Review on risk factors associated with childhood caries

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Abstract. Caries, also known as tooth decay or worm's tooth, is a disease of the oral cavity caused by multiple factors. It is one of the most common diseases of humans worldwide, and the World Health Organization (WHO) has identified it as one of "three major diseases affecting human health" along with tumors and cardiovascular disease. Genetics, the environment, and microorganisms all play a role in the development of its diseases. Caries is the leading cause of tooth loss in children, with a prevalence that is five times higher than that of asthma. It lowers adult life quality by causing pain in the teeth, spoiling their appearance, and making it difficult to replace missing teeth. Preventing and controlling a condition like childhood caries requires an understanding of the elements that contribute to it. This research will conduct a systematic literature review to examine the potential causes of caries in younger children.

Keywords: childhood caries, risk factors, genetic.

1. Introduction

Caries, also known as tooth decay or worm's tooth, is one of the most common diseases of humans worldwide and has been dubbed by the World Health Organization as one of the "three major diseases affecting human health" alongside tumors and cardiovascular disease. Factors at the genetic, environmental, and microbial levels contribute to its disease. Caries poses a number of risks to children's oral health, including: (a) the pain and discomfort associated with biting; (b) the continued development of pulpitis and periapical inflammation; (c) the loss of teeth in severe cases, which can have a negative impact on chewing function; (d) the loss of front teeth, which can have an aesthetic impact; (e) the loss of milk teeth, which can have a negative impact on the development of permanent tooth germ and tooth replacement. And child caries is caused by the interaction of several factors, mostly attributed to the interaction of sugar and microorganisms on the tooth surface under a certain time, as well as dietary habits, oral health behaviors, family genetic and environmental factors, etc. Consequently, preventing childhood caries requires a deeper familiarity with the elements that increase the likelihood of their development.

This research will use a literature review approach to examine the factors that increase the likelihood of caries developing in younger children. The study of factors related to childhood caries provides recommendations for the field of pediatric dentistry and dental prophylaxis, which is crucial for the prevention and control of this disease. These factors include genetics, the family environment, the social environment, and caries-causing microorganisms.

2. Current status of research on childhood caries

2.1. Prevalence of caries in children

Since 1983, a national oral health epidemiological survey has been conducted every decade to better understand the oral health status of both urban and rural residents. The first national oral health epidemiological survey was conducted with a total of 131,340 people in 1983. Two more were done, the second in 1995 with a total of 140,712 participants and the third in 2005 with a total of 93,826 people [2].The most recent one was in 2015, with a total of 172,720 participants. This study presents a summary and analysis of survey data collected from children aged 5 and 12 in 1995, 2005, and 2015 (data from 1983 is no longer usable).

Although the caries situation in the 12-year-old group is low (the average caries is 1.03 and the caries rate is 45.8%), the untreated caries accounts for a large proportion, 85.2%, according to the results of the second oral health epidemiological survey (1995); the caries situation in the 5-year-old group is very serious, with an average caries of 4.48 and a caries rate as high as 76.6%.

The third oral health epidemiology survey (2005) found that the caries rate for primary (baby) teeth in children aged 5 to 12 was 66.7% and for permanent teeth in children aged 12 to 15 it was 28.9%. The fourth oral health epidemiological study (2015) found that both the prevalence of childhood caries and the utilization level of oral health treatments by parents of children were at historically low levels. The survey found that the caries rate of permanent teeth in children aged 12 was 34.5 percent, which is 7.8 percentage points more than the rate seen in surveys conducted ten years ago. There has been a 5.8 percentage point increase in the prevalence of caries of milk teeth in children aged 5 over the past decade, reaching 70.9%. The incidence is greater in rural areas than in urban ones. Caries, or tooth decay, is on the rise among young people [1].

Our 12-year-olds have a relatively mild caries situation (Table 1 shows an average of 1.03 caries and a caries rate of 45.8%), but the proportion of untreated caries is high at 85.2%. In contrast, the 5-year-olds have a severe caries problem (Table 1 shows an average of 4.48 caries on milk teeth and a caries rate of 76.6%).

