Knowledge and Practice on Oral Health among Diabetic Patients

Md. Hasanul Arefin[1*], Hafiza Sultana[2], Anowar Hossain[3], Sk. Faija Fahmida[4], Mahamuda khatun[5]

[1] Department of Periodontology, Mymensingh Medical College, Mymensingh, Bangladesh

[2] Department of Health Education, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh

[3] Department of Community Medicine, Mugda Medical College, Dhaka, Bangladesh

[4] National Healthcare Network, Bangladesh Diabetic Shomiti (BADAS), Dhaka, Bangladesh

[5] Dhaka Dental College, Dhaka, Bangladesh

OPEN ACCESS

Conflicts of Interest
There were no conflicts of interest.

ABSTRACT

Diabetes mellitus is a major public health problem in Bangladesh. Several studies have shown that diabetic patients are at a greater risk of developing oral health problems. To improve the oral health among diabetic patients, it is of absolute importance to raise the existing level of knowledge and practice. The objective of this study was to assess the level of knowledge and practice of diabetic patients on oral health. This cross-sectional study was conducted among conveniently selected 120 adult diabetic patients (18 years and above) receiving treatment at outpatient department of two upazila health complexes and two diabetic centers in two upazilas of Tangail district, Bangladesh. The study period was from 1st January to 31st December 2019. Data were collected by face-to-face interview with a semi-structured questionnaire. Among diabetic patients, female was 52.5%, mean age was 51.34 ± 10.166 years, 25.68 % had primary level education, 32% were housewife, 93.3% were Muslim and 50.8% had monthly family income within 1000-15000 Bangladeshi taka. Among the patients, 18.3% had poor knowledge, 16.7% had average knowledge and 65% had good knowledge on oral health. On the other hand, 53.3%. 39.2% and 7.5% of respondents had poor, average and good level on oral health practice, respectively. There was statistical significance ($P < .05$) among participants' sex, education, occupation and marital status, and level of knowledge and practice. In addition, there was strong association ($P < .05$) between level of practice and participants'

monthly family income. This study showed that level of knowledge of diabetic patients on oral health was good but the level of practice on oral health was poor. Therefore, there is scope to take more interventions for enhancing oral health practices among the diabetic patients.

Introduction

The body's inability to use or produce insulin in a natural way cause hyperglycemia which is known as "Diabetes Mellitus (DM)" [1]. Although there are four types of diabetes namely; Type 1 diabetes (Insulin-Dependent Diabetes Mellitus -IDDM), Type 2 diabetes (Noninsulin-Dependent Diabetes Mellitus -NIDDM), Gestational diabetes (a type of glucose intolerance diagnosed during pregnancy) and other forms of diabetes but Type 2 DM is the most common type of diabetes which is seen in around 90-95 percent of the diabetic population in the world [2]. Due to the aggressive prevalence of this disease [3], the World Health Organization (WHO) declared diabetes mellitus as an epidemic [4].

It is estimated that the prevalence of diabetes in 2000 was 2.8% and will be 4.4% in 2030 indicating that 366 million people will be affected by this disease in 2030 [5]. The prevalence status of south-east Asian region is more conservative. The statistics shows that about 8.5% of the adult population aged 20-79 years had diabetes in 2017 in this geographical area [6]. The prevalence of diabetes in Bangladesh is also worrying as the number has been continuing to grow and it has been found that there were about 7.1 million people with diabetes in 2018 and it is likely to double by 2025 [7].

DM is associated with morbidity and mortality that affects almost all tissues in the human body [8,9], including oral cavity [10]. Prior studies shown that people with diabetes are at higher risk of problems with oral and dental health, such as gingivitis and periodontitis, delayed mucosal wound healing, dental caries, neuro-sensory mucosal disorders, oral candidiasis, and tooth loss [10,11]. Diabetes induced oral diseases can negatively affect the overall health of the person concerned [12]. In contrast, the deterioration of quality of life or the risk of diabetes complications can be prevented through proper knowledge and management of diabetes and its related disorders [13].

