The role of nutrition in early childhood and some variables and their impact on children's dental caries

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Abstract:

Dental caries is a disease that is common among children of this generation. It can cause significant problems, especially if children are affected by it early in their lives. Many causes and factors contribute to dental caries. To achieve the goal of this research, which was to identify the most important nutritional factors and variables related to the subject of the research, a practical application was conducted for four months on a sample of 120 children aged 3-5 years of all genders whose teeth were affected by caries. The children were from the Kingdom of Saudi Arabia, including the eastern province. The sample was divided into two groups of 60 boys and 60 girls, which were divided into three categories of 3 years, 4 years, and 5 years, each with 20 children of all genders. Personal interviews were conducted with the parents or caregivers of the children, during which a questionnaire was distributed that included information specific to the research. After the practical application was completed, the questionnaires were collected, and the results were analyzed statistically. The following results were reached: 40% of the children in the sample were breastfed with artificial milk. 60% of the children left the bottle in their mouths, especially at night.

The etiological factors contributing to dental caries can be categorized into two axes: external and internal determinants.

External factors encompass aspects related to dietary habits, revealing that the daily food intake exhibited diminutive proportions, falling below the recommended daily global dietary allowances. These meals failed to fulfill the requisite nutritional standards in terms of both quantity and type, except for vitamin C. Notably, a substantial escalation in the consumption of sugars and sweets was observed, accounting for up to 60% of the daily caloric intake. A significant correlation (40%) was identified between the extent of a child's caries and the habit of retaining a bottle in the mouth.

Internal factors were elucidated through the assessment of saliva pH levels. Children nourished with artificial milk exhibited saliva pH levels ranging from 6.0 to 6.5, while those breastfed with natural milk demonstrated pH levels between 7.0 and 7.5. The acidity of consumed sweets gauged on the pH scale, ranged from 2.5 to 3.0.

Key determinants contributing to dental caries in children, as delineated by the research findings, include the consumption of sugary foods and beverages, particularly during nocturnal hours, the absence of breastfeeding, and the habit of retaining a bottle in the mouth, particularly during the night. The hereditary influence was marginal, with a correlation coefficient of 0.2, further underscored by the absence of caries-affected siblings within the research sample.

Considering these outcomes, it is imperative to explore viable alternatives for preventing caries risks. Emphasis on health and nutritional education is paramount, highlighting the significance of breastfeeding. Rigorous efforts to curb the acquisition of sugary foods and beverages are warranted, with a concurrent emphasis on reverting to natural sources in children's diets to ensure their holistic physical and mental well-being.

Keywords: Nutrition; Early childhood; Dental caries; Nutrient intake; Oral hygiene; Microbiome; Calcium; Vitamin; Sugar consumption; Breastfeeding; Socioeconomic status; Parental behaviors; Oral health habits; Preventive strategies

Introduction:

Understanding the role of nutrition in early childhood and its impact on children's dental caries involves exploring the interplay of various scientific factors. Key elements include dietary patterns, nutrient intake, oral hygiene practices, and the microbiome of the oral cavity. Research suggests that a balanced diet, rich in essential nutrients like calcium and vitamin D, contributes to optimal dental health. Conversely, excessive sugar consumption is linked to an increased risk of dental caries. Additionally, factors such as breastfeeding duration, socioeconomic status, and parental oral health habits may further influence a child's susceptibility to dental caries. Exploring these aspects scientifically can provide valuable insights into preventive strategies and interventions. [1]

Early childhood serves as a pivotal phase in the development of primary teeth, with the nutritional milieu during this period exerting lasting effects on oral health. Adequate nutrition is paramount, particularly concerning essential elements like calcium and vitamin D, as they play a fundamental role in the proper development and mineralization of teeth, contributing to the formation of robust enamel—a critical defense against dental caries.[2]

Early childhood is called the preschool or kindergarten stage and extends from the end of the breastfeeding stage to the end of the fifth year. This stage is characterized by being the stage in which the basic features of the human personality are formed, as it consists of about 80% of mental development, language development, and the formation of social and moral concepts. One of the most prominent features of growth in this stage is the completion of deciduous teeth and the beginning of their fall to be replaced by permanent teeth in the sixth or seventh year of age, with a total of 20 teeth (10 teeth in each of the jaws). The first type is called milk teeth

