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Prevalence of caries and treatment needs among 15-17-year-old students in Calicut district: A cross-sectional study

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Abstract
Background: WHO suggests that caries prevalence done in age group 15 years would be more meaningful than 12 years age. At present there are such studies in age group of 15-17 years conducted in Calicut district. 3200 students from Government higher secondary schools in Calicut district were examined to evaluate the association of caries with respect to age, gender, dietary habits and location. All the data were entered in SPSS (18) software. Chi-square test was used to compare socio-demographic characteristics and risk factors. The level of statistical significance was be set at $p<0.05$. The overall prevalence of dental caries was found to be 66.13%. The prevalence rate was statistically significant when gender was considered. Caries prevalence was slightly more in rural 67% when compared to urban 65%. The association of caries and habits was not statistically significant. In the sample studied it was seen that 38.8% of the students did not need any treatment, whereas 5.28% needed two surface restoration, 55.8% required one surface restoration, 7.44% required RCT, 7.44% required crown,6.44 required extraction, 42.84% required oral prophylaxis,6.28% required bridge and 1.38% required other treatment procedures like orthodontic procedures.

Keywords: prevalence, caries, students, habits, treatment needs

1. Introduction
The World Health Organisation has ranked caries as number three among all chronic non communicable diseases that require worldwide attention for prevention and treatment [1]. Dental caries has high prevalence all around the world involving people of all regions and society [2]. The prevalence and incidence of dental caries is influenced by various socio-demographic factors like age, sex, ethnic groups, dietary patterns and oral hygiene habits [3]. Children of all age groups are affected by dental caries and so the best option which is more acceptable and economical is prevention. Thus, it becomes imperative to collect data on prevalence of dental caries and treatment needs to determine the course of action for preventive care. Calicut also known as the city of spices is a district in Kerala state, which is also the second largest urban agglomeration in the state of Kerala. The city of Calicut is 38.25% urbanised. It is divided into four taluks namely Kozhikode, Vatakara, Quilandy and Thamarassery. There are 191 higher secondary schools in Calicut under the Government of Kerala.
There are no studies done on the prevalence of caries in this age group in Calicut district till date. Hence, the present study was designed to assess the prevalence and treatment needs among 15-17-year-old school children in Calicut district.

2. Materials and methods
2.1 Study design: A cross-sectional school-based study

2.1.1 Study setting: The study was conducted in 16 higher secondary schools in Calicut, Quilandy, Vatakara and Thamarassery taluks of Calicut district.

2.1.2 Study Duration – November 2019 to January 2020

2.1.3 Inclusion Criteria: Students in the age group between 15 and 17 years from Government and Government aided higher secondary schools were included. Only those students who were present on the day of examination were included in the study.

2.2 Exclusion criteria
Boys only and girl's only schools were excluded. Early stages of dental caries and questionable lesions were excluded. Children with systemic diseases were excluded from the study. Uncooperative students and those students whose parents did not give consent were also excluded from the study.

2.3 Sampling
The sampling procedure involved multistage stratified sampling, where the schools were groups under the four taluks – Calicut, Vatakara, Quilandy and Thamarassery. Then the schools were grouped under two strata: urban and rural under the four taluks. In each taluks two schools each were selected under urban and rural criteria based on simple random sampling (lottery method). Thus a total of sixteen schools were selected.

2.4 Sample size calculation
Sample size was calculated on the basis of a previous study [4] using the formula-$N=4pq/d^2$
p =prevalence in an earlier study (50.6) q= 100-p, d= effect size n=399.9 rounded to 400 According to this formula, the sample size in each group (urban and rural) was calculated as 400 each i.e. 800 school children in one taluk. Total sample size for the four taluks together was 3200.

2.5 Methods

The study was carried out after obtaining permission from principals of the selected schools. Informed consent was obtained from school authorities and students. A written consent was also taken from each student before participating in the study. School authorities were notified in advance about examination dates so that maximum number of students could avail the opportunity.

Data collection was carried out by clinical examination and structured questionnaire. Participants underwent intraoral examinations performed by five trained dentists and they had to answer a questionnaire pertaining to their oral hygiene behaviour. The survey sheet also collected information on age, gender, oral hygiene behaviours such as frequency of cleaning teeth, type of dentifrice used, and use of tooth brush in cleaning. Information about daily habits such as frequency of consuming soft drinks, snacking in between meals will also be recorded.

