

**Sedentary behavior and oral health: an integrative review**

**Comportamento sedentário e saúde bucal: uma revisão integrativa**

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## **Abstract**

The present study aimed to verify the association between the sedentary behavior and the main disorders in oral health through an integrative review of the literature. Structured searches were carried out in the PUBMED, SCOPUS and SCIELO databases to find the original research studies. An electronic form was used to extract data about author, year, population, measures of evaluation of the outcomes of interest, main results and conclusions of the authors. Of the 216 studies identified in the databases, 12 included the inclusion criteria. Of these, 09 pointed out an association between sedentary behavior and oral health, indicating that such behavior has a negative impact on the oral health of the individuals. Three articles did not relate sedentarism as a risk factor for oral health disorders. Although most studies point to a possible association, there is still needed more well-designed and with longer follow-up studies to confirm sedentary behavior as a risk factor for the development of oral diseases. In the perspective of a dental approach to risk factors in common with systemic diseases, it is advised that clinicians should be aware of the lifestyle adopted by their patients in order to guide them in choosing a healthy lifestyle.

**Keywords:** Sedentary behavior; Oral health; Disease prevention.

## **Resumo**

Este estudo objetivou verificar a associação entre o comportamento sedentário e os principais agravos em saúde bucal. Foram realizadas buscas estruturadas nas bases PUBMED, SCOPUS e SCIELO a fim de encontrar os estudos originais. Um formulário eletrônico foi utilizado para extração dos dados sobre autor, ano, população, medidas de avaliação dos desfechos de interesse, principais resultados e conclusões dos autores. Dos 216 estudos identificados nas bases de dados, 12 contemplaram os critérios de inclusão. Destes, 09 estudos apontaram uma associação entre o comportamento sedentário e a saúde bucal, indicando que tal comportamento impacta negativamente na saúde bucal dos indivíduos. Três artigos não relacionaram o sedentarismo como fator de risco para agravos em saúde bucal. Embora a maior parte dos estudos aponte para uma possível associação, ainda há necessidade de estudos primários prospectivos e com maior tempo de seguimento para a confirmação do comportamento sedentário como fator de risco para o desenvolvimento de doenças bucais. Na perspectiva de abordagem odontológica para fatores de risco em comum com doenças sistêmicas, orienta-se que clínicos devem estar atentos ao estilo de vida adotado por seus pacientes, com o intuito de orientá-los para escolha de um estilo de vida saudável.

**Palavras-chave:** Comportamento sedentário; Saúde bucal; Prevenção de doenças.

## Resumen

Este estudio tuvo como objetivo verificar la asociación entre el comportamiento sedentario y los principales problemas de salud bucal. Se realizaron búsquedas estructuradas en las bases de datos PUBMED, SCOPUS y SCIELO para encontrar los estudios originales. Se utilizó un formulario electrónico para extraer datos sobre autor, año, población, medidas para evaluar los desenlaces de interés, principales resultados y conclusiones de los autores. De los 216 estudios identificados en las bases de datos, 12 cumplieron los criterios de inclusión. De estos, 09 estudios apuntaron a una asociación entre el comportamiento sedentario y la salud bucal, lo que indica que dicho comportamiento afecta negativamente la salud bucal de las personas. Tres artículos no enumeraron un estilo de vida sedentario como factor de riesgo de problemas de salud bucal. Aunque la mayoría de los estudios apuntan a una posible asociación, todavía se necesitan estudios primarios prospectivos con un período de seguimiento más largo para confirmar el comportamiento sedentario como factor de riesgo para el desarrollo de enfermedades bucodentales. Desde la perspectiva de un abordaje odontológico de los factores de riesgo en común con las enfermedades sistémicas, se aconseja que el clínico esté atento al estilo de vida adoptado por sus pacientes, con el fin de orientarlos en la elección de un estilo de vida saludable.

**Palabras clave:** Conducta sedentaria; Salud bucal; Prevención de enfermedades.

## 1. Introduction

Contemporary society is characterized by a more technological and consumerist profile, implying a sedentary lifestyle, regardless of age group (Meneguci et al., 2015). This lifestyle involves the lack of regular exercise associated with a diet with foods rich in carbohydrates and fats, factors that affect the general and oral health of individuals and, therefore, an important public health issue (Viana et al., 2018).

