Functional aspects of oral and general health in older adults: a scoping review of analytical observational studies

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Abstract

Objective: The aim of this scoping review was to map and characterize the available scientific evidence from studies investigating associations of oral function, oral frailty, or oral hypofunction with general health outcomes in older adults. *Method:* Five electronic databases (PubMed®, Scopus®, Web of Science®, SciELO®, and Google Scholar®) were systematically searched. Inclusion criteria encompassed analytical observational studies involving individuals aged 60 years or older, whether community-dwelling or institutionalized, that investigated functional aspects of oral health in relation to any general health outcome. Articles in English, Portuguese, or Spanish were considered. Two trained reviewers independently screened the records, selected the eligible studies, and extracted data on indexing, study design, population and sample, data collection and analysis, and main findings. *Results:* A total of 37 studies published between 2004 and 2024 were included, most of which employed a cross-sectional design. A wide range of methodological approaches was observed, both in the definition of general health outcomes and in the measurement of oral function. On average, studies used seven indicators to assess oral hypofunction, six for oral frailty, and five for oral function. The most frequently investigated general health outcomes were physical frailty, nutritional status, sarcopenia, risk of falls, depression, and mortality. Most studies reported an association between oral functional decline and poorer general health status. *Conclusion:* Oral functionality is a relevant component of general health. The methodological heterogeneity across studies highlights the need for standardized assessment of oral function to strengthen the evidence base and support strategies for promoting healthy aging.

Keywords: Oral Hypofunction. Oral Frailty. Oral Function. Older Adults. Scoping Review. Oral Health.

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INTRODUCTION

Oral health is an integral and essential component of general health and well-being. It encompasses not only the absence of disease but also the maintenance of basic functions such as chewing, swallowing, speech, and facial expression[1]. The FDI World Dental Federation further defines oral health as the ability to use the mouth fully for these functions throughout life, thereby affecting quality of life and the maintenance of general health[2].

Declining oral health in older adults is a continuous and potentially reversible process that may culminate in systemic dysfunction. The process is conceptually structured into progressive stages, notably oral frailty and oral hypofunction. Oral frailty is characterized by mild symptoms confined to the oral cavity, such as reduced tongue motor function, impaired articulation/speech, mild choking or food spillage during meals, and increasing difficulty chewing certain foods. As this trajectory of decline progresses, oral hypofunction may develop. Oral hypofunction is defined as a diagnostic condition that directly indicates the need for dental intervention. A formal diagnosis of oral hypofunction is confirmed when an individual presents results below reference values for at least three of seven quantifiable clinical criteria: poor oral hygiene, oral dryness, reduced occlusal force, impaired lip and tongue motor function, reduced tongue pressure, declining masticatory function, and impaired swallowing function. These two concepts are related: whereas oral frailty signals the early onset of symptoms of functional decline, oral hypofunction defines a measurable stage that enables oral health professionals to institute structured treatment aimed at restoring clinical status to an earlier stage and preventing progression to irreversible dysfunction or dependence on long-term care[3-7].

These concepts have informed subsequent models for assessing oral function in older adults by adopting a functional perspective rather than focusing on the presence or absence of disease. A number of studies have shown that both oral frailty and oral hypofunction are associated with adverse general health outcomes, including sarcopenia, nutritional decline, risk of falls, changes in body weight, depression, and mortality[5-10]. These findings highlight that oral function should not be analyzed in isolation from systemic health, as its deterioration may serve as an early marker of overall frailty, loss of autonomy, and worsening health status among older adults. Moreover, because oral frailty and oral hypofunction correspond to different stages of oral functional impairment, they may show different patterns of association with general health outcomes. In this regard, a recent systematic review investigated the association between oral hypofunction and general health, including physical, psychological, and social dimensions. However, by restricting its analysis to studies that explicitly used the term oral hypofunction, the review may not have captured evidence related to earlier stages of oral functional decline, such as oral frailty, or studies that addressed oral health from a broader oral-functionality perspective[4].

Thus, bringing these concepts together in a single review assumes that they represent distinct expressions of oral functional impairment. This perspective makes it possible to better capture the heterogeneity of definitions, assessment methods, and outcomes used in primary studies, offering a broader and more analytically consistent overview of the field. In addition, a scoping review is useful when conceptual and methodological diversity exists across studies, as it allows synthesis of existing knowledge, identification of gaps in the literature, guidance for future research, and support for the development of comprehensive care strategies[11].

Therefore, the aim of the present study was to map and characterize studies investigating the association of oral function, oral frailty, or oral hypofunction with general health outcomes in older adults, describing their conceptual and methodological characteristics and the outcomes assessed.

METHOD

A scoping review was conducted in accordance with the methodology proposed by the Joanna Briggs Institute (JBI). The review protocol was published in the Figshare repository under DOI: 10.6084/m9.figshare.30660893. This study was reported in accordance with PRISMA-ScR recommendations[12, 13].

The review was conducted to answer the following question: What are the characteristics of observational studies that investigated associations of oral function, oral frailty, or oral hypofunction with general health outcomes in older adults? Eligibility criteria were defined using the PCC mnemonic (Population, Concept, and Context). The population comprised older adults aged 60 years or older, of both sexes, irrespective of oral or general health status. The concept included functional aspects of oral health—oral function, oral frailty, and oral hypofunction—as well as general health conditions and mortality. The context was limited to community settings or long-term care facilities for older adults. Studies conducted in hospital settings or during the COVID-19 pandemic were excluded. This decision was based on the fact that the pandemic may have substantially affected care routines, access to health services, and the physical and mental health status of the participants. These changes could potentially introduce substantial contextual bias and compromise comparability with studies conducted in other contexts.

