Frequency of Early Childhood Caries & Associated Factors in a Low Income Urban Community of Karachi

Faraz Siddiqui[1], Farzeen Tanwir[2], Syeda Natasha Zaidi[3], Nabeel Hafeez[4], Rizwan Ullah[5], Tauqeer BiBi[6]

Abstract

Objectives: The primary and secondary objective of the study was to determine the prevalence of Early Childhood Caries among 2-6 year old children living in a low income, urban community of Karachi and to describe oral health and hygiene in the study population showing association between Early Childhood Caries and anemia in 2-6 year old children, which was also the aim of our study.

Methods: A cross-sectional, community-based survey was conducted on a total of 409 children in Sultanabad between 2 and 6 years of age, Karachi. A preformed, structured questionnaire collected information on child related, parental, and household characteristics. Included participants were one child, either male or female, aged between 2 years and 6 years at the time of the survey and the family was a permanent resident of Sultanabad, who had been living in the same vicinity for at least the last 6 months. Exclusion criteria were children with dento-facial or skeletal deformities such as cleft lip/palate or any congenital dysplasia. Statistical procedures and analyses including descriptive analysis, uni-variate and multivariable modeling were all performed on STATA version 12.

Results: A total of 409 households from 6 blocks were surveyed from the community. The overall prevalence of Early Childhood Caries was 52.5% (95% CI: 47.7%-57.3%), which included 29.3% (25.0%-33.6%) mild/moderate Early Childhood Caries and 23.2% (19.2%-27.2%) severe Early Childhood Caries. Frequency was higher in older age groups and in male children. The zero-inflated negative binomial regression model identified the child's anaemic status to be associated with DMFT scores; we found significant association between mean DMFT scores and the presence of severe anaemia in children.

Conclusion: The study concluded that high burden of Early Childhood Caries in the community, most of which comprises decayed, untreated teeth. The findings add to the current evidence showing association between Early Childhood Caries and anaemia in 2-6 year old children.

Keywords: Early childhood caries, Anemia, prevalence, oral health,

IRB: Approved by the Ethical Review Committee. The Aga Khan University. Ref # 2760-CHS-ERC-13 Dated: 6th Janruary 2019

Citation: Siddiqui F, Tanwir F, Zaidi SN, Hafeez N, Rizwanullah, BiBi T. Frequency of Early Childhood Caries & Associated Factors in a Low Income Urban Community of Karachi [Onlne]. Annlas ASH & KMDC 2024;29(1): 27-38

(ASH & KMDC 2024; 29(1): 27-38)

Introduction

Early childhood caries (ECC) is a major oral health problem which affects infants and preschool children worldwide. It begins with white-spot lesions in the upper primary incisors along the margin of the gingiva. If the disease continues, it leads to complete destruction of the crown. The main risk factors in the development of ECC can be categorized as microbiological, dietary, and environmental risk factors[1] Being the major cause of oral pain and tooth loss, dental caries can affect both the permanent and primary dentition[2,] and has the ability to affect both the crown and root portions of the susceptible teeth[3]. From 6 months of age with the eruption of the lower incisor to approximately 6 years of age[4].

ECC is a severe health condition found among children living in socially disadvantaged communities in which malnutrition is a social and health dis

[1] Department of Health Sciences, University of York, United Kingdom.
[2] Department of Periodontology, Bahria University Health Sciences Campus (BUHSC),
[3] Department of Periodontology, Bahria University Health Sciences Campus (BUHSC),
[4] PNS Shifa Hospital, Department of Oral Surgery, Karachi.
[5] Department of Oral Biology, Sindh Institute of Oral Health Sciences, JSMU.
[6] Department of Periodontology, Bahria University Health Sciences Campus (BUHSC),

Correspondence: Dr. Farzeen Tanwir
Department of Periodontology, Bahria University Health Sciences Campus (BUHSC)
Email: farzeentanwir21@gmail.com
Date of submission: 20th December 2023
Date of Revision: 17th February 2024
Date of Acceptance: 26th February 2024

parity[5-7]; severe ECC is recognized as the presence of smooth surface caries in any region of the oral cavity[8].

According to the national nutrition survey of Pakistan, the country wide estimate of anemia frequency in 2-5 years old children was reported to be 61.9%, which included 57% with moderate anemia and 5% with severe anemia[9].

Anemia and severe caries can be associated. One hypothesis says that low hemoglobin levels in S-ECC (Severe early childhood caries) children may be attributed to the body's inflammatory response to chronic pulpitis. The later triggers a series of events that ultimately leads to production of cytokines which in turn may inhibit erythropoiesis and thus reduce the level of Hb in blood[10].

Pakistan being a third world country has low health facilities. ECC frequency was found to be influenced by socioeconomic status, dietary habits, and oral hygiene practices, underscoring the importance of targeted interventions in such communities.