A sedentary lifestyle refers to the amount of time a person spends on low energy activities such as watching television or using the computer while sitting or lying down (Ainsworth et al., 2000). The large downtime spent in these activities can lead to overweight and obesity, as well as other health problems. This type of behavior has been pointed out in the literature as a shared risk factor between obesity and the main oral diseases (dental caries and periodontal disease) (Bawadi et al., 2011; Costacurta et al., 2014). And consequently with the sedentary lifestyle.

Individuals who exhibit sedentary behavior ingest low amounts of fiber and higher amounts of sugary and fatty foods, especially soft drinks and fermentable carbohydrates. These, associated with a higher frequency of consumption, influence the oral condition negatively, being etiological factors for dental caries (Costacurta et al., 2014). The nutritional deficiency of vitamins, minerals increases the susceptibility of the individual to oral pathogens by impairing the development and integrity of oral tissues. For example, low consumption of vitamin C, vitamin E and antioxidants is associated with periodontal disease (Pflipsen et al., 2017).

Because it is consider recent, the proposed relationship between sedentary lifestyle and oral health is not yet consolidated. Thus, from the perspective of individual and collective planning to deal with common risk factors for various health problems, including oral health problems, it is relevant to assess whether, in fact, sedentary behavior has deleterious consequences for oral health. Given the above, this study aimed to develop an integrative literature review to verify how scientific production relates obesity and oral health.

## **2. Methodology**

### ***Study Design***

This is an integrative literature review, as proposed by Broome. It is a method that summarizes past empirical or theoretical literature to provide a more comprehensive understanding of a particular phenomenon or healthcare problem (Broome, 2000). Our integrative literature review was organized to answer the following question: is sedentary behavior associated with deleterious consequences on oral health?

The research question was structured from the acronym PECO - Participants, Exhibition, Comparator, Outcome (Kloda et al., 2014; Mueller et al., 2018):

P (Participants): Patients oral health evaluation, regardless of the indicator used (caries, periodontal disease, oral hygiene or other).

E (Exposure): Sedentary behavior.

C (Comparator): No comparator or studies comparing sedentary versus active behavior.

O (Outcome): Any measures of association between indicators and sedentary behavior were established as outcomes.

### Search Strategy

Based on PECO, terms were extracted from Mesh to enable a specific strategy on the following electronic search platforms: PubMed, Scielo and Scopus. The terms Sedentary Behavior and Oral Health of Mesh and their respective synonyms were used. The search was conducted in February 2019, with no lower period limit and no language restriction. The combination of terms as well as the results found for each electronic search platform is presented in detail in Table 1.

**Table 1.** Search strategies and results on each electronic search platform.

Search Date	Database	Strategy Details	Results
February 28, 2019	PUBMED	((Sedentary Behavior OR Behavior, Sedentary OR Sedentary Behaviors OR Sedentary Lifestyle OR Lifestyle, Sedentary)) AND (Oral health OR Dental Decay OR Caries, Dental OR Decay, Dental OR Carious Dentin OR Carious Dentins OR Dentin, Carious OR Dentins, Carious OR Dental White Spot OR White Spots, Dental OR White Spots OR Spot, White OR Spots, White OR White Spot OR Dental White Spots OR White Spot, Dental OR Periodontal Diseases OR Disease, Periodontal Diseases, Periodontal Disease OR Parodontosis OR Parodontoses OR Pyorrhea Alveolaris OR Gingivitis)	168
February 28, 2019	SCIELO	(Oral health OR Dental Decay OR Dental Caries OR Periodontal Diseases OR Gingivitis) AND (Sedentary Behavior OR Behavior, Sedentary OR Sedentary Behaviors OR Sedentary Lifestyle OR Lifestyle, Sedentary)	32
February 28, 2019	SCOPUS	(TITLE-ABS-KEY ( <i>sedentary</i> AND <i>behavior</i> OR <i>behavior</i> , AND <i>sedentary</i> OR <i>sedentary</i> AND <i>behaviors</i> OR <i>sedentary</i> AND <i>lifestyle</i> OR <i>lifestyle</i> , AND <i>sedentary</i> )) AND ( <i>oral</i> AND <i>health</i> OR <i>dental</i> AND <i>decay</i> OR <i>periodontal</i> AND <i>diseases</i> )	16
<b>TOTAL</b>			<b>216</b>

Source: Authors.

