DOI Number: 10.37506/v14/i1/2020/ijfmt/193058

Assessment of the Correlation between the Salivary Flow Rate and Dental Caries Experience among Children with β-Thalassemia Major

Mudhafar Fadhil Jaddoa[1], Alhan Ahmed Qasim[2]

[1] M.Sc. Student, [2] Assistant Prof., Department of pediatric and preventive dentistry/College of Dentistry/Univ. of Baghdad, Iraq.

Abstract

Thalassemia constitutes a group of congenital blood disorders which characterized by a defect in synthesis of one or more globin chains of human hemoglobin molecule and the resultant microcytosis and hypochromia of the RBCs. It is of two main divisions, α- and β-thalassemia and several other subdivisions. The study group composed of 40 patient years previously diagnosed with β-thalassemia major attending the thalassemia center in Thi-Qar province/Iraq. The control group, matching the age and sex of the study group, and consisted from 40 child selected from a number of primary schools. Unstimulated salivary samples was taken from each subjects under standardized conditions. The mean value of flow rate of saliva was lower among β-thalassemias (0.466±0.024) than for controls (0.829±0.048). The (mean±SE) for the primary teeth (dmfs) in β-thalassemias (1.450±0.324) was higher than that for controls (1.250±0.808), this difference was not significant (P> 0.05). The (mean±SE) of the caries experience (DMFs) in β-thalassemias (6.850±0.782) was higher than for the control group (3.600±0.489).

Keywords**:** *β-Thalassemia major, Salivary flow rate, Dental caries experience (dmfs/DMFs).*

Introduction

Thalassemia is a very worldwide common autosomal and recessive genetic disorder with a large geographical incidence difference, it is a so severe and incurable disease because prevention is the only way to evade the disease [1]**.** Thalassaemias are caused by markdown or complete absent in the synthesis of one or more of the globin chains that constitute the hemoglobin (Hb) unit [2,3]. About 60,000 to 70,000 newly born children are born yearly with a severe form of thalassaemias around the world [4], and unfortunately most affected children are those who born in areas of low sources of income [5]. β-Thalassemia major is the most severe type of thalassemia and occurs due to a defect in the synthesis of β-globin chain [6]. Beta- homotetramers in α-thalassemia are more stable than alpha- homotetramers in β-thalassemia; therefore, in beta thalassemia α-homotetramers tend to precipitate priorly in the RBCs life span, producing marked RBCs haemolysis [7]. Few of the pro-erythroblasts beginning their maturation and can survive [8,9], the resultant few RBCs will bear an inclusion bodies that identified in the spleen, shortening the RBC lifespan and producing severe haemolytic anaemia [10]. The produced anaemia stimulates the production of erythropoietin stimulating hormone from the kidney and liver with a compensatory erythroid hyperplasia, but the marrow response is disrupted by ineffective erythropoiesis. [11]. Later on, massive bone marrow expansion will happened and the end result is skeletal deformities [12]. In thalassemias, high caries index, pallor of oral mucosa, atrophic glossitis, sialadenitis, retained deciduous teeth, shortened and spiked roots of teeth and thinning of the lamina dura could be seen [13]. Oral health, on the other hand, can also affect child's personality, knowledge, and social relationships [14]. Dental caries is a chronic disease resulted from a complex intercommunication of a mass of cariogenic oral microorganisms which grow on the teeth surfaces within the dental [15]. Dental caries is widely spread and can affecting all ages. The experience of dental caries could

Corresponding

Mudhafar Fadhil Jaddoa

email: moadhafar_f@yahoo.com.

be modified by several important factors, including diet, age, gender, socioeconomic level and some medicines [16]. Saliva is a heterogeneous mixture of fluids mainly produced via the major and minor salivary glands and contains oral bacteria and food debris from the gingival crevicular fluid [17,18]. Saliva have an important role in the maintenance of a healthy oral environment through a variety of physicochemical and biological properties. Unstimulated (resting) saliva includes secretions that enter the mouth without any exogenous stimuli [19,20]. Flow rate is the most important salivary parameter affecting oral health status and it represents the rate of salivary secretion and it is expressed in milliliters per minute [21]. Flow rate is very important protective factor against dental caries throughout its washing and buffering effect [22], any minimization in the normal salivary flow rate can results in establishment of dental caries [23]. Al-Jobouri and Al-Casey [24] and Kataria et al. [25]

