Original Article

Twins and Caries, is there a Correlation? An Observational Study

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ABSTRACT

Objective: To find the genetic correlation in twins and caries by accessing DMFT index.
Study Design: Cross-sectional study
Place and Duration of Study: This study was conducted at the department of conservative dentistry, College of Dentistry, Qassim University for a period of 03 months from January to March 2019.
Materials and Methods: A total of 25 pairs of twins were examined in the study. Data was analyzed by SPSS version 20.0. Mean values of each component of the DMFT index were calculated by using descriptive statistics, and comparison was made between male and female groups by using Pearson's correlation.
Results: The comparison showed significant differences in decayed and overall DMFT scores between male and female groups. The comparison amongst each subgroup of male and female twins showed a positive genetic correlation in both subgroups of the twin.
Conclusion: This study concluded that the DMFT index is a valid tool to determine caries. There was a significant difference in decayed and overall DMFT scores between the male and female twin groups. Also, there might be genetic influence to the carious disease process among the twins in both males and female subgroups.

Key Words: DMFT index, caries, twins, genetics, environment, decayed, missing, filled, teeth.

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INTRODUCTION

Dental caries is a prevalent chronic disease in the world. It's an infectious disease characterized by a multifactorial etiology, followed by the demineralization and destruction of hard tissues of teeth. (1)
Many factors contribute to the etiology of caries, and one of them is host susceptibility, which in turn is linked to potential genetic contribution for caries risk. The understanding of genetic contributions in caries can be helpful in future for the dentists in explaining to patients that some forms of caries are attributed to inherited risk associated with that kind. (2)
There has been circumstantial evidence of the degree of susceptibility of genetics in the etiology of caries. (3)
One way to determine the correlation is to study twins. A study of healthy twins, if properly conducted, will certainly be able to provide multidimensional evidence to distinguish the relative contribution of genetics and environment to disease variation. (4)

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Similar genotypes, family environment and ability to isolate a characteristic in twins, is valuable in determining the role of genes in a disease. Although, it is difficult to predict the exact influence of heredity due to various genetic patterns, twin studies are valuable in providing evidence against the purely environmental model. (5)
The Decayed, Missing, and Filled Teeth (DMFT) index has been used since the 1930, s and gives the estimate of the prevalence of the disease, as well the severity of the affected teeth and tooth surfaces. It determines the number of decayed teeth, the number of treated teeth, and the number of teeth missed due to decay. Although the DMFT provides an indicator of both current and past caries experience, individual variables (decayed/ missing/filled) can be separated in the data collection process. (6)
In this study, we investigated the genetic contribution in caries by assessing the DMFT index of twins.

MATERIALS AND METHODS

Data Collection: A cross-sectional observational study was undertaken after obtaining ethical clearance under Code #: EA/M-2018-3023, from the institute's Research Ethics Committee. Study was conducted in the department of conservative dentistry, College of Dentistry, Qassim University. The study duration was 3 months from January to March 2019. Twenty-five pairs of twins (13 pairs of males and 12 pairs of females), aged 13 to 24 years (mean age 18.5 ± 5.5 years), who are reared together, were included in the study. It's assumed that twins have been sampled from similar

environmental factors set upon them. The study samples were selected using the convenience sampling method, based on the availability of twins. Smoking, medically compromised patients, ongoing orthodontic treatment (an established risk factor for caries), periodontal disease, craniofacial syndromes and malocclusion were the exclusion criteria in this study. Written consent of each study participant was obtained from them or the parents/guardians.

The sample consisted of 50 subjects, divided into 2 groups. Group A consisted of males (13 pairs of twins), Group B consisted of females (12 pairs of twins). Each group A and B were further subdivided into subgroups. Group A had 13 subgroups, each subgroup consisting of a pair of male twins and Group B had 12 subgroups, each subgroup consisting of a pair of female twins. Caries detection was performed by two examiners and the dental caries status was recorded using Decayed Missing and Filled Teeth (DMFT) index. Inter-examiner reliability was determined by using Kappa co-efficient. K=0.85 (K < 1). The K value shows a good agreement between the examiners in detection of caries.

