GRADUATION PROJECT

Degree in Dentistry

EVALUATION OF FOOD ADVERTISING ON TELEVISION AND ITS RELATIONSHIP WITH ORAL HEALTH IN THE PEDIATRIC POPULATION

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ABSTRACT

Introduction: The media surrounds today's youth, and television is one of the most popular forms of entertainment for children. Several television channels are used to reach youngsters in order to encourage the purchase of food products**.** Consequently, it is possible for children to be manifested to sophisticated advertisements of foods that can harm their oral and overall health.

Objective:

The main objective of this project is to evaluate the impact of food and beverage advertising on television, and what type of correlation it might have on pediatric oral health. The second goal of this research is to determine how many cariogenic food or drink advertisements are provided at various broadcast times on different country cartoon channels. The third objective of this study is to ascertain whether TV ads for cariogenic foods target a particular age range, whether they are directed at boys, girls, or both, and whether this has any bearing on the prevalence of caries.

Methodology:

Commercials for children's programming on the most popular free-to-air national Turkish, Spanish, and American television networks in the country were studied for their content. The evaluations occurred on three separate weekdays between November 14, 2022 and January 26, 2023. Methods of quantitative research were used for this investigation.

Results: In total, there were 1090 TV commercials, with 500 of them promoting food or drinks for children. Advertisements for healthier options like fruits and vegetables were much less common than those for foods high in fats and sugars. High rates of dental caries were found in Turkish, American, and Spanish children.

Conclusions: Television advertising of potentially cariogenic foods was found to be associated with increased rates of dental caries in children. It was discovered that children under the age of six had the highest prevalence of caries. Tooth decay was also linked to the number of cariogenic commercials viewed by kids, regardless of whether they were watching TV in Spain, Turkey, or the United States.

Key words: Dentistry, Television advertising, Food Industry, Early childhood caries, Oral health.

RESUMEN

Introducción: Los medios de comunicación rodean a la juventud actual, y la televisión es una de las formas de entretenimiento más populares entre los niños. Se utilizan varios canales de televisión para llegar a los más jóvenes con el fin de fomentar la compra de productos alimenticios. En consecuencia, es posible que los niños se manifiesten ante sofisticados anuncios de alimentos que pueden perjudicar su salud bucodental y general.
Objetivo: El objetivo principal de este proyecto es evaluar el impacto de la publicidad de alimentos y bebidas en televisión, y qué tipo de correlación puede tener en la salud bucodental pediátrica. El segundo objetivo de esta investigación es determinar cuántos anuncios de alimentos o bebidas cariogénicos se emiten a distintas horas en canales de dibujos animados de distintos países. El tercer objetivo de este estudio es determinar si los anuncios televisivos de alimentos cariogénicos se dirigen a una franja de edad concreta, si se dirigen a niños, a niñas o a ambos, y si esto tiene alguna relación con la prevalencia de caries.
Métodos: Se estudió el contenido de los anuncios de programación infantil de las cadenas nacionales de televisión turca, española y estadounidense en abierto más populares del país. Las evaluaciones tuvieron lugar en tres días laborables distintos entre el 14 de noviembre de 2022 y el 26 de enero de 2023. Para esta investigación se utilizaron métodos de investigación cuantitativa.
Resultados : En total, había 1.090 anuncios de televisión, de los cuales 500 promocionaban alimentos o bebidas para niños. Los anuncios de opciones más saludables, como frutas y verduras, eran mucho menos frecuentes que los de alimentos ricos en grasas y azúcares. Los niños turcos, estadounidenses y españoles que veían muchos anuncios en la televisión presentaban tasas elevadas de caries dental.
Conclusión : Se descubrió que la publicidad televisiva de alimentos potencialmente cariogénicos estaba asociada a mayores tasas de caries dental en niños. Se descubrió que los niños menores de seis años tenían la mayor prevalencia de caries. La caries también se relacionó con el número de anuncios cariogénicos vistos por los niños, independientemente de si veían la televisión en España, Turquía o Estados Unidos.

Palabras claves : Odontología, Publicidad televisiva, Industria alimentaria, Caries de la primera infancia, Salud bucal.

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INTRODUCTION :

1.1 Caries definition and terminology

Caries, or dental decay, is a bacterial disease that affects the calcified tissues of teeth and causes the inorganic and organic components of the tooth to deteriorate and demineralize. Cavities, or holes in teeth, are the most typical outcome of dental caries. Dental caries can be extremely painful and even lead to tooth loss if left untreated. Biofilms are responsible for dental caries, which are fueled by sugar and characterized by multiple causes, a dynamic course, and the demineralization and remineralization of tooth enamel (1).

The tooth crown and, in later life, exposed root surfaces, are both vulnerable to caries damage, which can occur at any age and in either the primary or permanent dentition. The onset and development of caries are influenced by the equilibrium between pathological and protective factors (1,2). When biofilms (dental plaque) are allowed to accumulate and mature over time, dental caries lesions develop in sheltered areas of the dentition. These include the proximal surfaces cervical to the contact point area, the gingival margin, and pits, grooves, and fissures in the occlusal surfaces, especially during eruption.

It is essential to understand that the formation and growth of an oral biofilm on dental hard tissues does not automatically lead to the development of clinically visible caries lesions, despite the fact that biofilms form and grow ubiquitously on solid surfaces in the oral cavity. Biofilms are defined by persistent microbial activity, which manifests as minute PH fluctuations due to metabolic events. Changing one's diet can have a profound effect on one's metabolism, and the results of that metabolism can be measured as PH swings. The caries lesion develops when metabolic processes deviate, leading to a net loss of minerals and a decrease in pH (1,2).

When the composition and metabolic activity of the biofilm undergo ecological changes over time, the delicate balance between the biofilm fluid and the tooth mineral can be disturbed. A caries lesion forms when there is a cumulative loss of mineral in the tooth (2).

1.2 Evolution of caries

The term "early childhood caries" (ECC) refers to a specific form of tooth decay that is especially common in young children's teeth. According to estimates from the World Health Organization (WHO), early childhood caries affects between 60 and 90 percent of children worldwide(3). The health of a child's primary teeth is of utmost importance because they serve as the foundation for their permanent teeth and are also highly susceptible to dental caries (3). Dietary changes during human evolution have changed the oral microbiome from a "healthy" state to a "carious" state, which has made dental caries more common in modern populations. Caries and other diseases of the oral microbiome are thought to have become widespread in humans after the advent of an agricultural diet. The widespread adoption of an agricultural way of life significantly and adversely affected human health, leading to higher rates of malnutrition and contagious diseases (3,4).

Statistics from European countries show that 61 percent of children between the ages of 6 and 12 have at least one decayed tooth, and because dental caries affect people of all socioeconomic backgrounds, it can place a significant financial burden on the economy (3,4). Nutritional deficiencies, hereditary susceptibility, poor health status, certain dietary practices, the presence of organisms affecting tooth decay (such as streptococci), and a lack of fluoride and vitamin D all play a role in the development of caries (4).

1.2.1 American Dental Association Caries Classification System

Caries lesions must be consistently classified according to their location, site of origin, extent, and, if possible, activity level over time in order to determine the most effective clinical treatments and therapeutic interventions for their management and treatment.

The caries lesion is the disease's visible manifestation. The severity of caries disease is determined by the number and size of caries lesions (a clinical manifestation) present in a patient. The American Dental Association (ADA) assembled a group of specialists in 2008 to develop a user-friendly system for categorizing caries. Using criteria such as tooth surface,

presence or absence of a caries lesion, anatomic site of origin, severity of change, and estimation of lesion activity, the American Dental Association Caries Classification System (ADA CCS) assigns a score to every surface of the dentition. Table 1 defines the detection criteria for tooth surface origins as follows (3–5).

