

# Consequences of Dental Caries in Children and its Association with Sociodemographic Variables

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**Abstract:** ***Aim:** To assess the correlation between consequences of dental caries in children reporting to a tertiary dental health care centre and the sociodemographic variables. **Materials and methods:** 70 children between 6-11 years of age in the mixed dentition stage who had untreated dental caries on examination participated in the study. The dental caries status was assessed using deft and DMFT indices in primary and permanent dentition. The consequences of untreated dental caries was assessed by pufa/PUFA index. The data on sociodemographic variables were also collected. The data was analyzed using Spearman's rho, Mann Whitney U test and Kruskal Wallis test. The p value was set at <0.05. **Results:** The mean pufa score for primary teeth was  $3.06 \pm 2.070$ . The mean PUFA score for permanent teeth was  $0.30 \pm 0.729$ . The mean pufa/PUFA ratio for the sample was  $59.29 \pm 14.59$ . There was no statistically significant correlation between sociodemographic variables and pufa/PUFA index except for age. **Conclusion:** This study emphasize the need for treating dental caries at its earliest possible stage to avoid severe consequences. The pufa index can be used as a tool to highlight these adverse consequences to dental professionals and health authorities.*

**Keywords:** sociodemographic variables, pufa index, consequences of dental caries, correlation

## 1. Introduction

Dental caries is described as a dynamic process of demineralization and re-mineralization resulting from microbial metabolism on the tooth surface which over time results in a net loss of mineral and subsequently but not always leading to cavitation. It is one of the commonest oral childhood diseases.[1]

For the last 70 years, data on caries have been collected worldwide using the DMFT/dmft index. This classical index provides information on caries and restorative and surgical treatment but fails to provide information on the clinical consequences of untreated dental caries, such as pulpal involvement and dental abscess, which may be more serious than the caries lesions themselves.[2] In order to improve oral health care facilities, there was a need of a diagnostic index that presented an accurate picture of consequences of advanced stages of dental caries to the authorities. An index called as "pufa" index (i.e., pulpal involvement, ulcer due to root fragments, fistula and abscess) was developed by Monse et al. This new index attempted to compliment and increased the sensitivity of original DMF (def) index and was used to record consequences of a carious lesion. Data collected through this index can have impact on decision taken by authorities regarding oral care, which is not possible with DMF index.[3]

Researches have shown that dental caries is a multi-factorial disease. Among the most important distant risk factors include socio-demographic factors such as age, sex, education of parents, family annual income, domicile, etc. Thus, the aim of the present study was to assess the correlation between sociodemographic variables and the consequences of dental caries as measured by pufa index.

## 2. Materials and Methods

A cross sectional study was conducted at the Department of Pedodontics and Preventive Dentistry, Government Dental College, Trivandrum. 70 children aged between 6-11 years who were in the mixed dentition stage having untreated dental caries for the past six months were the sampling units. Permission from the Institutional Ethics Committee was obtained prior to the conduction of study (IEC/R/24/2015/DCT/dtd1/12/2015). Verbal and written informed consent was obtained from parents or caregivers of the child. Assent from the child was also obtained.

Data on sociodemographic variables such as age, gender, family annual income, mother's education and domicile were collected. Caries status was assessed using DMFT/deft index. Teeth which were decayed or filled with decay were counted as carious and in case of missing teeth only those missing/extracted due to caries were considered. The data was recorded for each patient separately and that gave the number of decayed (D), missing (M), filled (F) teeth in permanent teeth and number of decayed (d), extracted due to caries (e) and filled(f) teeth in primary teeth. For children with mixed dentition, the caries index was obtained by the sum of the deft and DMFT scores.

The consequences of oral conditions resulting from untreated dental caries was recorded using the PUFA index, which was assessed separately from the DMFT index. The index was recorded for the presence of either a visible pulp, ulceration of the oral mucosa due to root fragments, a fistula or an abscess. Lesions in the surrounding tissues that were not related to a tooth with visible pulpal involvement as a result of caries were not to be recorded.

