Oral Health-related Knowledge and Assessment of Oral Health Status of Diabetic Patients Attending Dental Clinics at College of Dentistry, Hail, Saudi Arabia

Rashid I Mian¹, Fawzyeh FH Rashidi², Tahani M Alshammary³, Saad Al Zubaidi⁴, Freah Al Shammary⁵, Ammar A Siddiqui⁶, Junaid Amin⁷, Rabia S Khan⁸

ABSTRACT

Aim: This study was aimed to evaluate the oral health status and knowledge of diabetic and nondiabetic patients attending College of Dentistry clinics, Hail, the Kingdom of Saudi Arabia.

Materials and methods: It was an observational cross-sectional study. Using nonprobability convenient sampling technique, data were collected from 202 respondents. A total of 202 diabetic and nondiabetic patients were screened for the study. Data were collected by interview using the structured, self-administered questionnaire, and assessment of oral health status was done by clinical examination. The collected data were analyzed using IBM SPSS software. The data were displayed as numbers and percentages and association among the variable of interests was measured using Pearson Chi-square.

Results: Of the 202 patients, 102 (50.6%) were males and 100 (49.4%) were females. Majority of the patients, 71 (35.2%) were in the age-group of 30–40 years. In all, 128 (63.4%) participants knew the effect of diabetes mellitus (DM) on oral health, 167 (82.7%) knew that diabetic patients needed special healthcare, 152 (75.25%) had never spoken to their doctors about oral health, and 164 (81.19%) had never spoken to their dentists regarding diabetes.

Conclusion: The complications associated with oral health are more common in diabetic patients when compared to the nondiabetic patients. This is the case in both male and female patients visiting the College of Dentistry in the Hail region.

Clinical significance: Diabetes mellitus is associated with increased susceptibility to oral infections especially periodontal disease. Role of a general dentist in diagnosis and raising patient awareness toward DM and its effects on oral health need to be emphasized.

Keywords: Diabetes mellitus, Hail, Oral health, Periodontal diseases, Saudi Arabia.

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) may lead to several oral complications such as xerostomia, infections, poor healing, candidiasis, caries’ severity, several periodontal diseases, and burning mouth disorders.¹ According to the recommendations of International Diabetes Federation, healthcare professionals at primary health centers should assess diabetic individuals (i) for routine of recommended oral self-care habits and (ii) for early signs of oral health problems and (iii) also provide recommendations to improve self-care and refer to a dentist. Several epidemiological studies have been carried out to understand the association between systemic health and periodontal diseases.² Periodontal disease is considered as “sixth complication” in addition to the already established five complications of DM, e.g., retinopathy, neuropathy, nephropathy, altered wound healing, and macrovascular disease.³ Gingivitis and its associated conditions are more commonly seen in poorly controlled insulin-dependent diabetes when compared to the controlled insulin-dependent diabetes. The increase in periodontal diseases occurs due to a change in host response, subgingival microflora, vascularity, and collagen metabolism.⁴

The periapical inflammatory disease shows some resemblance to chronic periodontal diseases. Chronic infection within the oral cavity is caused by gram-negative aerobic bacteria and enhanced cytokines levels.⁵ Diabetic patients are more inclined to different endodontic and periodontal problems.⁶ The periodontal diseases are found to a greater extent in patients with diabetes for a long duration when compared to those with diabetes for short duration. However, the same frequency was seen in diabetic and nondiabetic patients concerning caries. The apical periodontitis with infection can be controlled by root canal treatment and has a high success rate.⁷ However, the failure rate increases in the case of diabetic

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patients compared to nondiabetic patients. Oral diseases are
acknowledged as a major issue affecting the global public health. 
Gingivitis and periodontitis are common in diabetic patients
compared to those without diabetes. A previous study detected
chronic periodontitis, tooth mobility, and furcation involvement
were most common among DM patients compared to nondiabetic
patients.9

Research in the past decades has well established the fact that
periodontal disease and tooth loss are associated with systemic
metabolic disorders such as DM. It is now acknowledged that
DM adversely affects periodontal tissues supporting the tooth. In
2011, an international conference on diabetes and oral disease by
the New York Academy of Sciences focused on DM-periodontal
problems and recommended a multidisciplinary approach of a
medical and oral health professional with DM patients to achieve
the desired clinical outcomes. Thus, the DM-periodontal disease
connection is highly considered in clinical practice.9 With the advent
of terminologies such as periodontal medicine, the role of a dentist
is all the more imminent and cannot be undermined in a symbiotic
relationship with physicians in the management of patients affected
by DM. For some patients, dental visits may be the only exposure to
the healthcare system, which highlights the importance of including
diabetes risk assessment for patient well-being.

