

## Efficacy of Swallowing in Young Adults and Geriatric Population for 10 ML Thick Liquid (Honey)

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Received: April 21, 2021

Published: May 15, 2021

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### Abstract

**Introduction:** Presbyphagia is characterized by alterations in the anatomical and physiological aspects of swallowing that are a result of ageing in otherwise healthy older adults. Differentiation between dysphagia and presbyphagia is essential to avoid misdiagnosis and over treating by professionals.

**Aim of the Study:** The aim of the current study was to provide quantitative measures which can reflect the age-related changes in the swallowing mechanism by comparing swallowing efficacy of young adults and older adults of a thick liquid (honey) swallow.

**Subjects:** A total of 40 adults, 20 young adults (10 M and 10 F) and 20 older adults (10 M and 10 F), were included in the study.

**Method:** All the participants were given 10 mL honey and were asked to swallow in a routine manner. The parameters monitored were: a) Oral Transit Time (OTT), b) Number of Swallows, c) Volume per Swallow (VPS), d) Time per Swallow (TPS) and e) Swallow Capacity (SC).

**Results:** Swallowing capacity, volume per swallow and time per swallow yielded better results in young adults than in older adults with males performing better in both the groups. Mean oral transmit time (OTT) and number of swallows were also better in young adults than geriatrics ( $p < 0.05$ ). Overall, young adults showed better efficacy than geriatrics. It is important to consider the influence of age-related changes in an elderly individual before reaching a diagnosis and carrying out rehabilitation of geriatrics with swallowing dysfunction.

**Keywords:** Oral Transit Time (OTT); Volume Per Swallow (VPS); Time Per Swallow (TPS); Swallow Capacity (SC)

### Introduction

As age progresses, the anatomical and physiological alterations related to the swallowing mechanism emerge [1]. Few changes that are evident with ageing are dehydration of the laryngeal mucosa, ossification of the hyoid bone along with thyroid and cricoid cartilages, flaccidity and bowing of the vocal folds, atrophy of intrinsic laryngeal muscles, and loss of elasticity of laryngeal ligaments [9]. Additional changes that can be observed are impaired control and transport of the bolus, increased effort in swallowing, decreased pharyngeal swallow initiation, impaired pharyngeal clearance and crico-pharyngeal opening and reduced oesophageal peristalsis, reduced muscular strength and reduced muscular reserve [1-3]. Ad-

ditionally, anatomical and functional differences such as a smaller cross-sectional area of masseter and medial pterygoid muscles, altered muscle activity of the masseter, orbicularis oris, the supra- and infra-hyoid muscles and the thyroarytenoid muscle, an increased lingual atrophy are also seen. Shorter distance between C2 and C4 as compared to that of young adults has also been reported in literature which in turn can lead to reduced vertical and anterior hyoid movement. Presbyphagia or the anatomical and physiological alteration in the swallowing mechanism with progress in age can influence susceptibility to dysphagia, dehydration, malnutrition, and aspiration and can be explained by the reduced strength and range of motion of muscles in the oral cavity and aerodigestive system [7].

Swallowing patterns vary with age even in absence of pathological conditions, hence the performance of geriatrics and young adults on swallowing thick liquid consistency can provide with the quantitative measures which can reflect age-related changes in the swallowing mechanism. The study will define the differences between young adults and geriatrics in terms of swallow efficacy and it will facilitate in establishing a foundation of normative data for diagnosis and treatment of dysphagia.

### Aim of the Study

The present study aimed to conduct a comparative analysis of efficacy of swallowing in older adults and young adults with a thick liquid (honey) swallow.

### Objectives of the Study:

- To evaluate the influence of age in swallowing performance among young adults and healthy geriatrics.
- To evaluate the swallowing performance of healthy young adults with respect to gender.
- To evaluate the swallowing performance of healthy geriatrics with respect to gender.

### Methods

#### Subject selection

A total of 40 adults, 20 young adults (10M and 10F) and 20 older adults (10M and 10F), were included in the study. They were divided into two groups, with Group A comprising of 20 young adults and Group B comprising of 20 older adults. The age requirement for inclusion in Group A was between 20 - 30 years of age and participants who were between 60 - 70 years old were included in Group B. Additional criteria for inclusion was that all the participants were required to have normal structural and adequate functional swallowing mechanism along with being oriented, alert and providing consent to undergo the tests in the study. Any individual with speech and language issues, cognitive deficits, neurological problems, diabetes, H/O surgery at the level of oral cavity, pharynx or larynx and any other complications related to the swallowing mechanism were excluded.

#### Procedure

All the participants were seated comfortably and were given 10 mL honey to swallow at a comfortable, routine pace. Participants were observed for any evident difficulty or delay in swallowing. Oral Transit Time (OTT) was measured using a stopwatch. The timer was started when the cup touched the bottom lip and was stopped when the swallow ended, characterized by stoppage in movement of the larynx along with other signs such as opening of

the mouth, exhaling etc. Number of swallows were monitored using the Four Finger Analysis [10]. The participants were instructed to swallow while the clinician placed the 1<sup>st</sup> finger on the submental muscles, the 2<sup>nd</sup> finger on the hyoid bone, and the 3<sup>rd</sup> and the 4<sup>th</sup> fingers on the thyroid cartilage.