In addition, cross-sectional, case-control, and cohort observational studies were included when they analyzed oral health and/or general health variables as exposures or outcomes, regardless of the direction of the association investigated. Eligible publications were peer-reviewed original articles indexed in Portuguese, English, or Spanish and published from January 1, 2004 onward, covering the 20 years preceding the search update. Monographs, dissertations, theses, literature reviews, critiques, letters, opinion articles, book chapters, and conference abstracts were excluded.

Searches were conducted to identify primary sources of evidence in the PubMed/MEDLINE®, Web of Science®, Scopus (Elsevier)®, and SciELO® bibliographic databases, in addition to a supplementary search in Google Scholar®. The initial bibliographic search was conducted on February 4, 2022, and updated on October 6, 2024. In Google Scholar®, publications were identified by reviewing the first 10 pages of results, sorted by relevance and publication year from most recent to oldest[14]. The search strategy combined keywords and indexing terms related to the population and the assessment of oral health. Terms relating to potential outcomes were deliberately not included in order to avoid restricting results to specific outcomes. The strategy was adapted to each database and information source. Reference lists of the studies included were also examined to identify additional publications.

The search strategies for each database were as follows:

- **Pubmed/Medline®:** (("elderly" OR "elder" OR "aged" OR "older" OR "ageing" OR "aging" OR "older adult") AND ("oral hypofunction" OR "oral function" OR "oral frailty")) AND ((english OR portuguese OR spanish) AND (2004:2024))

- **Scopus®:** (TITLE-ABS-KEY("elderly") OR TITLE-ABS-KEY("elder") OR TITLE-ABS-KEY("older") OR TITLE-ABS-KEY("aging") OR TITLE-ABS-KEY("ageing") OR TITLE-ABS-KEY("older adult") AND TITLE-ABS-KEY("oral hypofunction") OR TITLE-ABS-KEY("oral function") OR TITLE-ABS-KEY("oral frailty")) AND (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE,"Spanish") OR LIMIT-TO (LANGUAGE, "Portuguese") AND (2004:2024))

- **Web of Science®:** (("oral hypofunction" OR "oral function" OR "oral Frailty") AND ("elder*" OR "older adult" OR "aged" OR "older" OR "aging" OR "ageing")) (All Fields) and 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 or 2013 or 2012 or 2011 or 2010 or 2009 or 2008 or 2007 or 2006 or 2005 or 2004 (Publication Years) and English OR Spanish OR Portuguese (Languages) (("oral hypofunction" OR "oral function" OR "oral Frailty") AND ("elder*" OR "older adult" OR "aged" OR "older" OR "aging" OR "ageing")) (All Fields) and 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 or 2013 or 2012 or 2011 or 2010 or 2009 or 2008 or 2007 or 2006 or 2005 or 2004 (Publication Years) and English OR Spanish OR Portuguese (Languages)

- **Scielo ®:** (("elderly" OR "elder" OR "aged" OR "older" OR "aging" OR "ageing" OR "older adult") AND ("oral hypofunction" OR "oral function" OR "oral frailty")) AND ((english OR portuguese OR spanish) AND (2004:2024))

- **Google Scholar®:** (("elderly" OR "elder" OR "aged" OR "older" OR "aging" OR "ageing" OR "older adult") AND ("oral hypofunction" OR "oral function" OR "oral frailty")) AND ((english OR portuguese OR spanish) AND (2004:2024))

After the search, all publications identified were imported into EndNote X7®/2013 bibliographic-management software (Clarivate Analytics, PA, USA), and duplicates were removed. Screening and selection were conducted independently by two reviewers who had been previously trained on applying the eligibility criteria. Disagreements were resolved by consensus and, when necessary, with the involvement of a third reviewer. Reviewer training consisted of a conceptual discussion of the criteria established in the protocol and joint assessment of 10 publications until reviewers reached a shared understanding.

Initially, the studies identified underwent screening based on titles and abstracts using the eligibility criteria. Potentially relevant publications were retrieved in full and assessed against the predefined inclusion criteria, and reasons for excluding publications were recorded. Search and study-selection results were presented in a flow diagram.

Data extraction was performed using a standardized form. The form was tested concurrently with reviewer training through joint reading, extraction, and discussion of 10 articles, until agreement was reached on the information to be collected, with the participation of a third researcher experienced in reviews and epidemiological studies. During this process, the form was successively revised until it included all information required for extraction. The form was divided into the following sections: publication indexing information (title, descriptors, and language); study details (objectives, hypothesis, when explicitly stated, setting, study type and design, and data-collection period); population and sample [reference population (community-dwelling or residing in long-term care facilities), sampling design, when applicable, and sample inclusion and exclusion criteria]; data collection [instrument/methodology for assessment of oral functionality (oral function, oral frailty, or oral hypofunction) and general health outcome; information on instrument validity and reproducibility, when applicable; examiner training and calibration; and variables analyzed]; data analysis (analytical approach used); and main results. Descriptors and, where present, study hypotheses were extracted because they helped characterize the publications and aided understanding of the scope of the research object and analytical approach. During extraction, conceptual uncertainties were discussed by the researchers, with participation of a third researcher, until consensus was reached.

The data extracted were recorded in spreadsheets and subsequently synthesized in tables, grouping studies according to the oral-functionality concepts adopted. Studies were characterized according to their methodological features, including methods used to assess oral functionality and general health outcomes. For each oral-functionality concept, the oral health indicators used in its assessment were presented.

DATA AVAILABILITY

The complete anonymized dataset supporting the findings of this study has been deposited in Figshare and is available at https://doi.org/10.6084/m9.figshare.32686089.

