficiency of various intervention programs to improve self-care practices – including the educational, psychological, technological and theoretical interventions, based on behavior change theories and models like the Social Cognitive Theory (SCT) and Transtheoretical Model (Ryan et al., 2020; Adu et al. 2020; Taloyan et al. 2021; Tseng et al., 2017; Mohammadi et al., 2018). However, the success of these interventions also depends on many factors documented in the literature, which makes the success of self-care practices unable to meet the expected outcomes. This review explores the range of empirically-interventions proven interventions in Saudi Arabia with a mission to recommend healthcare practices and policy change.

METHODS

This review followed the design of a systematic approach of exploring empirical evidence in the literature. Accordingly, a systematic review was conducted towards exploring the self-care management interventions of T2DM in Saudi Arabia. The review process begun by identifying the research articles, which were sought from three online journal collection sites – PubMed Central (PMC), CINAHL Open Access and Directory of Open Access Journals (DOAJ). More search was also done on the Google scholar for its wide range of free-access articles, and Google advanced search and the references of other articles. To conduct this search process, the researcher used a set of keywords combined with appropriate search operators. The key words included diabetes or T2DM and self-care or self-management and interventions or education, and a matrix of their truncated forms were also used to expand the outcomes.

The study was interested in articles that (i) were published within the past 10 years (from December, 2013 to December, 2023), (ii) were published in the English language as the primary language of publication, (iii) were conducted within the Kingdom of Saudi Arabia, (iv) have empirical evidence and (v) have full access. These inclusion considerations thus knocked out review articles and those that avail only the abstract. Nevertheless, all the resulting articles were assessed for quality of evidence based on the ROBINS-I (Risk of Bias In Non-randomized Studies - of Interventions) (Sterne et al., 2016).

An initial crude search gave a result of 2410 research articles. However, these articles were subjected to range of assessment and scrutiny, involving a quick check on their titles and aims. A quick assessment led to removal of 1035 articles as irrelevant and being non-intervention studies. Another batch of 309 was removed for being non-Saudi research and 72 articles were also removed for being similar across some databases. The remaining 994 were subjected to another quick round of assessment based on their variables, design, population and type of diabetes, which further excluded 811 articles, leaving 183 articles for keen assessment and appraisal. Finally, 174 articles were excluded from the list for combining populations from other countries in the Middle East with those from Saudi Arabia. A total of 9 articles qualified the rigorous assessment and were included in this review.

RESULTS

A total of nine articles were obtained from the literature search (Mohammad & Khresheh, 2018; AlHaqwi et al., 2023; Khan et al., 2022; McEwen et al., 2015; Almutairi, Gopaldasani & Hosseinzadeh, 2023; Ba-Essa et al., 2015; AL-Shahrani, 2018; Mokabel et al., 2017; Elfakki et al., 2022) (see abstraction table; Appendix A). These research studies applied different research designs, including quasi-experiment (Mohammad & Khresheh, 2018), a pre- and postintervention (AlHaqwi et al., 2023; Khan et al., 2022; McEwen et al., 2015; Almutairi, Gopaldasani & Hosseinzadeh, 2023), case-control intervention (Ba-Essa et al., 2015), prospective study design (AL-Shahrani, 2018), longitudinal experimental research (Mokabel et al., 2017), and randomized control trial (Elfakki et al., 2022). In all the studies, the primary goal was to assess the impact of intervention programs, which were either developed by the researchers of adopted from the already developed programs. The programs were either offered to the patients in a group or individualized.

According to the aim of this review, three thematic outcomes were noted; intervention programs, the impact of educational program on self-management practices and disease outcomes among patients with T2DM, and the factors moderating the impact of educational interventions on self-management practices of T2DM in Saudi Arabia.

a) Intervention programs

Various intervention programs were identified across the literature. However, all of them were aligned to educational format. These programs focused on various aspects of self-management and behavior profiles. While some programs, such as the Personalized Education Specialties program offered by AlHaqwi et al. (2023) focused on many features of self-management activities, including "diet, physical activity, monitoring of blood glucose, adherence to medications, problem-solving skills, healthy coping for a better quality of life, and reducing risks," others targeted a specific concept, such as the diabetic education program by AL-Shahrani (2018) focusing in glycemic control.

