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Article

Reshuffling the Risk Factors of Severe Early Childhood Caries

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Abstract: Severe early childhood caries remains the most common chronic disease affecting children. .Its multifactorial etiology lead to the controversy about which risk factors were more significant to its development. Therefore our study aimed through meticulous statistical analysis to arrange the "well agreed upon" common risk factors in order of significance to aid the clinician in tailoring an adequate preventive program for this affected age group. The study concluded that the risk factors contributing to severe early childhood caries in order of their significance were Night feeding, On demand feeding, Mother's Employment, Mother's caries Experience, Starting age of brushing, Mother's education, Sharing utensils, Child's first dental visit, Number of siblings, Brushing frequency, Sweetened food and beverage consumption, Sweetened beverages, and at last the snacking frequency.

Keywords: severe early childhood caries; risk factors

1. Introduction

Early childhood caries (ECC) remains a major unresolved dental public health problem in developing as well as developed countries, despite the continuous trials for implementation of preventive strategies [1, 2].The decline in the prevalence of ECC among children in developed countries cannot be denied but it is progressing at epidemic proportions in low middle income countries. [3,4].

It has been established in literature, that any child younger than 6 years of age presenting with at least one tooth which is decayed (cavitated or non-cavitated), missing (due to caries) or filled tooth surfaces in any primary tooth is suffering from ECC. When the child is younger the condition is considered to be more severe and hence the nomenclature "Severe early childhood caries (S-ECC)" [5]

Children with neglected S-ECC have a higher risk of developing new carious lesions, also untreated lesions may lead to complications such as pain, missing school days ,compromised eating habits, low self-esteem, which will all adversely affect the children's well-being and their oral health-related quality of life (OHQoL) .[6,7]

The risk indicators for the presence of dental caries in young children are far from a handful; in a systematic review, almost 90 risk factors were described [8].This complex etiology of S-ECC has intrigued researchers to dig deeper into the various risk factors involved such as feeding [9].and oral hygiene practices [10].*Streptococcus mutans* levels, active dental problems in

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parents/caregivers[11]. and socioeconomic status [12].which all apparently contribute to the risk of developing the disease.

Also, the required treatment costs and expertise of highly skilled professionals needed to treat the disease, made it necessary to trace the most contributing risk factors of the disease, which in accordance will enable us to follow a preventive economic approach to combat the disease. [7].

Besides variations and confounders from different samples as well as the study design itself ,the statistical analysis techniques may lead to different conclusions As It would be impossible to ignore the multifactorial nature of ECC therefore we designed this study to reshuffle the order of significance of the most identified risk factors..

2. Results

Chi square was performed on variables in each of the four assigned domains.(Tables 1-4)

Table (1): Comparison between children with ECC and ECC free regards socio-demographic characteristics

Socio-demographic ccc		*ECC free (n=50)*	*ECC (n=90)*	X^2	*P value*	*Sig.*
Age	*2-3yrs*	*32(43.2%)*	*42(56.8%)*	*3.88*	*0.049*	*S*
	3-4yrs	*18(27.3%)*	*48(72.7%)*			
Gender	*Female*	*33(47.8%)*	*36(52.2%)*	*8.69*	*0.003*	*HS*
	Male	*17(23.9%)*	*54(76.1%)*			
Mother education	*School*	*6(9.7%)*	*56(90.3%)*	*32.86*	*<0.001*	*HS*
	Higher	*44(56.4%)*	*34(43.6%)*			
Father education	*School*	*8(21.1%)*	*30(78.9%)*	*4.88*	*0.027*	*S*
	Higher	*42(41.2%)*	*60(58.8%)*			
Child1st dental visit	*None*	*4(8.3%)*	*44(91.7%)*	*42.56**	*<0.001*	*HS*
	Early	*35(68.6%)*	*16(31.4%)*			
	Late	*11(26.8%)*	*30(73.2%)*			

