https://doi.org/10.46389/rjd-2023-1320
www.rjdnmd.org

Rom J Diabetes Nutr Metab Dis
2023; volume 30, issue 2, pages 244-253

Review

Knowledge and oral health literacy in patients with type 2 diabetes: a systematic review

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Received: 3 February 2023 / Accepted: 8 April 2023

Abstract

Knowledge has a direct relationship with oral health. Since the oral health of patients with type 2 diabetes (T2DM) is affected by their blood sugar levels; therefore, the present systematic study was conducted to examine oral health literacy in patients with T2DM. Studies conducted in this field were searched in reliable scientific databases such as PubMed, CINAHL, Web of Science Core, Inform it Health Databases, Scopus, Google Scholar, ProQuest, PsycINFO and DoPHER, and were selected based on the study inclusion criteria and the main purpose of the research in 2022. As a result, among 6572 reviewed articles, 15 articles were included in the study. A number of 8642 patients with T2DM with an average age of 52.7 years were examined. The total awareness of these people with T2DM regarding oral health literacy was 48%. Pacients' oral health knowledge was investigated, which was about 43% in men and 58% in women. In 9 studies of patients with diabetes, oral health literacy was less than 50%. In 6 studies, it was observed that the level of oral health knowledge was higher than 50%, and a significant correlation was observed between patients with T2DM and their level of oral health literacy. City residents had higher oral health literacy. In conclusion, oral health literacy in people with T2DM was generally low and needed more attention. Some factors, such as urban life, access to the Internet and virtual space, as well as the gender of persons with T2DM, were effective on the level of oral health literacy.

Keywords: oral health, health literacy, type 2 diabetes, knowledge.

Introduction

Diabetes is one of the most important metabolic diseases that affect people's health and millions of people are diagnosed with diabetes every year. Studies show that diabetes affects the body's ability to regulate glucose or blood sugar for energy. High blood sugar puts cells under oxidative stress and inflammation and these changes have a negative impact on oral health in addition to the vital tissues of the body [1, 2]. In 2019, the World Health Organization announced that more than 3.5 million people worldwide were affected by oral diseases [3].

There is a direct relationship between diabetes and oral health, and it has been reported that oral diseases are more common in patients with type 2 diabetes (T2DM) [4, 5]. Studies also show that gum disease and other oral health problems are more common in persons with T2DM, and these people are at a higher risk of gum disease, gingivitis, and periodontitis [6, 7]. In fact, diabetes affects the body's ability to fight bacteria, which leads to gum infection. Diabetes is also related to dry mouth disease, and this issue increases the possibility of other oral diseases such as caries and dental infections. Therefore, more attention and awareness need to be given to these patients [8, 9].

Oral health knowledge and literacy levels have an effective role in controlling oral diseases and health behaviors [10]. Health literacy means people's understanding of factors affecting health and the implementation of health-promoting strategies [11]. Recent studies on people with T2DM show that their lack of health awareness and low oral health literacy are related to oral disease [12]. Of course, studies have shown conflicting findings concerning oral health literacy in persons with T2DM. Some studies have reported optimal oral health literacy and many studies have reported poor oral health literacy in persons with T2DM [12, 13].

So far, few systematic studies have investigated oral health literacy in persons with T2DM. As mentioned, oral health plays an effective role in the health of these patients, and increasing health literacy can have an impact on the awareness of people with T2DM. Considering the importance of oral health on the condition of patients with T2DM, oral health literacy in this study has been investigated.

Material and methods

Search strategy and study selection

Research articles published in English in the last 15 years were analyzed using relevant terms in PubMed, CINAHL, Web of Science Core, Informit Health Databases, Scopus, Google Scholar, ProQuest, PsycINFO and DoPHER databases. The search was done with the help of keywords and Medical Subject Headings (MeSH). Search terms for screening articles include "knowledge", "oral health", "oral hygiene", "diabetes", "type 2 diabetes", "diabetes mellitus", "adult literacy", "oral health knowledge", "literacy", "health literacy", "oral health behavior". The combination of these words with operators "AND" and "OR" was also examined. All articles related to the topic were reviewed.

