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A Correlation Between Socioeconomic Determinants and Dental Caries Risk in Islamabad, Pakistan

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ABSTRACT

Objective: Dental caries is a multifactorial infectious disease that causes demineralization of teeth. Socioeconomic status (SES) and educational level are associative factors in caries development. This study aimed to determine the correlation between socioeconomic determinants and dental caries risk among patients reporting to a tertiary care hospital in Islamabad.

Materials and Methods: This prospective cross-sectional analytical study was conducted at Islamabad Dental Hospital over six months from February 2023 to August 2023. A total of 322 participants were enrolled based on the convenience sampling technique. The participant's SES was assessed using the index score proposed by Oyedeji whereas caries risk status was evaluated using the DMFT index. Data was analyzed for frequency and percentages using SPSS version 22. Bivariate and multinomial regression analyses were performed to check for the association between SES and caries with a $p < 0.05$ considered statistically significant.

Results: Among all the participants, 260 (80.7%) had decayed teeth, 112 (34.7%) had missed and 50 (15.5%) had their teeth restored previously. The mean DMFT±SD score was 5.51±5.453. There was a statistically significant difference in the DMFT, D, M, and F scores between the different levels of SES. Participants with a high socioeconomic score (81.4%) are less likely to exhibit caries risk than those with a low socioeconomic score.

Conclusion: The prevalence of dental caries is higher among people of lower SES. High DMFT scores indicate that dental caries is a highly neglected disease among Pakistani people, particularly among people of low SES.

Keywords: Correlation, Dental Caries, DMF Index, Low Socioeconomic Status, Prevalence

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INTRODUCTION

Dental caries is an infectious disease that causes demineralization of teeth.[1] It has detrimental consequences on quality of life by inflicting pain, early loss of teeth, and hampering the daily routine. Primarily dental caries are implicated by bacteria, fermentable carbohydrates, susceptible tooth surface and time. The secondary modifying factors associated are behavioral aspects (presence of plaque, poor oral hygiene, increasing age, gender, inadequate tooth-brushing habits, frequency of consuming sugar) and an individual's socioeconomic status (SES).[2]

There is a complex relationship between the SES of an individual and dental caries. Socioeconomic status includes educational background, income, and residential area and is one of the strongest determinants of caries. Studies have shown that people with a low socioeconomic status have poorer oral health status and more carious lesions than those with a higher socioeconomic status. It has been stated in the literature that the gross income of the family and educational level has also significant associations with oral diseases. As Schwendicke et al reviewed in their study that people with less education or a financially poor background, were more likely to have a higher risk of caries lesions.[3]

For the assessment of caries risk status, the Decayed, Missing, and Filled Teeth (DMFT) index has been widely used. This is the universally accepted index and measures the total lifetime caries status of an individual. Therefore, the DMFT index quantifies dental caries status.[4]

Many studies conducted all around the world have shown the direct relationship between oral health with socioeconomic status, as the poor possess the most neglected mouths. In Pakistan, the high cost of treatment and low literacy rate in the low socioeconomic class are major barriers to poor oral health.[5]

Over a period, the prevalence and severity of dental caries have declined in developed countries where the socioeconomic status of the population is better. A study conducted in Australia evaluated the shape of the socioeconomic oral health gradient and showed a linear relationship of decreasing prevalence for individual oral conditions across increasing social status.[6] A cross-sectional study conducted in China to evaluate the association between socioeconomic status and dental caries in elderly people reported a high DMFT score in people with low socioeconomic status.[7] On the other hand, Leghari et al in their study on school children in Karachi reported an increase in DMFT score and caries risk with an increase in gross income but with low-level education of parents.[8] This shows that while describing socioeconomic status education and income both should be considered.

It is paramount to know the type of relationship that exists in society between caries and socioeconomic status as a contributing factor in the carious process, as it can be beneficial in understanding and developing better healthcare policies for improving people's social lives. Surayia and Amynah concluded in their study that oral health has a significant impact on an individual's social well-being.[9] Therefore, this study aimed to determine the association of socioeconomic status with dental caries risk among patients reporting to Islamabad Dental Hospital for dental checkups using the DMFT score.