USE OF ARTIFICIAL INTELLIGENCE

The authors declare that they did not use artificial intelligence tools at any stage of the development, writing, revision, or formatting of this article. All content presented is the result of the authors' exclusive intellectual authorship and production, and the authors assume full responsibility for the scientific integrity of the work.

RESULTS

The bibliographic search retrieved 2,157 studies from the databases consulted. Of this initial total, 1,010 were duplicates and therefore removed, and

a further 1,024 excluded after title and abstract screening for being off-topic, leaving 123 studies for full-text assessment. After application of the eligibility criteria, 86 studies were excluded, resulting in 37 studies selected for data extraction (Figure 1).

Table 1 summarizes the methodological characteristics of the included studies, organized according to the functional aspect of oral health assessed. Most studies (n=16) adopted the concept of oral frailty and 10 used the concept of oral hypofunction, whereas one study considered both concepts. Oral-function aspects, without adopting either specific concept, were assessed in 10 studies. Most studies were conducted among older adults aged >65 years, used a cross-sectional design, and took place in Japan (Table 1).

With regard to sampling, convenience recruitment predominated (n=33). Probability sampling designs were less frequent and included stratified cluster sampling (n=1), two-stage sampling (n=1), and simple random sampling (n=1). In one study, the recruitment method was not described. Four studies were conducted among older adults living in long-term care facilities, all recruited by convenience sampling.

Regarding general health outcomes, physical frailty was the most frequently addressed outcome (n=14), followed by nutritional status (n=9), which was assessed by a variety of different methods, including weight loss or gain, weight gain, body mass index (BMI), and dietary intake. Mapping general health outcomes according to the functional aspect of oral health showed that studies of oral hypofunction focused primarily on sarcopenia (n=5), followed by nutritional outcomes—nutritional status, weight change, appetite-related behaviors, and dietary intake (n=2)—and physical frailty (n=1). In studies assessing oral function, the most frequent outcomes were physical frailty (n=7) and nutritional status—nutritional status, risk of malnutrition, BMI, and serum albumin (n=4)—in addition to mortality, depression, diet-related quality of life, cognitive function, and loss of independence. Studies of oral frailty explored a broader range of outcomes, particularly physical frailty, nutritional status—nutritional status, weight loss, poor appetite, dietary variety, and serum albumin—falls, cognitive function, social isolation, mortality, depression, and sleep quality. Thus, physical frailty and nutritional status were the most recurrent outcomes, regardless of the functional aspect of oral health assessed (Table 1).

The oral health indicators used to assess oral function, oral frailty, and oral hypofunction are presented in Table 2. In the assessment of oral hypofunction, an average of seven indicators was used to identify this condition, with the most frequent being oral dryness (n=12), oral hygiene (n=10), occlusal force (n=11), masticatory function (n=11), and swallowing function (n=11). Approximately five oral health indicators were used to characterize oral function; the most frequent were lip and tongue motor function (n=6), swallowing (n=6), and oral dryness (n=5). Approximately seven indicators were used to assess oral frailty; the most frequent were masticatory function (n=16), swallowing function (n=13), occlusal force (n=11), lip and tongue motor function (n=10), number of teeth (n=10), subjective oral health aspects (n=9), oral dryness (n=9), tongue pressure (n=8), and poor oral hygiene (n=8). Subjective aspects, such as orofacial pain and oral-health-related quality of life, were specific to oral-function studies. Toothache was assessed in two studies.

With respect to the methods and instruments used to assess oral health indicators, questionnaires and clinical examinations were identified. Of these instruments, the Oral Frailty Index questionnaire (OFI-8) was used to measure most oral health indicators. Poor oral hygiene was assessed using three questionnaires and four different clinical examination indices. Dysphagia, social isolation resulting from oral health problems, denture use, dental visits at least once a year, and articulatory motor function were measured by questionnaire (Chart 1).

With regard to general health outcomes, three questionnaires and nine instruments for the assessment of physical frailty were found. The indicators sleep quality, diet-related quality of life, and depression were assessed by questionnaire

only. Sarcopenia, cognitive function, and executive function were measured by clinical examination. A wide variety of instruments was observed for measuring general health outcomes (Chart 2).

Most studies (n=35) reported a statistically significant association between the oral-functionality aspect assessed and at least one general health outcome.

