ORIGINAL RESEARCH

Association of Early Childhood Caries and Multiple Variable Factors in 3–6-year-old Children

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Abstract

Introduction: Dental caries is a globally prevailing condition. It is a common finding in all age-groups, whether it is young children or adults. Caries not only affects the oral health of an individual, but also the overall health of the individual.

Aims and Objectives: This article focuses on the association of ECC with BMI, SES status, maternal education, birth order, and number of siblings in age group of 3 to 6 year old children.

Material and methods: The study was planned and conducted in the Department of Pedodontics and Preventive Dentistry, Government College of Dentistry, Indore, Madhya Pradesh, India. The study consisted of 200 samples, including both groups. Group I included 100 patients with ECC and group II included 100 patients caries free. Children of age 3–6 years were randomly selected and evaluated for ECC and parameters like weight, height, number of siblings, birth order, SES status, and mothers' education.

Results: Body mass index (BMI) had no significant association with the occurrence of ECC. Statistical significant association was observed between the number of siblings and ECC. The "no caries" was significantly associated with "no sibling" or "one sibling". A significant association between SES status and ECC was observed. The upper and upper middle class had more number of caries free children, whereas the number of participants with ECC was significantly more in the upper lower class. There was a pronounced association between ECC and maternal education.

Conclusion: Researches like these help us to broaden our aspects of understanding that caries is not caused by only one factor but a magnitude of factors. It's prevention should take into consideration not only the dietary habits but also on increasing awareness about importance of oral hygiene and how it can be affected by other social varients.

This article focuses on the association of ECC with BMI, SES status, maternal education, birth order, and number of siblings in 3–6-year-old children.

Keywords: Body mass index, Birth order, Early childhood caries, Maternal education, Number of siblings, Socioeconomic status.

International Journal of Clinical Pediatric Dentistry (2023): 10.5005/jp-journals-10005-2515

Introduction

Dental caries is a multifactorial disease affecting all age-groups. Its prevalence ranges from 23 to 90% globally, whereas in India, it accounts for 27–59%.[1] Dental caries has been delineated by numerous terms like nursing bottle caries, comforter caries, milk bottle mouth (1962), baby bottle tooth decay, and baby bottle syndrome. These advertence for dental caries in preschool children were predominantly due to inappropriate feeding habits of the child using a baby feeding bottle. The current term ECC is a more complex disease related to frequent sugar consumption, which leads to more adheration of bacteria to enamel surface, thus causing tooth decay. The American Academy of Pediatric Dentistry in 2008 defined ECC as the presence of one or more decayed (noncavitated and cavitated), missing (as a result of caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.[2]

When dental caries are not treated and addressed properly, they exert influence on the growth and development in scores of young children. When the food intake is not sufficient, and there is repeated infection, it leads to undernutrition. This stunts growth and development in children.

One of the convenient methods for assessment of physical development in the early years of a growing child is by determination of physical growth and its measurement.

Evaluation of an individual's body weight relative to population norms is through computation of BMI using the formula:

BMI = weight in kilograms/height in square meters.[3]

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How to cite this article: Sahu P, Agrawal A, Jain D, *et al.* Association of Early Childhood Caries and Multiple Variable Factors in 3–6-year-old Children. Int J Clin Pediatr Dent 2023;16(1):42–47.

Source of support: Nil

Conflict of interest: None

Body mass index (BMI) is combined with age as well as gender and expressed as a percentile for age-group of 2–20-year-old individuals.[3]

Early childhood caries (ECC) is not linear but instead covers the wide interaction between pathogenic organisms, fermentable carbohydrate substrate, host susceptibility, and time. A variety of other factors are also directly and indirectly responsible for caries. Factors like SES status, maternal education and awareness, number of siblings, and birth order also play an important role.

This article focuses on the association of ECC with BMI, SES status, maternal education, birth order, and number of siblings

in the age-group of 3–6-year-old children. This would establish a relationship of ECC not only with the physical growth but also the other social constraints affecting caries prevalence.

