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Original Article

Comparative Study of Oral Health Status and Oral Health-Related Habits among Twins in Kodinhi Village, Kerala

P M Jaseena[1], T V Anupam Kumar[2], A Rita Zarina[3], M Lubna[4], Veena S Ravi[5]

[1]Senior Resident, Department of Pediatric and Preventive Dentistry, Government Dental College, Kozhikode, Kerala, India, [2]Professor and Head, Department of Pediatric and Preventive Dentistry, Government Dental College, Kozhikode, Kerala, India, [3]Professor and Head, Department of Pediatric and Preventive Dentistry, Government Dental College, Thiruvananthapuram, Kerala, India, [4]Senior Resident, Department of Pediatric and Preventive Dentistry, Government Dental College, Alappuzha, Kerala, India, [5]Senior Resident, Department of Pediatric and Preventive Dentistry, Government Dental College, Thrissur, Kerala, India

Abstract

Introduction: Researches involving twins are unique in nature as they have the ability to correctly isolate a genetic characteristic and determine its influence on different human traits.

Purpose: The purpose of the study was to compare the oral health status and oral habits of identical and non-identical twins of Kodinhi village, Kerala.

Materials and Methods: The present study conducted among identical and non-identical twins in Kodinhi village, Kerala. The total sample size were 71 pairs of twins aged between 3 and 15 years old, consisting of 142 individuals. Out of 71 pairs, 31 pairs were identical twins and 40 pairs were non-identical. The study compared oral health status and oral habits between the two pairs and also between the two members of a twin pair. The data were analyzed using Chi-square test. Kendall Tau-b Correlation was used to determine the correlation among identical and fraternal twin pairs.

Results: The results showed that all of the study participants had either good or fair oral health status. Among the total, 82.4% had good oral hygiene status and 17.6% had fair oral hygiene. The oral hygiene status of identical and non-identical twins was not statistically significant. The mean decayed missing and filled teeth (DMFT) in identical twins was 2.806 ± 2.023 and 1.944 ± 1.893 in fraternal twins. The mean decayed extracted and filled teeth (DEFT) in identical twins were 3.892 ± 2.973 and 5.021 ± 3.271 in non-identical twins. In both identical and non-identical twin pairs, the DEFT scores were higher than the decayed missing and filled teeth scores.

Conclusion: The correlation rates for oral hygiene status and dental caries were higher in identical twin pairs than the non-identical twin pairs, suggesting considerable evidence that genes play a significant role in the etiology of these traits. In case of habits, a statistically significant difference had obtained only for pencil biting.

Key words: Concordance, Correlation, Fraternal twins, Genetics, Identical twins

INTRODUCTION

In dentistry, we encounter numerous differences in the dentofacial characteristics of individuals, even among family members.[1] Dental characteristics or conditions have multi-factorial inheritance and there is significant evidence in the literature about the influence of genes on the expression of dental and occlusal variables or characteristics which are irrefutable.[2] Dental caries, malocclusion, and periodontal disease are the three most common problem faced in dentistry today. A multifactorial etiology for all three conditions has generally been assumed, with both genetic and environmental contributions to observe variability.[3] One way to determine the respective contribution of genes and environment for a trait is to conduct twin studies.

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Corresponding Author: Dr. P M Jaseena, Department of Pediatric and Preventive Dentistry, Government Dental College, Kozhikode, Kerala, India.

Introduction of the twins technique for studying disease pathogenesis is credited to Sir Frances Galton (1876), generally regarded as the father of the twin method. He identified the role of heredity and environment, or "nature and nurture."

Twin studies are a fascinating method of research that it allows disentanglement of the shared genetic and environmental factors for the trait of interest. Researchers can estimate the proportion of variance in a trait attributable to genetic variation, versus the proportion that is due to shared environment or unshared environment.

Kodinhi is a village in Malappuram district of Kerala, India. The village is situated close to the town of Tirurangadi and, as of statistics taken in the year 2016, homes around 3,000 families. The village entered the international spotlight when a survey done by locals found an unusually large number of twin births in the region. The rate of twin birth is several folds higher than the national as well as the global average of twin birth. Although initial estimates put the instance of multiple births at 100 pairs, follow-up surveys found the figure to be closer to 425 pairs (850 individuals) of twins, and two sets of triplets and over 79 pairs of twins within the age group of 0–10 years. Despite several studies being conducted, the exact cause of this phenomenon is yet to be ascertained.[4]

The aim of this study was to assess the oral health status and oral habits among twin pairs of Kodinhi village, Kerala and also to compare those habits between two members of a twin pair.