The programs aligned to different format and mode of delivery. Most of them were delivered through a physical meeting while others, such as Almutairi, Gopaldasani and Hosseinzadeh (2023) used telephones in addition to the physical convergence. The duration of the educational sessions also varied, ranging from 15 minutes to 45 minutes. Again, while some programs were offered continuously, other researchers opted for an intermittent mode. Nevertheless, the durations of delivery largely varied, averagely lasting for about four months.

b) Impact of educational program on self-management practices and disease outcomes among patients with T2DM

Across the studies, there was a notable positive impact of the applied educational programs on the self-management behaviors, practices and the clinical outcomes of patients with T2DM. Most studies reported the impact of the intervention programs on both clinical outcomes and self-management practices and behaviors (AlHaqwi et al., 2023; Khan et al., 2022; McEwen et al., 2015; Almutairi, Gopaldasani & Hosseinzadeh, 2023; Mokabel et al., 2017; Elfakki et al., 2022), with a few only focusing on self-management practices and behaviors (Mohammad & Khresheh, 2018; Ba-Essa et al., 2015), only one study focused on the clinical outcomes (AL-Shahrani, 2018). Nevertheless, all the studies focused their educational intervention on the self-management practices.

Overall, positive outcomes were noted from the intervention programs. The notable clinical outcomes include a reduction weight, BMI, obesity, blood pressure, and blood cholesterol, hemoglobin A1C (HbA1C), and lipid profiles. These were also observed after a successive implementation of an educational intervention program. Regarding the self-management and behaviors improvements, these studies reported various improvements, including diabetes knowledge, attitude and behavior, regular physical activities, self-monitoring of blood glucose, foot care, and adherence to medication. None of the studies reported improved outcomes regarding regular consultations with the clinicians despite being one of the core aspects of self-management behaviors.

c) Factors moderating the impact of educational interventions on self-management practices of T2DM in Saudi Arabia.

One study reported the impact of the moderating factors on the impact of impact of educational interventions on self-management practices of T2DM in Saudi Arabia. Mokabel et al. (2017) observed that "Divorced or widowed, smokers, those who did not examine their feet daily, and those who did not examine their eyes regularly, were more likely to have poor HbA1c" (P. 169). Other factors, such as age group did not contribute to the impact of the educational program despite being included in the study.

DISCUSSION

The purpose of this review was to identify the impactful intervention programs on the self-management practices and behaviors among patients with T2DM in Saudi Arabia. Accordingly, many different educational programs were identified with different modes, duration and settings of delivery and even scope of focus. These programs focused on one primary mission – to improve patients' knowledge about the disease. Secondary to the primary objective, the programs also focused on divergent other issues pertaining to patients' clinical outcomes and self-care practices and behaviors.

Educational programs have been applied towards the management of diabetes mellitus for long, and many studies have reported positive impacts across history. For instance, the Celik et al. (2022) recognize that the educational approach empowers and equips patients with adaptive skills to manage their health conditions diabetes to lower the potential risks of complications. The evidence of positive impacts of educational interventions in improving self-management practices, clinical outcomes and quality of life among patients with type 2 diabetes is all the literature (Karakurt & Kaşıkçı, 2012; Gagliardino et al., 2019; Chrvala et al., 2016). The effect of educational programs is apparent even the previous randomized control trails conducted in other regions (Fan et al., 2016; ALSharit & Alhalal, 2022).

The significance of education in improving the self-management behaviors, clinical outcomes and the quality of life among patients with T2DM can be explained from the nature of the disease. Similar to other chronic illnesses, diabetes requires a complex management approach with a daily commitment of the patients (Adwan & Najjar, 2013). Some scholars express that the educational programs thus need to be offered in a continuous manner in order to make more notable impact among the patients (Ayar, Öztürk & Grey, 2021).

The central focus of this review was to examine the impact of educational program on self-management practices and disease outcomes among patients with T2DM in Saudi Arabia. From the literature pieces of evidence, it was noted that the educational programs had a significant impact on the self-management practices as well as on the clinical outcomes. Regarding the self-management practices, this

study noted that the educational programs significantly equipped patients with the knowledge to perform various self-care practices, such as foot assessment and care, physical activity, dietary plans, and medication adherence. Pieces of evidence across the literature uphold to this effect (da Rocha et al., 2020; Marciano et al., 2019). The effect can be attributed to the regular reminders and essence of the practice as perceived by the patients (Avdal et al., 2011).

