


Metabolic Disorders And Periodontal Disease: A Scoping Review Of Recent Studies

Anggun Rafisa^{1*}, Felisha Febriane Balafif², Nuroh Najmi³, Faisal Kuswandani⁴

¹Physiology, Department of Oral Biology, Faculty of Dentistry, Universitas Padjadjaran, Indonesia. ²Microbiology, Department of Oral Biology, Faculty of Dentistry, Universitas Padjadjaran, Indonesia. ³Anatomy Pathology, Department of Oral Biology, Faculty of Dentistry, Universitas Padjadjaran, Indonesia. ⁴Pharmacy, Department of Oral Biology, Faculty of Dentistry, Universitas Padjadjaran, Indonesia

Article Info	ABSTRACT
Keywords: Obesity, diabetes, metabolic disorder, periodontitis, gingivitis	The bidirectional relationship between periodontal disease and metabolic disorders is of particular concern, as these conditions may exacerbate each other through shared inflammatory pathways and metabolic disturbances. This scoping review aims to comprehensively explore the current body of literature on the interconnection between metabolic disorders and periodontal disease. A comprehensive literature search was conducted across databases, such as PubMed and Scopus. This review included studies that focusing on the relationship between metabolic disorders and periodontal disease, as well as articles written in English and published between 2019 and 2024. Non-peer-reviewed articles, articles that were not available in full text, and animal studies were excluded. A total 186 studies met the inclusion and exclusion criteria and were included in the review. Only 2.2% of the studies employed an experimental design, while a substantial majority (77.4%) utilized observational methodologies The majority of the research (72.0%) focused on adults, with a relatively small proportion (16.1%) dedicated to children and adolescents. Research focusing on specific populations, such as women with obesity or gestational diabetes, was limited (7.5%). This review identified a significant gap in intervention studies specifically targeting metabolic disorders to improve periodontal outcomes. Furthermore, it underscores the need for more focused research on vulnerable populations such as children, adolescents, and pregnant women.
This is an open access article under the CC BY-NC license 	Corresponding Author: Anggun Rafisa Physiology, Department of Oral Biology, Faculty of Dentistry, Universitas Padjadjaran, Indonesia anggun.rafisa@unpad.ac.id

INTRODUCTION

Metabolic disorders encompass a diverse range of conditions characterized by impaired metabolic processes, including overweight/obesity, diabetes, metabolic syndrome, and related tissue or organ damage [1]. Overweight and obesity are defined using the body mass index (BMI), with overweight classified as a BMI greater than 25 kg/m² and obesity as a BMI over 30 kg/m². Obesity is a worldwide epidemic where 1 out of 8 people is affected with this condition in 2022 [2]. This condition affects various age groups, from children and

adolescents to adults. Projections indicate that the global prevalence of overweight and obesity will rise from 42% (2.2 billion people) in 2020 to nearly 54% (3.3 billion adults) by 2035 [3]. Moreover, the prevalence is expected to increase from 22% (430 million) to over 39% (770 million) by 2035 among young people aged 5 to 19 years, [3].

Obesity is characterized by excessive lipid accumulation, which is associated with numerous health risks. It can lead to insulin resistance, impaired glucose tolerance, and ultimately type 2 diabetes mellitus [4, 5]. Obesity can result in metabolic complications collectively referred to as metabolic syndrome, which includes abdominal obesity, hypertension, insulin resistance, and dyslipidemia [6, 7].

The close correlation between metabolic disorders and oral health is attributed to shared risk factors such as genetics, diet, socioeconomic status, and lifestyles [8]. Recent studies have demonstrated the relationship between metabolic disorders and periodontal diseases, including gingivitis [9], periodontitis [10, 11], and tooth loss [12, 13]. In obese individuals, the release of cytokines, adipokines, and C-reactive proteins from adipose tissue can cause bone resorption and damage to periodontal tissue. Periodontal disease is also a predictive marker for a high risk of metabolic syndrome and elevated HbA1c levels [14].

