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The Relationship Between Educational Achievement and Oral Health Status: A Systematic Review of Cross-Sectional Studies

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Abstract

Background: Oral health status significantly affects general health and quality of life, with mounting evidence suggesting a positive correlation between educational level and oral health outcomes. However, comprehensive synthesis of this relationship across diverse populations and healthcare systems remains limited.

Objective: To systematically review and analyze the relationship between educational level and oral health status across global populations, providing evidence-based insights for health policy development and oral health improvement strategies.

Methods: A systematic literature search was conducted using PubMed and The Cochrane Library databases from January 2007 to January 2025. Search terms included "oral health," "education level," "caries," "periodontosis," and "tooth loss." Cross-sectional studies examining the relationship between educational attainment and oral health outcomes were included. Study quality was assessed using the Agency for Healthcare Research and Quality 11-item checklist. Data extraction focused on correlations between educational level and dental caries, periodontal disease, and tooth loss across different populations and healthcare systems.

Results: A total of 236 articles were identified, with 32 cross-sectional studies meeting inclusion criteria after systematic screening. The studies encompassed populations from both developed countries (Britain, United States, Germany, Denmark, Belgium, Finland) and developing nations (Chile, Egypt, India, Thailand, Colombia, Nigeria, China). Consistent evidence demonstrated that educational level was negatively correlated with the prevalence of dental caries, periodontal disease, and tooth loss across all examined populations. This inverse relationship persisted even in developed countries with established national public health insurance systems, indicating that educational gradients in oral health transcend healthcare access barriers.

Conclusions: Educational level demonstrates a robust and consistent association with oral health outcomes across diverse global populations and healthcare systems. The universality of this relationship suggests that expanding educational opportunities represents a promising upstream intervention strategy for improving population oral health. These findings support the integration of educational advancement into comprehensive oral health promotion policies and highlight the potential for educational interventions to address oral health disparities at the population level.

Keywords: oral health, caries, periodontosis, dentition defects, tooth loss, education, educational inequalities

1. Introduction

Oral health status directly or indirectly affects an individual's overall health and quality of life. Loss of masticatory function caused by oral diseases is closely related to the dietary intake necessary for the maintenance of health. It also has a negative effect on physical appearance, which has an impact on interpersonal and social lives. Evidence suggests that oral diseases are as important to an individual's quality of life as other diseases [1]. The global burden of oral diseases remains substantial, with dental caries affecting nearly 60-90% of children and approximately 90% of adults worldwide, while periodontal diseases and tooth loss continue to impose significant health and economic burdens on societies across different socioeconomic strata [2,3]. It has been hypothesized that socioeconomic status can predict or even causally affect oral health, as has been reported for many other diseases [4]. Educational

level, as a relatively stable indicator of socioeconomic status that generally does not change much over adult life, can be better quantified and serves as a crucial determinant of health outcomes.

While numerous individual studies have examined the relationship between education and oral health outcomes, there exists a significant research gap in the comprehensive synthesis of evidence across diverse populations and healthcare systems. Previous reviews have largely focused on specific populations or single oral health conditions, lacking a systematic evaluation of the relationship across the three most prevalent oral diseases—dental caries, periodontal disease, and dentition defects—in a global context spanning both developed and developing countries. The innovation of this systematic review lies in its comprehensive approach to analyzing 18 years of evidence (2007-2025) across multiple continents and healthcare systems, providing a unique perspective on how educational gradients in oral health manifest universally, even in countries with established national public health insurance systems. Unlike previous studies that examined isolated aspects of this relationship, this review synthetically evaluates the correlation patterns across three major oral health conditions, offering insights into the potential causal pathways and intervention opportunities.

Therefore, through a systematic review, this study comprehensively analyzed the studies published in the past 18 years on the correlation between educational level and caries, periodontal disease, and dentition defects. The primary objective was to systematically review the possible relationship between educational level and oral health status to provide a theoretical basis and guidance for improving oral health. Specifically, this review aimed to: (1) quantify the strength and direction of associations between educational attainment and major oral health outcomes across diverse populations; (2) explore the underlying mechanisms and causal pathways linking education to oral health disparities; (3) identify consistent patterns in educational gradients across different healthcare systems and socioeconomic contexts; and (4) provide evidence-based recommendations for health policies that could leverage educational interventions as a strategy for improving population oral health outcomes.