Additional manual searches were also conducted for other articles not retrieved from the searches by analyzing the references of the relevant articles included to read the full text. This whole process was performed by two authors and disagreements were resolved by discussion until a consensus was reached.

### ***Eligibility Criteria***

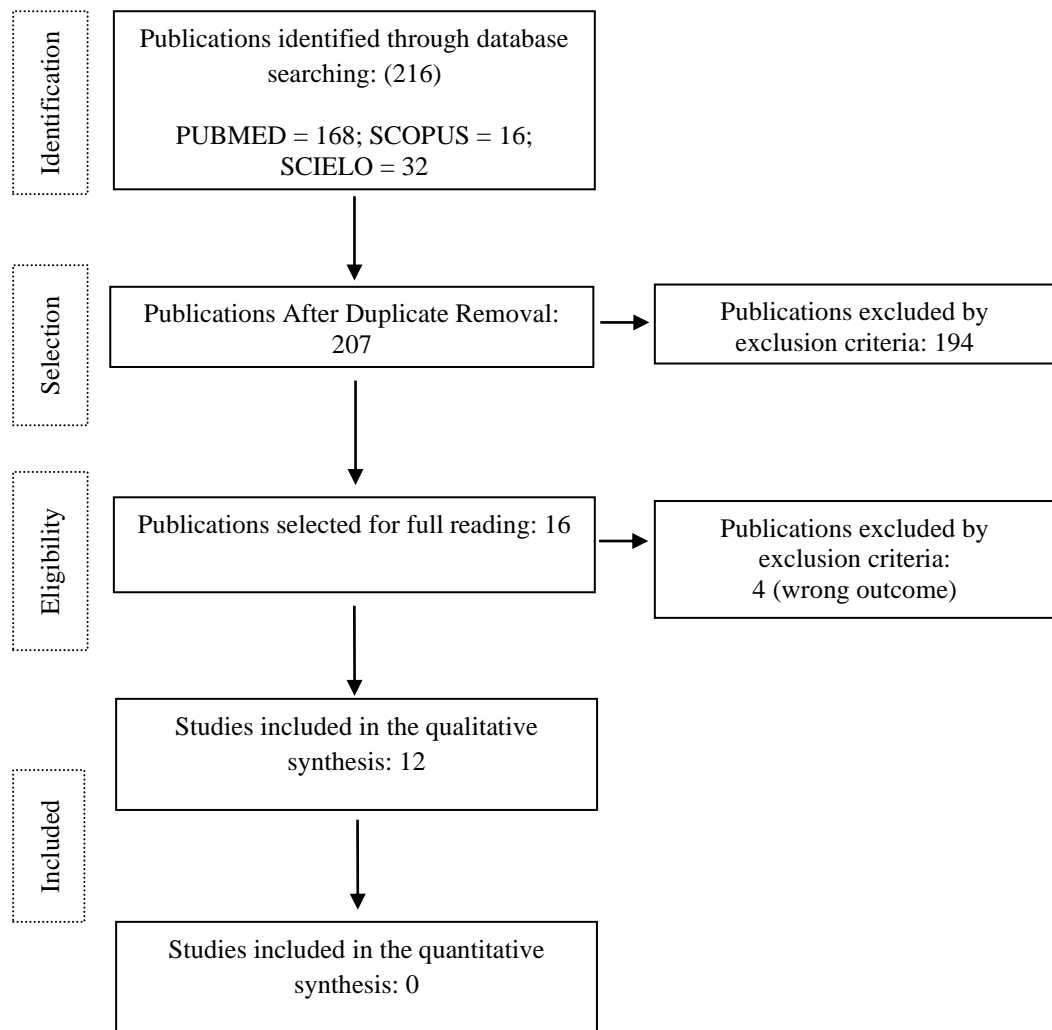
Only primary observational design studies (cohort, case-control and cross-sectional) were included. Other designs, conference summaries, letters to the editor, systematic reviews and narratives, as well as animal studies were excluded.