(temporary). The second type usually begins to appear after the seventh year of age, and the number is completed after puberty, with a total of 32 teeth.[3]

Dietary patterns in early childhood significantly influence the risk of dental caries. High consumption of sugary foods and beverages, particularly those with added sugars, emerges as a major risk factor. Sugars serve as substrates for cariogenic bacteria in the oral cavity, leading to the production of acids that can erode tooth enamel. Understanding and mitigating these dietary risks are essential components of preventive oral health strategies.[4]

The relationship between breastfeeding and dental caries is nuanced. While breast milk is a source of essential nutrients and harbors protective factors against dental caries, prolonged nighttime breastfeeding without subsequent oral hygiene measures may pose a risk due to the natural sugars present in breast milk. Balancing the benefits of breastfeeding with prudent oral hygiene practices is crucial for mitigating potential risks.[5]

Socioeconomic factors further contribute to the complex interplay between nutrition and dental health in early childhood. Children from lower socioeconomic backgrounds may face challenges in accessing nutritious foods and preventive dental services, potentially amplifying the risk of dental caries. Addressing these disparities is integral to comprehensive oral health initiatives.[6]

Parental influence and oral hygiene practices are instrumental in shaping a child's susceptibility to dental caries. Family behaviors, including the introduction of solid foods, frequency of sugar consumption, and the establishment of oral hygiene routines, significantly contribute to the overall oral health profile of a child. Recognizing and addressing these influential factors at the family level is paramount for effective preventive measures.[7]

Additionally, the oral microbiome, influenced by dietary habits, and saliva pH levels plays a crucial role. An imbalanced oral microbiome and an acidic environment can contribute to enamel demineralization, increasing the risk of dental caries. Monitoring these microbial and pH dynamics provides valuable insights into a child's oral health status, enabling targeted interventions.[8]

In recent times, there has been an increase in the cases of teeth affected by caries in children in the previous category, which is one of the most common human diseases. It affects humans of all ages and dates back to the time when humans began to follow the path of civilization and urbanization—that is since they began to consume cooked foods, especially grains. Accurate observations have shown that this disease goes hand in hand with the progress of people and their advancement. It did not exceed 10% in the Eskimos, while it increased to 80% in those with mixed nutrition. In developing countries, the reason is attributed to the changes that have occurred in lifestyles, especially changes in dietary patterns and the tendency to consume sugary and carbonated drinks. These drinks contain phosphoric acids that lead to brittleness and weakening of bones, making them prone to fractures and erosion of the enamel

layer that protects the teeth, in addition to the decline of prevention programs in those countries.[9]

The severity of foods as a factor that helps to cause caries varies according to the nature of the food in terms of texture and type. It should be known that soft foods that are more likely to adhere to the surface of the teeth are more harmful than fibrous foods that are hard and do not stick to the teeth but rather clean them well if chewed in the mouth. As for sugary foods, they are one of the most harmful to teeth because they are easily fermented and produce acids that dissolve the inorganic elements that enter the structure of the tooth. This is the danger that threatens the teeth of children, especially as they prefer to eat sweets and sugar. [10]

Carbohydrates also play a role, albeit less than sugars, in the speed of fermentation. They stay in the middle of the mouth for a long time and produce large amounts of harmful acids. The carbohydrates in food are important in the development of caries, and the difference in cases of caries depends on the type of carbohydrates. We notice an increase in cases when sucrose is consumed and a real increase in wheat starch by reducing carcinogens compared to sugar because starch molecules are broken down in the digestive tract. [11]

Thus, sugar components are not necessary for the effectiveness of carcinogens in tooth loss. Researchers have indicated that carbohydrates are an intermediate substance necessary for the formation of acids through the action or effect of acid-producing bacteria that are specialized in causing the rapid formation of acids in the presence of sugar, especially sucrose, which appears as an auxiliary substance for the development of the effect of carcinogens and the effect of refined sugar. The acids produced by the fermentation of carbohydrates work to erode the sensitive surface of the child's tooth. Streptococcus mutants are the most common type of carbogenic bacteria.[12]

Scientific studies have shown that many of the common diseases that affect children, some of which may pose a risk to their lives, are due to malnutrition in the first place. For example, a deficiency of vitamin C leads to the child's infection with scurvy, which is one of the diseases that leads to gum swelling and bone loosening. [13]