Inclusion and exclusion criteria

The inclusion criteria included articles in which the level of oral health literacy in persons with T2DM was examined without restrictions on age, weight and sample size. Studies in which oral health literacy was examined in the presence of other variables with no restrictions were included in this study. Exclusion criteria included studies in which subjects without diabetes were investigated. Studies in which persons with T2DM with specific diseases were investigated. Articles whose full text was unavailable, as well as data related to review studies, case reports, and invalid manuscripts, were not extracted.

Data extraction and screening

Two review authors performed search strategies. The abstract of all articles was reviewed, and in cases where the article could not be removed based on title or abstract, the full text of the article was retrieved and evaluated. In the initial search, 6572 records were obtained. At this stage, 3194 records were removed due to duplication and lack of inclusion criteria or because of indirect connection with the subject (2397 records). Then, 981 articles were retrieved for full-text review and detailed results. A complete review led to a final selection of 15 studies. The method of presenting topics, including determining study purpose and collecting findings, was based on Preferred Reporting Items for Systematic Review (PRISMA) (Figure 1).

Articles quality assay

The quality of the final articles was evaluated separately by two researchers with experience in the field of systematic review research. Then, in a joint meeting, results were discussed and in cases where there was a difference of opinion, discussion continued until a final agreement was reached between two evaluator researchers. In order to check the quality of the articles, the Cochrane Risk of Bias scale was used, and the articles were categorized based on low, high and unclear risk of bias [14]. This article is registered in PROSPERO (Code number: CRD42022368164).

Results

A total of 15 articles were included in the study (Table 1). Among reviewed articles, in 13 articles, persons with T2DM constituted the investigated community [15–27] and in four articles, studies were conducted on oral health literacy of type 2 and type 1 diabetes patients [17, 22–24, 28]. Four studies compared the health literacy of people with and without diabetes [15, 16, 23, 28]. Two studies showed that people without diabetes had more information about oral health literacy [15, 29].

Reports in 9 studies show that a high percentage of patients with diabetes have less than 50% oral health literacy [17–20, 22, 24, 27–29]. Meanwhile, the results of 6 other studies show that oral health knowledge level