Materials and Method

The total sample included in this study was (80) subjects. The study group was consisted of a (40) child suffering from β-thalassemia major and aged (11-12 years old). The control group, the non-thalassemic children, matching the age and gender of the study group, and consisted of a (40) child selected from the primary schools. An ethical approval was firstly obtained from the Ministry of Health and the Ministry of Education to perform the clinical examination and laboratory biochemical analysis. Also, a written consent form as well as patient information sheet were provided to each participant for gaining the acceptance of the child's parents or his/her caregiver. Children having other diseases whose known to affect the experience of dental caries or the characteristics of saliva such as diabetes mellitus, were excluded. The oral examination was performed under standardized conditions of oral health surveys (WHO 1997). During examination, a suitable chair is used with noticing that it supports the head of the child. Clinical examination was performed using plane mouth mirror and dental probe. The reported caries experience was based on the criteria suggested by Manjie et al. [26]. Unstimulated salivary samples was taken from each subjects under standardized conditions suggested by Navazesh and Kumar [27]. Statistical analyses were done using SPSS computer programme, version 21. Descriptive statistics including (the mean and SE) of each clinical variable were determined for all the subjects. Student t-test was used to compare the caries experience between the study and control groups. Pearson's correlation coefficient (r) was used to assess and compare the correlations among the variables. ($P > 0.05$) was considered statistically not significant. ($P \leq 0.05$) was considered statistically significant and ($P \leq 0.01$) was considered to be statistically highly significant.

Results

Table (1) illustrates the results showed that the (mean±SE) in β-thalassemias (1.450±0.324) was higher than that for the control group (1.250±0.808), This difference was not significant ($P > 0.05$).

Table (1): Show Dental caries experience by surfaces in primary dentition among β-thalassemias and their controls.

Variables	Study		Control		t-test	P-value
	Mean	SE	Mean	SE		
dmfs	1.45	0.324	1.250	0.808	**0.919**	**0.362***

* Not significant difference ($P > 0.05$).

Table (2) illustrates the results showed that the (mean±SE) value in β-thalassemias (6.850±0.782) was higher than that for the control group (3.600±0.489). This difference was highly significant ($P \leq 0.01$).

Table (2): Dental caries experience by surfaces in permanent dentition among β-thalassemias and their controls.

Variables	Study		Control		t-test	P-value
	Mean	SE	Mean	SE		
DMFs	6.85	0.782	3.600	0.489	3.524	0.001**

** Highly significant difference (P≤ 0.01)

Table (3) Results showed that the salivary flow rate among β-thalassemias was lower among β-thalassemia patients than for their control subjects. This difference was highly significant (P ≤ 0.01).

Table (3): Salivary flow rate among thalassemia patients and their controls.

Study		Control		t-test	P-value	
Mean	SE	Mean	SE			
Flow rate	0.466	0.024	0.829	0.048	6.818	0.00**

** Highly significant difference (P ≤ 0.01)

Table (4) In primary dentition, results showed a weak negative, not significant correlation between the salivary flow rate and (dmfs) index in the study and control groups. In permanent dentition, results showed a weak negative, not significant correlation between the salivary flow rate and (DMFs) index in the study and control groups..

Table (4): Correlation coefficients of the salivary flow rate and the dental caries experience among thalassemia patients and their controls.

*NS = Not significant

Groups Variables r		Flow rate P		Significance
Study	**dmfs**	- 0.097	**0.550**	**NS***
Control	**dmfs**	- 0.147	**0.367**	**NS**
Study	**Dmfs**	- 0.181	**0.263**	**NS**
Control	**Dmfs**	- 0.168	**0.301**	**NS**

Discussion

In the present study, the mean value of salivary flow rate was founded to be lower among β-thalassemias (0.466±0.024) than in their control subjects (0,829±0.048). This result was also documented previously by Norri [28] and by Al-Jobouri and Al-Casey [24]**.** This minimization in the salivary flow rate among the study group might be attributed to the fact that the salivary glands function in thalassemic patients can be affected directly by the excessive iron deposits, and the resultant painful inflammation of the salivary glands, with either regular or diminished salivary flow [23]. However, Siamopoulou et al [29] concluded in their study that the difference in salivary flow rate between the two groups is not significant. These results were in disagreement with Luglie et al. [30] and Greenberg et al. [31] whose showed in their studies that salivary flow rate was similar in both study and control groups.

The present study also concluded that the mean value of caries experience by surfaces in primary dentition (dmfs) among β-thalassemias was higher than that recorded in their controls. This result was corresponding with Gomber et al. [32], Kaur et al. [33], Dhote et al. [34]. On the contrary, this result was disagree with Scutellori

et al. [35], Qureshi et al. [36] and Arora et al. [37] who were concluded that there is no difference between the two groups.

Furthermore, the results of the present study revealed that the mean value of caries experience by surfaces in permanent dentition (DMFs) among β-thalassemias was higher than that recorded in their controls. This results was in agreement with Hattab et al. [38], Al-Raheem et al. [39] and Al-Hadithi [40], while it was in disagreement with the results of Scutellori et al. [35] and Arora et al. [37] who were founded a similar mean value between the two groups.

