International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Association Between Hormonal Fingerprints and Dental Caries Among Population of Moradabad, Uttar Pradesh

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ABSTRACT

Background: Hormonal fingerprint is the ratio between 2nd and 4th digit length. It is a biological marker that is used to predict and diagnose many metabolic disorders. It is also used for the detection of caries which is the most prevalent oral health disease.

Aim: To evaluate the association between hormonal fingerprints and caries among the population of Moradabad, Uttar Pradesh.

Materials and method: A cross-sectional study was conducted on 250 randomly selected subjects aged between 18- 25 years. Hormonal fingerprints were obtained by measuring the length ratio of the index to the ring finger with the help of a digital vernier caliper. Caries status was assessed by using decayed, missing due to caries and filled (DMFT) index which were according to WHO assessment form 2013. The entire subjects were split into two groups high 2D:4D and low 2D:4D ratio based on the calculations.

Results: Based on the findings, it was found that 29% were males and 45% were females with 2D:4D ≥1 whereas 71% of males and 55% of females had 2D:4D <1. The high DMFT score was higher in the low 2D:4D ratio as compared to the high ratio and this difference was statistically significant. (p= 0.02)

Conclusion: The study confirms a positive association between hormonal fingerprints and dental caries.

Keywords: Biological marker, Digit, Hormonal fingerprints.

INTRODUCTION

Despite remarkable advancements in oral health on a global scale, numerous challenges persist in communities worldwide, especially among underprivileged groups in both developed and developing nations. Among these challenges, dental caries stands out as a major issue, impacting 60-90% of schoolchildren and the majority of adults.[1] It presents a unique challenge as it is irreversible and not effectively managed through pharmacological interventions. This condition often leads to pain and can have detrimental effects on oral health, affecting an individual's nutritional status and growth.[2] Early and precise detection and analysis of dental caries are critical for effectively controlling and managing oral health in patients.[3]

A biological marker is a diagnostic tool used to identify specific illness conditions or physiological states within an organism.[4] In dentistry, various biological indicators have been established to predict the development of oral disorders such as dental caries, periodontal disease, and malocclusion.[5] One such biological sign is the hormonal fingerprint, also referred to as the digit ratio. This ratio has been found to be consistent, replicable, and distinctive for each individual.[6] It exhibits sexual dimorphism and can be assessed through various methods.[7] The primary mechanism underlying this sexual difference is attributed to the common genes Homeobox (Hox) A and Hox D, which play roles in both digit and gonad development. The stability of the digit ratio throughout life is attributed to consistent timing in gene regulation. Another proposed mechanism suggests that the finger ratio reflects androgen sensitivity rather than androgen concentration. In other words, the 2D:4D ratio is influenced by exposure to androgens, serving as a rough indicator of prenatal androgen exposure, with lower ratios indicating higher prenatal androgen exposure.[1] The measurement of hormonal fingerprint is easy and non-hazardous. It has been related to numerous physiological, psychological, and medical conditions. Therefore, this study was undertaken with the aim to see if there was an association between the hormonal fingerprints and dental caries in the Moradabad population.

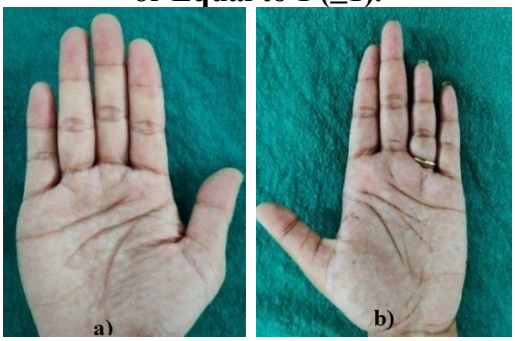
MATERIALS AND METHOD

A total of 250 subjects between the age group of 18 to 25 years of age visiting the department of Public Health Dentistry was invited to participate in the study. Subjects between 18 to 25 years of age with stable mental status and who were not under any specific dental caries preventive program were included in the study. Those who did not gave the consent, subjects undergoing orthodontic therapy and with deformed digits were excluded from the study. Ethical approval was obtained from the institutional ethics and review board of Kothiwal Dental College and Research Centre, Moradabad.

The caries experience was recorded using visible light, mouth mirror, and Community Periodontal Index probe in a dental chair. The scale of caries severity based on DMFT values were classified according to Garg et al, [4] in which DMFT score between 0 & 2.6 was considered as low, medium prevalence between 2.7 & 4.4 and high prevalence with a score greater than 4.5. Then, with the help of the digital vernier calliper the length of the index (2D) and ring (4D) fingers were measured for all the subjects from the ventral proximal crease of the digit to the end. In case of multiple creases at the bottom of the digit, the one with the most proximal to the hand was considered. The digit ratio was obtained by dividing these values. Based on these values, the subjects were split into two groups with 2D:4D ratio:

1. Less than 1 (<1).
2. Greater than or equal to 1 (≥1). (Figure 1.)

Figure 1: Diagrammatic Representation of 2D:4D Ratio; a) Less Than 1 (<1) and b) Greater Than or Equal to 1 (≥1).