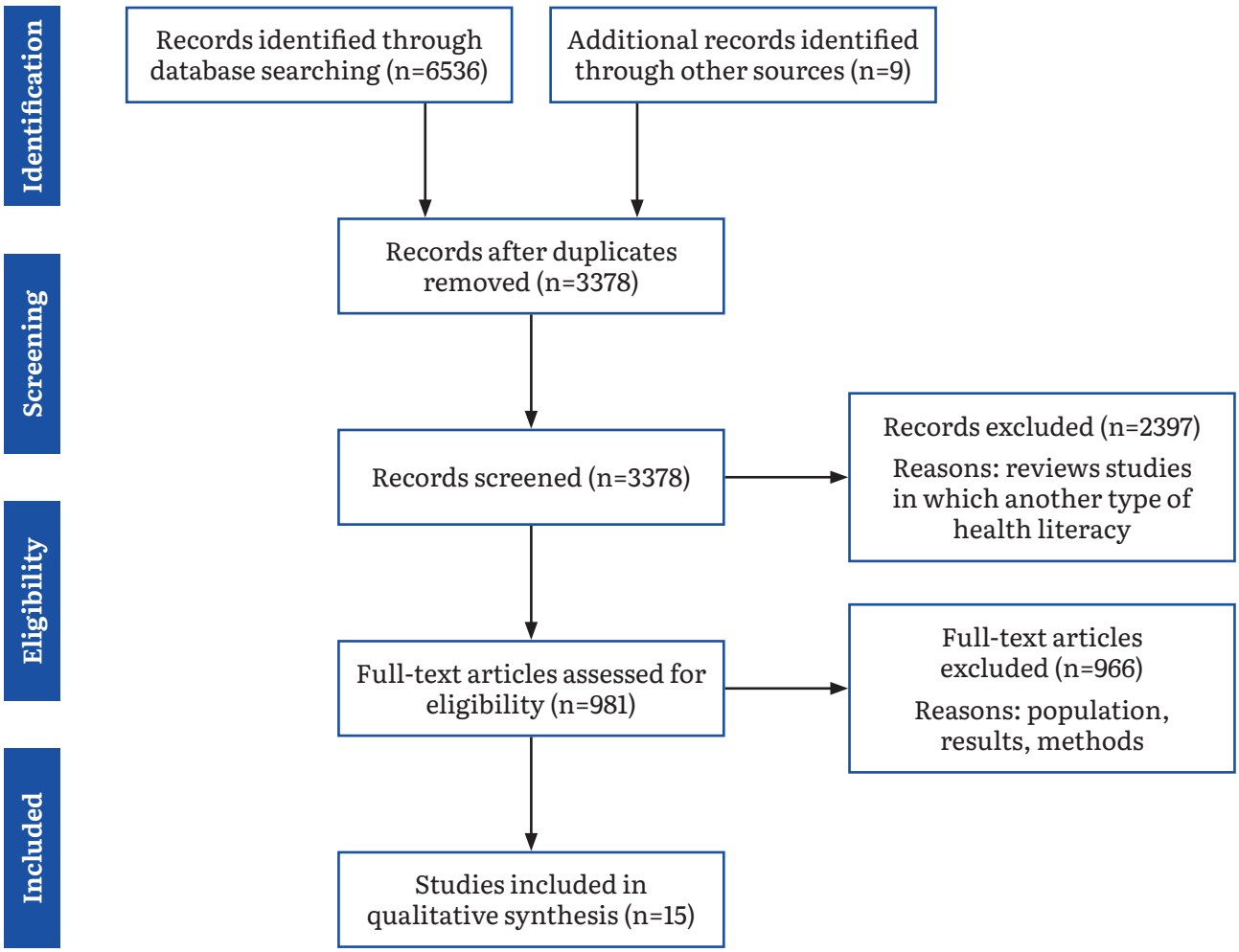

Figure 1: PRISMA flow diagram of selection of articles.

is higher than 50% and a significant relationship between persons with T2DM and the level of oral health literacy was observed in them [15, 16, 21, 23, 25, 26]. Findings show that in total of reviewed studies, 8642 patients with T2DM with an average age of 52.7 years have been analyzed, and the awareness level of these persons with T2DM in relation to oral health literacy is about 48%. In a study of how gender affects oral health literacy, 12 studies showed that this rate is reported to be about 43% in men and about 58% in women, which confirms that oral health literacy is higher in women. It was also found that city residents have higher oral health literacy [15, 28].

Mian *et al.*'s research on patients with T2DM found that awareness level is about 74% [29]. Another study stated that many persons with T2DM had high awareness, and the total score of oral health awareness was 64% [26]. A study by Wang *et al.* found that oral health literacy was around 81% and oral complications were lower in persons with T2DM with high awareness [15]. In other surveys, oral health literacy varied from 61 to 81 percent [18, 22].

Risk of bias assessment

The inclusion quality of 15 articles for systematic review was done by the Cochrane scale. The results of the article's quality assessment are presented in Table 1. According to the Cochrane evaluation scale, only three studies had a risk of bias in 2 biases, and six studies had a risk of bias in one area. Other studies had unclear levels of risk of bias in at least four areas of selection bias, performance, reporting and types of bias (Table 2).

Discussion

Insufficient health literacy is considered a serious obstacle to oral disease management and can affect people's performance. The present study has investigated oral health literacy in persons with T2DM. The findings of the present study show that oral health literacy was less than 50% in a high percentage of patients with diabetes and most patients had poor knowledge about oral health and diabetes [17, 19, 20, 29].

https://doi.org/10.46389/rjd-2023-1320

Table 1: Articles reviewed.