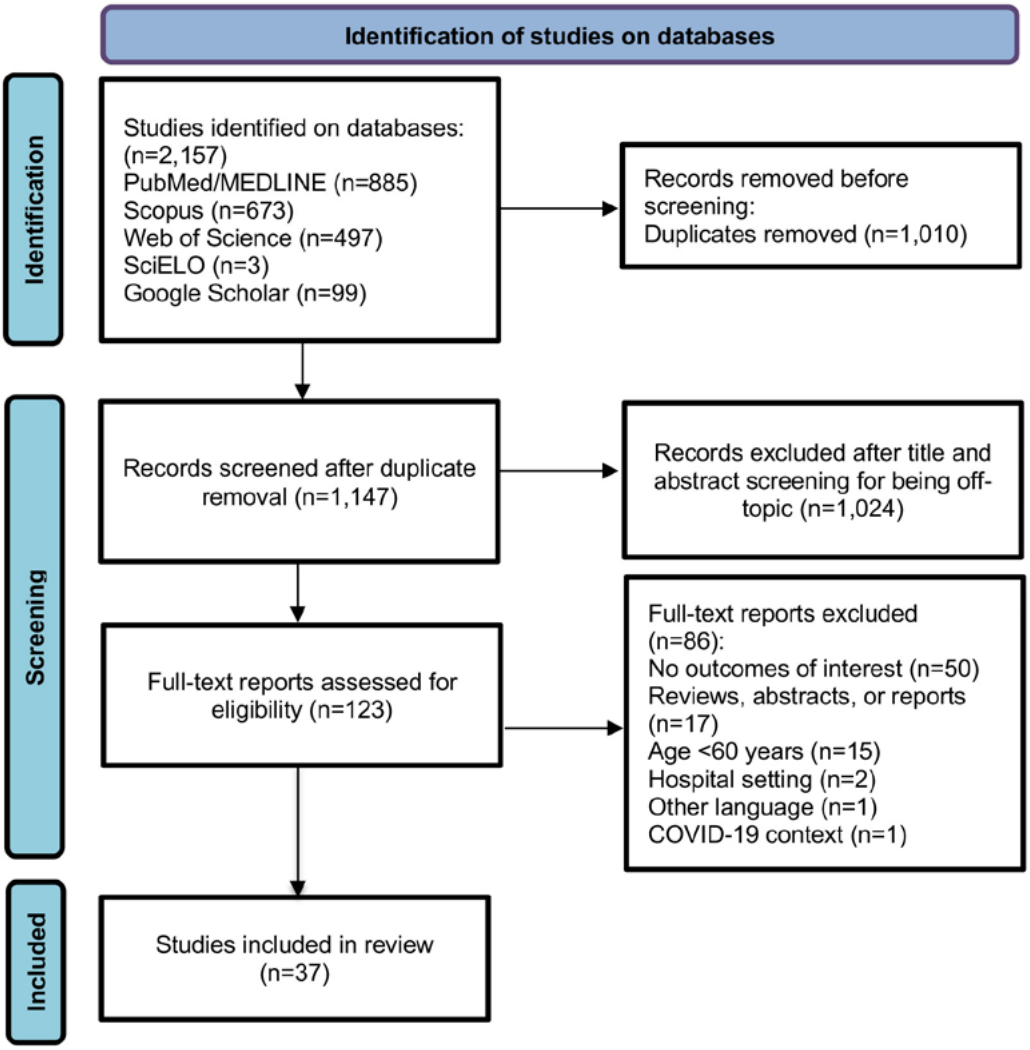


Figure 1. PRISMA flow diagram of bibliographic-search, screening, and study-selection results. Belo Horizonte, Minas Gerais state, Brazil, 2026.

Table 1. Methodological characteristics of studies investigating the association between oral function, oral hypofunction, or oral frailty and the general health outcomes assessed. Belo Horizonte, Minas Gerais state, Brazil, 2026.

Citation	Sample size – Age range (full years) – Population	Study site	Study design – year or period of study	General health outcomes
Oral hypofunction				
Kawamura, 2024[15]	111 - ≥ 65 - Community	Obu, Japan	Cross-sectional – 07/ 2021 to 01/2022	Sarcopenia and dynapenia
Cruz-Moreira, 2023[16]	589 - ≥ 65 - LTCF*	Guayaquil, Ecuador	Cross-sectional – 01/2018 to 12/2019	Physical frailty
Kugimiya, 2021[17]	878 - ≥ 65 - Community	Itabashi, Tokyo	Cross-sectional – 2018	Sarcopenia
Shiota, 2023[8]	63,602 - ≥ 65 - Community	28 cities in Japan	Prospective cohort - 2016 to 2019	Weight change (changes in appetite-related behaviors and dietary intake)
Kugimiya, 2023[5]	1,517 - ≥ 65 - Community	Itabashi, Tokyo	Cross-sectional - 2018	Sarcopenia
Shirahase, 2022[18]	269 - ≥ 65 - Community	Large city in northern Japan	Cross-sectional - 06/2019 to 03/2021	Sarcopenia
Yoshida, 2022[19]	340 - Mean 75 - Community	Kyoto community	Cross-sectional - 07/2019	Physical frailty and sarcopenia
Iwasaki, 2022[20]	715 - ≥ 65 - Community	Itabashi, Tokyo	Cross-sectional – 2018	Nutritional status (changes in appetite-related behaviors and dietary intake)
Shimazaki, 2020[21]	978 - ≥ 65-85 - Community	Higashiura, Aichi Prefecture, Japan	Cross-sectional – 06/2018	Physical frailty
Hihara, 2020[22]	272 -≥ 65 - Community	Not reported	Cross-sectional - 11/2016 to 04/2018	Physical frailty
Oral function				
Matsushita, 2024[23]	290 - ≥ 65 - Community	Eastern Hokkaido	Cross-sectional – 06/2019 to 04/2022	Sarcopenia
Nagata, 2023[6]	106 - ≥ 65 - Community	City in Japan	Cross-sectional – 10/2019 to 12/2020	Nutritional status (nutritional risk: dietary satisfaction assessment), depression, diet-related quality of life.
Tani, 2022[24]	381 - ≥ 65 - Community	Itoshima, Fukuoka Prefecture	Cross-sectional – 09/2020 to 12/2020	Physical frailty.
Sawada, 2022[25]	203 - ≥ 60 - Community	Okayama, Japan	Cross-sectional – 11/2017 to 01/2019	Physical frailty and nutritional status (risk of malnutrition: low dietary intake, weight loss in previous 3 months, change in BMI**)
Van de Rijt, 2021[26]	111 - ≥ 65 - LTCF*	London, United Kingdom	Cross-sectional - Not reported	Nutritional status (risk of malnutrition: reduced dietary intake, weight loss in past 3 months, change in BMI**)
Saito, 2021[27]	4,984 - 75-80 - Community	Mie, Japan	Longitudinal (cohort) - 2014 to 2018	Mortality
Miyoshi, 2020[28]	163 - ≥ 65 - Community	Takehara, Hiroshima	Cross-sectional – 08/2018 to 12/2018	Physical frailty
Watanabe, 2017[29]	4,720 - ≥ 65 - Community	Obu, Nagoya	Cross-sectional – 2011 to 2012	Physical frailty
Sumi, 2009[30]	79 - 65-95 - LTCF*	Japan	Cross-sectional – Not reported	Cognitive function and nutritional status (change in BMI** and low serum albumin level)
Nagamine, 2021[31]	1,272 - ≥ 65 - Community	Fukushima, Japan	Cohort – 2010 to 03/2014	Mortality and loss of independence

