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Original Article

Comparison of The Oral Health Status of Type-1 Diabetes Mellitus and Healthy Children: A Comparative Study

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ABSTRACT

Being a chronic systemic disease type-1 Diabetes Mellitus (DM) affect both physical health and oral health of an individual. As a dentist, a thorough comprehension of the pathology, clinical manifestations, and therapy of orofacial diseases in DM patients is necessary to provide the best care possible to the patients. **Objective:** The purpose of this study was to observe the impact of type-1 DM on dental health. **Methods:** A questionnaire-based study was conducted on 264 subjects (132 type-1 DM children, 132 healthy children) attending Children's hospital PIMS, Islamabad. The oral health status of type-1 DM and healthy children was compared using WHO oral health assessment form for children and Fox's questionnaire was used. Comparisons between the oral health status of type-1 DM children with healthy children was done by Mann-Whitney U test. A comparison of oral health status among Type-1 DM children based on glycemic control was done by one-way ANOVA test. **Results:** Females were in majority in both groups as compared to males. The frequency of oral diseases was more in type-1 DM children as compared to healthy children. A significant statistical difference $p < 0.005$ was found between the oral health status of both groups. Based on glycemic control among type-1 DM children, there was no significant statistical difference found for DMFT, halitosis, and xerostomia however, there was a significant statistical difference found for BOP and mucosal lesion. **Conclusions:** Type-1 DM children are more prone to developing oral diseases as compared to healthy children.

INTRODUCTION

Diabetes mellitus (DM) refers to a group of metabolic illnesses characterized by unusually high blood glucose levels due to defects in insulin secretion, increased cellular resistance to insulin, or both. Diabetes mellitus has been divided into different categories of DM however, type-1 DM and type-2 DM are the most common types of diabetes mellitus [1]. The prevalence of DM has been rising. The global prevalence of diabetes was projected to be 2.8% in 2000 and is expected to climb to 4.4% by 2030 [2]. The prevalence of type-2 DM was found to be 6.28% globally whereas type-1 DM prevalence was found to be highest for European countries at 76% while lowest for African countries at 8% [3,4]. A previous study reported the prevalence of DM in Pakistan to be 13.2% in males and 6% in females [5]. The estimated yearly increase in type-1 DM is around 3% per year [6]. There are multiple medical

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ailments that have been associated with DM. Among acute medical complications, hypoglycemia and diabetic ketoacidosis (DKA) is the most common. On the other hand, diabetic retinopathy, nephropathy, and neuropathy are common chronic medical conditions related to DM [7]. The type-1 DM patients were reported to be more frequently affected by hypoglycemia and DKA as compared to the type-2 DM patients [8,9]. Similarly, the prevalence of diabetic retinopathy is more in type-1 DM patients as compared to type-2 DM patients [10]. However, diabetic neuropathy and nephropathy were more commonly observed in type-2 DM patients [11,12]. Systemic diseases have got detrimental effects on the oral health of individuals. In dentistry one of the most commonly encountered systemic disease is DM. DM does not only affect the physical health of an individual as explained before but it also has multiple deleterious effects on the oral health of an individual. It also compromises the overall quality of life of an individual. Dental caries, xerostomia, taste dysfunction, oral infections, and periodontal diseases have been reported as the most common oral manifestations of DM [13]. Among oral complications, periodontal diseases, candidiasis, and poor wound healing were more frequently found in type-1 DM patients in comparison to type-2 DM patients and non-diabetic individuals [14,15]. Although studies have been done to explore the impact of diabetes mellitus on the oral health of individuals, however, sufficient research has not been done to check the prevalence of oral manifestations and the effects of type-1 DM on the oral health of an individual, especially in Pakistan. The prevalence of type-1 DM oral manifestations and their effective management is critical for endocrinologists and dentists to give necessary care in order to improve their quality of life of these patients. This study aimed to investigate the impact of Type-1 DM on oral health of an individual particularly in the Pakistani population.

