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Association between hereditary factor and dental caries among school aged children in Najran – KSA

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Abstract:
Background and aim: *Dental caries is the most prevalent and chronic disease worldwide. Caries occurrence and progression are known to be influenced by a complex interplay of both environmental and genetic factors. A genetics approach provides an opportunity for better discrimination between genetic and environmental components. The present study was carried out among 120 school age students and their families in Najran – Saudi Arabia to identify the association between dental caries and hereditary factor.*
Methodology: *It was a cross-sectional descriptive study undertaken in Najran city during the period from February to September, 2015. A total number of 120 school aged participants+ their families were selected randomly from various areas inside Najran city that composed of 86 (71.7%) Saudi nationality and 34 (28.3%) non-Saudi nationalities. The principal method of data collection was a semi structured questionnaire and interview, beside a clinical examination.*
Results: *The prevalence of dental caries for the total subjects is 67.5%. The mean and SD of dmft for the total subjects was 3.08 ± 2.45 while the mean and SD of DMFT was 1.09 ± 1.63. Our study findings show a significant association between hereditary factor and the occurrence of dental caries among school children (P value <0.05).*
Conclusion: *It was concluded that dental caries experience of children is strongly influenced by hereditary factor.*
Key words: *Dental caries, hereditary factor, school children*

I. Introduction:

When we think about genetics, we typically think of patterns of inheritance that affect us and our environment, it has become clear that every physiologic function and risk of pathology, whether organic or behavioral is, at least in part, genetically controlled. Genetics studies the individual genes, while genomics is more dynamic in that it looks at the interaction between genes and genes and environment.[1]

The prevalence of dental caries is increasing across different nations around the globe. Dental caries or tooth decay is one of the most preventable diseases. It is a multi-factorial disease that resulting from the interplay between microbial, environmental, behavioral and genetic factors although little is still known about the host genetic factors that influencing susceptibility. The multi-factorial nature of caries involves four factors as displayed in figure 1.[2]

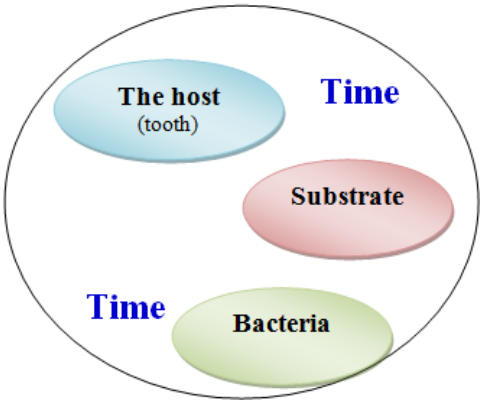

Figure 1 shows the necessary 4 factors for experiencing dental caries

Caries process starts when the PH of the plaque drops below (5.5) thus the produced acid begins to dematerialize the enamel. As far as there is a continual demineralization of enamels, therefore, people will never be free of dental caries.[3] On the other hand, Law et al believe that dental caries is caused by a combination of

environmental, behavioral factors as well as genetic predispositions.[4] The specificity of these factors is dependent on the genetic make-up of each individual and the expression of specific genes. It is possible that allelic variation related to a host factor may contribute to increased risks for the development of carious lesions. Genetic variation of various host factors may contribute to increased risk of dental caries.[5] Powell concluded that previous caries experience continues to be the best predictor for future disease. A child's resistance or susceptibility to caries can occur, regardless of exposure to external risk factors. These facts suggest there is a biological influence on the disease susceptibility, likely controlled by genetic factors.[6]

The role of genetics, which continues to be an active area of research, has been investigated in numerous of recent studies such as (Bretz et al[7] , Boraas et al[8], Vieira et al.[9] and Wang et al.[10]) have described a potential genetic contribution to the risk for dental caries. Moreover, a study by Venter et al on twins have provided strong evidence for the role of inheritance. They reported that decoding of the DNA that constitutes the human genome has been widely anticipated for the contribution it will make toward understanding human evolution, the causation of diseases which include dental caries, and the interplay between the environment and heredity in defining the human condition.[11]

Though genetic dentistry is still in its infancy, Charles identified five areas where genes play a role in tooth decay in terms of sweet preference and attitudes to sugar, tooth enamel whether soft or not, taste ability profile, saliva strength and microbiome (existing of various communities of bacteria in the oral cavity) and the genetic modification of immune response.[12]

It has been reported that inherited disorders of tooth development that result in altered enamel structure increased the incidence of dental caries.[13] Goodman et al reported that there was an association between two specific proline rich protein phenotypes (Pa+ & Pr_{22}) and increase in dental caries score in the permanent teeth of children. This suggests that persons with the genotype Pa + or Pr_{22} may be at significant risk for increased susceptibility to dental caries. They believe that the mechanism of action could be related to the formation of caries susceptible plaque on the teeth at risk.[14]

II. Material and methods

This is a cross-sectional descriptive study undertaken in Najran city during the period from February to September, 2015. A total number of 120 school children that aged between 10 – 12 years old participants were selected randomly from 2 primary schools for girls inside Najran city that composed of 86 (71.7%) Saudi nationality and 34 (28.3%) non- Saudi nationalities. Families were recruited for collection of demographic data, and clinical assessment of oral health, mainly caries scores beside family history of having dental caries. Exclusion criteria included individuals with neurological impairment, severe physical handicap, or psychosis. Clinical examinations were carried out by a female dentist using natural daily light source, dental mouth mirror and a graded periodontal probe. Radiographs were not taken. Examinations for dental caries were carried out according to World Health Organization criteria and methods. DMFT were determined in all subject. DMFT is an index of past caries experience based upon the number of decayed, missing or filled teeth.