This study was conducted in a multi-ethnic, low-income urban community of Karachi where no research on oral health of children has been conducted previously. Our aim was to gain new insight into factors associated with early childhood caries in such unprivileged settings. The findings can be used to gain research direction and program initiatives for oral health awareness with collaboration of local stakeholders.

Therefore, the objective of the study was to determine the prevalence of Early Childhood Caries among 2-6 year old children living in a low income, urban community of Karachi and to describe oral health and hygiene in the study population showing association between Early Childhood Caries and anemia in 2-6 year old children

Methodology

An analytical, cross sectional study design was used to address the primary and secondary research objectives. The study population comprises children of Sultanabad, Karachi between 2 and 6 years of age. Child, either male or female, aged between 2 years and 6 years at the time of the survey and the family was a permanent resident of Sultanabad, who had been living in the vicinity for at least 6 months. Children with dento-facial or skeletal deformities such as cleft lip/palate or any congenital dysplasia and any children suffering from severe childhood illnesses or those having mental retardation were excluded from the study. The Study was approved by the Ethics Review committee of The Aga Khan University, Karachi. 2760-CHS-ERC30.

Eligible households were included in the survey. A preformed, structured questionnaire was given to the mother to collect information on child related and parental household characteristics. Physical examinations were done for each child which included measurement of height and weight assessment for anemia using a point of care testing method and a detailed dental examination using disposable dental examination kits.

A structured questionnaire was used for data collection. The questionnaire comprised three separate sections. Section 1 contained questions on child related characteristics. Section 2 contained questions relating to parental and household characteristics. Section 3 was used to record physical examination which included height and weight. It also includes a written consent from the parents.

Blood samples were obtained to detect the presence of anemia in children using a point of care testing device. (Hemocue201)[4].

Sterile, disposable dental examination kits containing a mirror, dental probe and tweezers were used for children and, wooden tongue depressors were used to examine mothers.

A dental surgeon conducted clinical examination of the child's oral cavity at the home, to detect dental caries using a dental probe and mirror. They were also trained on how to collect a child's anthropometric measurements using height and weight scales as well as assessment of child's hemoglobin level using the Hemocue system. The blood was

drawn using a finger prick technique using the middle finger of the child. Capillary blood was sampled on to a microcuvette from the second or third drop of blood which was extruded and was placed in the Hemcoue. Readings were obtained in grams per deciliter. All operating procedures were standardized in accordance with guidelines for Hemocue use.

Statistical procedures and analyses including descriptive analysis, uni-variate and multivariable modeling were all performed on STATA version 12.1.

Results*:*

A total of 1319 households were approached in a house to house survey, of which 651 households were found to be eligible. Of these, 236 households did not participate. 6 households were excluded after they were surveyed due to violation of eligibility. Thus, data from 409 households was available for statistical analysis. The flow diagram for data collection is presented in Figure 1.