MATERIALS AND METHODS

This prospective cross-sectional analytical study was conducted at the affiliated hospital of Islamabad Medical and Dental College over six months from February 2023 to August 2023. The inclusion criteria include adult male and female patients reporting at the outpatient department of Islamabad Dental Hospital, Barakahu. Children with mixed dentition, patients with retained deciduous tooth/teeth, disabled and physically handicapped adults, patients with learning disability, and patients with a language barrier were excluded from the study.

A convenience sampling technique was used to achieve the estimated sample size of n= 322, which was calculated with a confidence interval of 95% and an anticipated population proportion of 0.30. The study was approved by the institutional review board and ethical committee before commencing the research.

Data was collected through an oral examination and questionnaire after taking the informed consent. Two authors conducted oral examinations after calibration for caries identification according to the International Caries Detection and Assessment System (ICDAS). The patient's teeth were air-dried and then examined with the help of a dental mirror and probe under an artificial light.

The teeth with an ICDAS score of 2 or above and teeth with evidence of caries on the root were noted as decayed teeth (D). Teeth that were restored with any restorative material without evidence of secondary caries were identified as filled teeth (F). Teeth that were not present in the oral cavity due to any reason were classified as missed teeth (M). Targeted questions were asked of the patient based on profession and education to determine their socioeconomic status.

The participant's caries risk status was evaluated using the DMFT index and its components. The scoring of DMFT was done according to the criteria used by Shirazi and colleagues. A DMFT score of 1 to 4 was regarded as low caries risk, a DMFT score between 5 to 9 was regarded as medium caries risk, and a DMFT score of greater than 9 was regarded as high caries risk.[4]

The socioeconomic status was determined, and the score was assigned to each participant by asking questions using the socioeconomic index score by Oyedeji as shown in Table 1.[10]

Table 1. Socioeconomic Index Score

Parent/Guardian Occupational scale	
Scores	**Criteria**
1	Senior public servants, professionals, business people, large-scale traders, contractors.
2	Intermediate grade public servants, senior school teachers.
3	Junior grade public servants, junior school teachers, artisans, drivers.
4	Petty traders, laborers, Messengers
5	Full-time housewives, unemployed, students, subsistence farmers.
Parent/Guardian Educational scale	
Scores	**Criteria**
1	University graduate or equivalent
2	School certificate holder with teaching or other professional training
3	School certificate holder
4	Primary six certificate holder
5	Illiterate

The sum of the two scores was then divided by 2 to calculate the mean of scores. The final mean score was used to determine the socioeconomic status of the participant. Intermediate values were rounded off to the nearest whole numbers e.g. 3.5 were rounded to 4. The final mean score of 1 was regarded as high socioeconomic status, scores of 2 and 3 were regarded as of middle socioeconomic status, and scores of 4 and 5 were regarded as low socioeconomic status. Data on caries risk gathered by a score of DMFT index and socioeconomic status was noted in a proforma along with other demographic details.

The data was tabulated and analyzed using the Statistical Packages for the Social Sciences Software (version 22.0). Mean, standard deviation, frequency, and percentages were calculated for Decayed, Missing, and Filled Teeth. Bivariate and multinominal regression analyses were performed to check differences among different divisions of society according to their socioeconomic status and the association between caries risk and socioeconomic status.

RESULTS

A total of n=322 patients were assessed; males and females were equally distributed. Most of the participants were young, i.e. 256 patients were below the age of 44 years. Among all patients examined, 260 (80.7%) had decayed teeth, 112 (34.7%) had missed and 50 (15.5%) had their teeth restored previously. The mean DMFT ± SD score was 5.51±5.453 as shown in Table 2.