Author & year study design	Sample population	Knowledge outcomes	Main findings	Recommendations
Mian *et al.* **[15] (2020) Observational cross-sectional self-administered questionnaire**	Among 202 participants aged 30 to 60, about 36% had type 2 diabetes, 11% were men and 24.7% were women.	In total, it was observed that 76.4% of persons with T2DM were aware of diabetes effects on oral health. Women were more aware than men (59.1% of men and 84% of women).	Most patients had relative knowledge about diabetes.	A noticeable communication gap was observed between health workers and patients.
Parakh *et al.* **[16] (2019) Cross-sectional**	447 patients were examined in village with the age range of 25 to 60 years, 54% were men and 46% were women.	Average patients' knowledge regarding oral health was low and average awareness was 41%. Women's awareness was higher than men's.	Lack of oral health knowledge was observed in target patients.	Information through treatment staff can be effective in increasing awareness of patients.
Wang *et al.* **[17] (2018) Face-to-face questionnaire**	One thousand and twenty-four Persons with T2DM aged 55 to 74 years were 46% male and 54% female.	65% awareness rate of oral health knowledge in patients. In urban areas, health knowledge was close to 69% and in rural areas, it was 59%, and this difference was statistically significant.	Oral health knowledge was average. Persons with T2DM had more knowledge than people without diabetes.	It is suggested to pay more attention to the medical staff of the villages.
Shanmukappa *et al.* **[18] (2017) Descriptive cross-sectional.**	Six hundred patients, 63% of whom were women	In total, oral health awareness was 34%. A high percentage of patients (71.4) were unaware of oral health impact on diabetes and blood glucose.	Oral health knowledge was at a low level. There was no correlation between age and awareness of oral health. Awareness was generally low, but health knowledge was significantly higher in educated people.	Providing health programs can be effective in improving awareness.

Table 1: Continued.

Author & year study design	Sample population	Knowledge outcomes	Main findings	Recommendations
Afolabi *et al.* **[19] (2017) interviewer-administered questionnaire. Descriptive cross-sectional.**	One hundred and twenty patients with an age range of 38 to 72 years, of which 62.5% were men and 37.5% were women. About 7% of type 1 diabetes, 86% of type 2 diabetes and 7% were unknown.	90% of patients had low awareness. Only 27% received information about the influence of gum disease and diabetes.	Most of the patients had little information about oral health and oral health literacy was at a low level.	Significant need for increased knowledge for persons with T2DM, regarding oral complications.
Al Amassi *et al.* **[20] (2017) Internet-based, cross-sectional.**	278 patients with an age range of 18 to 64 years, of which 115 were men and 163 were women.	74% knew the importance of blood sugar control in order to minimize oral complications. 81% had knowledge about the role of diabetes on oral diseases. 76% knew the relationship between diabetes and oral complications.	Acceptable level of awareness for Persons with T2DM regarding awareness of increased oral health problems.	Educational programs should be provided to increase the awareness of patients, especially choosing people with lower knowledge level and providing specific training to them can increase their health literacy. Dentists can be very effective in this way.
Kejriwal *et al.* **[21] (2017) Questionnaire**	Three hundred type 2 patients, 200 of whom were men and 100 were women.	Knowledge and awareness of oral health was less than half.	Low knowledge about increased risk for oral disease.	Dental professionals to increase Literacy of importance of maintaining good Oral health.
Lasisi *et al.* **[22] (2016) Cross-sectional.**	One hundred and forty-three patients with an age range of 26 to 89 years, 48 of them were men and 95 of them were women.	Only 23% had good knowledge. 17% mentioned having oral diseases could affect glycemic control. 467% agreed regular consultations with the dentist were necessary.	Poor oral health awareness, practices and status.	Oral health education should be incorporated into treatment plan of patients diagnosed with T2DM.

https://doi.org/10.46389/rjd-2023-1320

Table 1: Continued.

