**Research Article**

# Determining the DMFT index and its correlation with the Blood Sugar and HbA1c levels in type II diabetic patients in Ahvaz at 2016-2017

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## Abstract

**Introduction**: Diabetes as one of the most important disease of this century, causing problems and complications in the patients; of this complication are dental problem including dental caries. Given the lack of studies in these patients, this study aimed to "determining the DMFT index and its correlation with the Blood Sugar and HbA1c levels in diabetic patients in Ahvaz at 2016-2017".

**Materials and Methods**: This descriptive-analytic and cross sectional study was done in 2016-17, with participating of 245 type 2 diabetic patients that referred to hospitals of Ahvaz. Then DMFT index, Blood Sugar (BS) and HbA1c were surveyed in the patients.

**Results**: The mean and standard deviation of DMFT index in the patients were 15.51 and 7.86 respectively. Also, there are a significant correlations between DMFT index and BS levels and age in the samples (P< 0.001). But, there aren't any significant correlations between DMFT index and HBA1c levels(P> 0.05).

**Conclusion**: Given the importance of oral health in general improving of quality of life of diabetic patients and, given the results of this study showed that these patients are not in good condition in terms of dental health, educating patients and their families regarding the more use of dental services and dental and oral hygiene, is recommended.

**Keywords:** Type II diabetic patients, DMFT, Dental caries, Blood Sugar, HbA1c

## I. Introduction

Diabetes is a chronic disease, metabolic and clinically and genetically heterogeneous Caused by abnormalities in hormone secretion or function Insulin, blood glucose levels rise the failure of pancreatic insulin secretion or insulin resistance, body cells to act or Both results (1,2). Metabolism of carbohydrates and lipids directly or indirectly is undergoing significant changes. Changes made to your metabolism, cardiovascular and nervous system wide changes and therefore leaves in various organs (3). The main etiology of diabetes is unknown, but several factors are proposed as the cause of autoimmune factors, infectious agents (virus) are among the factors (4).

According to the World Health Organization estimates that 171 million people with diabetes in 2000 were double the level in 2030 (5). Diabetes mellitus is the third leading cause of death in the United States (6) annually in the death of forty thousand and twenty thousand people have been mutilated (7). Now more than 240

million people worldwide have diabetes (6). The prevalence of diabetes is increasing worldwide in different areas (8). To top it off disease 10 countries, including India, China, Indonesia, Japan, Russia, Brazil, Italy and Bangladesh and Iran also significantly increased (9 and 10). In Iran 7/7% of adults between the ages of 64-25 years, ie two million people have diabetes, age range (11).

In an epidemiological study suggests that poor control of diabetes and sugar may be risk factors for periodontal disease (12). The relationship between diabetes and periodontal infection, or periodontitis has been shown (13). Periodontitis, a severe form of destructive periodontal disease, a common complaint of people with diabetes is likely (14 and 15). The people involved in uncontrolled diabetes, the risk of developing periodontitis is three times higher than with diabetes (15,16). Compared with people who did not have diabetes, periodontitis in people with diabetes develop faster and more severe (15,19). Also, poor control of diabetes and uncontrolled diabetes susceptibility to opportunistic infections such as oral candidiasis oral increases (14) and in the development of Xerostomia (dry mouth) is involved (20,22). Which can lead to tooth decay, wounds, injuries and infection in the mouth (23 and 24).

Many studies show the high prevalence and severity of lesions in patients with diabetes are oral tissues (25,26). Knowledge about susceptibility to periodontal disease, dry mouth and prevention of oral and dental problems as well as effective management of these conditions is very important for people with diabetes (27). Studies have shown that improved knowledge about oral health and dental prerequisite for self-care behaviors (18,27,28). Insufficient knowledge of oral health (Such as ignoring warning signs and symptoms of oral disease) may increase the risks associated with oral health or cause the patient's diabetes self-care behavior very oral health teeth do not matter (29,30). The only effective and efficient strategy to solve the problems of oral health prevention and the key to prevention, as well as success in the treatment of oral and dental diseases, dental caries and loss of teeth, oral hygiene (31).

Considering the importance of this issue, we decided to go to indices ofDMFT index in diabetic patients in Ahvaz.