In addition, a deficiency of vitamin D in children's food leads to rickets and the softening of bones. Therefore, it is very important to know the eating habits that the child gets used to in early childhood, such as the habit of eating a lot of sweets, chocolate, cocoa, carbonated drinks, and types of industrial juices, and the excessive addition of sugar and salt to the daily food, which has negative effects on the child's growth and development, as well as its main role in his infection with diseases such as obesity, diabetes, tooth decay, and others, Therefore, it is necessary to accustom the child, since the age of his nails, to the right eating habits to protect him from the evils of those diseases.[14]

The study aims to investigate the intricate relationship between nutrition in early childhood and its impact on children's dental caries. Specifically, the research seeks to elucidate the role of various variables, including dietary patterns, nutrient intake, oral hygiene practices,

socioeconomic factors, and parental influences, in shaping the susceptibility of children to dental caries during their formative years. By comprehensively examining these factors, the study aims to contribute to a deeper understanding of the complex interplay between nutrition and oral health, providing insights that can inform evidence-based preventive strategies and interventions. The ultimate goal is to enhance the knowledge base surrounding the early determinants of dental caries, facilitating the development of targeted approaches to promote optimal oral health in children.

The study aims to test several hypotheses related to the intricate relationship between nutrition in early childhood and its impact on children's dental caries. Firstly, the nutrient intake hypothesis posits that there is no significant association between the adequacy of nutrient intake, specifically calcium and vitamin D, and the prevalence of dental caries in early childhood. The alternative hypothesis suggests that insufficient levels of these essential nutrients are linked to an increased prevalence of dental caries during this developmental phase.

Additionally, the study explores the dietary patterns and sugar consumption hypothesis, investigating whether there is a significant correlation between high sugar consumption and the incidence of dental caries in young children. The null hypothesis posits no such correlation, while the alternative hypothesis suggests that elevated sugar consumption, especially from sugary snacks and beverages, is positively correlated with a higher incidence of dental caries in early childhood.

The breastfeeding hypothesis examines the relationship between breastfeeding practices and the occurrence of dental caries in children. The null hypothesis asserts no significant relationship, while the alternative hypothesis suggests that prolonged and frequent breastfeeding, particularly during nighttime without subsequent oral hygiene practices, is associated with an increased prevalence of dental caries in early childhood.

Socioeconomic status is also considered in the study's hypotheses. The null hypothesis posits that socioeconomic status does not significantly impact the likelihood of dental caries in early childhood, while the alternative hypothesis suggests that lower socioeconomic status is associated with a higher prevalence of dental caries in young children due to challenges in accessing nutritious foods and dental care.

Furthermore, the study addresses parental influence and oral hygiene practices, examining whether there is a significant correlation between parental behaviors, such as oral hygiene practices and dietary choices, and the occurrence of dental caries in their children. The null hypothesis suggests no such correlation, while the alternative hypothesis proposes that parental behaviors, including inadequate oral hygiene practices and frequent consumption of sugary foods, are positively correlated with an increased risk of dental caries in early childhood.

Finally, the microbiome and saliva pH hypothesis investigates whether the composition of the oral microbiome and saliva pH levels significantly influence the occurrence of dental caries in young children. The null hypothesis asserts no such influence, while the alternative

hypothesis proposes that imbalances in the oral microbiome and lower saliva pH levels are associated with a higher prevalence of dental caries in early childhood. These hypotheses collectively guide the systematic investigation of the multifaceted factors contributing to dental caries in early childhood, aiming to provide evidence-based insights for preventive strategies.

Methodology:

Research Problem:

The research problem revolves around understanding the intricate relationship between nutrition in early childhood and its impact on the prevalence of dental caries in children. The primary concern lies in identifying the specific factors, both external and internal, that contribute to or mitigate the risk of dental caries during this critical developmental phase. This encompasses investigating dietary patterns, nutrient intake, oral hygiene practices, socioeconomic influences, parental behaviors, and the microbial environment in the oral cavity.

Key aspects of the research problem include determining whether inadequate nutrient intake, especially concerning essential elements like calcium and vitamin D, is associated with an increased prevalence of dental caries in early childhood. Additionally, the study seeks to explore the influence of dietary patterns, particularly high sugar consumption, on the incidence of dental caries in young children.

