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Evaluation of the Relationship Between Dental Caries and Anemia in Adult Patients

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Abstract: ***This study investigated a possible association between dental caries and anaemia in adult patients. It screened 403 adults who had reported for routine blood investigation with regard to their haemoglobin (Hb) and dental caries status. The mean DMFT index was 5.2 for both genders in the anaemic group, while the mean DMFT score was 5.204.97 for anaemic group and 3.483.10 for non-anaemic group. The Mann-Whitney U test showed a statistically significant association between dental caries and anaemia (p0.001). The p-value was calculated for each age strata to eliminate the confounding effect of age on dental caries and anaemia. The study results confirmed a strong association between dental caries and anaemia in adults.***
Keywords: Dental caries, Anaemia, Adult patients

I. INTRODUCTION

The Federation Dentaire Internationale (FDI) defined oral health as the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions without pain, discomfort, and disease of the craniofacial complex[1]. Dental caries is the most prevalent disease globally and is defined as a localised destruction of susceptible dental hard tissues by acidic by-products from bacterial fermentation of dietary carbohydrates[3]. Despite being the most common preventable disease[2], about half of the global population is still affected by dental caries due to the lack of complete understanding of its etiology. Risk factors of dental caries include cariogenic microflora, increased intake of refined sugars, poor oral hygiene, inadequate salivary flow, poor brushing habits, low socio-economic status and a low literacy level. Anaemia remains underestimated as a potential risk factor for dental caries though recent studies have suggested a significant association between severe early childhood caries and anaemia in children[4-6].

Anaemia is a condition in which the number of red blood cells (RBCs) or haemoglobin concentration is insufficient, consequently impairing the capacity of the blood to transport oxygen around the body to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status.7,8 It is diagnosed when the haemoglobin concentration falls below the normal levels. The World Health Organization (WHO) defines anaemia as a haemoglobin concentration less than 13 g/dL in adult males and less than 12 g/dL in non-pregnant adult females.

The association of dental caries with anaemia in adult patients has not been studied. Anaemia is a condition in which afflicted individuals have too few RBCs or haemoglobin functioning at a suboptimal level. Iron deficiency anaemia is the most common, afflicting about one third of the population worldwide. The global prevalence of anaemia has been estimated as 24.8%, and India has a prevalence of more than 40%. This study aims to analyse the relationship between decayed, missing, filled tooth (DMFT) scores and haemoglobin levels in adult patients to determine the association of dental caries and anaemia in adults.

II. AIM AND OBJECTIVE

The study aims to analyse the association between dental caries and anaemia in adult patients attending dental out-patient clinics at Chandra Dental College, Barabanki.

III. REVIEW OF LITERATURE

Bansal et al., in 2016[10] investigated 30 children with severe early childhood caries and 30 caries-free children, aged 2- to 6-years at India. The study demonstrated a definite difference in haemoglobin concentration, mean corpuscular volume, and packed cell volume between the study groups and severe early childhood caries was recognised as a risk factor for iron deficiency anaemia.

Nur et al., in 2016[11] studied the prevalence of iron deficiency anaemia in 160 children with severe early childhood caries, aged 2- to 6-years at Turkey and found a significant difference in the values of mean corpuscular volume, though there was no significant difference in haemoglobin and haematocrit values. The authors claimed severe early childhood caries to be a risk marker for iron deficiency anaemia.

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Costa et al., in 2017[12] reported the influence of iron deficiency anaemia on caries incidence in a sample of 121 pregnant women at Brazil. The authors recorded a higher risk of dental caries in the presence of iron deficiency anaemia and proposed the anaemia parameters in saliva to be a potential risk indicator for dental caries.

Venkatesh Babu et al., in 2017[13] reported a significant inverse association between caries experience and iron status in a cross-sectional study at India. The study compared the decayed, extracted, filled tooth (deft) scores with serum iron and ferritin levels in 120 children aged 3-to 12-years.