Materials and Methods

The study was planned and conducted in the Department of Pedodontics and Preventive Dentistry, Government College of Dentistry, Indore, Madhya Pradesh, India. The study consisted of 200 samples, including both groups. Group I included 100 patients with ECC and group II included 100 patients caries free. Children of age 3–6 years were randomly selected and evaluated for ECC and parameters like weight, height, number of siblings, birth order, SES status, and mothers' education were taken into consideration. Inclusion criteria applied to our study were 3–6-year-old children without any underlying medical condition, clinical diagnosis of caries according to World Health Organization criteria, and cooperative patients/parents. Exclusion criteria were medically compromised children, special care need children, and uncooperative patients/parents.

Data collection of children with caries was done from the department. Parents accompanying the patient were explained about the study, written consent was obtained as approval to participate in the study. Proper medical and dental history was obtained to preclude any systemic disease.

The diagnostic tools used in our study were a weighing machine (Eagle) and a stadiometer (MCP Healthcare). The weighing machine was checked by spirit level (Taparia SL10-12) to asses any irregularity in the level of the weighing machine. The height measuring unit stadiometer (MCP Healthcare) was mounted on the wall after standardization to avoid disparity in height measurement.

The height and weight of the child with caries were recorded after their clinical examination. Details like the number of siblings, order of siblings, maternal education, occupation, and monthly income were enquired from the parents who have given their consent for the study.

Data collection of group II, that is, the control group was done from local schools and aganwadi. Written permission was obtained from the institutes to conduct the study and record the required details from children and parents.

Same weighing machine and height measuring devices were used for measurements to avoid discrepancies. The school children in kindergarten falling under the age-group of 3–6 years were clinically assessed. Height as well as the weight of children not having caries were measured. Details regarding maternal education, number of siblings, birth order, occupation, and monthly income were enquired from the parents of respective caries free children.

The height was measured in centimeters and converted into millimeters. Weight was measured in kilograms. The formula for the calculation of BMI was applied and BMI for each individual patient was calculated.

BMI = weight in kilograms/height in square meters.

After obtaining the BMI of all the patients, they were divided into four categories. The Center for Disease Control and Prevention (CDC) uses BMI percentile to classify 2–20-year-old children into four weight groups—(1) underweight (<5th percentile), (2) normal weight (5th–84th percentile), (3) at risk for overweight (>85th–95th percentile), and (4) overweight (>95th percentile).

Details regarding the number of siblings and birth order were enquired from the parents.

The SES status was calculated by following the modified Kuppuswamy scale 2019 (Table 1). Parental education, occupation, and income of the head of the family per month were recorded. Scores corresponding to respective educational qualification, job, and income were denoted. The total score for each individual patient was calculated. The class and score corresponding to the total score calculated was mentioned.

Result

The data analysis was done using Statistical Package for the Social Sciences 20.0 version. Probability distribution in the study sample was done using the Kolmogorov–Smirnov test. A p-value < 0.05 reflected that the data was not normally distributed, thus, nonparametric tests of significance were applied.

The BMI was graded based on CDC guidelines. For the present study population:

- Body mass index (BMI) at 5th percentile—11.8563 kg/m^2.
- Body mass index (BMI) at 85th percentile—15.6795 kg/m^2.
- Body mass index (BMI) at 95th percentile—16.8105 kg/m^2.

Thus, patients with BMI:

- Of <11.8563 kg/m^2 were graded as underweight.

Table 1: Modified Kuppuswamy scale (2019)

Education of head of family	*Score*
Professional degree	7
Graduate or postgraduate	6
Intermediate or posthigh school diploma	5
High school certificate	4
Middle school certificate	3
Primary school certificate	2
Illiterate	1
Occupation of head of family	
Professional (white collar)	10
Semiprofessional	6
Clerical, shop owner/farm	5
Skilled worker	4
Semiskilled worker	3
Unskilled worker	2
Unemployed	1
Monthly income of family	
≥52,734	12
26,355–52,733	10
19,759–26,354	6
13,161–19,758	4
7,887–13,160	3
2,641–7,886	2
≤2,640	1
SES class	Total score
Upper	26–29
Upper middle	16–25
Lower middle	11–15
Upper lower	5–10
Lower	01–04

- Of 11.85–15.67 kg/m^2 were graded as normal.
- Of >15.67–16.8105 were graded as at risk of overweight.
- Of >16.8105 were graded as overweight.