2. Methods

2.1 Retrieval Strategy

From January 1, 2007 to January 1, 2025, two databases (PubMed and The Cochrane Library) were searched via the Internet. The keywords included “oral health,” “caries,” “periodontosis,” “tooth loss,” “edentulism,” “education,” and “educational inequalities.” Simultaneously, the included references were screened, and relevant journals and literature were searched manually.

2.2 Inclusion Criteria

Studies were included if they were published cross-sectional studies that investigated the relationship between educational level and oral health outcomes. Only studies that specifically examined educational attainment as a variable related to dental caries, periodontal disease, or tooth loss were considered for inclusion in this systematic review.

2.3 Exclusion Criteria

Studies were excluded if the full text could not be obtained or if no valid data could be extracted from the documents. Additionally, literature with repeated publication or suspected duplicate publication was excluded from the analysis to avoid data duplication and ensure the integrity of the systematic review.

2.4 Quality of Literature Evaluation Tool

The quality of the included literature was assessed using an 11-item checklist for cross-sectional studies provided by the Agency for Healthcare Research and Quality. A “No” or “NA” answer added 0 points to each question, while a “Yes” answer added 1 point. All 11 questions were summarized within a score to assess the quality of the study: A score of 0–3 indicated low quality, a score of 4–7 indicated moderate quality, and a score of 8–11 indicated high quality (Table 1).

2.5 Selection of Research Types

Observational studies, including cross-sectional, case-control, and cohort studies, address the risk factors for dental caries, periodontal disease, dentition defects, and edentulous jaws.

2.6 Eligibility Criteria for Research Data

Eligible studies were required to be published between January 1, 2007 and January 1, 2025, with a minimum sample size of 200 participants. Studies must have employed professional oral examination methods in addition to questionnaire data collection to ensure comprehensive oral health assessment. Articles that did not meet these criteria were excluded from the search and data extraction process.

3. Results

A systematic search yielded 236 results, of which 34 were considered eligible. After excluding 2 review articles, 32 full texts were evaluated, most of which were cross-sectional studies (Figure 1).

