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Malocclusion, dental caries, and nutritional status: systematic review

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Abstract

Malocclusion and dental caries are major oral health problems for public health. Malocclusion is considered to be a condition of imbalance in the size and position of the teeth, facial bones, and soft tissues; in Madagascar, 5% of the population is class II and 0.4 to 1.1% is class III. Dental caries is a multifactorial infectious disease and remains a major cause of pain worldwide. In Madagascar in 2016, 80 to 98% of the population was affected by dental caries. The impact of these oral health conditions is thought to influence the nutritional status of the population. Our research questions are as follows: What is the relationship between malocclusion, dental caries, and nutritional status? The overall objective is to assess the relation between malocclusion, dental caries and nutritional status.

Keywords: Dental caries; Malocclusion; Nutritional status; Systematic review; Madagascar

1. Introduction

Malocclusion, defined by the WHO as a disabling dentofacial anomaly, refers to abnormal occlusion and/or disturbed craniofacial relationships, which can affect aesthetic appearance, function, facial harmony, and psychosocial well-being [1]. In 2017 in Madagascar, the prevalence of Class I malocclusions was 93.9%, Class II malocclusions was 5%, and Class III malocclusions was 1.1% [2]. Dental caries is a multifactorial infectious disease involving three factors: the presence of cariogenic bacteria, the ingestion of fermentable carbohydrates, and the host's defense capabilities, particularly against the acidity produced by these bacteria. The duration of interaction and contact between these three factors is also crucial. When the balance between these three factors (dietary carbohydrates, cariogenic bacteria, and saliva) is disrupted, demineralization occurs and tissue damage progresses [3]. In Madagascar in 2016, 80 to 98% of the population was affected by dental caries [4]. Malocclusion is one of the most common oral health problems, along with dental caries [5]. The deterioration of oral health leads to changes in diet, altered phonation and diction, and changes in eating habits [6]. The objective of our research is to evaluate the relationship between malocclusion, dental caries, and nutritional status.

2. Methodology

This is a systematic review of the literature based on a bibliographic search using databases collected from search engines such as PubMed, Scopus, and Google Scholar. Our databases consist of articles available on the internet concerning malocclusions, dental caries, and nutritional status. We included: epidemiological studies on malocclusions and dental caries (systematic review); articles in English and French; studies involving adults aged 18 and over; and studies published in the last 15 years (2010-2024). We excluded: studies conducted on pediatric populations (under 18 years of age); studies without nutritional data; and publications in languages other than English and French. We opted for exhaustive sampling. We used search engines such as PubMed, Scopus, and Google Scholar, using the keywords “Malocclusion, Dental Caries, Nutritional Status” indicated in Mesh Bilingue, and the Boolean search operators “And, Or,

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Not." Data were collected on individual questionnaire forms (survey forms) to gather information and clinical data on individuals using the PRISMA method. For data analysis, we used SPSS version 25.0 software. We performed descriptive analyses. The statistical significance threshold was set at $p < 0.05$.