Table 1. Caries prevalence rate from 1995 to 2015.

Caries Prevalence Rate	5 years old	12 years old
1995	76.5%	45.8%
2005	66.0%	28.9%
2015	70.9%	34.5%

2.2. The influence of heredity and family environment on child caries

2.2.1. Genetic factors. Conservative treatments, such as medicine, often fail to halt the progression of dental caries, which is widely believed to be threatened by environmental and behavioral risk factors that result in the loss of masticatory function, quality of life, and economic loss. Dental caries have been shown to be genetically predisposed since the 1950s, and Bretz et al. further demonstrated the strong relationship between genetic variables and the development of caries [3]. The presence of single nucleotide polymorphisms in the ENAM gene may be an important predictor of caries in children, and many genes have been hypothesized as candidates for the study of caries in adults and children. For example, Olszowski et al. found that the diversity of the MBL2 gene was associated with the development of caries [3]. One possible predictor of childhood caries is the existence of a single nucleotide variation in the ENAM gene. Results from the studies are inconsistent, which may be attributable to the small sample sizes and the degree of sampling limitations used in most of the investigations. Due to the lack of agreement on the hereditary determinants of caries in younger children, several researchers have been unable to show a correlation between ENAM gene diversity and caries in Czech sampling. Genome-wide association studies (GWAS) have been successful in identifying

associations between common genetic variants and several common diseases, although progress has been slow and no genome-wide statistically significant associations are currently available. However, the emergence of GWAS paves the way for the development of dental genomics. Genotyping over 2.4 million single nucleotide polymorphisms with DNA isolated from saliva indicated the possibility of genomic analysis of caries in younger children, filling a gap in our understanding of the genomes of caries in children [3].

2.2.2. Family environmental factors. Parents' eating habits, attitudes about their children's oral health, and their children's caries rates have all been found to affect their oral health, however the exact nature of this relationship is still up for debate. In an oral examination and questionnaire study of 843 children aged 3-5 years, Pinto-Sarmento et al. showed a strong correlation between the prevalence of caries in children and the mother's education level of 8 years. Caries rates were much lower in households where both parents had high levels of education compared to those where both parents had lower levels of education. Children's attention to their dental health can be improved by encouraging them to maintain a higher level of cognitive development. Studies have revealed that single-parent households, which may be associated to lower household income and less supervision of children, are a significant risk factor for childhood caries [3]. Establishing healthy eating patterns in infancy and early childhood is crucial for preventing childhood caries and laying the groundwork for a lifetime of good nutrition.

The Mitrakul study also found a correlation between children's caries rates and their habit of eating sweets, especially before night [3]. Bottle feeding and nursing have both been recognized as potential risk factors for dental caries; however, other studies have revealed no significant difference between the two. The dental health of children can be affected by the foods their parents choose to feed them. When it comes to what they consume, younger children typically have to rely on their parents' preferences. Children are more likely to adopt their parents' eating habits than those they learn about on television, at school, or anywhere else. Mehta et al. found comparable evidence, demonstrating how parents' dietary habits and dental hygiene norms affect their offspring. Children spend more time with their parents, and as a result, they are more prone to pick up their parents' bad habits [4]. This could be attributed in large part to children's lack of cognitive development and their tendency to act like their parents.

2.3. Application of multifactorial analysis method and its limitation

Because caries is a complex disease, focusing on a single factor to evaluate its impact on caries in children runs the risk of exaggerating or downplaying that component's significance, and it also fails to accurately portray that element's significance in the full context. The use of a multivariate logistic regression model allows for the simultaneous examination of a number of potential risk factors for a disease; this satisfies the need for a thorough investigation of potential pathogenic factors; it also allows for the examination of the impact of genetics or family environment on the development of dental caries in children and thus provides a foundation for the early detection and prevention of dental caries in this population.