There was also a notable outcome regarding the impact of the educational programs on the clinical outcomes among the diabetes patients, including a reduction in the risk of cardiovascular diseases. According to AlHaqwi et al. (2023), education programs equip patients with skills that help them in "adopting a healthy lifestyle, developing problem-solving skills, active involvement, and acquiring coping strategies," which help manage the disease, keeping any signs for earliest possible mitigation. In the end, patients would not only have better glycemic control practices but also achieve better overall quality of life.

From the tabulated results, it is evident that the educational programs have been noted to produce an array of positive impacts, ranging from the lowering blood glucose concentration (HbA1c level), to reducing the risks of cardiovascular risk factors, such as obesity. Regarding the positive impact of the educational programs on risks of cardiovascular diseases, there are pieces of evidence linking better glycemic control to lower risks of cardiovascular complications in type 2 diabetes (Holman et al., 2008). Studies have also indicated that for every reduction in HbA1c level by 1%, there is 14% lower risk of myocardial infarction, a 21% lowered probability in fatalities related to type 2 diabetes, and a 37% and 43% decline in the risks of microvascular complications and amputations, respectively (Stratton et al., 2000). These pieces of evidence strongly exhibit the significance of educational interventions targeting glycemic control.

However, additional results showed that the impact of educational intervention on self-management practices and behaviors is not uniform across populations. A number of factors were noted to significantly affect the casual relationships, including widows, divorced and smokers. These variables were noted by Almutairi, Gopaldasani and Hosseinzadeh (2023) who examined the impact of intervention program on self-management practices and clinical outcomes. Those who smoke were less likely to achieve better results, regarding the clinical outcomes, from the educational program. The relationship can be explained from the physiological implications of cigarette smoking on diabetes treatment – literature evidence shows that smoking significantly increases insulin resistance and reduces rate of wound healing (Artese et al., 2017; McDaniel & Browning, 2014). Moreover, the widowed are faced with diverse social and economic challenges that may affect their competency in physical activities and nutritional balance.

CONCLUSION

Various research designs have been applied to examine the impact of educational programs on improving self-management and clinical outcomes among patients with T2DM in Saudi Arabia. However, this review has noted that all the intervention programs are only educational in nature. All the tested programs had a positive impact on the self-management practices and clinical outcomes among the named patient population. Nevertheless, while the educational programs have been proven in the literature to improve self-management practices, health behaviors, clinical outcomes and quality of life among patients with diabetes mellitus, there has been little attention on the other intervention programs aligned to theoretical models and technological approaches. This still leaves a gap regarding the test of intervention programs towards improving self-management practices of T2DM.

RECOMMENDATIONS

The healthcare staff need to embrace personalized patient education in order to help them cope positively with T2DM, reduce chances of complications and attain better quality of life. Moreover, there seem to be a critical gap in the translation of empirical pieces of evidence to practice since a lot of studies have exhibited the positive impact of educational programs, yet the complications and mortality incidences of T2DM persist in Saudi Arabia. Again, future researchers in Saudi Arabia need to examine the impact of other intervention programs, such as technology-based approaches since they could be more receptible among patients and healthcare staff in the current age of technological advancements.

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Appendices

Appendix A: Abstraction Table

#	Author(s)	Aim of the study	Methods and participants	Intervention applied	Results
1	Elfakki et al. (2022)	Impact of educational intervention on mean body weight, blood glucose, and the level of blood pressure.	Pragmatic clustered randomized trial where 180 patients with type 2 diabetes mellitus.	Structured Information, Education, and Communication in specified primary health care centers. There were four structured sessions on diabetes self-care at months: first, third, fifth, and seventh month.	A reduction in the waist and fasting blood glucose concentration across the 12 months. However, a reduction in BMI was only witnessed in the first month.
2	Mohammad and Khresheh (2018)	Examine the effect of educational intervention on diabetes foot care towards prevention of foot ulcers.	Quasi-experimental research design was utilized. Data was collected using pre and post-test checklist on foot care practices on four areas: knowledge, self-care practices, nutrition and insulin injection.	Educational intervention on foot care. Intervention developed by the researcher to include knowledge about diabetes foot care, self-care of foot care, diet, and insulin adherence. In the Internal Medicine Department and Outpatient clinic.	Improvements in patients' knowledge and practices regarding foot assessment toward prevention of foot ulcers.

