

Associations Between Oral Frailty Profiles and Related Factors in Institutionalized Older Adults: A Study on Latent Class Analysis and Its Influencing Factors

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Abstract

Background: Old age changes in oral health (in the number of teeth, oral hygiene, and function) can lead to eating disorders and malnutrition among the elderly. Preserving the latent profiles and factors influencing oral frailty in this population is crucial to a successful intervention program.

Methods: We used convenient sampling method to select 396 elderly people from different care institutions in Zhengzhou (start month 2024 to end month 2025) as survey participants. We used a latent profile analysis to assess the oral frailty status of these elderly people. Multivariate logistic regression was used to explore factors influencing the population, survey indicators and subtypes.

Results: The study involved 396 elderly individuals living in nursing homes. The median oral frailty score was 5 (3–6) in the interquartile range. Participants were classified into three groups based on oral frailty: class 1 moderate oral frailty with chewing difficulties, 153 (39.14%) and median score 6 (4–7); class 2 severe oral frailty with dysphagia, 66 (16.67%) and median score 8 (6–9); class 3, declining oral function, 177 (44.19%) and median score 3 (2–5). Significant factors were influenced the different latent profiles ($P < 0.05$).

Conclusions: Oral health of elderly residents of nursing homes is poor, and the oral frailty differs widely among individuals. Nursing staff should focus on those who are severe or moderate oral frailty. To prevent and delay the development of oral frailty, targeted interventions should be developed according to the type and influence of the individual patient.

Introduction

The number of elderly will double in the next three decades. They will represent 16–22% of the world population by 2050^[1]. This will pose challenges to social pension systems. China is a country with ageing population. The problem of oral frailty of elderly residents in nursing homes is recognized as a major health concern in aging societies^[2]. Oral frailty refers to gradual decline of oral functions such as chewing, swallowing and salivary secretion leading to eating difficulties, low intake of nutrients and poor quality of life^[3]. It is a key component of geriatric syndrome. Many studies have shown that oral frailty has negative effects on morbidity and mortality among elderly^[4]. China is the country with the most elderly population. Nursing home residents, who often suffer high disability rates, suffer from severe oral health problems. Mild oral disease can reduce chewing ability, appetite, food choices^[5], fatigue, weight loss, and immunity. These issues increase the risk of malnutrition, aspiration pneumonia, and cardiovascular diseases, and increase mortality risk, and the overall healthcare burden. Compared with general elderly population, nursing homes residents suffer from limited mobility, cognitive decline, and inadequate self care for oral health^[6]. Factors such as inadequate oral health resources in institutions and lack of knowledge about oral health among professional caregivers create a problem in this group^[7]. There is a wide range of variation between the symptoms and severity of oral frailty in nursing home residents, depending on their health conditions and lifestyles. Elderly people may have different dietary and nutritional needs and risk factors. Addressing these differences is important for targeting diet interventions.

The current tools such as the Oral Frailty Index – 8 (OFI) assess oral frailty in elderly people by chewing and swallowing functions, saliva secretion, oral hygiene, social interaction and medical care. The tools generate quantitative scores to evaluate the severity of oral frailty. Some of the researchers (both domestically and internationally) studied oral frailty in nursing homes. Most studies classify oral frailty in nursing homes according to scale scores, without recognizing that the various subgroups differ in the composition of the characteristic groups. Understanding this internal heterogeneity is key to designing precise interventions. Latent profile analysis deals with this problem by looking at individuals and grouping similar symptoms into different subgroups. This allows for discrimination from individual points of view. We used latent profile analysis to study population characteristics and heterogeneity of oral frailty among elderly nursing homes. We explored characteristic heterogeneity and mechanisms of different subgroups, thereby creating a basis for individual interventions.

Since oral frailty among elderly nursing home residents is complex and varied^[8], latent profile analysis (LPA) provides an alternative to traditional assessment. By incorporating various measures such as dental status, masticatory ability, swallowing function, and oral hygiene, LPA can identify different types of oral frailty, and it can also analyze distribution and influencing

factors of these types^[9], providing a scientific basis for accurately identifying high risk groups and designing interventions. Presently, there is no literature on classification and influencing factors of oral frailty among elderly nursing home residents using LPA. This makes this study useful to bridge the academic gap and inform clinical practice.