Although numerous twin studies have been conducted in different parts of the globe on various dental traits, very few studies have been done regarding the oral health status of twins in India. Therefore, this study was conducted to assess and compare oral hygiene status as well as oral habits in identical and non-identical twin pairs.

MATERIALS AND METHODS

Study Design and Sample

A cross-sectional study was conducted among the twins of Kodhini village. The particular study was conducted in 71 pairs of twins, consisting of 142 individuals. Out of 71 pairs, 31 pairs were identical (monozygotic) twins and 40 pairs were non-identical (Dizygotic). They were selected using the convenience sampling method based on the availability of twins. The study protocol was analyzed and approved by the Institutional Review Board. After obtaining consent from the schools, initial identification of twins was done from the school records. On further visits to the school, oral examination of the twin pairs was carried out. Developmentally healthy and cooperative twins belonging to the age group of 3–15 years were included in the study. Medically compromised, reared apart and twins with ongoing orthodontic treatment were excluded from the study.

The steps and procedures of study were explained to both school authorities and parents before conducting the study. Permission and written consent were obtained from the school authorities and parents for examination of the twin children.

In the present study, twins were segregated as monozygous (MZ, identical) and dizygous (DZ, non-identical) on the basis of general facial appearance, hair color, and eye color. This method of zygosity recording is easier and non-invasive, and requires little cooperation from the twin pairs. Comparison of facial appearance is a reasonably accurate means of distinguishing between MZ and DZ twin pairs.[5,6]

Examination of the Children

A proforma was used to record date of birth, gender, demographic details, and oral findings. A single-trained examiner conducted the oral examination using disposable, sterile mouth mirror, and probe. The children were seated upright on a chair and were examined in adequate natural daylight so as to receive maximum illumination.

The oral health status of the twin pairs was measured using decayed missing and filled teeth (DMFT) index, decayed extracted and filled teeth (deft) index, and the simplified oral hygiene index (OHIS and OHIS-M)[7,8]

Oral habits were assessed by asking to the parent and also by intraoral examination and were graded as present or absent.

Statistical Analysis

After completing data collection, data were fed in computer for processing and analysis done using the Statistical Package for the Social Science Version 23. The data were subjected to descriptive statistics such as frequencies, percentage, mean, median, and standard deviation. Qualitative data were compared using Chi-square test and Fischer exact test. Kendall Tau-b correlation coefficient was used to find the correlation between the twin groups.

RESULTS

The particular study was conducted in 71 pairs of twins, consisting of 142 individuals. The age group of the study population ranged from 3 to 15 years. Mean age of the study population was 9.75 years with a standard deviation

of 3.203 years. Out of 71 pairs, 31 pairs were identical twins and 40 pairs were non-identical. Of the identical twins, 15 pairs were male and 16 pairs were female, whereas in non-identical twins, 49 males and 31 females.

Among the study population, 82.4% had good oral hygiene status and 17.6% had fair oral hygiene. None had poor oral hygiene as per the OHI-S Scale [Table 1].

Within the identical twin pairs, a moderate positive correlation obtained for both debris and overall OHI index, whereas a strong positive correlation obtained for calculus index with correlation coefficient, tb = 0.624, 0.679, and 0.806, respectively, with $P = 0.001$ (<0.05) [Table 2].

Within the non-identical pairs, a negligible correlation was obtained for debris, calculus, and overall OHI-S index with correlation coefficient, tb = 0.210, 0.210, 0.261, and $P > 0.05$ [Table 3].

Table 1: Distribution of study subjects based on type of twin and oral hygiene status

Type of twin	Oral hygiene status		Total (%)
	Good	Fair	
Identical twins	48 (77.4)	14 (22.6)	62 (100)
Fraternal twins	69 (86.2)	11 (13.8)	80 (100)
Total	117 (82.4)	25 (17.6)	142 (100)

Chi-square test: 1.878, *P*=0.171 (Not significant)

Table 2: Correlation for oral hygiene status within identical pairs

Index	Kendall Tau-b correlation coefficient	*P*-value	Interpretation
Debris index (DI-S)	0.624	0.001	Moderate positive correlation: Significant
Calculus index (CI-S)	0.806	0.001	High positive correlation: Significant
Simplified oral hygiene index	0.679	0.001	Moderate positive correlation: Significant

