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Impact of Severe Early Childhood Caries on General Health in a Group of Egyptian Preschool Children

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ABSTRACT

Background: Early childhood caries (ECC) is a common chronic disease affecting young children and is considered a significant public health problem, it can be diagnosed in severe cases as severe early childhood caries (S-ECC). Children with S-ECC often suffer from pain, dietary changes, sleep disorders and behavioral changes. **Methods:** 1000 Egyptian children aged 3-6 years, including 100 children having complete blood count records participated in this case control study. Children were selected as 500 caries free and 500 with severe early childhood caries. Height and weight were measured for each child. Children who had CBC analysis for medical reason, Hb level was recorded. **Results:** there was insignificant difference between caries free and S-ECC groups regarding all BMI categories ($P > 0.05$). Children with low Hb levels (anemic) were significantly higher in S-ECC group than their caries free peers ($P < 0.05$). **Conclusions:** there was insignificant correlation between caries distribution and BMI, although there was a negative correlation between caries status and Hb level, indicating that S- ECC has a negative effect on child general health.

Keywords: Severe Early childhood caries, Growth, BMI, Anemia, Hb level

Introduction

Early childhood caries (ECC) is the most common chronic disease affecting children under 71 months and is now considered as a public health problem in various countries around the world. Dental caries remains a major health problem in developing countries due to low education level, lack of awareness and low socioeconomic status (Edem, 2018).

Severe early childhood caries (S-ECC) is an aggressive form of ECC, its impact extended beyond the oral cavity and were connected to nutritional deficiency and general health as children with S-ECC may experience pain and infection that can lead to eating and sleeping problems, affected growth (specifically in weight and height), and even behavioral changes (Davidson *et al.*, 2016).

Recently the whole world is worrying about effect of malnutrition on children as the term malnutrition includes both undernutrition and overnutrition. Undernutrition (underweight, wasting, stunting) is present most often in underdeveloped or developing communities, and overnutrition (overweight and obesity) is present in both developed and developing communities (Folayan *et al*., 2020).

Anemia is also a public health problem affecting 1.62 billion people, with the highest prevalence among preschool children (47%) especially in third world countries (Ibrahim *et al*., 2017). In Egypt, the overall prevalence of anemia is 39.1% and among preschool children is 39.6% (WHO, 2006).

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Consequently, to our knowledge, there is a few data that evaluate the growth, development and hemoglobin level in Egyptian preschool children with Severe Early childhood caries.

Participants and Methods

The present study is a cross sectional Case-control study which aims to assess the impact of S-ECC on different health parameters of preschool Egyptian children aged 3-6 years. The sample was collected from governmental hospitals.

Ethical approval and consent

Before starting this study, an ethical approval was obtained from Ethics Committee of Medical Research, at the National Research Centre number (18166). Also, Informed consent was taken from every child's parent, to agree for their participation in this study.

Sample size

Sample size was calculated with acceptable level of significance $p<0.05$ (Type I or α error=5%) and Power of the study =0.8. Accordingly, 1000 children, including 100 children having complete blood count records were selected and classified as follows

- **Cases: 500** children with S-ECC; including 50 children having complete blood count records.
- **Controls: 500** caries-free children; including 50 children having complete blood count records.

Inclusion criteria

- Egyptian children aged 3-6 years, with complete primary dentition.

Exclusion criteria

- Children with chronic medical problems that can affect normal growth.
- Children with mental or physical disabilities.
- Children who were born prematurely.
- Children who refuse to participate.

Clinical examination was done by single operator while children were seated in a supine position in an ordinary chair under day light and examined visually using disposable mirror and prob according to the methodology and criteria of the WHO, (2013) and it was recorded in a specially designed examination chart using dmft index (decayed, missed, filled primary tooth).

Children with S-ECC were diagnosed according to the diagnostic criteria established by the American Academy of Pediatric Dentistry (AAPD, 2020). All children with dental problems were guided for treatment through parents or sending an examination chart about the case of their child.

For every child, two anthropometric measurements (weight and height) were taken using the standardized methodology recommended by WHO, (2008).

BMI for age was calculated for every child using WHO Anthro (for children < 5 years) and WHO Anthro plus calculator software (for children > 5 years) (Version 1.0.4) (WHO, 2009) then percentiles were categorized according to the BMI percentiles obtained from WHO, (2007) reference data as follow:

• Underweight group: BMI - for age- less than 5th percentile.
• Normal weight group: BMI- for age greater than or equal to 5th percentile but less than 85 percentiles.
• Overweight group: BMI- for age-greater than or equal to 85 percentiles but less than 95 percentiles.
• Obese group: BMI-for age- greater than or equal to 95 percentiles.

