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Voice and Swallowing Changes in Elderly People with and without Depression: A Cross-Sectional Study

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Original Article

Abstract

Introduction: The natural ageing process can impact the performance of the speech system. Age-related vocal changes, even in the absence of voice disorders, can adversely affect the quality of life (QOL) of elderly individuals. Changes in the vocal tract may also lead to issues such as dysphagia and other oral health concerns. These alterations are particularly significant, as they correlate with diminished communication abilities, a reduced QOL, and an increased risk of depression. Unfortunately, these changes are often overlooked or misdiagnosed. This study aimed to assess age-related variations in voice and swallowing function among Iranian elderly individuals, both with and without depression.

Materials and Methods: In this cross-sectional study, 50 elderly participants from Iran, aged between 60 and 80, were recruited through convenience sampling. All participants reported no history of cognitive, neurological, respiratory, or speech-related disorders, a status confirmed by self-reports and medical records. The assessments utilized included the Mini-Mental State Examination (MMSE), the 15-item Geriatric Depression Scale (GDS-15), the Voice-Related Quality of Life (V-RQOL) questionnaire, and a 7-point Likert scale for swallowing evaluation. The distribution of the data was evaluated using the Shapiro-Wilk test, which indicated a normal distribution; therefore, group comparisons were conducted using the nonparametric Mann-Whitney U test.

Results: The total V-RQOL score was notably higher in the depressed elderly group (82.50) when compared to the non-depressed group (70.21) (P = 0.005). Additionally, the depressed elderly group experienced greater swallowing difficulties, as indicated by their higher scores on the 7-point swallowing Likert scale (1.55) compared to the non-depressed group (1.15) (P = 0.005).

Conclusion: Age-related voice and swallowing difficulties appear to be significantly more pronounced in elderly individuals experiencing depression compared to those who are not depressed. However, it remains uncertain whether these functional impairments contribute to the development of depression or are a result of it. The findings offer preliminary evidence of a potential correlation between depressive symptoms and reduced voice and swallowing function, which may ultimately impact overall QOL. Further research is necessary to gain a deeper understanding of this relationship.

Keywords: Depression; Aged; Dysphasia; Dysphonia; Quality of life

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Introduction

Speech serves as the primary means of communication (1, 2). Effective everyday speech is crucial for daily living, enabling individuals to express their basic needs and engage with the community (1, 3). The natural ageing process affects speech system performance (4). Among the age-related changes in speech performance, typically considered expected consequences of ageing are alterations in voice quality and swallowing function (4, 5).

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Throughout the lifespan, significant physiological and anatomical changes occur in the larynx. These changes include, but are not limited to, sclerosis of the bones and cartilage, atrophy of the internal laryngeal muscles, and calcification of cartilage. Assessments of vocal fold function have revealed incomplete glottal closure, diminished vibration amplitude, and a decline in the mucosal wave associated with ageing (4, 5). Consequently, the acoustic and perceptual characteristics of the voice also undergo alterations as a result of these anatomical and physiological changes in the larynx (6, 7). Furthermore, older adults often experience changes in fundamental frequency, increased jitter and shimmer, and a reduced harmonic noise ratio (HNR) (8-10). The voices of older individuals are typically marked by breathiness, vocal fatigue, tremors, and reduced loudness and pitch in women, while men may exhibit increased pitch (11-13).

Voice production complications associated with ageing can adversely affect various social, emotional, and physical dimensions of life (14, 15). These complications can lead to significant transformations across all aspects of living (16, 17). The quality of life (QoL) for older adults, as observed in a five-year follow-up study of healthy males aged 50 to 81, is influenced by vocal changes that result in modifications to an individual's perceptual and acoustic attributes, often causing a heightened tendency to withdraw from social interactions (18, 19). While this observation highlights the connection between ageing voices and QoL, it is important to note that the small sample size of male participants limits the generalizability of the findings. Another study focusing on individuals aged 65 to 94 who were living independently indicated that voice issues could increase anxiety and frustration and lead to repetitive speech patterns, ultimately contributing to a diminished QoL (15). Interestingly, while many older adults with vocal changes reported low levels of voice handicap on the Voice Handicap Index (VHI) questionnaire, this result may stem from a general lack of awareness regarding dysphonia among older individuals (20, 21).