SITE	DEFINITION
Pit and Fissure	Referring to the anatomic pits or fissures of teeth, such as occlusal, facial, or lingual surfaces of posterior teeth, or lingual surfaces of maxillary incisors or canines
Approximal	Referring to the immediate proximity to the contact area of an adjacent tooth surface; may exist on any surface of the tooth
Cervical and Smooth Surface	Referring to the cervical area or any other smooth enamel surface of the anatomic crown adjacent to an edentulous space; may exist anywhere around the full circumference of the tooth
Root	Referring to the root surface apical to the anatomic crown

Table 1. *American Dental Association Caries Classification System tooth surface site definitions (5)*

Tooth surfaces are categorized as either "sound," "initial caries lesion," "moderate caries lesion," or "advanced caries lesion" based on their combined clinical and radiographic presentation in the ADA Caries Classification System. In addition to categorizing the surfaces affected by a caries lesion, categorizing the site of origin for a caries lesion, when discernible, is helpful for determining the cause of the lesion and discussing the available treatments (5,6).

The International Caries Detection and Assessment System (ICDAS) is a classification tool created by the international community to aid in studies of caries' epidemiology and the proper clinical management of caries. Dentists can classify and manage caries lesions by implementing ICDAS and the related International Caries Classification and Management System (ICCMS). In addition, the occlusal and smooth visible surfaces are mapped from ADA CCS to ICDAS criteria using a cross-mapping. The system also shows the cross-mapping between the ICCMS's radiographic scoring criteria and the ADA CCS categories E0, E2, E3, D1, D2, and D3 radiographic classifications. The ADA CCS cross-mapping provides the option of using either more generalized terms like "sound," "initial," "moderate," and "advanced," or more specific terms like those found in the ICCMS, depending on the needs of the clinical practice. For this reason, the ADA CCS is appealing in a wide variety of clinical settings (6,7).

American Dental Association Caries Classification System.

	AMERICAN DENTAL ASSOCIATION CARIES CLASSIFICATION SYSTEM			
	Sound	**Initial**	**Moderate**	**Advanced**
Clinical Presentation	No clinically detectable lesion. Dental hard tissue appears normal in color, translucency, and gloss.	Earliest clinically detectable lesion compatible with mild demineralization. Lesion limited to enamel or to shallow demineralization of cementum/dentin. Mildest forms are detectable only after drying. When established and active, lesions may be white or brown and enamel has lost its normal gloss.	Visible signs of enamel breakdown or signs the dentin is moderately demineralized.	Enamel is fully cavitated and dentin is exposed. Dentin lesion is deeply/severely demineralized.
Other Labels	No surface change or adequately restored	Visually noncavitated	Established, early cavitated, shallow cavitation, microcavitation	Spread/disseminated, late cavitated, deep cavitation
Infected Dentin	None	Unlikely	Possible	Present
Appearance of Occlusal Surfaces (Pit and Fissure)*,†	ICDAS 0 	ICDAS 1  ICDAS 2 	ICDAS 3  ICDAS 4 	ICDAS 5  ICDAS 6 
Accessible Smooth Surfaces, Including Cervical and Root‡		 	 	 
Radiographic Presentation of the Approximal Surface§	 E0¶ or R0# No radiolucency	   E1¶ or RA1# E2¶ or RA2# D1¶ or RA3# Radiolucency may extend to the dentinoenamel junction or outer one-third of the dentin. Note: radiographs are not reliable for mild occlusal lesions.	 D2¶ or RB4# Radiolucency extends into the middle one-third of the dentin	 D3¶ or RC5# Radiolucency extends into the inner one-third of the dentin

* Photographs of extracted teeth illustrate examples of pit-and-fissure caries.
† The ICDAS notation system links the clinical visual appearance of occlusal caries lesions with the histologically determined degree of dentinal penetration using the evidence collated and published by the ICDAS Foundation over the last decade; ICDAS also has a menu of options, including 3 levels of caries lesion classification, radiographic scoring and an integrated, risk-based caries management system ICCMS. (Pitts NB, Ekstrand KR. International Caries Detection and Assessment System [ICDAS] and its International Caries Classification and Management System [ICCMS]: Methods for staging of the caries process and enabling dentists to manage caries. *Community Dent Oral Epidemiol* 2013;41[1]:e41-e52. Pitts NB, Ismail AI, Martignon S, Ekstrand K, Douglas GAV, Longbottom C. ICCMS Guide for Practitioners and Educators. Available at: https://www.icdas.org/uploads/ICCMS-Guide_Full_Guide_US.pdf. Accessed April 13, 2015.)
‡ "Cervical and root" includes any smooth surface lesion above or below the anatomical crown that is accessible through direct visual/tactile examination.
§ Simulated radiographic images.
¶ E0-E2, D1-D3 notation system.[33]
# R0, RA1-RA3, RB4, and RC5-RC6 ICCMS radiographic scoring system (RC6 = into pulp). (Pitts NB, Ismail AI, Martignon S, Ekstrand K, Douglas GAV, Longbottom C. ICCMS Guide for Practitioners and Educators. Available at: https://www.icdas.org/uploads/ICCMS-Guide_Full_Guide_US.pdf. Accessed April 13, 2015.)

Table 2. American Dental Association Caries Classification System (7)

1.2.2 CAMBRA and American Academy of Pediatric Dentistry risk assessment tools

Instead of waiting until irreversible damage has been done to the teeth before taking action to prevent and treat caries, the CAMBRA can be used as an evidence-based risk assessment tool. Each person's risk for current and future caries is calculated using CAMBRA based on their own unique disease indicators, risk factors, and protective factors. It's the gold standard for determining whether an individual is at risk for developing dental caries, and it's used on people of all ages (6+) (8). For those at high risk of developing dental caries and in need of preventive services and risk factor management, CAMBRA provides a streamlined method of identification. The healthcare provider will classify the patient's risk of developing caries as either "low," "moderate," "high," or "very high" or "extreme." You can picture the "caries balance" in your mind as you read the instructions and weigh clinical observations, preventative factors, biological and environmental risk factors, and the care provider's clinical judgment to come to a conclusion (9,10).

Protocols for assessing and managing caries risk are helpful tools for clinicians, according to the American Academy of Pediatric Dentistry (AAPD). The purpose of this guideline is to inform clinicians and others about caries risk assessment in modern pediatric dentistry so that they can make better decisions about diagnostic, fluoride, dietary, and restorative procedures for their patients(10).

The purpose of a caries risk assessment is to predict whether or not preexisting carious lesions will progress in size or activity, or whether new carious lesions will form, over a given period of time. possessing a sensitivity that allows for the early detection of caries. The American Academy of Pediatric Dentistry has made risk assessment tools for dentists, pediatricians, and other dental health care providers to use. These tools help dentists, pediatricians, and other dental health care providers find and refer children who are at high risk (8–10).