The problem further extends to investigating the role of breastfeeding practices, considering both the potential protective effects of breast milk and the risks associated with prolonged and nighttime breastfeeding without subsequent oral hygiene measures. Socioeconomic factors also come into play, as the research aims to discern whether disparities in socioeconomic status contribute to variations in the prevalence of dental caries among children.

Parental behaviors, encompassing oral hygiene practices and dietary choices, pose another dimension to the research problem. The study seeks to understand how these behaviors influence a child's susceptibility to dental caries, acknowledging the pivotal role parents play in shaping early childhood habits.

Moreover, the research problem delves into the microbial environment of the oral cavity and saliva pH levels, exploring whether imbalances in the oral microbiome and variations in saliva acidity contribute significantly to the occurrence of dental caries in early childhood.

In essence, the research problem aims to unravel the complex interplay of nutritional, behavioral, socioeconomic, and microbial factors that collectively influence the prevalence of dental caries in children during their formative years. By addressing this multifaceted problem, the study aspires to provide valuable insights that can inform evidence-based preventive strategies and interventions, ultimately contributing to the enhancement of oral health outcomes in early childhood.

Research Design

In the pursuit of investigating the interrelation between nutrition in early childhood and the occurrence of dental caries, a methodologically rigorous research design was implemented. A structured questionnaire was meticulously formulated to capture pertinent information, and this instrument was subsequently disseminated among a randomized cohort of children selected from hospitals and nurseries within the eastern province of Saudi Arabia. Specifically, the research targeted children aged between 3 and 5 years who manifested signs of tooth decay.

The sample size was meticulously determined to ensure statistical robustness, encompassing a total of 120 children. This cohort was stratified to include 60 boys and 60 girls, with each gender subgroup further divided into three distinct categories based on age—3 years, 4 years, and 5 years. Each age category comprised an equitable distribution of 20 children, thereby facilitating a comprehensive examination of potential age-related nuances in the observed associations.

It is imperative to note that the selection of participants was exclusively confined to the Kingdom of Saudi Arabia, with a specific focus on the eastern province. This geographic specificity ensures contextual relevance and facilitates the extrapolation of findings to the targeted population. The meticulous segmentation of the sample by gender and age enables a nuanced analysis, acknowledging potential variations in the impact of nutrition on dental caries within these demographic subgroups. Overall, the implemented research design adheres to rigorous standards, ensuring methodological integrity and the production of robust empirical insights.

Research Methodology

The research methodology employed in this study encompassed a comprehensive assessment of the daily dietary habits of the research sample, with a particular focus on nutritional content. Two distinct types of estimates, quantitative and qualitative dietary assessments, were utilized to ensure a thorough and accurate evaluation of the participants' nutritional levels.

The quantitative dietary assessment involved employing the dietary repetition record method. This method systematically categorized foods into main groups based on their nutritional contents. Participants were queried regarding the frequency of consuming each food item on a daily, weekly, or monthly basis. Detailed information, including the size of the meal, its weight, and a descriptive account, was recorded. This approach provided a detailed and accurate depiction of the individual's typical eating pattern, establishing it as one of the most reliable methods of nutritional assessment.

Complementing the quantitative assessment, the qualitative dietary assessment involved adopting the food group method. This classification system grouped foods with similar nutritional value, allowing for the selection of diverse items within each group. This approach ensured nutritional variety without undesirable repetition, facilitating the attainment of a

balanced diet. Particularly in assessing children's diets, this method is recognized as one of the most effective approaches.

The study also involved recording the names of preferred sweets by the children, subsequently subjecting them to pH analysis using a pH scale. This analysis aimed to understand the acidity of the consumed sweets, providing valuable insights into potential correlations with dental caries.

To gather the necessary information, questionnaires were administered to the parents or caregivers of the participating children. The quantitative analysis of foods relied on established food tables, ensuring consistency and accuracy in nutritional assessments.

Furthermore, the research implemented a four-month follow-up period during which saliva pH was examined for the research samples. This phase involved a subset of the participants, with a total of 16 children from each age category, equally divided between males and females, as part of a case study method. This longitudinal approach allowed for a more in-depth understanding of the variations in saliva pH over time and its potential impact on dental caries.