Standard infection control guidelines were applied during clinical examination. All the recordings were carried out in daylight. The oral examination of the study subjects was conducted in respective schools using a plane mouth mirror under natural light and community periodontal index probe as indicated by WHO. The index used is DMFT, where D=teeth requiring treatment as a result of carious, lost restoration; M= tooth lost as a result of caries and F= filled or crowned teeth. The total number of caries free children was also recorded.

The children were asked to rinse their mouth thoroughly with water before examination. Survey findings were reported to respective school authorities and referral was forwarded to the parents of the children who are in need of dental care. On completion of the survey, an oral health education session was conducted and correct way of brushing was demonstrated. Treatment needs will be assessed using WHO criteria and scored as follows [5]

0=none, 1= caries arresting or sealant care, 2=one surface filling, 3=two or more surface filling4= crown or bridge, 5=bridge element, 6=pulp care, 7= extraction, 8=need for other care, 9- specify

2.6 Segregation of collected Data

All the survey sheets was numbered and bundled according to the respective schools and the bundles was also given numbers. These bundles were further segregated according to rural and urban areas. Then 1600 survey sheets each was selected from urban and rural areas each to get the required sample size 3200.

2.7 Statistical Analysis

All the data were entered in SPSS (18) software. Both descriptive and analytic approaches were used in data analysis. Mean and standard deviation was calculated for quantitative variables and frequency for qualitative variables. The prevalence was expressed in percentage. Chi-square test was used to compare socio-demographic characteristics and risk factors (oral hygiene practises and personal habits). The t test was used to test mean DMFT. The level of statistical significance was set at $p<0.05$

3. Results

Table 1: Distribution of study subjects

Age		Sex		Total
		Male	Female	
15years	Frequency	158	265	423
	% within sex	10.30%	15.80%	13.20%
16years	Frequency	741	835	1576
	% within sex	48.50%	49.90%	49.30%
17years	Frequency	628	573	1201
	% within sex	41.10%	34.20%	37.50%
Total	Frequency	1527	1673	3200
	% within sex	100.00%	100.00%	100.00%

A total of 3200 students were examined, out of which 1527 were males and 1673 were females. In the age group of 15 years, there were 158 males and 265 females. In the age group of 16 years, there were 741 males and 835 females and in the age group of 17years, there were 628 males and 573 females (Table no 1)

Table 2: Caries prevalence

Caries	n	%
Absent	1100	33.87
Present	2100	66.13
Total	3200	100.0

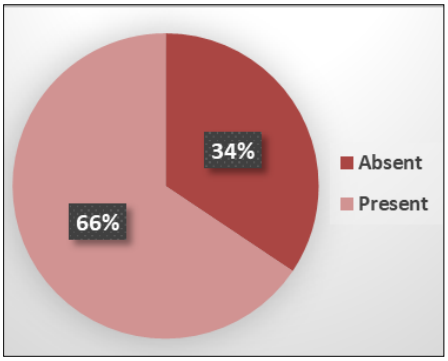

Fig 1

The overall prevalence of dental caries was found to be 66.13%. (Table no 2) (Figure no 1). The caries prevalence within age group 15, 16 and 17 was not significant as the p value was 0.190 (Table no 3). The prevalence rate was statistically significant when gender was considered as p value was less than 0.05. Females had a mean caries score of 2.27 and males showing a mean score of 2.09(Table no 4)

Table 3: Comparison of mean DMFT based on age

Age	Frequency	Total DMFT					
		Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
15years	423	2.2175	2.20404	2.0069	2.4281	0	9
16years	1576	2.2487	2.33354	2.1334	2.364	0	10
17years	1201	2.0916	2.24127	1.9647	2.2185	0	9
Total	3200	2.1856	2.28288	2.1065	2.2648	0	10
p-value		0.190					

Table 4: Comparison of mean DMFT based on sex

	sex	Frequency	mean	Std deviation	p- value
Total DMFT	Male	1527	2.09	2.243	0.023
	Female	1673	2.27	2.316	

*p value <0.05 is statistically significant; ** <0.001 is statistically highly significant

Table 5: Taluk wise caries experience

Taluks	Absent	Present	Chi square value	P value
Kozhikode urban	168(15.3)	232(11.0)	59.2	0.001*
Kozhikode rural	136(12.4)	264(12.6)		
Quilandy urban	181(16.5)	219(10.4)		
Quilandy rural	143(13)	257(12.2)		
Vadakara urban	120(10.9)	280(13.3)		
Vadakara rural	139(12.6)	261(12.4)		
Thamarassery urban	95(8.6)	306(14.6)		
Thamarassery rural	118(10.7)	281(13.4)		
Total	1100	2100		