For the selection process, the *Rayyan* (Ouzzani et al., 2016) application was used for the initial screening of titles and summaries from a review bench. Then, based on the exclusion and inclusion criteria, the texts were selected for full reading.

### **3. Results**

The selection process for eligible studies is presented in Figure 1. The search for evidence on the platforms resulted in 216 articles, of which 9 studies were excluded because they were duplicates and 12 were analyzed because they met all previously established eligibility criteria.

**Figure 1.** Flowchart of selection of included studies.



Source: Authors.

To facilitate the analysis and understanding of current scientific knowledge about the relationship between sedentary behavior and oral health, two tables were elaborated. Table 2 presents the general characterization of the studies included in this review.

**Table 2.** General characterization of the included studies, presenting measures for the evaluation of sedentary behavior and oral health used in each design.

Author, year	Country of study	Characteristics of included population	Measure for sedentary behavior	Oral Health Assessment Measure
(Viana et al., 2018)	Brazil	School children between 13 and 17 years old, both male and female, attending private or public schools.	Physical inactivity and time watching television. The International Physical Activity Questionnaire for Older Children (PAQ-C) was used to assess physical inactivity.	The diagnosis of oral health conditions included evaluation of dental caries, gingival bleeding and oral hygiene. For this, the CPO-D, Löe and simplified oral hygiene index (OHI-S) were used.
(Anand, 2014)	India	School children between 9 and 12 years old, both male and female.	Leisure activities (time spent watching TV, playing video games and using the computer). Questionnaire.	Diagnosis of oral health conditions included caries scores and calculus scores, examining the buccal and labial surfaces of some fully erupted teeth (16, 11, and 26) and the lingual surfaces of some fully erupted teeth (36; 31 and 46).
(Zeng et al., 2014)	China	School-aged adolescents 12, 14 and 17, both male and female, from 48 schools in Guangxi province.	Time watching television (<30, 30-60, 60-120, 120-180 or > 180) minutes per day. Behavioral factors and demographic questionnaire that included a question about time spent watching television per day.	The diagnosis of oral health conditions included evaluation of dental caries through the WHO method. For this we used the analysis of the number of untreated decayed teeth and the CPO-D index.
(Bawadi et al., 2011)	Jordan	Individuals aged between 18 and 70 years, both female and male.	Three categories: low, medium and intense physical activity. International Physical Activity Questionnaire (IPAQ) was used to evaluate the intensity of physical activity.	The diagnosis of oral health conditions included periodontal clinical evaluation. Oral hygiene of six selected teeth (16, 21, 24, 36, 41 and 44) and the periodontal status of all teeth (except third molars) were assessed using the Silness & Loe Plaque Index, the Loe & Gingival Index. Silness, Probing Depth, and Clinical Insertion Loss (PIC)
(Costacurta et al., 2014)	Italy	Children between 6 and 11 years old, both female and male.	Extracurricular physical activity, sedentary lifestyle (watching TV, computer use, reading and study). Through a questionnaire.	Diagnosis of oral health conditions included tooth count (deciduous and permanent), teeth extracted by tooth decay or other reason, tooth decay, sealants, dental trauma, and permanent or temporary restorations. DMFT index was used, as well as radiographic examinations.
(Eberhard et al., 2014)	Germany	Healthy male subjects aged 45 to 65 years old who had not participated in an exercise or sports program, had no leisure-time physical activity, and had a working position preferably sitting for the past three years.	Low status of physical activity in relation to sports and leisure activities or working conditions. A validated questionnaire (Freye et al, 1999) evaluates activities during normal daily routine and leisure time (daily activities, leisure time activities and sedentary activities at home), as well as frequency and duration per session (for each type of activity).	The diagnosis of oral health conditions included periodontal clinical evaluation. Probing depth and clinical insertion level (six sides per tooth) were measured. Patients were classified into presence (mild, moderate or severe) or absence of periodontal disease.
(Freddo et al., 2008)	Brazil	13 year olds, both female and male, attending municipal public school, residents of both urban and rural areas.	A young woman who reported sports or exercise less than once a week and was not traveling to school on foot or by bicycle.	The diagnosis of oral conditions was made through questionnaires that asked about: daily frequency of tooth brushing, daily use of dental floss, frequency of use of dental services, and reason for using the service.
(Jacobsen et al., 2016)	Norway	School-aged adolescents of 16 years, both female and male.	Physical activity (frequency or intensity), based on participants' leisure activities recorded and graded as sedentary, low, moderate or high. Frequency of active physical or	The diagnosis of oral conditions was made through clinical examinations and two interproximal radiographs, maxillary and mandible impressions, eight intraoral photographs and a