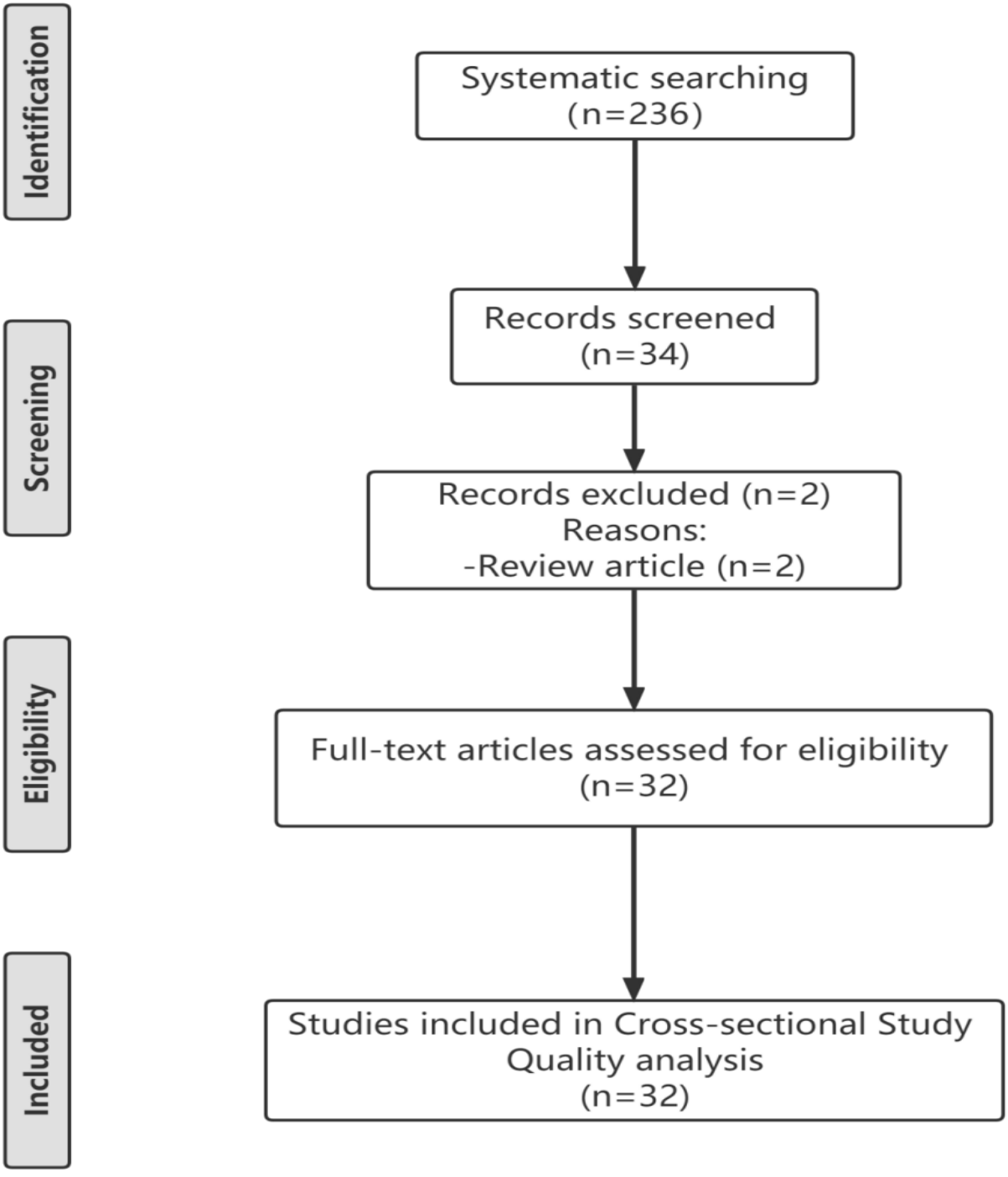

Figure 1. PRISMA diagram for systematic review process

3.1 Study Population

The research objects of the included references were from developed countries such as Britain, the United States, Germany, Denmark, Belgium, and Finland. The developing countries include Chile, Egypt, India, Thailand, Colombia, and Nigeria. There are also Sichuan Province and the Guangxi Zhuang Autonomous Region in China, as well as other Asian countries with similar education and culture, such as Japan and South Korea. In the study

of caries-related references, the focus of research was mostly young and middle-aged people. Most of the references related to "periodontal disease" and "dentition defect" included studies on elderly people, which may be due to age being one of the important factors of these two diseases.

3.2 The Correlation Between Education Level and "Dental Caries" (Table 2)

Dental caries are increasingly becoming a serious public health problem worldwide, with nearly 60–90% of children and approximately 90% of adults suffering from dental caries, thereby placing a health and economic burden on society [2,3]. A secondary analysis of data collected from the National Health and Nutrition Examination Surveys in the United States from 1988 to 1994 and 1999 to 2004 found that people with fewer years of education had more cavities and those with more years of education had fewer cavities over time, controlling for the number of missing teeth and fillings [5]. Oral disease prevalence data from the fourth German Oral Health Study showed that low education and low income may produce higher oral health risks, with years of education inversely related to the Decayed, Missing and Filled Teeth index (DMFT) [6]. In Finland, the educational level of subjects was inversely related to the number of cavities, and there was a significant linear trend in the number of cavities over the cumulative period in the low-education group; that is, the number of cavities increased more with increasing exposure to low socioeconomic levels [7]. In 2010, a Belgian study involving 2,563 people showed that participants with higher levels of education had a lower DMFT than those with little or no education, and lower levels had more untreated cavities [8]. Data from the 11th Survey of the Third National Oral Health Survey in China showed that DMFT was negatively correlated with educational level among people aged 35–44 years and 65–74 years in Sichuan Province [9]. The data of people who were 35–44 years old and 65–74 years old in the Tibet Autonomous Region showed that a high educational level was negatively correlated with crown caries [10]. Among Iranian adults aged 35–44, education level was inversely associated with DMFT [11]. A secondary analysis of seven adult oral health outcomes from Chile's National Health Survey in 2003 and 2016–2017 showed a gradual decline in caries rates with increasing years of education [12]. Data from the 2014 Colombian Oral Health Survey showed an inverse relationship between caries incidence and education [13]. A cross-sectional study of a mixed rural and urban population in south-central Ethiopia showed that the probability of dental caries decreased significantly as adults became more educated [14]. One study found that the risk of dental caries was 76% lower in subjects with formal education than in those without it [15].