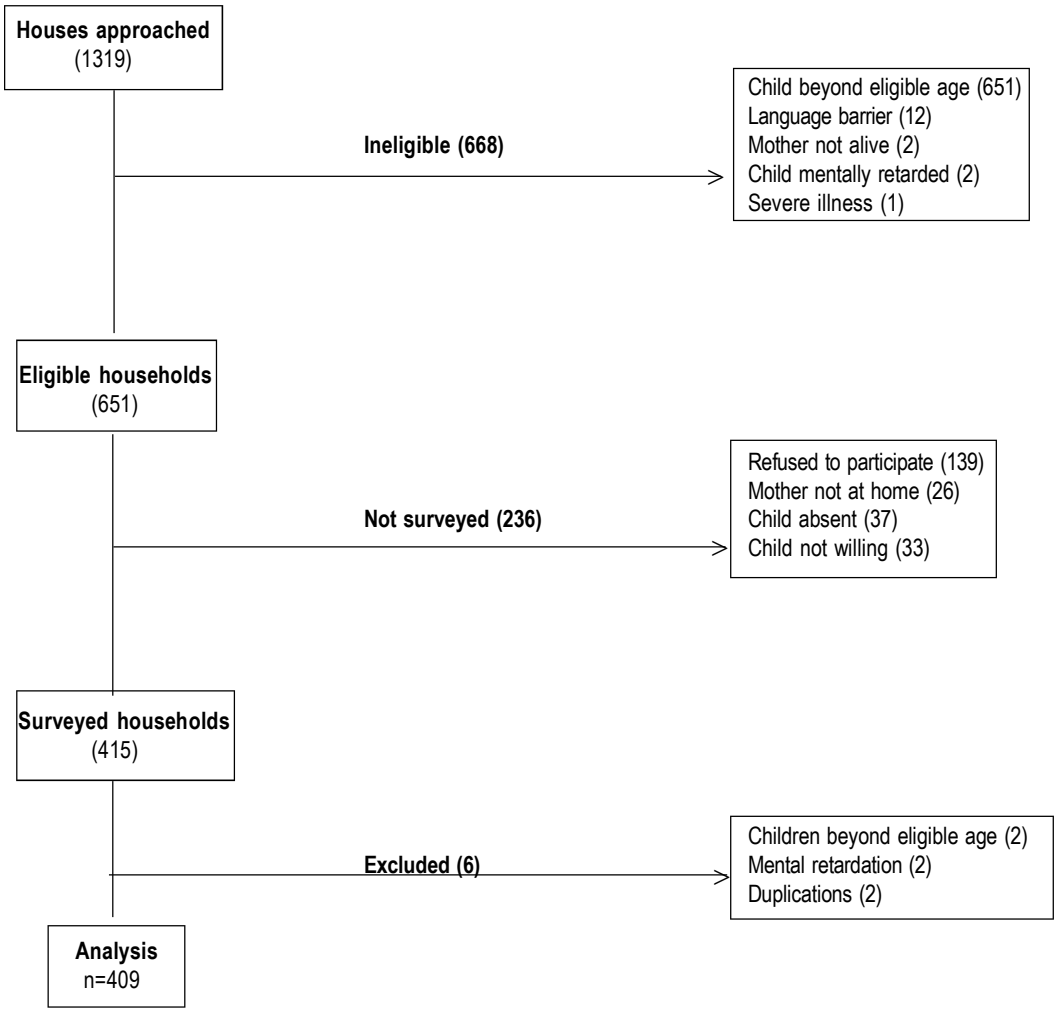

Fig 1. Flow diagram for data collection

The sociodemographic and household characteristics are presented in Table 1

Table 1. Socio-demographic and household characteristics of 2-6 year old children in Sultanabad, Karachi (n=409)

		n	%
Child's age			
	24-35 months	69	16.8
	36-47 months	116	28.3
	48-59 months	122	29.8
	60-71 months	102	24.9
	Mean age of children (SD) (in months)	47. 6	(12.4)
Sex			
	Male	196	47.9
	Female	213	52.1
Birth order of child			
	1st	134	32.7
	2nd	95	23.2
	3rd	85	20.8
	4th	47	11.5
	5th or higher	48	11.8
Maternal schooling (years of formal education)		141	34.5
	No schooling	25	6.1
	1-5 years	90	22.0
	6-8 years	86	21.0
	9-10 years	67	16.4
	11 years and above		
Father's schooling (years of formal education)			
	No schooling	52	12.7
	1-5 years	7	1.7
	6-8 years	69	16.9
	9-10 years	147	35.9
	11 years and above	134	32.8
Father's occupation			
	White collar	26	6.4
	Blue collar	321	79.8
	Self employed	39	9.7
	Unemployed/retired	16	3.9
Ethnicity [a]			
	Pashto	165	40.3
	Hindko	153	37.4
	Punjabi/seraiki	52	12.7
	Others	39	9.5
House ownership			
	Owned	214	52.4
	Rented	195	47.6
Family setup			
	Nuclear	225	55.1
	Joint	184	44.9

Ownership of transport vehicles [b]			
	Motorcycle	132	32.3
	Rickshaw/chingchi	24	5.9
	Commercial wagon/truck	18	4.4
	Bicycle	11	2.7
	Car	8	1.9
Ownership of household items [b]			
	Mobile phone	400	97.8
	Iron	395	96.6
	Television	352	86.1
	Washing machine	307	75.1
	Desktop Computer	73	17.9
	Microwave oven	21	5.1
	Air conditioner	19	4.6
	DVD player	9	2.2
	Deep freezer	6	1.5

[a] Kashmiri, Urdu speaking and Balochi categorized as “others”

[b] Reported as number and % of households having ownership for each item

The frequency of ECC and the of distribution of Decayed, missing and filled teeth for the overall study participants, as well within categories of age and sex are presented in **Tables 2 and 2(a)**.

Table 2. Frequency (95%) of early childhood caries among 2-6 year old children in Sultanabad (n=409)

Category	N	ECC% (95% CI)	Mild/moderate ECC [a]% (95% CI)	Severe ECC [b]% (95% CI)
Overall	409	52.5% (47.7%, 57.3%)	29.3% (25.0%, 33.6%)	23.2% (19.2%, 27.2%)
Child’s Age 24-35 months 36-47 months48-59 months60 & above				
	69	40.5% (35.7%, 45.2%)	28.9% (24.9%, 32.9%)	11.6% (8.9%, 14.6%)
	116	49.1% (44.3%, 53.9%)	26.7% (22.5%, 30.9%)	23.8% (19.8%, 27.8%)
	122	51.6% (46.8%, 56.4%)	27.8% (23.5%, 32.1%)	22.4% (18.4%, 26.4%)
	102	65.6% (61%, 70.2%)	34.3% (29.8%, 38.8%)	31.3% (26.9%, 35.7%)
Sex				
Male	196	55.6% (50.1%, 59.8%)	28.6% (24.3%, 32.9%)	27.0% (22.7%, 31.3%)
female	213	49.7% (44.2%, 53.8%)	30.0% (25.6%, 34.4%)	19.7% (15.9%, 23.5%)