			sports activities outside of school hours was recorded in three categories ( $\leq 01$ days a week, 2-3 days a week and $\geq 4$ days a week). Time in front of the TV / computer screen was recorded in days weekdays and weekend days and separated by $<4$ hours per day or $\geq 4$ hours per day.	questionnaire. Proximal, occlusal, buccal and lingual caries were diagnosed and rated on a scale; CPO-D index. The periodontal evaluation was only six teeth (16, 11, 26, 36, 31 and 46), using number of teeth with gingival bleeding and number of teeth with periodontal pocket (4 to 5 mm or $> 5$ mm).
(Jordão et al., 2018)	Brazil	Adolescents of the ninth grade of the first grade (between 13 and 15 years old), both female and male, attending private or public schools in the five regions of the country (26 capitals and the Federal District).	Physical activity was measured by the open-ended question "In the last 7 days, how many days were you physically active for a total of at least 60 minutes a day?" To produce the 60-minute measure of vigorous moderate physical activity (MPVA).	The diagnosis of oral conditions was made through a questionnaire. The frequency of tooth brushing was reported as: once a day, twice a day, three times a day, four or more times a day, not daily. The categories for dental appointment frequency in the last 12 months were as follows: none, once, twice and three times or more.
(Peltzer and Pengpid, 2015)	Philippines	Schoolchildren aged 11 years (or younger) to 16 years (or older), both female and male.	Defined as spending 03 hours or more per day in a sitting position. Used the GSBH survey questionnaire (one question).	The diagnosis of oral conditions was made through a questionnaire (GSBH). The question was related to daily brushing (less than 02 times a day).
(Peltzer et al., 2016)	Cambodia	Schoolchildren with an average age of 15.7 years, both female and male.	Related to leisure time with a quiz question. "How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking to friends or doing other activities, such as playing games or talking on the phone or computer?" Answers were staggered at 1 = less from 01 hour per day to 6 = more than 08 hours per day.	The diagnosis of oral conditions was made through a questionnaire. The questions addressed perceived teeth condition, perceived gum condition, dental symptoms, oral check-up, and oral health behavior.
(Peltzer and Pengpid, 2014)	India, Indonesia, Myanmar and Thailand.	School aged between 13 and 15 years, both male and female.	Defined as spending 03 hours or more per day in a sitting position. Used the GSBH survey questionnaire.	The diagnosis of oral conditions was made through a questionnaire (GSBH) with four questions. The first question asked: "During the last 30 days, how many times a day did you clean or brush your teeth?" (The answer options were 1 = I did not clean or brush my teeth during the last 30 days, 2 = less than 1 time. per day at 6 = 4 or more times per day).

Source: Authors.

Of the twelve articles included, nine associated sedentary behavior with oral health. Dental caries and/or periodontal disease were found in subjects with low level of physical activity, showing that sedentary behavior may be a common risk factor between obesity and the individual's oral condition. However, three articles did not relate sedentary lifestyle to undesirable oral conditions.

Table 3 presents the design used in each study, as well as the results and conclusions of the authors.

