Meta-Analysis of the Prevalence of Oral Frailty in Older Adults (Postprint)

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Abstract

Background With intensifying population aging, the health of older adults has garnered increasing attention. Oral frailty, as a new phenotype of frailty in older adults, has a prevalence rate that directly affects their quality of life. A comprehensive understanding of the current status of oral frailty among older adults is of great significance for formulating effective prevention and intervention measures.

Objective To systematically evaluate the prevalence of oral frailty among older adults.

Methods A computerized search was conducted for studies on the prevalence of oral frailty among older adults in CNKI, Wanfang Data, VIP, CBM, PubMed, Web of Science, Embase, CINAHL, and Cochrane Library databases from inception to April 19, 2024. Two researchers independently screened the literature, extracted information, and assessed quality. Meta-analysis of the included studies was performed using Stata 14.0 software.

Results A total of 19 cross-sectional studies were included, with a total sample size of 11,776 cases. The risk-of-bias quality scores ranged from 6 to 9, indicating moderate or high quality. Meta-analysis results showed that the overall prevalence of oral frailty among older adults was 29.5% (95%CI=24.1%~35.2%), and the overall prevalence of pre-oral frailty was 47.9% (95%CI=40.5%~55.4%). Subgroup analysis results indicated that the prevalence of oral frailty increased with age, and was higher among older adults using the Oral Frailty Index-8, in China, females, those in medical-nursing institutions, those without spouses, those living alone, smokers, and those with primary school education or below ($P<0.05$).

Conclusion The overall prevalence of oral frailty among older adults is relatively high. Special attention should be paid to the oral health status of older adults in China who are of advanced age, female, residing in medical-nursing

institutions, living alone without a spouse, smokers, and with low educational levels.

Full Text

Meta-Analysis of the Prevalence of Oral Frailty in the Elderly

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Abstract

Background: As population aging intensifies, the health of older adults has attracted increasing attention. Oral frailty, a novel frailty phenotype in the elderly, directly impacts quality of life. A comprehensive understanding of the current status of oral frailty among older adults is crucial for developing effective prevention and intervention strategies.

Objective: To systematically evaluate the prevalence of oral frailty in the elderly.

Methods: A comprehensive search was conducted across CNKI, Wanfang Data, VIP, CBM, PubMed, Web of Science, Embase, CINAHL, and Cochrane Library databases for studies on the prevalence of oral frailty in older adults from inception to April 19, 2024. Two researchers independently screened literature, extracted data, and assessed quality. Meta-analysis was performed using Stata 14.0 software.

Results: Nineteen cross-sectional studies with a total sample size of 11,776 participants were included. The risk of bias quality scores ranged from 6 to 9, indicating moderate to high quality. Meta-analysis revealed an overall oral frailty prevalence of 29.5% (95%CI=24.1%-35.2%) and pre-oral frailty prevalence of 47.9% (95%CI=40.5%-55.4%). Subgroup analyses showed that oral frailty prevalence increased with age and was significantly higher among elderly individuals assessed using the Oral Frailty Index-8, those in China, females, residents of medical and nursing care facilities, those without a spouse, those living alone, smokers, and those with primary school education or lower ($P<0.05$).

Conclusion: The overall prevalence of oral frailty among older adults is high. Particular attention should be paid to the oral health status of elderly individuals in China who are advanced in age, female, residing in medical and nursing

care facilities, living alone without a spouse, smokers, and have lower educational levels.

Keywords: Frailty; Oral frailty; Prevalence; Aged; Oral Frailty Index-8; Meta-analysis

Introduction

According to World Health Organization reports, the global population aged 80 and above is projected to reach 434 million by 2050. As population aging accelerates, the quality of life among older adults has become a major public health concern. Frailty is a common multidimensional geriatric syndrome characterized by depleted physiological reserves and diminished stress resistance, with an overall prevalence of approximately 13%. While previous frailty research has primarily focused on physical, cognitive, and social frailty, recent scholars have proposed oral frailty as a novel frailty phenotype. Oral frailty refers to age-related deterioration of oral structures and functions, representing a specific geriatric syndrome that commonly manifests as self-reported difficulties in chewing and swallowing. Oral frailty is significantly associated with increased risks of physical frailty, sarcopenia, disability, and all-cause mortality. Early identification and effective intervention for oral frailty can help prevent or delay adverse health outcomes and are crucial for achieving healthy aging. However, substantial heterogeneity exists across studies due to regional differences and varying assessment tools. Therefore, this study aims to systematically evaluate the current status of oral frailty among older adults to provide reliable evidence for clinical practice.