continue

Continuation of Table 1

Citation	Sample size – Age range (full years) – Population	Study site	Study design – year or period of study	General health outcomes
Oral frailty				
Hu, 2024[32]	380 - ≥ 60 - Community	China	Cross-sectional – 09/2023 to 11/2023	Physical frailty, nutritional status (recent weight loss) and sleep quality index
Song, 2024[33]	409 - ≥ 60 - Community	Yangzhou, China	Cross-sectional – 10/2022 to 03/2023	Fall risk
Fei, 2024[34]	307 - ≥ 60 - Community	Nanjing, China	Cross-sectional – 06/2023 to 08/2023	Global cognitive function and executive function.
Watanabe, 2024[10]	11,374 - ≥ 65 - Community	Kameoka, Kyoto, Japan	Cohort – 07/2011 to 11/2016	Mortality
Nakagawa, 2024[35]	2,727 - ≥ 75 - Community	Tottori, Japan	Cross-sectional – 04/2016 to 03/2020	Dietary variety (poor appetite and non-diverse diet)
Iwasaki, 2024[36]	1,206 - ≥ 65 - Community	Itabashi, Japan	Cross-sectional – 2022	Physical frailty
Kamide, 2024[7]	237 - ≥ 65 - Community	Sagamihara, Japan	Cross-sectional – 09/2021 to 03/2022	Fall risk
Nagatani, 2023[37]	1,410 - ≥ 65 - Community	Kashiwa, Chiba, Japan	Cohort - 2012, follow-ups in 2013, 2014, 2016, 2018 and 2021	Cognitive function
Lin, 2022[9]	1,100 - ≥ 65 - Community	Taiwan, China	Cross-sectional – 05/2018 to 01/2019	Depression
Kuo, 2022[38]	308 - ≥ 75-84 - Community	Chiayi, Taiwan	Cross-sectional – 09/2019 to 06/2020	Physical frailty
Hiltunen, 2021[39]	349 - ≥ 65 - LTCF*	Helsinki, Finland	Cross-sectional – 09/2017 to 01/2019	Physical frailty
Komatsu, 2021[40]	380 - ≥ 65 - Community	Tamba-Sasayama, Hyogo Prefecture, Japan	Cross-sectional – Not reported	Physical frailty
Iwasaki, 2020[41]	1,054 - ≥ 70 - Community	Itabashi, Tokyo	Cohort - 10/2016 to 12/2016	Nutritional status (poor appetite and serum albumin level)
Hoshino, 2021[42]	769 - ≥ 65 - Community	Kusatsu City, Gunma	Cross-sectional – 07/2018	Dietary variety (weekly frequency of food consumption and diet quality)
Hironaka, 2020[43]	682 - ≥ 65 - Community	Tokyo, Japan	Cross-sectional - 2011 to 2018	Physical frailty and social isolation
Oral hypofunction and oral frailty				
Hasegawa, 2020[44]***	427 - ≥ 65 - Community	Tamba-Sasayama, Hyogo Prefecture, Japan	Cohort - 04/2016 and 04/2017 and two years later in 2019	Social isolation

* LTCF: long-term care facility; **BMI: body mass index; ***Study assessed both oral hypofunction and oral frailty

Table 2. Oral health indicators used to assess oral hypofunction, oral function, or oral frailty in studies included in the scoping review. Belo Horizonte, Minas Gerais state, Brazil, 2026.

Indicators	Poor oral hygiene	Oral dryness	Occlusal force	Lip and tongue motor function	Tongue pressure	Masticatory function	Swallowing function	Articulatory motor function	Oral health-related QoL*	Number of teeth	Toothache	Dysphagia	Orofacial pain	Subjective aspects**	Denture use	Dental caries	Dental visits***	Total oral health indicators assessed
Oral hypofunction																		
Kawamura, 2024[15]	■	■	■	■	■	■	■											7
Cruz-Moreira, 2023[16]	■	■	■	■	■	■	■											7
Shiota, 2023[8]		■				■	■			■								4
Kugimiya, 2021[17]	■	■	■	■	■	■	■											7
Shirahase, 2022[18]	■	■	■	■	■	■	■											7
Yoshida, 2022[19]	■	■	■	■	■	■	■											7
Kugimiya, 2023[5]	■	■	■	■	■	■	■											7
Iwasaki, 2022[20]	■	■	■	■	■	■	■											7
Shimazaki, 2020[21]	■	■	■	■	■	■	■											7
Hihara, 2020[22]									■						■			2
Total studies	09	10	09	09	09	10	**10**		01	**01**	00		00	**00**	01	00		—
Oral function																		
Matsushita, 2024[23]	■	■		■	■	■	■			■					■			8
Tani, 2022[24]	■	■		■	■	■	■							■				7
Nagata, 2023[6]	■	■		■	■	■	■							■				7
Sawada, 2022[25]	■	■	■			■	■							■		■		7
Van de Rijt, 2021[26]	■	■	■	■		■	■		■	■				■		■		10
Saito, 2021[27]		■	■	■	■	■	■		■	■	■			■				10
Miyoshi, 2020[28]		■	■	■			■				■		■		■			7
Watanabe, 2017[29]	■	■							■					■		■		5
Sumi, 2009[30]				■		■	■							■				4
Nagamine, 2021[31]				■			■							■				3
Total studies	06	08	04	08	04	07	**09**		03	03	**02**		01	08	02	**03**		—