Author & year study design	Sample population	Knowledge outcomes	Main findings	Recommendations
Ummadisetty *et al.* **[23] (2016) Self-constructed questionnaire.**	Two hundred and three patients were 123 men and 80 women.	61 people with diabetes had sufficient knowledge about oral health.	The level of knowledge was optimal, but the older and high-risk age group had less knowledge.	Health professionals can be effective in increasing oral health knowledge by providing information.
Sahril *et al.* **[24] (2014) self-administered questionnaire, Cross-sectional.**	Four thousand and 17 people with type 2 diabetes	More than 60.0% of patients did not know the association between diabetes and oral health.	Knowledge about oral care and health was at a low level. Behaviors and oral habits were at a low level. Low demand for dental referral among patients.	Comprehensive oral health promotion program, healthcare workers to routinely refer patients for oral healthcare for holistic diabetes care.
Weinspach *et al.* **[25] (2013) Self-administered questionnaire.**	444 with an average age of 59 years, of which 23 had type 2 diabetes, 101 had type 1 diabetes, and 111 were non-diabetes.	About 38% of people with T2DM had knowledge about oral diseases. persons with T2DM are most often affected by periodontitis than persons without T2DM.	Deficient knowledge about mutual influence between periodontitis and diabetes.	Dentists and diabetologists to provide more oral care information.
Aggarwal *et al.* **[26] (2012) Self- administered questionnaire**	500 patients with type 2 diabetes between 35 and 87 years old, 53% of whom were men and 47% were women.	61% confirmed the relationship between diabetes and oral complications. 79.4% never referred by physical for dental care.	Significant need for increase in knowledge of periodontal disease in patients with T2DM.	All health professionals need to support comprehensive oral care, as an integral part of general health.

Table 1: Continued.

Author & year study design	Sample population	Knowledge outcomes	Main findings	Recommendations
Eldarrat *et al.* **[27] (2011) Self- administered questionnaire**	One hundred patients with T2DM with an average age of 47. Of which 58% had type 2 diabetes and 48% had type 1 diabetes.	60% aware of their increased risk for periodontal disease. 70% did not know the relationship between dry mouth and oral complications. 37% received knowledge of oral disease risk from dentists.	Patients more knowledgeable of oral health.	Health professionals need to develop educational programs.
Bangash *et al.* **[28] (2011) Descriptive cross-sectional.**	300 patients with T2DM, of which 36 were type 1 diabetes and 264 were type 2 diabetes.	64% patients had knowledge about the oral complications of diabetes.	The level of awareness was at an optimal level. It may be related to investigated people organization and army's attention to health of the soldiers.	Need for health education programs for higher of literacy patients.
Bowyer *et al.* **[29] (2011) Self-completed questionnaire**	Out of 229 patients with T2DM, 62.5% were men and 37.5% were women.	13% knew the role of oral diseases on oral health and 23% had no information. About 70% of patients needed counseling regarding oral health knowledge.	Patients with T2DM generally had little knowledge about oral health.	Training and advice for health professionals and patients on oral health and diabetes is needed

https://doi.org/10.46389/rjd-2023-1320

Table 2: Study quality scores.

Scales in 5 fields	Cochrane Risk of Bias Tool scale (types of biases)						
	Function bias		Selective bias		Report Bias	Fall Bias	Other types of biases
	RGS	AC	SF	CF			
Mian. [15]	low	Un	Un	Un	Un	Un	low
Parakh. [16]	Un	Un	Un	Un	Un	low	Un
Wang. [17]	low	Un	Un	Un	Un	low	Un
Shanmukappa. [18]	Un	Un	Un	Un	Un	Un	Un
Afolabi. [19]	Un	low	Un	low	Un	low	Un
Al Amassi. [20]	low	Un	Un	Un	Un	low	Un
Kejriwal. [21]	Un	low	Un	Un	Un	Un	Un
Lasisi. [22]	Un	low	Un	low	Un	low	Un
Ummadisetty [23]	Un	low	Un	low	Un	low	Un
Sahril. [24]	Un	Un	Un	Un	Un	Un	Un
Weinspach. [25]	Un	Un	Un	Un	Un	low	Un
Aggarwal. [26]	Un	low	Un	Un	Un	Un	low
Eldarrat. [27]	Un	Un	Un	Un	low	Un	Un
Bangash. [28]	Un	low	Un	Un	Un	Un	low
Bowyer. [29]	low	Un	Un	Un	Un	low	Un

Note: Un – Unknown; RGS – Random generation sequence; AC – Allocation concealment; SF – Sample furnace; CF – Consequence furnace.