Methods

Search Strategy

We systematically searched CNKI, Wanfang Data, VIP, CBM, PubMed, Web of Science, Embase, CINAHL, and Cochrane Library databases for studies on the prevalence of oral frailty in older adults from database inception to April 19, 2024. A combination of subject headings and free-text terms was used. Chinese search terms included “elderly” and “oral frailty,” while English search terms included “aged,” “elderly,” “oral frailty,” “oral weakness,” and “oral health.” The PubMed search strategy is detailed in Table 1 .

Inclusion Criteria

Studies were included if they met the following criteria: (1) cross-sectional study design; (2) study population of older adults (age $ $60 years); (3) clear definition of oral frailty with specified screening or assessment methods; and (4) outcome measure of oral frailty prevalence.

Exclusion Criteria

Studies were excluded if they were: (1) duplicate publications, conference abstracts, reviews, or studies with unavailable full text or incomplete data; or (2) not published in Chinese or English.

Literature Screening and Data Extraction

Two researchers independently screened literature, extracted data, and cross-checked results. Disagreements were resolved by a third researcher. The screening process involved initial title and abstract review to exclude obviously irrelevant studies, followed by full-text review for final inclusion. Extracted data included: (1) basic study characteristics (first author, publication year, country, age, sample size, oral frailty prevalence, assessment tool); (2) participant characteristics (age, education level, marital status); (3) outcome measures and results; and (4) key elements for risk of bias assessment.

Oral Frailty Assessment Standards

The following assessment criteria were used: (1) Oral Frailty Index-6 (OFI-6): scores $ $2 indicated oral frailty; (2) Oral Frailty Index-8 (OFI-8): scores of 1-3 indicated pre-oral frailty, and scores $ $4 indicated oral frailty; (3) Oral Frailty Index-5 (OFI-5): scores $ $2 indicated oral frailty; and (4) Oral Frailty Checklist (OF-checklist): meeting $ $2 criteria defined oral frailty.

Risk of Bias Assessment

Two researchers independently assessed the risk of bias using the Agency for Healthcare Research and Quality (AHRQ) recommended criteria for cross-sectional studies. The AHRQ scale ranges from 0 to 11 points, with scores of 0-3 indicating low quality, 4-7 moderate quality, and 8-11 high quality.

Statistical Analysis

Meta-analysis was conducted using Stata 14.0 software. Prevalence rates and 95% confidence intervals (CIs) were calculated as effect measures. Heterogeneity was assessed using the ^{2} test (α=0.1) and I^2 statistic. A fixed-effects model was used when P>0.1 and $I^2$$ $50%; otherwise, a random-effects model was applied. Subgroup analyses were performed by assessment tool, region, gender, age, population source, marital status, living situation, smoking status, and education level. Sensitivity analysis was conducted by sequentially removing individual studies. Publication bias was assessed using Egger's test and funnel plots.

Results

Literature Screening Process

The initial search yielded 4,181 records. After systematic screening, 19 studies were ultimately included [9-27]. The screening process is illustrated in Figure 1 [Figure 1: see original paper].

Basic Characteristics and Risk of Bias

Nineteen cross-sectional studies with a total sample size of 11,776 participants were included (4,842 males [41.12%] and 6,934 females [58.88%]). Studies were primarily conducted in China and Japan, with one study from Finland [24] (excluded from subgroup analysis due to insufficient number). Eight studies used OFI-6 [9-14,16,23], nine used OFI-8 [15,17-22,26-27], and one study each used OF-checklist [24] and OFI-5 [25] (excluded from subgroup analysis due to insufficient number). Risk of bias scores ranged from 6 to 9, indicating moderate to high quality. Detailed characteristics are presented in Table 2 .