In 2014, the World Health Organization (WHO) reported
that Saudi Arabia ranked second in the Gulf and seventh in the
worldwide, with 7 million people diagnosed with diabetes. In 2014,
community-based national epidemiological health survey reported
32.8% prevalence of DM in Saudi population, with 26.2% being
males and 21.5% females.10 Likewise, in 2014, an epidemiological
survey of Hail city reported an overall high prevalence (31.1%) of
DM; and in men it is 32.6% and women 29.6%.11

The aim of the present study was to report oral health-related
knowledge of diabetic and nondiabetic patients attending College
of Dentistry clinics. To our best knowledge, this was the first study of
its kind in Hail region, Saudi Arabia. This study will give an overview
of participants’ oral health knowledge in contrast to DM and will
lead as a baseline for future research in this regard.

Materials and Methods
It was an observational study, having a cross-sectional design,
approved by the Research Ethical Committee of University of
Hail, with an approval number H-2018-070. The present study was
conducted in Hail city located in North-West of Saudi Arabia with
a population of approximately 412,758. The sample size of the study
was 202 patients, male (n = 102) and female (n = 100), with age
ranging between 30 years and 60 years, attending dental clinics at
College of Dentistry. The data were collected using nonprobability,
convenient sampling technique. Verbal and written informed
consent was taken from all participants before collecting data.
Participants were interviewed by a single trained research assistant
using a self-administered validated standardized structured
questionnaire including sociodemographics and oral health-related
knowledge. Reliability of the study tool was pretested pre
and postinterview using the above-mentioned questionnaire. Internal
consistency was measured using Cronbach’s a test and was found
to be in an acceptable category if it is 0.77. Data were collected
from March 2018 to December 2018. Individuals with disabilities
or having any systematic disease except T2DM were included as a
sample of the present study. Patients with type 1 diabetes, those
below 30 years of age, and those above 60 years were excluded from
the study. Data were also collected by doing clinical examination
comprising the plaque index and coronal caries using the decayed,
missing, and filled teeth (DMFT) index. For each participant,
root surface caries was recorded (yes/no) and expressed as the
percentage of teeth with root caries. Tools used for the examination
were (N22) color-coded probe 2–4–6–8–10–12 mm markings, mouth
mirror, explorer, gauze cotton roll, and plaque disclosing tablets.
Clinical examination was done by a licensed dentist.

The collected data were entered, coded, and analyzed using
SPSS version 21. Data were displayed as descriptive statistics as
numbers and percentages. Pearson Chi-square test was used
for reporting inferential statistics. p values of less than 0.05 were
considered significant.

Results
Total eligible participants were 237, but 202 agreed to participate
in this study, giving a response rate of 85.23%. In all, 22 (10.9%) DM
male and 80 (39.7%) non-DM male; 50 (24.7%) DM female and
50 (24.7%) non-DM female patients) were examined to determine
their oral health status.

The study sample included 102 (50.6%) male and 100 (49.4%)
female patients. Among these, a total of 22 (10.9%) male and 50
(24.7%) female were diabetic patients. In this study, the majority
of patients, 71 (35.2%) were in the third to the fourth decade, followed
by 66 (32.6%) in the fifth to the sixth decade of age-group. Most of
the diabetic patients were in the fifth to sixth decade, i.e., 12 (54.5%)
males and 34 (68%) females. Most of the respondents, 74 (36.6%)
and 60 (29.7%) of the study population, had university and higher
secondary level education, respectively, and only 24 (11.9%) were
without any education. The 20 (40%) female patients with DM and
20 (40%) non-DM female patients had a primary level of education.
The 17 (77.3%) male patients with DM and 27 (33.8%) studied higher
secondary education and 51 (63.7%) male non-DM patients studied
university level of education. Majority 104 (51.5%) of the patients
were earning an income in the range of 3,000 to 10,000 Saudi Riyals
(SR) per month. The monthly income of 20 (40%) female patients
with DM was <3,000 SR, while 15 (68.2%) male patients with DM
and 26 (52%) female patients with DM were earning between 3,000
SR and 10,000 SR (Table 1).

Majority of the respondents, i.e., 144 (71.3%), reported that they
visit dentists only upon feeling pain. In all, 18 (81.8%) male patients
with DM and 36 (72%) female patients with DM visited their dentists
only on feeling pain. In all, 128 (63.4%) patients were aware of the
oral issues associated with diabetes. Of those, 13 (59.1%) male DM
and 42 (84%) female DM were aware of the effect of diabetes on oral
health. Majority of the patients, 167 (82.7%) were aware that diabetic
patients needed special healthcare, of those 18 (81.8%) were male
patients with DM and 43 (86%) female patients with DM (Table 2).