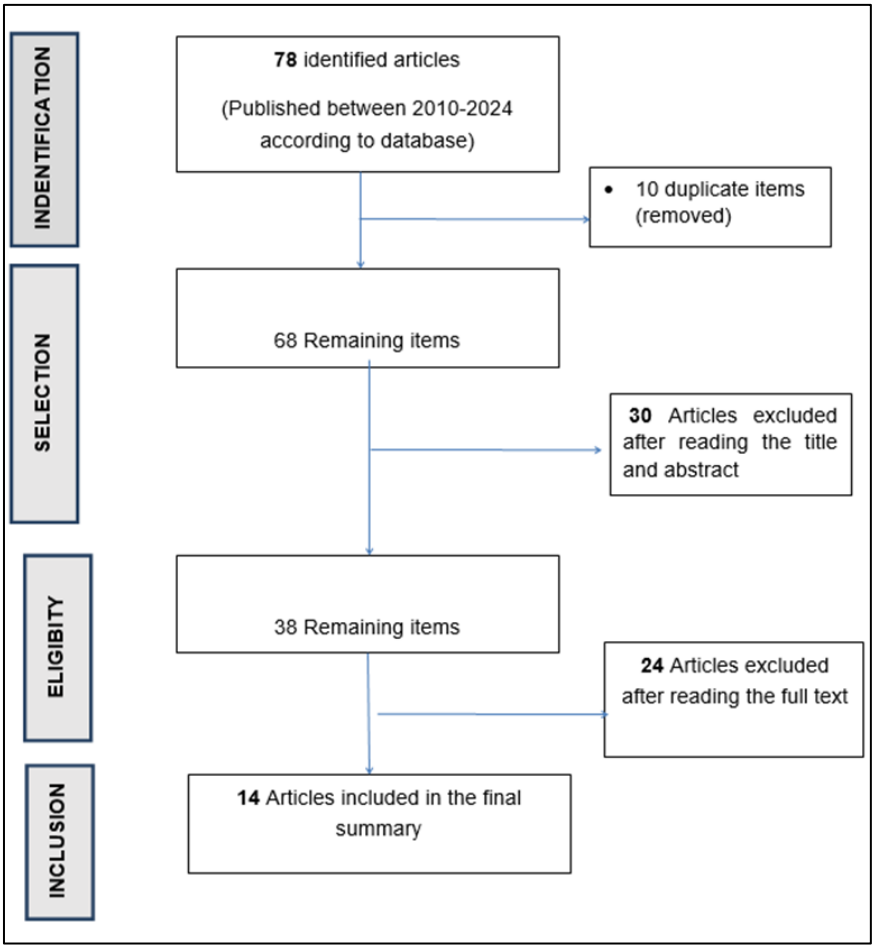

Figure 1 PRISMA flow diagram

3. Results

Table 1 Breakdown by publication date

Period	Number of articles	Percentage
2012-2014	4	28,6%
2015-2017	4	28,6%
2018-2020	1	7,1%
2021-2023	0	0%
Total	14	100%

Table 2 Breakdown by country of origin of studies

Country	Number of articles	Percentage
France	5	35,7%
Brazil	2	14,3%
Italy	1	7,1%
Japan	1	7,1%
United Kingdom	1	7,1%
United States	1	7,1%
International	2	14,3%
Total	14	100%

Table 3 Breakdown by language of publication

Language	Number of articles	Percentage
English	9	64,3%
French	5	35,7%
Total	14	100%

Table 4 Breakdown by focus or intervention

Focus / Intervention	Number of articles	Percentage
Oral health and nutrition	4	28,6%
Untreated dental caries	2	14,3%
Tooth loss or edentulism and nutritional status	3	21,4%
Occlusion or malocclusion and nutrition / BMI	2	14,3%
Malnutrition and oral hygiene	2	14,3%
Overall burden of oral diseases	1	7,1%
Total	14	100%

Table 5 Breakdown by type of study

Types of studies	Number of articles	Percentage
Systematic review	2	14,3%
Narrative/global review	2	14,3%
Observational study	3	21,4%
Descriptive study	3	21,4%
Clinical study	1	7,1%
Longitudinal study	1	7,1%
Epidemiological study	1	7,1%
Total	14	100%

4. Discussion

4.1. Depending on the year of publication

During the periods 2012–2014 and 2015–2017, several major studies were published. Donini et al. (2014) examined the links between malnutrition and edentulism in older adults, highlighting the functional impact of tooth loss on food consumption [7]. Lopez-Jornet et al. (2013) assessed the prevalence of malnutrition according to the MNA index in older adults in relation to their oral health, confirming a significant correlation between oral health and nutritional status [8]. Between 2015 and 2017, Klotz et al. (2016) published a study on the influence of edentulism on nutritional quality of life, showing that patients without functional prostheses had a significant impairment in their diet [9]. Furthermore, Marcenes et al. (2013) presented a global analysis of the burden of untreated oral diseases, highlighting the high prevalence of dental caries in adults [10]. The recent period (2018–2023) was represented by a smaller number of publications in this corpus. Among these, Mikami et al. (2023) conducted a systematic review of the association between occlusal support and nutritional status in older adults, confirming the importance of functional occlusion in maintaining good nutritional status [11].

