Journal of Research in Medical and Dental Science
2022, Volume 10, Issue 8, Page No: 115-120

Available Online at: www.jrmds.in
eISSN No.2347-2367: pISSN No.2347-2545

Evaluation of Some Salivary Characteristics in Relation to Dental Caries among Children with Beta-Thalassemia Major

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ABSTRACT

Background: Thalassemia can cause obvious systemic as well as oral health problems so that clinicians must be concerned about the impact of this genetic disorder among those patients. A significant risk of dental cavities and poor oral hygiene can be noted among children with β-thalassemia major. This could be due to that among those patients there is a reduction in the salivary flow rate as well as the pH of the saliva.

Objective: This study was undertaken to determine some of salivary characteristics in relation to dental caries among children with beta-thalassemia major.

Materials and methods: A total of 80 children their age ranged from 10 to 12 years were enrolled in this study (40 thalassemic children who were previously diagnosed with β-thalassemia major as a study group compared to 40 healthy children as a control group). Their teeth were examined using dmfs/ds and DMFS/DS indices. From each child and under standardized conditions a sample of unstipulated saliva to evaluate the salivary flow rate and the saliva PH a whole saliva sample was taken. Then the data recorded was analysed statistically.

Results: For both the primary and permanent teeth, high dental caries experience (dmft/DMFT) was found among β-thalassemic children those be comparable to the controls, this difference was statistically significant ($p<0.05$). Salivary flow rate was significantly low among thalassemiac children compared to the control group. Although the salivary pH was found to be higher among the control group than those in the study group were, this difference was not significant statistically.

Conclusion: Beta thalassemia major was related to the presence of higher mean of dental caries and lower level of salivary rate of flow and pH.

Key words: Beta thalassemia major, Dental caries experience (dmfs/DMFs), Salivary flow rate, Salivary PH

HOW TO CITE THIS ARTICLE: Shaymaa Rasheed Ali, Aseel Haidar MJ Al Haidar, Evaluation of Some Salivary Characteristics in Relation to Dental Caries among Children with Beta-Thalassemia Major, J Res Med Dent Sci, 2022, 10 (8): 115-120.

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E-mail: ali.mario28@yahoo.com
Received: 06-Jun-2022, Manuscript No. JRMDS-22-62390;
Editor assigned: 09-Jun-2022, Pre QC No. JRMDS-22-62390 (PQ);
Reviewed: 23-Jun-2022, QC No. JRMDS-22-62390;
Revised: 10-Aug-2022, Manuscript No. JRMDS-22-62390 (R);
Published: 20-Aug-2022

INTRODUCTION

Thalassemia syndrome is a kind of hereditary haemolytic anaemia in which one (or more) globin chains are partially or completely unable to develop properly due to a genetic error that occurs during the synthesis of the haemoglobin molecule. Anaemia is caused by inadequate of erythropoiesis in the bone marrow and excessive haemolysis of red blood cells. Broadly, there are two types of thalassemia syndrome: α-type and β-type [1,2].

The negative outcome of thalassemia is not restricted to the patient's health, chronic hospitalization and complex treatment can challenging the individual's emotional and cognitive levels and disrupts the quality of life. Continuous and complex treatment may leading to a financial burden of the patient and his/her family, parents may experience a large scope of emotional, mental, communal, economic, physical and familial outcome [3].

Although dental caries and periodontal diseases can develop in a healthy individual, the existence of systemic disorders might raise the chance of their emergence, which could be due to a weakened body defence system that has a great influence on this high risk situation [4-6].

Saliva is a complicated and vital bodily fluid that helps to keep the oral tissues in good shape. It protects the oral mucosa as well as the entire body against illness [7-10]. Through its quality as well as its quantity, saliva exerts a natural flushing and neutralizing actions (by regulating the plaque pH and neutralize the acids produced by the cariogenic bacteria) that represent the most important caries protective function [11]. Therefore, any decrease in salivary flow rate might hasten the development of dental caries [12].

Children affected by Thalassemia major had poor oral health that could be due to the focusing of their parents on the children medical condition rather than treating their oral health problems. Further damage will arise in turn for

those children because of this poor oral health. Several studies had been conducted in regard to dental caries among children with thalassemia. While some of these studies deny the presence of any association with dental caries, other studies had contradicted this [12-14]. Hence, the purpose of this study was to see if there was any link between dental decay and β-Thalassemia major in children and further, to get comparison with their normal peers in Basra/Iraq. So that to gain knowledge regarding the oral health problems of this target group which may allow the setting for a preventive program for those medically comprised subjects.

MATERIALS AND METHODS

Sample selection

This case control research was organized from May 2021 to August 2021 after getting the ethical approval (334) according to the declaration of Helsinki guidelines [15].

It was conducted in the thalassemia centre in Basra governorate/Iraq. After receiving ministry of health ethical permission to conduct the clinical evaluation and laboratory biochemical investigation, forty child aged from 10 to 12 years attending the thalassemia centre for their routine blood transfusion regime were enrolled as a study group in this research. Whereas the control group (40 children) was made up of healthy, normal kids of the same age and gender as the research group. They were selected from the patients' relative that attended with them. Prior to the commencement of the study, the parents signed a permission form after being informed of the study's goals. A patient information sheet was obtained for each participant.