METHODS

This comparative questionnaire survey-based study was conducted in Children's Hospital PIMS and the pediatric dentistry department of the School of Dentistry, Islamabad. Prior ethical approval by the ethical review committee of Shaheed Zulfiqar Ali Bhutto Medical University Islamabad Pakistan under ref. no. F.1-1/2015/ERB/SZABMU/958, was taken before conducting the study. The study population consisted of 132 Type-1 DM patients that attended the endocrinology outpatient department and 132 non-diabetic children that attended the pediatric dentistry department of the School of Dentistry between 5th April 2022 to 27th June 2022. Prior consent was taken on a consent form from the participants before the examination. Type-1 DM patients diagnosed as per WHO criteria, ages ranging between 7-12 years, and having at least one permanent tooth erupted in the oral cavity were recruited in this study. because 1st permanent tooth erupts usually after the age of 6 years [16]. The patients having a history of systemic diseases other than type-1 DM or infectious diseases and patients undergoing orthodontic treatment were excluded from this study. The type-1 DM patients were categorized on the basis of their Glycated Hemoglobin A1c (HbA1c scores as: good glycemic control HbA1c less than or equal to 6.5%, moderate glycemic control HbA1c 6.6-8.9%, poor glycemic control HbA1c more than 9%) [17]. The current study questionnaires included the WHO oral health assessment form for children in 2013 and Fox's questionnaire to assess the oral health status and xerostomia symptoms respectively. SPSS software was used to examine the data (version 22). Descriptive data were computed for both type-1 DM patients and healthy children. Comparisons of oral health status of both groups was done using Mann-Whitney U test and further comparison of oral health status among type-1 DM patients depending upon their glycemic control was done by apply one-way ANOVA test. Statistical significance was determined by a p-value of less than 0. 05.

RESULTS

A total of 264 subjects (132 type-1 DM patients and 132 non-diabetic healthy children) were examined for oral health status. The mean age of type-1 DM children was 10.0±1.6 years and the mean age of non-diabetic children was 9.67±1.5 years. The total number of female subjects were in slight majority 71 (53.8%) and 74 (56.1%) in type-1 DM children and non-diabetic healthy children respectively as compared to male subjects. Table 1 provides specifics on the demographic information of the study participants.

Variables		Type-1 DM children	Non-diabetic healthy children
Gender	Male	61 (46.2 %)	58 (43.9%)
	Female	71 (53.8%)	74 (56.1%)
Age(Years)	7-8	16 (12.1%)	28 (21.2%)
	9-10	54 (40.9%)	60 (45.5%)
	11-12	62 (47.0%)	44 (33.3%)
Education	No schooling	26 (19.6%)	19 (14.35)
	Primary school	59 (44.6%)	63 (47.7%)
	Middle school	47 (35.6%)	50 (37.8%)
Area of living	Rural	79 (59.8%)	65 (49.2%)
	Peri urban	37 (28.0%)	46 (34.8%)
	Urban	16 (12.1%)	21 (15.9%)

Table 1: Demographic data of study population

Table 2 presented the frequency of oral diseases among type-1 DM children and non-diabetic children. The frequency of caries was more in type-1 DM children (39.4%) as compared to non-diabetic children (20.9%). Bleeding on probing was more frequent in type-1 DM children (18.9%) as

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compared to non-diabetic children (8.3%). Also, mucosal lesions (ulcers, abscesses, and candidiasis) were more frequently seen in type-1 DM children (12.8%) in comparison to non-diabetic children (4.6%). Moreover, type-1 DM patients experience halitosis more frequently (43.2%) as compared to non-diabetic healthy children (16.7%). Lastly, type-1 DM children experienced xerostomia more frequently (39.4%) as compared to non-diabetic children who barely had any complaint of xerostomia (6.2%). These results indicated that type-1 DM children experience more dental health issues as compared to non-diabetic healthy children.

Variables	Frequency	
	Type-1 DM	Non-diabetic
DMFT	39.4%	20.9%
BOP	18.9%	8.3%
Halitosis	43.2%	16.7%
Mucosal lesions	12.8%	4.6%
Xerostomia	39.4%.	6.2%

Table 2: Frequency of oral health issues among Type-1 DM children and non-diabetic children

DMFT=decayed, missing, filled, teeth; BOP=bleeding on probing

The comparison of the oral health status of both type-1 DM children and non-diabetic children is presented in table 3.

Variables	Mean ranks		p-value
	Type-1 DM	Non-diabetic	
DMFT	165.5	99.4	<0.005
BOP	125.5	139.5	0.012
Halitosis	127.3	137.7	0.024
Mucosal lesions	115.0	150.0	<0.005
Xerostomia	111.0	154.0	<0.005

Table 3: Comparison of oral health status between Type-1 DM children and non-diabetic children using the Mann-Whitney U test

DMFT=decayed, missing, filled, teeth; BOP=bleeding on probing, p-value of <0.005 was considered statistically significant. It can be observed that there is a significant statistical difference (p-value <0.005) between the oral health status of children with type-1 DM and non-diabetic children for DMFT, mucosal lesions and xerostomia. Further analysis was done to compare the oral health status of type-1 DM based on their glycemic control. The details can be seen in Table- 4. There was no statistically significant relationship found among the oral health status of type-1 DM children based on their glycemic control for DMFT, halitosis and xerostomia. However, a significant statistical difference was found among type-1 DM children for BOP and mucosal lesions (p< 0.05). further post Hoc analysis was done that showed that diabetic children with poor glycemic control has experienced more bleeding on probing and mucosal lesions as compared to the diabetic children with good- moderate glycemic control. These findings indicated that type-1 DM children with poor glycemic control experienced more dental health issues as compared to those who have good to moderate glycemic control.