Various degrees of changes in the larynx and vocal tract are observed in older adults (22, 23). These alterations can lead to disorders such as dysphasia and oral complications among the elderly (24). Dysphasia, characterized by difficulty or pain during swallowing, is a common acute or chronic condition in older individuals that often goes unreported (24, 25). Research indicates that over 10% of people aged 50 and older experience some level of dysphasia, yet many do not seek consultation with a specialist (26).

As people age, the larynx descends due to decreased tension in the external muscles and loosened ligaments (22, 23). This change leads to a delay in the swallowing reflex and a reduction in the strength of the muscles involved in swallowing (22-24). Additionally, key protective mechanisms, such as the glottic closure reflex and airway cleaning mechanisms, decline with age (23-25). These factors, either individually or in combination, may contribute to aspiration or restricted laryngeal movement in older adults (22). Video-fluoroscopy conducted on healthy individuals aged 72 to 93 years revealed that 25% exhibited reduced tone in the pharyngeal muscles, while 93% demonstrated dysfunction of the Cricopharyngeus muscle. Remarkably, only 16% of participants maintained normal swallowing function (25, 26).

The prevalence of dysphasia among older adults is higher than in the general population (27, 28). It is expected to rise in the near future as the demographic pyramid shifts toward an ageing population (29). Similarly, older adults with oropharyngeal dysphagia and aspiration experience higher rates of recurrent pneumonia, frequent hospitalizations, and mortality compared to other elderly groups (30). These patients often report a lower quality of life (29); the complications associated with dysphagia adversely impact their social and mental well-being, leading to feelings of isolation and anxiety related to food (31).

In summary, changes in the speech system are a significant concern for seniors, as they are closely linked to overall communication ability and quality of life. Such changes can result in depression, feelings of isolation, and a tendency to avoid social interactions—issues that are often neglected during clinical and physical assessments (32).

With advances in healthcare and rising life expectancy, the global elderly population is growing rapidly. According to the 2016 census in Iran, over 9 million individuals (10.6% of the population) are aged 60 or older (33). This number is projected to rise substantially, surpassing global averages (34). This demographic shift highlights the critical need for research into the changes associated with ageing and their effects on health and quality of life (QoL) (35).

Depression, social isolation, and impaired communication are known to have a detrimental effect on quality of life (QoL). Understanding the impact of age-related changes in speech and swallowing on an individual's quality of life can guide interventions to alleviate these challenges and enhance the well-being of the elderly. Assessing the effects of these changes through clinical studies can inform the development of prevention programs and customized

rehabilitation strategies.

Although some research has indicated that older adults with depression experience voice changes and diminished prosodic variability (36) , there has been a lack of studies comparing these vocal alterations among elderly individuals with and without depression. This study aimed to compare the voice and swallowing functions of Iranian elderly individuals, both depressed and non-depressed. The hypothesis posited that elderly individuals experiencing depression would have a lower QoL and a greater prevalence of age-related changes in voice and swallowing. The primary goal of this research was to provide preliminary evidence linking these changes to reduced QoL and subsequent depression, thereby encouraging further exploration into effective intervention strategies.

Materials and Methods

This cross-sectional study was a part of a larger research project (registration code: 194347) approved by the institutional research ethics committee in 2015.

Participants

A total of 50 elderly individuals, aged 60 to 80 years, voluntarily participated in the study. Participants were recruited from the Isfahan metropolitan area using convenience sampling methods. The inclusion criteria stipulated that participants must have no history of cognitive impairment, respiratory diseases, neurodegenerative disorders, stroke, gastrointestinal issues, movement disorders, clinically diagnosed speech or language disorders, hearing loss, or smoking. Furthermore, participants should not have a history of receiving prescribed medication for voice or swallowing disorders. Eligibility was confirmed through self-report and medical record review.