## II. Materials and Methods

This study was a descriptive-analytical by observation and examination technique and using the information in the hospital diabetes unitKhomeini took place in Ahvaz. After determining the sample size in diabetic patients referred to the center, for example,sample size was continuous until completion. It should be noted that after obtaining informed consent from all personsOver 15 years, the sampling was conducted. After reviewing the file and test new patients by oral specialists and dentists were trained for this research, the oral examination was done. Persons with a history of smoking, alcohol, any malignancy, anemia or any systemic diseases include thyroid disease, hyperlipidemia, heart and blood pressure, kidney problems, eye disorders and other diseases were considering the possibility of their being influenced and oral protests from these diseases were excluded. Oral examination in place, by natural light and bypass the lip and searched in all areas of the mouth and under the right lightwas done. And patient data was recorded in a two-part questionnaire: In the first part demographic data such as age, sex, etc with the information in the records of patients with diabetes such as type, duration and final test of fasting blood sugar (FBS) and glycosylated hemoglobin (HbA1c) in Inventory are registered in advance. The second part includes the state of the teeth, which then wipe the teeth with gauze with the help of mirrors (dental mirror No.22) and catheter (No.23) and under the proper examination was carried out according to the situation of each tooth proprietary code it was awarded. Caries in DMFT index was used to determine the index numbers are assigned and encoded according to the World Health Organization (WHO) were recorded in the examination. The data to perform statistical analysis software SPSS version 22 was taken.

## III. Results

The findings of this study showed that 39.2% of men and 60.8 percent are women Mean age of 55.13 years with standard deviation 12 And a minimum age of 27 years and maximum 78 years (Table-1). The sampling strategy with regard to indicators associated with the disease are presented in Table-2. Also in this study, the level of HbA1c, as an indicator of diabetes control, into two groups: diabetes mellitus (HbA1c level of less than 7) and uncontrolled (HbA1c level above 7) divides the frequency is presented in Table-3.

DMFT index in samples of this study showed that the mean decayed teeth samples, 3.32 (SD = 2.73), teeth, 9.08 (SD=8.74), and the average tooth, 3.11 (SD=3.18) is. In total, DMFT index in 15.51 samples with a standard deviation is 7.86 (Table-4).

In this study, also the correlation between some variables and DMFT index in the samples examined. And the results of the study showed a significant relationship between DMFT index and age and FBS samples are there (p<0.001) but HbA1c, no significant statistical relationship (p>0.05). Meanwhile, the average DMFT index was higher in men than women, and this difference was statistically significant (p<0.05) But between gender and the average tooth decay, teeth and fillings, there is no significant relationship (p>0.05).

Table 1- Demographic characteristics of samples

|  |  | Number | Percent |
|---|---|---|---|
| Age range | <40 years | 41 | 16.7 |
|  | 40-60 years | 106 | 43.3 |
|  | >60 years | 98 | 40.0 |
| Gender | Man | 96 | 39.2 |
|  | Women | 149 | 60.8 |

Table 2- Indicators associated with diabetes in samples

| Diabetes Index | Average | SD | Min | Max |
|---|---|---|---|---|
| FBS | 194.75 | 92.19 | 72 | 450 |
| HbA1c | 8.46 | 2.26 | 5.1 | 13.3 |

Table 3- Typical characteristics in terms of diabetic treatment

| HbA1c | Number | Percent |
|---|---|---|
| Controlled(<7) | 74 | 30.2 |
| Non-controlled(>7) | 171 | 69.8 |
| All | 245 | 100 |

Table 4- DMFT index in samples

| DMFT Index | Mean | SD | Min | Max |
|---|---|---|---|---|
| Decay Tooth | 3.32 | 2.73 | 0 | 12 |
| Extracted Tooth | 9.08 | 8.74 | 0 | 28 |
| Filled Tooth | 3.11 | 3.18 | 0 | 12 |
| DMFT | 15.51 | 7.86 | 2 | 28 |