Factors	High Risk	Moderate Risk	Low Risk
Biological			
Patient is of low socioeconomic status	Yes		
Patient has >3 between meal sugar-containing snacks or beverages per day	Yes		
Patient has special health care needs		Yes	
Patient is a recent immigrant		Yes	
Protective			
Patient receives optimally-fluoridated drinking water			Yes
Patient brushes teeth daily with fluoridated toothpaste			Yes
Patient receives topical fluoride from health professional			Yes
Additional home measures (eg, xylitol, MI paste, antimicrobial)			Yes
Patient has dental home/regular dental care			Yes
Clinical Findings			
Patient has ≥1 interproximal lesions	Yes		
Patient has active white spot lesions or enamel defects	Yes		
Patient has low salivary flow	Yes		
Patient has defective restorations		Yes	
Patient wearing an intraoral appliance		Yes	

Table 3: AAPD *risk of developing dental caries in children aged 6 and up (10).*

1.3 Television and lifestyle assessment

There are many potential causes of dental caries, but an increase in the disease's prevalence has been linked to poor dietary habits (11). The WHO Regional Office fashioned a template in 2015 for limiting the marketing of unhealthy foods and drinks to children. The model classified food and drink into distinct categories and made suggestions about which ones should and shouldn't be advertised to youth. It was suggested that certain types of products, regardless of their nutritional value, be prohibited from being marketed to children. Chocolate, candies, cakes, cookies, juices, and energy drinks were all on the list. However, fresh or frozen fruits, water, cheese and vegetables, as well as unprocessed meats, should be sold without regulation (12).It has been shown that children's food and drink choices are affected by the commercials they see on TV. Observational studies have found a link between excessive television viewing and the consumption of nutritionally deficient or sweetened foods and beverages. Furthermore, new research shows that it may be the ads, not the TV itself, that are the main cause of unhealthy changes in eating habits (13). Dental caries, which is regarded as the most common CNCD (chronic non-communicable diseases) and has the second-highest incidence in the world, is one of the CNCDs that is significantly increased by a high-sugar diet (13,14).

A complex confluence of unchangeable factors, such as genetics and neurological factors, contribute to childhood obesity. A person's environment, diet, and level of physical activity, on the other hand, are all factors that can be modified to reduce the likelihood of obesity. In the last 30 years, children have been eating fewer fruits and vegetables and steadily more sugary drinks and foods (13–15). In light of this, children younger than six who consume more than three between-meal sugary snacks or beverages per day are at a high risk of developing early childhood caries (ECC), according to the American Academy of Pediatric Dentistry's (AAPD) caries risk assessment tool (16). The Caries Management by Risk Assessment (CAMBRA) method says that drinking sugary drinks between meals is the same as having 20 more risk factors or indicators. In addition to this, a number of additional factors influence oral health, such as oral hygiene practices, tooth shape, surface characteristics, eating patterns, and the quality and quantity of saliva (16,17).

The World Health Organization (WHO) updated its sugar intake guidelines in 2015, recommending that children consume less than 10 percent of their total energy intake as sugar. This is equivalent to about 25 grams, or 6 teaspoons, of sugar per day (18). Even in elementary school, many kids between the ages of 6 and 12 don't know how to properly care for their teeth. Therefore, it's important to start caring for teeth and gums as early as possible. Children's motor skills, such as brushing their teeth, are best developed around the time they enter elementary school (17,19). Additionally, the first permanent molars in the mandible typically erupt between the ages of 6-7 years old, making them the teeth most vulnerable to caries due to the prevalence of sugary and sticky foods in children's diets at that age. Exposed teeth are at a higher risk of developing caries, which can lead to the tooth being extracted and potentially altering your bite, leading to temporomandibular disorder, or making it more difficult for your body to absorb nutrients when you chew (16,17,19).

1.3.1 **Socioeconomic status and unhealthy food advertisement**

In their multilevel conceptual model of children's oral health, Fisher-Owens et al. (2020), hypothesized that individual, familial, and community-level factors interact to cause early childhood caries (ECC) (20). Mothers in particular influence children's health-related behavior

by setting an example and providing a supportive environment (21). Children often mimic their parents' actions, and a mother's feeding habits can significantly affect her child's risk of ECC and obesity later in life. In-home interviews with mothers were conducted by four researchers with extensive experience in public health and qualitative research for about an hour.

• What do you think is a healthy and unhealthy diet? Why?
• How important is it that your child eats and drinks healthy? Why?
• What are the sources of information you rely on for information on healthy eating?
• How do you decide on the food choices in your family?
• How do you decide the drinks your child drinks?
• What do you think about fruit juices?
• How do you decide the snack your children have?
• What makes it easier for you to feed your child the right kinds of food?
• What makes it difficult for you to feed your child the right kinds of food?

Table 4. Semi-structured interview guide (21)

Mothers said there were a variety of meal options, including rice, pasta, meat, and vegetables, as well as sandwiches. When reporting on drink preferences, they mentioned that juices and milk were the next most popular drinks among young children after water. Furthermore, mothers said their children snacked on a wide variety of foods (22). In particular, parents and other caretakers play a crucial role in setting positive examples for their children when it comes to oral hygiene. A number of studies have found a strong correlation between maternal oral health and their offspring's oral health (20–22).

As a population parameter amenable to direct estimation from prospective cohort studies, risk can be quantified using a number of different techniques. In the field of oral health, risk is typically communicated through the use of the simple fraction cumulative incidence expressed over a given time period. An individual will either be a case or a non case, but this is not what risk is meant to communicate, despite common misconceptions. Put another way, risk is not something that can be hedged against or distributed to others. Instead, we can use longitudinal observations or counterfactual arguments to estimate risk for populations or subgroups of populations (20–22).