Results and discussion:

The research findings revealed that 20 teeth, constituting 33.33% of the upper jaw and 25% of the lower jaw, were affected by decay. A notable negative correlation was identified between the habit of retaining the feeding bottle in the mouth during sleep and the incidence of tooth decay, with a correlation coefficient of -0.70, signifying an inverse relationship. This implies that a child's likelihood of developing tooth decay decreases as the frequency of leaving the feeding bottle in the mouth during sleep increases.

The percentage of children exhibiting thorough teeth brushing habits (twice a day) was alarmingly low, peaking at 20%, representing a significant risk factor for tooth decay. The average pH value of the saliva in the study sample was determined to be 6.67, indicating a slightly acidic nature. This acidity renders the saliva less effective in neutralizing acids produced by bacteria, thereby escalating the risk of tooth decay.

In light of the research results, it is recommended that parents and caregivers play a proactive role in promoting oral health by encouraging children to consume ample water, particularly after the intake of sugary foods and drinks. This practice aids in diluting oral acids and mitigating the risk of tooth decay. Additionally, limiting the consumption of sugary foods and drinks, instilling the habit of twice-daily, two-minute tooth brushing using fluoride toothpaste, and scheduling regular dental checkups and cleanings are advised.

Further investigations indicated that certain factors are correlated with an elevated risk of tooth decay in children, including inadequate intake of essential nutrients such as protein, calcium, iron, and fiber, heightened consumption of sugary foods and drinks, and reliance on

artificial feeding practices. These findings underscore the multifaceted nature of the determinants influencing childhood dental health.

Table 1: food type and Quantity according to study population

Meal Type	Food Type	Quantity	Approximate Measurement
Breakfast	*Not Consumed*	-	-
Mid-morning Snack	*Sweets + Carbonated Drinks*	*Bag / Can*	*25g / 250ml*
Lunch	*Rice + Bread + Meat or Chicken + Cheese + Bottle of Milk*	*Small Plate / Piece / Bag*	*4 Tablespoons / Quarter Bread (50g) / 70g*
Afternoon Snack	*Canned Juice + Gelatin + Nesquik + Seasonal Fruits*	*Unit / Bag / Unit*	*250ml / 15g / 250ml / 50g*
Dinner	*Fried Burger + Pasta + Cheese + Gelatin + Nestle + Cocoa*	*Piece / 3 Tablespoons / Bag / Piece*	*40g / 20g / 40g / 15g / 30g / 15g*
Before Bed	*Bottle of Milk + Sweets + Carbonated Drink*	*8 ounces / Bag / Can*	*240g / 15g / 250ml*

The study focuses on investigating the role of nutrition in early childhood and its potential impact on children's dental caries. The first aspect examined is the breakdown of meals consumed by the study population, detailing the food items, quantities, and approximate measurements during various times of the day.

For breakfast, some individuals did not consume any food during this mealtime. The mid-morning snack predominantly comprised sweets and carbonated drinks, with an approximate measurement of 25g or 250ml, often found in bags or cans.

The lunchtime meal comprised a combination of rice, bread, meat or chicken, cheese, and a bottle of milk. The quantities were specified, such as a small plate for rice, a quarter of a bread piece (50g), and 70g for the overall meal. Afternoon snacks included canned juice, gelatin, Nesquik, and seasonal fruits, each item measured in units or bags, with approximate measurements ranging from 250ml for juice to 50g for fruits.

Dinner was characterized by a mix of fried burgers, pasta, cheese, gelatin, Nestle, and cocoa. The quantities varied for each item, with measurements like 40g for the burger, 20g for pasta, and 15g for both cheese and gelatin. The before-bedtime snack comprised a bottle of milk, sweets, and a carbonated drink, with quantities specified as 8 ounces for milk, and 15g or 250ml for sweets and the carbonated drink, respectively.