## IV. Discussion

Diabetes is one of the most important metabolic disorders in this century and in all societies, that Leading to multiple complications and problems that created problems in the mouth of one of the most important health problems in these patients. So far, several studies have examined this problem in the country and abroad. However, these studies have provided mixed results. Moreover, these studies often have to search an index, such as DMFT index and other oral problems these patients have been under consideration. Accordingly, in this study attempted to DMFT index and its relationship with other oral problems and with blood glucose levels and HbA1c sample of patients with type II diabetes, be examined. The index DMFT, study findings showed that mean DMFT index in 51/15 samples with a standard deviation is 7.86. The average number of decayed teeth were 3.32 (SD=2.73) 9.08 teeth (SD=8.74) and filled teeth, 3.11 (SD=3.18) is. The situation above average, suggesting unfavorable conditions of participating in the study of DMFT index in general as well as any one component of it. According to the age of the participants in this study, with an average above 55 years of age So that, for example, in a study by

Haji Ibrahim et al (2014) to assess the oral health status of the elderly was conducted in Gorgan, the results showed that the 62.6% of women and 54.3% of men and had lost all his teeth. Keep all the teeth in the mouth in men 6.4% and among women 1.5%, average teeth missing in men 22.5 ± 12.4 teeth and in women 24.4 ± 11.2 respectively. The researchers also concluded that oral health in the elderly is considered inappropriate (33).

However, tooth decay is an infectious disease that many factors are involved in its creation at a specified interval. Primary factors include the presence of cariogenic microorganisms, host (teeth), the food and the level of patient safety (34).

In connection with the effect of diabetes on the incidence of dental problems, various studies have been completed. For example, Miralles et al (2006) also showed that during the study of diabetes and complications from the disease affects increased dental caries (35) The study Miko et al (2010) also found that poorly controlled blood sugar levels and early onset diabetes mellitus may increase the risk of tooth decay (36).

In a study by Rafaatju et al to assess the oral health status in children with type 1 diabetes compared to healthy children in 1392 was conducted in Hamedan, 80 patients 5 to 18 years with type I diabetes referred to endocrine clinic for children and 80 healthy children and adolescents admitted to pediatric wards and Dental School, Hamedan, matched for age and sex matched groups were examined and evaluated. The results showed averaged DM index in the study group was 3.78 with 3.24 standard deviation and Their average number of decayed teeth,2.013 with 2.34 standard deviation that was not any significant differencein comparison with healthy children. Although oral hygiene and health habits were similar in both groups, the average DMFT And the D in patients with diabetes was slightly higher than the healthy group (37). Also, some researchers believe by age increasing and Increasing the duration of the disease, the impact of diabetes on oral and dental conditions and, in particular, secretion and composition of saliva, which can be more effective in diabetic patients is a permanent increase in tooth decay (37) That's according to age range of patients and duration of missing teeth in its mouth, a high level of DMFT is somewhat justified. In addition, the findings of this study showed a significant relationship between DMFT index of the samples with FBS(p<0.001)but there is no significant relationship with HbA1c(p>0.5)

Despite the low-sucrose diet, lack of good oral hygiene, salivary flow decreases, reducing the buffering capacity of saliva, saliva PH decreased, glucose and albumin concentration of saliva, the relative increase in fungal growth of Streptococcus mutanscan lead to oral-dental problems (37- 39). On the other hand, some researchers believe that chronic infections and inflammatory conditions (such as dental caries) leads to increased blood glucose and HbA1c will increase in the long term (40). Studies have shown that poorly controlled diabetes also leads to a reduction in salivary flow, which may lead to an increased rate of decay in the patients (41).

In this regard, the Study Farahat et al (2013), which aimed to determine the DMFT index and its relationship with HbA1C in patients with type II diabetes in Yazd in 1392, was 203 patients with type II diabetes in 2013-2014, referred to Yazd Diabetes Research Center, the two groups with and without diabetes control (HbA1C of less than or more than 77%) were randomly selected and studied.The findings showed that the mean age of participants was more than 53 years and the average number of decayed teeth in this study, a controlled diabetes, 4.20 with a standard deviation of 1.44, and in diabetic patients uncontrolled, 5.36 to 1.71 standard deviation, respectively. The average number of missing teeth, in diabetic patients controlled with a standard deviation of 5,2.31 and uncontrolled diabetes group, 8.2 ± 4.3 respectively. The mean number of teeth restored,

diabetic rats controlled, SD 5.83 to 2.07, and in uncontrolled diabetes,7.71 to 2.31 standard deviation respectively. More generally, in this study, the mean number of decayed and missing teeth and restored significantly in patients with uncontrolled diabetes, a group that had higher HbA1c,were higher and this difference was statistically significant (P=0.000) (41). The findings of the present study of the relationship between DMFT index with HbA1c, was not significant, is incompatible.