Selection criteria

Children in the study group had already been diagnosed with beta thalassemia major. Children with diabetes mellitus and various disorders that had been linked to dental caries or salivary features were omitted.

Children who were healthy and had no systemic diseases and those who did not take any medication were taken as healthy controls.

Those who their parents refused the participation and/or partially filled the questionnaire related to this study were excluded.

Data collection

At the thalassemia centre and after getting their routine blood transfusions, children were instructed to brush their teeth and they were asked to stop eating and drinking for approximately two hours before the clinical assessment. Meanwhile, an interview was done to get the demographic data for each child included in the study which was recorded on a special case sheet [16].

According to the oral health surveys, an oral examination was done on the dental chair unit utilizing a plane mouth mirror and a dental probe under standardized settings [17].

Dental caries experience was documented using the DMFT index for permanent teeth and the dmft index for primary teeth, as described by Manjie [18].

Navazesh and Kumar advised taking unstimulated salivary samples from each person under standardized settings [19]. In this study, spitting method was used for the collection of the saliva. Before commencing the collecting procedure, the youngsters were instructed to swallow all of their residual saliva, and this was accomplished by having the youngsters sit with their heads tilted forward and their right hands holding the collecting tube. For 5 minutes, the children drooled gently into the collecting tube to collect unstimulated saliva. During the process, they were also told not to swallow saliva. The pH of the saliva was measured using a pH indicator paper as soon as it was collected. Using the salivary volume collected on the tube, the salivary flow rate was computed [20].

The statistical analysis was carried out using version 22 of the statistical package for social sciences. For both of the studied groups, descriptive statistics (including mean and standard deviation) were calculated for each clinical parameter. The research and control groups were compared in terms of dental decay experienced in the adult and deciduous dentition. Independent t test was used. Pearson's correlation coefficient (r) was used to assess and compare the correlations among the variables. The level of significance was set at $p<0.05$.

RESULTS

Clinical examination indicated that both of the groups under the study were affected by dental caries, with the higher rate for the decidious teeth than that for the adult teeth, (Table 1). The mean of dmft/DMFT among the thalassemic children was high level than that found among the control group. This difference was found to be statistically significant ($p<0.05$).

Table 1: Dental caries experience by surfaces among β-thalassemiac children and their controls.

Variables	β-thalassemic		Control		t-test	p-value
	Mean	SE	Mean	SE		
dmfs	8.225	1.13	4.25	0.784	2.89	0.005*
DMFs	6.175	0.738	3.2	0.197	3.895	0.00000**

* Significant difference (p< 0.05).

Children with beta-thalassemia major had a low mean flow rate (0.117 ± 0.013) and low salivary pH (5.813 ± 0.131) with a statistical significant difference (Table 2).

Table 2: Salivary pH and flow rate among thalassemia patients and their controls.

Variables	Groups				T test	df	p value
	B-thalassemic		Control				
	Mean	± SE	Mean	± SE			
Flow rate	0.117	0.013	0.274	0.019	6.922	78	0.00000 *
PH	5.813	0.131	6.175	0.168	1.704	78	0.093 ^

* Significant difference (p< 0.05), ^=not significant p>0.05.

Table 3 reveals that for both of the study groups, salivary flow rate and salivary pH had a weak negative non-significant correlation with dmft index as well as the DMFT index.

Table 3: The salivary flow rate and dental caries experience of beta-thalassemia patients and their controls were correlated.

Groups (r)	Variables	Flow rate		pH	Significance	
		r	p	r	p	
Study	dmfs	-0.065	0.69	-0.208	0.197	NS*
Control	dmfs	-0.138	0.396	-0.057	0.725	NS
Study	Dmfs	-0.066	0.685	-0.214	0.185	NS
Control	Dmfs	-0.006	0.971	-0.202	0.211	NS

DISCUSSION

The study's main purpose was to find the connection between dental caries and thalassemia major in children. Based on past studies, no clear conclusions about the association between the development of dental caries and thalassemia have been made as of yet. Because of the widely differing findings about the relationship between dental caries and thalassemia, this study was an attempt to go deeper into the subject and focus solely on the relationship between the two, especially because no previous research had been conducted in Basra/Iraq.

The current study discovered that the average value of dental decay reported by primary dentition surfaces is (dmfs) among β-thalassemiac children was greater than that recorded in their controls (8.225 ± 1.130, 4.250 ± 0.784 respectively), with a statistical significant difference. This result was in agreement with that of some researches [20,21]. On the contrary, it was in disagreement with others [14,22,23]. Who were stated that there was no difference was found between the β-thalassemiac and the healthy one.

Meanwhile the results revealed also an increase in the mean value of (DMFs) with a statistical significance difference among β-thalassemiac children than that was recorded in their controls (6.175 ± 0.738, 3.200 ± 0.197 respectively). This result was in accordance with the findings of some studies [20,24-26], while it was in opposite with the conclusions documented by others [14,22] who were stated that the control and study groups had the same mean value.