This paper investigates categorical patterns of oral frailty among nursing homes elderly using latent profile analysis (LPA) and multidimensional assessment indicators. We clarify the category types and study relation between diet, nutrition factors and oral frailty categories. We identify key nutritional factors in the frailty categories and provide scientific basis for precise, personal oral health management and dietary interventions in nursing homes that improve oral health and quality of life of elderly while reducing the societal medical burden^[10].

Methods

1.1 Design and data collection

From July 2025 to December 2025, we used a convenience sampling method to select elderly residents from a nursing home in Zhengzhou City as participants. The inclusion criteria were over 60 years old, clear consciousness and ability to communicate. Further criteria were continuous stay in the hospital for at least one week and ability to express themselves sufficiently to complete the questionnaire with help from a caregiver. The participants also had to give informed consent to join the study. The inclusion criteria excluded severe cognitive impairment (MoCA score below 17) and people who were in the acute stage of diseases such as acute stroke or severe infection. Multiple organ failure or mental illness were also excluded. This study has the approval of the Ethics Review Committee of life sciences in the First Affiliated Hospital of Zhengzhou University (Approval No. 2023-KY-1373-002, Date: 01/11/2024). All participants provided written informed consent prior to data collection. All procedures were performed in accordance with the Declaration of Helsinki.

The average sample size is 5-10 times the number of independent variables. This study had 15 independent variables. The average sample size is 188 cases, because 20% of invalid samples are discarded. The ethics committee of our hospital approved this study. All participants signed informed consent forms.

1.2 Measurements

1.2.1 General Information Questionnaire

The researchers developed the content themselves, drawing from a literature review and group discussions. It encompasses demographic characteristics such as gender, age, educational level, marital status, living conditions, transfer mode, number of comorbid diseases, vision, and hearing. The full English version of this questionnaire is provided in Supplementary File S1.

1.2.2 Oral Frailty Index - 8

The Oral Frailty Index-8^[11], developed by Tanaka et al. in 2021, comprises eight items. For items 1 through 3, a "yes" response earns 2 points, while a "no" response earns 0 points. For items 4 through 8, a "yes" response earns 1 point, and a "no" response earns 0 points. The total score ranges from 0 to 11 points, with scores exceeding 4 indicating oral frailty.

1.2.3 Katz Activities of Daily Living Scale (ADL),

The ADL scale^[12] comprises six items: bathing, dressing, using the toilet, eating, self-mobility, and bladder and bowel control. Each item independently completed earns one point; otherwise, it scores zero. The total score spans from 0 to 6 points. A score of 6 signifies full independence in activities of daily living (ADL), whereas a score between 0 and 5 indicates varying degrees of impairment in ADL abilities.

1.2.4 Mini Nutritional Assessment - Short Form

The Mini Nutritional Assessment - Short Form (MNA-SF)^[13], simplified by Rubenstein et al. in 2001 and translated into Chinese by Zhang Yan et al. in 2019, assesses the nutritional status of study subjects. This scale comprises 6 items, yielding a total score

between 0 and 14 points. Typically, scores are categorized as follows: <7 points indicate malnutrition, 8-11 points suggest a risk of malnutrition, and >12 points denote a well-nourished status. Lower scores signify a higher risk of malnutrition.

1.2.5 Frailty Screening Scale

Frailty Screening Scale^[3] In 2008, The International Working Group on Nutrition, Health and Aging published a frailty screening scale in 2008 with five indicators: 1. The patient has felt fatigued most of the time in the past month; 2. He has lost weight 5g or more in the past year; 3. The patient cannot climb 10 steps independently, equivalent to climbing a one-story building; 4. He cannot walk 100 meters independently; 5. The patient has five or more chronic diseases such as hypertension, diabetes, acute cardiac disease, stroke, malignant tumors, heart failure, asthma, arthritis, chronic obstructive pulmonary disease, kidney disease, or angina. Each one of these criteria scored 1 point and 3 or more points indicates frailty.