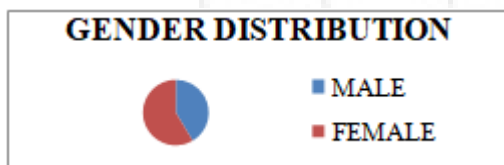
The assessment was made using mouth mirror and explorer. Only one score was assigned per tooth. In case of doubt concerning the extent of odontogenic infection, the basic score (P/p for pulp involvement) was given. If the primary tooth and its permanent successor tooth are present and both present stages of odontogenic infection, both teeth were scored. Uppercase letters were used for the permanent dentition and lowercase letters for the primary dentition. The pufa score per person was calculated in the same cumulative way as for the deft and represents the number of teeth that meet the pufa diagnostic criteria.

The PUFA for permanent teeth and pufa for primary teeth were reported separately. Thus, for an individual person the score can range from 0 to 20 pufa for the primary dentition and from 0 to 32 PUFA for the permanent dentition. The prevalence of pufa is calculated as percentage of the population with a pufa score of one or more. The PUFA/pufa experience for a population is computed as a mean figure and can therefore have decimal values. The untreated caries, pufa ratio is calculated as  $PUFA + pufa/D + d \times 100$ .

Data was tabulated using Microsoft Excel 2007. Statistical analysis was done using SPSS 16.0 version. Correlation of PUFA/ pufa scores with sociodemographic variables were also assessed.

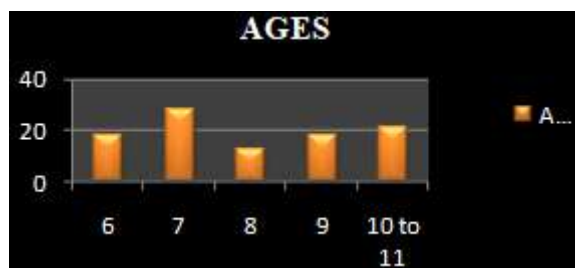
### 3. Results

Of the 70 children, 29 children were male (41.4%) and 41 were (58.6%) were females.(figure 1)



**Figure 1:** Pie diagram showing gender distribution of sample

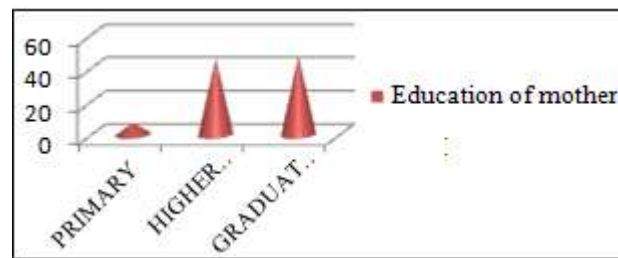
Children in the study sample were categorized in such a way that each age was taken as a group and thus there were 5 age groups(6yrs, 7 yrs, 8yrs, 9 yrs,10-11 yrs). As there was only one child in 11 year group, both 10 and 11 years were combined in to one group.(figure 2)



**Figure 2:** Bar diagram showing age distribution of sample

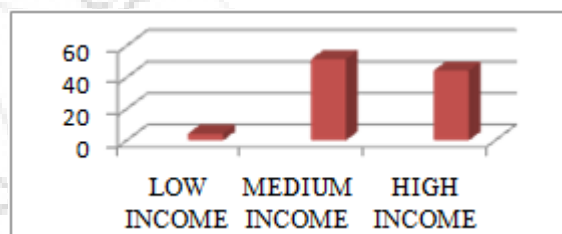
The education of mother was grouped as 3 groups: primary school level, higher secondary level and graduate and post graduate level. 47.2 % of mothers were having graduate or post graduate level of education, 45.7% mothers with higher

secondary level of education, whereas only 7.1% of mothers with primary level of education. [figure 3]