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Mother caries experience	*Free*	*37(77.1%)*	*11(22.9%)*	*54.45*	*<0.001*	*HS*
	Carious	*13(14.1%)*	*79(85.9%)*			
Sibling	*Zero*	*21(75.0%)*	*7(25.0%)*	*37.97**	*<0.001*	*HS*
	One	*19(47.5%)*	*21(52.5%)*			
	Two	*9(19.1%)*	*38(80.9%)*			
	Three	*1(5.9%)*	*16(94.1%)*			
	Four	*0*	*8(100.0%)*			

*Chi-Square Test, Fisher's exact Chi-Square test**

There were statistically significant differences, between children with ECC and caries free children in all socio-demographic data

Table (2): Comparison between children with ECC and ECC free regards Oral hygiene practices.

Oral hygiene practices		*ECC free (n=50)*	*ECC (n=90)*	X^2	*P value*	*Sig.*
Brushing frequency	*Never*	*1(3.8%)*	*25(96.2%)*	*38.48**	*<0.001*	*HS*
	1-2/wk	*2(7.1%)*	*26(92.9%)*			
	1/day	*29(54.7%)*	*24(45.3%)*			
	2/day	*18(54.5%)*	*15(45.5%)*			
Brushing time	*Night*	*34(58.6%)*	*24(41.4%)*	*28.51**	*<0.001*	*HS*
	other	*15(26.8%)*	*41(73.2%)*			
	never	*1(3.8%)*	*25(96.2%)*			
Who Brush	*Never*	*0*	*26(100.0%)*	*61.17**	*<0.001*	*HS*
	Himself	*3(7.3%)*	*38(92.7%)*			
	Mother	*47(64.4%)*	*26(35.6%)*			

*Chi-Square Test, Fisher's exact Chi-Square test**

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As regards to oral hygiene practices, there was a highly significant statistical differences, between children with ECC and caries free children in all the studied aspects.

In ECC the higher percentage of children never brushed or employed self-brushing only once or twice a week

Table (3): Comparison between children with ECC and ECC free regards feeding practices

Feeding practices		*ECC free (n=50)*	*ECC (n=90)*	X^2	*P value*	*Sig.*
Feeding mode	*Breast*	*38(36.5%)*	*66(63.5%)*	*0.12*	*0.729*	*NS*
	Bottle	*12(33.3%)*	*24(66.7%)*			
	Mixed	*0*	*0*			
On demand	*No*	*31(70.5%)*	*13(29.5%)*	*33.73*	*<0.001*	*HS*
	Yes	*19(19.8%)*	*77(80.2%)*			
Night feeding	*No*	*29(90.6%)*	*3(9.4%)*	*54.48**	*<0.001*	*HS*
	Yes	*21(19.4%)*	*87(80.6%)*			
Sharing utensils	*No*	*46(47.4%)*	*51(52.6%)*	*18.86**	*<0.001*	*HS*
	Yes	*4(9.3%)*	*39(90.7%)*			
Weaning age	*6 mnths*	*6(37.5%)*	*10(62.5%)*	*2.42**	*0.491*	*NS*
	1Yr	*15(41.7%)*	*21(58.3%)*			
	2Yr	*27(35.5%)*	*49(64.5%)*			
	>2Yr	*2(16.7%)*	*10(83.3%)*			

Chi-Square Test, Fisher's exact Chi-Square test*

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Table (4): Comparison between children with ECC and ECC free regards dietary practices

Dietary habits		*ECC free (n=50)*	*ECC (n=90)*	X^2	*P value*	*Sig.*
Sugary food & sweets	*never*	*18(81.8%)*	*4(18.2%)*	*68.91**	*<0.001*	*HS*
	Once/ wk	*12(75.0%)*	*4(25.0%)*			
	2-3/wk	*13(56.5%)*	*10(43.5%)*			
	Once/day	*4(33.3%)*	*8(66.7%)*			
	2-3/ day	*2(5.6%)*	*34(94.4%)*			
	Several/ day	*1(3.2%)*	*30(96.8%)*			
Fruity juices	*never*	*26(36.1%)*	*46(63.9%)*	*1.83**	*0.794*	*NS*
	Once/ wk	*14(36.8%)*	*24(63.2%)*			
	2-3/wk	*6(30.0%)*	*14(70.0%)*			
	Once/day	*4(50.0%)*	*4(50.0%)*			
	2-3/ day	*0*	*2(100.0%)*			
	Several/ day	*0*	*0*			