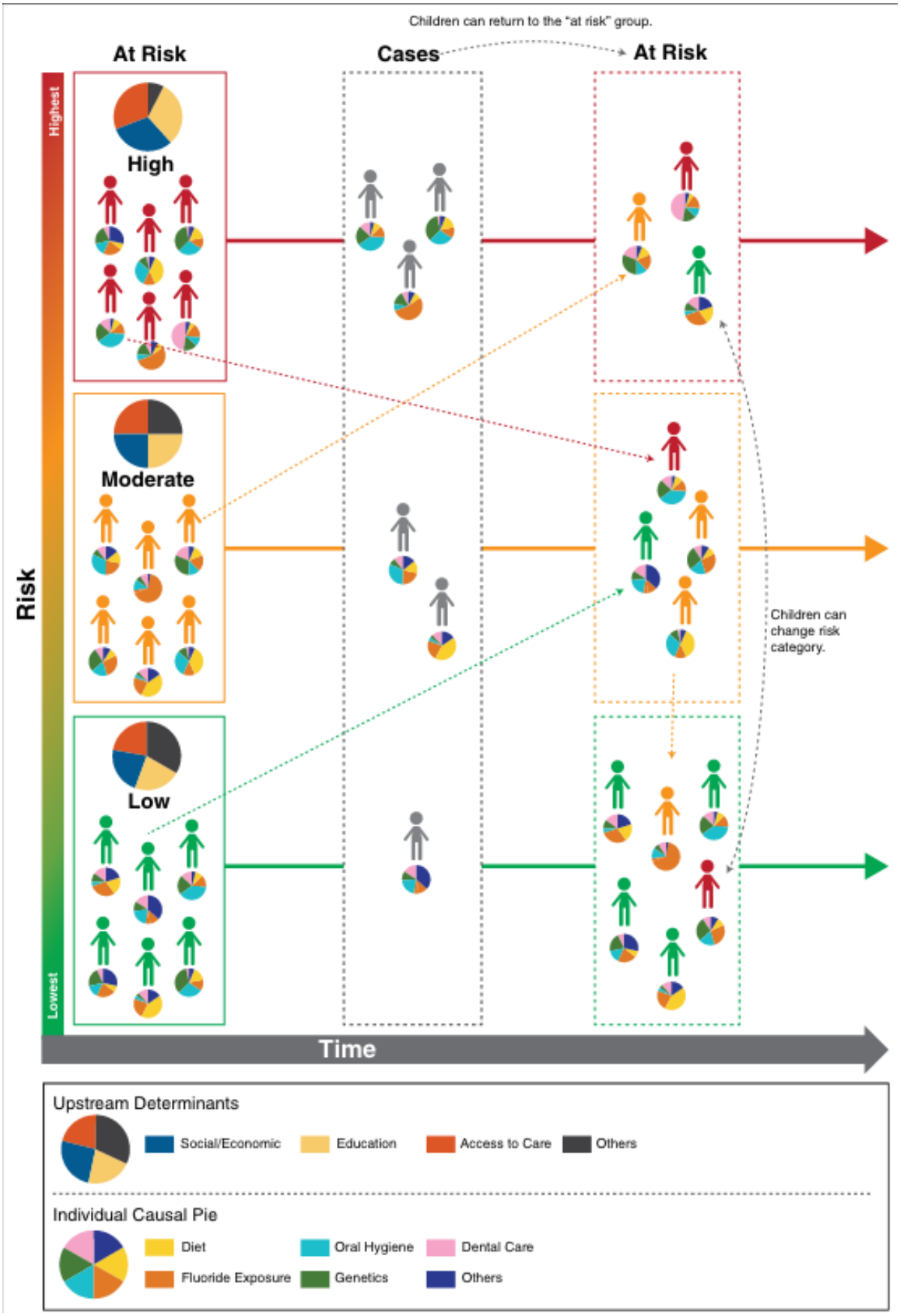


Figure 1. *Is a simplified representation of the wide range of susceptibility to early childhood caries (ECC) across the various ECC risk categories (17).*

Probability can be expressed on a continuum from low to moderate to high at the population level, but there are only two possible diagnoses for an individual child: either they have or do not have early childhood caries. Even though they may all be in the same "risk group," different children within that group face different causal risk sets, making it impossible to individualize or privatize risk and to use traditional, population-level risk factors for accurate prediction at the individual level (17,21). Proximal factors (such as simple sugars) are important risk factors, but upstream determinants (such as socioeconomic status) have a far greater impact on the prevalence of ECC in the population. Because the disease is defined at the individual level, as shown, children no longer belong to the at-risk population when they are diagnosed with an active disease. However, if they recover from their illness, they may once again be considered part of the at-risk population. Similarly, if they don't have any cavities or other damage to their teeth, they aren't at risk, but they'll be added back to it when they get new, vulnerable teeth. Children can move between different danger levels at any time, as is also shown (17,20–22).

1.3.2 Health claims and ultra-processed foods

Despite the fact that dental caries is primarily a chronic health issue that can be prevented, recent reports from around the world indicate that oral health has not improved over the past 25 years, with 573 million children in 2015 estimated to have untreated dental caries in their primary teeth. In line with the Childhood Obesity Surveil-lance Initiative (COSI) strategy of the WHO European Office, the study keeps track of and looks into the factors that affect how much Spanish schoolchildren weigh. The primary objective of the Childhood Obesity Surveillance Initiative is to monitor the rate of childhood obesity in the European Region of the WHO on a regular basis. Public health officials can compare conditions in various nations, set national goals, monitor advancement over time, and assess the impact of interventions thanks to COSI (23,24). About once every three years, different areas of the WHO European Region are surveyed for COSI data. In 2018, 17 countries participated in the first-ever COSI data collection round, and that number includes both Spain and Turkey.

An accurate measurement of body fat and a reliable cutoff range are needed to define obesity. The body mass index (BMI) was determined by rounding the product of a person's height in meters squared by their weight in kilograms to the nearest whole number. Using the growth charts published by the Centers for Disease Control and Prevention (CDC), we classified children as obese if their body mass index (BMI) was higher than the age- and gender-specific 95th percentile, and as overweight if their BMI was between the 85th and 95th percentiles. Examiners who had received training in measuring body weight and height according to WHO standards took measurements of children as part of the data collection process (23–25).

According to data from the 2019 wave, 17.3% of schoolchildren and 23.3% of students were obese (26). Children who spend less time playing outside and more time in front of electronic devices are more likely to develop metabolic syndrome (26,27). A lack of adequate sleep in childhood has been linked to increased obesity and cardio metabolic risk in youth. These are habits that people pick up when they are young and keep even when they are adults. Until now, studies examining the link between lifestyle and obesity have tended to focus on the effects of specific behaviors rather than the accumulative effects of multiple unhealthy ones. Despite the fact that it is generally accepted that a combination of genetic predisposition, environmental factors, and unhealthy lifestyle choices all contribute to an increased risk of obesity, it is also recognized that these factors often coexist and are interconnected. In order to create interventions that address the causes of obesity within this larger complex system, it is necessary to take a comprehensive look at people's lifestyle behaviors (27,28).

Family characteristics	Parent's BMI during pregnancy
	Number of siblings of the child at 18 months
	The ethnicity of the child
	Age of the mother at delivery
Childhood lifestyle	Time spent watching TV
	Time in the car per day (weekdays/weekend)
	Duration of night sleep
	Dietary pattern
Infant feeding	Breast feeding/formula feeding
	Age of introduction to solid foods
Intrauterine and perinatal factors	Birthweight
	Sex
	Maternal parity
	Maternal smoking during pregnancy (28-32 weeks)
	Season of birth (winter, summer, fall, spring)
	Number of fetuses
Other	Maternal social class (SES)
	Maternal education
	Energy intake of the child

Table 5. *Possible causes of overweight in children (23).*

Many studies have shown the negative health effects of eating ultra-processed foods, including weight gain and nutritional deficiencies. Consumption of ultra-processed foods has been linked to an increased risk of obesity and an unfavorable lipid profile in the few studies that have looked at the topic (26–28). Studies have also shown that kids who eat more fruits and vegetables are less likely to become overweight or obese. Spain has passed a number of laws about advertising, nutrition, and, to a greater or lesser extent, advertising that makes health claims. On top of making voluntary agreements with the food industry and following European law, this is something else that needs to be done. This means that in Spain, if a product satisfies the requirements outlined in the regulation pertaining to the claim made, nutrition and/or health claims may be permitted for foods that are high in fat, salt, and/or sugar (27–29).

1.3.3 Industry policies and television rating system

The availability, cost, promotion, and nutrition information of unhealthy foods and beverages are all consistently shown to have an impact on dietary intake. The oral health of a person is greatly affected by the lifetime consumption of unhealthy foods and drinks, as well as by the resulting microbiome distortions, infections, and inflammation.

Vandevijvere et al. (2022), showed that rising sales of ultra-processed food and drink were seen around the world, and that this trend was linked to unhealthy dietary choices in populations. Since carbonated beverages were the primary factor in the rise in ultra-processed drink sales around the world, this trend may have contributed to a rise in dental erosion and caries. An illustration of the relevant relationship is shown in Figure 2 (25,28,29).

Despite the fact that a biomedical strategy is required for the creation and distribution of clinical preventive interventions, the widespread occurrence of oral diseases suggests that population-wide upstream strategies should target the social and commercial factors that influence food choices (25,28,29).