In the study of other, Jawed and colleagues (2011) demonstrated that overall blood glucose levels, HbA1C and DMFT index in people with diabetes than in normal subjects is (42),Increased incidence of glucose and a higher average of DMFT, is somewhat similar study of the present. Also, in line with the results of our Study; Sukminingrum and colleagues (2013) reported in their study of the correlation between DMFT index in patients with diabetes mellitus (HbA1c<7%) and patients with uncontrolled diabetes (HbA1c=7%) does not exist (43). Twetman study findings and colleagues, as well as the relationship between these two indicators are not reported similar results.

In sum, given the known risk factors for caries in diabetic patients, the association between dental caries and diabetes is controversial (37).

In this study, the results showed that there was a significant relationship between DMFT index with age.Thus the higher age groups, DMFT index had a tendency to increase.According to some researchers, aging and increase the duration of the disease, the impact of diabetes on oral and dental conditions and, in particular, secretion and composition of saliva, which can be more effective in diabetic patients is a permanent increase in tooth decay (37). In this connection, the results Stojanovic et al (2010) (44) and Leung et al (2008) (45), and Farahat et al (2013) (34), also showed that the DMFT index is directly related to the age of diabetics which is consistent with the study results.

In the present study, the results showed that mean DMFT index is higher in men than women, and this difference was statistically significant (P<0.05). In line with these findings, the study results Bakhshandeh and colleagues (2010) showed that HbA1c levels in men with high DMFT there (40).But the study Farahat et al (2013), the relationship between DMFT score by gender of patients in the diabetic group and the control group was observed uncontrolled diabetes (34).

## V. Conclusion

Overall, findings showed that mean DMFT index in 15.51 samples with a standard deviation is 7.86.The average number of decayed teeth were 3.32 (SD=2.73), 9.08 teeth (SD=8.74) and filled teeth, 3.11

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(SD=3.18) is. The situation above average, suggesting unfavorable conditions of participating in the study of DMFT index in general as well as any one component of it. Meanwhile, Study findings showed a significant relationship between DMFT index with samples FBS, but with HbA1c, no significant relationship.

Therefore, according to study results which showed broadly the high average DMFT index in patients with Type II diabetes isand given that it seems Due to the high rate of complications and health problems in patients with diabetes, dental problems are considered less. Addressing the oral health of patients in managed care plans as well as provide training to the patients to oral hygiene, is recommended.

## VI. Acknowledgments

## References

1- Shareef BT, Ang KT, Naik VR. Qualitative and quantitative exfoliative cytology of normal oral mucosa in type 2 diabetic patients.Med Oral Pathol Oral Cir Bucal. 2008; 13(11): E 93-6.

2- Pozzilli P, Guglielmi C, pronina E, petraikina F. Double or hybrid diabetes associated with an increase in type1 and type2 diabetes in children and Youths. Pediatr Diabetes 2007; 8(9):88-95.

3- Soltesz G, Patterson C, Dahlquist G. Diabetes in the young: a global perspective. In: Gan D, Editors. IDF Diabetes atlas. 2nd ed. Brussels: International Diabetes Federation; 2003. p. 113-34. Available from:
http://www.idf.org/sites/default/files/IDF_Diabetes_Atlas_2ndEd.pdf

4- Yoon Jw. The role of viruses and environmental factors in the induction of diabetes. Curr top microbial immunol.2000 Apr; 164(2): 95- 12.

5- http//www.WHO.Int . Diet physical activity. Publications facts diabetes en index. HTML.

6- Little JW, Falace DA, Miller CS, Rhodus NL. Dental management of the medically compromised patients. 7th ed.St. Louis: Mosby Elsevier, 2008: P. 212-36.