Chi-Square Test, Fisher's exact Chi-Square test*

As regards to consumption of sugary food and sweets a highly significant statistical difference existed between the 2 groups, while none was encountered as regards to fruity juices consumption.

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Table (5): Correlation between risk factors and log. Streptococcal count

Risk factors	*Log. Streptococcal count*	
	rho	*P Value*
Age	*-0.034*	*0.693*
Male gender	*0.287*	*0.001***
Mother education	*-0.483*	*<0.001***
Father education	*-0.198*	*0.019**
Child 1 dental visit	*-0.364*	*<0.001***
Mother current caries experience	*0.530*	*<0.001***
Siblings	*0.400*	*<0.001***
Brushing frequency	*-0.605*	*<0.001***
Brushing time	*-0.602*	*<0.001***
Who brushes	*-0.774*	*<0.001***
Feeding on demand	*0.452*	*<0.001***
Night feeding	*0.518*	*<0.001***
Sharing utensils	*0.420*	*<0.001***
Sugary food intake frequency	*0.584*	*<0.001***

*Spearman Correlations, **HS, *S*

There were direct correlations between male gender, mother's current caries experience, number of siblings, feeding on demand, night feeding, sharing utensils, sugary food intake frequency and log. Streptococcal count in both groups.

While there was an inverse correlation between mother's and father's education, earlier child 1st visit, increased brushing frequency, night brushing, who brushes (mother) and log. Streptococcal count.

Table (6): Logistic regression analysis of the most predictable risk factors associated with prevalence of ECC

Risk factors		P Value	Exp. (β)	95.0% C.I. for Exp. (β)
Night feeding	No	Ref.		
	Yes	0.012*	44.48	2.32-853.99
Mother,s current caries experience	No	Ref.		
	Yes	<0.001**	29.30	4.95-173.47
Gender	No	Ref.		
	Yes	0.017*	11.54	1.56-85.54
Child 1st dental visit	None	0.022*	Ref.	
	Late	0.961	1.069	0.073-15.74
	Early	0.031*	0.068	0.006-0.78
Brushing time	Never	0.294	Ref.	
	Others	0.183	0.070	0.001-3.50
	Night	0.117	0.048	0.001-2.15
Brushing frequency	Never	0.424	Ref.	
	1/day	0.194	11.02	0.30-409.85
	2/day	0.552	1.72	0.29-10.18
Mother education	School	Ref.		
	Higher	0.175	0.094	0.003--2.87

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Father education	*School*	*Ref.*		
	Higher	*0.274*	*6.27*	*0.23--168.34*
On demand feeding	*No*	*Ref.*		
	Yes	*0.177*	*4.08*	*0.53--31.44*
Sharing utensils	*No*	*Ref.*		
	Yes	*0.648*	*0.607*	*0.71--5.16*

***HS, *S*

Possible risk factors of socio-demographic characteristics, feeding practices, Oral hygiene practices were adjusted into a regression model. Siblings and who brushes and sugar consumption variables couldn't be entered in the regression since one cell of the table was empty) .

After adjustment with other possible risk factors; children who were night feeding, their mother had current caries experience with gender male predominance, will have a greater chance to develop ECC by 44.48, 29.30 & 11.54 times, respectively , than those who were not night feeding, had caries free mothers and a female gender predominance. Children who benefited from early dental visits had less chance to develop ECC than those who never visited the dentist by 93.2%.

To override the omitted variables Finally Odds ratio was performed for all 4 domains then combined and arranged in one table (Table 7) with descending order(starting with the highest odds ratio) after omitting the non-significant variables.