Test of correlation: Kendall Tau-b correlation

Table 3: Correlation for oral hygiene status within fraternal pair

Index	Kendall Tau-b Correlation coefficient	*P*-value	Interpretation
Debris index (DI-S)	0.210	0.084	Negligible correlation: Not Significant
Calculus index (CI-S)	0.210	0.154	Negligible correlation: Not Significant
Simplified oral hygiene index	0.261	0.029	Negligible correlation: Significant

Test of correlation: Kendall Tau-b Correlation

The prevalence of dental caries was found to be 69.7% [Table 4]. Among identical twins, 71% had dental caries, whereas among fraternal twins 68.8% had dental caries. This difference was not found to be statistically significant with a Chi-square value of 0.081 at $P = 0.775$ [Table 5]. The mean DMFT in Identical twins were 2.806 ± 2.023 and 1.944 ± 1.893 in non-identical twins. Similarly, the mean deft in identical twins were 3.892 ± 2.973 and 5.021 ± 3.271 in non-identical twins [Figures 1 and 2].

There was a high positive correlation for dental caries within identical twins with a correlation coefficient of 0.767, whereas a low positive correlation obtained for non-identical twins (Correlation coefficient: 0.460) [Table 6].

Among identical twin pairs, 61.3% showed concordance for dental caries, whereas among fraternal twins, only 30 % showed concordance for dental caries. This difference was found to be statistically significant with a Chi-square value of 6.951 at $P = 0.008$ [Table 7].

On comparing the prevalence of various oral habits among the different types of twins, it was found that

Table 4: Prevalence of dental caries in the twin pairs

Dental caries	Frequency	Percent
Present	99	69.7
Absent	43	30.3
Total	142	100.0

Table 5: Distribution of study subjects based on type of twin and presence of dental caries

Type of twin	Dental caries (%)		Total (%)
	Present	Absent	
Identical twins	44 (71.0)	18 (29.0)	62 (100)
Fraternal twins	55 (68.8)	25 (31.2)	80 (100)
Total	99 (69.7)	43 (30.3)	142 (100)

Table 6: Correlation for dental caries index within identical and fraternal pairs

Type of twin	Kendall Tau-b correlation coefficient	*P*-value	Interpretation
Identical twin	0.767	0.001	High positive correlation: Significant
Fraternal twin	0.460	0.001	Low positive correlation: Significant

Test of correlation: Kendall Tau-b correlation

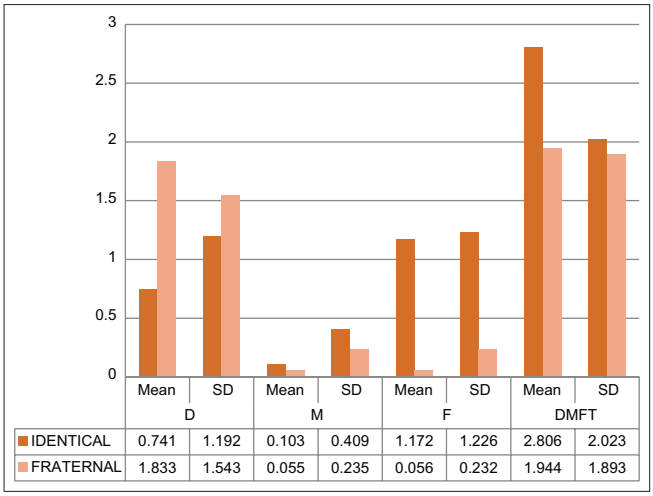

Figure 1: Comparison of decayed missing and filled teeth index between identical and non-identical twin pairs

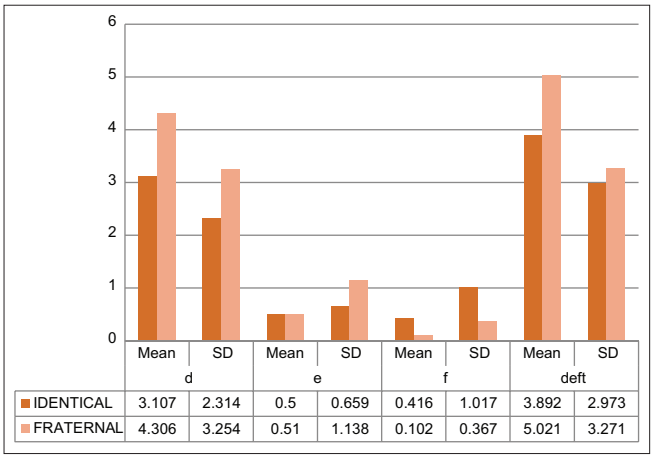

Figure 2: Comparison of decayed extracted and filled teeth index between identical and non-identical twin pairs

Table 7: Distribution of study subjects based on type of twin and concordance for dental caries

Type of twin	Concordant pairs (%)		Total (%)
	Present	Absent	
Identical twins	19 (61.3)	12 (38.7)	31 (100)
Fraternal twins	12 (30.0)	28 (70)	40 (100)
Total	31 (43.7)	40 (56.3)	71 (100)

all the habits were more among identical twins and a statistically significant difference was observed in case of mouth breathing, tongue thrusting, and pencil biting [Table 8].