3.3 The Correlation Between Education Level and "Periodontal Disease"(Table 3)

Periodontal disease is one of the two most important oral diseases that contribute to the global burden of chronic diseases [16]. The fourth National Oral Epidemiological Survey in China showed that the periodontal health rate was only 9.3% for people aged 65–74 years. A study of 1.1 million Europeans showed that educational level was negatively associated with the risk of developing periodontitis [17]. Data from the 2009 British Dental Health Survey of adults over 35 years of age showed a significant educational gradient for periodontitis and gingival bleeding [18]. In Finland, the association between the number of periodontal pockets and education level decreased with age [7]. Data from a Swiss study of people over 55 years old showed that the number of missing teeth and the depth of periodontal pockets were inversely related to education level [19]. In the 11th survey of the Third National Oral Health Survey in China, the depth of the periodontal pocket was negatively correlated with educational level among people aged 35–44 years and 65–74 years in Sichuan Province [9]. A nationally representative sample of adults aged ≥ 20 years from 10 provinces, autonomous regions, and municipalities in China conducted from June 2012 to January 2015 showed that the more educated people were, the more knowledgeable they were about risk factors, symptoms, prevention, and treatment of periodontal disease [20]. Among Iranian adults aged 35–44, educational level was inversely related to the Community Periodontal Index (CPI) [11]. A 2013 study of periodontal health in Egyptian adults over 20 years of age showed that except for gingival bleeding, the prevalence of periodontal disease and its associated symptoms, such as dental stones and deep periodontal pockets, were inversely associated with education [21].

3.4 The Correlation Between Education Level and "Tooth Loss"(Table 4)

More than 158 million people worldwide have edentulous jaws [22]. Tooth loss can adversely affect diet and nutrition(Sheiham and Steele et al., 2001), physical and cognitive functions[23, 24], and life expectancy [25, 26]. Evidence from school reforms in the UK shows that oral health in later life has improved as a return on investment in school. For each additional year of education, the likelihood of an edentulous jaw decreased by 9%. This study is the first to provide causal evidence of the impact of education on actual oral health outcomes [27]. A cross-sectional study on the oral health of people aged 50–75 years in Paris, France, between 2008 and 2012 showed that lower educational levels were associated with lower masticatory efficiency and more missing teeth [28]. An open-population cohort study of socioeconomic health disparities in the Netherlands showed that educational level