[a] mild/moderate ECC is defined as having “The presence of at least 1 or more decayed, missing or filled tooth surfaces in any primary tooth for a child below 6 years of age

[b] Severe early childhood caries (S-ECC) is defined as “the presence of 1 or more decayed, missing or filled maxillary anterior teeth or a decayed, missing and filled tooth (DMFT) score of greater $\geq$4 for age $\geq$3 years (36-47 months), $\geq$5 for age $\geq$ 4 years (48-59 months), or $\geq$6 for age $\geq$ 5years/60-71 months). In children less than 3 years of age (24-36 months), any sign of smooth-surface caries is indicative of S-ECC.

Table 2(a). Distribution of decayed, missing and filled teeth among 2-6 year old children in Sultanabad (n=409)

	n	Mean DMFT(SD)	Children With Decayed Teeth n (%)	Children with missing teeth n (%)	Children with filled teeth n (%)
Overall	409		214 (52.3%)	7 (1.7%)	2 (0.5%)
Overall Mean(SD)[a]		2.08(2.9)	2.04 (2.9)	0.03 (0.3)	0.004 (0.07)
Child's Age					
24-35 months	69	0.98 (1.9)	28 (40.5%)	1(1.4%)	
36-47 months	116	1.67 (2.4)	56 (48.3%)	1(0.9%)	-1 (0.8%)
48-59 months	122	1.99 (2.9)	63 (51.6%)	1(0.8%)	
60-71 months	102	3.42 (3.7)	67 (65.6%)	4(3.9%)	-1 (0.9%)
Sex					
Male	196	2.44 (3.3)	109 (55.6%)	6(3.1%)	1 (0.4%)
female	213	1.76 (2.6)	105 (49.3%)	1(3.1%)	-2 (0.9%)

[a] mean DMFT, decayed, missing and filled teeth for all study participants (n=409)

The overall frequency of ECC in 2-6 year old children in Sultanabad was 52.5%, with a mean DMFT score of 2.08 $\pm$ 2.9. Within the 52.5% of children with ECC, 29.3% of the surveyed children were affected with mild to moderate form of ECC, whereas 23.2% of the children were suffering from severe ECC.

Similarly, the DMFT scores were also higher for each increase in the age category.

In contrast, frequency of Severe ECC was higher in males at 27% compared to females

The oral health status and oral hygiene habits of 2-6 years old children are presented in **Table 3.**

Table 3. Oral health status and oral hygiene habits of 2-6 years old children in Sultanabad (n=409)

	n	**%**
Child's Debris score		
0 (good)	151	36.9
0.1-0.5 (acceptable)	102	25.0
0.6-1.0 (unsatisfactory)	90	22.0
>1.0(poor)	66	16.1
Mean Debris score(SD)	0.34	(0.38)
Presence of enamel defects on primary tooth surfaces		
None	386	94.4
Hypoplasia	11	2.7
Demarcated opacity	3	0.7
Diffuse opacity	1	0.2
More than 1 enamel defect present	8	1.9
Presence of dental fluorosis on primaryTooth surfaces		
Absent	396	96.8
Present	13	3.2

Frequency of cleaning		
Daily	143	34.9
Less than once daily	96	23.4
never	170	41.5 ~~41.5~~
Method of cleaning child's teeth [a, b]		
Toothpaste	224	54.8
Other methods	15	3.74
Not applicable	170	41.5
Maternal assistance/supervision during teeth cleaning [b]		
Yes	52	12.7
No	187	45.8
Not applicable	170	41.5
Mother's oral hygiene index		
0-0.5 (good)	98	24.0
0.6-1.0 (acceptable)	130	31.7
1.1-1.5 (mild/moderate)	89	21.8
1.6-2.0 (unsatisfactory)	43	10.5
>2.0 (poor)	49	12.0
Mean mothers' OHI score (SD)	1.51	(2.7)

[a] Miswak, plain water, manjhan and tooth powder categorized as "other methods"

[b] "not applicable" includes children who were reported not to clean their teeth at all.

The unadjusted beta-coefficients with their standard errors, along with mean DMFT ratios and their 95% confidence intervals are provided in **Table 3a.**

Table 3a. Unadjusted â- coefficients (SE) of log of mean DMFT scores) and mean DMFT score ratios (95% CI) for factors associated with ECC using zero-inflated negative binomial regression (n=409)