In present study, there was a negative correlation between salivary flow rate and caries experience. Salivary flow rate may play an important role in relation to dental caries in which the flow rate of saliva exert cleansing activity which is critical in the clearance of food remnants and bacteria [41]. It was documented that the caries experience is obviously increased when salivary flow rate is stunted and this fact sign that the chronic decrease in flow rate is a risk factor for dental caries initiation and progression [42]. In thalassemic patients, reduced salivary flow rate can help in colonization of cariogenic S. mutans, which may have a role in the higher caries experience. Al-Zaidi [43] has documented an indubitable correlation between oral mutans streptococci and dental caries in β-thalassemia patients.

However, the higher caries experience in β-thalassemias than the normal controls can be related to factors other than a reduced salivary flow rate. This could be explained on the idea that these patients are less concern with their oral health, their parents are more worried about the serious physical condition, they paying less care to the oral health care, and seeking professional oral care just when the child experience severe pain [23, 44].

Al-Wahadni [45] and Gomber and Dewan [32] concluded in their studies that skeletal changes as enlargement in maxillary arch that occur in thalassemias in could result in protrusion of anterior segment, increased space between upper and lower teeth, over-bite or open-bite which all could predispose to dental caries.

Conclusion

Dental caries experience was higher among beta thalassemias compared to the control group. The salivary flow rate among β-thalassemias was lower among β-thalassemia patients than for their control subjects. The reduced salivary flow rate detected in β-thalassemia major patients could be considered as a modifying factor for the increased experience of dental caries in these patients.

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the College of Dentistry/Univ. of Baghdad, Iraq and all experiments were carried out in accordance with approved guidelines.

References

1. Tahura S, Selimuzzaman MD, Ahmed Khan W. Thalassemia Prevention: Bangladesh Perspective - A Current Update. Bangladesh J Child Health. 2016; 40 (1): 31-38.
2. Modell B, Barlison M. Global epidemiology of haemoglobin disorders and derived service indicator. Bull World Health organ. 2008; 86: 480-487.
3. Weatherall DJ. The inherited disease of hemoglobin are an emerging global health burden. Blood. 2010a; 115: 4331-36.
4. Weatherall DJ, Clegg JB. Inherited haemoglobin disorder: An increasing global problem. Bulletin of WHO. 2001; 79: 704-712.
5. Weatherall DJ. The challenge of haemoglobinopathies in resource-poor countries. Br J Haematol. 2011;154:736-44.
6. Miri-Aliabad G, Fadaee M, Khajeh A, Naderi M. Marital status and fertility in adult Iranian patients with beta-thalassemia major. Indian J Hematol Blood Transfus. 2016; 32(1): 110-113.
7. Rund D, Rachmilewitz E. Beta-thalassemia. N Engl J Med. 2005; 353(11): 1135-1146.
8. Braunwald E, Hauser S, Fauci A, Longo D, Kasper D, Jameson J. Principles of Internal Medicine. Harrison's 15th ed., McGraw-Hill, NewYork. 2001 .p. 666-674.
9. Hoffbrand A.V. Essential Haematology 4th ed., Italy, Milan, 2001.
10. Lichtman M, Kipps T, Prchal J. Williams Hematology. 7th ed., USA, 2006.