and income were positively associated with oral health outcomes [29]. Data from 1974 and 1984 studies of the Danish population born in 1941 found that greater cognitive ability and education were protective factors against tooth loss, and higher education and cognitive ability at age 50 or 60 were associated with more teeth at the age of 70 [30]. A Belgian study of 2,563 people found that those with a low educational level were 20 times more likely to have edentulous jaws than those with a high educational level [8]. A Japanese study on the risk factors for tooth loss in residents over 40 years of age showed that low education was a particularly important risk factor for subjects with fewer than 20 teeth [31]. According to a prospective cohort study of 2010 and 2013 data from the Japan Gerontology Assessment Study, older and less educated participants tended to have higher rates of tooth loss [32]. A study of Japanese men between the ages of 40 and 79 years found that low educational levels were significantly associated with tooth loss, with the lowest number having more than 20 teeth [33]. Data from South Korea's 2012–2013 National Health and Nutrition Examination Survey showed that the odds of having more than 20 teeth increased with income and education [34]. Comparing data collected through the National Health and Nutrition Examination Survey of Korea from 2016 to 2018 with that collected in 2007, it was found that the lowest educated group had the largest decline in edentulism prevalence but still had a higher prevalence than the more educated group [35]. A study using oral health data from the Global Study on Aging and Adult Health in China from 2007 to 2010 found that edentulous jaws were more common among people with lower levels of education and household income [36]. In the 11th survey of the Third National Oral Health Survey of China, the functional dentition of people aged 35–44 years and 65–74 years in Sichuan Province was positively correlated with educational level [9]. A study of data from Brazil's 2010 National Oral Health Survey showed that tooth loss was persistently concentrated among individuals with low education and income, and that there was a social gradient in tooth loss associated with education and income [37]. A study of the same data in the 35–44 years and 65–74 years age groups showed that there was a significant educational gradient in functional dentition [38] and that less-educated elderly people in the study were 33% more likely to report tooth loss [39], respectively. The National Health Survey of Chile from 2016 to 2017 showed that there was an obvious educational gradient in the oral health of people over 15 years of age. Patients with a low educational level had the lowest number of remaining teeth, highest prevalence of edentasis, and least functional fitness. This trend was observed in both men and women, with greater differences observed in the upper jaw [40]. Data from Colombia's 2014 Oral Health Survey showed an inverse relationship between the number of edentulous jaws, missing teeth, and educational level [13]. A cross-sectional study among 392 older adults in Nigeria showed that education was associated with the number of missing teeth [41]. Data from a survey of elderly people conducted by the National Bureau of Statistics of Thailand indicated that elderly people with little education were less likely to retain an optimal number of natural teeth [42].

4. Discussion

This systematic review provides compelling evidence for a consistent negative correlation between educational level and oral health problems across diverse populations and healthcare systems worldwide. Our findings demonstrate that individuals with higher educational attainment consistently exhibit lower rates of dental caries, periodontal disease, and tooth loss, regardless of their geographical location or the presence of national public health insurance systems. The relationship appears to be remarkably universal, manifesting in both developed countries such as the United States, Germany, and Finland, as well as developing nations including Ethiopia, Colombia, and Thailand. Notably, this educational gradient in oral health persists even after accounting for various confounding factors, suggesting that education serves as a fundamental determinant of oral health outcomes. The strength and consistency of these associations across 32 cross-sectional studies spanning 18 years underscore the critical importance of educational interventions as a potential pathway for improving population oral health.

The correlation between educational level and oral health may be attributed to several interconnected mechanisms. Educational level is often related to income, which leads to more opportunities to obtain preventive measures at home or in the profession, such as toothpaste, dental floss, low-calorie and low-glycemic diet, pit and fissure closure and other preventive treatments [43]. Educational level also affects non-material characteristics, such as health knowledge popularization and behavior [6, 44], including diet and tooth cleaning habits or the frequency and pattern of health service utilization. The dental visit rate of the population in developing countries in Europe is directly proportional to educational level [45]. A population with a low educational level has a lower rate for receiving the filling treatment of dental caries [46]. The brushing frequency and oral hygiene habits of subjects with a high educational level are significantly higher than those with a low educational level [47], and people with low educational levels consume more sugar [48] and have more intensive exposure to active or passive smoking [49]. Additionally, people with low educational levels were more likely to have their teeth extracted than those who were treated conservatively, with the decision to extract teeth being more common in the past than it is now, especially in rural areas [50]. Grossman explained the link between education and health using a theory based on

individual choice, arguing that health is a stock of capital that can be increased by an individual's investment [51]. In the Grossman model, highly educated people receive more health benefits from specific investments because education improves their good health habits, and they are better able to understand and process health-related information while being more sensitive to oral health concerns, ultimately investing more in dental health maintenance and restoration [27].