Table (7): Odd's ratio of possible risk factors associated with prevalence of ECC

Risk factor		*ECC free (n=50)*	*ECC (n=90)*	*OR*	*95% CI*	*P value*
Several times Sugary food	*never*	*18(81.8%)*	*4(18.2%)*	*Ref.*		
	Several/ day	*1(3.2%)*	*30(96.8%)*	*135.0*	*13.98-1303.95*	*<0.001***
	2-3/ day	*2(5.6%)*	*34(94.4%)*	*76.50*	*12.76-458.63*	*<0.001***
3 Siblings	*Zero*	*21(75.0%)*	*7(25.0%)*	*Ref.*		
	Three	*1(5.9%)*	*16(94.1%)*	*48.0*	*5.35-430.57*	*0.001***

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Night feeding	*No*	*29(90.6%)*	*3(9.4%)*	*Ref.*		
	Yes	*21(19.4%)*	*87(80.6%)*	*40.05*	*11.13-144.13*	*<0.001***
Who Brushes	*Mother*	*47(64.4%)*	*26(35.6%)*	*Ref.*		
	Himself	*3(7.3%)*	*38(92.7%)*	*22.90*	*6.43--81.48*	*<0.001***
Mother caries experience	*Free*	*37(77.1%)*	*11(22.9%)*	*Ref.*		
	Carious	*13(14.1%)*	*79(85.9%)*	*20.44*	*8.37-49.92*	*<0.001***
2 Siblings	*Zero*	*21(75.0%)*	*7(25.0%)*	*Ref.*		
	Two	*9(19.1%)*	*38(80.9%)*	*12.67*	*4.12-38.91*	*<0.001***
On demand feeding	*No*	*31(70.5%)*	*13(29.5%)*	*Ref.*		
	Yes	*19(19.8%)*	*77(80.2%)*	*9.66*	*4.26-21.93*	*<0.001***
Once/day Sugary food	*never*	*18(81.8%)*	*4(18.2%)*	*Ref.*		
	Once/day	*4(33.3%)*	*8(66.7%)*	*9.0*	*1.79-45.34*	*0.008***
Sharing utensils	*No*	*46(47.4%)*	*51(52.6%)*	*Ref.*		
	Yes	*4(9.3%)*	*39(90.7%)*	*8.79*	*2.92-26.51*	*<0.001***
One Sibling	*Zero*	*21(75.0%)*	*7(25.0%)*	*Ref.*		
	One	*19(47.5%)*	*21(52.5%)*	*3.32*	*1.15-9.54*	*0.026**
Gender	*Female*	*33(47.8%)*	*36(52.2%)*	*Ref.*		
	Male	*17(23.9%)*	*54(76.1%)*	*2.91*	*1.42-5.99*	*0.004***
Father education	*School*	*8(21.1%)*	*30(78.9%)*	*Ref.*		
	Higher	*42(41.2%)*	*60(58.8%)*	*0.381*	*0.16-0.91*	*0.030**
	None	*4(8.3%)*	*44(91.7%)*	*Ref.*		

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Late 1st Child dental visit	*Late*	*11(26.8%)*	*30(73.2%)*	*0.248*	*0.072-0.852*	*<0.027**
Brushing time	*Never*	*34(58.6%)*	*24(41.4%)*	*Ref.*		
	Others	*1(3.8%)*	*25(96.2%)*	*0.109*	*0.014-0.879*	*0.037**
Mother education	*School*	*6(9.7%)*	*56(90.3%)*	*Ref.*		
	Higher	*44(56.4%)*	*34(43.6%)*	*0.083*	*0.03-0.21*	*<0.001***
Early 1st Child dental visit	*None*	*4(8.3%)*	*44(91.7%)*	*Ref.*		
	Early	*35(68.6%)*	*16(31.4%)*	*0.042*	*0.013-0.136*	*<0.001***
Brushing frequency	*Never*	*1(3.8%)*	*25(96.2%)*	*Ref.*		
	1/day	*29(54.7%)*	*24(45.3%)*	*0.033*	*0.004-0.263*	*0.001***
	2/day	*18(54.5%)*	*15(45.5%)*	*0.033*	*0.004-0.276*	*0.002***
Brushing time	*Never*	*34(58.6%)*	*24(41.4%)*	*Ref.*		
	Night	*15(26.8%)*	*41(73.2%)*	*0.028*	*0.004-0.223*	*0.001***