The study included 200 participants, 100 were caries free (group I) and 100 were having ECC (group II).

The median Inter Quartile Range (IQ) age of the children belonging to groups I and II was 5.0 (4.0–6.0) years and 5.0 (4.0–6.0 years), respectively (p-value > 0.05). Both groups had 54 males and 46 females.

Body mass index (BMI) grade had no significant association with the occurrence of ECC (Table 2). The median BMI of the participants belonging to group I [14.3487 (13.5466 –15.2137) kg/m^2] and group II [13.9225 (12.9282–15.1937) kg/m^2] did not differ significantly (p-value > 0.05). Statistical significant association was observed between the number of siblings and ECC (p-value <.05). The "no caries" was significantly associated with "no sibling" or "one sibling" (Fig. 1). A significant association between SES status and ECC was observed. The upper and upper middle class had more number of caries free children, whereas the number of participants with ECC was significantly more in the upper lower class (p-value < 0.05) (Table 3). There was a pronounced association between ECC and parental education (p-value < 0.05) (Table 3). The present study also found that BMI had no significant association with SES status, maternal education, birth order of the child, and number of siblings (p-value > 0.05).

Discussion

Oral health is a very important determinant of an individual's overall health. An impaired dentition causes compromised chewing, leading to nutritional deficiencies, thus affecting the overall growth of the individual. This study was conducted to establish a relationship of ECC and BMI along with other aspects like maternal education, SES status, number of siblings, and order of birth in the age-group of 3–6-year-old children. Also, how is the prevalence of dental caries dictated by all these factors.

Before discussing the details of the study, we would like to highlight the pros and cons of the study. Pros of the study were that it was carried on a large sample size; also, the samples were almost evenly distributed among both genders.

The cons of the study were first that it took into consideration the population of Indore, thus limiting other geographical determinants of the place. Second, the classification of the children was done as caries free or with caries just on the basis of clinical examination; no advanced diagnostic aids or radiographic examination was done. Third, no dietary records were obtained from the patients.

The results in our study showcased that there was a statistically significant weak negative correlation between height, weight, and ECC and that there was statistically no significant correlation between ECC and BMI. This can be attributed to the fact that BMI measures weight and height status of the individual, but it will not mention about the etiology behind the status of height and weight, also the type of diet consumed. For example, a child in the overweight category might be caries free because of the high amount of fiber-rich diet consumption like that of fruits and vegetables.

Whereas the height and weight of participants belonging to caries free group were found to be significantly more than that of participants belonging to the group of children having caries, on the contrary BMI of the participants belonging to the two groups did not differ significantly.

There was statistically no significant difference between the age of the patients of the two groups. Also, the number of male and female patients did not differ significantly between the groups.

Table 2: Comparison of BMI class of participants belonging to two groups

	Group I	*Group II*	*Chi-square value*	*Degrees of freedom*	*p-value*$^{\infty}$
Underweight	1 (1.0%)	6 (6.0%)	4.489	3	>0.05
Normal	86 (86.0%)	79 (79.0%)			
At risk of overweight	7 (7.0%)	10 (10.0%)			
Overweight	6 (6.0%)	5 (5.0%)			
Total	100 (100.0%)	100 (100.0%)			

$^{\infty}$Chi-squared test

Table 3: Association of SES status and maternal education with the occurrence of ECC