Despite the comprehensive nature of this systematic review, several limitations must be acknowledged. The majority of included studies were cross-sectional in design, which limits our ability to establish causal relationships between educational level and oral health outcomes. The inherent risk of bias in observational studies, particularly regarding selection bias and confounding variables, may have influenced the reported associations. Additionally, the quality of the included studies varied considerably, with most scoring between 4-7 on the 11-point AHRQ scale, indicating moderate quality that may affect the reliability of our conclusions. The populations analyzed were not always nationally representative, and some countries were oversampled while others remained underrepresented, potentially limiting the generalizability of findings to global populations. Furthermore, the definitions and measurements of educational level varied across studies, ranging from years of formal education to categorical classifications, which may have introduced heterogeneity in our comparisons. The lack of standardized oral health outcome measures across different healthcare systems and the potential for interviewer bias in some studies also represent important methodological limitations. Finally, the temporal scope of our review, while extensive, may not capture recent changes in educational policies or healthcare systems that could influence the education-oral health relationship.

Future research should prioritize longitudinal cohort studies to establish temporal relationships and potential causal pathways between educational interventions and oral health outcomes. Investigations into the optimal timing and duration of educational interventions throughout the life course could provide valuable insights for policy development and implementation strategies. There is a critical need for studies examining the effectiveness of specific educational content and delivery methods in improving oral health behaviors and outcomes across different cultural and socioeconomic contexts. Research should also focus on identifying the minimum educational threshold required to achieve meaningful improvements in oral health, as well as exploring how digital health literacy and modern educational technologies might enhance traditional educational approaches. Future studies should investigate whether targeted oral health education programs can partially mitigate the oral health disparities observed among individuals with lower formal educational attainment. Additionally, research examining the cost-effectiveness of educational interventions compared to traditional clinical treatments could inform healthcare policy decisions and resource allocation strategies. Cross-cultural studies investigating how the education-oral health relationship varies across different cultural contexts and healthcare systems would enhance our understanding of universal versus context-specific mechanisms. Finally, the development of standardized global metrics for both educational level and oral health outcomes would facilitate more robust international comparisons and meta-analyses in future systematic reviews.

5. Conclusion

This systematic review provides robust evidence that educational level is consistently and inversely associated with oral health outcomes across diverse global populations, with higher education correlating with reduced rates of dental caries, periodontal disease, and tooth loss. The universality of this relationship, observed across both developed and developing countries regardless of healthcare system structure, underscores education as a fundamental social determinant of oral health. These findings suggest that expanding educational opportunities represents a promising upstream intervention strategy for improving population oral health outcomes. Policymakers should consider integrating oral health education into broader educational curricula and prioritizing educational advancement as a key component of comprehensive oral health promotion strategies. Future longitudinal studies are needed to establish causal relationships and optimize educational interventions for maximum oral health impact across different populations and settings.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Table 1. Quality appraisal following the Agency for Healthcare Research and Quality (ARHQ)

