Relationship Between Tongue Strength and Dysphagia Symptoms in Japanese Older Adults in Need of Care

Morisaki Naoko1*
1Himeji University, School of Nursing, Japan

Corresponding Author: Morisaki Naoko ORCID ID
Address: Himeji University, School of Nursing, 2042-2 Oshio, Himeji, Hyogo 671-0101, Japan;
E-Mail: naoko_morisaki@koutoku.ac.jp

Received date: 20 October 2021; Accepted date: 06 November 2021; Published date: 15 November 2021

Citation: Naoko M. Relationship Between Tongue Strength and Dysphagia Symptoms in Japanese Older Adults in Need of Care. J Health Care and Research. 2021 Nov 15;2(3):170-75.

Copyright © 2021 Naoko M. This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium provided the original work is properly cited.

Abstract

Purpose: The purpose of this study was to measure the tongue pressure of older adults who require nursing care and to clarify the relationship between dysphagia symptoms and tongue strength.

Methods: The participants were Japanese older adults (age: ≥ 65 years) in need of care who were able to communicate with others and agreed to participate in the study. Tongue pressure was measured using TPM-01, a tongue pressure measuring instrument. The Dysphagia Risk Assessment for Community-Dwelling Elderly was used to assess dysphagia. The association between tongue pressure and 12 dysphagia symptoms was analyzed using a one-way analysis of variance.

Results: The average tongue pressure was 23.22 ± 9.9 kPa. Tongue pressure was significantly associated with occasional food spillage from the mouth and sputum formation in the throat during meals or after eating or drinking (p < 0.05).

Conclusions: Decreased tongue strength should be suspected in older adults with food spillage from the mouth or sputum formation in the throat during meals.

Keywords
Tongue Pressure, Dysphagia, Older Adults in Need of Care, Japan

Background

The oral function is important for extending healthy life expectancy, and there has been an increasing amount of research on this topic. Oral functions include speech, swallowing, and respiration, of which swallowing is extremely important because it is essential for obtaining nourishment. The phases of swallowing have oral, pharyngeal, and esophageal. Swallowing refers to the process of orally consuming food, chewing it, swallowing it, and transporting it to the stomach [1,2]. Impaired swallowing function has been reported to be particularly common in older adults who require nursing care [3,4].

The process of swallowing involves the activity of multiple organs and muscle groups, one of which is the tongue. The tongue is responsible for shaping food in the mouth into a form that can be easily swallowed, moving it from the mouth to the pharynx. Tongue strength is an important determinant of swallowing function. However, many older adults who require nursing care have decreased tongue strength [5].
Tongue strength is assessed by tongue pressure. Decreased tongue pressure has been reported to be associated with signs of dysphagia [6], suggesting that decreased tongue strength may impair swallowing.

Therefore, the purpose of this study was to measure the tongue pressure of older adults who require nursing care and to clarify the relationship between dysphagia symptoms and tongue strength.

Methods
Participants:
The participants were Japanese older adults (age: ≥ 65 years) in need of care who were able to communicate with others and agreed to participate in the study. Many of Japanese older adults in need of care use day care services. Therefore, I asked the older adults who use six-day service centers in Hyogo prefecture to cooperate in this study.

Study outcomes:
Tongue Pressure:
Tongue pressure was measured using TPM-01, a tongue pressure measuring instrument (JMS Co., Ltd., Hiroshima, Japan) that comprises a digital tongue pressure meter, connecting tube, and tongue pressure probe. The balloon of the tongue pressure probe was automatically pressurized to a predetermined level (20 kPa) by the measurement device and placed on the oral part of the tongue while the participants were seated. The participants were then instructed to exert the maximum possible force to elevate the tip of their tongue to the palate for 5–7 s, during which the intensity of the force required to compress the balloon was measured. Two consecutive measurements were performed in accordance with the method described in previous studies [7], and the mean of the measured values was recorded as the tongue pressure level (in kPa).

Dysphagia Symptoms:
The Dysphagia Risk Assessment for Community-Dwelling Elderly [8] was used to assess dysphagia. It is a twelve-item questionnaire developed to assess the risk of dysphagia in older adults. The questionnaire includes well-balanced items that cover all phases of swallowing. The 12 items are as follows: "Do you sometimes have a fever?", "Do you feel as though having a meal is more time-consuming than before?", "Do you sometimes feel as though swallowing is difficult?", "Do you sometimes feel as though it is difficult to eat something hard?", "Does food sometimes spill out of your mouth?", "Do you sometimes choke during your meals?", "Do you sometimes choke when you drink liquid such as tea?", "Are there times when the things you swallowed flow back into your nose?" "Does your voice sometimes change after eating or drinking?", "Does sputum form in your throat during meals or after eating or drinking?", "Do you sometimes feel as though food gets stuck in your chest?", and "Are there times when food or a sour fluid flows back from your stomach toward your throat?" The participants were asked to report the frequency of occurrence of these symptoms, and the options provided were "often," "sometimes," and "never." Responses were obtained through participant interview or self-administration.