In response to any changes observed in oral health status,
35 (32.11%) female patients with DM complained of dry mouth. A
total of 97 (31.49%) patients complained of decayed teeth, among
which 10 (27.8%) were male patients with DM and 20 (18.35%) were
female patients with DM.

A total of 69 (22.4%) patients were reported complaining about
the bleeding gums, with 26 (23.85%) being female patients with
DM. Only a few patients, i.e., 9 (2.92%) complained of ulcers; among
these, 2 (5.6%) were male DM and 3 (2.75%) female DM patients.
In all, 15 (68.18%) male patients with DM and 38 (76%) female patients
with DM were among the 152 (75.25%) patients who had never
talked to their doctors about their oral health. A noticeable number
of 164 (81.1%) patients had never reported to their dentists or the dental hygienists about their diabetes, among these 15 (68.18%) were male patients with DM and 42 (84%) were female patients with DM (Table 2).

Majority of the male and female patients with DM showed poor plaque index of around 59.09 and 60%, respectively. Most of male and female non-DM patients showed fair plaque index of about 21.25 and 40.1%, respectively. This indicated that patients with DM showed poor oral health and had poor plaque index, while the non-DM patients showed fair oral health with fair plaque index. The \( p \) value for the poor plaque index was statistically significant \( p < 0.05 \) using the Chi-square test. The \( p \) value for income and education is 0.009 and 0.039, respectively, which is less than 0.05. This reflects that the poor plaque index is statistically significant, among those with both no income and no educational background. High income and higher education background influence the plaque index, as they were more aware of oral hygiene and also had proper maintenance of their teeth (Table 3).

Most of the male patients with DM, 7 (31.82%) showed a caries index of 18 to 25 and 8 (36.36%) showed 25 to 32 caries index (DMFT), whereas the male non-DM patients of about 45% showed 11 to 18 caries index (DMFT). Majority of the female DM patients, i.e., 19 (38%), and non-DM patients, i.e., 16 (32%), showed a caries index (DMFT) of about 20 to 26 range. In 15 (30%) DM female patients and