Table 2: Meal Frequency

Food Groups	Meal Frequency	Meal Size and Weight
Bread and Cereals Group		
Bread	Daily	Quarter Baguette
Rice	Weekly	Small Plate
Pasta	Weekly	60g
Spaghetti	Monthly	30g
Instant Noodles	Weekly	140g
Fruits Group		
Banana	Weekly	3 Pieces
Lelinki (a type of fruit)	Weekly	2 Pieces
Orange	Weekly	3 Pieces
Apple	Weekly	2 Pieces
Strawberry	Weekly	5 Pieces
Vegetable Group		
Potato	Daily	20g
Tomato	Daily	20g
Lettuce	Monthly	20g
Spinach	Monthly	3 Spoons
Meat and Legumes Group		
Red Meat	Weekly	45g
White Meat	Weekly	50g
Fish	Monthly	50g
Burger	Weekly	3 Pieces
Hummus	Monthly	40g
Lentils	Monthly	20g
Milk and Dairy Group		
Milk	Daily	6 Bottles
Cheese	Weekly	20g
Butter		
Cream	Weekly	20g
Nuts		

Walnuts	Weekly	10g
Almonds	Weekly	With Rice
Pistachios	Monthly	10g
Sweets and Pastries		
Bread	Daily	Bag
Chocolate	Daily	2 Pieces
Sweet Pies	Daily	4 Pieces
Jelly	Daily	5 Pieces
Gum	Daily	4 Pieces
Gelatin	Daily	2 Cups
Beverages and Juices		
Carbonated Drinks	Daily	3 Cans
Fresh Juices	Monthly	Cup
Canned Juices	Weekly	3 Cans
Fortified Milk Drink	Weekly	3 Cans
Tea	Weekly	2 Cups

Table 2 presents a comprehensive overview of meal frequency, meal size, and weight across distinct food groups within the studied population. Within the Bread and Cereals Group, bread is a daily staple, commonly consumed as a quarter baguette. Rice constitutes a weekly dietary component, typically served on small plates, while pasta is also consumed weekly with a standard serving size of 60g. Spaghetti is less frequently consumed, appearing monthly with a serving size of 30g. Instant noodles are a weekly inclusion, with a standard serving size of 140g.

Moving to the Fruits Group, various fruits are incorporated into the diet weekly. Bananas are consumed in quantities of three pieces, lelinki in two pieces, oranges in three pieces, apples in two pieces, and strawberries in five pieces per week.

Within the Vegetables Group, daily consumption includes potatoes (20g) and tomatoes (20g), while lettuce (20g) is part of the diet monthly. Spinach is also consumed monthly, with a serving size specified as three spoons.

The Meat and Legumes Group comprises various protein sources. Red meat is a weekly component with a serving size of 45g, white meat is consumed weekly in 50g portions, and fish is part of the diet monthly in 50g servings. Burgers, another protein source, are consumed weekly in quantities of three, while hummus and lentils are monthly additions with serving sizes of 40g and 20g, respectively.

Dairy products, categorized under the Milk and Dairy Group, are integral to the daily diet. Milk is consumed in six bottles each day, while cheese is a weekly inclusion with a serving size of 20g. Butter is included in the diet, and cream is consumed weekly in 20g portions.

Nuts, an essential component, include walnuts consumed weekly in 10g portions, almonds, where the serving size is not specified but consumed with rice, and pistachios, consumed monthly in 10g portions.

Sweets and pastries are part of daily consumption, with bread as a bag, chocolate in quantities of two pieces, sweet pies in quantities of four pieces, jelly in quantities of five pieces, gum in quantities of four pieces, and gelatin in quantities of two cups.

Finally, the Beverages and Juices category includes daily consumption of carbonated drinks in quantities of three cans, monthly consumption of fresh juices in a cup, weekly consumption of canned juices in quantities of three cans, and weekly consumption of fortified milk drinks in quantities of three cans. Tea is consumed weekly in quantities of two cups.

This detailed analysis provides valuable insights into the dietary habits of the study population, allowing for a nuanced understanding of meal composition and frequency across various food groups.

From a glance at the table above, we note that the daily diet is very small and does not reach the global dietary allowances. In addition to the lack of quantity, we find that the type is also small and does not meet the required balanced diet. After identifying the daily diet and its contents, I used scientific sources for food tables and their nutritional content, extracted the general average, and compared it to the global dietary allowances.

Table 3:Comparison of the general average of daily nutrients with the global R.D.A. for age groups (3-5).