	Unadjusted â (SE)	$e^{â}$ (95% Confidence Intervals)
Anemic status (using Hb level) [b]		
Normal (ref*)*		
Mild anemia	-0.08 (0.20)	10.92 (0.62 – 1.37)
Moderate anemia	0.08 (0.08)	1.08 (0.80 – 1.47)
Severe anemia	0.60 (0.25)	1.82 (1.11 – 2.99)
Child's age		
24-35 months (ref)		
36-47 months	0.53 (0.22)	11.7 (1.10 – 2.63)
48-59 months	0.70 (0.21)	2.02 (1.31 – 3.10)
60-71 months	1.12 (0.21)	3.07 (2.00 – 4.69)
Sex		
Female (ref)		1
Male	0.30 (0.13)	1.35 (1.04 -1.74)
Birth order		
First (ref)		1
Middle/last	0.34 (0.15)	1.41 (1.05 – 1.90)

Duration of breastfeeding		
Never breastfed (ref)		1
Up to 6 months	0.30 (0.29)	1.35 (0.76 – 2.40)
7-12 months	-0.59 (0.28)	0.55 (0.31 – 0.97)
13-18 months	-0.46 (0.24)	0.63 (0.38 – 1.02)
19-24 months	-0.20 (0.19)	0.81 (0.56 – 1.18)
>24 months	-0.49 (0.30)	0.63 (0.33 – 1.11)
Bottle use		
current *(ref)*		1
\Past use	0.39 (0.20)	1.48 (0.99 – 2.23)
Never	0.31 (0.19)	1.37 (0.94 – 2.00)
Child's Debris score		
0 (good) (ref*)*		1
0.1-0.5 (acceptable)	0.43 (0.17)	1.54 (1.08 – 2.19)
0.6-1.0 (unsatisfactory)	0.82 (0.20)	2.28 (1.53 – 3.39)
≥1.0(poor)	1.01 (0.33)	3.00 (1.55 – 5.81)
Maternal age (years)	0.02 (0.01)	1.02 (0.99 – 1.04)
Maternal schooling (years of formal education)1		
1 years and above (ref*)*		1
9-10 years	0.31 (0.22)	1.86 (1.17 – 2.96)
6-8 years	0.08 (0.34)	1.65 (1.03 – 2.62)
1-5 years	0.50 (0.23)	1.08 (0.55 – 2.12)
No schooling	0.62 (0.23)	1.37 (0.88 – 2.12)
Mothers oral hygiene index score		
0-0.5 (good) *(ref)*		1
0.6-1.0 (acceptable)	0.31 (0.22)	1.19 (0.84 – 1.67)
1.1-1.5 (mild/moderate)	0.17 (0.17)	1.43 (0.99 – 2.06)
1.6-2.0 (unsatisfactory)	0.52 (0.24)	1.69 (1.04 – 2.75)
>2.0 (poor)	0.49 (0.22)	1.63 (1.04 – 2.55)
Household size		
<5 *(ref)*More than 5	0.28 (0.14)	11.33 (1.00 -1.77)
ratios (95% CI)		
negative binomial regression (n=409)		
Frequency of Plain biscuits Consumption		
Never/<1 per month (ref)		1
At least 1/week	-0.19 (0.21)	0.82 (0.53 – 1.26)
At least 1/day	0.17 (0.14)	1.19 (0.90 – 1.57)
Frequency of Cream biscuits consumption		
Never/<1 per month (ref)		1
At least 1/week	-0.20 (0.20)	0.81 (0.54 – 1.20)
At least 1/day	0.20 (0.14)	1.22 (0.92 – 1.63)
Frequency of Sheermal consumption		
Never/<1 per month (ref)		1
At least 1/week	1.27 (0.87)	3.57 (0.64 – 19.76)
Frequency of sweetened yoghurt (Dahi cheeni) consumption		
Never/<1 per month (ref)		1
At least 1/week	0.49 (0.15)	1.63 (1.20 – 2.21)
At least 1/day	-0.15 (0.18)	0.85 (0.59 – 1.21)

Frequency of betelnut (chalia) consumption		
Never/<1 per month (ref)		1
At least 1/week	0.54(0.53)	1.72 (0.60 – 4.95)
At least 1/day	0.78 (0.52)	2.20 (0.78 – 6.18)
Frequency of Cold drink consumption		
Never/<1 per month (ref)		1
At least 1/week	0.25 (0.15)	1.28 (0.95 – 1.73)
At least 1/day	0.72 (0.30)	2.07 (1.13 – 3.79)

Using the zero inflated negative binomial regression with DMFT scores as the dependent variable, a total of 17 factors were significant in the uni-variate analysis having a p-value less than 0.20. Among child related factors, this included anemic status of the child, the child's age, sex, birth sequence, duration of breastfeeding and bottle use. Among parental and household characteristics, maternal age, the mother's schooling and household size were associated.

Mean DMFT ratios along with their 95% confidence intervals for variables included in the final model are presented in Table 3b.