### Table 1: Sociodemographic characteristics of the participants (stratified by gender and DM/non-DM patients)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>DM</td>
<td>Non-DM</td>
<td>DM</td>
<td>Non-DM</td>
</tr>
<tr>
<td>30–40 years</td>
<td>1 (4.54)</td>
<td>43 (53.7)</td>
<td>5 (10)</td>
<td>22 (44)</td>
</tr>
<tr>
<td>41–50 years</td>
<td>9 (40.9)</td>
<td>29 (36.3)</td>
<td>11 (22)</td>
<td>16 (32)</td>
</tr>
<tr>
<td>51–60 years</td>
<td>12 (54.5)</td>
<td>8 (10)</td>
<td>34 (68)</td>
<td>12 (24)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male/female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>22 (10.9)</td>
<td>80 (39.7)</td>
<td>50 (24.7)</td>
<td>50 (24.7)</td>
</tr>
<tr>
<td>Female</td>
<td>9 (4.54)</td>
<td>2 (1)</td>
<td>1 (0.0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Level of education</td>
<td>Primary</td>
<td>University</td>
<td>Without education</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>2 (9.1)</td>
<td>3 (13.6)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Higher secondary</td>
<td>17 (77.3)</td>
<td>51 (63.7)</td>
<td>15 (30)</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>1 (0.5)</td>
<td>6 (12)</td>
<td>9 (18)</td>
<td></td>
</tr>
<tr>
<td>Without education</td>
<td>0 (0)</td>
<td>3 (6)</td>
<td>9 (18)</td>
<td></td>
</tr>
<tr>
<td>Monthly Income</td>
<td>&lt;3,000</td>
<td>3,000–10,000</td>
<td>&gt;10,000</td>
<td></td>
</tr>
<tr>
<td>&lt;3,000</td>
<td>4 (18.2)</td>
<td>15 (68.2)</td>
<td>3 (13.6)</td>
<td></td>
</tr>
<tr>
<td>3,000–10,000</td>
<td>8 (33.3)</td>
<td>39 (48.8)</td>
<td>33 (41.2)</td>
<td></td>
</tr>
<tr>
<td>&gt;10,000</td>
<td>7 (29.2)</td>
<td>26 (52)</td>
<td>3 (6)</td>
<td></td>
</tr>
<tr>
<td>Without income</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>2 (4)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Assessment of participants’ knowledge (stratified by gender and DM/non-DM)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you visit dentists?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once a year</td>
<td>1 (4.55)</td>
<td>6 (12)</td>
<td>36 (17.8)</td>
<td>0.0201</td>
</tr>
<tr>
<td>Twice a year</td>
<td>3 (13.6)</td>
<td>2 (4)</td>
<td>10 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Thrice a year</td>
<td>0 (0)</td>
<td>6 (12)</td>
<td>12 (5.9)</td>
<td></td>
</tr>
<tr>
<td>Only on feeling pain</td>
<td>18 (81.8)</td>
<td>36 (72)</td>
<td>144 (71.3)</td>
<td></td>
</tr>
<tr>
<td>Do you know diabetes can affect oral health?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13 (59.1)</td>
<td>42 (84)</td>
<td>128 (63.4)</td>
<td>0.0029</td>
</tr>
<tr>
<td>No</td>
<td>9 (40.9)</td>
<td>8 (16)</td>
<td>74 (36.6)</td>
<td></td>
</tr>
<tr>
<td>Do you know diabetic patients need special healthcare?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>18 (81.8)</td>
<td>43 (86)</td>
<td>167 (82.7)</td>
<td>0.065</td>
</tr>
<tr>
<td>No</td>
<td>4 (18.2)</td>
<td>7 (14)</td>
<td>35 (17.3)</td>
<td></td>
</tr>
<tr>
<td>Have you noticed any of the mentioned change in your mouth lately?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry mouth</td>
<td>6 (16.6)</td>
<td>35 (32.1)</td>
<td>53 (17.21)</td>
<td>0.019</td>
</tr>
<tr>
<td>Decayed teeth</td>
<td>10 (27.8)</td>
<td>20 (18.35)</td>
<td>97 (31.49)</td>
<td></td>
</tr>
<tr>
<td>Missing teeth</td>
<td>10 (27.8)</td>
<td>24 (22.02)</td>
<td>56 (18.19)</td>
<td></td>
</tr>
<tr>
<td>Bleeding gums</td>
<td>7 (19.4)</td>
<td>26 (23.85)</td>
<td>69 (22.40)</td>
<td></td>
</tr>
<tr>
<td>Other changes (abscess, ulcer, sensitivity)</td>
<td>2 (5.6)</td>
<td>3 (2.75)</td>
<td>9 (2.92)</td>
<td></td>
</tr>
<tr>
<td>There is no change</td>
<td>1 (2.8)</td>
<td>1 (0.92)</td>
<td>24 (7.79)</td>
<td></td>
</tr>
<tr>
<td>Have you ever talked to your doctor about diabetes and oral health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7 (31.82)</td>
<td>12 (24)</td>
<td>50 (24.75)</td>
<td>0.013</td>
</tr>
<tr>
<td>No</td>
<td>15 (68.18)</td>
<td>38 (76)</td>
<td>152 (75.25)</td>
<td></td>
</tr>
<tr>
<td>Have you ever talked to your dentists or a dental hygienist about your diabetes?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7 (31.82)</td>
<td>8 (16)</td>
<td>38 (18.81)</td>
<td>0.118</td>
</tr>
<tr>
<td>No</td>
<td>15 (68.18)</td>
<td>42 (84)</td>
<td>164 (81.19)</td>
<td></td>
</tr>
</tbody>
</table>
Oral Health-related Knowledge and Assessment of Oral Health Status of Diabetic Patients

Table 3: Assessment of plaque index (stratified by gender and DM/non-DM)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male</th>
<th>Female</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM</td>
<td>Non-DM</td>
<td>p value</td>
</tr>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Plaque index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0.025</td>
</tr>
<tr>
<td>Good</td>
<td>0 (0)</td>
<td>4 (5)</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>9 (40.91)</td>
<td>59 (73.75)</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>13 (59.09)</td>
<td>17 (21.25)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Assessment of caries index (decayed, missing, and filled teeth) (stratified by gender and DM/non-DM)