According to the studies reviewed in this article, awareness is influenced by various factors, including the characteristics of the participants in the study. The relevant findings showed that women had more health knowledge than men, and attention to oral health was a higher priority in women, and behaviors related to health and appearance were more colorful [17, 29, 30]. Higher oral health knowledge in women compared to men has been reported in past studies, both in patients with T2DM and persons without diabetes [30–32].

In several studies, a positive and significant relationship was observed between health knowledge and education variables, so education can be an effective step in increasing health literacy [16, 18, 33, 34]. During the research of Afolabi *et al.*, one hundred and twenty persons with T2DM with an age range of 38 to 72 years were examined. Their findings showed that there is a significant linear relationship between oral health literacy and oral health behavior, and the decrease in oral health literacy in people with oral injuries is related [17]. The place of residence has been one of the other effective options, so rural people obtained a lower score concerning oral health [15, 28]. Some studies have shown that characteristics related to experiences, including education, were related to health knowledge [29, 33]. Also, access to the Internet plays an effective role in increasing oral health literacy in people with diabetes, and the level of communication people have with cyberspace and society can affect their oral health [18]. Another study reported that persons with T2DM living in the city show higher health knowledge compared to their rural counterparts [28]. In this regard, Wang *et al.* showed that the oral health literacy in patients living in the city was 68%, while 59% in rural patients [18].

The articles reviewed in this article show patients' poor knowledge regarding the mouth and diabetes. In many types of research, it has been reported that paying attention to education can be effective in improving the knowledge of patients with T2DM. Improving communication and educational programs at the global level, reducing the challenges of accessing health facilities in remote areas, reducing health service disparities around the world, and providing Internet access and awareness of oral complications may have a positive effect on increasing people's health [15, 16, 25, 27]. Parakh *et al.* have suggested that all health professionals should work together to improve oral health literacy and that outreach programs may help [28].

In our systematic review, in 11 studies (75% of studies), authors considered the role of healthcare professionals in promoting health literacy to be very colorful and suggested that education through these people can be effective. Harada *et al*. stated that non-dental healthcare professionals have a promising role in promoting oral health among people with T2DM [35]. In addition to health care professionals, it is also important to pay attention to people who are effective in the lives of persons with T2DM. In a survey that was conducted on the awareness level of persons with T2DM relatives in 60 different countries, it showed that bad eating habits, use of tobacco and cigarettes, and fear of dentistry were prevalent in many relatives of patients with T2DM, and despite these cases, in addition to patients with T2DM education is also important for their relatives and their families [36].

Low health literacy brings many problems to persons with T2DM and the country's economy. Diabetes Mellitus is an increasing public health concern [37]; on the other hand, measuring health literacy can create proper knowledge in this regard [38]. It has been reported that health literacy can be effective in improving various diseases in persons with T2DM and future research should be done mainly with the aim of testing interventions' effectiveness in improving health literacy among patients with T2DM so that a better solution can be used [39]. In this regard, paying attention to educational programs for persons with T2DM can effectively prevent oral problems. Of course, one of the limitations in developing countries is the lack of infrastructure and television networks related to oral health and, most importantly, the economy of families. In many cases, attention to oral health has become secondary. Health policymakers should provide basic educational instructions to diabetics and provide conditions for improving oral health literacy.

One of the limitations of this systematic study was the incompleteness of data of many articles in relation to method and classification and the low quality of many articles. In many studies, results details, including oral health literacy scores, should have been mentioned. However, in the review of the quality of articles, as much as possible, studies of appropriate quality and similar in terms of the method were collected.

Conclusion

Oral health literacy in persons with T2DM was generally low and needed more attention. Results also showed that oral health literacy in persons with T2DM positively affects health and health-seeking behaviors. Increasing knowledge of oral health is related to people's education level. Some factors, such as urban life, access to the Internet and virtual space, as well as the gender of people with T2DM, were effective on the level of people's health literacy. The placement of educational programs related to oral health literacy can be effective on patients' understanding and health performance in relation to improving oral complications. More cross-sectional studies in different populations are needed for a more detailed investigation.

Conflict of interest

The authors declare no conflict of interest.

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