7- Alberti S, Spadella CT, Francischone TR, Assis GF, Cestari TM, Taveira LA. Exfoliative cytology of the oral mucosa intype II diabetic patients: Morphology and cytomorphometry. J Oral Pathol Med 2003; 32(9): 538-43.

8- Vernillo AT. Diabetes mellitus:relevance to dental treatment. Oral SurgOral Med Oral PatholRadiolEndod. 2001;91(3): 263-70.

9- World Health Organization. Prevalence of Diabetes. Available from:
http://www.who.int/diabetes/facts/world_figures/en/.

10- Greenberg M, Glick M, Ship JA. Burket's Oral Medicine. 11th ed. Hamilton, Ont: B.C. Decker; 2008. p. 89, 509-36.

11- Jajarm HH, Mohtasham N, Rangiani A. Evaluation of oral mucosa epithelium in type II diabetic patients by anexfoliative cytology method. J Oral Sci 2008; 50(3): 335-40.

12- Campus G, Salem A, Uzzau S, Baldoni E, Tonolo G. Diabetes and periodontal disease: a case-control study. J Periodontol 2005; 76(3): 418-25.

13- Hintao J, Teanpaisan R, Chongsuvivatwong V, Dahlen G, Rattarasarn C. Root surface and coronal caries in adults with type 2 diabetes mellitus. Community Dent Oral Epidemiol 2007; 35(4): 302-9.

14- Lamster LB, Lalla E, Borgnakke WS, Taylor GW. The relationship between oral health and diabetes mellitus. J Am Dent Assoc 2008; 139 (Suppl.): 19S–24S.

15- Mealey BL, Oates TW. Diabetes mellitus and periodontal diseases. J Periodontol 2006; 77(8): 1289-1303.

16- Taylor GW, Manz MC, Borgnakke WS. Diabetes, periodontal diseases, dental caries, and tooth loss: a review of the literature. CompendContinEduc Dent 2004; 25(3): 179-84.

17- Tsai C, Hayes C, Taylor GW. Glycemic control of type 2 diabetes and severe periodontal disease in the US adult population. Community Dent Oral Epidemiol 2002; 30(3): 182-92.

18- Khader YS, Dauod AS, El-Qaderi SS, Alkafajei A, Batayha WQ. Periodontal status of diabetics compared with nondiabetics: a meta-analysis. J Diabetes Complications 2006; 20(1): 59-68.

19- Taylor GW, Borgnakke WS. Periodontal disease: associations with diabetes, glycemic control and complications. Oral Dis 2008; 14(3): 191-203.

20- Chavez EM, Borrell LN, Taylor GW, Ship GA. A longitudinal analysis of salivary flow in control subjects and older adults with type 2 diabetes. Oral Surg. Oral Med Oral Pathol Oral RadiolEndod 2001; 91(2): 166-73.

21- Kao CH, Tsai SC, Sun SS. Scintigraphic evidence of poor salivary function in type 2 diabetes. Diabetes Care 2001; 24(5): 952-53.

22- Moore PA, Guggenheimer J, Etzel KE, Weyant RJ, Orchard T. Type 1 diabetes mellitus, xerostomia, and salivary flow rates. Oral Surg. Oral Med Oral Pathol Oral RadiolEndod 2001; 92(3): 281-91.

23- Matthews DC. The relationship between diabetes and periodontal disease. J Can Dent Assoc 2002; 68(3): 161-4.

24- Soell M, Hassan M, Miliauskaite A, Haikel Y, Selimovic D. The oral cavity of elderly patients in diabetes. Diabetes Metab 2007; 33 (Suppl. 1): S10-8.

25- Ship JA. Diabetes and oral health: An overview. J Am Dent Assoc 2003; 134 Spec No: 4S-10S.

26- Chavez EM, Borrell LN, Taylor GW, Ship JA. A longitudinal analysis of salivary flow in control subjects and olderadults with type 2 diabetes. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2001; 91(2): 166-73.

27- Brown LF. Research in dental health education and health promotion: a review of the literature. Health Educ Q 2000; 21(1): 83-102.

28- Horowitz AM, Kleinman DV, Wang MQ. What Maryland adults with young children know and do about preventing dental caries. Am J Public Health 2013; 103(6): e69-76.