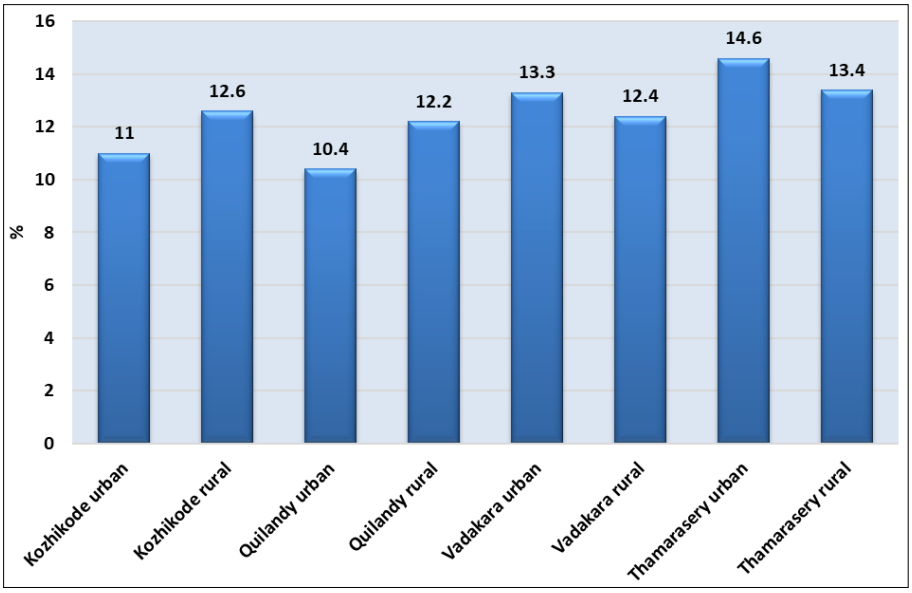

Fig 2

Table 6: Caries Experience in Calicut District-Urban vs. Rural

	Total	Number of students with caries	Prevalence
Urban	1600	1044	65.25%
Rural	1600	1056	67.00%
TOTAL	3200	2100	66.13%

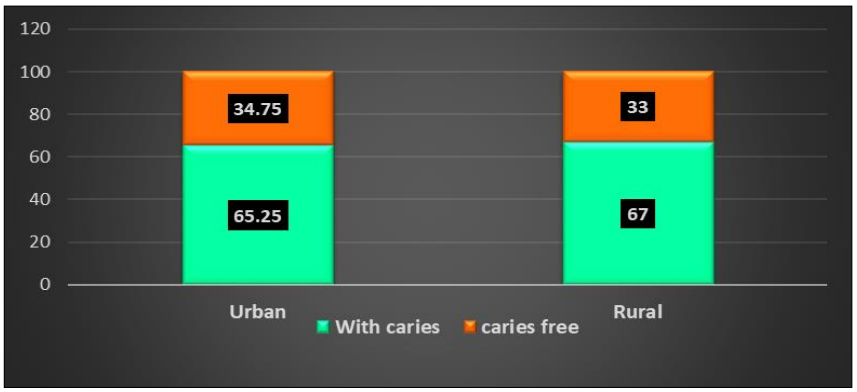

Fig 3

From Table no 5 and (Figure no 2), caries prevalence within the taluks showed a higher prevalence in Thamarassery urban (14.6%), followed by Vadakara urban (13.3 %), Kozhikode urban (11%) and the lowest in Quilandy urban (10.4%). In the rural group comparison, the highest prevalence was in Thamarassery (13.4%), followed by Vadakara (12.4%), Kozhikode (12.6%) and Quilandy (12.2%).

When caries experience was considered in Calicut district (urban versus rural), it was seen that the caries prevalence was slightly more in rural (67%) when compared to urban (65%). (Table no 6) (Figure3)

When habits were analyzed, it was found that majority 98.8% used toothbrushes, 1.1% used finger brushing and 0.1% used other aids. Frequency of brushing once daily was found in 44.2%, twice daily in 55.5% and 0.3%brushed between meals. Majority of the students 91.9% did not use mouth wash, whereas 8.1% used mouth wash. Habit of snacking between meals was found in 55.5% students. Pan Masala usage was found in only 0.7% students. Use of soft drinks once a day was found in 8.3%, once a week in 55.3% students. 36.3% did not use soft drinks. (Table no 7) (Figure 4, 5, 6, 7, 8, and 9)