According to dialectical materialism, everything influences, interacts with, and is constrained by everything else. This includes not only the things themselves but also the parts that make them up and what happened before and after they existed. To suggest an approach to analyze the problem, we can refer to the elements and all other things within a certain object as factors, and we may label the influence between these things factors. The term "factor analysis" is used to describe a process of problem resolution that involves identifying and considering all of the potential influences on a given phenomenon, as well as their direction, strength, and interaction. The core concept behind it is to examine how everything is interconnected. Because of the global nature of the relationship, there can be a wide variety of influences on a given subject. Considering the sheer number of potential variables involved, it is necessary to first categorize them. Some classification schemes allow for more nuanced categorization of factors than others. Factors can be broken down into several categories based on their location in the system (internal vs. external), the direction of their impact (helpful vs. detrimental), the magnitude of their impact (major vs. moderate vs. minor), the mode of their impact (direct vs. indirect),

and the degree to which we can influence them (major vs. minor). In contrast, the multi-factor analysis approach selects a sufficient number of relevant elements to examine and explain the problem [5].

The relative importance of different drivers in driving market shifts and the relative sizes of their individual impacts are not revealed by a factor analysis of the data. However, factor analysis does not provide a more precise quantitative representation of the quantitative connection among market variables. The success of a factor analysis relies greatly on the skill and knowledge of the forecaster [6].

3. Case study

The epidemiological research of caries among Guangzhou kindergarteners will be reviewed and analyzed in greater detail in this chapter. With the Third National Oral Health Epidemiological Survey Program as a guide, the authors of this study designed their own oral health survey questionnaire. In their research, the questionnaire focused primarily on assessing factors associated with dental caries in young children. Multiple logistic regression analysis was used to screen the relevant factors in the questionnaire, with the exception of the multiple-choice questions; various relevant factors were entered into the regression equation in the form of Forwards stepwise LR; and the group that had never seen the teeth was used as the control group. The caries rate of children who had seen teeth was lower than that of those who had never seen teeth ($x2=5.918$, $p=0.015$), thus suggesting that regular oral examination of children can reduce the occurrence of caries; the caries rate of children who were taken care of by their mothers was significantly lower than that of children who were not taken care of by their mothers ($x2=4.826$, $p=0.028$); the caries rate of children whose parents never helped their children to brush teeth was significantly higher than that of other groups ($x2= 9.712$, $p=0.046$) [7].

Conclusions drawn from the questionnaire study included the following: first, younger children ate less of the traditional caries-prone foods like candy/chocolate and sugar water than older children did; second, younger children ate more fresh fruits, sweet snacks like bread/cakes, and sweet milk than older children did; and third, the structure of caries-prone foods had changed from what it had been in the past. Second, while many young children do wash their teeth, few do so before bed and even fewer do it twice after each meal due to a lack of appropriate parental supervision and assistance. Thirdly, most parents are aware of the importance of dental checkups for their children, but only a minority of kids actually get them. Half of kids under 18 have never had a dental exam, which suggests that their parents are overly optimistic about their oral health despite the fact that many people still use the absence of tooth pain as a proxy for the quality of a child's oral hygiene. Fourth, the dentistry department sees a disproportionate number of young children from the city's kindergartens for preventative care and treatment. When children wash their teeth properly under parental supervision and get frequent dental examinations, they reduce their risk of developing dental caries.

4. Conclusion

Many variables, including genetics, environment, and microorganisms, influence caries in younger children; nevertheless, many reasons and the occurrence of caries in younger children are still contentious and need to be further explored. These indicators can be used as criteria for risk assessment of the disease in younger children, and they play a crucial role in ensuring that appropriate preventative measures are taken by various high-risk groups.

The study's limitations include the small sample size, the lack of a flawless experimental technique, the selection of only a subset of relevant literature, etc. The most significant limitation of this study is that it relied solely on a survey of the current literature rather than conducting original research in the topic. We can travel to other areas to establish more specific age groups in order to delve deeper into the topic of childhood caries study in the future.

The prevention and treatment of childhood caries have made remarkable advancements, but the theory of childhood caries knowledge and the public's awareness of the dangers are still insufficient. Many variables, including genetics, the environment, and microorganisms, contribute to childhood caries, although much remains debatable about the prevalence of caries in younger children. These

characteristics can be used as a benchmark for assessing the likelihood of childhood caries, and they play a crucial role in informing targeted preventative strategies for those at highest risk.

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