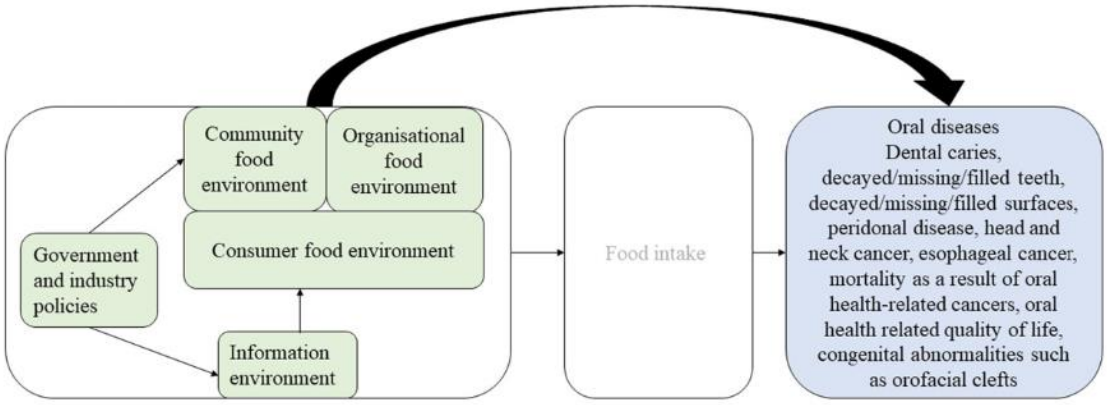


Figure 2. *Relationship between the food environment and oral health outcomes (25).*

The TV content rating system is a visible and/or audible warning system designed to prevent minors from being exposed to sexually explicit, violent, or otherwise inappropriate content on television. Warning systems like this also give viewers information about the minimum and maximum ages they should be watching certain shows at. As a result, people view these systems as advising and preventative rather than prohibitive and audible (30,31).

All broadcasts and advertisements in Spain must display a rating symbol; however, the design and placement of these symbols are left to the discretion of the individual channels. The appropriate age rating icons (13, 16, and 18) are visible through the screen's transparency for the whole show. In contrast, the seven-, ten-, and twelve-year-old icons are only present in the opening thirty seconds (30,31).

There is a 15 second segment at the beginning of every American television program dedicated to showing the ratings icons. When a TV-Y7 icon appears on the screen, it means the show is suitable for children older than 7 years old. Children of all ages can watch shows labeled with the TV-G symbol. The TV-PG icon means that parents should keep an eye on their kids' viewing habits because the show might not be suitable for them. Television programming rated TV-14 are not intended for viewers under the age of 14 (30,32).

A family icon should appear before and after commercials in Turkey's TV rating system, indicating that the program is suitable for kids of all ages. At the start of the show and after

each commercial break, a 7+ symbol indicates that the content is appropriate for viewers aged 7 and up. All of 13+ symbols are intended for an audience aged 13 and up. Table 6 provides the icons and their respective descriptions (30,32).

	General Audiences
	Appropriate for the age of 7 and above
	Appropriate for the age of 13 and above
	Appropriate for the age of 18 and above
	Sexuality
	Violence/ Horror
	Behaviors that may create adverse examples

Table 6. *Iconic figures from the television screen and their appropriate descriptions (30).*

1.3.4 Government agencies

There is a growing need to regulate what can be advertised and how that process is run as advertising has become more significant in many nations. Self-regulation within the advertising industry has been considered a viable alternative to and supplement to the various forms of government regulation. While each country's advertising self-regulatory system has its own unique set of rules and regulations, they all have one thing in common: they aim to keep the government out of the advertising industry by creating a system that allows the industry to regulate itself (33,34).

TV commercials in Spain are regulated by the Spanish Advertising Self-Regulatory Organization (Autocontrol). In addition, Autocontrol participates in the EASA, or European Advertising Standards Alliance. The European Advertising Standards Alliance (EASA) is a Brussels-based nonprofit that unites EU-based advertising industry groups and national advertising self-regulatory organizations (SROs). The group is made up of 32 European Union SROs and 16 European advertising trade groups from countries all over the world, including Turkey, Canada, South Africa, Brazil, and New Zealand (33,34).

The Autocontrol jury is made up of impartial lay experts in consumer affairs, including retired advertising professionals, former civil servants, and academics with backgrounds in law, economics, sociology, and commercial communications. Twenty-five percent of Autocontrol members are selected by the Spanish National Institute of Consumer Affairs. All complaints and controversies brought forward regarding particular advertisements are resolved by the jury through procedural rules governing the jury's adjudication activity. Anyone, whether or not they are members of the association, can file a complaint if they have a valid reason to do so regarding a specific advertisement(33,34).

The Federal Trade Commission (FTC) is the US government agency in charge of regulating commercials broadcast on television. The FTC has not sought to more aggressively regulate food advertising to children for a number of reasons, but its ideological and practical attraction to industry self-regulation is probably the most significant. Concerning the unfairness authority, these include limits on the commission's ability to make rules, the doctrine of reasonable avoidance, questions about what caused what, problems with how things are made, and constitutional limits. The last two things also affect the chances that the deception doctrine will be used to regulate something. The Federal Trade Commission has a number of opportunities to take steps toward reducing the impact of the advertising industry on the childhood obesity crisis, despite its troubled history of policing children's advertising (33–35).

The Radio and Television Supreme Council (RTUK) in Turkey is responsible for regulating the airing of advertisements, including those aimed at children, and investigating viewer complaints. For the sake of keeping children safe from potentially harmful or inappropriate content in advertisements, RTUK has implemented specific guidelines. The length of commercial breaks and the types of products that can be advertised to children are both governed by these rules. Yet RTUK has been criticized for how it deals with commercials for unhealthy foods and drinks aimed at kids. The RTUK has been criticized by those who believe that the rules it has put in place to prevent children from being exposed to commercials for junk food and sugary drinks are insufficient (36,37).

1.4 Justification

It is well established that dietary choices are affected by factors such as exposure to marketing messages, price, ease of purchase, and knowledge of the nutritional value of unhealthy food and drink options. Most of the increase in dental caries can be traced back to changes in eating habits that are bad for oral health. In addition, most countries do not regulate food and beverage advertisements, and over the past three decades, children's diets have shifted away from healthy foods like fruits and vegetables and toward sugary drinks and processed foods. This research will give useful information about how advertising for food and drinks on different broadcasts might affect the oral health of children.

1.5 Research question

Is the prevalence of caries higher in nations where commercials on TV are not regulated compared to those where they are?

1.6 Hypothesis

The prevalence of dental caries is significantly higher in countries that have a greater number of commercials on television compared to those that have a lower number.

2. OBJECTIVES

GENERAL

- To determine whether exposure to television advertisements of potentially cariogenic foods is related to higher caries rates in the pediatric population.

SPECIFIC

- Determine if commercials for cariogenic foods on TV target children under the age of six, children aged seven to twelve, or children aged thirteen and up.
- Determine if there is a correlation between the number of cariogenic commercials shown to children and the prevalence of tooth decay in children who watch Spanish, Turkish, or United States television.
- Investigate whether the ads are directed at boys, girls, or both, and whether this has a relationship to caries prevalence.

3. MATERIALS AND METHODS

The present study has the approval of the Pre-Clinical Department of the Faculty of Biomedical and Health Sciences under code – OD.058/2223

3.1 Search strategy:

The most used database is "MEDLINE Complete," but others have been integrated into the database's calibration process as well: "Academic Search Ultimate," "eBook Collection (EBSCOhost)," "E-Journals," and "Dentistry & Oral Sciences Source." Statistical analysis of the studies' data collection tables revealed: All of the information that was useful was extracted from the articles that were chosen. The most important findings of the articles have been separated and classified to clarify the types of information and make comparisons between articles easier.

