Oral Health Screening Status of Diabetes Patients in Selected Hospitals of Addis Ababa, Ethiopia, 2018

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Objective: The study assessed the oral health screening status of diabetes patients and its associated factors in selected public hospitals of Addis Ababa, 2018.

Patients and Methods: An institutional-based cross-sectional study was conducted on 388 diabetes patients selected on the bases of a systematic random sampling method from March to May 2018 at two selected public hospitals in Addis Ababa. Data were collected with a pre-tested, structured, and translated questionnaire. Bi-variable and multivariable logistics regression were undertaken to identify predictors of oral health screening among diabetes with their respective 95% CI and a p-value of less than 5% level of significance.

Results: The oral health screening status among diabetes patients in this study was 21.1%. The odds of having had an oral health screening was 82.4% higher in those with an educational status of college and above than those who cannot read and write and it was ten and five folds higher in participants with a monthly income of less than 750 birr than those with above 2,000 birr and those who brushed their teeth twice or more times a day than occasionally, respectively. The odds of having had an oral health screening was 17, four, and five folds higher among participants with perceived susceptibility, perceived severity, and benefit, respectively, whilst it was 8.8% lower in participants with a perceived barrier and it was as high as 19.782 times among participants with malocclusion.

Conclusion: A lower level of oral health screening was observed. A higher educational level, a lower monthly income, a higher frequency of tooth brushing per day, positive perceptions of susceptibility, severity, and benefits, and presence of malocclusions were statistically associated with a higher frequency of oral health screening. Concerned bodies were recommended to work on the identified predictors and improve the oral health screening of diabetes patients.

Keywords: oral health screening, diabetes patients, associated factors

Introduction

Globally 4.6 million deaths attributed to diabetes mellitus (DM) occur annually. 1 About 366 million people had DM, most of which were type 2 DM (90%) 2 and found in low- and middle-income countries. 3 By the year 1994, the Center for Disease Control and Preventions (CDC) declared DM as an epidemic in the US. 4 Periodontal disease and DM share common risk factors and bidirectional relationships. 5, 6

The global burden of oral disease is predominantly periodontal disease, ranging from 20–50% 6 and is the most common complication of diabetes. 7 The estimated
prevalence of diabetes in Ethiopia ranges from 2–5% nationally." Evidence suggests that its prevalence could be greater than 5% in people older than 40 years of age.

There was a positive link between diabetes status and undertaking oral health screening. As the attitude of diabetes patients about oral health problems affects their oral health screening status, raising awareness about oral health care had a pivotal role in the improvement of the daily practice of oral health care.

Though DM was associated with poor oral health status, it was evidenced that only a few proportions of DM patients were aware of their increased risk of periodontal disease, and hence very few utilized oral health care. Some of the reasons for lower oral health care utilization among diabetes were the perceived lack of necessity for a dental check-up, and the perception that dental problems were not serious.

A higher cost of dental care, lower awareness among diabetes patients about oral health care, cost of transportation, and dental fears were among factors affecting oral health screening of diabetes patients.

To the best of our knowledge there was a shortage of published works in Ethiopia which primarily focused on the oral health screening status of diabetes patients and its associated factors in Addis Ababa, this study was planned to assess the oral health screening status of diabetes patients and its associated factors in selected hospitals of Addis Ababa, Ethiopia, and would hopefully fill the existing gap in the literature.

Methods
Participants and Study Design
An institution-based cross-sectional study was undertaken on 388 participants at the two conveniently selected hospitals from March to May 2018. The study received ethical approval from the University of South Africa Research review ethics committee and Addis Ababa Health Bureau research and Ethics office then conducted at Menelik II Referral Hospital and Zewditu Memorial Hospital. All participants were provided written informed consent. The source population was all diabetes patients within the catchment area of the two conveniently selected Hospitals. The study population included 388 diabetes patients who were available during the data collection period at the study settings. The sample was determined based on a single population proportion with the premises of the proportion of oral health screening status to be 50%, where the final sample size was 403, inclusive of a 5% non-response rate. Diabetes participants who were on follow-up at diabetes clinics during the study period, not-admitted, not with severe complication were included in the study. Participants were selected on the bases of systematic random sampling methods with the sampling interval of K=8. The sampling frame was a medical record number of diabetes patients in both selected hospitals (N=1680 for Menelik II Hospital and N=1513 for Zewditu Memorial Hospital per three months). Data were collected with a pre-tested interviewer-administered questionnaire where a pre-test was conducted on 5% of cases at Yekatit 12 Hospital Medical College two weeks before actual the data collection period. The questionnaire was first developed by the investigators after rigorous review of literatures then given to senior researchers, and dentists for the incorporation of their inputs. Data collection was performed by five nurses after trained for two days; after which training was given by the researcher.