Hemoglobin level was only recorded for the children who already had analysis for medical reason to diagnose anemia. Children with hemoglobin values less than 11 g per dL were diagnosed as being anemic according to WHO, (2007).

Statistical analysis was performed with SPSS 20®, Graph Pad Prism® and Microsoft Excel 2016. All qualitative data were presented as frequency and percentages; all comparisons were performed by using Chi square test. All Correlations were performed by using Pearson`s correlations.

Results

1. Descriptive data

A total of 1000 children were included in this study 526 boys, 474 girls. They were collected from governmental hospitals and their age range was 2.4: 6.8 years while mean ± standard deviation was (4.53 ± 0.97) as presented in table (1, 2).

Table 1`: Count, minimum, maximum, mean and standard deviation of age.

Age	N	Min.	Max.	M.	SD
	1000	2.4	6.8	4.53	0.97

N: count Min: minimum Max: maximum M: mean SD: standard deviation

Table 2: Frequency and percentages of gender.

Gender	N	%	P value
Male	526	52.60%	0.02*
Female	474	47.40%	

N: count %: Percentage *significant difference as P < 0.05.

Comparison between different BMI categories revealed significant difference (P < 0.05) between all categories as normal children (70.3%) were significantly the highest while underweight children (8.7%) were significantly the lowest, as presented in figure (1).

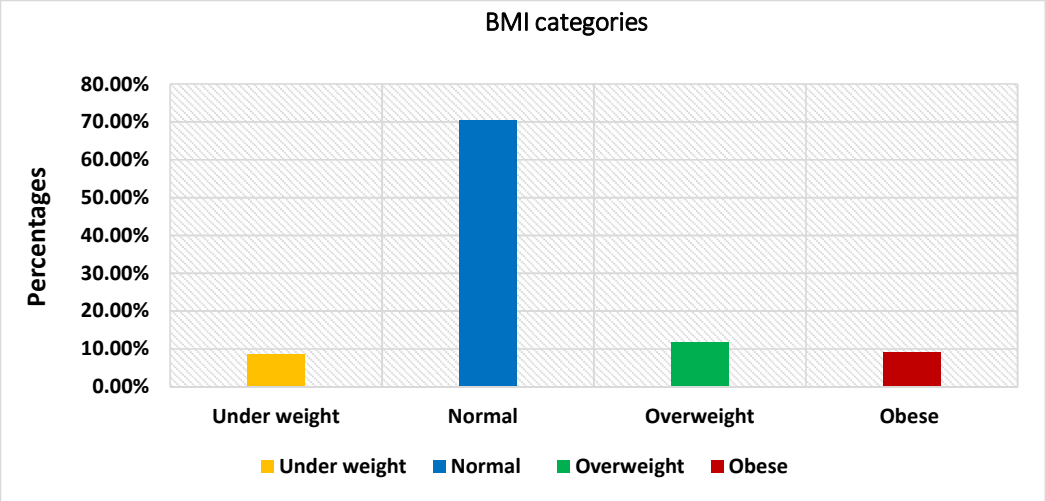

Fig. 1: Bar chart of percentages of BMI categories.

Comparison between non-anemic and anemic children based on Hb level revealed that non-anemic children (37%) were significantly lower than anemic children (63%) (P < 0.05), as presented in figure (2).

Caries distribution

Comparison between different BMI categories in caries free and S-ECC groups revealed a significant difference (P < 0.05) between all categories in both caries groups as normal children were significantly the highest and underweight children were significantly the lowest in both groups. Comparison between both caries groups concerning BMI categories revealed insignificant difference between them (P > 0.05) regarding all BMI categories. Moreover, correlation between BMI and caries distribution revealed weak (r<0.5), positive (+) and insignificant (P>0.05) correlation between them, as presented in table (3).