Brushing twice a day with fluoride toothpaste, using regular flushing or other devices such as inter-proximal brushing, going to the dentist for regular dental advice and professional cleaning, and not to do smoking can maintain the health of the oral cavity well [14]. However, earlier an author found that people with diabetes have poor awareness about oral care [15]. Another study showed that people with diabetic are not familiar with the factors contributing to the oral ill health [16]. Many studies reported that diabetic patients are much less

informed of their risk for oral diseases in comparison with their knowledge of their increased risk for systemic diseases [15, 17, 18]. On the other hand, there is a strong relationship between diabetics' knowledge and its proper management [19,20]. In Bangladesh, the knowledge and practice related to the diabetics about general health has been explored but the study about oral health in diabetes patients has not been investigated yet. But there is a clear need of integration of oral health care into the overall care of diabetic patients. It is therefore vital to assess their knowledge and practices in order to implement measures to improve their oral health. Thus, this study aimed to find out the level of knowledge and practice of diabetic patients on oral health.

Materials and methods

The cross-sectional study was conducted among conveniently selected 120 diabetics' patients at the two Upazila health complexes and two diabetic centers of Ghatail Upazila and Dhanbari Upazila in Tangail District, Bangladesh. One Upazila health complex and a diabetic center were selected from each Upazila. Regardless of gender, religion, ethnicity or other social–backgrounds, person with diabetics aged 18 years or above were included as the study participants. However, severely sick, persons with disabilities, and reluctant to participate in the study were excluded from the study. Prior to data collection, a standard equation was used to determine the sample size [21]. Calculated sample size was 230. But due to unavailability of the respondents and resource constraint, data were collected from 120 respondents. The study period was lasting from January, 2019 to December, 2019. A face-to-face interview through semi-structured questionnaire was carried out to collect the data by the first author. Due permission was obtained from the Upazilla health complexes and diabetic centers after explaining the objective of the study. A pre-test of questionnaire was conducted as soon as the research protocol was approved by the approval committee of the National Institute of Preventive and Social Medicine (NIPSOM), Bangladesh.

After necessary modification and correction, the final questionnaire included four domains to meet the study objectives. The first domain was designed for obtaining socio-demographic information on diabetic patients (age, sex, education, occupation, religion, monthly family income, marital status), and information on the duration of diabetics, and history of diet, physical activity, medication and addiction. The second domain captured information related to knowledge regarding oral health. The third domain gathered information about the source of getting news regarding oral health. The last segment contained information regarding practices about oral health. The questionnaire and the consent form were translated into Bengali for the convenience of respondents.

Prior to data collection, necessary permission was taken from the participants. After completion of data

collection, the data were checked and edited manually and verified for any omission, error or irrelevance before tabulation. Data were coded, entered and analyzed in a computer. Data analysis was conducted using SPSS (statistical package for social science) software. The findings of the study were presented by frequency and percentage in tables and pie chart. Mean and standard deviations for continuous variables and frequency distributions for categorical variables were used to describe the characteristics of the total sample. A P-value of <0.05 were considered as significant.

Results

Variables	Category	Frequency	Percentage
Age (years)	21-29	3	2.5
	30-59	83	69.2
	60-70	34	28.3
	Mean ± SD	**51.34 ± 10.166**	
Sex	Male	57	47.5
	Female	63	52.5
Education	Illiterate	22	18.33
	Primary	31	25.68
	SSC	25	21
	HSC	20	16.66
	Graduate or above	22	18.33
Occupation	House wife	38	32
	Service	22	18.3
	Retired	18	15
	Business	20	16.7
	Day Labor	10	8
	Others	12	10
Religion	Muslim	112	93.3
	Hindu	8	6.7
Monthly family income (Bangladeshi Taka)	1000-15,000	61	50.8
	15,001-30,000	38	31.7
	30,001-45,000	11	9.2
	45,001-60,000	9	7.5
	60,001-75,000	1	.8
Marital status	Married	103	85.8
	Separated/Divorced	3	2.5
	Widowed	14	11.7