Table 7: Percentage of subjects versus different habits

Habits		n	%	
Brushing aids	Finger	35	1.1	Figure 6
	brushes	3162	98.8	
	Other aids	3	0.1	
Frequency of brushing	Once	1415	44.2	Figure 7
	Twice	1775	55.5	
	Between meals	10	0.3	
Use of mouth wash	yes	260	8.1	Figure 8
	no	2940	91.9	
Use of snacks between meals	Yes	1771	55.3	Figure 9
	no	1429	44.7	
Use of pan masala	Yes	23	0.7	Figure 10
	No	3177	99.3	
Use of soft drinks	Once a day	267	8.3	Figure 11
	Once a week	1771	55.3	
	Do not use	1162	36.3	

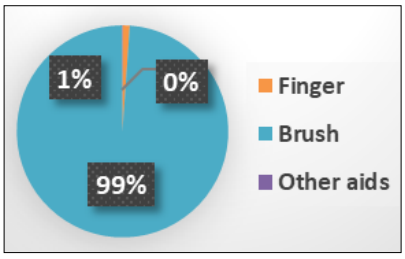

Fig 4: Percentage of subjects using brushing aids

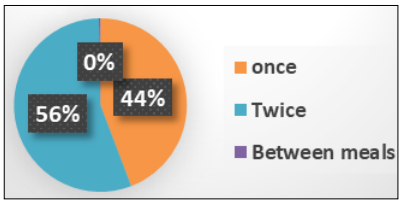

Fig 5: Percentage of subjects showing frequency of brushing

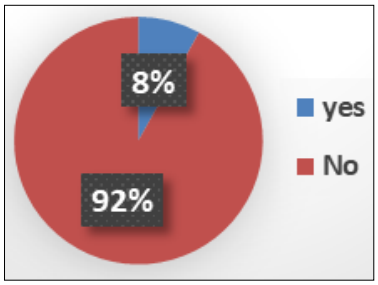

Fig 6: Percentage of subjects using mouthwash

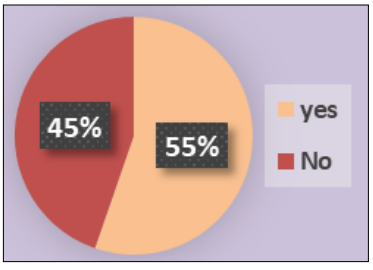

Fig 7: Percentage of subjects using snacks between meals

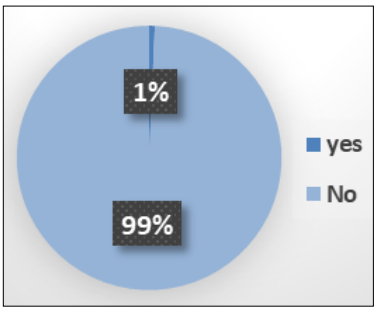

Fig 8: Percentage of subjects using pan masala

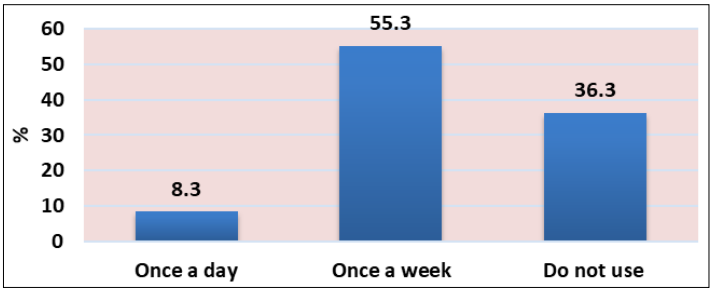

Fig 9: Percentage of subjects using soft drinks

Table 8: Decayed, missing filled tooth components in different age groups and gender

Groups	Total no of students	Decayed (mean)	p value	Missing (mean)	P value	Filled (mean)	p value
15 years	423	1.747		0.0972		0.3735	
16 years	1576	1.8571	0.028	0.0952	0.274	0.2978	0.098
17 years	1201	1.6486		0.0749		0.3683	
Male	1527	1.75		0.08	0.085	0.27	0.001
female	1673	1.78	0.614	0.1		0.39	
Total	3200	1.7643		0.0879		0.3343	

The breakdown in Table no 8 shows that the decayed component in the age group studied, is statistically significant with a mean score 18.5 in the age group 16 years when compared to the other age groups. The filled component in females is more when compared to males and this finding was statistically significant.