continue

Continuation of Table 2

Indicators	Poor oral hygiene	Oral dryness	Occlusal force	Lip and tongue motor function	Tongue pressure	Masticatory function	Swallowing function	Articulatory motor function	Oral health-related QoL*	Number of teeth	Toothache	Dysphagia	Orofacial pain	Subjective aspects**	Denture use	Dental caries	Dental visits***	Total oral health indicators assessed
Oral frailty																		
Hu, 2024[32]	■	■	■			■	■				■			■	■		■	9
Song, 2024[33]	■	■	■			■	■				■			■	■		■	9
Fei, 2024[34]	■	■	■	■		■	■			■				■				8
Watanabe, 2024[10]	■	■	■			■	■							■	■		■	8
Nakagawa, 2024[35]				■		■	■	■		■								4
Iwasaki, 2024[36]		■				■	■	■		■								5
Kamide, 2024[7]			■		■	■	■			■								6
Nagatani, 2023[37]			■	■	■	■	■			■								6
Lin, 2022[9]	■	■	■	■		■						■						6
Kuo, 2022[38]	■	■	■			■	■							■	■		■	8
Hiltunen, 2021[39]	■	■	■				■			■				■	■			7
Komatsu, 2021[40]			■	■	■	■	■			■								6
Iwasaki, 2020[41]				■	■	■	■											4
Hoshino, 2021[42]				■	■	■	■			■				■				6
Hironaka, 2020[43]				■	■	■		■		■				■				6
Total studies	07	08	10	08	06	14	13	03	00	09	02	01	00	08	05	00	04	—

*****QoL: quality of life; **Subjective aspects included questions assessing social isolation as a consequence of oral health problems; ***Dental visits at least once per year.

Chart 1. Methods and instruments used to assess oral health indicators in studies included. Belo Horizonte, Minas Gerais state, Brazil, 2026.

Indicators/ assessment methods	Instruments used
Poor oral hygiene	Questionnaire: Oral Frailty Index-8 (OFI-8)[7,10,32,34,] Oral Hygiene Index (OHI)[5,16,18-21,23,26,40] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38]
	Clinical examination: Oral Health Assessment Tool (OHAT)[32,43] Tongue-coating index by visual inspection[5,15,17] Plaque Index of Silness–Löe[9,25,44] Presence of food debris[27,39]
Oral dryness	Questionnaire: Oral Frailty Index-8 (OFI-8)[7,10,32,34,43] 5-Item Oral Frailty Checklist (OF-5)[36] **Kihon Checklist[8,31] Xerostomia Inventory[9,26] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38]
	Clinical examination: Oral Health Assessment Tool (OHAT)[42] Oral moisture checker (Mucus; Life Co. Ltd., Saitama, Japan)[5,15,17,22,25,44] Sialometry[5,16,18-21,23,26,40] Mirror test to assess adherence to the mucosa or tongue[39] Moisture test (L-SALIVO®)[27]
Occlusal force	Questionnaire: Oral Frailty Index-8 (OFI-8)[7,10,32,34,42] ***Assessment of 6 oral functions according to Tanaka et al. (2018)[35,37,41-43] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38]
	Clinical examination: Eichner Index[9] Number of remaining teeth[16] Occlusal force assessed using Dental Prescale 50H Type-R, Fuji Film Co., Tokyo, Japan[5,17,29] Functional tooth count[21] Occlusal force meter (GM-10; Nagano Keiki Co., Ltd.)[22]
Lip and tongue motor function	Clinical examination: Oral diadochokinesis test - Oral function measurement device (Kenkoukun Handy; Takei Scientific Instruments, Niigata, Japan)[5,6,9,15,17,23,24,28,29,34,44] ***Assessment of six oral functions according to Tanaka et al. (2018)[35,37,41-43]
Tongue pressure	Clinical examination: Tongue pressure measurement device (JMS tongue pressure device TPM-02; JMS Co., Ltd., Hiroshima, Japan)[5,6,17,24,27,28,44] *** Assessment of six oral functions according to Tanaka et al. (2018)[35,37,41-43]

continue

Continuation of Chart 1

Indicators/ assessment methods	Instruments used
Masticatory function	Questionnaire: Oral Frailty Index-8 (OFI-8)[7,10,32,34,] 5-Item Oral Frailty Checklist (OF-5)[36] **Kihon Checklist[8,31,41,42] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38]
	Clinical examination: Chewing-gum test[5,9,10,15--21,23,24,26,39,40,44] ***Assessment of six oral functions according to Tanaka et al. (2018)[35,37,41,42,43]
Swallowing function	Questionnaire: Oral Frailty Index-8 (OFI-8)[7,10,32,34,] 10-item Eating Assessment Tool[5,15-21,23,25, 26,40] 5-Item Oral Frailty Checklist (OF-5)[36] **Kihon Checklist[8,31,41,42] ***Assessment of six oral functions according to Tanaka et al. (2018)[35,37,41-43] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38] Self-reported soft diet[39]
	Clinical examination: Repetitive Saliva Swallowing Test (TSRS)[6,27] Tohata et al. water-swallowing test[30]
Articulatory motor function	Questionnaire: 5-Item Oral Frailty Checklist (OF-5)[36] Self-reported unclear speech[39]
Number of teeth	Questionnaire: ***Assessment of six oral functions according to Tanaka et al. (2018)[35,37,41-43] Self-reported number of teeth present[8]
	Clinical examination: Tooth count[5,15,16,18-20,23,34,39,40] Decayed, Missing, and Filled Teeth Index (DMFT)[27]
Toothache	Questionnaire: Oral Health Assessment Tool (OHAT)[41,44]
	Clinical examination: Pain elicited during palpation and probing[39]
Dysphagia	Questionnaire: 15-item dysphagia screening questionnaire developed by Ohkuma[9] Dysphagia Risk Assessment for the Community-dwelling Elderly (DRACE)[28]
Subjective oral-health-related aspects	Questionnaire (social isolation due to oral health problems): Oral Frailty Index-8 (OFI-8)[7,10, 32,34] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38]

continue

Continuation of Chart 1

Indicators/ assessment methods	Instruments used
Denture use	Questionnaire: Oral Frailty Index-8 (OFI-8)[7,10,24,32,34,43] Denture use/need for repair[18,39] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38]
Dental visits at least once per year	Questionnaire: Oral Frailty Index-8 (OFI-8)[7,10,24,32,34,43] *Oral frailty assessment checklist proposed by the Japanese Dental Association[38]