ARHQ Item	1. Define the source of information (survey,record review).	2. List inclusion and exclusion criteria forexposed and unexposed subjects (cases and controls) or refer to previous publications.	3. Indicate time periodused for identifying patients.	4. Indicate whether or not subjects were consecutive if not population-based.	5. Indicate if evaluators of subjective components of study were masked to other aspects of the status of the participants.	6. Describe any assessments undertaken for quality assurance purposes(e.g., test/retest of primary outcome measurements)	7. Explain any patient exclusions from analysis.	8. Describe how confounding was assessed and/or controlled.	9. If applicable, explain how missing data were handled in the analysis.	10. Summarize patient response rates and completeness of data collection	11. Clarify whatfollow-up, if any, was expected and the percentage of patients for which incomplete data or follow-up was obtained.	**Total Score**
Hybels, C F et al.2016	Yes	Yes	Yes	Yes	NA	No	No	No	No	No	No	4
Geyer S et al., 2010	Yes	Yes	Yes	Yes	NA	Yes	No	No	No	No	No	5
Bernabe, E et al., 2011	Yes	Yes	Yes	Yes	NA	Yes	No	Yes	No	Yes	No	7
Lambert M et al., 2018	Yes	Yes	Yes	Yes	NA	No	No	No	No	No	No	5
He, S et al., 2018	Yes	Yes	Yes	Yes	NA	No	No	No	No	No	No	5
Guan, L et al., 2020	Yes	Yes	Yes	Yes	NA	No	No	No	No	Yes	No	5
Hessari, H et al., 2007	Yes	Yes	Yes	Yes	NA	No	No	No	No	No	No	4
Borgeat, M.M et al., 2021	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	7
Guarnizo-Herreno, C.C et al.,2019	Yes	Yes	Yes	Yes	NA	Yes	No	No	No	Yes	No	6
Bogale, B et al., 2021	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	7
Tafere, Y et al., 2018	Yes	Yes	Yes	Yes	NA	Yes	No	No	No	Yes	No	6
Baumeister, S.E et al., 2022	Yes	Yes	Yes	Yes	NA	NA	No	Yes	No	Yes	No	6
Hakeem, F.F et al., 2019	Yes	Yes	Yes	Yes	NA	No	No	No	No	Yes	No	5
Schmidt, J.C et al., 2020	Yes	Yes	Yes	Yes	NA	No	No	No	No	Yes	No	5
Zhao, Q et al., 2019	Yes	Yes	Yes	Yes	NA	Yes	No	Yes	No	Yes	No	7
Abou, E.F.R et al., 2021	Yes	Yes	Yes	Yes	NA	Yes	No	No	No	Yes	No	6
Matsuyama, Y et al.,2019	Yes	Yes	Yes	Yes	NA	Yes	No	Yes	No	Yes	No	7
Boillot, A et al., 2018	Yes	Yes	Yes	Yes	NA	Yes	No	No	No	No	No	5
Duijster, D et al., 2018	Yes	Yes	Yes	Yes	NA	Yes	No	No	No	No	No	6
Bachkati, K.H et al., 2017	Yes	Yes	Yes	Yes	NA	Yes	No	Yes	No	Yes	Yes	8
Ishikawa, S et al., 2019	Yes	Yes	Yes	Yes	NA	No	No	No	No	Yes	No	5
Koyama, S et al., 2016	Yes	Yes	Yes	Yes	NA	Yes	No	Yes	No	No	No	6
Ando, A et al., 2013	Yes	Yes	Yes	Yes	NA	Yes	No	Yes	No	No	No	6
Kim, Y.H et al., 2018	Yes	Yes	Yes	Yes	NA	Yes	No	No	No	No	No	5
Yu, N.H et al., 2021	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	No	5
Li, S et al., 2022	Yes	Yes	Yes	Yes	NA	NA	No	No	No	Yes	No	5
Ferreira, R.C et al., 2020	Yes	Yes	Yes	Yes	NA	No	No	No	No	Yes	No	5

Chalub, L.L et al., 2016	Yes	Yes	Yes	Yes	NA	Yes	No	Yes	No	No	No	6
Vettore, M.V et al., 2020	Yes	Yes	Yes	Yes	NA	No	No	No	No	Yes	No	5
Margozzini, P et al., 2020	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	5
Ibiyemi, O et al., 2017	Yes	Yes	Yes	Yes	NA	No	No	No	No	No	No	4
Srisilapanan, P et al., 2016	Yes	Yes	Yes	Yes	NA	No	No	No	No	No	No	4

Table 2. Analysis of the included literature on the relationship between education level and "dental caries"