Measures

Assessment of cognitive function, self-reported depression, swallowing, and voice

Data collection included assessments of cognitive function, depressive symptoms, voice-related quality of life, and swallowing ability. The following instruments were used:

Mini-Mental State Examination (MMSE): The Mini-Mental State Examination (MMSE) (37) is a widely used 30-point questionnaire that assesses cognitive function, including orientation, memory, attention, and language (38). The Persian version of this instrument demonstrates strong internal consistency, with a Cronbach's alpha of 0.81. It has a cut-off score of 22, yielding a sensitivity of 90% and a specificity of 93.5% (39). In this study, participants who scored above 24 on the MMSE were included.

Geriatric Depression Scale – 15 items (GDS-15): The Geriatric Depression Scale-15 (GDS-15) serves as a valid screening tool for identifying depressive symptoms in older adults. Scores of 10 or higher indicate a high likelihood of depression, while scores exceeding 5 suggest the possibility of depression (40) (39). The Persian version of the GDS-15 demonstrates sensitivity rates ranging from 73% to 97% and specificity rates ranging from 60% to 96%, depending on the selected cut-off (41). For the purposes of analysis, participants were categorized based on their GDS-15 scores into “depressed” (scores $\geq$5) and "non-depressed" (scores <5) groups. A psychiatrist administered the assessment.

Voice-Related Quality of Life (V-RQOL): The V-RQOL is a self-report tool designed to evaluate the impact of voice disorders on quality of life (42). It consists of items rated on a 5-point Likert scale (1 = never to 5 = always) that focus on both social-emotional and functional-physical aspects of voice issues. Scores range from 0, indicating the lowest quality of life related to voice, to 100, representing the highest quality of life concerning voice (41). The interpretation categories are as follows:

- Severe voice-related impairment: <40
- Mild to Moderate Impact: 40-79
- Excellent: 80-100

These scores reflect the individual's perception of their voice quality over the past one to two weeks (41). The Persian version has demonstrated high internal consistency (Cronbach’s alpha = 0.88-0.91) and strong test-retest reliability (0.93–0.95) (43).

7-Point Swallowing Likert Scale: The 7-Point Swallowing Likert questionnaire is a self-reported questionnaire assessing the severity of dysphagia when swallowing liquids, solids, or both. Scores range from 1 (normal swallowing) to 7 (severe dysphagia), classified as follows:

1 = Normal,
2 = Very mild,
3 = Mild,
4 = Mild to moderate,
5 = Moderate,
6 = Moderate to severe,
7 = Severe (35)

Procedure

All assessments were conducted in a private room at the speech therapy clinic, ensuring a distraction-free environment. Eligible volunteers received informed consent forms detailing the study's objectives and procedures, with ample time provided for participants to decide whether to participate. Participants' medical records were thoroughly reviewed, and a blinded

speech-language specialist collected additional data. Each participant's scores on the MMSE, GDS-15, V-RQOL, and the swallowing Likert scale were documented. Trained raters were present to assist participants and clarify any items as needed. The V-RQOL and swallowing scores were calculated using standardized scoring algorithms. Participants were intentionally categorized into depressed and non-depressed groups, with recruitment continuing until each group contained a sufficient number of eligible individuals.

Statistical analysis: Descriptive statistics were employed to summarize demographic and clinical characteristics, including age, gender, and depression status. The Shapiro-Wilk test was used to assess the data distribution. Due to the non-normal distribution, group comparisons were carried out using the nonparametric Mann-Whitney U test. Statistical analysis was conducted with SPSS version 16 (SPSS Inc., Chicago, IL, USA) at a significance level of 0.05.

Results

Demographic data of the participants and P-value between the depressed and non-depressed groups are shown in Table 1.