		Group I	*Group II*	*Chi-square value*	*Degrees of freedom*	*p-value*$^{\infty}$
SES status	Upper	25 (25.0%)	8 (8.0%)	69.603	3	<0.001*
	Upper middle	51 (51.0%)	16 (16.0%)			
	Lower middle	23 (23.0%)	32 (32.0%)			
	Upper lower	1 (1.0%)	44 (44.0%)			
Maternal education	Illiterate	1 (1.0%)	5 (5.0%)	63.428	6	<0.001*
	Primary school	0 (0.0%)	4 (4.0%)			
	Middle school	5 (5.0%)	37 (37.0%)			
	High school	17 (17.0%)	14 (14.0%)			
	Intermediate or posthigh school diploma	12 (12.0%)	23 (23.0%)			
	Graduate/postgraduate	62 (62.0%)	17 (17.0%)			
	Professional degree	3 (3.0%)	0 (0.0%)			

$^{\infty}$Chi-squared test; *p-value < 0.05 was considered statistically significant

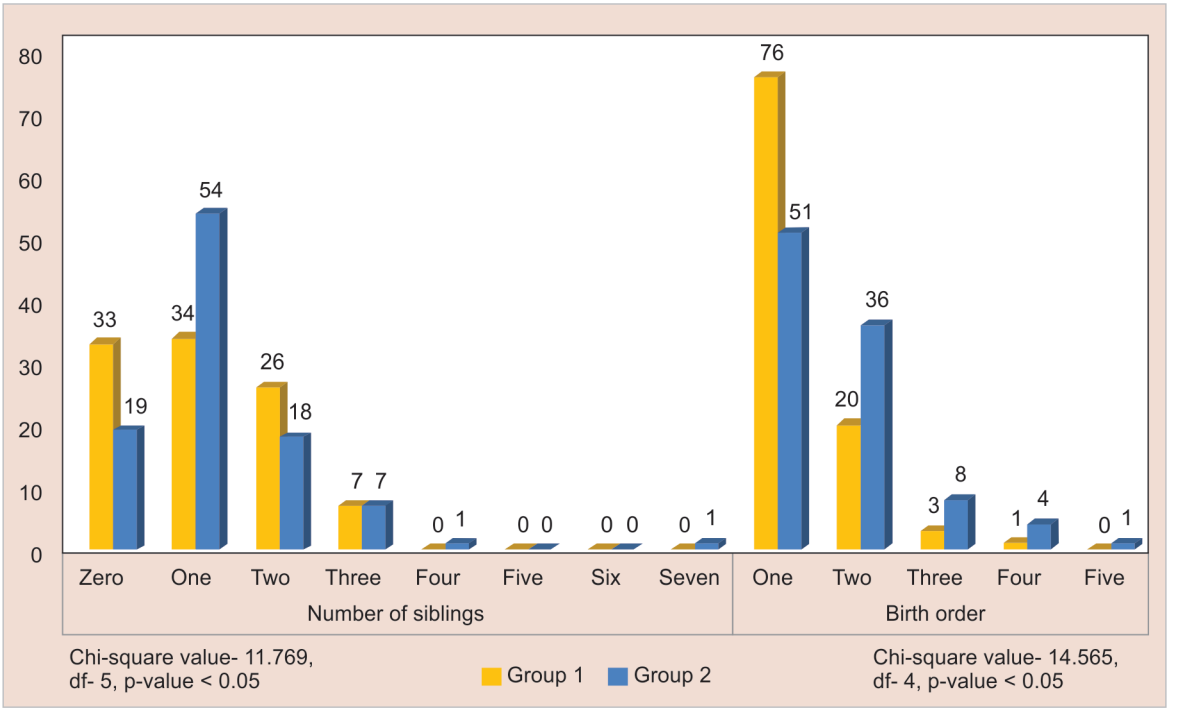

Fig. 1: Association of the number of siblings and birth order with the occurrence of ECC

Studies done by various other authors were also in line with the result found in our study.

Studies done by Gaur and Nayak,[4] Norberg et al.,[5] Parkar and Chokshi,[6] and Ahmadi-Motamayel et al.,[7] concluded and supported that there was an inverse relationship between ECC and BMI. Children with more caries had significantly less BMI.