#	Author(s)	Aim of the study	Methods and participants	Intervention applied	Results
3	AlHaqwi et al. (2023)	To examine the impact of impact of patient-centered diabetes education on controlling diabetes and cardiovascular risk factors	Pre-experimental pretest-posttest one group study design. 130 patients with type 2 diabetes mellitus. Data was collected in three phases, first, third and sixth month.	Educational sessions based on association of Diabetes Care and Personalized Education Specialties (ADCES) addressing 7 elements for better outcomes – diet, physical activity, monitoring of blood glucose, adherence to medications, problem-solving skills, healthy coping for a better quality of life, and reducing risks. Begun with an initial 30–45 min session.	A notable reduction in risk factors of cardiovascular diseases, such as obesity, blood pressure, and blood cholesterol.
4	Khan et al. (2022)	To determine the impact of Pharmacist-Based Diabetic Intervention (PDIM) on knowledge, adherence to medications and self-care practices during COVID-19.	A multi-arm pre-post study design. 110 patients with type 2 diabetes mellitus. Data collected using set of self-administered questionnaire scales.	Pharmacist-Based Diabetic Intervention (PDIM) – which included diabetic educational module and medication improvement strategies.	Significant improvement patients' self-care practices, medication adherence, disease knowledge, and HbA1c.
5	McEwen et al. (2015)	To examine the impact of education program on safer fasting among patients with type 2 diabetes during Ramadan.	Intervention-based research study using education program to improve self-care practices among 774 individuals with T2DM.	Individualized type 2 diabetes education focusing on meal planning, physical activity, blood glucose monitoring and acute metabolic complications.	A significant improvement in self-monitoring of blood glucose, knowledge about hypoglycemic signs, physical activity. A reduction in BMI and glycated hemoglobin.
6	Ba-Essa et al. (2015)	To examine the impact of education program on patients with diabetes mellitus.	Case- control intervention-based study with a control group. A total of 60 patients with type 1 and type 2 diabetes mellitus were included.	A 4-month Glucose self-monitoring education program with cognitive and psychomotor domains– which aimed at improving disease knowledge, optimum glycemic control (HbA1c <6.0), regular exercise, diet, and medication adherence.	There was a significant reduction in the patients' fasting blood glucose, HbA1c and lipid profile levels. A significant improvement in patients' knowledge, attitude and behavior towards self-care practices.

#	Author(s)	Aim of the study	Methods and participants	Intervention applied	Results
7	Mokabel et al. (2017)	To determine the impact of educational program on self-management outcomes and the predictors of compliance.	A longitudinal experimental research design was utilized involving 150 patients with T2DM in outpatient clinics.	An educational program covering diabetes knowledge, risk factors, smoking cessation, diet regulation, glycemic index, insulin injection, self-monitoring of blood glucose, physical activity and lifestyle changes.	The education program had a positive impact on various self-care activities; regular self-checks of blood sugar, dietary regimen, foot care, and exercise and lifestyle behaviors. Poor glycemic control was noted among individuals who were divorced or widowed, smokers, did not examine their feet daily, and did not examine their eyes regularly.
8	Almutairi, Gopaldasani and Hosseinzadeh (2023)	To investigate the impact of patient activation-tailored intervention on self-management practices and clinical outcomes among T2DM patients.	A pre- and postintervention study design was utilized involving 100 patients with T2DM attending primary care services.	An education programs consisting of monthly face-to-face, 15–20-minute sessions for three months delivered by trained doctors. A follow-up check was done using phone calls per month for 3 months. The program focused on diabetes knowledge, problem-solving skills, self-management, and stress management skills.	A significant reduction in hemoglobin A1c and BMI after the sixth month. A significant improvement in blood glucose self-testing, diet, diabetes knowledge, and physical exercise after 6 months.
9	AL-Shahrani (2018)	To assess the impact of education program on glycemic control measures among patients with diabetes mellitus.	A prospective study design involving 465 patients with diabetes mellitus.	A30 min regular diabetic education program every two months along one-year period focusing on glycemic control.	A significant improvement in glycemic control (bA1c 10.41 ± 1.89 to 8.22 ± 1.68 (P<0.012)).