Table 2: Descriptive Statistics for Dependent Variables of Decayed, Missed, and Filled Teeth and the overall DMFT Index

		Decayed	Missing	Filled	DMFT
N	**Valid**	322	322	322	322
Frequency and Percentage		260 (80.7%)	112 (34.7%)	50 (15.5%)	-
Mean		3.57	1.50	0.45	5.51
Std. Deviation		3.878	3.678	1.580	5.453

As an individual component of DMFT, the mean value ± SD for the decayed teeth was 3.57±3.878, while that of missing teeth was 1.50±3.678 and filled teeth was 0.45±1.580 (Table 2). About 31 patients (22 males and 9 females) had a DMFT score of 0.

The distribution of DMFT according to different independent variables is shown in Table 3.

Table 3: Descriptive Information and Bivariate Analysis (n=322)

Independent variables	N	DMFT>0 N (%)	DMFT (mean±SD	DMFT *p*-value	D *p*-value	M *p*-value	F *p*-value
Gender							
Male	161	139 (47.76)	4.66± 5.28	.00^	.00^	0.480^	0.942^
Female	161	152 (52.23)	6.37± 5.50				
Socioeconomic status							
Low	158	145 (49.82)	7.32± 6.30	0.00*	0.00*	0.012*	0.002*
Medium	129	117 (40.20)	3.86± 3.91				
High	35	29 (9.96)	3.46± 3.15				
Adjusted socioeconomic status							
Low	158	145 (49.82)	7.32± 6.30	0.00^	0.000^	0.023^	0.005^
High	35	29 (9.96)	3.46± 3.15				

^Mann Whitney U-Test
*Kruskal-Wallis Test

The inequality in the DMFT score distribution was associated with gender and socioeconomic status. Table 3 shows a statistically significant difference in the DMFT, D, M, and F scores between the different levels of socioeconomic status. High socioeconomic patients are 81.4% less likely than low socioeconomic patients to develop high caries risk.

Multinomial regression revealed a statistically significant association between low caries risk and high and medium socioeconomic status. The high socioeconomic group (OR=5.38, 95% CI, 1.44 to 20.07

p=0.012) and medium socioeconomic group (OR=6.31, 95% CI 2.71 to 14.68 *p*=0.000) both indicated a higher chance of having a low caries risk compared with the low socioeconomic group. The chi-square test showed a statistically significant association between caries risk and socioeconomic status (*p* < 0.005). As shown in Figure 1, the high socioeconomic group had the least cases of high caries risk and high caries risk patients were most common in the low socioeconomic status group.
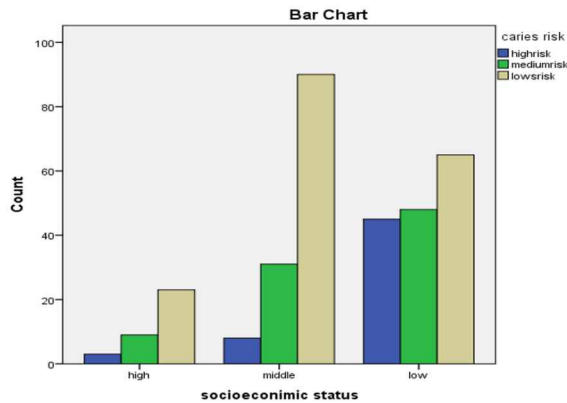
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Figure 1: Association of Caries Risk and Socio-economic Status

DISCUSSION

This study highlights how socioeconomic status relates to caries risk in a Pakistani population using a theoretical construct based on education and occupation to gauge the SES. The strong association between high SES and low caries risk, as identified in our study, is similar to studies conducted in developed countries. Yet, it becomes all the more alarming for a developing country like Pakistan.[7,11,12] Previous studies on the Pakistani population have demonstrated a similar trend of association between SES and caries risk.[13,14] These studies however differed in terms of methodology and age of sampled population.