Table 1: Participants' socio-demographic profile (n=120)

Table 1 illustrates the socio-demographic information of the respondents. Participants' mean ± SD age was 51.34 ± 10.166 years where the highest 83 (69.2%) of them was in 30-59 age group. Among the participants, there were 63 (52.5%) females and 57 (47.5%) males. In terms of the educational status, maximum 31 (25.68%)

number of diabetic patients' highest academic qualification was primary, followed by SSC 25 (21%), graduate/above 22 (18.33%), 22 illiterate (18.33%) and HSC 20 (16.66%). The majority (32%) of the respondents were housewife while 18.3%, 16.7%, 15%, 10%, and 8% of them mentioned their occupation as service, business, retired, others and day labor, respectively. It has been observed that the utmost 102 (93.3%) participants were belonging to Islam religion. Further, most 61 (50.8%) of the respondents had a monthly family income ranging from 1000-15,000 Bangladeshi Taka where only 1 (0.8%) of the family's monthly income was ranging from 60,001-75,000 Bangladeshi Taka. In the case of marital profile, there were 103 (85.8%) married, 3(2.5%) separated/divorced and 14 (11.7%) widowed.

Variables	Category	Frequency	Percentage
Duration of Diabetes (years)	< 1	23	19.2
	1-5	35	29.2
	5-10	37	30.8
	> 10	25	20.8
	Mean ± SD 2.53 ± 1.028		
Frequency of taking meal	Just eat 3 times	43	35.8
	Divide into 4 times	32	26.7
	Divide into 5-6 times	45	37.5
Sugar containing food	Yes	20	16.7
	No	100	83.3
Fat containing food	Yes	87	72.5
	No	33	27.5
Intake of vegetables that grow below ground	Yes	92	76.7
	No	28	23.3
Intake of unrefined CHO and vegetables	Yes	117	96.5
	No	3	2.5
Type of Physical Activity	No activity	22	18.3
	Walking	98	81.7
Betel-nut chewing habit	Yes	64	53.3
	No	56	46.7
Smoking Habit	Yes	14	11.7
	No	106	88.3
Oral Medicine	Yes	83	69.2
	No	37	30.8
Insulin	Yes	9	7.5
	No	111	92.5
Oral and Insulin	Yes	14	11.7
	No	106	88.3

Table 2: Participants' history about diabetics, food, physical activity, habit and medication (n=120)

Table 2 shows respondents' information about the duration of diabetes in patients, the variety of foods, physical

activity, unhealthy habits, and the use of various diabetes medications. The mean ± SD duration of diabetics was 2.53 ± 1.028 years where highest 37 (30.8%) respondents had a diabetic history of 5-10 years. Most 45 (37.5%) respondents took meals 5-6 times in a day. About 20 (16.7%), 87 (72.5%), 92 (76.7%) and 117 (96.5%) of participants took sugar containing food, fat containing food, below grounded vegetables, and unrefined CHO and vegetables, respectively. In regards to the physical activity, walking was performed by 98 (81.7%) respondents while 22 (18.3%) of them did not take participation in any activity. Among the diabetic patients, 64 (53.3%) and 14 (11.7%) had betel-nut chewing and smoking habit. Oral medicine, insulin and both (oral medicine and insulin) was taken by 83 (69.2%), 9 (7.5%) and 14 (11.7%) participants, respectively.
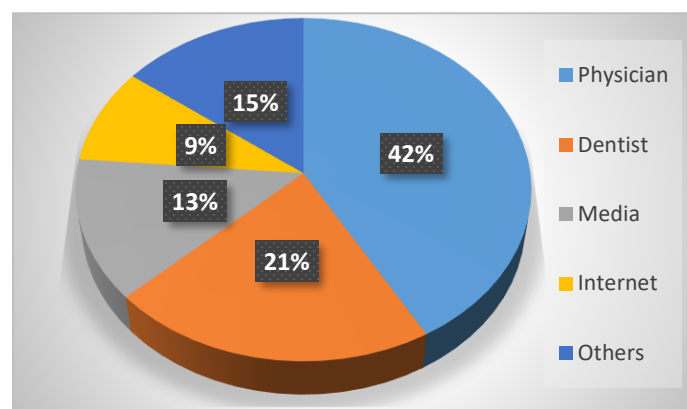