STATISTICAL ANALYSIS

Data description, analysis and presentation were performed using Statistical Package for social Science (SPSS) version 19. Chi-square test was used to find out the association between the hormonal fingerprints and dental caries. A p value of ≤0.05 was considered as statistically significant.

RESULTS

The present study was conducted in Moradabad population to evaluate whether there was an association between hormonal fingerprints and dental caries.

Table 1 shows the distribution of males and females in 2D:4D <1 or ≥1. A total 250 participants were included in the study, out of which 29% were males and 45% were females with 2D:4D ≥1 whereas 71% males and 55% females were having 2D:4D <1.

Table 2 shows the association between 2D:4D <1 or ≥1 and caries. It was found that out of 91 subjects with high 2D:4D ratio, 41% subjects had a low DMFT score, 28.5% subjects had a medium DMFT score and 16% had a high DMFT score. And out of 159 subjects with low 2D:4D ratio, 59% had low DMFT score, 71.5% subjects had medium DMFT score and 84% had high DMFT score.

High DMFT score was more in the low 2D:4D ratio as compared to high ratio and this difference was statistically significant. (p= 0.02)

Table 1: Distribution of males and females in 2D:4D <1 or ≥1.

Distribution of males and females in 2D:4D <1 or ≥1			
Sex	**2D:4D ≥1**	**2D:4D <1**	**Total**
Male	38(29%)	94(71%)	132
Female	53(45%)	65(55%)	118
Total	91	159	250

Table 2: Association between 2D:4D <1 or ≥1 and caries

Association between 2D:4D <1 or ≥1 and caries					
Ratio	**Caries**			**Total**	**P Value**
	Low	**Medium**	**High**		
2D:4D ≥1	74	14	3	91	0.02
2D:4D <1	108	35	16	159	
Total	182	49	19	250	

DISCUSSION

Hormonal fingerprint is the relative length between the second digit and the fourth digit. It is also known as digit ratio.[8] They are non-invasive and are easy to measure without causing any discomfort to the patient. The 2D:4D ratio has been suggested as a potential indicator of prenatal hormone exposure, as well as the expression of Homeobox and androgen receptor genes.[9] In the past five years, numerous articles have highlighted the link between the 2D:4D ratio and various human traits and behaviors. However, there

is a limited number of dental studies examining how hormonal fingerprints impact oral health. Hence, the study was conducted to find the association between the hormonal fingerprints and dental caries.

In the present study, it was found that low digit ratio group was dominated by male and high digit ratio was dominated by females which is in, accordance with studies done by George et al (1930)[10] Manning et al (1998)[11] and Fink et al (2003)[12]. A lower 2D:4D ratio in males suggests that they may have experienced higher levels of prenatal testosterone and lower levels of prenatal estrogen compared to females. This hormonal imbalance may result in the fourth digit being relatively longer than the second digit.[3]

In the present study, subjects with low 2D:4D ratio had high DMFT score as compared to the high ratio which was similar to the findings of Lakshmi et al (2016)[2] and Verma et al (2018)[13]. The findings of the Verma et al (2018)[13] concluded that the hormones can impact taste perception and dietary preferences, consequently influencing the caries index.

The 2D:4D ratio remains constant throughout early life, and there is no evidence suggesting any changes to this ratio with age.[6] Manning et al (1998)[11] and Brown et al (2002)[14] observed that the digit ratio, once established, remains consistent throughout one's life. While finger lengths may vary during growth and development, the ratio typically remains constant due to the concentration of prenatal androgen exposure.

PUBLIC HEALTH SIGNIFICANCE

The digit ratio can be regarded as a consistent and stable anatomical marker for predicting the risk of dental caries. Early recognition of dental caries vulnerability within the high-risk group, such as those with a low digit ratio, will not only promote good oral health but will also aid in preventing the emergence of potential lifestyle-related disorders. This proactive strategy can significantly mitigate financial burdens on families and the healthcare sector in the long term.

LIMITATIONS

Firstly, additional studies should be conducted in larger population samples to strengthen the validity of the findings. Secondly, there was an uneven distribution of genders in our study.

CONCLUSION

The current study confirms the high prevalence of dental caries in individuals with a low 2D:4D ratio. Hormonal fingerprints, as emerging biomarkers, hold promise as a tool for predicting caries susceptibility. This simple, non-invasive chair-side procedure could facilitate the implementation of new preventive measures against dental caries. Moreover, it may offer insights into excluding other risk factors in dentistry through the assessment of hormonal fingerprints.

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