RESULTS

The group distribution, mean age, mean values of each component of DMFT index, and comparison between male and female are shown in Table 2. The highest mean score for both male and female was seen in missing teeth, followed by decay and the least score was observed for filled teeth. The comparison of male and female DMFT scores showed there is a significant difference in the score of decayed teeth (P=0.001). Also, the difference was significant in the overall DMFT index between the male and female twins. (P=0.002) Both the scores were significantly higher in females, whereas, there was no significant correlation between missing and filled teeth when compared in male and female twins.

Data were entered in Microsoft Excel (Ver.16.0 Microsoft corporation 2016, California) and statistically analyzed using SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp) to calculate the descriptive statistics, the mean DMFT scores of males and females were compared using student sample t-test. Pearson's correlation coefficient was calculated to determine the correlation among the twin pairs. The level of significance was set at 0.05. (P<0.05).

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Before each examination, participants received professional oral hygiene care to remove plaque and calculus, and examination was carried out under good light, using WHO probe and compressed air to access carious lesions. Data were collected according to the World Health Organization Oral Health Assessment Form 2013 by WHO. The permanent dentition status of each tooth (crown and root) is recorded as a score from 0 to 9. Table 1.

Table No.1: Showing the DMFT scoring criteria according to WHO assessment form

DMFT score for each tooth (WHO ,2013)	
Score	Status
0	**Sound** - A crown/root is coded as sound if it shows no evidence of treated or untreated clinical caries.
1	**Carious crown** - Caries is recorded as present when a lesion in a pit or fissure, or on a smooth tooth surface, has an unmistakable cavity, undermined enamel, or a detectably softened floor or wall.
2	**Filled crown, with caries** - A crown is considered filled, with caries, when it has one or more permanent restorations and one or more areas that are decayed.
3	**Filled crown, with no caries** - A crown is considered filled, without caries, when one or more permanent restorations are present and there are no caries anywhere on the crown.
4	**Missing tooth, due to caries** - This code is used for permanent teeth that have been extracted because of caries and are recorded under coronal status.
5	**Permanent tooth missing due to any other reason**
6	**Fissure sealant**
7	**Fixed dental prosthesis abutment**, special crown or veneer - This code is used under coronal status to indicate that the tooth forms part of a fixed bridge abutment.
8	**Unerupted tooth (crown)** - This classification is used only for a tooth space with an unerupted permanent tooth.
9	**Not recorded** - This code is used for an erupted permanent tooth that cannot be examined for any reason such as severe hypoplasia etc.

Showing the group distribution, mean values of each component of DMFT index and P value. Pearson's correlation showed a significant correlation in Decay (0.001*) and DMFT scores (0.002*).

Table No.2: Group distribution, mean values of each component of DMFT index and P value.

Variables	Gender	N	Mean	Std. Deviation	P-Value
Age	Male	26	18.23	2.804	0.023*
	Female	24	20.08	2.749	
Decay	Male	26	3.42	2.802	0.001*
	Female	24	7.88	5.424	
Missing	Male	26	12	0.326	0.329
	Female	24	25	0.608	
Filled	Male	26	1.73	2.662	0.602
	Female	24	1.42	1.283	
DFMT Score	Male	26	5.27	3.317	0.002*
	Female	24	9.54	5.883	

Table 3, illustrates the comparison of DMFT scores between subgroups within male and female twin groups respectively. The results show a significant p value of DMFT score between the twins of both male and female subgroups (P= 0.007* and 0.000* respectively). Also, the Pearson co-relation suggests a positive genetic co-relation between caries and twins showing the Pearson's correlation and comparison between the mean DMFT scores of male and female twin subgroups.