**Figure 3:** Cone diagram showing Education of mother

The family annual income was also presented as 3 groups namely low, medium and high income groups. Family annual income of below Rs.1000 and Rs.1000- 10,000 were grouped as low income group, Rs.10,000-Rs. 50,000and Rs.50,000-Rs. 1 lakh were grouped as medium income group and above Rs.1 lakh was grouped as high income group.44.3% were in the high income group , 51.5 % were in the medium income group and only 4.3 % of children belonged to low income group.[figure 4]



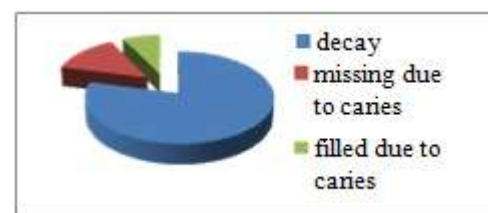
**Figure 4:** Bar diagram showing distribution of sample according to family annual income

62.8% of children were from urban area and 37.2% were residing in rural area.[figure 5]



**Figure 5:** Diagram showing distribution of sample according to domicile

The mean deft in primary dentition was  $6.50 \pm 3.94$ . On analyzing the contribution of each component of deft index to the mean score, it was found that 89.4% was by decay component, 15.45% was by missing teeth which were extracted due to caries and only 8.3% by the filled component.[figure 6]



**Figure 6:** Pie diagram showing deft distribution in primary dentition

The mean DMFT in permanent dentition was  $0.56 \pm 1.030$ . On analyzing the contribution of each component of DMFT index to the mean score, it was found that 95.12% was decay component, 4.8% was by missing teeth which was extracted due to caries and no filled component was recorded. [figure 7]



**Figure 7:** Pie diagram showing DMFT distribution in permanent teeth

The mean pufa score for primary teeth was 3.06 with a standard deviation of 2.070. The mean PUFA score for permanent teeth was  $0.30 \pm 0.729$ . The mean pufa/PUFA ratio for the sample was  $59.29 \pm 14.59$ . The pufa/PUFA ratio ranged from 9.09 to 100. 15 out of 70 children (21.4%) had a pufa/PUFA ratio of 100 i.e., in 21.4 % of children all the untreated carious lesions in their mouth had progressed to the consequences of dental caries. In about 15.7 % of children, 50% of untreated carious lesions had progressed to its consequences. Spearman's rho was used to find out the correlation between age with pufa scores, PUFA scores and pufa/PUFA ratio. There was no statistically significant correlation between age and the consequences of untreated dental caries in primary teeth which was denoted by pufa scores as p value was  $>0.05$ . However, there was a statistically significant correlation between the age and consequences of untreated dental caries in permanent dentition as given by PUFA scores at p value = 0.0001. There was also a statistically significant correlation between the age and pufa/PUFA ratio at p value  $<0.05$ . [table 1]

**Table 1:** Table showing correlation between age and pufa/PUFA index

age	pufa scores	Spearman's rho = -0.209 p value = 0.082(>0.05)	Weak negative correlation Not significant
	PUFA scores	Spearman's rho = 0.411 p value = 0.0001	Moderate correlation Highly significant
	pufa/PUFA ratio	Spearman's rho = 0.258 p value = 0.0319(<0.05)	Moderate correlation Significant

Mann-Whitney U test was employed to assess the correlation between sex and pufa scores, PUFA scores and pufa/PUFA ratio. There was no statistically significant correlation between sex and consequences of dental caries in primary and permanent dentition and between pufa/PUFA ratios. (p value  $<0.05$ ) [table 2]

**Table 2:** Table showing correlation between sex and pufa/PUFA index

sex	pufa scores	p value = 0.260 (>0.05)	Not significant
	PUFA scores	p value = 0.978 (>0.05)	Not significant
	pufa/PUFA ratio	p value = 0.614 (>0.05)	Not significant