Deane et al., in 2018[14] investigated the combined vitamin D and anaemic status of 144 preschoolers aged below 72 months with severe early childhood caries and 122 caries free controls at Canada. The study revealed significantly lower haemoglobin levels and vitamin D levels in the severe early childhood caries group than the control group. The authors concluded on an increased prevalence of vitamin D deficiency and anaemia in severe early childhood caries children.

Bahdila et al., in 2019[15] investigated the association between iron deficiency anaemia and dental caries in an animal model. The study induced iron deficiency anaemia in mice with iron-deficient cariogenic diet and the control group was fed on a similar cariogenic diet but iron-rich. The caries status in both the groups were compared and a significantly higher caries score was recorded in mice with iron deficiency anaemia than the control group, thereby suggesting a higher susceptibility of dental caries in iron deficiency anaemia.

IV. METHODOLOGY

The study was conducted in the Auto-Haematology and Biochemistry Laboratory associated with the Department of Oral and Maxillofacial Pathology and Microbiology, Chandra Dental College, Barabanki. It was approved by the Institutional Review Board, Reference No: 7/IRB/2017 dated 30.11.2022. The study population included 384 adult patients (19- to 50-years of age) who were referred for laboratory blood investigations by various departments in Chandra Dental College, Barabanki. The sampling method was simple random sampling based on the inclusion and exclusion criteria. The haemoglobin concentration and mean corpuscular volume (MCV) of the study participants were estimated with a computerised Sysmex XN-1000 haematology analyser.

Anaemia was classified based on the MCV values. The study examined the effects of age on dental caries and anaemia. Dental examinations were carried out and DMFT index was recorded. Data was entered in a pre-designed clinical assessment form and submitted for statistical analysis. Parametric and non-parametric methods were used

V. ANALYSIS OF DATA

Table -1 Distribution of the gender in the study group according to age

Gender	Age Group							
	19-29-years		30-40-years		41-50-years		Total	
	N	%	N	%	N	%	N	%
Male	53	37.3%	41	28.9%	48	33.8%	142	100.0%
Female	85	32.6%	108	41.4%	68	26.1%	261	100.0%
Total	138	34.2%	149	37.0%	116	28.8%	403	100.0%

Table-2Distribution of the gender in the two study groups according to age

Group	Gender	Age Group							
		19-29-years		30-40-years		41-50-years		Total	
		N	%	N	%	N	%	N	%
Anaemic Group	Male	3	27.3%	1	9.1%	7	63.6%	11	100.0%
	Female	67	35.4%	75	39.7%	47	24.9%	189	100.0%
	Total	70	35.0%	76	38.0%	54	27.0%	200	100.0%
Non- Anaemic Group	Male	50	38.2%	40	30.5%	41	31.3%	131	100.0%
	Female	18	25.0%	33	45.8%	21	29.2%	72	100.0%
	Total	68	33.5%	73	36.0%	62	30.5%	203	100.0%

Table-3 The mean DMFT scores among the anaemic and non-anaemic groups.

DMFT	Anaemic group			Non-Anaemic group		
	Male	Female	Total	Male	Female	Total
N	11	189	200	131	72	203
Mean	4.00	5.27	5.20	3.30	3.81	3.48
Std. Dev.	3.16	5.05	4.97	3.16	2.98	3.10
Median	2.0	4.0	4.0	2.0	4.0	3.0
1st Quartile	2.0	2.0	2.0	1.0	1.0	1.0
3rd Quartile	5.0	8.0	7.5	5.0	6.0	6.0

Table-4 Mann-Whitney U Test to compare DMFT scores between anaemic and non- anaemic groups

	Z-value	p-value
Male	0.957	0.339
Female	1.735	0.083
Total	3.551	<0.001

Table -5 Mann-Whitney U Test to compare DMFT scores between anaemic and non- anaemic groups with age stratification.