Table No.3: Comparison of DMFT scores between subgroups within male and female twin groups respectively

Twin Groups	Twin Subgroups	N	Pearson's Correlation	P Value
Male Group A	Subgroup (1-13)	13	0.705*	0.007*
Female Group B	Subgroup (1-12)	12	0.861*	0.000*

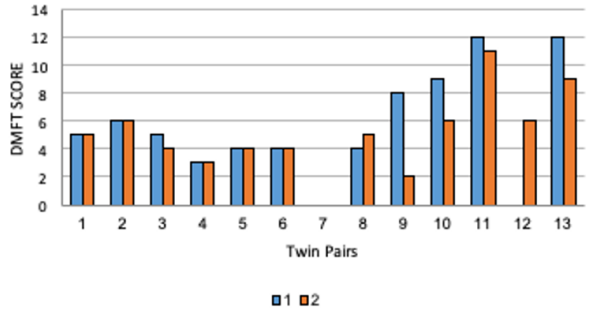

Figure No.1: Shows the distribution of DMFT score among subgroup within male twins

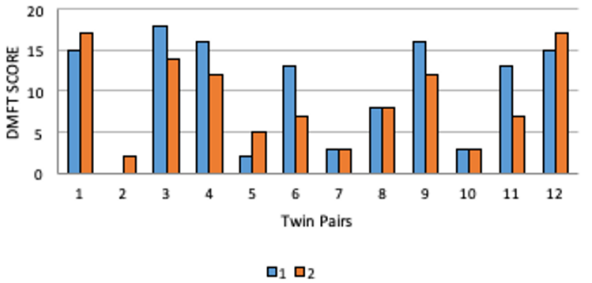

Figure No.2: Shows the Distribution of DMFT Score Among Subgroup Within Female Twins

Figure 1 & 2, illustrates the DMFT scores amongst the male and female subgroups of twins respectively. Figure 3, illustrates the percentage distribution of scores among the male and female groups of all the 25 twins (50 samples). 9 pairs of them had the same DMFT score (36%), 7 pairs had closely related scores ± 3 (28%) and 9 pairs of them had different scores (36%).

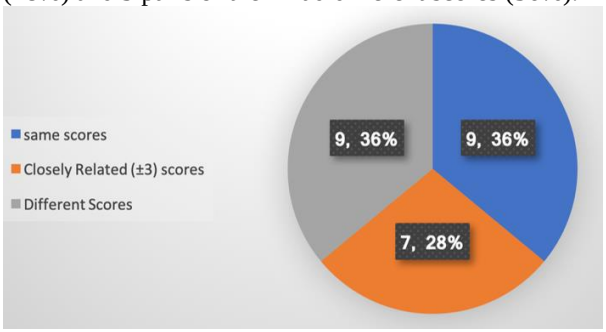

Figure No.3: Showing the percentage distribution of scores among the male and female groups of all the 25 twins (50 samples). 9 pairs of them had the same DMFT score (36%), 7 pairs had closely related scores ± 3 (28%) and 9 pairs of them had different scores (36%)

DISCUSSION

Interpretation of twin studies has gained importance in dental literature following genetic correlation. If a study on twins shows higher intrapair correlations, it suggests that heredity may play a role and that it may be worthwhile to look for the possible role of genes in a disease. However, it does not constitute proof and the estimates may be off. An effort was made in the present study to determine genetic influence on caries, it does not take into account the environmental factors. Thus, sticking to genetic correlation will only tell us about possible genetic influence on a disease.

This study aimed to correlate the caries status (Decayed, Missing and Filled Teeth, DMFT Index) among 25 pairs of twins, and investigated the possible role of genes in the oral health status of twins by using the DMFT index. The results demonstrated that it is possible to use caries experience as an approximation of an overall dental health status of the twins.

In this study, there was a significant difference in the score of decayed teeth, also, the difference was significant in the overall DMFT index between the male and female twins. Missing teeth were highest in both male and female twins, while the filled teeth were least in both the groups and the difference was insignificant for both missing and filled teeth between both the groups. Females showed significantly higher mean values of decayed and overall DMFT scores (Table 2). The difference in DMFT values and decayed teeth, between male and female groups in our study, may be due to influence of varied environmental and risk factors. There is a possibility that DMFT of one gender

may have been influenced by poor oral hygiene practices, eating habits, fluoride exposure, access to dental care and other risk factors etc. Also, it is likely that the effect of environmental factors on caries may vary with gender and age. Moreover, shared and non-shared environmental factors may have been the reason for difference in DMFT/ caries risk in males and female groups.