Table 9: Dental treatment needs in age groups and gender

Age	Total no	No Treatment	Two surface filling	One surface filling	RCT	Crown	Extraction	Oral prophylaxis	Bridge	Others
15 years	423	153 (36.17)	17 (4.02)	237 (56.03)	45 (10.64)	44 (10.41)	35 (8.27)	197 (46.56)	35 (8.27)	7 (1.65)
16 years	1576	603 (38.26)	96 (6.09)	882 (55.96)	110 (6.98)	106 (6.73)	110 (6.98)	688 (43.65)	106 (6.73)	19 (1.21)
17 years	1201	486 (40.470)	56 (4.66)	650 (54.12)	83 (6.91)	82 (6.83)	61 (5.08)	486 (40.47)	60 (4.99)	18 (1.50)
Male	1527	613 (40.14)	87 (5.70)	834 (54.62)	113 (7.40)	111 (7.27)	93 (6.09)	637 (41.72)	92 (6.02)	20 (1.31)
Female	1673	629 (37.60)	82 (4.90)	935 (55.89)	125 (7.47)	121 (7.23)	113 (6.75)	734 (43.87)	109 (6.52)	24 (1.43)
Total	3200	1242 (38.81)	169 (5.28)	1769 (55.28)	238 (7.44)	232 (7.25)	206 (6.44)	1371 (42.84)	201 (6.28)	44 (1.38)

From Table no 9, it was seen that 38.8% of the students did not need any treatment, whereas 5.28% needed two surface restorations, 55.8% required one surface restoration, 7.44% required RCT, 7.44% required crown, 6.44% required extraction, 42.84% required oral prophylaxis, 6.28% required bridge and 1.38% required other treatment procedures like orthodontic procedures.

4. Discussion

Dental caries is a common oral disease affecting children of varied age groups. Despite incredible scientific advances and the fact that caries is preventable, the disease continues to be a major public health problem. The prevalence of dental caries is a principal subject of many epidemiological researches being carried out around the world. Hence, an attempt has been made in the present study to evaluate the prevalence of dental caries and treatment needs among 15 to 17-year-old students of Calicut district in Kerala, since no such studies in the sample population have been reported till date.

The study sample consisted of 3200 subjects of which 1527 were males and 1673 were females. 423 (13.2%) subjects were 15 years, 1576 (49.3%) were 16 years, 1201 (37.5%) were in the age group17 years. The overall prevalence of dental caries in the present study was found to be 66.13% which is more than the reported caries prevalence in India (i.e. 53.8%) in National Oral Health Survey [6]. The overall prevalence was also higher than in the study done in 12-year children by Faizal Peediyakal [7] *et al*. in Kannur district of Kerala where the prevalence was 49.44%. A similar study by Ibrahim Alsharani *et al*. [8] in southern Asir, Saudi Arabia in the age group 15-17 years also reported a higher prevalence rate of 72.9%.

The present study showed that females (mean 2.27) were slightly more affected than males (2.09%). These findings are in concurrence to the studies by Shingare *et al*. [9] and

Mosha *et al*. [10]. On the contrary, in the studies conducted by Arora Sachit *et al*, [11] Yevenes *et al*. [12] males were more commonly affected.

The present study reported the prevalence of dental caries more in rural (67%) than in urban areas (65.25%) of Calicut district. Similar findings were seen in other studies [13, 15] but prevalence rate was more in urban areas in some other studies [16, 17]. The present study did not find any statistical difference in caries rate within the age groups as the p value was greater than 0.05. However, age group of 17 years (mean 2.09) had less caries rate compared to the other groups. This may be due to increased awareness in caries preventive methods.

The study also shows that the decay component in the study sample was more (mean 1.76) than the missing and filled components indicating that many carious teeth were left untreated and is a cause for concern. Similar results were reported by Singh *et al*. [18] This could be due to less availability or utilization of dental services, lack of parental knowledge regarding maintenance of oral health care or inaccessibility to affordable dental services