Children with one, two and three siblings had a greater chance than those with zero siblings to develop caries by 3.32, 12.67 & 48 times, respectively.

Children whose mother had carious experience had a greater chance by 20.44 more than those with caries free mothers to develop caries.

Children with male gender predominance had a greater chance by 2.91 times more than females to develop caries.

Children who had late or early 1st dental visit had less chance to develop caries than those who never had dental by 75.2%& 95.8%, respectively.

Children with higher mother's and father's education had less chance to develop caries than those whose mother's and father's education was school by 91.7% & 61.9%, respectively.

Children with bushing frequency 2/ day and 1/day; had less chance to develop ECC than those who never brushed by 96.7%.

Children who performed night brushing or no specified brushing time; had less chance to develop ECC than those who never brushed by 97.2% & 89.1%, respectively.

Children who were responsible for their own oral hygiene practices had a greater chance to develop ECC by 22.90 times, than those whose mothers were responsible for brushing

Children who were feeding at night, feeding on demand and sharing utensils had greater chance to develop ECC by 40.05, 9.66 & 8.79 times, respectively more than those who were not.

Children with frequency of sugary food intake once/day, 2-3/day & several/ day had greater chance to develop ECC by 9.0, 76.50 & 135.0 times, respectively more than those who their frequency of sugary food intake was never.

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4. Materials and Methods

Sampling and sample size

A minimal sample size of 108 was calculated using Epicalc program version 1.02 assuming a power of 80 % and alpha=0.05. It was based on percentage of oral hygiene practices performed for children (No brushing and Brushing 3/ day) were 31.05% and 12.11%, respectively.

We designed a cross sectional study to analyze and reshuffle the risk factors for ECC among preschool children. Prior to the main study, a pilot study was carried out in our Department on a group of 25 children. The preliminary study was carried out to evaluate the feasibility of conduct of a larger study and to aid in the calculation of sample size.

Study design and ethical approval

Subject Selection. To identify children for the study, Cairo was divided into four strata by administrative boundaries (4 largest counties in Cairo). Subsequently, 3 immunization centers were selected in each stratum as primary sampling units and 13 subjects were selected randomly from each primary sampling unit. The project was submitted to and approved by the ethical committee of Ain Shams University, The study was conducted from November 2015 till April 2016. On the days assigned for examination patients attending the facility fulfilling the inclusion criteria were identified, then 13 were chosen with the aid of random tables for each day till the required sample size was reached.

Inclusion and exclusion criteria

Inclusion criteria were normal healthy children aged (2-4) years. . Children with serious medical problems, those attending with a caregiver other than their mother whom the authors thought would not give accurate information in the process of interviewing or children whose mothers declined to participate were excluded. Another exclusion criterion was previous fluoride varnish application as it could affect the bacterial sm counts

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After their routine oral examination, the mothers were approached, the purpose of the interview was clearly explained they were assured that there weren't any possible side effects for the study on their children, after their verbal approval for participation, they were requested to sign the Informed consent prior to enrollment. We ended up with a sample of 140 mothers and their preschoolers from the 12 assigned immunization centers.

All parents were motivated by offering preventive procedures such as fluoride application, and educational sessions on the proper oral hygiene measures and dental treatment for those in need was performed.

Survey procedure

The study was undertaken in three stages: stage 1 and stage 2, comprising of a questionnaire survey and an intra-oral examination, 3 saliva sample collection Plaque samples were collected from children suffering from S-ECC, as well as caries-free children. This was followed by sm count.