Age Group	DMFT	Groups		Z-value	p-value
		Anaemic group	Non-Anaemicgroup		
19-29-years	N	70	68	2.763	0.006
	Mean	3.77	2.57		
	Std. Dev.	3.08	2.91		
	Median	3.0	2.0		
	1st Quartile	2.0	.0		
	3rd Quartile	6.0	4.0		
30-40-years	N	76	73	2.074	0.038
	Mean	5.37	3.47		
	Std. Dev.	5.22	2.66		
	Median	4.5	3.0		
	1st Quartile	2.0	1.0		
	3rd Quartile	8.0	5.0		
41-50-years	N	54	62	1.996	0.046
	Mean	6.81	4.48		
	Std. Dev.	6.04	3.50		
	Median	5.5	4.0		
	1st Quartile	3.0	2.0		
	3rd Quartile	9.0	6.0		

Table-6.1 Prevalence of dental caries in anaemic and non-anaemic groups

Group	Dental Caries					
	No (DMFT=0)		Yes (DMFT≥1)		Total	
	N	%	N	%	N	%

Anaemic group	26	13.0%	174	87.0%	200	100.0%
Non-Anaemicgroup	41	20.2%	162	79.8%	203	100.0%
Total	67	16.6%	336	83.4%	403	100.0%

Table-6.2 Pearson Chi-Square test to compare the prevalence of dental caries between anaemic and non-anaemic groups

Chi-Square Tests	Value	p-value
Pearson Chi-Square	3.765	0.052

Table-6.3 Risk estimate of dental caries in anaemic and non-anaemic groups.

Risk Estimate	Value	95% CI	
		LB	UB
Relative Risk	1.090	0.999	1.190

Table-7.1 Prevalence of adult rampant caries in anaemic and non-anaemic groups

Group	Adult Rampant Caries					
	No (DMFT score<7)		Yes (DMFT score≥8)		Total	
	N	%	N	%	N	%
Anaemic	150	75.0%	50	25.0%	200	100.0%
Non-Anaemic	180	88.7%	23	11.3%	203	100.0%
Total	330	81.9%	73	18.1%	403	100.0%

Table-7.2 Pearson Chi-Square test to compare the prevalence of adult rampant caries between anaemic and non-anaemic groups

Chi-Square Tests	Value	p-value
Pearson Chi-Square	12.692	<0.001

Table -7.3 Risk estimate of adult rampant caries in anaemic and non-anaemic groups.

Risk Estimate	Value	95% CI	
		LB	UB
Relative Risk	1.21	1.40	3.47

VI. DISCUSSION

The present investigation is an attempt to explore the possible role of anaemia as a risk factor in the etiology of dental caries. It is a cross-sectional survey that compared the DMFT scores in anaemic and non-anaemic participants between 19- to 50-years of age, in order to evaluate the association between dental caries and anaemia. A recent study has claimed dental caries in permanent dentition to be the most prevalent disease worldwide in 2010, whereas dental caries in deciduous dentition ranked the 10th most prevalent condition in the world. The WHO standards have been used to identify the study group as anaemic and non-anaemic, and the DMFT index of the study participants has also been recorded as per the WHO criteria. The study results are pertinent to the global population as well, though only a specific population of the Indian subcontinent was investigated.

The WHO recognises haemoglobin concentration as the most reliable indicator of anaemia at the community level. This study revealed that among the 403 adult patients, the anaemic patients had a mean Hb concentration of 10.4721.64 g/dL and a mean DMFT score of 5.204.97, whereas the non-anaemic patients had a mean Hb concentration of 14.3241.39 g/dL and the mean DMFT score was 3.483.10 in the non-anaemic patients. The study attempted to classify the type of anaemia based on the MCV values into microcytic, normocytic or macrocytic type. Iron deficiency anaemia remains the most important and the most common form of anaemia, followed by anaemia of chronic inflammation. Of the anaemic patients, about 60% (120/200) presented with normocytic anaemia (MCV = 80 to 100 fL) while the remaining 40% (80/200) had microcytic anaemia

VII. CONCLUSION

This study compared caries status in anaemic and non-anaemic participants aged 19- to 50-years to determine the association between anaemia and dental caries in adults. Statistical analysis revealed a significant association between dental caries and anaemia, which is the starting point for future studies in adult patients.