Figure 1: Percentage of diabetic patients according to source of information regarding oral health (n=120)

Figure 1 pictures the percentage of diabetic patients according to source of information regarding oral health. The maximum 50 (42%) diabetic patients had received information about oral health from physician, followed by 25 (21%) diabetic patients from dentist, 18 (15%) from other sources, 16 (13%) from media and 11 (9 %) diabetic patients from internet.

Variables	Attributes	Response	
		No f (%)	**Yes** f (%)
Effect of diabetes mellitus on the oral health	Diabetes mellitus are more prone to oral diseases	65 (54.2%)	55 (45.8%)
	Fungal infection, dry mouth and periodontitis oral manifestations are related to diabetes mellitus	27 (22.5%)	93 (77.5%)
	Diabetes mellitus may lead to dental caries	29 (24.2%)	91 (75.8%)
	Diabetes mellitus affects gingiva of the teeth	45 (37.5%)	75 (62.5%)
	Chewing betel-nut and smoking can cause oral cancer	38 (31.7%)	82 (68.3%)
Signs of gingival diseases	Bleeding during brushing is a sign of gingival diseases	48 (40%)	72 (60%)

	Swollen red colored gingiva is a sign of gingival diseases	28 (23.3%)	92 (76.7%)
	Soreness of gingiva is a sign of gingival diseases	77 (64.2%)	43 (35.8%)
Importance of oral health	Oral hygiene practice can prevent oral diseases	8 (6.7%)	112(93.3%)
	Regular dental check-up should be maintained to improve oral and periodontal health	14 (11.7%)	106(88.3%)
	Teeth should be cleaned twice daily	17 (14.2%)	103(85.8%)

Table 3: Information related to knowledge regarding oral health among diabetic patients (n=120)

Table 3 represents the information related to knowledge regarding oral health among diabetic patients. Approximately 62% to above participants had given positive response about the effects of diabetics' mellitus on the oral health such as fungal infection, dry mouth and periodontitis oral manifestations are related to diabetes mellitus, dental caries can be caused by DM, gingiva of teeth can be occurred due to DM, and chewing betel-nut and smoking can cause oral cancer. But, only 45.8% of the respondents had knowledge whether diabetes mellitus is more prone to oral diseases or not. On the other hand, among the diabetic patients, 92(76.7%) diabetic patients said swollen red colored gingiva is a sign of gingival diseases, 72(60%) diabetic patients said that bleeding during brushing is a sign of gingival diseases and rest of the diabetic patients 43(35.8%) said that soreness of gingiva is a sign of gingival diseases. However, 85.8% to above respondents had possessed positive knowledge about the importance of oral health.

Variables	Category	Frequency	Percentage
Regular tooth brushing	Yes	83	69
	No	37	31
Tooth brushing habit after breakfast	Yes	11	9.2
	No	109	90.8
Use of materials for tooth cleaning*	Toothbrush	93	77.5
	Finger	67	55.8
	Miswak	53	44.2
	Charcoal	38	31.7
	Others	78	65
Use toothpaste for cleaning the teeth	Yes	88	73.3
	No	32	26.7
Use dental floss	Yes	7	5.8
	No	113	94.2
Use mouth wash	Yes	15	12.5
	No	105	87.5
Duration of tooth cleaning (minutes)	< 1	18	15.0
	1-3	19	15.8
	> 3	83	69.2
Frequency of visiting to a dentist	No visit	68	56.7
	More than 1 year	31	25.8

| | Once a year | 13 | 10.8 |
| | Every 6 months | 8 | 6.7 |

*= multiple answer

Table 4: Information related to oral health practice among diabetic patients

Information about oral health practice among the participants can be noticed from Table 4. Maximum 77.5% of respondents use toothbrush as the cleaning materials of teeth; in addition to this, finger, miswak and charcoal were also used by 55.8%, 44.2% and 31.7% of them. Approximately 69% and 73.3% of respondents had brushed their teeth regularly, and used tooth paste for cleaning the teeth. In contrast, about 90.8%, 94.2% and 87.5% did not brush their teeth after breakfast, did not use dental floss, and mouth wash, respectively. The highest 45.8% of diabetic patients brushed their teeth once in a day. On the other hand, most (69.2%) of the respondents cleaned their teeth for more than 3 minutes. However, the utmost 56.7% of the participants had no history of going to the dentist in their lifetime.