For this study, the outcome variable (oral health screening status) was measured as ‘yes’ or “no,” whether the diabetes patients have visited a dentist every six months or twice a year, considered as “yes” otherwise “no” as per the recommendation of CDC. The health belief model in line with other factors was used to identify factors affecting oral health screening.

Statistical Analysis
Descriptive statistics were used for the summarization of data. With an inter-item reliability coefficient for the health belief model constructs of perceived susceptibility, perceived severity, perceived benefits, and perceived barriers; 0.705, 0.731, 0.857, and 0.899 respectively. For the identification predictors of oral health screening, binary (bi-variable and multivariable) logistics regression was used, with their respective 95% Confidence Interval (CI) and p-value of less than 0.05 as statistically significant level.

Results
Socio-Demographic Characteristics of Participants
A total of 388 participants were enrolled in the study with a response rate of 96.3%. More than half (52.1%) of respondents were female. The mean age of participants was 52.27 years with a standard deviation of 14.797. Two hundred sixty-four (68%) of the respondents were married (Table 1).
Table 1 Socio-Demographic Characteristics of Respondents at Selected Public Hospitals in Addis Ababa, Ethiopia, May 2018 (n=388)

| Characteristics     | Categories   | Number | %   |
|---------------------|--------------|--------|-----|
| Sex                 | Male         | 186    | 47.9|
|                     | Female       | 202    | 52.1|
| Age in years        | <20          | 4      | 1.0 |
|                     | 20–29        | 29     | 7.5 |
|                     | 30–39        | 53     | 13.7|
|                     | 40–49        | 58     | 14.9|
|                     | 50–59        | 102    | 26.3|
|                     | 60–69        | 96     | 24.7|
|                     | 70–79        | 39     | 10.1|
|                     | ≥80          | 7      | 1.8 |
| BMI                 | <18.5 KG/M²  | 7      | 1.8 |
|                     | 18.5–24.9 KG/M² | 146 | 37.2|
|                     | 25–29.9 KG/M² | 159   | 41.6|
|                     | >30 KG/M²    | 76     | 19.4|
| Marital status      | Married      | 264    | 68.0|
|                     | Single       | 58     | 14.9|
|                     | Widowed      | 47     | 12.1|
|                     | Separated    | 16     | 4.1 |
|                     | Divorced     | 3      | 0.8 |
| Occupational status | Daily Laborer| 7      | 1.8 |
|                     | NGO Employed | 13     | 3.4 |
|                     | Government   | 69     | 17.8|
|                     | Employed     | 83     | 21.4|
|                     | Private work | 216    | 55.7|
|                     | Jobless      |        |     |
| Educational status  | Cannot Read and Write | 72 | 18.6|
|                     | Read and Write | 39   | 10.1|
|                     | Primary Education | 73 | 18.8|
|                     | Secondary Education | 106 | 27.3|
|                     | College and Above | 98 | 25.3|
| Monthly income in birr | ≤750      | 57     | 14.7|
|                     | 751–1,300    | 76     | 19.6|
|                     | 1,301–2,000  | 87     | 22.4|
|                     | >2,000       | 168    | 43.3|

**Abbreviations:** BMI, body mass index; KG, kilogram; M², meter square; birr, Ethiopian currency.

Table 2 Behavioral and Physical Characteristics of Diabetes Participants at Selected Public Hospitals in Addis Ababa, Ethiopia, May 2018 (n=388)

| Characteristics     | Categories          | Number | %   |
|---------------------|---------------------|--------|-----|
| Diabetes mellitus type | Type 1              | 111    | 28.6|
|                     | Type 2              | 277    | 71.4|
| Medication type     | Oral Injection form | 157    | 40.5|
|                     |                     | 231    | 59.5|
| Current fasting blood glucose level in g/dl | <100 | 38 | 9.8 |
|                     | 100–125             | 40     | 10.3|
|                     | 126 and more        | 310    | 79.9|
| Past fasting blood glucose level in mg/dl | <100 | 23 | 5.9 |
|                     | 100–125             | 44     | 11.3|
|                     | 126 and more        | 321    | 82.7|
| Duration since diagnosis in years | <5 | 141 | 36.3|
|                     | 5–10                | 104    | 26.8|
|                     | 10–15               | 62     | 16.0|
|                     | 15–20               | 53     | 13.7|
|                     | ≥20                 | 28     | 7.2 |
| Family history of diabetes mellitus | Yes | 130 | 33.5|
|                     | No                  | 250    | 64.4|
|                     | I do not know       | 8      | 2.1 |
| Tooth brushing      | Yes                 | 308    | 79.1|
|                     | No                  | 80     | 20.9|
| Number tooth brushing per day (n=308) | 2 and more | 59 | 19.2|
|                     | Once                | 168    | 54.5|
|                     | Occasionally        | 81     | 26.2|
| Have you been used of alcohol? | Yes | 77 | 19.8|