**Table 3.** Results and conclusions presented by the authors in the included studies.

Author, year	Study Design	Objective of the study	Number of participants	Results according to authors	Conclusions according to the authors
(Viana et al., 2018)	Epidemiological cross-sectional	Verify the association between physical inactivity and oral health conditions.	353	There was a statistically significant association between physical inactivity in adolescents and the following variables: dental caries, dental plaque and time spent watching TV.	The authors confirmed the hypothesis that physical inactivity was associated with poor oral conditions.
(Anand, 2014)	Epidemiological cross-sectional	To evaluate the correlation as to how oral hygiene and periodontal health were influenced by obesity and lifestyle factors among 9-12 year olds.	426	The prevalence of poor oral hygiene and inappropriate eating habits was observed in children who spent more time watching television, playing video games and using a computer. Good oral hygiene has been observed in children who have visited dentists in the past.	There is a strong association of lifestyle factors with oral hygiene in pre-teens. Physical inactivity, with more leisure activities, has a negative impact on children's oral health.
(Zeng et al., 2014)	Epidemiological cross-sectional	To examine the association between dental caries experience and TV viewing among Chinese adolescents.	3452	There was a positive association between time spent watching TV and dental caries per day among Chinese adolescents. The longer the time spent watching TV, the greater the number of decayed teeth and higher CPO-D index.	The authors confirmed the association between dental caries and TV viewing in Chinese adolescents. There is a greater likelihood of having more decayed teeth with increased time spent watching TV.
(Bawadi et al., 2011)	Epidemiological cross-sectional	Determine the association between diet quality, physical activity and periodontitis.	340	Poor diet was significantly associated with increased odds of periodontal disease. A healthy (non-sedentary) lifestyle is associated with a lower prevalence of periodontitis.	A low level of physical activity and a poor diet are significantly associated with increased likelihood of periodontal disease.
(Costacurta et al., 2014)	Cross-sectional statistic.	To evaluate the association between obesity and dental caries, and to estimate the impact of food consumption, oral hygiene and lifestyle on the incidence of dental caries in obese pediatric patients.	96	Positive association between obesity and dental caries.	This study shows a direct association between dental caries and obesity, evidenced by the correlation between prevalence of dental caries and % body fat mass. Analysis of dietary intake, DMFT, % body fat mass, as measured by DXA, shows that specific dietary habits (sugary drink intake, frequency of sugar intake limited to main meals, frequency of dietary intake between meals) can be considered as common risk factors for dental caries and childhood

					obesity.
(Eberhard et al., 2014)	Cross-sectional study	To investigate the association between periodontal disease severity and cardiorespiratory fitness (RCA) in sedentary non-smoking men.	72	There is an association between severity of periodontal disease and functional status of the respiratory, cardiovascular and skeletal muscular system in sedentary nonsmoking men between 45 and 65 years.	This study shows that moderate and severe periodontitis was associated with reduced levels of cardiorespiratory fitness in sedentary men.
(Freddo et al., 2008)	Cross-sectional study	To investigate oral hygiene habits and the use of dental services and their association with sociodemographic and lifestyle-related variables of schoolchildren in the municipal public school of Gravataí, RS.	1170	Among sedentary students, the frequency of inappropriate use of dental floss was higher, as well as a lower demand for dental services. There is an association between service visits for curative treatment and sedentary lifestyle.	Lifestyle indicators, such as the consumption of cariogenic products, tobacco and sedentary lifestyle, were associated with the studied outcomes, showing that oral hygiene habits and the use of dental services are part of a larger set of related habits and behaviors. to good overall health.
(Jacobsen et al., 2016)	Cross-sectional study	Record the prevalence of initial or manifest dental caries in a sample of 16-year-old subjects. Investigate whether teens with a history of immigration or Sami advance have higher caries rates. To examine variations in caries prevalence related to independent selected variables, including oral health lifestyle, attitudes and perceptions, oral health parameters, and general health.	869	Intensity and frequency of physical activity or hours spent in front of the TV / computer screen are not associated with caries prevalence.	Gingival bleeding was very often recorded among adolescents, particularly men in the present investigation. This finding suggests the need for different approaches to oral health education in men and women. Our finding that a high percentage of adolescents (about 80%) brushing their teeth at least twice a day with gingival bleeding may indicate the need for preventive measures.
(Jordão et al., 2018)	Cross-sectional study	To evaluate how oral and general health risk behaviors are grouped among Brazilian adolescents.	109.104	In the subsample of male subjects only, less frequent tooth brushing was not related to low physical activity.	Interventions aimed at improving adolescent health should preferably employ a common risk factor approach. We suggest that health promotion topics be integrated.
(Peltzer and Pengpid, 2015)	Cross-sectional study	Provide trend estimates on the prevalence of various health risk behaviors assessed in the Global School-based Survey (GSBH) in 2003, 2007 and 2011.	18.285	Sedentary behavior increased not very significantly in both girls and boys from 2003 to 2011. The opposite is observed for oral hygiene, with a significant decline in poor oral hygiene.	Results show that intensified school health promotion programs should be convened to reduce such risk behaviors.
(Peltzer et al., 2016)	Cross-sectional study	To study the health status of perceived teeth and oral health behavior, and their correlates, among adolescents in Cambodia.	3.806	There is a relationship between sedentary leisure time and poorly perceived dental condition.	This study found a significant proportion of poor health of perceived teeth and poor oral health behavior. Several sociodemographic factors and a series of grouped health risk factors have been identified, which may help guide