29- Catteau C, Piaton S, Nicolas E, Hennequin M, Lassauzay C. Assessment of the oral health knowledge of healthcare providers in geriatric nursing homes: additional training needs required. Gerodontology. 2013 Dec 8. doi: 10.1111/ger.12094. [Epub ahead of print]

30- Slaughter A, Smith VJ, Taylor L. Progressing toward a more culturally competent approach to dental care for African American elders. Spec Care Dent 2004; 24(6):301-7.

31- Yuen HK, Wiegand RE, Slate EH, Magruder KM, Salinas CF, London SD. Dental health knowledge in a group of Black adolescents living in rural South Carolina. J Allied Health 2008; 37(1): 15-21.

32- Bader JD, Rozier G, Harris R, Lohr KN. Dental Caries Prevention: The Physician's Role in Child Oral Health Systematic Evidence Review [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2004 Apr. Available from: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH00 08113

33- Hajiebrahimi MH, Charkazi A, Rastgarimehr B, Homayonpour A, Hajiebrahimi Z, Mansourian M, Qorbani M, Shafieyan Z, Rezapoor A. Oral health situation in elder people in Gorgan city, 2009. Iranian journal of Diabetes and Metabolism (Elderly Health Research Center, Special Issue ) 2014; 13 (6): 505-512.

34- Farahat F, Daneshkazemi A, Amiri M, EbrahimpoorAghdari A. Evaluation of DMFT index in type II diabetic patients and its correlation with HbA1c in Yazd city in 2013. TB. 2016; 15 (1) :150-161.

35- Miralles L, Silvestre FJ, Hernández-Mijares A, Bautista D, Llambes F, Grau D. Dental caries in type 1 diabetics: influence of systemic factors of the disease upon the development of dental caries. Medicina Oral Patologia Oral Y CirugiaBucal. 2006;11(3): E256-60 .

36-Miko S, Ambrus S, Sahafian S, Dinya E, Tamas G, Albrecht M. Dental caries and adolescents with type 1 diabetes. British dental journal. 2010; 208 (6):E12.

37- Rafatjou R, Razavi Z, Khalili M, Farhadian M. Oral health status in 5-18 years old children and adolescent with type 1 diabetes compared with healthy group in Hamadan, Iran 2013-2014. jdm. 2016; 29 (2) :109-115.

38- Alves C, Brando M, Andion J, Menezes R. Oral health knowledge and habits in children with type 1 diabetes mellitus. Braz Dent J. 2009; 20 (1):70-3.

39-Tagelsir A, Cauwels R, van Aken S, Vanobbergen J, Martens LC. Dental caries and dental care level (restorative index) in children with diabetes mellitus type 1 .International journal of paediatric dentistry. Int J Paediatr Dent 2011; 21(1):13-22.

40- Bakhshandeh S, Murtomaa H, Vehkalahti MM, Mofid R, Suomalainen K. Oral health behaviour and periodontal treatment needs in a group of Iranian adults with diabetesone year after an oral health intervention. OHDMBSC. 2010; 9 (2):122-30.

41-Moore PA, Guggenheimer J, Etzel KR, Weyant RJ, Orchard T. Type 1 diabetes mellitus, xerostomia, and salivary flow rates. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2001;92(3):281-91.

42- Jawed M, Shahid SM, Qader SA, Azhar A. Dental caries in diabetes mellitus: role of salivary flow rate and minerals. Journal of diabetes and its complications. 2011;25(3):183-6.

43- Sukminingrum N, Ishak I, MasudiSaM, Alam MK. Comparison of Decayed, Missing or Filled Teeth (DMFT) Indexes between Diabetic and Non-Diabetic Patients. Int Med J 2013;20(4):443-5.

44- Stojanovic N, Krunic J, Cicmil S, Vukotic O. Oral health status in patients with diabetes mellitus type 2 in relation to metabolic control of the disease. Srpskiarhivzacelokupnolekarstvo 2010;138 (7-8):420-4.

45- Leung WK, Siu SC, Chu FC, Wong KW, Jin L, Sham AS, et al. Oral health status of low-income, middle aged to elderly Hong Kong Chinese with type 2 diabetes mellitus. Oral health & preventive dentistry 2008;6(2):105-18.