Overall Prevalence of Oral Frailty

All 19 studies [9-27] reported oral frailty prevalence. Significant heterogeneity was observed (I^2=97.73%, P<0.001), warranting use of a random-effects model. The pooled prevalence of oral frailty among older adults was 29.5% (95%CI=24.1%-35.2%), as shown in Figure 2 [Figure 2: see original paper].

Prevalence of Pre-Oral Frailty

Ten studies [10-12,15-17,21-23,27] reported pre-oral frailty prevalence. Considerable heterogeneity was present (I^2=97.83%, P<0.001), and the random-effects model yielded a pooled prevalence of 47.9% (95%CI=40.5%-55.4%), illustrated in Figure 3 [Figure 3: see original paper].

Subgroup Analysis

Subgroup analyses by assessment tool, country, gender, age, population source, marital status, living situation, smoking status, and education level revealed that oral frailty prevalence increased with age. Higher prevalence rates were significantly associated with use of OFI-8, Chinese populations, females, medical/nursing facility residents, those without a spouse, those living alone, smokers, and individuals with primary school education or lower (P<0.05). Results are detailed in Table 3 .

Sensitivity Analysis and Publication Bias

Sensitivity analysis using the sequential exclusion method yielded oral frailty prevalence rates ranging from 25.03% to 35.27%, showing minimal deviation from the overall estimate and indicating robust results. Egger's test suggested

publication bias (t=2.57, P=0.02); however, trim-and-fill correction did not substantially alter the findings, confirming result stability, as shown in Figure 4 [Figure 4: see original paper].

Discussion

This meta-analysis included 19 cross-sectional studies on oral frailty prevalence in older adults, all with quality scores >5, indicating good methodological quality. The pooled prevalence of oral frailty was 29.5%, with pre-oral frailty at 47.9%. These rates are higher than the 14%-16% reported in Japanese studies [30-31] but align with Chinese prevalence estimates of 21%-69% [32]. These discrepancies may reflect variations in baseline data (sample size, economic conditions, healthcare resources), assessment tools, and sampling methods across different regions and studies.

Impact of Assessment Tools on Prevalence

The OFI-8 self-report scale demonstrated higher detection rates for oral frailty compared to OFI-6. OFI-6 is primarily used in dental clinics, requiring professional assessment with specialized equipment to measure four objective indicators (tooth count, chewing ability, oral diadochokinesis, tongue pressure) combined with two self-reported items (eating and swallowing difficulties). While more precise, OFI-6 demands specialized equipment and personnel, making it unsuitable for rapid screening [30]. In contrast, OFI-8 is a self-reported instrument with eight items (Cronbach's α=0.692) demonstrating adequate reliability and validity for community and outpatient screening. However, its discriminatory capacity requires further optimization, and its psychometric properties in Chinese populations need validation [33]. Future research should develop culturally adapted assessment tools integrating both subjective and objective indicators for different populations and settings.

Regional Variations in Prevalence

Oral frailty prevalence was higher among Chinese older adults compared to their Japanese counterparts. This may be attributed to China's larger population and uneven healthcare distribution, as well as the predominant use of the subjective OFI-8 in Chinese studies, which is susceptible to cognitive and recall biases. Japan has pioneered oral frailty research with high public awareness, and national health insurance covers dental treatment with legislated oral examinations across age groups, fostering greater attention to oral health among Japanese older adults [34]. The Finnish prevalence of 17.7% aligns with Japanese estimates [30], possibly because Puranen et al.'s [24] instrument development drew heavily from Japanese research. Currently, oral frailty research predominantly originates from Asian countries, likely reflecting larger populations and more pronounced aging demographics. Future studies should conduct global multicenter investigations accounting for regional population characteristics. Given

the serious situation in China, efforts should strengthen oral self-care education, enhance awareness, and recommend annual or biannual routine dental check-ups.