*The Oral Frailty Index-8 includes the questions: "Do you find it more difficult to eat hard foods now than six months ago?"; "Do you sometimes choke when drinking tea or soup?"; "Do you use dentures?"; "Are you concerned about oral dryness?"; "Do you go out less frequently now than six months ago?"; "Are you able to chew hard foods, such as pickled radish or shredded dried squid?"; "Do you brush your teeth at least twice a day?"; and "Do you visit the dentist at least once a year?". **The Kihon Checklist addresses: "Do you have any difficulty eating hard foods compared with six months ago?"; "Have you recently choked on tea or soup?"; and "Do you often feel that your mouth is dry?". ***Assessment of oral functions through: difficulty eating hard foods compared with six months earlier; choking when consuming tea or soup; number of current teeth (<20 teeth; retained roots were not counted as current teeth); oral diadochokinesis /pa/ (men <5.2 repetitions/s; women <5.6 repetitions/s); oral diadochokinesis /ka/ (men <4.4 repetitions/s; women <5.0 repetitions/s); tongue pressure; and masticatory ability assessed using color-changing chewing gum (green to red during chewing).

Chart 2. Methods and instruments used to assess general health outcomes in studies included. Belo Horizonte, Minas Gerais state, Brazil, 2026.

Indicators/assessment methods	Instruments used
Physical frailty	Questionnaire:
	Fried frailty phenotype[16,24,39]
	*Kihon Checklist (KCL)[19,21,31,44]
	Geriatric Depression Scale (GDS-15)[6,9]
	Clinical examination:
	International Academy on Nutrition and Aging frailty scale[43]
	Japanese version of the Cardiovascular Health Study criteria[19,25,36,40]
	Fried frailty phenotype[16,24,38]
	Study of Osteoporotic Fractures Index (Study of Osteoporotic fracture)[9,38]
	*Kihon Checklist (KCL)[19,21,31,44]
	Handgrip strength measured using a Smedley-type hand dynamometer[22,23,28,29,42,43]
	Gait speed assessed by the 5-m walk test[23,29,42]
	Gait speed assessed by the 3-m walk test[22]
	Body Mass Index[23,28,30,42,44]
Nutritional status	Questionnaire:
	Simplified Nutritional Appetite Questionnaire (SNAQ)[35]
	Dietary Variety Score (DVS)[35,36,41]
	Short Diet-Related Quality of Life Scale (DRQOL-SF, 8 items)[6]
	MNA®-SF (Mini Nutritional Assessment–Short Form)[6,20,24,26,41,43]
	Clinical examination:
	Self-reported weight loss of more than 5% over the previous 2 years[29]
	Serum albumin level[30,41]

continue

Continuation of Chart 2

Indicators/assessment methods	Instruments used
Sarcopenia	Clinical examination:
	Calf circumference, appendicular skeletal muscle mass, handgrip strength, and physical performance according to the 2019 Asian Working Group for Sarcopenia consensus[5,15,17-19,23]
Cognitive function	Clinical examination:
	Montreal Cognitive Assessment (MoCA)[34]
	MMSE (Mini-Mental State Examination)[30,37,44]
Executive function	Clinical examination
	Trail Making Test[34]
	Trail Making Test A (TMT-A)[34]
Mortality	Records:
	Municipal death registry (Kameoka City Hall, Japan)[10]
	Records managed by health-care insurer[27,31]
Fall risk	Questionnaire:
	Self-reported history of falls during the previous year (≥1 fall)[7]
	Clinical examination
	Stay Independent Brochure (SIB)[44]
	Timed Up and Go test[28]
Sleep quality	Questionnaire:
	Pittsburgh Sleep Quality Index (PSQI)[9,41]
Diet-related quality of life	Questionnaire:
	Diet-Related Quality of Life Scale – Short Form (DRQOL-SF, 8 items)[6]
Social isolation	Questionnaire:
	Lubben Social Network Scale[36]
Weight change	Questionnaire:
	Self-reported weight in 2016 and 2019 and calculation of percentage change[8]
Depression	Questionnaire:
	Geriatric Depression Scale (GDS-15)[9,29]
Loss of independence	Certification:
	No certification for long-term care insurance (LTCI)[31]

*The Kihon Checklist addresses: "Do you have any difficulty eating hard foods compared with six months ago?"; "Have you recently choked on tea or soup?"; and "Do you often feel that your mouth is dry?".

DISCUSSION

This scoping review mapped studies on the association between oral functionality—investigated through the concepts of oral function, oral frailty, or oral hypofunction—and general health outcomes in older adults. The findings showed a wide range of outcomes and marked conceptual and methodological heterogeneity in the assessment of oral functionality. Physical frailty, nutritional status, sarcopenia, risk of falls, depression, and mortality were among the most frequently investigated outcomes, showing that oral functionality has been studied in relation to different dimensions of health in aging.