Data Collection

Intra-oral examination

The children's teeth were examined by the principal investigator NK who was unaware of the outcome of the mothers' interview by the coauthor SE

Intraoral examination was conducted according to WHO standards in a well-lit natural light area with the use of disposable plane dental mirrors, gauze wipes and wooden tongue depressors. Children were examined in a supine position on tables except for those infants who were either required to be held on the lap of their caregiver, or by knee to knee examination. The child was considered to be suffering from ECC according to the definition of the American Academy of Pediatric Dentistry (AAPD) which defined Early Childhood Caries (ECC) as the presence of one or more decayed, missing or filled tooth surface in any primary tooth in a child of 71 months of age or younger.)"S-ECCis used to describe any sign of smooth surface caries in children younger than 3 years of age. From ages 3 to 5, 1 or more cavitated, missing due to caries, or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of ≥4 (age 3), ≥5 (age 4), or ≥ 6 (age 5) surfaces constitutes S-ECC. A white spot lesions or a filled tooth with recurrent caries were considered relevant. [5]

Collection and Serial Dilution of plaque samples

Plaque samples were obtained from 25 children having S-ECC, and 15 who were caries free, and all microbiological tests were done by the same operator to ensure standardization. All patients were instructed not to eat for an hour before obtaining the sample.

A culture was taken from a pooled plaque sample which was obtained from the gingival third of the buccal surfaces of primary molars and incisors using a sterile sharp spoon excavator size 51, until the excavator was filled by plaque to its maximum level to ensure standardization.

Samples were weighed and their average weight was (0.12±0.03). Weighing the samples was done at the Faculty of Dentistry, Ain Shams University using a digital scale. ** (Maillefer)

The content of each excavator was then taken using a sterile cotton swab and placed in 10mL of phosphate buffered saline which was considered as initial dilution.

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All samples were kept in an ice box and transferred to the laboratory within 6 hours of collection. Serial 10 fold dilution was prepared by taking 1 ml from the initial dilution and adding it to 9ml of sterile normal saline for the next dilution (1:1000), and then 1ml was transferred from the (1:1000) to another 9ml of sterile saline to create the last dilution (1:10000).

ii. Bacterial Culture

Bacterial strains were cultured on M17 for total *streptococcal* count. Colonies of *Streptococci, Lactobacilli,* and *Bifidobacterium* were counted to identify the total viable count as colony forming unit per ml (cfu/ml).

Oral Health questionnaire

The mothers' were interviewed by the dentist %% who was unaware of the outcome of the children's oral examination performed by the first researcher NK.

A Structured questionnaire interview was designed after literature reviewing, it was pre-tested tested for validity, reliability and clarity in our department with the aid of 20 volunteer mothers of young children. During the pretest, some questions were found to be confusing, they were revised and retested with another 10 mothers. The responses were recorded through direct interviewing

The questionnaire included four domains; socioeconomic factors, feeding practices, and oral health behaviors (Table *2).*

SOCIO demographic

Questionnaires were administered to the mothers of participating children to obtain socio-demographic information such as: name, sex, age, number of siblings, mothers and fathers level of education, which were categorized into two levels: primary school or Illiterate, or high school education and university education. Mothers were asked about presence or absence of caries or if they had fillings before and if unsure were examined for verification. To throw light on the child's oral health, the mother was asked about any previous dental visit, whether it was early, late or no visit at all.

Oral hygiene practice

In this domain Mothers were asked about their child's brushing frequency, answers were categorized into: no brushing, brushing 1-2/week, once/day and twice/day. They were specifically asked if brushing was performed at night or any random time. Finally if brushing was self or performed by the mother.

Feeding practice

Dietary and nutritional information involved questions about whether the child was breast or bottle fed. History of whether night time and on demand feedings were practiced. Weaning age of the child and whether the household shared the same utensils specifically the spoon

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Dietary Habits

Also, information was collected about consumption of sugary food, sweets and drinks as well as fruit juices. (Never, once a week, 2-3/week, once/day, 2-3/day and several times/day.