Table 3b. Adjusted â- coefficients (SE) of log of mean DMFT scores and mean DMFT ratios (95% CI) for factors associated with ECC using zero-inflated negative binomial regression (n=409)

		Adjusted â (SE)	$e^{â}$ (95% Confidence Intervals)
Anemic status (using Hb level) [b]			
	Normal (ref)		1
	Mild anemia	0.08 (0.18)	1.05 (0.73 – 1.52)
	Moderate anemia	0.142 (0.14)	1.17 (0.88 – 1.56)
	Severe anemia	0.785 (0.23)	2.23 (1.42 – 3.51)
Child's age			
	24-35 months (ref)		1
	36-47 months	0.67 (0.22)	2.06 (1.33 – 3.17)
	48-59 months	0.82 (0.21)	2.46 (1.60 – 3.79)
	60-71 months	1.02 (0.21)	2.97 (1.96 – 4.52)
Sex			
	Female (ref)		1
	Male	0.50 (0.12)	1.35 (1.04 – 1.74)
Child's Debris score			
	0 (good) (ref)		1
	0.1-0.5 (acceptable	0.15 (0.16)	1.06 (0.74-1.51)
	)0.6-1.0 (unsatisfactory)	0.44 (0.17)	1.56 (1.10-2.22)
	≥1.0(poor	0.70 (0.27)	1.50 (1.04-2.18)
Frequency of Consumption of sweetened yoghurt			
	Never/less than 1 per month (ref)		1
	≥1/week	0.41 (0.14)	1.43 (1.08 – 1.91)
	≥1/day	-0.26 (0.17)	0.76 (0.54 – 1.06)
Household size≤5 persons (ref)			1
	>5 persons	0.28 (0.12)	1.33 (1.03-1.71)
Constant		-0.80 (0.34)	

Log likelihood= -724.49
Vuong test p-value: 0.02

In the final model, the null hypothesis of the Vuong test was rejected (p=0.02), indicating that the zero inflated model was better than the negative binomial to account for the excessive zeros.

Discussion

Our study reports the frequency of ECC and the factors associated with caries severity in 2-6 year old children of a typical low income, urban community of Karachi. In our analyses, we used the DMFT score of children as a measure of caries severity in children and found a significant relationship between caries severity and anemia[11], other factors were also significantly associated with ECC in our study population. These factors include the child's age and sex, debris index score, household size and the consumption of sweetened yoghurt [12].

The overall frequency of ECC in our study population was 52.5%. This included 29.3% mild to moderate ECC while the prevalence of severe ECC was 23.2%. Our findings were comparable to those of Dawani et al,[13], who conducted a survey of preschool children in selected schools of Saddar and estimated the prevalence of ECC at 51%. In contrast, our estimates were higher than that reported by Sufia et al., who reported an overall frequency of 40% in selected rural and urban sites of Lahore, and Charania et al[14], reported a frequency of 29% among 3 to 5 year old children enrolled in selected kindergartens in the Clifton, a high income area of Karachi.[15] Possible reasons for a higher prevalence in our survey could be due to differences in population characteristics. Our study was conducted in a low income community, where frequency of ECC tends to be higher than in more affluent settings [16]. In our study, both the frequency and severity of ECC were greater than studies conducted previously. Most of the frequency was accounted for by untreated, decayed teeth, and is consistent with reports from other developing countries [17]

Trained dentists examined the children's teeth using sterile, disposable dental equipment is strength of our study. We also calculated the daily iron intake in order to adjust for the differences in iron intake among children. The overall iron intake among children was low in our study population and did not differ with the severity of caries, therefore not included in our model[18]. In our adjusted analysis, mean DMFTs were higher in each category of anemia, showing a dose response relationship. The strength of association improved in each category after adjustment on other co-variates. highest severity of caries was observed in children with severe anemia, who had mean DMFT scores which were more than 2 times higher compared to normal children[19] Our hypothesis was to detect a higher proportion of anemia in ECC children using ECC as a dichotomous variable. Through modeling caries severity on the basis of DMFT scores, we were still able to find an association that supports our hypothesis[20]. The association between ECC and anemia has been discussed in a few articles that suggest pathways through which tooth related diseases may affect general health[21]. These include shared risk factors, bacterial dissemination and stimulation of inflammatory mediators caused by infections in the teeth and Periodontium[11].

To date, only a few studies have discussed the association between caries and anemia in children. Clarke et al observed higher prevalence of iron deficiency anemia in children with ECC, compared to population reference values[22]. Schroth colleagues compared Severe ECC children with caries free children and found lower mean Hb in children with Severe ECC, and 6 times greater odds of iron deficiency anemia compared to caries free children[23]. Similarly, Tang and colleagues reported more than 7 times greater odds of anemia in children with higher number of carious tooth surfaces ($\geq$35 DEFS) compared to those having lesser number of affected tooth surfaces (<35 DEFS)[23]. Study used a different modelling approach and observed that caries severity is higher in children with anemia, which is consistent with these previous studies[24]

Our information was collected through the child's mother, this was an advantage as direct interaction was done. Our study was conducted within a single community, due to which we cannot translate our findings to other low income communities.

Small sample size and cross sectional design were the limitations of study.