Kruskal Wallis test was employed to assess the correlation between mother's education and pufa scores, PUFA scores and pufa/PUFA ratio. There was no statistically significant

correlation between mother's education and consequences of dental caries in primary and permanent dentition and between pufa/PUFA ratios (p value  $<0.05$ ). [table 3]

**Table 3:** Table showing correlation between mother's education and pufa/PUFA index

Mother's education	pufa scores	p value = 0.733 (>0.05)	Not significant
	PUFA scores	p value = 0.661 (>0.05)	Not significant
	pufa/PUFA ratio	p value = 0.474 (>0.05)	Not significant

Kruskal Wallis test was employed to assess the correlation between family annual income and pufa scores, PUFA scores and pufa/PUFA ratio. There was no statistically significant correlation between family annual income and consequences of dental caries in primary and permanent dentition and between pufa/PUFA ratios. (p value  $<0.05$ ) [table 4]

**Table 4:** Table showing correlation between family annual income and pufa/PUFA index

Family annual income	pufa scores	p value = 0.922 (>0.05)	Not significant
	PUFA scores	p value = 0.125 (>0.05)	Not significant
	pufa/PUFA ratio	p value = 0.137 (>0.05)	Not significant

Mann-Whitney U test was employed to assess the correlation between domicile and pufa scores, PUFA scores and pufa/PUFA ratio. There was no statistically significant correlation between domicile and consequences of dental caries in primary and permanent dentition and between pufa/PUFA ratios. (p value  $<0.05$ ). [table 5]

**Table 5:** Table showing correlation between domicile and pufa/PUFA index

Domicile	pufa scores	p value = 0.681 (>0.05)	Not significant
	PUFA scores	p value = 0.896 (>0.05)	Not significant
	pufa/PUFA ratio	p value = 0.748 (>0.05)	Not significant

#### 4. Discussion

The mean deft in primary dentition was  $6.50 \pm 3.94$  and the mean DMFT in permanent dentition was  $0.56 \pm 1.030$ . Thus, the caries experience in primary teeth was higher compared to permanent teeth. This could be due to the fact that the sample consisted of 6-11 year old children and caries in permanent teeth involved mainly first permanent molars, and in children less than 12 years, the DMFT was based on the caries experience of these first molars alone. Similar to the present study, the caries experience was lower in permanent dentition than in primary dentition in the study by Saravanan et al[4]. He had studied 5-10 year old children and reported a decrease in caries with increasing age and reasoned that the exfoliation of deciduous teeth in the older age group might explain why the mean deft score was lower for older children. Generally, the total caries experience indicators are higher in the mixed dentition. Primary teeth are exposed to risk factors of caries such as regular consumption of sugar-sweetened snacks, sugar-sweetened beverages and confectionery items such as sweets and chocolates over a longer period of time than permanent teeth. This explains why primary dentition have a higher mean number of caries lesions than permanent dentition.[5] This high caries experience in primary teeth could be attributed to the fact that permanent teeth have a lower susceptibility to dental

caries. It may also be due to the structural differences that may increase caries susceptibility in deciduous teeth.

Boys had a slightly higher prevalence of caries in primary and permanent dentition than girls in the present study despite the fact that number of girls in the study were higher than boys. Results indicated that male children had higher mean DMFT/deft value than the female children. Similar results were found in studies done by Jain M [6] & Joyson Moses et al [7]. The reason may be a marked preference for sons regardless of the socioeconomic status, which leads to longer feeding of sons compared to daughters. Whereas in a study done by Shingare et al [8], female children showed higher incidence of dental caries than male children due to frequent snacking habits and fluctuating hormonal levels during puberty by female children. Whereas, boys had a slightly higher prevalence of caries in primary dentition than girls, whereas girls had higher prevalence of caries in their permanent dentitions in the study by Ferizi et al [5] where the number of boys were higher than girls. No significant gender predilection was found in deft scores in the study by Basha et al [9] and Dehghani et al [10].