1.2.6 Water Swallow Test (WST)

The water swallowing test (WST)^[14] is a well-established method for assessing swallowing function. During the test The patient sits and attempts to swallow 30mL of warm water in one gulp. The grade is as follows: Grade 1 is that the patient swallows the water in one gulp without choking (5 seconds is normal), Grade 2 is that he swallows water in two or more sips without choking (5 seconds) and Grade 3 is given if the patient swallows the water in one gulp but chokes, which indicates swallowing disorder. Grade 4 is given if he swallows multiple sips and chokes (indicating swallowing disorder). Grade 5 is frequent choking and difficulty swallowing all water (indicating swallowing disorder). Grade 3 or higher indicates a swallowing disorder.

1.2.7 Sarcopenia Screening Scale

The sarcopenia screening scale^[15], originally developed by Malmstrom et al. in 2013, was first translated into Chinese by Wang Xiaoying in 2016. This translation demonstrated strong reliability and validity, making it suitable for preliminary sarcopenia screening among community-dwelling elderly individuals in China. The scale assesses five key areas: muscle strength, assisted walking, chair stand, stair climbing, and the number of falls. Each item is scored between 0 and 2 points, resulting in a total score range of 0 to 10 points. A score equal to or greater than 4 is indicative of sarcopenia.

1.3 Quality control

Five students, trained in data collection procedures, were involved in collecting data during the study period. When completed with the questionnaires, they reviewed their answers and checked for missing items. After 24 hours of collecting the data, we checked the accuracy before entering the data in the system.

1.4 Statistical methods

An online latent profile analysis (LPA) was performed using EasyR software to assess the oral frailty of elderly persons in nursing homes. Model fit was determined using Akaike information criterion (AIC), Bayesian information criterion (BIC), adjusted Bayesian information criterion (aBIC), Lo-Mendell-Rubin adjusted likelihood ratio test (LMRT), Bootstrap likelihood ratio test (BLRT), and entropy. Smaller AIC, BIC, and aBIC values suggested better fit, while p values less than 0.05 for LMRT and BLRT suggested better fit to a k class model than a k-1 class model. An entropy value closer to 1 represented higher classification accuracy, with values 0.8 represented classification accuracy above 90%^[16]. After finding the best fit model descriptive analysis, chi-square tests, one-way analysis of variance and binary logistic regression were performed using SPSS 27 software. P values below 0.05 were considered statistically significant.

Results

2.1 Oral frailty in elderly nursing home residents is increasing and characterized by a decline in oral function and health. This condition can impact quality of life, causing difficulties eating, malnutrition^[17], and systemic diseases. Recent studies have highlighted the prevalence of oral frailty in elderly nursing homes and stressed the need for comprehensive oral health assessments and interventions. Oral frailty is not only a result of age but also due to poor oral hygiene, inadequate dental care and limited access to dental services. In nursing homes, oral frailty is often exacerbated by physical and cognitive impairments.

Those residents can lose their ability to maintain proper oral care routines. Regular dental check-ups, oral health education to residents and caregivers and oral care into daily routines have been used in nursing homes to improve oral health and improve overall well-being of elderly residents.

In this study, we included 406 elderly individuals residing in nursing homes, and successfully retrieved 396 valid questionnaires, achieving an effective recovery rate of 97.5%. The participants' ages ranged from 60 to 92 years, with an average age of 72.55 ± 8.71 years. The sample comprised 214 males (54.04%) and 182 females (45.96%). The median total score for oral frailty was 5 (interquartile range: 3, 6), with 63.13% (250 out of 396) scoring above 4, indicating a significant prevalence of oral frailty. Additional demographic details are presented in Table 1.

2.2 Latent profile analysis of oral frailty in the elderly

In the latent profile model analysis for oral frailty among the elderly, when three models were considered, the decrease in Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and sample-corrected BIC values (7279.852, 7415.221, 7307.338) began to slow. The entropy value was 1.00, and both the Lo-Mendell-Rubin (LMR) test and Bootstrapped Likelihood Ratio Test (BLRT) achieved significance ($P < 0.05$). The category proportions were 0.38, 0.17, and 0.45, respectively. With four models, the BIC and sample-corrected BIC values started to increase. Consequently, Model 3 was identified as the optimal fit for assessing oral frailty in elderly residents of nursing homes.