4.2. Depending on the country of origin

The geographical distribution of the 14 studies included in this systematic review showed a marked predominance of French publications, which accounted for 35.7% of the total corpus. This strong contribution from France was reflected in studies focusing on the links between oral health and nutritional status in older people. For example, Moynier et al. (2017) examined the oral health of nursing home residents in relation to their nutritional status [12], while Belmin et al. (2012) analyzed the effects of malnutrition on oral hygiene in hospital geriatric wards [13]. Brazil ranked second with two publications (14.3%). Silva Jr. et al. (2019) assessed the association between tooth loss and nutritional deficiencies in an adult Brazilian population [14]. In addition, Marcenes et al. (2013) presented a global study, involving Brazilian institutions in particular, which estimated the global burden of oral diseases, including untreated caries [10]. Finally, two articles adopted a multinational or global approach, accounting for 14.3% of the sample. Among these, Marcenes et al. (2013) mapped the global burden of oral diseases in a systematic analysis covering several continents [10]. More recently, Mikami et al. (2023) synthesized data from several countries on the link between dental occlusion and nutritional status in older adults [11].

4.3. Depending on the language of publication

Of the 14 articles included in this systematic review, 9 were published in English, representing 64.3%, while 5 were published in French, representing 35.7% of the total corpus (Table 3). This predominance of English in the scientific literature reflected the international dynamics of publications in public health and clinical research, particularly on the links between oral health and nutrition. Donini et al. (2014) published an Italian study in English on the effects of poor oral health on the nutritional status of older adults [7]. Marcenes et al. (2013) presented a global review of the burden of untreated oral diseases in the Journal of Dental Research, a peer-reviewed journal ranked Q1 in the field [10]. In French publications, several authors addressed issues specific to the elderly population in France. Belmin et al. (2012) assessed the impact of malnutrition on oral hygiene in hospital geriatric wards [15].

4.4. Depending on the type of study

Among the 14 articles included, cross-sectional studies and observational studies were the dominant methodological categories, each representing 21.4% of the analyzed corpus (Table 5). These types of research highlighted statistical associations between variables without establishing a direct causal link, which proved relevant for exploring the relationship between oral health and nutritional status. Silva Jr. et al. (2019) conducted a cross-sectional study in Brazil to assess the impact of tooth loss on the nutritional quality of adults, concluding that there was a negative relationship between edentulism and food intake [14]. Similarly, Moynier et al. (2017) conducted an observational study in nursing homes in France, highlighting the central role of oral health in maintaining good nutritional status in dependent elderly subjects [12]. Systematic reviews and narrative or global reviews accounted for 28.6% of the publications included, reflecting a strong focus on critical syntheses of the literature. Donini et al. (2014) proposed a narrative review addressing the relationship between oral hygiene and malnutrition in older adults [7], while Mikami et al. (2023) conducted a recent systematic review on the links between dental occlusion and nutritional status, including international data [11]. Finally, Marcenes et al. (2013) contributed to a major global analysis of the burden of oral diseases in the Journal of Dental Research, based on global epidemiological data [10].

5. Conclusion

This systematic review covered 14 articles published between 2010 and 2024, selected from a structured search in accordance with PRISMA recommendations. The periods 2012–2014 and 2015–2017 each accounted for 28.6% of the publications selected. The majority of studies came from France (35.7%), followed by Brazil (14.3%), with individual contributions from other European, Asian, and American countries. English-language publications accounted for 64.3% of the sample, compared to 35.7% in French. The most common topics were the link between oral health and nutrition (28.6%), followed by tooth loss associated with nutritional status (21.4%). Other topics, such as untreated caries, malocclusion, malnutrition, and the global burden of oral diseases, were also addressed. In terms of methodology, cross-sectional and observational studies were the most common (21.4% each), followed by systematic and narrative reviews (28.6%). Other types of descriptive, clinical, longitudinal, and epidemiological studies were represented equally, with one article per category (7.1% each). The final corpus consisted of 14 articles that met the defined inclusion criteria.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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