Gender Differences in Prevalence

Oral frailty prevalence was higher among older women, consistent with Karla et al.'s findings [35]. This may relate to gender differences in muscle strength, with older women exhibiting weaker chewing, biting force, and maximum tongue pressure compared to men [36]. Additionally, gingival tissue is an estrogen target organ; postmenopausal estrogen deficiency leads to greater bone calcium loss, alveolar osteoporosis and atrophy, reduced salivary secretion, slower blood flow, and increased vascular permeability, potentially contributing to oral frailty [29]. However, some studies suggest the relationship between oral frailty and gender remains inconclusive [10], warranting further multicenter prospective research.

Age-Related Prevalence Trends

Oral frailty prevalence increased progressively with age: 31.4% in those aged 60-69 years, 39.6% in 70-79 years, and 61.6% in those $ $80 years, consistent with previous research [37]. Advancing age alters the oral environment, with adults over 80 experiencing more pronounced tooth loss, chewing difficulties, reduced bite force, and oral microbiota dysbiosis. Poor oral health may compromise nutritional intake, leading to malnutrition that exacerbates oral frailty [38]. We recommend multi-level oral frailty screening and early intervention tailored to different age groups.

Influence of Population Source

Older adults in medical and nursing facilities showed higher oral frailty prevalence than community-dwelling and rural populations. This vulnerable group often lacks self-care capacity, has multiple comorbidities, greater dependency on others, and weaker oral health awareness. Healthcare and long-term care facilities should prioritize oral health education, encourage regular brushing and rinsing, and help residents establish good oral hygiene habits.

Marital and Living Status Effects

Older adults living alone or without a spouse exhibited higher oral frailty prevalence. Research indicates these individuals experience social frailty, lacking family support and care, with poor self-care behaviors and increased risks of depression and anxiety. Social frailty may further worsen oral frailty and increase disease burden [39]. Family members should address older adults' social and emotional needs, while communities can organize support groups and health promotion activities for isolated or widowed seniors.

Smoking as a Risk Factor

Smokers showed higher oral frailty prevalence due to chronic tobacco use causing oral mucosal dryness, impaired immune function, and increased periodontal disease risk, all exacerbating oral health problems [40]. Older adults should be encouraged to quit smoking and limit alcohol consumption to maintain healthy lifestyle habits.

Educational Level Impact

Lower educational attainment was associated with higher oral frailty prevalence, likely due to limited oral health knowledge, economic constraints, unhealthy lifestyle habits, and malnutrition. Public health efforts should develop culturally appropriate, easy-to-understand educational materials tailored to different literacy levels to enhance awareness and comprehension of oral frailty.

Study Limitations

This study has several limitations. First, all included studies were cross-sectional, resulting in high heterogeneity that persisted despite subgroup and sensitivity analyses; findings require further validation. Second, the inclusion of only four assessment tools (OFI-6, OFI-8, OFI-5, and OF-checklist) with varying performance characteristics may have introduced assessment bias. Third, the search was limited to published Chinese and English studies, potentially missing relevant literature. Fourth, insufficient reporting of comorbidity types and prevalence in included studies precluded analysis of oral frailty across different comorbidity profiles.

Conclusion

This meta-analysis found a high pooled prevalence of oral frailty (29.5%) and pre-oral frailty (47.9%) among older adults. Subgroup analyses identified advanced age, female gender, residence in medical/nursing facilities, living alone without a spouse, smoking, and low education level as factors associated with higher prevalence. The situation in China is particularly concerning, necessitating focused attention on oral health status among high-risk elderly populations. Early identification and screening of vulnerable groups are essential to reduce incidence and alleviate disease and economic burdens. Communities and hospitals should implement comprehensive prevention strategies combining nutritional support with oral exercises (tongue pressure, chewing, and rhythmic training) to effectively prevent or mitigate oral frailty and improve quality of life among older adults.

Author Contributions: QIAO Wanwan contributed to conceptualization, literature search, data extraction and analysis, and manuscript writing. TIAN Haiping contributed to literature search, data extraction, and analysis. JING

Jie was responsible for quality control and manuscript review, with overall responsibility for the article. GUO Runfang contributed to literature search and data compilation.

Conflict of Interest Statement: The authors declare no conflicts of interest.

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Note: Figure translations are in progress. See original paper for figures.