The bidirectional relationship between periodontal disease and metabolic disorders is of particular concern, as these conditions may exacerbate each other through shared inflammatory pathways and metabolic disturbances. This scoping review aims to explore the current body of literature on the interconnection between metabolic disorders and periodontal disease. By systematically mapping the evidence, we seek to identify the extent and nature of research activities in this field, highlight key findings, and identify gaps in knowledge that warrant further investigation.

METHOD

Identification of Relevant Studies

A comprehensive literature search was conducted across multiple electronic databases, including PubMed and Scopus. The search strategy combined keywords and Medical Subject Headings (MeSH) related to metabolic disorders (e.g., “overweight,” “obesity,” “diabetes mellitus,” “dyslipidemia”) and periodontal disease (e.g., “periodontitis,” “gingivitis,” “periodontal disease,” “tooth loss”). The search was limited to articles published January 2019 to June 2024.

Study selection

This review included studies that focusing on the relationship between metabolic disorders and periodontal disease, as well as articles written in English and published between 2019 and 2024. Non-peer-reviewed articles (editorials, commentaries, letters), articles that were not available in full text, and animal studies were excluded. The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) protocols was used in study selection.

Data extraction and analysis

The extracted data included author(s) and year of publication, study design, population characteristics, types of metabolic disorders studied, and themes. Data were tabulated and then subjected to a descriptive analysis.

RESULTS AND DISCUSSION

The study selection process is illustrated in Figure 1. Out of 2860 articles identified through PubMed and Scopus, 1120 articles were deemed eligible for further assessment. Ultimately, 186 studies met the inclusion and exclusion criteria and were included in the review. Table 1 provides an overview of the scope of research on metabolic disorders and periodontal disease. The highest number of publications was recorded in 2021, accounting for 30.1% of the total. Over the past five years, only 2.2% of the studies employed an experimental design, while a substantial majority (77.4%) utilized observational methodologies. All experimental studies reviewed reported a significant correlation between metabolic disorders and periodontal disease, reporting that interventions targeting metabolic conditions can enhance the success of periodontitis treatments and improve periodontal health outcomes [15-18].