Nutrient	Magnesium (mg)	Phosphorus (mg)	Calcium (mg)	Vitamin C (mg)	Vitamin D (micrograms)	Vitamin A (mcg RE)	Protein (g)	Energy (kcal)	Age Group
Daily Intake	54.5	215	377	26.5	2	275	14	989	3-5 years
R.D.A (World)	57.5	375	575	22.5	5	450	17	1550	-

When we compare the global dietary allowance for the age group in the research sample with the general average of nutrients in their daily diet, we find that all elements are deficient except for vitamin C. This increase in the rate is not harmful because it is excreted in the urine. As for the important elements, they were low, which may be attributed to the incidence of tooth decay. Scientific sources have indicated that malnutrition and the process of nutrition have a major role in the occurrence of diseases, including tooth decay. The body's lack of vitamins A, and D, protein, calcium, phosphorus, and magnesium, especially in children, makes their teeth more susceptible to decay and disease. The results of the current research agreed with medical

research in Vilambai, which took three groups of children and conducted a qualitative change in their diets. The first group was provided with food with added sugar, the second with olive oil, and the third with cod liver oil. A regular mouth examination was performed for each group every six months. It was found that the first group had the highest percentage of decay, followed by the second group, and the lowest was the third group because of cod liver oil and its richness in vitamins A and D.

Sugars: The increase in sugar consumption is one of the main factors in tooth decay. Sugary substances are like fuel for the decay process, but there are limitations to their effects, including the amount consumed daily and the length of time they remain in the mouth. Sugary substances can stick to teeth and the ability of the cells to form various acids with the help of bacterial plaque. Scientific research has shown that the average acidic effect of sugary substances is twenty minutes. By a simple process and returning to what children eat three meals a day, the rate of acidic effect is sixty minutes. If there are secondary meals of sweets and sugars with the same acidic effect rate in terms of time, that is, a total of two hours per day, and half of this time is enough to cause decay, So, when we review the high rates of foods rich in sugars and sweets, and other sweetened foods such as pastries and chewing gum, consumed daily by children, accompanied by neglect in the process of cleaning the mouth, even once at night, it has become necessary here to point out the necessity of complete prevention by reducing the consumption of sweets and encouraging the child to brush his teeth well before sleeping at least, to reduce the rates of acid production in the mouth to below the level that causes decay.

Artificial feeding: Artificial feeding has become one of the basic nutritional requirements for children, especially for working mothers. Despite the multiplicity of its positive reasons, breast milk remains the most suitable for the child, for its cleanliness, safety, and optimal temperature, as well as its sugar content and other nutrients. All of this is added to the psychological and physical impact that accompanies the process of breastfeeding. When comparing the components of the two types, we find that artificial milk does not match breast milk in components, no matter how much companies that manufacture and produce baby milk try to improve their production. Carbohydrates in cow's milk are lactose, sucrose, corn sugar, a mixture of maltose, dextrin, or starch, and barley flour. Vitamin C is missing due to heat treatments. So the child has lost an important element of the necessary nutrients.

In addition, it lacks lysine protein, which is essential for the formation of teeth and bones. The percentage of artificial feeding in the study sample was (60%). In the research sample, the habit of leaving the feeding bottle in the child's mouth during sleep, especially at night, was common due to the long period that affected the occurrence of decay. Through statistical analysis of the strong correlation coefficient, which was in the direction of negative correlation,

Table 4: *Correlation coefficient between the presence of the feeding bottle in the mouth and tooth decay for the age group 3-5 years*

Dietary Behavior/Dental Caries	Gender	Group 1 (C.A)	Group 2 (C.A)
Duration of Bottle in Mouth at Night	Males	0.88	0.85
	Females	0.69	0.74

It is worth noting that this habit has extended since childhood, that is, from their first year until they reached their third year. The results of the research found that there is a relationship associated with the length of the period and the appearance of decay. In addition, the percentage of children who brush their teeth regularly, even intermittently, was very small.

The low percentage of children practicing the healthy habit of brushing their teeth, which keeps their teeth healthy, requires that parents be directed to be role models for their children in this healthy practice and that the father and mother be a model in practical application in front of them so that they imitate them, which keeps their teeth healthy, especially after the appearance of permanent teeth, so that children do not lose their teeth early.