Whereas some authors concluded in their study that there was no pronounced relation between ECC and BMI. The authors supporting this fact were Edalat et al.,[8] Upadhyay et al.,[9] and Swaminathan et al.[10]

Socioeconomic (SES) status is the social standing or class of an individual or group. It is measured as a combination of education, income, and occupation. SES status reveals disparity in issues related to privilege, power, control, and access to resources.

The various SES scales used in India have dated back from the year 1961. To name a few of them; B.G Prasad's classification (1961), Udai Pareek scale (1964), Kuppuswamy SES classification (1976), S.C Tiwari et al. scale (2005), O.P Agrawal et al. (2005) and many more.[11] The one used in our study is the modified Kuppuswamy SES classification.

In our study, there were significant observations between SES status and ECC. The number of caries free individuals was significantly more in the upper and upper middle class, whereas the number of participants with ECC was significantly more in the upper lower class. A possible explanation to this fact could be that higher income groups are in a state to provide better healthy food and better living conditions to the child. Whereas children in low SES strata demand an easily available high carbohydrate diet like potato, etc., more consumption of fermentable carbohydrates leads to more caries experience.

The result of our study was supported by many authors like that of Sogi and Bhaskar,[12] Postma et al. in 2006,[13] Chosack et al. in 1990,[14] Kumar et al.,[15] Oyedele et al.,[16] and Grieshaber et al.,[17] agreed and established a positive association between ECC and low SES status.

According to Mansbridge in 1960,[18] and Subramaniam and Singh,[19] more caries were prevalent in children of upper classes.

Savara and Suher, in 1955 stated that no correlation exists between the SES status of the mother and dental caries in children.[20]

Oral hygiene and it's maintenance is determined by the awareness, knowledge, and practices of the parents. The oral habits inculcated by parents to their offsprings estimates the dental caries status in them. In our study, on comparing the status of the presence or absence of caries with maternal education, it was seen that there was a significant association between ECC and maternal education. It could be supported by the fact that educated mothers are more aware about the dietary habits, oral hygiene maintenance, and periodic dental visit importance.

This statement was supported by Drewnowski and Specter,[21] Decklerck et al.,[22] Bhardwaj and Bhardwaj.[23]

On the other end, in a study by Koya et al. in 2016, they concluded that children of an educated mother were having a slightly higher prevalence of early childhood.[24]

Birth order was significantly associated with the occurrence of ECC. Significantly more number

of first children were found to have ECC, whereas a significantly more number of second-born children were caries free.

The number of siblings of the participants belonging to the two groups differed significantly. It was found there was a statistically significant association between the number of siblings and the occurrence of ECC. The no caries was significantly associated with no sibling or one sibling.

The two schools of thought have prevailed. One supporting a high incidence of caries in firstborns, whereas the second supporting the high prevalence of dental caries in late borns.

In 1943 Berk,[25] Zadik in 1978,[26] Johnsen et al. in 1980,[27] Ghanghas et al. in 2007,[28] Wellappuli and Amarasena in 2012,[29] Folayan et al. in 2017,[30] and Oyedele et al. in 2018[16] concluded that birth order is associated with caries development and less prevalence of caries is observed in firstborns when compared to the late borns.

Mansbridge in 1960[18] and Chung et al. in 1970[31] said children having birth rank >3 had lower caries prevalence than that of firstborn children.

Wigen et al. in 2011[32] and Julihn et al. in 2020[33] emphasized in their study that there was no association between the presence of older siblings in the family and dental caries.

The number of siblings in a family also dictates the prevalence of ECC in children. In large-sized families, equal attention to oral hygiene is not served to each and every child, thus compromising the oral status of children. Authors have associated this factor in studies.

Marjoribanks in 2001,[34] Christensen et al. in 2010,[35] Sujlana and Pannu in 2015,[36] and Sengupta et al. in 2020[37] also supported the fact that number of siblings and dental caries are associated; they focused about more the number of siblings in a family, more is the prevalence of caries encountered.

Conclusion

Researches like these help us to broaden our aspects of understanding that caries is not caused by only one factor but a magnitude of factors. It should also be taken into consideration that how caries prevalence can be reduced in constraints like that of low SES status and maternal education.

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