The Shapiro-Wilk test result indicated that the total scores of V-RQOL and the Number of participants with each 7-Likert swallowing rating did not follow a normal distribution. Therefore, a nonparametric approach was employed for data analysis.

As shown in Table 2, total scores of V-RQOL and 7-Likert swallowing in depressed older adults were significantly higher than those of non-depressed older adults (P value<0.005). The frequencies of the V-RQOL categories are shown in Figure 1.

Discussion

This cross-sectional study aimed to investigate whether voice and swallowing scores, along with cognitive performance, differ between elderly individuals with and without depression. Our findings revealed that depressed elderly participants had significantly higher scores on the swallowing self-report questionnaire compared to their non-depressed counterparts, with scores approximately 1.85 times greater. This outcome is consistent with previous research indicating that dysphagia is common among older adults and that depression can intensify dysphagia symptoms (35) . Holland et al. noted a dysphagia prevalence of 11.4% among older adults, demonstrating a strong and independent association between depression and dysphagia symptoms (44). Dysphagia symptoms are prevalent among older adults, affecting nearly 1 in 9 individuals living independently in the community (45).

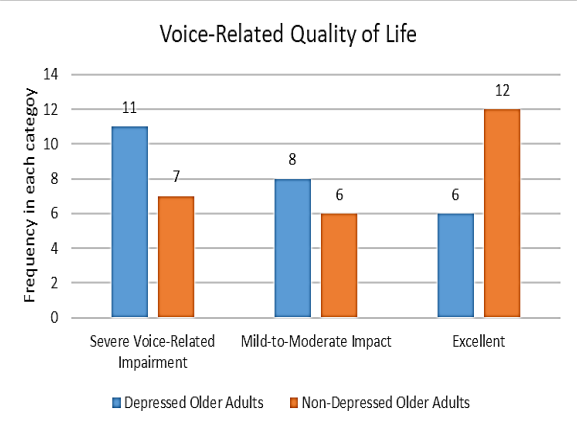

Figure 1. Frequency of Older Adults in V-RQOL Categories, Compared by Depression Status

While cognitive factors do not directly contribute to dysphasia, they may interact with swallowing difficulties, affecting quality of life and psychological well-being (3). In our study, the cognitive scores of the two groups differed significantly; however, this finding should be interpreted with caution. It is possible that the participants' depressive states influenced their motivation and engagement when responding to cognitive assessments.

Table 1. Demographic characteristics of the participants and P-value in the Depressed and non-depressed groups

Group	Gender	N (%)	Mean age (Year)	Mean MMSE Scores	Mean GDS scores	Mean years of education
Depressed	Male	14 (56)	66.77 ± 4.60	27	11	8
	Female	11 (44)	65.63 ± 3.13	25	12.3	7
	Total	25 (100)	66.27	26.1	11.57	7.5
Non-depressed	Male	12 (48)	66.36 ± 6.28	28	3	10
	Female	13 (52)	65.88 ± 1.12	27	3.1	8
	Total	25 (100)	66.11	27.48	3.05	8.9
Total		50	66.19	26.79	7.03	8.2
P-value between 2 groups*		-	0.57	0.04	0.001	0.22

*Significance level was set at 0.05

Table 2. Mean (SD), maximum, and minimum in total scores of V-RQOL and 7-likert swallowing in 2 groups

	Depressed elderly people			Non-depressed elderly people			P-value
	M (SD)	Maximum score	Minimum score	M (SD)	Maximum score	Minimum score	
V-RQOL (0–100)	70.21 ± 3.48	100.00	0.00	82.50 ± 2.11	100.00	0.00	< 0.005
Swallowing score*	14 (56%)-9 (36%)-1 (4%)-1 (4%)	4.00	1.00	22 (88%)-2 (8%)-1 (4%)	3.00	1.00	< 0.005

*Swallowing difficulties were assessed using a 7-point Likert scale ranging from 1 (normal) to 7 (severe). The Number in each rank is reported from left to right in order

Importantly, all participants met the inclusion criteria for normal cognitive function prior to the study, indicating that despite the statistical difference, both groups maintained overall cognitive health adequate for participation.