The comparative analysis revealed marked methodological differences among the three constructs assessed. Oral hypofunction follows the most standardized and systematized model and comprises five main indicators: oral dryness, occlusal force, masticatory function, swallowing function, and oral hygiene[3]. By contrast, oral function exhibits

greater methodological diversity, and some studies assessed functional aspects in isolation, without adopting the construct of oral hypofunction, demonstrating a broader and more diverse approach. Lastly, oral frailty incorporates a larger number of indicators, with greater emphasis on subjective and social markers, broadening understanding of oral function in the context of systemic decline. These findings suggest that the three constructs overlap in some areas but should not be considered equivalent or used interchangeably.

The distribution of outcomes also varied according to the construct investigated. Oral hypofunction was examined mainly in relation to muscular and nutritional outcomes, whereas oral frailty was associated with a broader spectrum of general health conditions. This difference may stem from the characteristics of the instruments used, the components included in each definition, and the different stages of functional impairment that these constructs seek to represent. Comparative studies are needed to determine the extent to which they identify distinct phenomena or complementary dimensions of declining oral functionality.

The associations observed are biologically and socially plausible. Impaired chewing, swallowing, and salivary production may affect the choice, consistency, variety, and amount of foods consumed, favoring nutritional inadequacies and loss of muscle mass, contributing to sarcopenia, physical frailty, and a greater risk of falls[19,23]. Hyposalivation, commonly associated with polypharmacy, affects the integrity of the oral mucosa, favoring the development of lesions and infections. The condition also affects speech and social interaction, which, in turn, may negatively affect mental health[9] and cognition[30].

Heterogeneity was evident not only in the assessment of oral functionality but also in the measurement of general health outcomes. Physical frailty, for example, was assessed using different diagnostic criteria, such as the Cardiovascular Health Study (CHS) criteria[36] and the Kihon Checklist (KCL), an instrument widely used in Japan[19,21]. Although both are used to identify individuals with frailty, they differ in the domains assessed, mode of administration, and cutoff points used. Similarly, cognitive function was measured heterogeneously across studies, including screening with the Mini-Mental State Examination (MMSE)[30,37], the use of dementia-specific scales, and investigation based on self-reported cognitive decline[30]. This methodological heterogeneity, although reflecting the complexity of the constructs investigated, hampers the comparison of results and consolidation of robust evidence.

The diversity of definitions, indicators, and instruments highlights the need for greater methodological standardization. This does not necessarily mean adoption of a single construct but rather the establishment of clear operational definitions, identification of essential measures, and appropriate differentiation among oral function, oral hypofunction, and oral frailty. The use of validated instruments and minimum sets of indicators could increase the comparability, reproducibility, and clinical applicability of studies.

The predominance of cross-sectional designs also characterizes the available body of evidence. This design is fitting for estimating frequencies and identifying associations, as well as for offering easier implementation, lower cost, and the possibility of assessing multiple exposures and outcomes simultaneously[45]. However, because exposure and outcome are measured at the same time, results cannot establish the temporal direction of associations. Thus, it remains unclear whether changes in oral functionality precede, accompany, or result from the general health conditions investigated. The scarcity of longitudinal studies therefore reduces the possibility of examining trajectories of decline and potential causal relationships. Convenience samples were also often used, increasing the risk of selection bias and limiting the representativeness of results. This issue is relevant given the clinical, functional, and social heterogeneity of the older population. Future studies should make greater use of probability sampling and include participants with different socioeconomic profiles, levels of dependence, and care settings to improve the external validity of the findings[45].

There was also a marked geographic concentration of studies in Japan, which may be explained by the country's pioneering role in developing the concepts of oral hypofunction and oral frailty[3]. These findings

may also be explained by Japan's demographic context, having one of the world's oldest populations, with high levels of functional dependence and increasing demand for long-term care. This setting prompted public policies and clinical guidelines focused on oral functionality and encouraged the local scientific community to investigate the topic in depth[3]. Oral hypofunction was recognized as a new dental condition, stimulating the development of more systematized and methodologically structured studies[17]. Nevertheless, it is vital to recognize that the findings of these studies reflect a specific sociocultural context, given the concentration of investigation in a single country, and that extrapolation to other settings, especially low- and middle-income countries, requires caution. The dearth of studies outside East Asia reveals an important gap in the literature, suggesting the need to expand research on this subject in different regions using more diverse and representative methodological approaches.

A limitation of the current review is the non-inclusion of gray literature, such as government documents and studies published in conference proceedings. This decision may have led to the exclusion of relevant evidence and increased the likelihood of selection bias. Despite this limitation, the broad mapping allowed the identification of methodological patterns, conceptual gaps, and priorities for the development of research on oral functionality and general health in older adults.

CONCLUSION

The studies mapped investigated oral functionality in association with different general health outcomes in older adults, mainly physical frailty, nutritional status, sarcopenia, risk of falls, depression, and mortality. However, the wide diversity of concepts, indicators, diagnostic criteria, and assessment instruments limits the comparability of results and highlights the need for greater conceptual and methodological standardization.

Future studies should adopt longitudinal and multicenter designs with probability samples to clarify the temporality of associations and improve the external validity of findings. From a clinical and public health perspective, the findings reinforce the importance of functional assessment of the oral cavity as part of comprehensive care for older adults, including strategies for prevention, early diagnosis, and functional oral health rehabilitation. Identifying signs of oral frailty or oral hypofunction may contribute to timely interventions and to the promotion of healthy aging.

AUTHORSHIP

- Álvaro Augusto da Silva Alves: study conception and design; drafting or critical revision; final approval of the version to be published; accountability for all aspects of the work; formal analysis; conceptualization; data curation; writing—review and editing; investigation; methodology; validation; and visualization.
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