The results of the present study showed that 1415 (44.2%) study subjects brushed their teeth once daily, and 1775 (55.5%) brushed their teeth twice daily and only very few 10 students (0.3%) brushed their teeth between meals. Very similar results were also reported by Harikiran *et al*. who found that only 38.5% of the children brushed their teeth two or more times a day [19]. Another study by Prasad *et al* in Tamil Nadu also revealed that only 30.7% of the students brushed their teeth two or more times a day [20]. However, a study by Lian *et al*. [21] conducted among secondary school students showed that about 95.7% of the respondents brush their teeth at least twice per day. The decreased frequency of tooth brushing in the present study when compared to the study by Lian *et al* may be due to lack of knowledge on the significance of tooth brushing and its effect on dental health. The present study also revealed that majority of students 1771 (55.3%) had the habit of snacking between meals whereas 1429 (44.7%) did not snack between meals. This study also showed that majority of the students did not use mouth wash (91.9%). When analyzing habits and the prevalence of caries; it was higher in students who did not use mouthwash, used soft drinks daily and had a habit of pan chewing and snacking between meals. These findings may be due to the cariogenic sugars present in soft drinks and snacks and lack of knowledge that mouthwash prevents decay. Another observation in this study was prevalence of caries was more in students who brushed their teeth twice with brushes. This may be because majority in the sample group used faulty brushing techniques, in spite of brushing their teeth twice a day.

When analyzing the treatment needs amongst the different age groups, (Table 8), the need for oral prophylaxis was 42.84%, and one surface restoration was 55.28% when compared to other treatment needs. Dash *et al*. [22], Dhar *et al*. [23] and Saravanan *et al*. [24] had also found the higher need of restorative treatment. The present study also shows that 55.89% females required oral prophylaxis and 43.87% females required one surface restoration. These findings are contrary to the findings of Faizal Peediyakal *et al*. [7] where males showed higher percentage of treatment needs when compared to females. The contradictory results in our study may be due to the fact the females (1673) were more than males (1527) in our study group.

5. Conclusion

The overall prevalence of dental caries was found to be 66.13% in the study conducted in 16 Government Higher Secondary Schools in Calicut District. Students aged between 15 and 17 years from two schools each in urban and rural area in the respective four taluks were chosen.

- A total of 3200 students were examined out of which 1527 were males and 1673 were females. In age group 15 years, there were 158 males and 265 females. In age group 16 years, there were 741 males and 835 females and in age group 17years, there were 628 males and 573 females.
- The caries prevalence within age group 15, 16 and 17 was not statistically significant.
- The prevalence rate was statistically significant when gender was considered. Females exhibiting mean caries score 2.27 and males showing a mean score of 2.09.
- When caries experience was considered in Calicut district (urban versus rural), it was seen caries prevalence was slightly more in rural 67% when compared to urban 65%.
- Caries prevalence within the taluks showed a higher prevalence in Thamarassery urban (14.6%), followed by Vadakara urban (13.3. %), Kozhikode urban (11%) and the lowest in Quilandy urban (10.4%). In the rural group comparison, the highest prevalence was in Thamarasery (13.4%), followed by Vadakara (12.4%), Kozhikode (12.6%) and Quilandy (12.2%).
- When habits were analyzed, it was found that majority used brushes 98.8%, 1.1% used finger brushing, and 0.1% used other aids. Frequency of brushing once daily was found in44.2%, twice daily in 55.5% and 0.3% brushed between meals. Majority of the students 91.9% did not use mouth wash, whereas 8.1% used mouth wash. Habit of snacking between meals was found in 55.5%. Pan Masala usage was found in only 0.7% whereas majority 99.3% of the students did not use pan masala. Use of soft drinks once a day was found in 8.3%, 55.3% used once a week and 36.3% did not use soft drinks
- It was seen that 38.8% of the students did not need any treatment, whereas 5.28% needed two surface restoration, 55.8% required one surface restoration, 7.44% required RCT, 7.44% required crown, 6.44 required extraction,42.84% required oral prophylaxis, 6.28% required bridge and 1.38% required other treatment procedures like orthodontic procedures

The present study highlighted the extent of dental disease in this community. The prevalence of dental caries was high in Calicut district despite the good health care system in the state which reveals lacunae in the awareness of oral hygiene measures and its importance on oral health. The study revealed that decay component of DMFT index was high indicating that many carious teeth were left untreated. This implies an urgent need for awareness initiative for preventive dental health behavior and attitudes, and restorative treatments for the decayed teeth. An early first dental visit may ensure that the dentist can perform preventative measures such as the application of fluoride and fissure sealants, provide oral hygiene instructions, and motivate the parents and their children regarding proper oral hygiene maintenance and dietary control as well as importance of regular visits to the dentist. Parents should

also be made aware of brushing methods, usage of pit and fissure sealants, mouth wash and the importance of preventive measures for the child.

6. Acknowledgement
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