This study found an inverse relationship between SES and caries risk which is in agreement with the findings of a systematic review published by Reisine and the meta-analysis done by Schwendicke F et al.[3,15] However, these findings should be considered with caution as in the present study the proportion of patients with high SES were relatively few compared to low SES. This makes it difficult to make a true comparison of the mean DMFT from patients belonging to each of these strata. Nevertheless, the high cost of dental treatment is an important factor that precludes certain members of society from seeking regular dental care. As reported by Waseem and colleagues while investigating a Pakistani population the cost factor is a huge hurdle in acquiring dental treatment.[5]

The DMFT result of our study is much lower than that reported in elderly Chinese (13.32 ± 9.58) population but comparable to the DMFT in Iranian (7.32 ± 2.85) and Indian (4.0 ± 5.7) populations.[7,16,17] In this study, the number of diseased teeth contributed the most to the overall DMFT score, followed by the missing teeth. The low ratio of diseased to filled teeth in the sample suggests general neglect in seeking dental care among the patients in the study. The disparity between the diseased and the filled could also be attributed to the fact that patients presenting to a hospital are being screened before receiving dental treatment. Hence the difference in the diseased and filled will be reduced following treatment rendering the results to be an overestimation of the difference in population.

While there have been various indexes for gauging the SES, the present study adopted a method proposed by Oyedeji.[10] This method used information regarding education and occupation to assign a socioeconomic status. The validity of these measures of SES is supported by literature.[18]

To assess the caries risk of the patients, a DMFT index was used which indicated a significant difference in the distribution of DMF scores concerning gender and SES. Schwendicke F et al also revealed that while considering SES based on low educational grounds the carious process was more in this portion of society.[3] In our society illiteracy is a menace (i.e. only 68% of males and 40% of females are literate)[19] which leads to poor jobs and low income which makes them unable to visit the doctor in the initial stages of disease which deteriorates the oral problem further and so does the DMFT score rises. It's a vicious cycle that goes on. It can be seen in the graph (Fig 1) that the greatest number of high and medium-risk patients were in the low SES.

A study by Harchandani and colleagues in 2012 reported that DMFT was 1.38 in 2004 in Pakistan which was 0.9 in 1999, while it is 5.5 in this study, though this study is limited in its locality still the DMFT score has risen.[19] The value of filled teeth has improved from 0.08 in 2004 to 0.45 at present but it still shows a very low amount of treatment being done.

Although the gender proportion was equal in the current study, the DMFT score was higher in females than males i.e. 4.66 ± 5.28 in males and 6.37 ± 5.50 in females. This finding is consistent with other studies conducted in Karachi, Lahore, India, Saudia Arabia, and the Philippines. However, Khairpur, Peshawar, and Qatar studies reported caries were more prevalent in females.[20]

In this study, we analyzed that low SES had the highest

DMFT score of 7.32± 6.30 and high SES had a score of 3.46±3.15 but it is in contrast to the study done by Leghari MA, Tanwir F, Ali H in 2014 where they discussed that higher the SES higher were the decayed and filled teeth present.[8] They attributed this anomaly to their dietary habits and usage of high sugar intake and having the perception to go to the dentist as they could afford it.

The reasons for missing teeth were not identified in the present study making it difficult to establish whether the teeth were lost due to advancement in the caries process or periodontal disease. Also, caries is a multifactorial process and SES is one of the factors, and that too is dependent on various aspects. Still, we only investigated the income and education measures for SES. The results are only representative of the patients reporting to the Islamabad Dental Hospital Barakahu and any generalizations should be carefully drawn.

Since the patients were enrolled and examined after approval of the research proposal it allowed calibration of the examiners identifying caries. However, the cross-sectional nature makes it difficult to establish a cause-and-effect relationship between socioeconomic status and caries risk.

CONCLUSION

Within the limitations of the study and considering the DMFT score we got from our study it can be concluded that there is a significant association between the SES and caries risk. Also, the high DMFT scores indicate that dental caries is a highly neglected disease among Pakistani people, particularly among people of low SES.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

Ethical approval was provided by the Ethical Review Committee at Islamabad Medical and Dental College. (Ref no IMDC/DS/IRB/304)

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AUTHORS CONTRIBUTION

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Drafting of the manuscript: M.U. Ashraf, A. Farid

Critical review of the manuscript: N.U.M. Allah, Z. Iftikhar

Approval of the final version of the manuscript to be published: M.U. Ashraf, U.A. Bhatti, N.U.M. Allah, A. Farid, H. Naveed, Z. Iftikhar

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