**Abbreviations:** DM, diabetes mellitus.

Behavioral and Physical Measurements

Most (71%) of participants were type 2 diabetes patients, where most (60%) took injection and 80% of the participants had a current fasting blood glucose level of 126 g/dl and more. Most (64.4%) of respondents had no family history of DM (Table 2).

Perceptions of Oral Health

Less than one fifth (18.8%) of participants agreed that a person with diabetes has a higher risk of getting periodontal disease, and 25.5% of participants perceived that periodontal disease can result in heart disease. Most (64%) of participants believed complications of periodontal disease are dangerous whereas
more than half (53%) of respondents perceived that oral health screening had benefits for the prevention and control of periodontal disease.

Less than one third (31.4%) of respondents agreed that there was a long waiting time to have oral health check-ups and 26.8% agreed that the long distance between diabetes clinic and dental clinic prevented them from having oral health screening. (Table 3)

**Table 3** Perception of Diabetes Participants at Selected Public Hospitals in Addis Ababa, Ethiopia, May 2018 (n=388)

| Characteristics                                                                 | Agree | Neither Agree nor Disagree | Disagree |
|---------------------------------------------------------------------------------|-------|-----------------------------|----------|
| **Perceived Susceptibility**                                                    |       |                             |          |
| A person with diabetes mellitus have a higher risk of periodontal disease       | 73    | 18.8                        | 215      | 55.4 |
| Presence of periodontal disease will result me in getting heart disease         | 99    | 25.5                        | 63       | 16.2 |
| Smoking Cigarette will lead to periodontal disease                              | 193   | 49.7                        | 35       | 9.0  |
| I know a person with periodontal disease even it will affect me as well         | 149   | 38.4                        | 87       | 22.4 |
| While taking drugs of diabetes, blood sugar level will remain high.             | 288   | 74.2                        | 58       | 14.9 |
| I am likely to get periodontal disease                                          | 215   | 55.4                        | 120      | 30.9 |
| I had a problem of accepting the advice of health professionals                | 99    | 25.5                        | 266      | 68.6 |
| **Perceived Severity**                                                          |       |                             |          |
| Someone can have periodontal disease while unaware of the condition             | 303   | 78.1                        | 51       | 13.1 |
| Periodontal disease is non-curable disease                                       | 96    | 24.7                        | 233      | 60.1 |
| Complication of periodontal disease is dangerous                                | 248   | 63.9                        | 60       | 15.5 |
| A relative tooth loss following periodontal disease motivated me to have check-up at dental clinic strictly | 220   | 56.7                        | 109      | 28.1 |
| Periodontal disease is a fatal disease                                          | 109   | 28.1                        | 198      | 51.0 |
| Periodontal disease in diabetes can affect the family income                    | 327   | 84.3                        | 41       | 10.6 |
| **Perceived Benefits**                                                          |       |                             |          |
| Diabetes control prevents periodontal disease                                   | 116   | 29.9                        | 128      | 33.0 |
| Medicine stop symptoms and I feel good                                         | 214   | 55.2                        | 89       | 22.9 |
| Dental check-up reduces periodontal disease                                     | 170   | 43.8                        | 94       | 24.2 |
| Tooth brushing reduces the risks of periodontal disease                         | 214   | 55.2                        | 40       | 10.3 |
| Having oral check-up prevents tooth loss                                        | 217   | 55.9                        | 64       | 16.5 |
| Having oral check-up reduces mal-odor related stigma                            | 224   | 57.7                        | 70       | 18.0 |
| Dental check-up reduces periodontal related mortality and morbidity            | 182   | 46.9                        | 87       | 22.4 |
| **Perceived Barriers**                                                          |       |                             |          |
| There is long waiting time to have oral health check up                         | 122   | 31.4                        | 69       | 17.8 |
| There is long distance between diabetic and dental clinics                      | 104   | 26.8                        | 76       | 19.6 |
| There is no stigma if tooth is lost                                            | 239   | 61.6                        | 114      | 29.4 |
| Procedure of oral health check-up is exhausting                                 | 114   | 29.4                        | 123      | 31.7 |
| Health professionals are disrespecting patients                                 | 88    | 22.7                        | 278      | 71.6 |
| Cost of treatment is high                                                       | 162   | 41.8                        | 108      | 27.8 |
| The side effects of oral drugs are high                                         | 86    | 22.2                        | 101      | 26.0 |

Marital status, perception of susceptibility, severity, benefit and barriers were independently associated with oral health screening at p<0.05.