Level	Knowledge			Practice		
	Scoring range	Frequency (f)	Percentage (%)	Scoring range	Frequency (f)	Percentage (%)
Poor	0-4	22	18.3	0-5	64	53.3
Average	5-7	20	16.7	6-9	47	39.2
Good	8-11	78	65	10-13	9	7.5

Table 5: Distribution of the diabetic patients according to knowledge and practice score (n=120)

Table 5 illustrates the distribution of the respondents according to their knowledge and practice level. Among 120 respondents, 22 (18.3%) respondents had scored from 0 to 4 and 78 (65%) respondents had scored from 8-11 which categorized as poor and good knowledge, respectively. On the other hand, about 64 (53.3%) diabetic patients showed scores ranging from 0 to 5 which represented the poor practice levels. Only 9 (7.5%) participants had good practice levels because their scores ranged from 10-13.

Table 6 shows the association of respondents by socio-demographic characteristics and the level of knowledge and practice regarding oral health. In terms of knowledge level, the significant association was found with sex ($P < .05$), education ($P < .05$), occupation ($P < .05$) and marital status ($P < .05$). On the other hand, sex ($P < .05$), education ($P < .05$), occupation ($P < .05$), monthly family income ($P < .05$) and marital status ($P < .05$) had significant association with the practice level of respondents about the oral health.

Variables	Subgroups	Level of knowledge on oral health			Statistics	Level of oral hygiene practice			Statistics
		Poor knowledge f (%)	Average knowledge f (%)	Good knowledge f (%)		Poor practices f (%)	Average practices f (%)	Good practices f (%)	
Age group (in years)	21-29	2 (9.1)	0 (0)	1 (1.3)	P > .05	2 (3.1)	1 (2.1)	0 (0)	P > .05
	30-59	16 (72.7)	14 (70)	53 (67.9)		42 (65.6)	35 (74.5)	6 (66.7)	
	60-70	4 (18.2)	6 (30)	24 (30.8)		20 (31.3)	11 (23.4)	3 (33.3)	
Sex	Female	18 (81.8)	8 (40)	37 (47.4)	**P < .05**	40 (62.5)	23 (48.9)	0 (0)	**P < .05**
	Male	4 (18.2)	12 (60)	41 (52.6)		24 (37.5)	24 (51.1)	9 (100)	
Education	Illiterate	8 (36.4)	7 (35)	5 (6.4)	**P < .05**	19 (29.7)	1 (2.1)	0 (0)	**P < .05**
	Primary	6 (27.3)	5 (25)	18 (23.1)		24 (37.5)	5 (10.6)	0 (0)	
	S.S.C	6 (27.3)	6 (30)	16 (20.5)		13 (20.3)	15 (31.9)	0 (0)	
	H.S.C	1 (4.5)	1 (5)	17 (21.8)		4 (6.3)	13 (27.7)	2 (22.2)	
	Graduate or Above	1 (4.5)	1 (5)	22 (28.2)		4 (6.3)	13 (27.7)	7 (77.8)	
Occupation	House wife	16 (72.7)	7 (35)	24 (30.8)	**P < .05**	34 (53.1)	13 (27.7)	0 (0)	**P < .05**
	Service	1 (4.5)	2 (10)	19 (24.4)		5 (7.8)	13 (27.7)	4 (44.4)	
	Retired	1 (4.5)	1 (5)	16 (20.5)		5 (7.8)	10 (21.3)	3 (33.3)	
	Business	3 (13.6)	5 (25)	12 (15.4)		10 (15.6)	8 (17)	2 (22.2)	
	Day labor	0 (0)	0 (0)	1 (1.3)		1 (1.6)	0 (0)	0 (0)	
	Others	1 (4.5)	5 (25)	6 (7.7)		9 (14.1)	3 (6.4)	0 (0)	
Religion	Islam	19 (86.4)	18 (90)	75 (96.3)	P > .05	57 (89.1)	46 (97.9)	9 (100)	P > .05
	Hindu	3 (13.6)	2 (10)	3 (3.8)		7 (10.9)	1 (2.1)	0 (0)	
Monthly family income (taka)	1000-15000	17 (77.3)	10 (50)	34 (43.6)	P > .05	43 (67.2)	17 (36.2)	1 (11.1)	**P < .05**
	15001-30000	3 (13.6)	8 (40)	27 (34.6)		13 (20.3)	20 (42.6)	5 (55.6)	
	30001-45000	2 (9.1)	1 (5)	8 (10.3)		4 (6.3)	7 (14.9)	0 (0)	
	45001-60000	0 (0)	1 (5)	8 (10.3)		4 (6.3)	2 (4.3)	3 (33.3)	
	60001-75000	0 (0)	0 (0)	1 (1.3)		0 (0)	1 (2.1)	0 (0)	
Marital status	Married	14 (63.6)	17 (85)	72 (92.3)	**P < .05**	48 (75)	46 (97.9)	9 (100)	**P < .05**
	Separated/Divorced	1 (4.5)	0 (0)	2 (2.6)		3 (4.7)	0 (0)	0 (0)	
	Widowed	7 (31.8)	3 (15)	4 (5.1)		13 (20.3)	1 (2.1)	0 (0)	