Classes	LogLik	AIC	BIC	ssaBIC	Entropy	Class_Probs	p_ LMRT	p_ BLRT
1	-4493.037	9018.073	9081.776	9031.008	1.000	1		
2	-3799.749	7649.499	7749.034	7669.709	1.000	0.83/0.17	<0.001	<0.010
3	-3605.926	7279.852	7415.221	7307.338	1.000	0.38/0.17/0.45	<0.001	<0.010
4	-3595.875	7277.749	7448.950	7312.510	0.969	0.17/0.28/0.29/0.27	<0.001	0.059
5	-3529.601	7163.203	7370.236	7205.240	0.950	0.17/0.3/0.21/0.18/0.14	<0.001	<0.010
6	-3518.126	7158.252	7401.118	7207.564	0.897	0.17/0.14/0.21/0.18/0.13/0.16	<0.000	0.059

The figure below presents the oral frailty scores for the three groups.

Cluster	Class1	Class2	Class3
Item 1	2(0.2)	2(0.2)	0(0.0)
Item 2	1(1.1)	1(0.1)	0(0.0)
Item 3	0(0.0)	2(2.2)	0(0.0)
Item 4	0(0.1)	1(0.1)	0(0.1)
Item 5	2(0.2)	2(0.2)	2(0.2)
Item 6	1(0.1)	1(0.1)	1(0.1)
Item 7	1(0.1)	1(0.1)	0(0.1)
Item 8	1(1.1)	1(1.1)	1(1.1)

2.3 Types of three components

Class 1 consists of 153 cases and is 39.14% of the total. Class 1 was considered to be moderately frail - masticatory difficulty due to high scores on items 1, 2 and 5. Class 2 consists of 66 cases and is 16.67% of the total. Items 3 and 6 scored higher than the other two groups.

Class 2 comprised 66 cases, accounting for 16.67% of the total. In this group, items 3 and 6 scored higher compared to the other two groups. This class was primarily characterized by abnormal swallowing function, accompanied by symptoms such as dry mouth and decreased social activities. Consequently, it was designated as the severe oral frailty - dysphagia type.

Class 3 Class 3 consist of 177 cases (44.19%) with median score of 3 (interquartile range: 2, 5) suggesting good chewing and swallowing functions without a severe oral frailty. Class 3 is referred to as oral function decline type. Figure (1) shows the line chart of item scores for the three groups.

2.4 Univariate Analysis of Potential Oral Frailty Profiles in the Elderly Population (Refer to Table 1)

The results of the univariate analysis (Table 1) revealed statistically significant differences among the three characteristic groups across 13 variables. These variables include transportation mode, education level, hearing status, number of comorbidities, ability to perform activities of daily living, grades from the Kubota drinking test, frailty screening scores, simplified nutritional assessment scores, and sarcopenia screening scores ($P < 0.05$). In contrast, no statistically significant differences were observed among the groups for variables such as gender, age, and marital status ($P > 0.05$).

Table 1 Univariate analysis of general information of the elderly in nursing homes and potential profiles of oral frailty