Keywords: “television advertising," “child nutrition," “food industry,", “socioeconomic status,” “early childhood caries," “oral health."

Inclusion criteria:

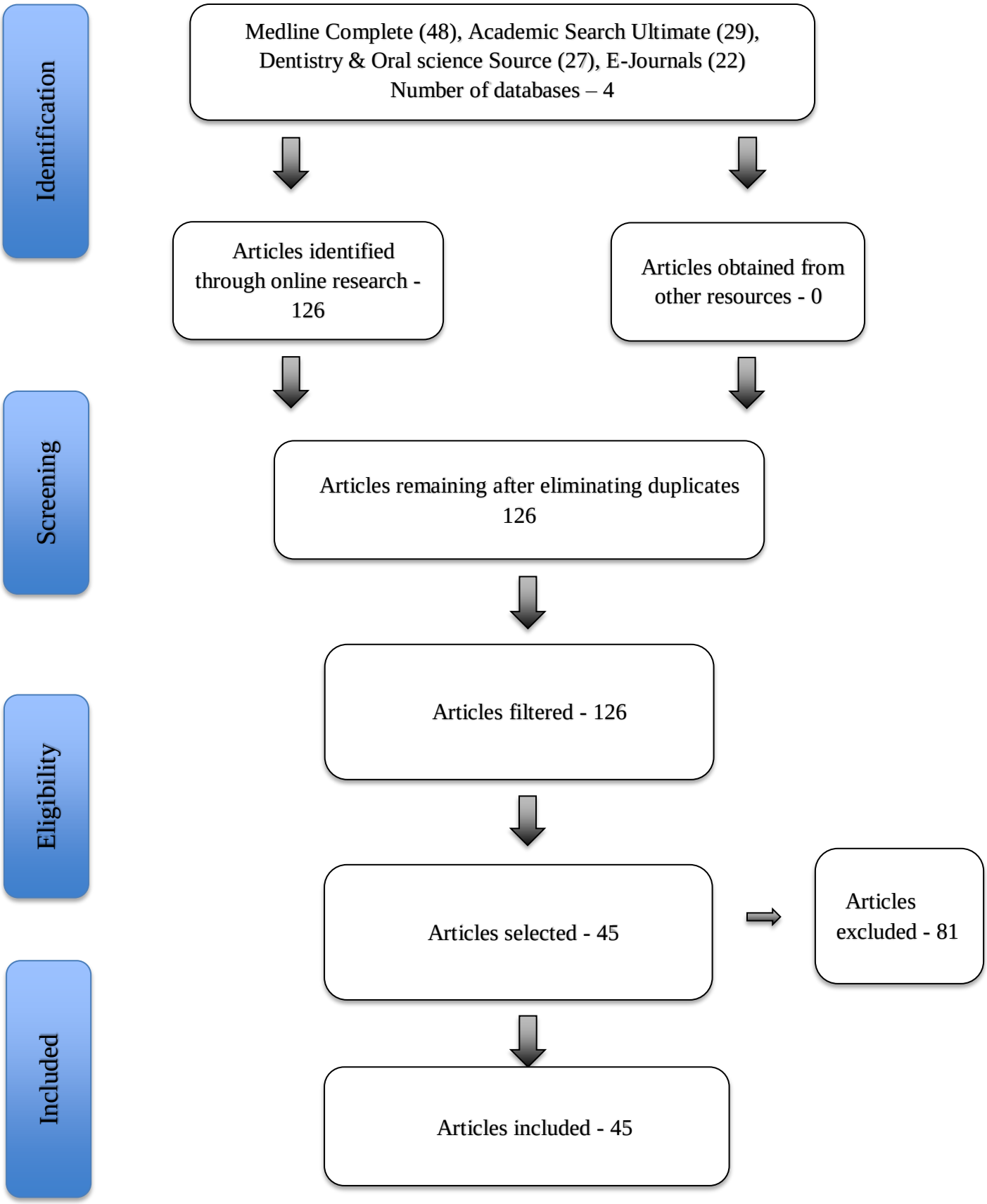
- Original research articles on the prevalence of caries in children in Turkey, Spain, and the United States.
- Research studies on the exposure of various age groups for children, including those aged 0 to 6, 7 to 12, and 13 and older, to advertisements for unhealthy foods and beverages.
- Review and investigate articles that discuss whether or not advertisements targeted at boys or girls are related to the prevalence of dental caries.

Exclusion criteria:

- Original research articles on the prevalence of caries in adults in Turkey, Spain, and the United States.
- Review or research articles that identify cariogenic food TV commercials for various age groups in nations other than Turkey, Spain, and the United States.

Procedure: There was content research done on children's television commercials aired on the most watched free-to-air national Turkish, Spanish, and American television networks in the entire country. Beginning on November 14, 2022, and ending on January 26, 2023, assessments were conducted on three weekdays. This took place from 15:00 to 17:00 (local time) on Mondays, Tuesdays, and Thursdays, for a total of 66 hours. Quantitative research methods were employed for this study. Statistical information is gathered from groups of children rather than from specific individuals. Foods and beverages featured in TV commercials were examined. Food and drink consumption in all three countries were compared statistically. The genders targeted by commercials were also examined. The data was analyzed using the Microsoft Excel program.

4. RESULTS:


Identification
Medline Complete (48), Academic Search Ultimate (29), Dentistry & Oral science Source (27), E-Journals (22) Number of databases – 4
Articles identified through online research - 126
Articles obtained from other resources - 0
Screening
Articles remaining after eliminating duplicates 126
Eligibility
Articles filtered - 126
Articles selected - 45
Articles excluded - 81
Included
Articles included - 45

Children's commercials on the most popular free-to-air networks in Turkey, Spain, and the United States were analyzed for their content. This went on for a total of 66 hours, taking place on Mondays, Tuesdays, and Thursdays between the hours of 15:00 and 17:00 (local time) each day.

Country	**Watching TV time**	**Commercials**	**Ads promoting food**	**Ads promoting unhealthy food**	**Ads promoting healthy food**
Turkey	22 hours	320	132	106	26
Spain	22 hours	340	176	132	44
United States	22 hours	430	192	160	32
Total	66 hours	1090	500	398	102
Age	**n of commercials**	**%**			
0-6	210	42	210	177	33
7-12	170	34	170	128	42
13 +	120	24	120	93	27
Total	500	100	500	398	102
Sex/gender	**n of commercials**	**%**			
Male	320	64%	320	254	66
Female	180	36%	180	144	36
Total	500	100	500	390	102
Quantitative varables	**Minimum**	**Maximum**	**Range**	**Mean**	**SD**

Number of country commercials	320	430	110	363,33	58,59
Sex	180	320	140	250	98,99

Table 1. *Results of the procedure and quantitative variables*

Altogether, 66 hours of television programming were analyzed. In total, there were 1090 TV commercials, with 500 (or 48% of them) promoting food or drinks for children. 22 hours of television programming were analyzed for each national television network. On the Turkish national television network, there were over four times as many ads for sugary foods and drinks as there were for healthy options (106/26). Secondly, on the American national television network, there were over five times as many ads for sugary foods and drinks as there were for healthy options (160/32). On the other hand, on the Spanish national television network, there were three times as many ads for sugary foods and drinks as there were for healthy options (132/44).