11. Boon N, Colledge N, Walker B. Davidson's medicine. 20th ed., chain, 2006.
12. Greer J, Rodgers G, Foerster J, Glader B, Arber D, Means R. Wintrobe's clinical hematology.12th ed., chain. 2009; 1(4): 1083.
13. Helmi N, Bashir M, Shireen A, Ahmed IM. Thalassemia review: features, dental considerations and management. Electron Physician. 2017; 9(3): 4003-8.
14. Nemati S, Ghasempour M, Khafri S. Impact of oral and dental health on quality of life in Iranian preschool children and their families. Electron Physician. 2016; 8(11): 3296-301.
15. Bader J, Shugars D, Rozier G, Lohr K, Bonito A, Nelson J. Diagnosis and management of dental caries. Evid. Rep. Technol Assess. 2001; 36: 1-4.
16. Al-Hadithi, H. K. Caries experience among children 6-12 years with the beta-thalassemia major syndrome in comparison to healthy control in Baghdad-Iraq. J Bagh Coll Dentistry. 2011; 23: 28-32.
17. Edgar WM. Saliva: its secretion, composition and functions. Br Dent J. 1992; 172: 305-12.
18. Roth G, Calmes R, editors. Salivary glands and saliva. In: Oral biology. St Louis: CV Mosby. 1981. p.196-236.
19. Amerongen A, Ligtenberg A, Veerman E. Implications for diagnostics in the biochemistry and physiology of saliva. Ann N. Y. Acad Sci. 2007; 23 (2): 1-6.
20. Stooky G. The effect of saliva on dental caries. J Am Dent Assoc . 2008; 139(2): 11-17.
21. Guy C. Role of saliva in the oral processing. In: Jianshe Ch. and Lina E. Food oral processing. Garsington Road, Oxford, 2012.
22. Lagerlöf F. Caries-protective factors in saliva. Advances in Dental Research. 1994; 8(2): 229-238.
23. Babu N.S.V. and Shah S. Comparative assessment of salivary flow rate, buffering capacity, resting pH and dental caries in children with beta thalassemia. The Journal of Middle East and North Africa Sciences. 2018; 4(3): 18-22.
24. Al-Jobouri H.S. and Al-Casey M. Selected salivary constituents among 16-18 years patients with beta thalassemia major in relation to oral diseases. J Bagh College Dentistry. 2011; 23(2): 124-127.
25. Kataria S.K., Arora M., Dadhich A., and Kataria K.R. Orodental complications and orofacial manifestation in children and adolescents with thalassemia major of western Rajasthan population: a comparative study. Int J Biol Med Res. 2012; 3(1): 1816-9.
26. Manji F, Fejerskov O, Baelum V. Pattern of dental caries in an adult rural population. Caries Res. 1989; 23: 55-62.
27. Navazesh M, Kumar S. Measuring salivary flow challenges and opportunities. JADA. 2008; 139(5): 35-40.
28. Noori M. Orofacial, salivary and radiographic changes in major thalassemic patients in Mousl. Master thesis, College of Dentistry, University of Baghdad, 2004.
29. Siamopoulou MA, Mavridou A, Galanakis E, Vasako S, Fatourou H, Lapatsanis P. Flow rate and chemistry of parotid saliva related to dental caries and gingivitis in patients with thalassemia major. Int J Pediatr Dent. 1992; 2(2): 93-7.
30. Luglie P.F., Campus G., Deiola C., Mela M.G. and Gallisai D. Oral condition, chemistry of saliva, and salivary levels of Streptococcus Mutaus in thalassemic patients. Clini. Oral. Inves. 2002; 6(4). (Medline Abstract).
31. Greenberg M, Glick M. Burket's oral medicine.10th ed. Spain, 2003.
32. Gomber S, Dewan P. Physical growth & dental caries in thalassemia. Indian Pediatr. 2006; 43: 1064-1069.
33. Kaur N, Hiremath S.S. Dental caries and gingival status of 3-14 year old Beta Thalassemia major patients attending pediatric OPD of Vani Vilas Hospital, Bangalore. Archives of Oral Sciences & Res. 2012; 2(2): 67-70.
34. Dhote V., Thosar N., Baliga S, Evaluation of oral hygiene status and salivary biochemistry of patients with thalassemia major: A clinical study. IOSR-JDMS. 2015; 14(12): 98-102.
35. Scutellori PN, Orzincolo C, Andraghetti D, Gamberini MR. Anomalies of the masticatory apparatus in beta-thalassemia. The present status after transfusion and iron-chelating therapy. Radio Med. 1994; 87: 389-96.
36. Qureshi A, Chaudhry S, Shad MA, Izhar F, Khan AA. Is oral health status of children with β-thalassemia worse than that of their normal counterparts? Journal of Khyber College of

Dentistry. 2010; 1: 4-7.

37. Arora R, Malik S, Arora V, Malik R. Comparison of dental caries prevalence in Beta Thalassemia major patients with their normal counterparts in Udaipur. Am Int J Res Form Appl Nat Sci. 2014; 5: 06-9.
38. Hattab FN, Hazza'a AM, Yassin OM, Rimawi HS. Caries risk in patients with thalassemia major. Int Dent J. 2001; 51(1): 35-8.
39. Al-Raheem Y, Abdul Hussein M, Al-Ani R, Al-Rubayee M. The impact of thalassemia major on dental integrity and development. MDJ. 2009; 6(4).
40. Al-Hadithi, H. K. Caries experience among children 6-12 years with the beta-thalassemia major syndrome in comparison to healthy control in Baghdad-Iraq. J Bagh Coll Dentistry. 2011; 23: 28-32.
41. Millar K, Geddes D, Hammersely R, Baddy J. Is salivary flow related to personality? Brit Dent J. 1993; 175: 13-9.
42. Pedersen AM, Reibel J, Nordgarden H, Bergem HO, Jensen JL, Nauntofte B. Primary Sjögren's syndrome: Salivary gland function and clinical oral findings. Oral Diseases. 1999; 5: 128-38.
43. Al-Zaidi R.R. Dental caries among a group of boys with β-thalassemia major (10-12 years old) in relation to selected salivary ions and mutans streptococci. M.Sc. Thesis, College of Dentistry, Univ. of Baghdad, 2013.
44. Kaplan RL, Werther R, Costano FA. Dental and oral findings in Cooley's anaemia. A study of fifty cases. Ann N Y Acad Sci. 1964; 119: 664-666.