In the present study, the highest percentage of children belonged to mother's who were graduates and post graduates (47.2%) and none of the mothers of children in the sample were illiterate indicating the high literacy rate of Kerala. Similarly, 44.3% were in the group of high family annual income only 4.3% in the low income group. Despite these, sample had high deft values which could be due to the fact that parents and children had low awareness on dental caries and its preventive measures.

Children of parents belonging to high income group showed highest deft score ( $9.09 \pm 4.36$ ) and children in the low income group showed lowest deft ( $4.33 \pm 3.78$ ). This finding is similar to the trend observed in other developing countries where caries prevalence was observed to increase with increasing socio-economic status. Woodward and Walker [11] attributed this to an increase in sugar consumption in those developing countries in addition to limited access to fluoride and other dental caries preventive measures. According to Seyedain et al [12], developing countries like Kenya, Iraq and Lebanon have westernized their dietary habits which resulted in an increase in their caries prevalence.

Similarly, children in urban areas showed slightly higher deft ( $6.63 \pm 3.96$ ) than those in rural areas ( $6.39 \pm 3.99$ ). This was in contrast to the study by Pal et al [13] who examined the prevalence of dental caries in primary dentition of 5–6-year-old children in urban and rural areas of Jabalpur city and found that significantly higher decayed missing filled teeth were among rural children than urban children. According to him, low perception of the need for treatment of dental caries within the socially disadvantaged section of the society places a low priority for oral health care compared to other needs. This could be the reason for not restoring the teeth.

PUFA index is currently used to epidemiologically assess carious lesions and classify the consequences of untreated caries. This index is easy to use, fast, and safe; it doesn't

require any equipment, and it can be used by individuals other than dentists as well. In fact, PUFA/pufa provides policy makers with complete information, especially when combined with DMFT/deft. The PUFA/pufa index is also recommended for use in populations with high rates of dental caries who have no access to therapeutic and preventive measures.

The mean PUFA scores of males were slightly lower when compared to females. Among age groups the highest PUFA score was recorded for 10 - 11 years and the lowest was for 6 and 7 years. Comparing the education of the mother, the highest PUFA score was recorded in children whose mothers were graduates and post graduates and lowest was recorded in children whose mothers were educated till primary level. Children in medium income group showed highest PUFA score and children in the low income group showed lowest PUFA. Similarly, children in urban areas showed lower PUFA than those in rural areas.

Though, there was a negative correlation between pufa in primary dentition with age, it was not statistically significant. Negative correlation may be due to the fact that the teeth with consequences might have been extracted as age advanced or they might have been exfoliated. However, there was a statistically significant positive correlation between the age and consequences of untreated dental caries in permanent dentition as given by PUFA scores as the permanent teeth erupt with increasing age in the study sample of 6-11 years and become more teeth become prone to caries. The correlation between pufa/PUFA ratio was lesser compared to PUFA with age because ratio combines consequences in both primary and permanent dentition and the value was influenced by pufa scores in primary dentition.

Other sociodemographic variables like sex, mother's education, family annual income and domicile did not have any significant correlation with pufa values. This could be due to the inadequate sample size. Dedeke et al [1] showed that father's socioeconomic status had a significant association in the prevalence of caries experienced.

In the PUFA/pufa index, there is no score pertaining to the severity of pain as the consequence of untreated dental caries. This drawback can be considered as one limitation of the index. In various studies pain parameter as the consequence of dental disease itself or the outcome of treatment intervention has been evaluated. However, in PUFA/pufa index which is only relied on objective signs, the subjective parameters such as pain and discomfort have not been considered.

## 5. Conclusion

Though a relationship was found between consequences of dental caries and sociodemographic variables, there was no statistically significant correlation between them except for age. Thus more studies focussing on this relationship are of paramount importance to focus resources on preventive care in order to address caries and its subsequent complications,

as well as establish accessible and affordable oral health services in the community.

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