Advertising of various unhealthy products for children on Turkish TV		
Type of food product	**Frequency**	**% Percentage of total food products**
High-sugar snacks	28	26 %
Breakfast cereals	23	22 %
Sweet-yoghurt	17	16 %
Fast food	14	13 %
Juices/Fruit drinks	14	13 %
Chocolate milk	10	10 %
Total	106	100 %

Table 2. *Advertising of various unhealthy products for children on Turkish television.*

Advertising of various unhealthy products for children on Spanish TV		
Type of food product	**Frequency**	**% Percentage of total food products**
High-sugar snacks	30	23 %
Breakfast cereals	27	21 %
Sweet-yoghurt	24	18 %
Fast food	20	15 %
Juices/Fruit drinks	16	12 %
Chocolate milk	15	11 %
Total	132	100 %

Table 3. *Advertising of various unhealthy products for children on Spanish television.*

Advertising of various unhealthy products for children on American TV		
Type of food product	**Frequency**	**% Percentage of total food products**
High-sugar snacks	40	25 %
Breakfast cereals	31	19 %
Sweet-yoghurt	27	17 %
Fast food	24	15 %
Juices/Fruit drinks	23	14 %
Chocolate milk	15	10 %
Total	160	100 %

Table 4. *Advertising of various unhealthy products for children on American television.*

The tables 2–4 show that ads for high-sugar snacks were shown 28 times in Turkey, which is 26% of the total of 106 commercials. High-sugar snacks were advertised 30 times on Spanish television, which is 23% of the total number of commercials (132). High-sugar snacks finally made an appearance in the United States 40 times, making up 25% of the 160 commercials. In the three countries, breakfast cereals, high-sugar snacks, and sweet yogurt were the most heavily advertised products, according to an analysis of the advertisements.

Television commercials aimed at different age groups on child-oriented channels		
Age groups	Frequency	Percentage
0-6 years old	210	42 %
7-12 years old	170	34 %
13+ years old	120	24 %
Total	500	100 %

Table 5. *Television commercials aimed at different age groups on child-oriented channels*

According to research into children's commercials, the youngest viewers, those between the ages of 0 and 6, were the main focus of the various age groups. Children of this age range were targeted through the use of vibrant packaging, toys, snacks, and drinks. Due to the prevalence of TV food marketing, children are more likely to develop a lifelong preference for high-calorie, high-fat, and high-sugar foods, putting them at greater risk for weight problems and tooth decay.

Commercials aimed at boys and girls that air on children-oriented channels		
Type of protagonist for children	Frequency	Percentage
Female protagonist	180	36 %
Male protagonist	320	64 %
Total	500	100 %
Type of voice for children	Frequency	Percentage
Male voice	340	68 %
Female voice	160	32 %
Total	500	100 %

Table 6. *Commercials aimed at boys and girls that air on children-oriented channels.*

When analyzing commercials aimed at children, it was discovered that boys tended to play the lead role. Male voice actors predominated, and male characters outnumbered female ones. Our research shows that TV ads for food and drinks are more likely to feature animated male characters. Many more junk food advertisements target boys than girls because of the emphasis on physical activity in these ads. Teenage boys thought that eating energy bars and other junk food would help them do better in sports because of commercials in which famous athletes promoted these foods.

Year, Author	**Country**	**Sample characteristics**	**Prevalence of dental caries %**
Kazemina et al (2020) (3)	United States	• Children < 7 years old	• 92,6%
Dye Bruce A et al (2015) (35)	United States	• Children 6-8 years old • Children 12-15 years old	• 56% • 50%
Kazeminia et al (2020) (3)	Spain	• Children < 10 years old • Children 12 years old • Children 15 years old Meta –regression analysis was conducted	• 47% • 25,50 % • 26,20%
Kazeminia et al (2020) (3)	Turkey	• Children 3-6 years old	• 49,60 %

Guner Onur et al (2020) (38)	Turkey	• Children 7-12 years old Children who visited the department of Pediatric Dentistry for an examination between 2016 and 2018 were analyzed.	• 68%

Table 7. *Prevalence of dental caries* in Spain, United States, and Turkey

When comparing the findings of various reviews and research articles, it was discovered that the prevalence of dental caries in children in Turkey, Spain, and the United States of America varied, each with their own unique sample sizes. Comparing the three countries in the table, the United States had the highest prevalence of dental caries among children under the age of 7, with 92,6% of the sample, and Spain had the lowest, at 47%. Furthermore, children aged 6 to 12 were found to have the lowest rates of dental caries in Spain, ranging from 25,50% to 47%, and the highest rates in Turkey, at 68%.

Year, Author	**Country**	**Sample characteristics / Gender**	**Prevalence of dental caries**
Claiborne et al (2022) (39)	United States	Sample : - 7719 children aged 2-4-year-old - Boys 50,8%, girls 49,2%	When the gender of the participants was controlled for, the adjusted results showed that girls had a higher odds ratio of reporting dental caries than boys did.
Prada et al (2020) (40)	Spain	- 150 children - Children 0-5 years old - Children aged 6-12 years old - 52,5% of the 150 kids were boys and 47,5% were girls	- Dental caries were more common among boys than girls in the 0-5 age range. -Boys aged 4 had 18.4% dental caries, while girls had 15%. - Dental caries were higher in girls aged 6-12 than boys. - Dental caries was 8.3% in girls and

			5.3% in boys aged 6.
S. Gökalp et al (2010) (41)	Turkey	- 2429 boys aged 5-15 years old - 2223 girls aged 5-15 years old	- Caries prevalence was 73% in 5-year-old boys and 66.2 % in girls. - Boys and girls aged 12 did not significantly differ in their DMFT scores. - Girls aged 15 had a prevalence of dental caries of 59,7%, compared to boys who had a prevalence of dental caries of only 37,2%.

Table 8. *Dental caries prevalence in Spain, the US, and Turkey by gender.*

Comparing reviews and research articles, it was found that dental caries prevalence in children in Turkey, Spain, and the US varied by gender and sample size. In the US, girls had a higher odds ratio of reporting dental caries than boys. In Spain, dental caries was more common in boys 0–5 years old than in girls, but they were more common in girls 6–12 years old than in boys. In Turkey, boys aged 5 had a caries prevalence of 73% while girls had a 66.2% prevalence. In addition, girls had a 59,7% prevalence of dental caries at the age of 15, compared to boys' prevalence of only 37,2%.

5. DISCUSSION

Marketers of consumables frequently use TV commercials to reach consumers. Children's media, sporting events, cartoon characters, and celebrity endorsements are just some of the marketing channels that have been used to push sugary treats, high-sugar foods, and junk food on the younger generation (12,21).

High rates of caries were found among Turkish, American, and Spanish children who watched television commercials. When it comes to children's oral health, the high prevalence of dental caries emphasizes the need for comprehensive oral health interventions and the regulation of television advertisements in a variety of countries (3,38,42). Children's television programs (n = 398) featured advertisements for unhealthy foods and beverages. The majority of these commercials promoted unhealthy foods like high-sugar snacks, sugary cereals, and sweet yogurts. In contrast to the frequent advertising of foods high in fats and sugars, advertisements for healthier options such as fruits, and vegetables were uncommon.

In our study, we found that 170 commercials targeted kids 7-12 years old, 210 targeted kids 0-6 years old, and 120 targeted kids 13 and up. Commercials on television were aimed primarily at kids under six, rather than those between the ages of seven and twelve or those older than thirteen. Kazemina et al. (2020), also found that the prevalence of caries was highest among children under the age of 6 in United States compared to all other age groups. Research findings may vary because of country-specific factors, such as differences in study populations, socioeconomic status, and the size of the sample taken in the different investigations. There was a wide range in the prevalence of dental caries, from 47.0% to 92.6%, with the USA having the highest prevalence and Spain having the lowest (3,38,42).