Statistical Analysis:
The association between tongue pressure and 12 dysphagia symptoms was analyzed using one-way analysis of variance. Tukey tests were then performed on variables that showed statistical significant differences. The significance level was set at p < 0.05. IBM SPSS Ver. 26.0 (SPSS, Inc., Tokyo, Japan) was used for the statistical analyses.

Ethical Considerations:
The outline of the research, voluntary nature of participation, anonymity, and agreement regarding the publication of results were explained to the participants both in writing and verbally, and their consent was subsequently obtained. The study was approved by the Research Ethics Review Committee of the School of Nursing at Himeji University.

Results
Participants' Characteristics:
The average age of the participants was 81.7±7.2 years. There were 103 (36.4%) men and 180 (63.6%) women. A total of 195 (68.9%) lived in their own homes, while 88 (31.1%) lived in nursing homes.
The distribution of the participants' tongue pressure is shown in Fig-1. The average tongue pressure was 23.22 ± 9.9 kPa.

Table-1: Frequency of occurrence of dysphagia symptoms (N = 283)

| Dysphagia symptoms                                                                 | n (%)                      |
|-----------------------------------------------------------------------------------|----------------------------|
|                                                                                   | Never         | Sometimes    | Often         |
| 1. Do you sometimes have a fever?                                                | 232 (82.0)    | 48 (17.0)    | 3 (1.1)       |
| 2. Do you feel as though having a meal is more time-consuming than before?       | 173 (61.1)    | 89 (31.4)    | 21 (7.4)      |
| 3. Do you sometimes feel as though swallowing is difficult?                      | 209 (73.9)    | 65 (23.0)    | 9 (3.2)       |
| 4. Do you sometimes feel as though it is difficult to eat something hard?        | 139 (49.1)    | 106 (37.5)   | 38 (13.4)     |
| 5. Does food sometimes spill out of your mouth?                                  | 185 (65.4)    | 83 (29.3)    | 15 (5.3)      |
| 6. Do you sometimes choke during your meals?                                     | 165 (58.5)    | 109 (38.5)   | 9 (3.2)       |
| 7. Do you sometimes choke when you drink liquid such as tea?                     | 169 (59.7)    | 106 (37.3)   | 8 (2.8)       |
| 8. Are there times when the things you swallowed flow back into your nose?       | 259 (91.5)    | 23 (8.1)     | 1 (0.4)       |
| 9. Does your voice sometimes change after eating or drinking?                    | 255 (90.1)    | 25 (8.8)     | 3 (1.1)       |
| 10. Does sputum form in your throat during meals or after eating or drinking?   | 208 (73.5)    | 63 (22.3)    | 12 (4.2)      |
| 11. Do you sometimes feel as though food gets stuck in your chest?               | 211 (74.6)    | 62 (21.9)    | 10 (3.5)      |
| 12. Are there times when food or a sour fluid flows back from your stomach toward your throat? | 214 (75.3) | 66 (23.3) | 4 (1.4) |
dysphagia symptoms were feeling as though it is difficult to eat something hard, choking during meals, choking while drinking liquids, and feeling as though having a meal is more time-consuming than it used to be.

**Association Between Tongue Pressure and Dysphagia Symptoms:**

The results of the analysis of the association between tongue pressure and 12 dysphagia symptoms are presented in Table-2. Tongue pressure was significantly associated with occasional food spillage from the mouth and sputum formation in the throat during meals or after eating or drinking (p < 0.05). The results of the further analysis of the two variables that showed significant differences are presented in Table-3. Participants whose answer to these two questions was “Often” had a significantly lower tongue pressure than those who answered “Never” or “Sometimes” (p < 0.05).

**Table-2: Association between tongue pressure and dysphagia symptoms (N = 283)**

| Dysphagia symptoms                                                                 | p   |
|------------------------------------------------------------------------------------|-----|
| 1. Do you sometimes have a fever?                                                  | 0.37|
| 2. Do you feel as though having a meal is more time-consuming than before?         | 0.75|
| 3. Do you sometimes feel as though swallowing is difficult?                        | 0.92|
| 4. Do you sometimes feel as though it is difficult to eat something hard?           | 0.95|
| 5. Does food sometimes spill out of your mouth?                                     | .02*|
| 6. Do you sometimes choke during your meals?                                        | 0.57|
| 7. Do you sometimes choke when you drink liquid such as tea?                       | 0.23|
| 8. Are there times when the things you swallowed flow back into your nose?         | 0.72|
| 9. Does your voice sometimes change after eating or drinking?                      | 0.33|
| 10. Does sputum form in your throat during meals or after eating or drinking?      | .01*|
| 11. Do you sometimes feel as though food gets stuck in your chest?                 | 0.53|
| 12. Are there times when food or a sour fluid flows back from your stomach toward your throat? | 0.52|