Data Analysis Statistical analysis

Both the questionnaire and oral examination forms were manually checked for completion of the required information. Data was collected, recorded in standardized form and entered into SPSS software for statistical analysis

Chi square test was performed for each categorical variables to assess whether significant differences were observed between the two groups.

Spearman correlation was used to find the correlation between the different risk factors and the log streptococcal count.

A logistic regression model was used to identify risk factors for caries development among children by considering independent variables simultaneously (Table *6).* a P-value <.05 was considered statistically significant

Odds ratio was calculated for all possible risk factors associated with the prevalence of EEC and arranged in descending order after omitting all the insignificant variable which was the main idea of the study.

Discussion

A deeper insight into the risk factors of ECC is always of value to aid in its prevention and management. The findings of our study agreed with several others in most of the different variables in the tested domains but our main aim was to reshuffle the risk factors in an order of significance, to throw light on the weight of each isolated variable as a caries risk indicator.

S-ECC caries possesses a great social and economic burden throughout the world therefore it's important for public health to be cognizant of deterioration in the level of oral health and dental caries so that efforts can be directed towards prevention of these problems.([15]

Collection of data on children's lifestyle factors and demography was performed by interviewing parents rather than having them fill a questionnaire by themselves to avoid misinterpretation of questions. Face to face questionnaires were assumed by some researchers to be inaccurate because subjects will attempt to say what they knew rather than what is in fact practiced, [16] yet the low educational and socioeconomic level of the patients examined made it impossible to conduct a self-administered questionnaire.

An age group of 2-4 years was chosen due to the difficulty of finding caries free children older than this age. Results revealed that the mean age of children with S-ECC was found to be higher than the CF group. This finding was consistent with several studies that related this to the fact that older children have been exposed to cariogenic challenges for a longer time. [8,10]) Further explanation to this can be attributed to the fact that as the age of the child increases the nature of food consumption differs, i.e. as children grow older especially at school age, they tend to consume more sweets.

Based on the clinical examination of children, the mean value of dmft in children with S-ECC was found to be (9.96±3.86) which was close to other studies in developing countries. [17] Gingival and plaque indices were higher in S-ECC group, and the results were highly significant ($p<0.001$) and this may be due to the lack of oral hygiene measures in children suffering from S-ECC and hence development of caries and gingival inflammation[18]

According to our study, boys have been reported to have a higher prevalence of caries compared to girls, and the results were highly significant ($p<0.001$), and this was in consistence with some studies [10,19] These findings suggest that mothers especially in low socioeconomic status countries such as Egypt tend to prefer boys than girls and subsequently they parent them differently and this is interpreted by giving them more sweets and hence more caries development. [20]

Interestingly, the number of siblings of the child could be considered as one of the risk factors associated with S-ECC, such that the more siblings the child had, the more his risk to develop S-ECC. The results were statistically significant ($p=0.001$) and this goes in agreement with several studies and was specially proved in families having more than two children. [21,22]One explanation for this is that in large families'parents' attention to their children's oral health is shared based on their number of siblings thereby less care is provided for each child and chances to have oral problems increase.

The maternal educational level was inversely proportional to the presence of S-ECC in children, The results were similar to another study that attributed this to the lack of information and education about the oral health care for children of uneducated mothers[23]While children whose mothers are employed (70.4%) were found to have lower risk of S-ECC development unlike another study[24]In our study, the correlation between mother's work and S-ECC occurrence in her child may be attributed to the cultural restrictions in developing countries, since females with higher educational levels are more likely to work than lower educational level females.