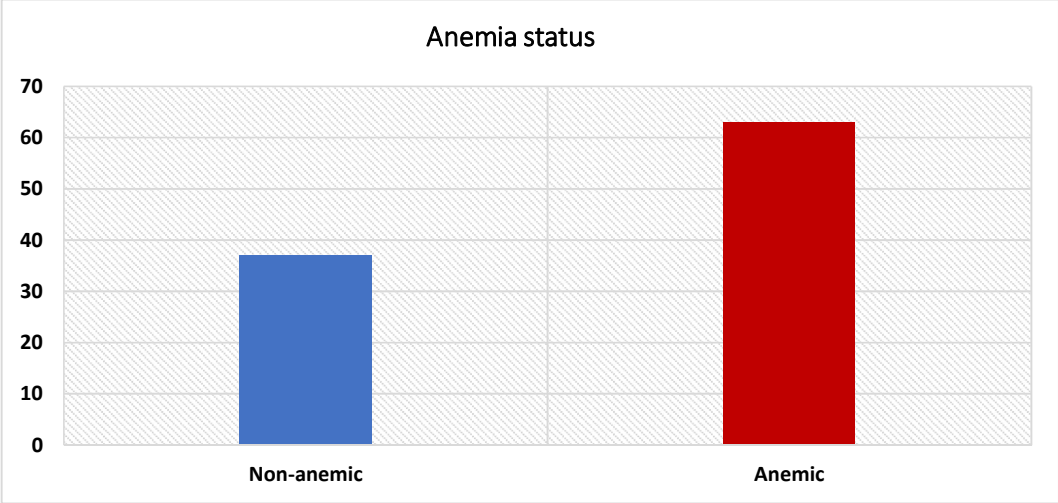

Fig. 2: Bar chart representing percentage of Anemia.

Table 3: Frequency and percentages of BMI categories among caries free and S-ECC groups.

BMI	Cries free		S-ECC		P value	r (P)
	N	%	N	%		
Under weight	44	8.80%	43	8.60%	0.91	
Normal	355	71.00%	348	69.60%	0.49	
Overweight	54	10.80%	64	12.80%	0.32	0.017(0.61)
Obese	47	9.40%	45	9.00%	0.82	
P value	0.0001*		0.0001*			

N: count %: Percentage *significant difference as P < 0.05. r: Pearson`s correlation coefficient

It was found that anemic children in caries free group were insignificantly higher than non-children, while in S-ECC, anemic children were significantly higher than non-anemic children. Comparison between caries groups revealed that non-anemic children in S-ECC group were significantly lower than their peers in caries free group, while anemic children were significantly higher in S-ECC group. Moreover, correlation between Hb level and caries revealed weak (r<0.5), negative (-), and significant (P<0.05) correlation between them, as presented in table (2).

Table 4: Frequency and percentages of anemia among caries free & S-ECC groups

HB	Cries free		S-ECC		P value	r (P)
	N	%	N	%		
Non-Anemic	22	44.0%	15	30%	0.04*	
Anemic	28	56.0%	35	70%	0.04*	-0.18 (0.01*)
P value	0.23		0.001*			

N: count %: Percentage *significant difference as P < 0.05. r: Pearson`s correlation coefficient

Discussion

S-ECC is severe form of early child hood caries affecting deciduous teeth, its debilitating effect can not only affect the children but also their families and the communities in which they live (Gift *et al.*, 1992). Most previous studies were conducted on western populations and limited evidence was found to relate early childhood caries especially severe form to different health parameters in preschool children.

Consequently, the aim of this study was to shed light on the impact of severe early childhood caries on different health parameters including growth, development and general health. For each child, weight and height were measured, dental status (dmft) was examined, hemoglobin level was recorded.

According to WHO, altered eating habits can rapidly manifested in younger children aged from 3 to 6 years (Gaur and Nayak, 2011). Also, definition of S-ECC is targeting the children younger than 6 years (AAPD, 2012). Hence, this age group was selected for our study.

BMI (body Mass Index) was used in many studies involving body weight, this is because BMI is age and gender specific so that children of different ages and gender can be compared accurately (CDC, 2014).

In this study, it was found that overweight and obese children were significantly higher than underweight children. These results were in agreement with previous study on Egyptian preschool children from Alexandria and this was explained due to high daily fat intake, frequent snacking on fatty fast foods and massive marketing promotion of high fat foods (Salama and Tayel, 2018).

Alterations in lifestyles, As decreased physical activity along with more consumption of low nutrient and high sugar foods are major contributors to both nutritional and dental caries diseases (Bagherian and Sadeghi, 2013).

On the other hand, many studies in different countries found insignificant correlation between caries distribution and BMI like was found in this study (Hong *et al.*, 2008; Edalat *et al*., 2014; Krishna *et al.*, 2017 and Kennedy *et al*., 2020). Since the data was cross sectional, cause and effect relations cannot be detected so there is a need for longitudinal studies to evaluate this relation.