On comparing the concordance rate of various oral habits among the different types of twins, it was found that for all habits, concordance rate was more among identical twins, but a statistically significant difference was observed only in case of nail biting [Table 9].

DISCUSSION

Twin studies are one of the types of study designs to understand the individual differences by highlighting the role of environmental and genetic causes on phenotypes. Twins are invaluable for studying these important questions, because they disentangle the sharing of genes and environments. The twin design compares the similarity of identical twins who share 100% of their genes, to that of fraternal twins, who share only 50% of their genes.[9]

The present study was conducted in Kodinhi village of Malappuram district, which took the world by surprise when the locals found an unusual and astonishing increase in the number of twins.

The classical twin approach for separating the effects of nature and nurture involves comparing identical (MZ) twins and non-identical (DZ) twins. Differences between MZ twin pairs reflect environmental factors, whereas differences between DZ twin pairs are due to both genetic and environmental factors. Therefore, greater similarities between MZ twin pairs compared with DZ twin pairs can be interpreted as reflecting genetic influences on the feature(s) being studied.[10]

In the present study, the oral hygiene status did not differ between the twin pairs, irrespective of zygosity (monozygosity or dizygosity). This could be due to similar oral hygiene practice followed by the twin pair of children at home.

The observations in the present study are in accordance with the study by Subramaniam *et al.*,[11] where "good" as well as "fair" oral hygiene categories were the most prominent conditions. In his study, he found that oral hygiene was good in about 90% of both MZ and DZ twin pairs. Twin A and twin B of MZ twins showed similar oral hygiene status, with no significant difference between them. This may be due to the shared environment in MZ and DZ twin pairs.

In our study, a significant high positive correlation existed for each of the Debris index, Calculus Index, and overall OHI-S index in Identical twins. In non-identical twins, there was a negligible and non-significant correlation obtained for all the components of OHI-S. It was observed that the correlation rates were higher in identical twin pairs than the non-identical twin pairs, suggesting a strong genetic influence for the same.

Dental caries is a complex, chronic, multifactorial disease, and one of the most common diseases in dentistry along with periodontal disease and malocclusion. Various factors

Table 8: Distribution of study population based on presence of various oral habits and type of twin

Oral habits	Type of twin	Frequency (Percentage)	Test of significance	*P*-value	Impression
Mouth breathing	Identical	18 (29)	χ^2=8.459	0.004	Significant
	Fraternal	8 (10)			
Thumb sucking	Identical	6 (9.7)	Fischer exact test	0.066	Not significant
	Fraternal	2 (2.5)			
Tongue thrusting	Identical	29 (46.8)	χ^2=10.391	0.001	Significant
	Fraternal	17 (21.2)			
Bruxism	Identical	2 (3.2)	Fischer exact test	0.192	Not significant
	Fraternal	0 (0)			
Nail biting	Identical	20 (32.3)	χ^2=2.773	0.096	Not significant
	Fraternal	16 (20)			
Pencil biting	Identical	16 (25.8)	Fischer exact test	0.001	Significant
	Fraternal	4 (5.0)			

Table 9: Distribution of study population based on concordance for various oral habits and type of twin

Oral habits	Type of twin	Concordant pairs (%)	Test of significance	*P*-value	Impression
Mouth breathing	Identical	31 (100)	Fischer exact test	0.126	Not significant
	Fraternal	36 (90)			
Thumb sucking	Identical	31 (100)	Fischer exact test	0.986	Not significant
	Fraternal	39 (97.5)			
Tongue thrusting	Identical	26 (83.9)	χ^2=0.175	0.676	Not significant
	Fraternal	32 (80)			
Bruxism	Identical	31 (100)	Fischer exact test	0.986	Not significant
	Fraternal	39 (97.5)			
Nail biting	Identical	30 (96.8)	Fischer exact test	0.035	Significant
	Fraternal	31 (77.5)			
Pencil biting	Identical	29 (93.5)	Fischer exact test	0.690	Not significant
	Fraternal	36 (90.0)			

such as diet, saliva, oral bacteria, and tooth morphology have been attributed to the occurrence of dental caries, suggestive of environmental as well as genetic influence in its etiology. The earlier twin studies have shed light on this fact (Bretz *et al*., 2005; Conry *et al*., 1993).[12]

In both identical and non-identical twin pairs, the deft scores were higher than the DMFT scores. This may be due to more number of twin pairs included in the 6–11 age groups and probably be due to their similar dietary pattern and oral hygiene habits. There was a significant high positive correlation obtained for dental caries in identical twins, whereas only a significant low positive correlation was existed in non-identical twins.