The burden of ECC among 2-6 year old children in Sultanabad is higher than most previously reported local and regional estimates. We observed oral hygiene practices to be inadequate in the surveyed population, and found a number of factors to be associated with ECC. In particular, our study highlighted the association between increasing caries severity and the presence of anemia in children. The findings of our study can be translated into the following recommendations.

Research efforts should emphasize on obtaining more generalizable estimates through larger, community based studies. Studying ECC in a broader population with a diverse set of socioeconomic and ethnic backgrounds will expand our knowledge regarding the associated factors in our communities.

Conclusion:

The study concluded that high burden of Early Childhood Caries in the community, most of which comprises decayed, untreated teeth. The findings add to the current evidence showing association between Early Childhood Caries and anaemia in 2-6 year old children.

Conflict of Interest

Authors have no conflict of interest and no grant funding from any organization.

References

1. Anil S, Anand PS. Early childhood caries: prevalence, risk factors, and prevention. Front Pediatr 2017;5:157. [DOI: 10.3389/fped.2017.00157]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5514393/pdf/fped-05-00157.pdf. Accessed on 20th February 2024.
2. Featherstone JD. The science and practice of caries prevention. J Am Dent Assoc 2019;131(7):887-99. [DOI:0.14219/jada.archive.2000.0307]. Available from: https://jada.ada.org/article/S0002-8177(14)62673-8/abstract. Accessed on 20th February 2024.
3. Fejerskov O, Kidd EAM, Fejerskov OLE. Dental caries. Blackwell Munksgaard; 2013. Avalabel from: https://www.wiley.com/en-ca/Dental+Caries%3A+The+Disease+and+its+Clinical+Management%2C+3rd+Edition-p-9781118935828. Accessed on 20th February 2024.
4. Nelson SJ. Wheeler's dental anatomy, physiology and occlusion. Elsevier Health Sciences; 2019. Avalabel from: https://shop.elsevier.com/books/wheelers-dental-anatomy-physiology-and-occlusion/nelson/978-0-323-63878-4. Accessed on 20th February 2024.
5. De Grauwe A, Aps JK, Martens LC. Early childhood caries (ECC): what's in a name? Eur J Paediatr Dent 2004;5(2):62–70. Available from: https://pubmed.ncbi.nlm.nih.gov/15198622/. Accessed on 20th February 2024.
6. Ripa LW. Nursing caries: a comprehensive review. Pediatr Dent 2017;10(4):268-82. Available from: https://www.aapd.org/globalassets/media/publications/archives/ripa-10-04.pdf. Accessed on 20th February 2024.
7. Feldens CA, Giugliani ER, Duncan BB, Drachler Mde L, Vitolo MR. Long-term effectiveness of a nutritional program in reducing early childhood caries: a randomized trial. Community Dent Oral Epidemiol (2019) 38(4):324–32. [DOI:10.1111/j.1600-0528.2010.00540.x]. Available from: https://onlinelibrary.wiley.com/doi/10.1111/j.1600-0528.2010.00540.x. Accessed on 20th February 2024.
8. Schroth RJ, Halchuk S, Star L. Prevalence and risk factors of caregiver reported Severe Early Childhood Caries in Manitoba First Nations children: results from the RHS Phase 2 (2018-2020). Int J Circumpolar Health 2013;72(1):1-10. [DOI: 10.3402/ijch.v72i0.21167]. Available from: https://www.tandfonline.com/doi/epdf/10.3402/ijch.v72i0.21167?needAccess=true. Accessed on 20th February 2024.
9. Bansal K, Goyal M, Dhingra R. Association of severe early childhood caries with iron deficiency anemia. J Indian Soc Prev Dent 2016;34(1):36. [DOI: 10.4103/0970-4388.175508]. Available from: https://pubmed.ncbi.nlm.nih.gov/26838146/. Accessed on 20th February 2024.
10. Mohamed WE, Abou El Fadl RK, Thabet RA, Helmi M, Kamal SH. Iron deficiency anaemia and early childhood caries: a cross sectional study. Aust Dent J 2023;66:S27-36. [DOI: 10.1111/adj.12842]. Available from: https://onlinelibrary.wiley.com/doi/10.1111/adj.12842. Accessed on 20th February 2024.
11. Dawani N, Nisar N, Khan N, Syed S, Tanweer N. Prevalence and factors related to dental caries among pre-school children of Saddar town, Karachi, Pakistan: a cross-sectional study. BMC Oral Health 2018;12(1):1-9. [DOI: 10.1186/1472-6831-12-59]. Available from: https://bmcoralhealth.biomedcentral.com/articles/10.1186/1472-6831-12-59. Accessed on 20th February 2024.

12. Perera PJ, Abeyweera NT, Fernando MP, Warnakulasuriya TD, Ranathunga N. Prevalence of dental caries among a cohort of preschool children living in Gampaha district, Sri Lanka: A descriptive cross sectional study. BMC Oral Health 2020;12(1):1-6. [DOI: 10.1186/1472-6831-12-49]. Available from: https://bmcoralhealth.biomedcentral.com/articles/10.1186/1472-6831-12-49. Accessed on 20th February 2024.