The odds of having had an oral health screening was as higher as 82.4% in participants with an educational level of college and above, compared to those who cannot read and write (AOR: 0.176, 95CI: 0.035–0.892, P<0.05).

The odds of having had an oral health screening was ten fold higher among participants with a monthly salary of fewer than 750 birr against those with a monthly salary of 2,000 birr and more (AOR: 9.847, 95% CI:1.878–51.644, P<0.001).

Possibly, this might happen due to an increase in income may lead to tightness with duties to have the follow up regularly.

**Oral Health Screening and its Predictors**

The oral health screening level in this study was 21.1% (95% CI: 17.2–25.5%), whereas, the majority (78.9%) had less than two oral health screens per year (Figure 1).
The odds of having had an oral health screening was five times higher in those who brush their teeth at least twice a day compared to those who brush occasionally (AOR: 5.070, 95% CI: 1.117–23.016, P<0.05).

The odds of having had oral health screening was 17.272, and 4.070 times higher in people with perceived susceptibility to, and severity of periodontal disease (AOR: 17.272, 95% CI: 4.161–71.705, P<0.001) and (AOR: 4.070, 95% CI: 1.371–12.083, P<0.05) respectively.

The odds of having had an oral health screening was 4.75 times higher in participants with perceived benefits that taking preventive actions can prevent oral health problems (AOR: 4.751, 95% CI: 1.666–13.550, P<0.05).

The odds of having had an oral health screen was lower in participants with barrier perceptions (AOR: 0.088, 95% CI: 0.033–0.231, P=0.001) and the odds of having had an oral health screening was as high as 20 times among participants with malocclusion than their counterparts (AOR: 19.782, 95% CI: 6.387–61.270, P<0.001) (Table 4).

**Discussion**

In this study, one-fifth of diabetes patients reported having had two or more oral health screenings per year. Which was lower than the findings; 55% in France,24 79% in England,25 58.6% in the US,17 63.8% in Brazil,20 and 85.1% in Sweden.26 These differences might be due to the lower oral health care coverage, and awareness in Ethiopia.

One-third (33%) of diabetes patients were aware of their increased risk for periodontal disease,14 which was almost consistent with the current study. The oral health screening status in this study was almost consistent with the findings; 27% in India,22 17% and 33.3% in Malaysia, during 2016 and 2012.10,27

In this study, the level of oral health screening was higher than the findings; 12.6% and 15.1% in Saudi Arabia,28,29 and 10% in Jordan.30 This difference might be due to variations in types of population demographics and study time.

In this study, being in education, college-level and above, was associated with more oral health screening than those who cannot read and write, which was supported by a study in Nigeria which stated; a higher educational status was associated with more frequency of oral screening than their counterparts.31

In this study, the presence of malocclusion was statistically associated with higher oral health screening status, but not well investigated in other studies. In this study, tooth brushing at least twice per day was associated with a higher oral health screening status than occasional tooth brushing, and was supported by a study in India that stated a higher frequency of tooth brushing was associated with a higher frequency of dental visits.32

The more diabetes patients know about oral health problems, the more they visit dental clinics,33 but in this study knowledge of diabetes patients did not show an association with oral health screening. This might be due to variability in the application and use of available information regarding oral health in diabetes patients.

A low level of knowledge about dental problems, fear of having treatment, and financial issues were associated...
Table 4 Predictors of Oral Health Screening of Diabetes Participants at Selected Public Hospitals in Addis Ababa, May 2018 (n=388)