Table 6: Relation between Socio-demographic characteristics and the level of knowledge, and practice on oral health (n=120)

Discussion

This cross-sectional study was conducted among 120 conveniently selected diabetic patients in two upazila health complexes and two diabetes centers in two upazilas of Tangail district in Bangladesh. Based on a semi-structed questionnaire, a face-to-face interview was carried to find out the knowledge and practice level about the oral health among the diabetic patients.

The majority of participants in the current study (65%) had a good level of knowledge, but, in terms of the practice about oral health, the most of the participants (53.3%) had poor levels. Among these investigations, respondents to the current study had a much better knowledge of oral health than a study conducted in Iran [22], but both studies found that most participants had lower levels of oral health practice. In contrast, a similar study conducted in Srilanka by De Silva et al. (2015), the overall knowledge and practice about oral health among diabetic patients was moderate [23].

The present study found that only 45.8% of participants were aware that diabetics are more prone to oral diseases which is very similar to prior studies' findings in this case [23,24]. Therefore, the concerned authorities are requested to plan and implement the program for raising knowledge of diabetic patients in this regard. However, a large proportion of participants had adequate knowledge on various effects of diabetes mellitus on the oral health, and signs of gingival diseases, hence, these results reflect the overall good level knowledge of participants which is discussed above. In addition, this study found a great number of participants was aware about the importance of oral health practice in life. Although a considerable portion (64.2%) of participants did not know that soreness of gingiva can lead to gingival disease. As a consequence, it is required to promote the updated and contemporary knowledge about oral health towards diabetic patients through utilizing human resources or technology. Because this study found that human resources such as physician and dentist, and technology such as media and internet were the main source of information regarding to receive oral health knowledge for the participants.

In regards to the practice of oral health, more than 69% of the participants showed that they practice to maintain a healthy oral health such as brushing the teeth regularly (69.1%), using toothpaste for cleaning the teeth (73.3%), and brushing the teeth for at least 3 minutes (69.2%). The report of these investigations supports a research study conducted in India by Kejriwal et al. (2014) [25]. On the other hand, in this study, a controversial result was observed as most participants were aware of the importance of oral health practice but again found that more than half of the respondents (56.7%) did not go to the dentist, and a very large proportion of respondents such as 87.5% and 94.2%, respectively did not use mouthwash and dental floss. Decreased use of other aids for oral hygiene maintenance may be due to lack of knowledge about the existence of these various materials or having financial difficulties to purchase. An affordable cost of various teeth cleaning materials and a wide range of promotional programs about these materials can help diabetes patients to maintain oral hygiene practices.