					interventions to promote oral health in this school population.
(Peltzer and Pengpid, 2014)	Cross-sectional study	To investigate oral hygiene and hand hygiene behavior and risk factors among 13 to 15 year old schoolchildren in four Southeast Asian countries.	13.824	Health risk behaviors, as well as the lack of protective factors, were, as found in other studies, associated with suboptimal oral hygiene.	Transnational data on oral and hand hygiene behavior from four Southeast Asian countries found suboptimal hygiene behavior. Several risk factors for suboptimal hygiene behavior have been identified as low socioeconomic status, health risk behaviors, psychological stress, and lack of protective factors that may inform programs in order to improve the hygiene behavior of the adolescent population.

Source: Authors.

#### 4. Discussion

It is noticed that the knowledge about the influence of sedentary behavior on oral health is still little known, however, it is verified in the existing literature that this influence is described, relating sedentary lifestyle to poor oral health conditions (Anand, 2014; Bawadi et al., 2011; Costacurta et al., 2014; Eberhard et al., 2014; Freddo et al., 2008; Peltzer et al., 2016, 2014; Viana et al., 2018; Zeng et al., 2014).

Due to the modernization of daily household tasks, the displacement of the population by collective and private means of transportation and the increase of activities in a static position, sedentary behavior had its high levels, revealing itself as a public health problem (Amorim et al., 2012). According to data from the World Health Organization (WHO), 20% of adults and 80% of adolescents in the world population do not practice physical activities (WHO, 2018). Physical inactivity is considered a risk factor for obesity, and the barriers to physical activity are not restricted only to obese individuals, but also to non-obese individuals, which can be explained by the lack of motivation, influence of family and social, perception or negative experiences about physical education, self-awareness about the body, concerns about visibility and material resources (Martins et al., 2015). Regarding the common risk factors, dental caries shares with the obesity factor the diet (Sheiham et al., 2000), but, in the face of changes in society, both diseases may be dividing factors beyond this. Thus, it is necessary to expand the scientific knowledge on the subject, allowing the design of interprofessional planning with a view to comprehensive and individualized oral health care, according to the patient's profile.

One of the main characteristics of sedentary behavior is the time spent watching TV or using the computer in sitting or lying positions (Meneguci et al., 2015), that is, with technological media that do not require dynamism or movement to use it. In addition, the high rate of advertising of sugary and fatty foods affects the choice of individuals, as it promotes a large supply of foods and low cariogenic beverages. Biological and psychological factors justify the increase in the consumption of unhealthy food, since eating unconsciously or emotionally is a frequent reality, being associated with the use of screens such as a television or computer (Kebbe et al., 2017). This was clear in the studies included in this work, since most were conducted in the last decade, showing that the subject has become of importance to health due to behavioral changes brought about by technological evolution.

The cariogenic diet combined with poor oral hygiene and other factors, such as frequency of ingestion and food consistency, lead to the emergence of caries disease. Studies indicate that adolescents with sedentary behavior are associated with dental caries (Viana et al., 2018; Zeng et al., 2014), while others do not relate the intensity and frequency of physical exercise or hours spent in front of a screen with the prevalence of caries (Jacobsen et al., 2016). Regarding periodontitis, there is also a relationship, and the pathophysiological mechanisms are not yet well understood, but can be explained by the anti-inflammatory effect of regular exercise (Bawadi et al., 2011; Eberhard et al., 2014).