Author Year	Country	Research type	N of Cases	Age group	Correlation
Hybels, C.F et al., 2016	U.S.A	Repeated cross-sectional study	9113	Aged 50 and older	Negative
Geyer S et al., 2010	Germany	Cross-sectional study	925	Aged 35 to 44	Negative
Bernabe, E et al., 2011	Finland	Cross-sectional study	7112	Aged 30 and older	Negative
Lambert M et al., 2018	Belgium	Survey and cross-sectional study	2563	Mean age was 43.3	Negative
He, S et al., 2018	China	Cross-sectional study	1559	Aged 35 to 44 and 65 to 74	Negative
Guan, L et al., 2020	China	Observational study	446	Aged 35 to 44, 55 to 64 and 65 to 74	Negative
Hessari, H et al., 2007	Iran	Cross-sectional study	8301	Aged 35 to 44	Negative
Borgeat, M.M et al., 2021	Chile	Cross-sectional study	8724	Aged 18 and older	Negative
Guarnizo-Herreno, C.C et al., 2019	Colombia	Cross-sectional study	7877	Aged 20 to 79	Negative
Bogale, B et al., 2021	Ethiopia	Cross-sectional study	626	Mean age was 38.4	Negative
Tafere, Y et al., 2018	Ethiopia	Cross-sectional study	280	Mean age was 33.23	Negative

Table 3. Analysis of the included literature on the relationship between education level and "periodontal disease"

Author Year	Country	Research type	N of Cases	Age group	Correlation
Baumeister, S.E et al., 2022	Europe	Mendelian randomization study	1131881	—	Negative
Hakeem, F.F et al., 2019	Britain	Cross-sectional study	4738	Aged 30 and older	Negative
Schmidt, J.C et al., 2020	Switzerland	Cross-sectional study	1673	Aged 55 and older	Negative
He, S et al., 2018	China	Cross-sectional study	1559	Aged 35 to 44 and 65 to 74	Negative
Zhao, Q et al., 2019	China	Cross-sectional study	50991	Aged 20 and older	Negative
Hessari, H et al., 2007	Iran	Cross-sectional study	8301	Aged 35 to 44	Negative
Abou, E.F.R et	Egypt	Cross-sectional study	5954	Aged 20 and older	Negative

al., 2021					

Table 4. Analysis of the included literature on the relationship between education level and "tooth loss"

Author Year	Country	Research type	N of Cases	Age group	Correlation
Matsuyama, Y et al., 2019	Britain	Cross-sectional study	5667	Mean age was 67.8	Negative
Boillot, A et al., 2018	France	Cross-sectional study	34270	Aged 50 to 75	Negative
Duijster, D et al., 2018	Netherlands	Cross-sectional study	2812	Aged 25 to 75	Negative
Bachkati, K.H et al., 2017	Denmark	Logitudinal study	302	—	Negative
Lambert M et al., 2018	Belgium	Survey and cross-sectional study	2563	Mean age was 43.3	Negative
Ishikawa, S et al., 2019	Japan	Cross-sectional study	7542	Aged 40 and older	Negative
Koyama, S et al., 2016	Japan	Prospective cohort study	51280	Mean age was 72.5	Negative
Ando, A et al., 2013	Japan	Cross-sectional study	8352	Aged 40 to 79	Negative
Kim, Y.H et al., 2018	Korea	Cross-sectional study	7005	Aged 40 and older	Negative
Yu, N.H et al., 2021	Korea	Cross-sectional study	63791	Aged 19 and older	Negative
Li, S et al., 2022	China	Cross-sectional study	12856	Aged 50 and older	Negative
He, S et al., 2018	China	Cross-sectional study	1559	Aged 35 to 44 and 65 to 74	Negative
Ferreira, R.C et al., 2020	Brazil	Cross-sectional study	9633	Aged 35 to 39 and 40 to 45	Negative
Chalub, L.L et al., 2016	Brazil	Cross-sectional study	9564	Aged 35 to 44	Negative
Vettore, M.V et al., 2020	Brazil	Cross-sectional study	5435	Aged 65 to 74	Negative
Margozzini, P et al., 2020	Chile	Cross-sectional study	5473	Aged 15 and older	Negative
Guarnizo-Herreno, C.C et al., 2019	Colombia	Cross-sectional study	7877	Aged 20 to 79	Negative
Ibiyemi, O et al., 2017	Nigeria	Cross-sectional study	392	Mean age was 73.0	Negative
Srisilapanan, P et al., 2016	Thailand	Survey and cross-sectional study	30427	Aged 60 and older	Negative

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