Variable	Description n=396	Moderate oral frailty - chewing difficulty type n=153	Severe oral frailty - dysphagia type n=66	Oral function decline type n=177	Test statistic	P
Educational level, n (%)						
Primary school or below	168 (42.4)	80 (52.3)	23 (34.8)	65 (36.7)	26.981 ^a	<0.001
Junior high school	89 (22.5)	38 (24.8)	17 (25.6)	34 (19.2)		
Senior high school & technical secondary school	66 (16.7)	20 (13.1)	17 (25.8)	29 (16.4)		
Junior college and above	73 (18.4)	15 (9.8)	9 (13.0)	49 (27.7)		
Hearing, n (%)						
Normal	96 (24.2)	31 (20.3)	15 (22.7)	50 (28.2)	32.776 ^a	<0.001
Mild decline	169 (42.7)	46 (30.1)	35 (53.0)	88 (49.7)		
Moderate decline	74 (18.7)	43 (28.1)	8 (12.1)	23 (13.0)		
Severe decline	42 (10.6)	24 (15.7)	6 (9.1)	12 (6.8)		
Loss	15 (3.8)	9 (5.9)	2 (3.0)	4 (2.2)		
Number of comorbidities (quartile)	1 (1.0, 2.0)	1 (0.5, 2.0)	1 (1.0, 3.0)	1 (1.0, 2.0)	17.369 ^b	<0.001
Activities of daily living (ADL)	5 (1.0, 6.0)	5.0 (2.0, 6.0)	1.0 (0.0, 5.0)	6.0 (2.0, 6.0)	34.687 ^b	<0.001
Kubota water swallow test, n (%)						
Grade 1	245 (61.7)	97 (63.4)	14 (21.2)	134 (75.7)	107.997 ^a	<0.001
Grade 2	117 (29.5)	50 (32.7)	28 (42.4)	39 (22.0)		
Grade 3	23 (5.8)	6 (3.9)	14 (21.2)	3 (1.7)		
Grade 4	7 (1.8)	0 (0.0)	6 (9.1)	1 (0.6)		
Grade 5	4 (1.0)	0 (0.0)	4 (6.1)	0 (0.0)		
Frailty screening score (quartile)	2 (1.0, 3.0)	2.0 (1.0, 3.0)	2.5 (2.0, 3.0)	1.0 (0.0, 2.0)	26.725 ^b	<0.001
Mini Nutritional Assessment score (quartile)	9 (8.0, 11.0)	9 (8.0, 11.0)	9 (8.0, 10.0)	10 (8.0, 11.0)	9.606 ^b	0.008
Sarcopenia screening score (quartile)	5 (0.1, 7.0)	4 (1.0, 7.0)	7 (5.0, 8.0)	4 (0, 7.0)	25.652 ^b	<0.001

a) χ^2 b) H

2.5 Multivariate Analysis of Latent Profiles of Oral Frailty in Elderly Nursing Home Residents This section presents a multivariate analysis aimed at identifying latent profiles of oral frailty among elderly residents in nursing homes. Oral frailty is an important part of older adults' health and can impact their overall well-being and quality of life. Understanding its latent profiles

can inform targeted interventions and improve care. We used data collected from several nursing homes, which included dental health, chewing ability and oral hygiene. We applied a latent profile analysis (LPA) in order to classify the elderly nursing home residents into groups based on these indicators. We found several distinct profiles of oral frailty. Each profile had unique characteristics and different levels of oral health challenges. One profile had severe tooth loss and poor chewing ability while another had moderate dental issues but maintained adequate oral hygiene. These results underscore the heterogeneity of oral frailty in elderly nursing home population. Identification of profiles allows tailoring interventions tailored to meet individual needs of each group. Such targeted approaches are essential for improving oral health care in nursing homes and improve the resident's overall quality of life. Conclusion, multivariate analysis gave valuable insights about the latent profiles of oral frailty among elderly nursing home residents. Future research should focus on longitudinal studies to track change in profiles over time and evaluate effectiveness of targeted interventions.

In examining the three potential profiles of oral frailty among elderly residents in nursing homes, we used these profiles as dependent variables. We incorporated four statistically significant variables from the univariate analysis as independent variables in a multiple logistic regression model. The analysis revealed that education level, activities of daily living, hearing, and the number of comorbid diseases significantly influenced oral frailty in this population (all $P < 0.05$), as detailed in Table 2.

Table 2: Multivariate Logistic Regression Analysis of Potential Factors Influencing Oral Weakness in Elderly Residents of Nursing Homes

	Item	B	SE	Wald	P	OR	95%CI
C2C1 ¹⁾	Constant	-0.006	0.898	0	0.994		
	Educational status	0.337	0.161	4.352	0.037	1.400	1.021~1.922
	ADL	-0.26	0.076	11.728	<0.001	0.771	0.665~0.895
C1C3 ²⁾	Constant	-0.88	0.67	1.726	0.189		
	Educational status	-0.391	0.116	11.434	<0.001	0.676	0.539~0.848
	Hearing status	0.407	0.114	12.623	<0.001	1.502	1.200~1.879
C2C3 ²⁾	Constant	-0.886	0.88	1.014	0.314		
	Comorbidity	0.473	0.15	9.989	0.002	1.604	1.197~2.150
	ADL	-0.239	0.073	10.549	<0.001	0.788	0.682~0.910

C1 refers to the moderate oral weakness-chewing difficulty group; C2 refers to the severe oral weakness-swallowing difficulty group; C3 refers to the oral function impairment group.1) C1 is used as the reference group; 2) C3 is used as the reference group.