Oral hygiene (tooth brushing and flossing) was identified as poor when accompanied by physical inactivity and poor eating habits (Anand, 2014; Peltzer et al., 2016, 2015). In this sense, there is an association between visits to the dental office for curative treatment and sedentary behavior, since people considered sedentary have an inadequate frequency of dental consultations higher than the non-sedentary population, thus affecting the prevention of disease (Freddo et al., 2008). However, other studies have not found a relationship between low physical activity index and poor oral hygiene, but consider points to be explored in health policies (Jordão et al., 2018; Peltzer et al., 2015).

The type of food and the frequency of ingestion are important factors for the development of the two most prevalent oral diseases in the world population: caries and periodontal disease. Thus, some types of carbohydrates such as sucrose serve as a specific substrate for cariogenic bacterial metabolism, since they imply energy production and metabolites related to the facilitation of dental biofilm accumulation. Accumulation is considered the primary etiological factor critical for the development of both caries and periodontal disease (Pflipsen et al., 2017). This becomes relevant from the point of view of the etiopathogenesis of these two diseases, as they may direct decision-making on healthy

public policies, such as control over the amount of sugars, especially sucrose, in processed foods and restrictions on admittedly deleterious food advertisements. Therefore, the central role of oral hygiene and other etiological factors that may interfere in the health-disease process, for both caries and periodontal disease, should be considered in the specificities of the studied population.

Sociodemographic factors influence the lifestyle of individuals and are responsible for how they perceive the habits around them. Socially disadvantaged or vulnerable subjects tend to have a less costly diet rich in fermentable carbohydrates, which sustains long periods of cariogenic challenge, favors the demineralization of the dental surface and promotes the development of caries (Costacurta et al., 2014; Pflipsen et al., 2017). From this perspective, socioeconomic vulnerability was also related to hygiene habits, and it was found that socially vulnerable individuals had inadequate oral hygiene practices, which favor the accumulation of supragingival biofilm. This information is of great relevance in the perspective of prevention and health promotion. The empowerment and empowerment of the most socioeconomically vulnerable populations should be sought to generate greater autonomy for individuals, enabling them to make better decisions for their individual health and the health of their community. From the perspective of public oral health policies, specific actions can be directed to this target population, thus increasing the resolvability of the work of oral health teams.

It is important that during anamnesis and clinical examination, especially in children and pre-adolescents, include the calculation of Body Mass Index (BMI), record of leisure time activities, nutritional diary and socioeconomic conditions for a broad view of patient's oral and general hygiene routine (Anand, 2014). Knowing how to follow and direct the patient with risk factors such as physical inactivity and high consumption of cariogenic foods for a healthier lifestyle is essential for clinical dental practice and for directing public policies for health promotion.

The present study had no restrictions on its research, performing a broad search on electronic platforms. However, a limiting factor was the lack of a common methodology for the diagnosis of oral condition among the included studies. This made the meta-analysis unfeasible, since some researches used questionnaires about oral hygiene habits and self-perception of the oral condition, while others had clinical and/or radiographic examinations with professionals calibrated for this. It is necessary to plan primary studies that address physical inactivity as a contributing factor for oral diseases such as dental caries and periodontal disease.

Thus, it is suggested that future studies be robustly and sensitively designed for the object of study, using standardized (comparable) methodology with well-defined experimental groups. Thus, it will be possible to verify, with greater reliability, in obese patients, besides the effect of diet, the mechanical control pattern of the biofilm and its relationship with caries and periodontal diseases in this specific population. Therefore, prospective studies with longer follow-up should be used.

## 5. Final Considerations

The results point to a possible association between physical inactivity and the development of both caries and periodontal disease, although it should be emphasized that both are direct sequel of the accumulation of dental bacterial biofilm, which goes beyond the condition of being sedentary or not. Thus, this hypothesis reinforces the importance of behavioral dimension management as a fundamental requirement for the control of the oral health-disease process. From the perspective of oral health care approach supported by the consideration of risk factors in common with systemic diseases, it is advise that dental surgeons, acting in both the private and public spheres, should be aware of the lifestyle adopted by their patients in order to encourage them to adopt healthy behaviors, considering the socio-cultural context in which the patient is inserted.

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