The common risk factors for anemia and ECC, including poor dietary habits, food instability and low SES might play a role in the link between the two diseases. This relationship could be described as bidirectional in this situation with shared variables mediating it. It is widely known that low-income families tend to consume low nutrient high sugar foods, due to lack of parental awareness and affordability of unhealthy snacks which makes children more prone to dental caries (Angelopoulou *et al.*, 2019).

Children with low Hb levels were significantly higher in S-ECC group than their caries free peers, these results were in agreement with Bansal *et al*. (2016). A preclinical study on a mouse model was exploring the relationship between anemia and susceptibility to decay and showed that anemic mice were at a higher risk of developing deep carious lesions (Bahdila *et al.*, 2019). This was assumed to be due to that iron has a high affinity for the organic part of enamel and is capable of compensating for the loss of minerals during demineralization so iron can act as a protective factor against dental caries (Lacruz *et al*., 2012).

Correlating caries status to Hb level in Egyptian children in this study showed a significant weak negative correlation as S-ECC was associated with low Hb level. This result was in agreement with a previous study on Egyptian population Mohamed *et al.* (2021) and another study on Taiwanese children (Tang *et al*., 2013). This can be due to an inflammatory reaction in the body that can occur with rampant forms of dental caries. Inflammation associated with S-ECC inhibits erythropoiesis and thus lowers Hb level in the blood and so the level of iron. It is also known that the pain accompany S-ECC can cause altered eating habits (Schroth *et al*., 2009).

Another possible mechanism of how untreated severe caries with pulpitis affects Hb level was that interleukin-1 (IL-1), which has an important role in inflammation, can induce inhibition of erythropoiesis (erythrocyte production in the bone marrow) and so suppression of hemoglobin which can lead to anemia of chronic disease. Low hemoglobin level is a common in many chronic diseases and, if severe enough, may lead to "anemia of chronic disease". S-ECC may be one of such chronic disease (Schroth *et al*., 2013).

The clinical importance of this study is that S-ECC can be a risk marker for underlying conditions (nutritional deficiency and /or anemia). Therefore, physicians and dentists treating young children should take that into consideration. Nutritional deficiencies should alert physicians that S-ECC may be a possible explanation for the deficiencies. On the other hand, children with S-ECC should be considered at risk for malnutrition that may affect long-term health and well-being.

Conclusions

There was a negative correlation between caries status and Hb level indicating that S-ECC can be a risk factor for anemia. On the other hand, there was insignificant correlation between caries distribution and BMI and this needs more longitudinal studies to clarify the relation more clearly.

Limitations

Covid 19 was one of the most difficult challenges that restricted entrance to many hospitals and preschools. It took many efforts and long time to have access to children to collect data.in addition,

sometimes low level of literacy hindered answering some questions like child birth date so they were excluded.

References

American Academy of Pediatric Dentistry (AAPD), 2012. Definition of early childhood caries (ECC): Classifications, consequences, and preventive strategies. Pediatr Dent Ref Man.13: 34-12.

American Academy of Pediatric Dentistry (AAPD), 2020. Policy on early childhood caries (ECC): Classifications, consequences, and preventive strategies. Pediatr Dent Ref Man. Chicago, Ill. 79-81.

Angelopoulou, M., D. Shanti, C. Gonzalez, A. Love and J. Chaffin, 2019. Association of food insecurity with early childhood caries. J Public Health Dent; 79:102–108.

Bagherian, A., and M. Sadeghi, 2013. Association between dental caries and age-specific body mass index in preschool children of an Iranian population. Indian Journal of Dental Research, 24(1).

Bahdila D., K. Markowitz, S. Pawar, and K. Chavan, 2019. The effect of iron deficiency anemia on experimental dental caries in mice. Arch Oral Biol., 105:13–1.

Bansal, K., M. Goyal and R. Dhingra, 2016. Association of severe early childhood caries with iron deficiency anemia. J. Indian Soc. Pedod. Prev. Dent., 34:36-42.

Centers for Disease Control and Prevention (CDC), 2014. About BMI for children and teens.

Davidson, K., R. Schroth, J. Levi and B. Mittermuller, 2016. Higher body mass index associated with severe early childhood caries. BMC Pediatr., 16(1):137-144.