In this study, we also investigated the concordance for dental caries between the twin pairs. About 61.35% of identical twins showed concordance for dental caries, whereas among non-identical twins, only 30% showed concordance and the results were statistically significant.

Twin studies by Bretz *et al*, Conry *et al*., and Lovelina *et al*.[13] on dental caries have shown that genetic as well as environmental factors play a significant role. Mansbridge[14] studied the caries incidence in 96 MZ and 128 DZ twins. The study showed that dental caries experience had a greater similarity between MZ twins than DZ twins, whereas unrelated pairs of children showed less similarity. This observation was supported by other studies that showed dental caries resemblance which was higher among MZ twins. The MZ twins showed a greater correlation than the DZ twins, which is in accordance with this study.

Majority of the earlier studies failed to establish a significant genetic contribution for phenotypes. Twins reared apart model allows a more precise assessment of the inherited component controlling the phenotype. Regarding caries development, two twin studies using twin pairs reared apart demonstrated that MZ twins had higher similarity in incidence of dental decay than DZ twins, despite the fact that the individuals have been raised in different families, communities, and/or even countries, there is a strong argument in favor of the existence of a genetic contribution (Boraas *et al*., Conry *et al*.).[15]

Only few reported studies are available regarding the oral habits among twins. On comparing the prevalence of various oral habits among the different types of twins, it was found that all the habits were more among identical twins and a statistically significant difference was observed in case of mouth breathing, tongue thrusting, and pencil biting, suggesting a possible genetic contribution for these

habits. In contrary to this, Panchmal *et al.*,[16] in his study in the same twin population in 2013, found that mouth breathing, bruxism, and thumb sucking were the most prevalent oral habits.

This study presented a comprehensive over view of the oral health-related habits among twins. There were only few previous studies reported in the literature regarding the habits and practices related to oral health in twins. Studies had reported similarity in dietary pattern and oral health status among twins.[17,18] The findings of our study suggest that identical twins exhibited a correlation in certain oral health-related behaviors and habits which suggest a strong genetic and environmental relationship.

Some of the habits reported in this study like tongue thrusting, thumb sucking, and bruxism seen in identical twins suggest a positive relation of the genetic traits of the individuals. Other habits such as pencil biting and nail biting could have a genetic influence or they may have been adopted as a result of socio-environmental influence.

Although co-twin analysis control for genetic and shared environmental factors, it is always possible that residual confounding by environmental factors may exist. On the other hand, if identical twins and non-identical twins are more similar with respect to these environmental risk factors, we may attribute confounding by an environmental factor to a genetic factor.

CONCLUSION

Like many of the population based studies, this study also has some limitations. Our study was an attempt to compare the oral health status and oral habits of identical and fraternal twins of Kodinhi village, a village known for its unusual number of twin births. The following conclusions were drawn from the study:

- Identical twin pairs showed a higher correlation rate for oral hygiene status and dental caries than the non-identical twin pairs, suggesting considerable evidence that genes play a significant role in the etiology of these traits
- It was found that all the habits were more among identical twins and a statistically significant difference was observed in case of mouth breathing, tongue thrusting, and pencil biting, suggesting a positive relation of the genetic traits of the individuals
- For concordance of oral habits, a statistically significant difference had obtained only for pencil biting. Other habits such as thumb sucking and nail biting could have been a genetic influence or they may have been adopted as a result of socio-environmental influence.

Clinical Significance of the Study

Identification of genetic risk factors for common dental problems would help to reduce costs associated with treatment and prevention of the most frequent oral diseases. Similarly, genetic disorders are attended with less importance than other diseases. There is a lack of knowledge between genetic diseases and its prevention among the general population. Therefore, better understanding of the genetic etiology of the diseases can facilitate early detection in high-risk groups. General awareness should be raised by the government policies about cost-effective genetic diseases and genetic counseling technique, and genetic therapy should be made affordable by the community level.

Along with emerging genome and molecular researches, twin studies surely shed light on how environmental and genetic factors influence on human traits and behaviors.

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