Discussion

3.1 There is heterogeneity in oral frailty among the elderly in nursing homes.

In this study, we employed latent profile analysis to categorize the oral frailty of 396 elderly residents in nursing homes into three distinct subgroups: "moderate oral frailty - chewing difficulty type" (39.14%), "severe oral frailty - swallowing difficulty type" (16.67%), and "oral function decline type" (44.19%). The research suggests that oral frailty in the elderly is not a uniform condition but rather exhibits multi-dimensional and differentiated characteristics^[18]. Examining the characteristics of each subgroup, the "severe oral frailty - swallowing difficulty type," despite being the smallest group, poses the highest clinical risk. This group exhibited a relatively high total oral frailty score, with item 3 (swallowing function) scoring significantly higher than the other subgroups. Masticatory dysfunction may lead to dysphagia and raise risks such as aspiration^[19].increasing the risk of choking and aspiration and potentially leading to serious complications like aspiration pneumonia^[20]. Additionally, restricted food intake exacerbates malnutrition, creating a vicious cycle of "oral frailty - insufficient nutrition - systemic functional decline^[21]."

Furthermore, this group's sarcopenia screening scores were notably higher than those of the other subgroups, indicating that decreased muscle mass may further impair masticatory and swallowing muscle functions, exacerbating oral frailty^[22]. The "moderate oral frailty - chewing difficulty type," the second-largest group, is characterized by chewing dysfunction and a high rate of denture dependence. This is directly linked to the high tooth loss rate and insufficient oral restoration resources among the elderly in nursing homes. According to the Beijing Municipal Health Commission's educational materials, chronic periodontitis is the primary cause of loose and lost teeth in the elderly. Failure to repair teeth promptly after loss can lead to occlusal disorder and decreased chewing efficiency, further limiting food choices, such as avoiding hard foods, and potentially causing insufficient dietary fiber intake over time^[23]. Additionally, a significant portion of this group has an education level of primary school or below (52.3%), and their lack of oral health awareness may lead to neglect of denture cleaning and regular oral examinations, further exacerbating oral function decline^[24]. The "oral function decline type," comprising the largest proportion (44.19%), had a relatively low total oral frailty score. Their chewing and swallowing functions were generally normal, and they scored best on the Katz scale for activities of daily living and nutritional status. This subgroup's existence suggests that nearly half of the elderly in nursing homes maintain good oral function. Key protective factors include higher education levels, a lower incidence of hearing impairment, and fewer comorbid chronic diseases. Existing evidence indicates higher education correlates with better mastery of oral health information^[25], and delay oral function decline through regular tooth-brushing and examinations^[26]. Moreover, good general health provides a foundation for maintaining oral function.

3.2 Elderly individuals residing in nursing homes, who experience a decline in activities of daily living and possess numerous comorbidities, are more prone to severe oral frailty and dysphagia.

The multivariate logistic regression analysis of different oral frailty groups among elderly residents in nursing homes revealed that a decline in daily living ability is a significant risk factor for oral frailty^[27]. Specifically, compared to the "oral function decline type" (Class 3), those with "severe oral frailty - dysphagia type" (Class 2) exhibited a notably higher risk of impaired daily living ability, which indicates that a decline in daily living ability not only hampers the elderly's capacity for independent oral hygiene but also restricts activity^[28], thereby reducing orofacial muscle movement and accelerating oral function deterioration^[29]. Consequently, tailored nursing care should be provided based on self-care ability deficits, and additional nursing staff should be allocated to assist with daily care. Furthermore, the risk of elderly individuals with "multiple comorbid diseases" (≥ 3 types) developing "severe oral frailty - dysphagia type" increases. This may be due to multiple comorbidities exacerbating oral frailty through various mechanisms. The concurrent use of multiple medications can decrease saliva secretion, impairing the oral cavity's self-cleaning ability and worsening oral frailty, likely due to organ decline and chronic diseases in the elderly^[30]. Therefore, nursing home staff should proactively identify oral frailty risks in this population based on existing risk factors^[31], implement targeted interventions, engage more professional nursing staff, and modify food and water consistency to enhance dietary safety for the elderly.