<table>
<thead>
<tr>
<th>Variables</th>
<th>DM</th>
<th>Non-DM</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caries index</td>
<td>4–11</td>
<td>1 (4.55)</td>
<td>24 (30)</td>
</tr>
<tr>
<td>(DMFT) male</td>
<td>11–18</td>
<td>6 (27.27)</td>
<td>36 (45)</td>
</tr>
<tr>
<td></td>
<td>18–25</td>
<td>7 (31.82)</td>
<td>15 (18.75)</td>
</tr>
<tr>
<td></td>
<td>25–32</td>
<td>8 (36.36)</td>
<td>5 (6.25)</td>
</tr>
<tr>
<td>Female</td>
<td>8–14</td>
<td>4 (8)</td>
<td>6 (12)</td>
</tr>
<tr>
<td>Caries index</td>
<td>14–20</td>
<td>12 (24)</td>
<td>15 (30)</td>
</tr>
<tr>
<td>(DMFT) female</td>
<td>20–26</td>
<td>19 (38)</td>
<td>16 (32)</td>
</tr>
<tr>
<td></td>
<td>26–32</td>
<td>15 (30)</td>
<td>13 (26)</td>
</tr>
</tbody>
</table>

13 (26%) non-DM female patients, the range of caries index (DMFT) was 26 to 32 (Table 4).

Discussion

Diabetic mellitus is one of the major noncommunicable diseases in Saudi Arabia. Its prevalence was estimated to be around 32.8% during 2014. The trend is increasing with time especially in the urban regions compared to the rural regions. According to the data published by the World Health Organization (WHO) on DM, Saudi Arabia ranked as the second-largest country in the Middle East and seventh in the world per the diabetes rate. The complication of DM is massive in general as well as oral health leading to high mortality, morbidity, and vascular complications with low quality of life.

According to our best knowledge, in the past, few studies have been conducted in different regions of Saudi Arabia to determine the impact of DM on overall as well as oral health. However, we did not find any studies in Hail province, instead few measured oral health-related knowledge, attitude, and practice, but none specifically took data from DM patients in relation to oral health. A study from Riyadh reported that diabetic patients scored very low for health-related quality of life (HRQOL) questions compared with disease-free individuals. Another study by Al-Shehri et al. from Al-Khobar province documented that HRQOL among type 2 diabetes patients was lower compared to the control group and was influenced by many factors. Finding from another study conducted in Riyadh in 2012, on 283 T2DM patients concluded that gender, economic status, and complications of DM were independent risk factors for the majority of the subscales of HRQOL. The present study aims to measure the oral health status of DM patients in contrast with healthy individuals in Hail, Saudi Arabia. To our best knowledge, this is first study of its kind in Hail region.

Impact of DM on oral health is well-documented and very evident. According to the findings of a study from Medina by El-Khateeb, the DMFT index in a sample of young DM women living in Al Medina showed a high prevalence of dental caries compared to the non-DM women. The finding of the present study is somehow in line with the above-mentioned study. Results of the present study reported that the prevalence of plaque and dental caries was more common in diabetic patients when compared to the non-diabetic patients. Another study from Saudi Arabia studied the relationship between diabetes and periodontal diseases and reported plaque index and concluded that poor controlled diabetic patients showed an increased percentage of calculus and greater risks of periodontitis, which is in agreement with the finding of the present study.

Our study reflected that the majority of the patients were aware of the oral health issues related to diabetes. However, most of the patients did not inform the dentist about their diabetes, as it is imperative for the patients to report their health status to the dentist to better understand their case. There are communication gaps between the healthcare provider and the patients. Thus, there is a need for awareness campaigns for patients, so that they get more information about the association/relationship between oral health and diabetes.

The complications associated with oral health are more common in diabetic patients as compared to the nondiabetic patients. This is for both male and female patients visiting the College of Dentistry in the Hail region. Based on the findings of the current study, we suggested the need for awareness for the maintenance of good oral hygiene/oral health. A study conducted in Jordan reported that knowledge of DM and periodontal health must be given, alongside an eye should be kept on factors related to their knowledge and organize effective education programs. Similar results were expressed by Albert et al., which in turn are in contrast to the findings of our study. As documented by Lindenmeyer et al., at the time of diagnosis of diabetes, the patients should be provided with the written information concerning diabetes and its effects on oral health needs. Likewise, Valerio et al. has also reinforced to improve oral health, quality of life and literacy about oral health issues in diabetic adult population who are at risk of oral health problems.

Conclusion

The poor plaque index is statistically significant with both income and educational background. Thus, proper care and advice need to be given to the diabetic patients to avoid and lessen the occurrence of these oral health complications. The communication between the dentists and the patient needs to be improved, and a proper history and medical update of the patient need to be documented before the start of the treatment. If proper steps are taken to guide them properly, we can control the oral health complications such
as caries and xerostomia. Dental awareness among the population of nonmajor cities can be beneficial in determining the education level of individuals to uplift the dental care and pinpoint the specific diseases, which in turn will be help for the future research as well as to build the necessary campaigns for educating the community.

References