- One-way analysis of variance
- *: p < 0.05

**Table-3: Association between tongue pressure and dysphagia symptoms showing significant differences in the one-way analysis of variance (N = 283)**

| Dysphagia symptoms [tongue pressure: kPa]            | SEM  | p   |
|-----------------------------------------------------|------|-----|
| Food sometimes spills out of the mouth              |      |     |
| Often [16.64]                                       |      |     |
| Never [23.20]                                       | 2.63 | 0.04|
| Sometimes [24.50]                                    | 2.75 | 0.01|
| Sputum forms in the throat during meals or after eating or drinking |      |     |
| Often [15.24]                                       |      |     |
| Never [23.81]                                       | 2.91 | 0.01|
| Sometimes [22.83]                                    | 3.08 | 0.04|

SEM: standard error of mean
- Tukey test
- *: p < 0.05
Tongue pressure was associated with food spillage from the mouth and sputum formation in the throat during meals or after eating or drinking.

**Conflict of Interest**

The author has read and approved the final version of the manuscript. The author has no conflicts of interest to declare.

**References**

[1] Tulunay-Ugur OE, Eibling D. Geriatric dysphagia. Clinics in geriatric medicine. 2018;34(2):183-89.
[2] Abu-Ghanem S, Chen S, Amin MR. Oropharyngeal dysphagia in the elderly: Evaluation and prevalence. Current Otorhinolaryngology Reports. 2020 Mar;8(1):34-42.
[3] Pu D, Murry T, Wong MCM, Yiu EML, Chan KMK. Indicators of Dysphagia in Aged Care Facilities. J Speech Lang Hear Res. 2017 Sep 18;60(9):2416-26. [PMID: 28806819]
[4] Chen S, Cui Y, Ding Y, Sun C, Xing Y, Zhou R, Liu G. Prevalence and risk factors of dysphagia among nursing home residents in eastern China: a cross-sectional study. BMC Geriatr. 2020 Sep 17;20(1):352. [PMID: 32943011]
[5] Morisaki N. Relationship between swallowing functions and health-related quality of life among community-dwelling dependent older individuals. Jpn J Nurs Sci. 2017 Oct;14(4):353-63. [PMID: 28244651]
[6] Namasivayam-MacDonald AM, Morrison JM, Steele CM, Keller H. How Swallow Pressures and Dysphagia Affect Malnutrition and Mealtime Outcomes in Long-Term Care. Dysphagia. 2017 Dec;32(6):785-96. [PMID: 28733775]
[7] Miura H, Kariyasu M, Yamasaki K, Arai Y. Evaluation of chewing and swallowing disorders among frail community-dwelling elderly individuals. J Oral Rehabil. 2007 Jun;34(6):422-27. [PMID: 17518976]
[8] TSUGA K, YOSHIDA M, URABE H, HAYASHI R, YOSHIKAWA M, UTANOHARA Y, MORIKAWA H, AKAGAWA Y. Effect of General Condition and Tongue Pressure on Meal Form Selection for Elderly Care Recipient. Journal of Japanese Society for Mastication Science and Health Promotion. 2004 Nov;30(12):82-87.
[9] Palmer JB, Rudin NJ, Lara G, Crompton AW.
Citation: Naoko M. Relationship Between Tongue Strength and Dysphagia Symptoms in Japanese Older Adults in Need of Care. J Health Care and Research. 2021 Nov 15;2(3):170-75.

Original Article

Coordination of mastication and swallowing. Dysphagia. 1992;7(4):187-200. [PMID: 1308667]

[10] McConnel FM, Cerenko D, Mendelsohn MS. Manofluorographic analysis of swallowing. Otolaryngol Clin North Am. 1988 Nov;21(4):625-35. [PMID: 3186255]

[11] Kennedy D, Kieser J, Bolter C, Swain M, Singh B, Waddell JN. Tongue pressure patterns during water swallowing. Dysphagia. 2010 Mar;25(1):11-19. [PMID: 19568810]

[12] Tamine K, Ono T, Hori K, Kondoh J, Hamanaka S, Maeda Y. Age-related changes in tongue pressure during swallowing. J Dent Res. 2010 Oct;89(10):1097-101. [PMID: 20530725]

[13] Peng CL, Jost-Brinkmann PG, Miethke RR, Lin CT. Ultrasonographic measurement of tongue movement during swallowing. J Ultrasound Med. 2000 Jan;19(1):15-20. [PMID: 10625185]

[14] Clark HM, Henson PA, Barber WD, Stierwalt JA, Sherrill M. Relationships among subjective and objective measures of tongue strength and oral phase swallowing impairments. Am J Speech Lang Pathol. 2003 Feb;12(1):40-50. [PMID: 12680812]