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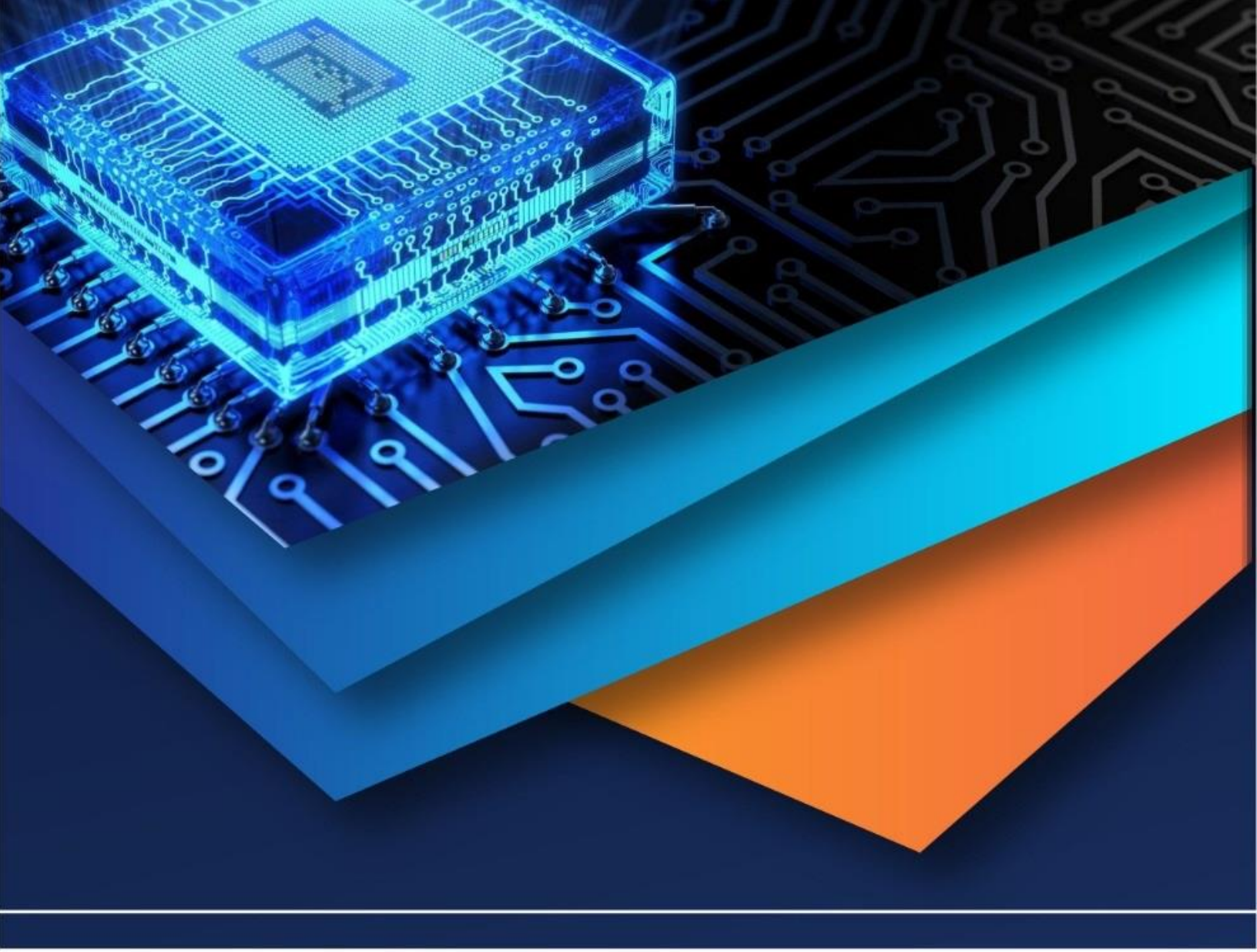

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