The Federal Trade Commission (FTC) was informed by U.S. quick service restaurant (QSR) chains that they had spent $161 million on advertising specifically to children aged two to eleven. The majority of the money that QSRs spent (74.4 million) was on cross-promotions that linked their food to popular media properties like movies, TV shows, and cartoons. Bernhardt et al. (2013) , explained that children's perceptions of food's flavor and appeal are influenced when they associate it with cartoon characters, and have shown that children who

are exposed to food advertisements are more likely to engage in unhealthy eating behaviors (33–35).

Numerous experimental studies show that television advertising for unhealthy foods in general increases immediate snack food intake in children (18,28,43). Children in Turkey had 106 unhealthy commercials during 22 hours of screen time, Spain had 132 unhealthy food commercials during 22 hours of screen time, and the United states had a total of 160 unhealthy food commercials during 22 hours of screen time. These results demonstrate the potency of television ads as a marketing tool, particularly when children are the target audience. As was mentioned earlier, it was evident that compared to other nations, the United States had a higher prevalence of dental caries among children under the age of 6. This may also suggest that caries rates are higher in countries with laxer regulation of television commercials than in those with stricter oversight. However, when comparing the prevalence of caries in children aged 7-12, Turkey stands out as having a higher rate than the other countries. In a range from 25.50% to 68%, with Turkey at the high end and Spain at the low, the prevalence varied widely (3,38,42). Further, the research findings show that healthy product advertisements in Spain were more prevalent than in Turkey and the United States. There were only 26 healthy commercials in Turkey, 32 in the United States, and 44 in Spain. Possible explanation for Turkey's higher prevalence of caries in children aged 7–12 compared to other countries.

Role models who display socially acceptable behavior and whom viewers can observe frequently have the potential to influence children's actions through television. As a corollary, when kids see themselves reflected in an advertisement's characters, they're more likely to mimic the actions they see. Media such as television shows and commercials can serve to reinforce a society's culture and norms by presenting stereotypical characters in a positive light. However, the captivating nature of television can also act as a potent representation of unfavorable stereotypes permeating society. Advertising continues to focus on boys, as evidenced by the high volume of commercials featuring more boys than girls and entirely male casts. Boys are frequently portrayed as being more daring and active, whereas girls are seen as being more compliant. This may be one explanation. Many commercials feature action figures and sports equipment because of the widespread belief that these products are more

likely to appeal to boys than girls. While it's true that advertising as a whole tends to target male consumers, there are certainly examples of commercials that aim to appeal to females by highlighting their strengths, redefining gender norms, or promoting gender equality. While many advertisers still cling to outdated gender norms, there are some who are making strides to create more gender-neutral and inclusive commercials (13,35,44).

Kelly et al. (2016), described that both randomized controlled trials and observational studies have found that being exposed to food advertisements on television is positively correlated with increasing consumption of unhealthy foods and drinks. The scores for both unhealthy food and unhealthy food and drinks were lower among those who watched the least commercial television compared to those who watched the most (13). Our research shows that animated male characters show up more often in TV ads for food and drinks. The investigation revealed that male protagonists were used 320 times in commercials for foods and beverages, while female protagonists were only used 180 times. Additionally, male voices were used during commercials 68% of the time, while female voices were used 32% of the time. According to these findings, boys were subjected to more exposure than girls were while watching television commercials.

As mentioned earlier our research showed that boys were subjected to more exposure than girls were while watching television commercials, however comparing review and research articles it was found that in the US, girls had a higher odds ratio of reporting dental caries than boys according to Claiborne et al. (2022). Prada et al. (2020), in Spain, dental caries was more prevalent in girls aged 6 to 12 than in boys, but they were more prevalent in boys aged 0 to 5 than in girls. S. Gökalp et al. (2010), showed that caries prevalence was 73% among Turkish 5-year-old boys and 66.2% among Turkish 5-year-old girls. Also, by age 15, the prevalence of dental caries was 59.7% for girls and 37.2% for boys (39–41). No statistically significant relationship between sex and the prevalence of caries among 12-year-old boys and girls was discovered by S. Gökalp et al. (2010). However, Claiborne et al.'s study from 2022, found a statistically significant relationship between caries prevalence and sex, with the female sex having a higher prevalence of caries than the male sex. The study by Prada et al (2020), on the other hand, obtained opposite results, with the male sex having the highest caries experience (39–41).

According to Gatou et al. (2016), a positive correlation between the amount of time spent in front of the television and the incidence of cavities was discovered in a sample of research that included 88 boys and 95 girls. Children chose a significantly higher percentage of unhealthy foods after being exposed to food advertisements compared to the control condition, and caries experience was significantly correlated with the type of exposure(43).

One of the major lifestyle factors that influences our health and quality of life is eating habits. It has been identified as a widespread contributor to various health problems, including dental caries (43). Kelly et al. (2016), described that 417 children were surveyed online about their exposure to television commercials and their consumption of commonly advertised unhealthy foods and beverages. Findings from the survey showed that being exposed to advertisements for unhealthy foods and beverages was significantly linked to an increase in such consumption. Children who were exposed to the most commercials had the strongest association between TV viewing and poor diet (13). However, this does not prove that kids with dental caries are more receptive to food marketing. Understanding the complex web of relationships between these variables and the causes they contribute to requires longitudinal studies.

According to Kelly et al. (2016), the lack of direct evaluation of the advertisements' efficacy is another caveat of the study. Nonetheless, it is well established that advertising to children does influence their decisions. In particular, young children lack the cognitive capacity to understand TV advertising, and the pervasive patterns used in advertising may have manipulative effects on them (11,35,43). Shqair et al. (2019), a study on children found that advertising was linked to an increase in dental caries. Children's diet quality was found to be inversely related to screen time, including time spent watching television, playing video games, and using computers. Furthermore, with a moderate degree of certainty, children who spend an excessive amount of time in front of screens had a higher intake of a potentially cariogenic diet (45). Previous research has linked exposure to TV ads for cariogenic foods, like fast food and soft drinks, with an increased risk of dental caries in children (12).

6. CONCLUSION

1. Television advertising of potentially cariogenic foods was found to be associated with increased rates of dental caries in children. Additionally, it supports the findings of earlier research that children who watch a lot of TV are more susceptible to the effects of advertising and, as a result, are more receptive to messages on TV about foods and eating habits, whether they are healthy or not.
2. According to our research, children under the age of six were the main audience for television commercials, as opposed to children between the ages of seven and twelve or older than thirteen. However, research results may differ due to country-specific factors, such as differences in study populations, socioeconomic status, and the size of the sample taken in the various investigations.
3. Tooth decay was also linked to the number of cariogenic commercials viewed by kids, regardless of whether they were watching TV in Spain, Turkey, or the United States. Most of these advertisements promoted sugary snacks, sugary cereals, and sweet yogurts, all of which are unhealthy foods. Advertising for healthier options like fruits and vegetables was rare, in contrast to the frequent promotion of foods high in fats and sugars.
4. Our analysis reveals that TV commercials for food and beverages more frequently feature animated male characters than female ones. These findings demonstrate that boys were more exposed to television commercials than girls. More exposure to commercials might suggest that boys are more likely than girls to have dental caries. However, longitudinal studies are necessary for deciphering the intricate web of connections between these factors and the outcomes they influence.

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