Edalat A., M. Abbaszadeh, M. Eesvandi and A. Heidari, 2014. The Relationship of Severe Early Childhood Caries and Body Mass Index in a Group of 3- to 6-year-old Children in Shiraz. J Dent Shiraz Univ Med Sci., 15(2): 68-73.

Edem, A., 2018. Early Childhood Caries Update. Dental Caries - Diagnosis, Prevention and Management. Chap, 6: 79-96.

Folayan M., M. Tantawi, R. Schroth, A. Vukovic, A. Kemoli, B. Gaffar, M. Obiyan and Early Childhood Caries Advocacy Group, 2020. Associations between early childhood caries, malnutrition and anemia: a global perspective. BMC Nutrition, 6:16.

Gaur, S. and R. Nayak, 2011. Underweight in low socioeconomic status preschool children with severe early childhood caries. Journal of Indian Society of Pedodontics and Preventive Dentistry, 4, 29.

Gift, H., S. Reisine and D. Larach, 1992. The social impact of dental problems and visits. *Am J of Public Health*, 82: 1663-8.

Hong, L., A. Ahmed, M. McCunniff, P. Overman and M. Mathew, 2008. Obesity and dental caries in children aged 2–6 years in the United States: national health and nutrition examination survey 1999–2002. J Public Health Dent., 64(4):227-233.

Ibrahim, H., H. El Sayed and E. Abd El-Aal, 2017. Diet Behavior Modification of Pregnant Woman with Iron Deficiency Anemia Using Construct of the Trans-Theoretical Model: A Theory-Based Study. IOSR Journal of Nursing and Health Science. 2320–1959, 6 (3). Ver. VI; 72-85.

Kennedy T., C. Rodd, C. Daymont, C. Grant, B. Mittermuller, A. Pierce, M. Moffatt and R. Schroth, 2020. The association of body mass index and severe early childhood caries in young children in Winnipeg, Manitoba: A crosssectional study. Int. J. Paediatr Dent. 30:626–633.

Krishna, H., E. Manaswini, V. Kumar, P. Bellamkonda, A. Bhargava and R. Jaidupally, 2017. Association between nutritional status and early childhood caries in Indian children. J Int Soc Prevent Communit Dent., 7: 131-135.

Lacruz, R., C. Smith, and P. Moffatt, 2012. Requirements for ion and solute transport, and pH regulation during enamel maturation. J. Cell Physiol., 227:1776–1785.

Mohamed W.A., R. Thabet, M. Helmi and S. Kamal, 2021. Iron deficiency anaemia and early childhood caries: a cross-sectional study. Australian Dental Journal, 66:(1 Suppl) S27–S36.

Salama A. and D. Tayel, 2018. Overweight and Obesity among Preschool Children aged 2–5 Years in Alexandria, Egypt. Canad. J. Clin. Nutr., 6 (1): 34-54.

Schroth, R., R. Harrison and M. Moffatt, 2009. Oral health of indigenous children and the influence of early childhood caries on childhood health and well-being. Pediatr Clin North Am., 56:1481-99.

Schroth, R., J. Levi, E. Kliewer, J. Friel and M. Moffatt, 2013. Association between iron status, iron deficiency anaemia, and severe early childhood caries: a case-- control study. BMC Pediatr., 13(1):22.

Tang, R., M. Huang and S. Huang, 2013. The relationship between dental caries status and anemia in children with severe early childhood caries. Kaohsiung J. Med. Sci., 29:330-6.

World Health Organization, 2006. WHO child growth standards: length/height-for-age, weight- for-age, weightfor-length, weight-for-height and body mass index-for-age.

WHO Multicentre Growth Reference Study Group., 2007. WHO Child Growth Standards: length/height-for-age, weight-for-age, weight-for-length, weight for-height and body mass index-for-age: methods and development. Geneva.

World Health Organization, 2007. Assessing the iron status of populations: report of a joint World Health Organization/ Centers for Disease Control and Prevention technical consultation on the assessment of iron status at the population level, 2nd ed., Geneva. Available at http://www.who.int/nutrition/publications/micronutrients/anaemia_iron_deficiency/9789241596107.

World Health Organization, 2008. Global Strategy on Diet, Physical Activity and Health, Childhood Oveaweight and Obesity, Geneva.

World Health Organization, 2009. WHO Anthroplus for personal computers manual: software for assessing growth of the world's children and adolescents. Geneva: http://www.who.int/childgrowth/software/anthro_pc_manual.pdf

World Health Organization, 2013. Oral health survey, Basic Methods.