3.3 Individuals with lower education levels and more severe hearing impairments are more likely to be classified as having moderate oral frailty, specifically the chewing difficulty type.

Research indicates that elderly individuals with a primary school education or less are more prone to moderate oral frailty, specifically in terms of chewing difficulties. Individuals with higher education levels tend to recognize the importance of oral health and engage in proactive health behaviors^[32]. Conversely, those with lower education levels may overlook early oral issues due to insufficient oral health knowledge and limited cognitive abilities. Additionally, inadequate nutritional intake can exacerbate oral frailty^[33]. Therefore, nursing staff in care facilities should tailor food textures to accommodate chewing difficulties^[34], ensuring that elderly residents receive food that is easier to chew and swallow, thereby maintaining balanced nutrition. Furthermore, the study discovered a strong link between hearing impairment and oral frailty. Elderly individuals with moderate to severe hearing loss are 1.879 times more likely to experience "moderate oral frailty - chewing difficulty type" compared to those with normal hearing. This may be because hearing impairment can hinder communication between the elderly and nursing staff^[35], preventing timely oral care guidance. Additionally, reduced social interaction may lower the frequency of oral muscle movement, indirectly worsening oral function decline. Communication barriers during daily oral hygiene guidance can increase the risk of dental caries and periodontal diseases. Chronic disease-related inflammation may also affect the oral microenvironment through systemic circulation, worsening gingival recession and alveolar bone resorption. To address these

issues^[36], nursing staff should develop effective communication strategies, utilizing tools like instruction cards to enhance communication. This approach will help the elderly express their needs and receive more comprehensive care.

Conclusions

Significant heterogeneity exists in oral frailty among elderly residents in nursing homes, which can be categorized into three latent profiles: the severe oral frailty-dysphagia group, the moderate oral frailty-masticatory decline group, and the oral function decline group. Key factors influencing these profiles include hearing, education level, activities of daily living ability, and the number of comorbid diseases. It is advised that nursing home staff implement a classified management intervention model tailored to the distinct characteristics of each profile. This approach aims to enhance the oral health of the elderly, ensure their safety during meals, prevent aspiration incidents, and maintain balanced nutrition intake. Addressing specific oral issues within each group is crucial to preventing and delaying the progression of oral frailty.

Declarations

Ethical considerations

This study has the approval of the Ethics Review Committee of life sciences in the First Affiliated Hospital of Zhengzhou University (Approval No. 2023-KY-1373-002, Date: 01/11/2024). All participants provided written informed consent prior to data collection. All procedures were performed in accordance with the Declaration of Helsinki.

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Conflict of Interest

All the authors of this research declare no competing interests.

Ethics approval

This study has the approval of the Ethics Review Committee of life sciences in the First Affiliated Hospital of Zhengzhou University (2023-KY-1373-002).

Consent to participate

All subjects signed written informed consent prior to participating in this study. Researchers fully communicated the content of the research to every participant, and all participants took part in the survey on a voluntary basis.

Consent for publication

Not applicable. No individual identifiable data, images or clinical case records of the participants were included in this manuscript. All data presented are aggregated statistical results without any information that could identify any single elderly subject.

Data availability

The datasets generated and analyzed during the current study are not publicly available due to relevant institutional regulations and privacy protection requirements for the elderly participants. However, the corresponding author can provide the de-identified raw data upon reasonable request after approval from the Ethics Review Committee of the First Affiliated Hospital of Zhengzhou University.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions

Shujing Liu, Keke Ma: Conceptualized the research, designed the study protocol, conducted field investigation and data collection, and drafted the original manuscript. Caixia Yang, Wenwen Wang, Shubei Pang: Participated in participant recruitment, questionnaire distribution and data sorting, performed preliminary data collation and quality control. Jiachen Gao: Assisted with literature retrieval, sorted out research scales and relevant reference materials, and revised the language of the manuscript. Renke Gao, Dazhen Li: Responsible for statistical analysis using EasyR and SPSS 27 software, interpreted the research results, and organized relevant statistical tables. Yuanli Guo: As the corresponding author, supervised the whole research process, reviewed and revised the manuscript critically, and approved the final version to be published. All authors have read and agreed to the published version of the manuscript.