13. Slabsinskiene E, Milciuviene S, Narbutaite J, Vasiliauskiene I, Andruskeviciene V, Bendoraitiene EA et al. Severe early childhood caries and behavioral risk factors among 3-year-old children in Lithuania. Medicina (Kaunas) 2010;46(2):135-41. Available from: https://medicina.lsmuni.lt/med/1002/1002-09e.htm. Accessed on 20th February 2024

14. Adam I, Ahmed S, Mahmoud MH, Mohammed I Yassin. Comparison of HemoCue® hemoglobinmeter and automated hematology analyzer in measurement of hemoglobin levels in pregnant women at Khartoum hospital, Sudan. Diagn Pathol 2019;7:1-6. [DOI: 10.1186/1746-1596-7-30]. Available from: https://diagnosticpathology.biomedcentral.com/articles/10.1186/1746-1596-7-30. Accessed on 20th February 2024.

15. Gale. Dental Examination, Gale Encyclopedia of Nursing and Allied Health. Available from: https://www.gale.com/nursing-and-allied-health. Accessed on 20th February 2024.

16. Mushtaq MU, Gull S, Khurshid U, Shahid U, Shad MA, Siddiqui AM. Prevalence and socio-demographic correlates of stunting and thinness among Pakistani primary school children. BMC Public Health 2011;11:1-11. [DOI: 10.1186/1471-2458-11-790]. Available from: https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-11-790. Accessed on 20th February 2024.

17. Neufeld LM, Larson LM, Kurpad A, Mburu S, Martorell R, Brown KH. Hemoglobin concentration and anemia diagnosis invenous and capillary blood: biological basis and policy implications. Ann N Y Acad Sci 2019;1450(1):172-89. [DOI:10.1111/nyas.14139]. Available from: https://nyaspubs.onlinelibrary.wiley.com/doi/10.1111/nyas.14139. Accessed on 20th February 2024.

18. Mejía-Rodríguez F, Villalpando S, Shamah-Levy T, García-Guerra A, Humarán IMG, la Cruz-Góngora V De. Prevalence of ironde ciency was stable and anemia increased during 12 years (2006–2018) in Mexican women 20–49 years of age. Salud Publica Mex 2021;63:401-11. [DOI:10.21149/1215]. Available form: https://pubmed.ncbi.nlm.nih.gov/34098613/. Accessed on 20th February 2024.

19. Hruschka DJ, Williams AM, Mei Z, Leidman E, Suchdev PS, Young MF, et al. Comparing hemoglobin distributions between population-based surveys matched by country and time. BMC Public Health 2020;20(1):1-10 . [DOI:10.1186/s12889-020]. Available from: https://bmcpublic health .biomedcentral.com/articles/10.1186/s12889-020-08537-4. Accessed on 20th February 2024.

20. Palmer CA, Kent R, Loo CY, et al. Diet and Caries-associated Bacteria in Severe Early Childhood Caries. Journal of Dental Research 2010;89(11):1224-29. [DOI:10.1177/0022034510376543]. Available from: https://bmcpublic health. biomedcentral.com/articles/10.1186/s12889-020-08537-4. Accessed on 20th February 2024.

21. Schroth RJ, Levi J, Kliewer E, Friel J, Moffatt MEK. Association between iron status, iron deficiency anaemia, and severe early childhood caries: a case control study. BMC pediatrics. 2023;13(1):1-7. [DOI: 10.1186/1471-2431-13-22]. Available from: https://bmcpediatr.biomedcentral.com/articles/10.1186/1471-2431-13-22. Accessed on 20th February 2024.

22. Easwaran HN, Annadurai A, Muthu MS, Sharma A, Patil SS, Jayakumar P et al. Early Childhood Caries and Iron Deficiency Anaemia: A Systematic Review and Meta-Analysis. Caries Res 2022; 56(1):36-46. [DOI: 10.1159/000520442]. Available from: https://karger.com/cre/article/56/1/36/822507/Early-Childhood-Caries-and-Iron-Deficiency-Anaemia. Accessed on 20th February 2024.

23. Amrollahi N, Tarrahi M J. Iron Deficiency Anemia in Children with and Without Dental Caries: A Systematic Review and Meta-Analysis. Iran J Pediatr. 2022;32(4):1-10. [DOI:10.5812/ijp-124071]. Available from: https://brieflands.com/articles/ijp-124071. Accessed on 20th February 2024.

24. Özyýlkan D, Tosun Ö, Ýslam A. The Impact of Anemia-Related Early Childhood Caries on Parents' and Children's Quality of Life. *Medicina* 2023;59(3):1-17. [DOI: 10.3390/medicina59030521]. available from: https://www.mdpi.com/1648-9144/59/3/521. Accessed on 20th February 2024.