In terms of the association among respondents' gender and their level of knowledge and practice, this study results contradict the research findings of Atarbashi Moghadam et al. (2013) [22] because a strong relationship has been found in the current study among those variables. As with previous authors [22, 26], the present study found a strong correlation ($p < 0.05$) between participants' educational profile and their level of knowledge and practice. Further, in this study, respondents 'occupations ($p < 0.05$) were identified as a factor related to their level of knowledge and practice. In addition, practice level had relationship with the monthly income of the respondent in the current research which upholds a prior study investigation [27]. It is very common that the more educated you are, the better job you will get and earn. However, unlike a study [28], the current research did not find any relationship with the age of participants but there had association between marital status and the level of knowledge and practice in the current study which is very suspicious. Therefore, a further depth study about the association between diabetics' patients' socio-demographic status and their level of knowledge and practice about oral health are recommended to carry out.

Limitations

Although this study was carefully prepared, there were some unavoidable limitations. For instance, a small sample size which may not reflect the whole population, practices on oral health might not representative as it was assessed on the basis of verbal responses of the respondents and there was recalling biased during the data collection process because some of the respondents may have answered the questions depending upon the answering way of others.

Conclusion

Diabetes mellitus is a major public health problem in Bangladesh. It is a chronic long-term condition, affecting all age groups. Uncontrolled diabetes can lead to serious oral complications ranging from acute to chronic, which manifest in several ways and can affect diabetic patient's overall health including oral health. However, these problems can be prevented with good oral health knowledge and oral hygiene practices. Since there was a wide gap between participants' levels of oral health knowledge and practice, this study calls for the planning and implementation of rational public health education activities, including well-defined strategies.

References

1. Afolabi O and Okeoghene OA (2017). Awareness and oral self-care practices of diabetic patients at a tertiary hospital in Lagos. Ann Med Health Sci Res, 7 (3): 36-43.
2. American Diabetes Association (2012). Diagnosis and classification of diabetes mellitus. Diabetes Care, 35(1): 64-71.
3. Kumaresan GD and Subha M (2017). Awareness on oral disorders in diabetes mellitus among general population in Chennai. Int J Orofacial Research, 2(1): 28-31.
4. Smyth S and Heron A (2006). Diabetes and obesity: the twin epidemics. Nat Med, 12 (1): 75-80.
5. Wild S, Roglic G, Green A, Sicree R and King H (2004). Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care, 27(5):1047-53.

6. International Diabetes Federation (2017). IDF Diabetes Atlas. Retrieved from [https://www.diabetesatlas.org/upload/resources/previous/files/8/IDF_DA_8e-EN-final.pdf]

7. Mohiuddin AK (2019). Diabetes fact: Bangladesh perspective. International Journal of Diabetes Research, 2(1): 14-20.

8. Greenberg MS and Glick M (2003). Burket's oral medicine diagnosis & treatment, 10th edn., Hamilton: BC Decker Inc.

9. Marks L (1996). Counting the cost: the real impact of non-insulin-dependent diabetes: A King's Fund report commissioned by the British Diabetic Association, 1st edn., London: British Diabetic Association.

10. Matthews DC (2002). The relationship between diabetes and periodontal disease. J Can Dent Assoc, 68 (3):161–164.

11. Al-Maskari AY, Al-Maskari MY and Al-Sudairy S (2011). Oral manifestations and complications of diabetes mellitus: A review. Sultan Qaboos University medical journal, 11(2):179–186.