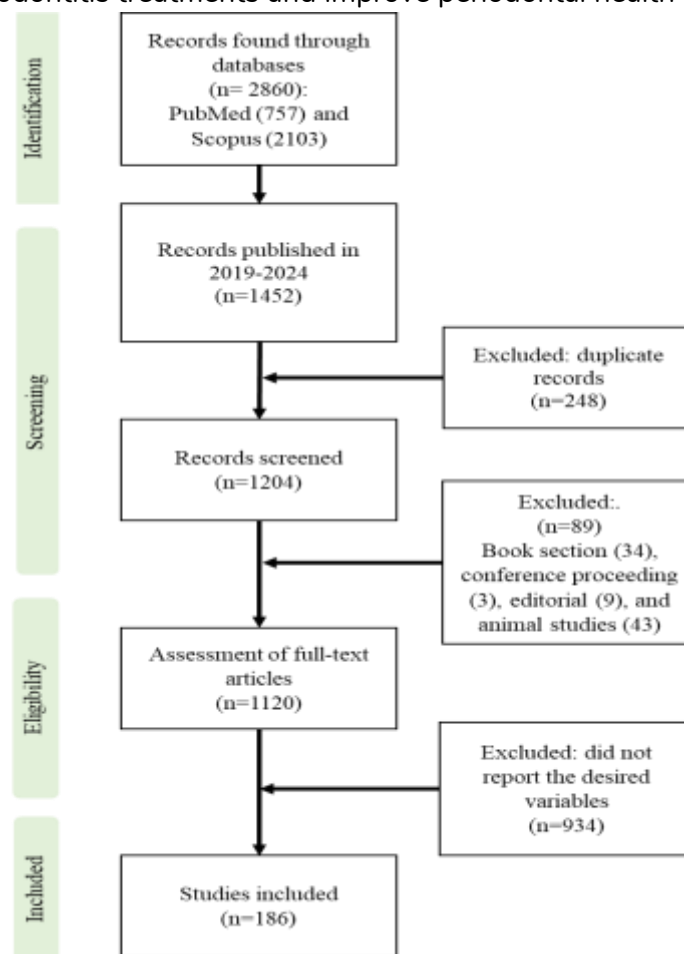


Figure 1. Study selection process using PRISMA protocols

Table 1. Overview of the included research scope

Characteristics	Frequency	Percentage (%)
Year of publication		
2019	28	15.1
2020	25	13.4
2021	56	30.1
2022	26	14.0
2023	37	19.9
2024	14	7.5
Study Design		
Observational	144	77.4
Experimental	4	2.2
Review	38	20.4
Population		
Adult	134	72.0
Children and adolescent	30	16.1
Non-specific/general	22	11.8
Types of metabolic disorders studied		
Overweight or obesity	143	76.9
Pre-diabetes or diabetes	23	12.4
Metabolic syndrome	16	8.6
Obesity, pre-diabetes, and diabetes	2	1.1
Obesity and metabolic syndrome	1	0.5
Obesity and dyslipidemia	1	0.5
Themes		
General relationship between metabolic disorder and periodontal disease	111	59.7
Biomarkers and biological mechanisms	22	11.8
Treatment outcomes and interventions	20	10.8
Pregnancy and maternal health	14	7.5
Prevalence	19	10.2
Total	186	100.0

Some studies, particularly review articles, did not focus on a specific population and were thus categorized under general/non-specific populations. The majority of the research (72.0%) focused on adults, with a relatively small proportion (16.1%) dedicated to children and adolescents. This discrepancy is concerning given the rising trends in overweight and obesity among young individuals, which predisposes them to chronic conditions such as periodontal diseases at an early age [3, 19]. Additionally, gingival inflammation in children often presents less severely than in adults due to different tissue responses to bacterial infections, potentially masking the true severity of periodontal disease in this population [19].

Most studies reviewed concentrated on overweight or obesity compared to other metabolic disorders. Obesity was frequently investigated due to its high prevalence and its significant impact on various health outcomes [7]. Findings consistently demonstrated that individuals with obesity had higher rates of periodontitis, supporting the hypothesis that excess adipose tissue contributes to systemic inflammation, which in turn exacerbates periodontal disease [14, 20]. A smaller subset of studies examined the association between less common metabolic disorders, such as metabolic syndrome and dyslipidemia, and periodontal disease. Future research should focus more on these metabolic disorders to better understand the broader relationship between metabolic disturbances and periodontal health.

The predominant theme in the reviewed research was the relationship between overweight/obesity and periodontal diseases (59.7%). Furthermore, 11.8% of the studies investigated biomarkers such as serum interleukin-6, salivary cytokines, oral microbiota, salivary matrix metalloprotein-8, C-reactive protein, salivary Thy-1, gingival crevicular fluid, and adipokine levels to deepen the understanding of the relationship between metabolic disorders and periodontal diseases. Research focusing on specific populations, such as women with obesity or gestational diabetes, was limited (7.5%). This is particularly noteworthy because both metabolic disorders and periodontal disease significantly affect fetal health. Gestational diabetes increases risks such as macrosomia, stillbirth, and the development of metabolic disorders later in life [21, 22]. Similarly, periodontitis is associated with adverse pregnancy outcomes, including preterm birth and low birth weight [23].

CONCLUSION

This review identified a significant gap in intervention studies specifically targeting metabolic disorders to improve periodontal outcomes. Furthermore, it underscores the need for more focused research on vulnerable populations such as children, adolescents, and pregnant women. Addressing these gaps is essential for developing comprehensive, integrated care strategies that effectively manage and improve both metabolic and periodontal health outcomes across diverse population groups.

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