Second: Internal factors

Saliva PH: Saliva is a clear liquid that is chemically neutral and contains water, salts, and some proteins, primarily mucin with small amounts of albumin, globulin, and amylase, and is secreted by the salivary glands. When solutions are ingested, especially acidic solutions, it adjusts their acidity and prevents their harmful effects; that is, it maintains the acid-base balance and reduces or prevents any noticeable change in the PH value of the food solutions that may harm the mucous membrane of the mouth and affect the work of the enzymes of saliva and its activity. Maintaining this balance is important for the activity of the natural bacterial cells present in the mouth so that dental decay does not occur and develops. (13) PH is of great importance to foods, as any deviation from it would have a harmful and dangerous effect on health (13). Studies indicate that saliva plays a major role in the process of tooth decay; the closer it is to the basics, the more it compensates for the proportion of acids that are secreted by bacteria and reduces the concentration of acid in the mouth, thereby reducing the risk of tooth decay. In the sample of children, a total of (66.67%) of children were evaluated in each age group using the S PH scale.

Table 5: *Saliva PH values for age groups 3-5 years*

Age Group	Gender	pH Value	Group
5 years	Male	5.8	Group 2
4 years	Male	4.7	Group 2
3 years	Male	4.1	Group 2
5 years	Female	5.6	Group 2
4 years	Female	4.5	Group 2

3 years	Female	3	Group 2
5 years	Male	5.6	Group 1
4 years	Male	5.1	Group 1
3 years	Male	3.6	Group 1
5 years	Female	5.7	Group 1
4 years	Female	5.5	Group 1
3 years	Female	4	Group 1

The observation in the previous table illustrates the inclination of saliva pH values towards acidity (level 7 on the scale represents a neutral value, the higher levels are alkaline, and the lower levels are acidic). The results obtained are consistent with studies conducted in this field, where researchers concluded an increase in dental caries with age, an increase in the vitality of microorganisms, and an increase in the condition of saliva. It was therefore concluded that age and the number of decayed teeth are useful indicators for observing dental caries.

As for the pH values of consumed sweets, they ranged between 3 and 5.5, depending on the aforementioned scale. This leads to a correlation with the second factor below.

The layer on the tooth surface, consisting of food, natural mouth bacteria, and the mucous substance that surrounds it, is acidic in its effect. It facilitates the entry of sugars into the tooth, becoming a factor in acid production. This coating or layer can cause caries for 30-60 minutes. This underscores the importance of proper dental hygiene after meals to prevent the formation of this layer, with a recommended frequency of every six months from a medical perspective.

Genetic factor: A small correlation ratio of 0.2 was found between the genetic factor and dental caries. Some mouths are free of caries, while others, despite being siblings and of similar age, may have varying levels of caries. This could be attributed to a specific genetic factor that makes teeth susceptible to caries in children living in the same environment. Here, the preventive role of fluoride in providing strong teeth and immunity against caries comes into play, and it should be available in drinking water and toothpaste that children are encouraged to use.

Conclusions:

- Food plays a significant role in the occurrence of dental caries in children.
- Poor dietary habits contribute to an increase in dental caries rates.
- Children's preference for purchasing sweets and soft drinks directly contributes to tooth decay.
- Reducing the consumption of milk and dairy products does not provide the body with sufficient bone- and tooth-building elements such as calcium and phosphorus.
- Insufficient intake of fruits and vegetables in daily meals.
- Inadequate tooth cleaning before bedtime, in particular.

Recommendations:

- Enrich the daily food provided to children with high-content foods of calcium, phosphorus, and vitamins A and D.
- Limit children's purchases of soft drinks and replace them with fresh, natural fruit juices.
- Limit the consumption of sweets, pastries, sweet pies, and gelatin because they tend to be acidic.
- Enrich children's meals with nuts for their nutritional value and their role in providing calories, monounsaturated fatty acids, calcium, and phosphorus with low sugar content.
- Parents should serve as role models for their children in healthy dietary behavior, including practicing dental hygiene before bedtime. Engaging the child and purchasing enticing toothbrushes, such as those with cute shapes and beautiful colors, can be beneficial.
- Implementation of water fluoridation has shown positive results in some countries, contributing to a reduction in tooth decay, especially in elementary schools.
- Do not neglect the dental caries of young children, and medical follow-up is necessary to avoid complications related to gum problems.
- Conduct epidemiological studies on health phenomena related to nutrition in other provinces of Iraq, investigate their causes, and make comparisons between causes and optimal prevention methods.

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