12. Campus G, Salem A, Uzzau S, Baldoni E and Tonolo G (2005). Diabetes and periodontal disease: a case-control study. Journal of periodontology, 76(3), 418–425. https://doi.org/10.1902/jop.2005.76.3.418

13. Asmelash D, Abdu N, Tefera S, Baynes HW and Derbew C (2019). Knowledge, attitude, and practice towards glycemic control and its associated factors among diabetes mellitus patients, Journal of Diabetes Research, 2019 :1-9. https://doi.org/10.1155/2019/2593684

14. Saengtipbovorn S and Taneepanichskul S (2014.) Knowledge, attitude, and practice (KAP) toward oral health and diabetes mellitus among the elderly with type 2 diabetes, Bangkok, Thailand. J Health Res. 2014; 28(6): 433-441.

15. Bowyer V , Sutcliffe P, Ireland R, Lindenmeyer A, Gadsby R, Graveney M et al (2011). Oral health awareness in adult patients with diabetes: a questionnaire study. British dental journal, 211(E12) :1-5. https://doi.org/10.1038/sj.bdj.2011.769

16. Taiwo JO (2000). Oral health education needs of diabetic patients in Ibadan. African Journal of Medicine and Medical Sciences, 29(3-4): 269–274.

17. Eldarrat A (2011). Awareness and attitude of diabetic patients towards their increased risk for oral diseases. Oral Health and Preventive Dentistry, 9 (3): 235-241.

18. Allen EM, Ziada HM, O'Halloran D, Clerehugh V and Allen PF (2008). Attitudes, awareness and oral health-related quality of life in patients with diabetes. Journal of Oral rehabilitation, 35(3):218–223. https://doi.org/10.1111/j.1365-2842.2007.01760.x

19. Chavan GM, Waghachavare VB, Gore AD, Chavan VM, Dhobale RV and Dhumale GB (2015). Knowledge about diabetes and relationship between compliance to the management among the diabetic patients from rural area of Sangli District, Maharashtra, India. Journal of Family Medicine and Primary Care, 4(3):439–443. https://doi.org/10.4103/2249-4863.161349

20. Karaoui LR, Deeb ME, Nasser L and Hallit S (2018). Knowledge and practice of patients with diabetes mellitus in Lebanon: a cross-sectional study. BMC Public Health, 18(525):1-9 https://doi.org/10.1186/s12889-018-5416-7

21. Hoque MM (2019).ABC of research methodology and biostatistics, 3rd edn., Dhaka: Bangladesh Medical Book Seller Association.

22. Atarbashi Moghadam F, Haerian A, Sadat Salami M, Akhavan Karbasi MH, Fakhr-Tabatabayi R and vaziri F (2013).Evaluation of knowledge, attitude and practice between periodontal disease and diabetes. JCHR, 2(2):124-130

23. De Silva T,Weerasekera M, Edirisinghe D, Gunasekara C ,Sampath A , Bulugahapitiya U et al (2015). Patients with diabetes; their perception and practices towards oral health. World Journal of Pharmaceutical Research, 5(3):149-158.

24. Ismaeil FMR and Ali N (2013). Diabetic patients' knowledge, attitude and practice toward oral health. Journal of Education and Practice, 4 (20):19-25

25. Kejriwal S, Bhandary R and Thomas B (2014). Assessment of knowledge and attitude of diabetes mellitus type 2 patients about their oral health in Mangalore, India. Univ Res J Dent, 4:44-47.

26. Karikoski A, Ilanne-Parikka P and Murtomaa H (2002). Oral self-care among adults with diabetes in Finland. Community Dentistry and Oral Epidemiology, 30 (3): 216-223

27. Mejia GC, Elani HW, Harper S, Thomson WM, Ju X, Kawachi I et al (2018). Socioeconomic status, oral health and dental disease in Australia, Canada, New Zealand and the United States. BMC Oral Health 18:176. https://doi.org/10.1186/s12903-018-0630-3

28. Márquez-Arrico CF, Almerich-Silla JM and Montiel-Company JM (2019). Oral health knowledge in relation to educational level in an adult population in Spain. Journal of Clinical and Experimental Dentistry, 11(12):1143–1150. https://doi.org/10.4317/jced.56411

Acknowledgements