| Characteristics                  | Categories       | Oral Screening | COR(95% CI)       | AOR(95% CI)       |
|----------------------------------|------------------|----------------|-------------------|-------------------|
|                                  |                  | Yes | No |                  |                  |
| Marital status                   | Married          | 54  | 210| 1.000(0.647–3.027)| 3.467(0.765–15.710)|
|                                  | Single           | 9   | 49 | 0.750(0.365–1.542)| 1.442(0.323–6.441)|
|                                  | Widowed          | 12  | 35 | 1.400(0.118–9.280)*| 0.799(0.144–4.423)|
|                                  | Separated/divorce| 7   | 12 | 0.667(0.253–1.757)| 0.766(0.114–5.159)|
| Educational status               | Cannot Read and Write| 12  | 60 | 0.495(0.222–1.031)| 0.429(0.094–1.956)|
|                                  | Read and Write   | 9   | 30 | 1.125(0.497–3.264)| 1.581(0.356–7.019)|
|                                  | Primary Education| 21  | 52 | 1.698(0.739–3.898)| 4.416(0.875–22.294)|
|                                  | Secondary Education| 16  | 90 | 1.153(0.570–2.333)| 9.847(1.878–51.644)**|
|                                  | College and Above| 24  | 74 | 0.617(0.285–1.335)| 0.176(0.035–0.892)*|
| Monthly Income in birr           | Less than 750    | 14  | 43 | 1.494(0.222–1.031)| 1.581(0.356–7.019)|
|                                  | 751–1300         | 17  | 59 | 1.130(0.503–2.358)| 3.652(0.700–19.054)|
|                                  | 1,301–2,000      | 14  | 73 | 1.698(0.739–3.898)| 4.416(0.875–22.294)|
|                                  | Greater 2,000    | 37  | 131| 1.153(0.570–2.333)| 9.847(1.878–51.644)**|
| Duration after diagnosis for DM in years | ≤5              | 23  | 118| 1.000(0.647–3.027)| 3.467(0.765–15.710)|
|                                  | 5–10             | 23  | 81 | 0.686(0.361–1.306)| 0.788(0.244–2.547)|
|                                  | 10–15            | 16  | 46 | 0.560(0.272–1.155)| 0.319(0.085–1.193)|
|                                  | ≥15              | 20  | 61 | 0.543(0.255–1.157)| 0.550(0.152–1.984)|
| Frequency tooth brushing per a day | 2 and more       | 10  | 29 | 1.418(0.725–2.775)| 2.751(0.649–11.662)|
|                                  | Once             | 31  | 124| 1.984(0.885–4.448)| 5.070(1.117–23.016)*|
|                                  | Occasionally     | 29  | 85 | 0.794(0.419–1.504)| 0.570(0.165–1.965)|
| Ever use of Alcohol              | Yes              | 14  | 63 | 0.794(0.419–1.504)| 0.570(0.165–1.965)|
| Knowledge status                 | Good Knowledge   | 48  | 157| 1.000(0.647–3.027)| 3.467(0.765–15.710)|
|                                  | Poor knowledge   | 34  | 149| 1.340(0.818–2.194)| 0.700(0.268–1.827)|
| Perceived Susceptibility         | Yes              | 78  | 171| 1.539(0.547–4.314)**| 17.272(4.161–71.705)**|
|                                  | Yes              | 71  | 151| 6.626(3.379–12.993)**| 4.070(1.371–12.083)**|
|                                  | Yes              | 68  | 154| 4.794(2.586–8.888)**| 4.751(1.666–13.550)**|
|                                  | Yes              | 18  | 184| 0.186(0.105–0.330)**| 0.088(0.033–0.231)**|
| Perceived severity               | Good             | 2   | 15 | 1.000(0.647–3.027)| 3.467(0.765–15.710)|
|                                  | Fair             | 14  | 76 | 0.724(0.149–3.520)| 1.274(0.087–18.637)|
|                                  | Poor             | 66  | 215| 0.434(0.097–1.948)| 0.509(0.034–7.590)|
| Perceived benefit                | Yes              | 71  | 137| 7.962(4.059–15.620)**| 19.782(6.387–61.270)**|
| Malocclusion                     | Yes              | 75  | 270| 1.429(0.611–3.339)| 0.847(0.145–4.947)|

Notes: *p<0.05, **p<0.001-statistically significant association.

with lower oral health screening status.16 Whilst diabetes patients with perceived susceptibility, severity, and benefits of undertaking oral health preventive measures had a higher oral health screening experience than their counterparts.

**Conclusion and Recommendation**

In this study, a lower level of oral health screening was observed. A higher educational level (college and above), a lower monthly income (less than 750 birr), a higher (two or more) frequency of tooth brushing per day, positive perceptions of susceptibility, severity, and benefits, and presence of malocclusions were statistically significantly associated with a higher frequency of oral health screening in the study settings. Whereas the presence of a perceived barrier was statistically significantly associated with a lower frequency of an oral health screening. Researchers were recommended to undertake a large scale community-based study. Policymakers and health professionals were also recommended to work jointly to enhance the oral health screening of diabetes patients in the study settings.

**Consent for Publication**

Consent for publication of the manuscript was not applicable due to the fact that there were no participant’s individual data videos or images.
Declaration

Acknowledgments

Author Contributions

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