Mother's education and employment is also related to her current caries experience. In our study mothers current caries experience appeared to be an important factor in the development of S-ECC in children and the results were highly significant ($p<0.001$). This was consistent with a study that reported evidence of maternal transmission of Sm in 41% of mother/child pairs[25]Mother's continuous contact with their children was interpreted by higher influence on child's oral hygiene measures as compared to father's whose employment status, and education didn't affect their children. However, the effect of paternal education and employment status is important nowadays since both parents have currently become the main caregivers and educators of their children. [21]

It was also found that children who had a late first dental visit or no dental visits at all tend to be more liable to develop dental caries. A possible interpretation for this could be that early dental visits provide an excellent opportunity for educating parents on proper guidelines for promoting their child's oral health especially among low socioeconomic groups where oral health is not considered a priority. [26]

Regarding early feeding habits, the current study revealed no significant difference in caries experience between children who were breast or bottle fed. Our results were consistent with a systematic review revealing that the interaction of risk factors and intraoral bacterial load might carry a greater responsibility than the mode of feeding. [21,27]Added to this, although children suffering from S-ECC were weaned at an older age than those in caries free group, yet this difference was insignificant. Despite that, a significant association was detected in our research between overnight and on demand feeding and development of S-ECC. Night feeding decreases the clearance of liquid carbohydrates from the oral cavity due to decreased salivary flow at night. On the other hand, on demand feeding leads to increased amounts of fermentable carbohydrates in the

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mouth and early colonization by oral Sm. [28] interestingly, this goes in line with a study attributing S-ECC mainly to frequency of feeding rather than age of weaning. [29]

Considering other habits that could have direct influence on bacterial transmission and caries incidence, sharing utensils was significantly more common in S-ECC group as compared to CF group. This explains why international guidelines for prevention of ECC [30] encourage parents to stop bacterial transmission to their children through sharing food, drinks, utensils, toothbrushes and other items. ([25]

The frequency of unhealthy in between meal snacking was higher among children with S-ECC group than those who were caries free, this was moderately significant (p=0.008) and was consistent with more than one study which showed that caries increases when the number of snacks increases more than 4 times a day. The nature of food consumed also played a major role in the development of S-ECC. Children who consumed more sugary food, sweets and sweetened beverages showed significantly higher risk of developing S-ECC (p= 0.001) and this can be interpreted by the high sucrose content of confectionaries and sweetened beverages, since sucrose is considered the main carbohydrate responsible for the development of dental caries. [26]Among the beverages consumed that had a controversial relationship with the development of S-ECC in literature were fruity juices. In our study found 100% fruity juices were more significantly consumed by the CF group (p<0.001) and this can be explained by the presence of a negative correlation between consumption of 100% juice and sweetened beverages. Sweetened beverages most commonly have sucrose or high fructose corn syrup, which are more effectively metabolized by Sm while 100% juices contain fructose and glucose without sucrose. [26]

Our study showed that CF group adhered more to proper oral hygiene practices and especially in regards to the frequency of brushing (p<0.001), regular brushing at night time (p=0.005), starting brushing at an earlier age with a mean age of 2.5±0.98 in children with S-ECC in contrast to 1.4±0.5 in CF group, as well as, performance of the oral hygiene measures by the caregiver instead of the child himself (p=0.001). Those results conformed to a study, showing that parental training to brush their child teeth and daily frequency of tooth brushing are major determinants in S-ECC. [31]) Another study stated that S-ECC is more common among children who commenced brushing at an age older than 24 months [32]and hence oral hygiene measures should be implemented as early as the eruption of the first tooth.

Therefore our present study has attributed the development of S-ECC mainly to age, sex, family size, maternal education, employment, and caries experience, child's first dental visit, improper feeding and snacking, nursing habits such as on-demand/night feeding, sharing of utensils, and lack of oral hygiene measures. While other factors as paternal education and employment, and mode of feeding were not found to have a significant effect on the occurrence of S-ECC. (Table7)

5. Conclusions

- The risk factors contributing to severe early childhood caries in order of their significance were Night feeding, On demand feeding, Mother's Employment, Mother's caries Experience, Starting age of brushing, Mother's education, Sharing utensils, Child's first dental visit, Number of siblings, Brushing frequency, Sweetened food and beverage consumption, Sweetened beverages, and at last the snacking frequency.

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