Eslamipour, showed prevalence of decayed teeth did not vary significantly between genders. His results also showed a higher number of filled teeth in females than in males [7], these finding differ from our study.

Twin researches have indicated a strong genetic component to many dental traits. [8,9] Horowitz et al., [10] Goodman et al., [11] and Finn and Caldwell [12] indicated that dental caries have a genetic component. In our study, the comparison of male and female subgroups (twin pairs), showed the possibility of genetic correlation with the DMFT scores.

Genetic basis of certain variables such as oral flora, tooth morphology, tooth eruption time and sequence, arch shape, tooth spacing, and diet have been found to cause dental caries. [13,14] However, still requires further investigation.

A study by Rintakoski K, observed a strong genetic component behind caries experience in twins, differing between males (49%) and females (68%), suggesting genetic influence on oral health with possible gender differences. [15] Corby et al, noted moderate to high heritability estimates for microbial species (h2 = 56–80%) in 118 caries-free twins and 86 caries-active twins. In caries-free twins, the similarity of the overall oral microbial flora was more obvious. Therefore, colonization of oral beneficial species in twins due to similar genetic factors may in turn be a reason for good oral health. [16]

The higher concordance and heritability between twins in various other studies demonstrates that dental caries occurrence and severity are influenced genetically by several factors. However, the influence of environmental factors cannot be dismissed. In a recent study by Mihiri J. Silva about genetics and environmental role in caries, concluded that associations with genetic factors, although credible in dental caries, are less pertinent caries risk at an individual level compared with environmental factors[17].

The classic Vipeholm study showed, although the greater exposure to food rich in sugars increased the severity of caries, yet 20% of the sample had not developed any carious lesion. They concluded that individual genetic susceptibility also controlled caries experience. [18] Another study done on twins by Alexendre, also suggests genes most likely influence individual susceptibility to caries, and these include genes involved in enamel development, in saliva function, and in immune response. [19] Several variables related to caries experience (missing, filled, decayed) show statistically significant concordance rates in twins. Also, many studies done on twins in different parts of the world measure heritability, or the amount of variation in the disease due to genetics, show the heritability values ranging from 25-80%.[20] This is a high range of genetic susceptibility and is in concordance with our study.

The comparison of male and female subgroups in our study showed closely matched percentage distribution and scores of DMFT index in twin pairs. (Fig 3) This suggests there might be a genetic component involved in carious disease process. Interaction of host factors, bacteria and substrate that favors cariogenic pathogens play a role in caries process. Genetic influences controlling these factors, such as bacterial adhesion due to saliva factors or its buffering capability may explain how a twin pair may have similar caries experience.

Based on the limited number of study participants in our study, definite conclusions should be drawn with caution.

CONCLUSION

This framework allowed us to test the evidence, whether caries manifestation in twins is influenced by genes. The study concluded that the DMFT index is a valid tool to determine the caries in twins. There were significant differences in decayed and overall DMFT scores of male and female twin groups. Study further showed a possible contribution of genes in the carious disease process as the comparison of male and female subgroups suggested positive co-relation showing there might be a genetic component involved in caries.

Recommendations: Longitudinal studies with larger samples and longer duration are required to establish stronger correlation between genes and caries.

Multidisciplinary studies of twins, with input from dentists, molecular geneticists and twin researchers hold great promise for the future in unraveling the mysteries of how genetic factors contribute to oral diseases and disorders.

Author's Contribution:

Concept & Design of Study:	Bilal Arjumand
Drafting:	Abdulmalik Alharbi
Data Analysis:	Abdulmalik Alharbi
Revisiting Critically:	Bilal Arjumand, Abdulmalik Alharbi
Final Approval of version:	Bilal Arjumand

Conflict of Interest: The study has no conflict of interest to declare by any author.

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