The ultimate goal of this survey is to identify the association between hereditary factor and occurrence of dental caries among the school children. Written informed consent was obtained from all adult participants. Additionally, assent obtained for all child participants. All procedures and forms that including the questionnaire were approved by the college board.

III. Statistical Methodology

Data were analyzed using statistical package for social sciences version 20 (SPSS, Chicago, USA). Descriptive statistics were calculated for every measured variable, in order to evaluate the studied sample. Means, standard deviations were used to describe the different study samples. Probabilities of $p < 0.05$were considered statistically significant.

IV. Results:

The response rate was 100%. The mean age of the participants was 10.8 ± 1.9 years old as illustrated in table 1. The participants were from families with various socio-economic status. Each tooth was identified as either permanent or primary, and each surface on each tooth was scored as decayed, missing due to caries, or filled. The mean and SD of dmft for the total subjects was 3.08 ± 2.45 while the mean and SD of DMFT was 1.09 ± 1.63 as shown in table 2. Table 3 reflects the prevalence of dental caries that was found to be 67.5% among the studied subjects. Very interesting that 95% of the children who have dental caries have a positive family history of the disease with significant association (P value <0.05) as shown in table 4.

Table (1): Demographics characteristics and nationalities of the study population

	Saudi	Non-Saudi
Sample size	86 (71.7%)	34 (28.3%)
Mean age ± SD,	10.9±1.8	10.5±1.6
Mean age ± SD for the total population	10.8 ± 1.9	

(n=120);

Table (2): Comparison of dmft and DMFT values in students according to nationality

Nationality	No. of students	dmft (Mean ± SD)	DMFT (Mean ± SD)
Saudi	86	3.17 ± 2.20	1.19 ± 1.14
Non-Saudi	34	3.01 ± 2.40	1.09 ± 1.13
Total	120	3.08 ± 2.45	1.09 ± 1.63

(n=120); (*p <0.05)

Table (3): Prevalence of dental caries among students according to nationalities

	Students with			
	Healthy teeth	Decayed teeth	Missing teeth	Filled teeth
Groups	No. (%)	No. (%)	No. (%)	No. (%)
Saudi	27 (22.5%) [a]	29 (24.17%) [a]	19 (15.83%) [a]	11 (9.17%) [a]
Non- Saudi	12 (10%) [b]	9 (7.5%) [b]	8 (6.67%) [b]	5 (4.16%) [b]
Total	39 (32.5%)	38 (31.67%)	27 (22.5%)	16 (13.33%)

[a,b]Values with different superscripts in the same column differ (p <0.001).

Table (4): shows the association between genetic factor (family history) & dental caries

Family history of dental caries	Healthy		Unhealthy		Total (%)	
	Saudi	Non-Saudi	Saudi	Non-Saudi		
Positive history	23	11	58	22	114	95%
No family history	4	1	1	0	6	5%
Total	27	12	59	22	120	100%

(n=120); (*p <0.05)

V. Discussion:

Caries is still a major problem in most industrialized and non-industrialized countries, affecting 60–90% of schoolchildren and the vast majority of adults.[15]

The multi-factorial nature of dental caries has limited the opportunity to link patterns of inheritance with susceptibility to dental caries.[16] Numerous human and animal studies have given an indication to inheritance of this disease.[17] Moreover, a family- based association test was used by Bretz et al for testing the association between genetic factor and caries status where SNPs (Single Nucleotide Polymorphism) in three genes (DSPP, KLK4, and AQP5) showed consistent associations with protection against caries.[18] This study finding goes with what was reported by Mansbridge in pioneering twin studies that investigated the heritability of dental caries in children that clearly supported the key role of genetics in tooth decay. Four more studies detected a statistically significant genetic component in the susceptibility to caries and demonstrated that the caries experience of monozygotic twins had a greater concordance than either dizygotic twins or unrelated controls.[19] Boraas also speculated on the particular inherited traits that could contribute to the results by stating several genetically variable factors which involved in the development of dental caries and contribute to the greater MZ (Mono-Zygotic) similarity in dental caries experience, these factors are: 1) Salivary factors and oral flora, 2) tooth eruption time and sequence, 3) tooth morphology, 4) arch shape, 5) dental spacing, 6) propensity for diet. [20] Luli et al extended the same study to a greater number of twins and reached the same conclusions that genetic factor has a profound effect on dental caries occurrence.[21]

VI. Conclusion And Recommendation

We concluded that dental caries is under genetic control (i.e. heritable). It is difficult to exclude the view that dental disease susceptibility in children involves strong familial vectors, which very likely have a genetic basis.

Consanguineous marriage is very common among the inhabitants of Najran and this could be the source of the genetic factor that behind the high prevalence rate of dental caries.

Replication analysis in independent cohorts is highly recommended in order to verify the validity of our finding. Additionally, establishing a basis for future studies that utilizing the human genome sequence for understanding the disease process is highly recommended too.

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