Variables	Mean±SD			p-value
HbA1c	Good	Moderate	Poor	
DMFT	0.21±0.42	0.16±0.64	0.19±0.02	0.170
BOP	1.75±0.43	1.73±0.42	1.97±0.17	0.021
Halitosis	1.75±0.43	1.47±0.55	1.55±0.55	0.524
Mucosal lesions	3.78±0.42	3.80±0.56	3.91±0.52	0.045
Xerostomia	1.75±0.43	1.56±0.50	1.55±0.50	0.163

Table 4: Comparison of oral health status among Type-1 DM children based on glycemic control using one-way ANOVA test p-value < 0.05 was considered significant

DISCUSSION

Oral health is an important aspect of general health and well-being. Poor dental and oral health has a negative impact on the systemic health of an individual as well. In the present study, a significant statistical difference has been observed in the oral health status of children with type-1 DM and healthy children. The current study agrees with the previously done research that reported that type-1 DM children had a greater risk of developing oral complications in comparison to healthy children [18-20]. In the present study, the frequency of caries was found to be higher in type-1 DM children as compared to healthy children. A previous study conducted in Kosovo reported that children with type-1 DM are at a greater risk of developing dental caries as compared to healthy children [21]. Similarly, another study conducted in Finland reported that type-1 DM patients were at a greater risk of developing caries in comparison to healthy individuals [22]. Likewise, another study conducted in Lithuania reported that children with type-1 DM and adolescents were at a greater risk of developing dental caries as compared to healthy individuals [23]. Another study conducted in India on type-1 DM children reported that type-1 DM children are more prone to development of dental caries as compared to healthy individuals [24]. In our study, type-1 DM children had more frequent bleeding on probing than non-diabetic children. Another study conducted in Italy on type-1 DM children showed that they are more prone to gingivitis, bleeding on probing, and bacterial plaque as compared to healthy children [25]. Furthermore, another study conducted in Kuwait on type-1 DM patients reported that periodontal diseases are more commonly encountered in these patients as compared to healthy individuals [26]. Also, according to our study, type-1 DM children experienced halitosis more frequently as compared to non-diabetic children. Similar to our study, a study conducted on Swedish type-1 DM children reported that type-1 DM children patients with uncontrolled diabetes had a greater prevalence of halitosis as compared to type-1 DM children

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with good glycemic control [27]. In our study, the prevalence of oral mucosal lesions (ulcers, abscesses, and candidiasis) was higher in children with type-1 DM as compared to healthy children. A study conducted in Brazil on type-1 DM children and adolescents reported that type-1 DM patients were more prone to develop oral mucosal lesions as compared to healthy subjects [28]. Correspondingly, another study conducted in Greece on type-1 DM children and adolescents reported that type-1 DM children and adolescents with poor glycemic control had a greater risk of developing oral infections as compared to healthy individuals [29]. In our study xerostomia was reported to be more prevalent in type-1 DM children as compared to non-diabetic children, which are in accordance with the results of previously done studies where xerostomia was found to be more frequently associated with type-1 DM patients as compared to healthy individuals [30-31]. A previous study conducted in Greece on type-1 DM children reported that these patients had a higher prevalence of xerostomia as compared to healthy individuals [32]. Another study conducted in Iran on type-1 DM children reported that these patients have lower salivary flow rates as compared to healthy individuals [30]. Lastly, our study showed that type-1 DM children with poor glycemic control experienced more oral health issues as compared to those who had good to moderate glycemic control. A previous study conducted in Brazil on DM had reported that DM patients with poor glycemic control were more prone to periodontal disease and caries as compared to those with good glycemic control [33]. Another study conducted in Greece of type-1 DM patients reported that the risk of developing oral diseases was higher in those patients when their metabolic control was poor [29]. Similarly, another study conducted in Saudi Arabia on DM had reported that good glycemic control significantly decreased the risk of oral diseases in DM patients [34]. In summary, our study has reported that oral health issues for example dental caries, periodontal issues, oral infections, halitosis and xerostomia are common oral manifestations of type-1 DM and are more frequently noted in children having type-1 DM as compared to non-diabetic healthy children.

CONCLUSIONS

Type-1 DM children are more susceptible to developing oral diseases in comparison to non-diabetic children. The oral health issues were more frequently noted in type-1 DM children in comparison to non-diabetic children. Medical professionals should take the lead in motivating type-1 DM patients to schedule routine dental appointments to improve the patient's quality of life by preventing such oral complications.

Conflicts of Interest

The authors declare no conflict of interest.

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