Abnormalities in the endocrine system is behind the increase of the mean of dental decay experienced among children suffering from β-thalassemia major where the parathyroid functions and density of bone mineral in Relation to serum ferritin, alkaline phosphatase and calcium phosphorus levels will be affected. After a period from the blood transfusion received by the children with thalassemia (which is needed periodically), and because of the lysis of the red blood cell, the iron level in the in the body increased and stabilized in some tissues causing destruction of these tissues. The hormone secretions essential for the maintenance of calcium levels in the body, including bone and teeth, would be affected if the parathyroid gland is destroyed [27].

In addition, high level of dental decay among kids with β-thalassemia could be caused by the fact that their parents pay more attention to their children's serious general problems, while they are of less concern about the children's oral health that make them seeking dental treatment only when children have pain [28].

Several reasons can explain the variation between the studies concerning the mean of deft/DMFT of the β-thalassemiac children, such as variation in the sample size, the place where the study conducted, age range of the sample in addition to the variation in the criteria used for the diagnosis [29].

Whole unstimulated saliva sample is easily to measure and it is also reproducible [30]. In the current study, a lower mean of the salivary flow rate with a statistical significant difference was found among the β-thalassemiac children compared to their controls (0.117 ± 0.013, 0.274 ± 0.019 respectively). This result was

coincide with the results documented previously [20,31]. While, the difference in salivary flow rate between the two groups, according to Siamopoulou [32] was not statistically significant. According to Luglie [33] there was no change in salivary flow rate between the study and healthy groups. The thalassemic patients' had decreased salivary flow rate that could be linked to the difficulties produced by their regular blood transfusions (which could be performed at least once monthly). One of these negative effects is that diminished of their salivary glands as a result of the excessive deposition of iron, which will lead to a painful salivary gland inflammation that may influence the salivary rate of flow [21].

The salivary flow rate was shown to have a weak negative correlation with dental caries among β-thalassemiac children. This result was in agreement with that reported by other researchers [20,23]. Direct relationship was recorded between the salivary flow rate and the rate of oral clearance, which successively can affect the development of dental decay [34]. Salivary rate of flow is a very crucial key parameter in the assessment of caries risk by which low flow rate of saliva will be linked with increased caries risk while the high flow rate will be related to reduction in the caries risk [35,36]. Al-Zaidi discovered an undeniable correlation between oral *mutans streptococci* and dental caries and founded that decreased salivary flow rate in thalassemic patients can aid in the growth of cariogenic *S. mutans* that have a main role in the development of dental decay among beta-thalassemic children [37].

The pH of a solution, the degree of acidity/alkalinity in the solution might be represented by the negative logarithm of the hydrogen ion concentration. A lower pH value corresponds to a higher hydrogen ion concentration, and vice versa. The proportion of hydrogen ions in saliva affects most oral chemical processes, notably the equilibrium between the calcium and phosphate ions of the tooth and the surrounding base fluid [34].

In the present study, β-thalassemiac children possessed lower mean value of salivary pH (5.813 ± 0.131) than the controls had (6.175 ± 0.168). This result was in accordance with that of Babu and Shah [21]. Whereas it was opposite to that of Siamopoulou [35] and Jaddoa [20] who reported a higher salivary pH among the thalassemia children than the controls. This variation between the studies could be resulted from the differences in the method of saliva collection [19].

One of the important factors that has an essential role and can affect the salivary pH is the salivary rate of flow. Its reduction in patients with beta thalassemia will exert an adverse effect on the salivary inorganic components including the bicarbonate and phosphate (which act as a salivary buffering system that serve in neutralizing the acidity) [38].

Although the conclusions of the prevalent study showed a weak negative correlation between the salivary pH and dental decay among β-thalassemiac children (which was in agreement with others [20,37], it was not significant statistically.

In regard to the severity of dental caries, salivary flow rate and pH have a significant influence [36,39]. However, such a relationship was not significant statistically in the current investigation among thalassemic children suggesting that among those children there are other factors affecting the severity of dental caries rather than the pH and the flow rate. Therefore, additional studies with a larger sample size are needed to take into consideration the other components.

CONCLUSION

In the recent study, although β-thalassemiac children had a several oral health problems (*i.e.* increase the prevalence of dental caries experience, lowering in both salivary flow rate and salivary pH) in comparison the normal healthy children, no statistical significant correlation was found between dental decay and salivary rate of flow and salivary pH among those group of children.

Children with β-thalassemia major are found to be at high risk to be affected with oral diseases; therefore, preventive educational programs and utmost attention for their parents are required to create awareness about the importance of the reduction of the oral health problems so that to increase the life expectancy.

FINANCIAL DISCLOSURE

There is no financial disclosure.

CONFLICT OF INTEREST

None to declare.

ETHICAL CLEARANCE

All experimental methods were approved by the College of Dentistry at the University of Baghdad in Iraq, and all operations followed the permitted guidelines.

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