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Figures

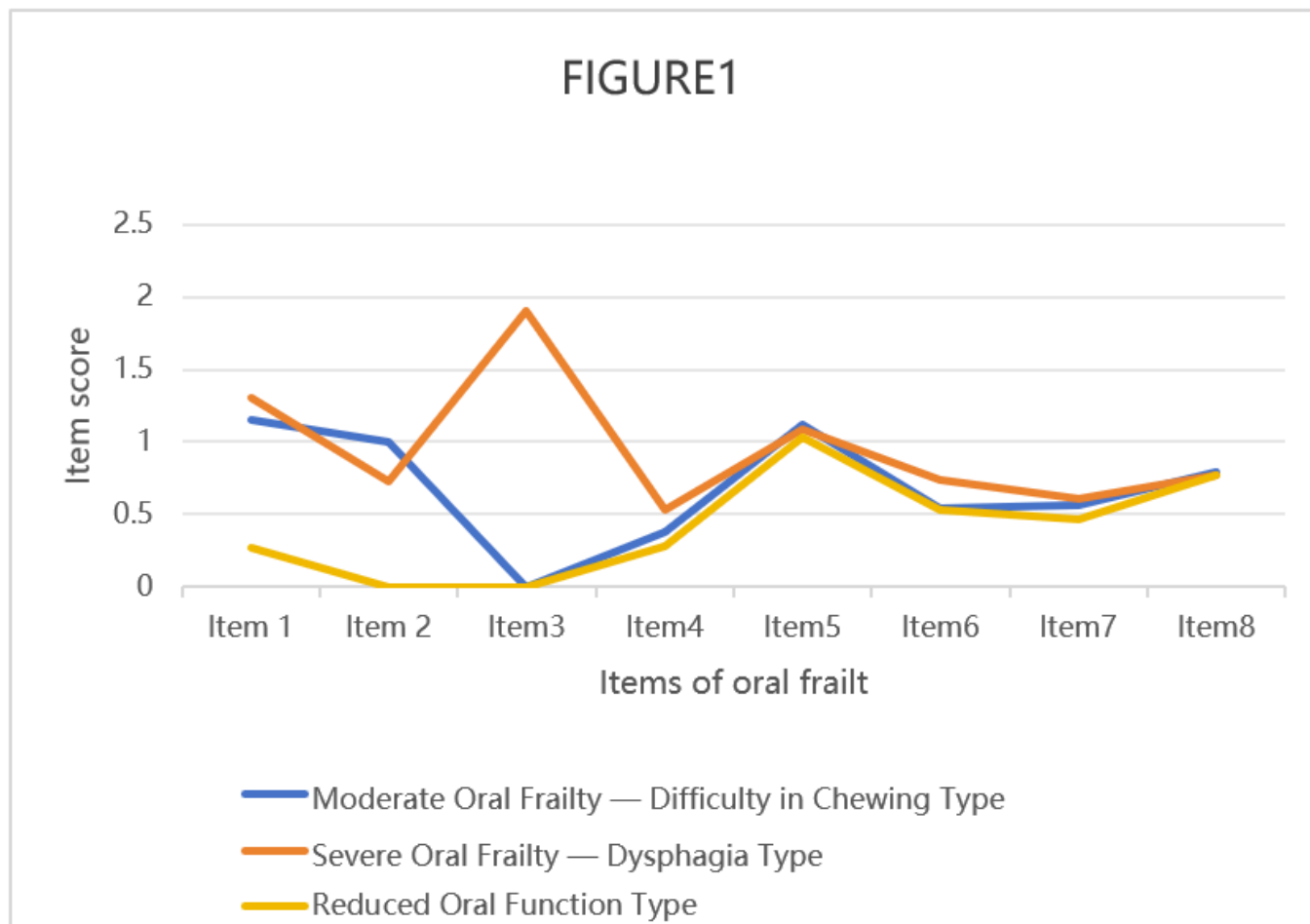


Figure 1

Unnumbered image in the results section.

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