Changes in voice and swallowing functions among the elderly have significant implications for their physical, social, and emotional well-being. Dysphagia can adversely affect overall health, leading to diminished physical and mental performance, social isolation, and heightened anxiety related to eating (46). These findings underscore the importance of increasing awareness among older adults and healthcare professionals about both normal and pathological changes in swallowing and voice. Early detection and appropriate interventions can help alleviate the impact of these age-related changes, particularly in individuals experiencing depressive symptoms (44, 47).

In contrast, demographic factors such as age, gender, and education did not reveal significant differences between groups, suggesting that the observed variations in swallowing, voice, and cognitive scores are more likely associated with depressive status rather than demographic characteristics.

Overall, these results indicate a complex relationship between depression, swallowing, voice function, and quality of life in elderly populations.

Limitations

The primary limitation of this study was the small sample size. Recruiting older adults proved challenging due to accessibility concerns and a reluctance to participate.

Recommendations

The findings of this study underscore the necessity of investigating the prevalence of voice and swallowing disorders among both depressed and non-depressed elderly individuals in Iran. Future longitudinal studies are needed to explore causal relationships and assess the effectiveness of interventions aimed at enhancing communication abilities and alleviating the psychosocial burden of dysphagia in older adults with depression. Furthermore, future research should examine the extent to which depression affects changes in voice and swallowing functions. Investigating these associations may yield valuable insights for early detection, prevention, and tailored management strategies.

Conclusion

The results indicated that among the elderly with depression, V-RQOL scores were significantly higher compared to their non-depressed counterparts. While the frequency of poor and good V-RQOL ratings in the depressed elderly was 1.57 and 1.33 times that of non-depressed individuals, the prevalence of excellent rankings was notably greater in the depressed group. This outcome is not surprising, as non-depressed individuals may not perceive voice-related issues as having a substantial impact on their quality of life, resulting in fewer "excellent" V-RQOL ratings when compared to those experiencing depression, whose voice-related quality of life is more profoundly affected and thus reported more frequently.

Interestingly, the depressed participants who displayed higher severity of depression, as measured by the GDS-15 score, reported elevated V-RQOL scores. The severity of depressive and anxiety symptoms may correlate with the duration of functional dysphonia, appearing independent of other health concerns. Therefore, symptoms of depression and anxiety could exacerbate conditions in individuals at risk for dysphonia. Given that changes in the voice of the elderly, such as functional dysphonia, can stem from psychological issues, it is essential to consider and accurately assess symptoms of depression and anxiety, regardless of whether depression is a contributing factor or a consequence of functional dysphonia.

On the other hand, voice changes in older adults do not always present abruptly; these alterations may be overlooked, particularly in retired individuals who communicate significantly less than before their retirement (8). Therefore, it is essential to inform and educate older adults about monitoring their voice quality, as we do with their physical abilities (9). It is

estimated that around 15 percent of older adults over the age of 65 exhibit clear signs of depression, with approximately 2 percent progressing to severe depression (11). Additional issues such as dysphonia and dysphasia may further elevate the incidence of these conditions.

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Providing equipment and statistical sample: Parisa Ahmadi
Data collection: Parisa Ahmadi
Analysis and interpretation of the results: Parisa Ahmadi, Seyed Hesamedin Shahrokni Nia, Fatemeh Abedian
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Approving the final manuscript to be submitted to the journal: Fatemeh Abedian, Parisa Ahmadi, Seyed Hesamedin Shahrokni Nia
Maintaining the integrity of the study process from the beginning to the publication, and responding to the reviewers' comments: Parisa Ahmadi, Seyed Hesamedin Shahrokni Nia, Fatemeh Abedian

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Conflict of Interest

The authors have no conflict of interest.

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