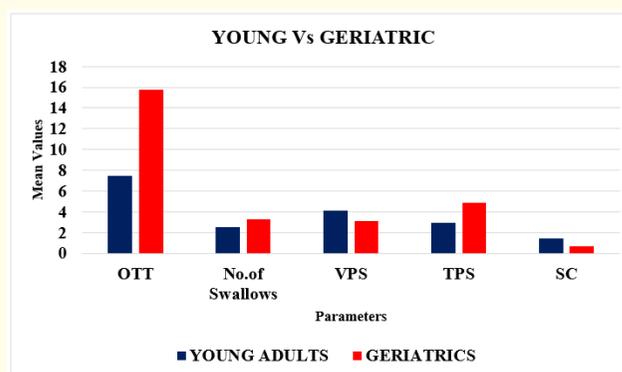
Volume per swallow (VPS) was measured using the formula: Volume per swallow = 100 mL of water/total number of swallows (mL/swallow). This measurement represented the volume of intake of honey during each swallow (represented with the unit 'mL/swallow'). Time per swallow (TPS) was measure using the formula: Time per swallow = total time taken to swallow 100 mL of water in seconds/total number of swallows (sec/swallow). This parameter represented the mean time for 1 hyolaryngeal movement in the swallowing process (measured in sec/swallow). Swallow Capacity (SC) was measured using the formula: Swallow capacity = 100 mL of water/time taken to swallow 100 mL of water (mL/sec). This parameter represented the time taken to swallow 10 mL honey (represented with the unit mL/sec).

### Statistical analysis

Statistical analysis was done using the SPSS software. Mean values and standard deviation was determined for each parameter. An independent t-test was also carried out.

### Results

The study yielded better results in young adults than older adults among SC, VPS, and TPS with males performing better in both the groups. The OTT and No. of swallows were better in young adults than geriatrics ( $p < 0.05$ ). The mean differences of all 5 parameters across the age groups (young adult vs geriatrics) are illustrated in figure 1. Table 1 shows the mean, SD, t-value and p-values of different parameters across the age (young adult vs geriatrics).

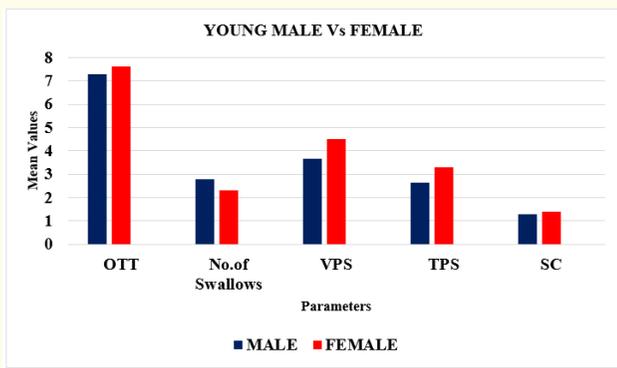


**Figure 1:** Comparison of the average values of five different parameters (OTT, No. swallows, VPS, TPS and SC) of young adults vs geriatrics.

Parameters	Young adults		Geriatrics		t-value	p-value
	Mean	SD	Mean	SD		
OTT	7.4445	1.64565	15.7535	.96962	-19.454	.000*
No. S	2.5500	.51042	3.2500	.44426	-4.626	.000*
VPS	4.0815	.85240	3.1250	.37022	4.603	.000*
TPS	2.9753	.60011	4.9031	.49646	-11.070	.000*
SC	1.40237	.11422	.6371	.03911	21.364	.000*

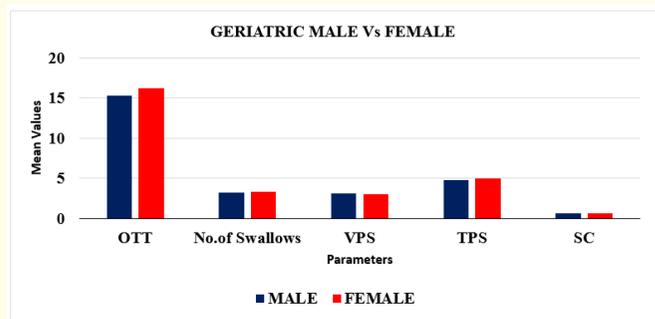
**Table 1:** Mean, standard deviation, p-value, and t-value of independent t-test of young adults vs geriatric across the five parameters (OTT, No. swallows, VPS, TPS and SC).

Young males showed a better OTT than females. The mean time was found to be less in males than in females although not statically significant. Females had less No. of swallows with mean values better in females than males in both groups ( $p < 0.05$ ). Results for VPS and TPS were found to be better in males ( $p < 0.05$ ). There is no significant difference in SC in both genders. Figure 2 and table 2 shows the average, mean, SD, t-value and p-value of young male vs female group.



**Figure 2:** Comparison of the average values of five different parameters (OTT, No. Swallows, VPS, TPS and SC) of Young males vs females.

Geriatric males presented with better OTT and SC than females. The mean time and SC was found to be better in males than females ( $p < 0.05$ ). Results for VPS, TPS and No. of swallows show better performance by males than females although not statically significant. Figure 3 and table 3 shows the average, mean, SD, t-value and p-value of geriatric male vs female group.



**Figure 3:** Comparison of the average values of five different parameters (OTT, No. of swallows, VPS, TPS and SC) of geriatric male vs female.

Parameters	Male		Female		t-value	p-value
	Mean	SD	Mean	SD		
OTT	7.2860	1.47120	7.6030	1.87002	-.421	.679
No. S	2.8000	.42164	2.3000	.48305	2.466	.024*
VPS	3.6640	.70413	4.4990	.80669	-2.466	.024*
TPS	2.6475	.62179	3.3030	.36735	-2.870	.010*
SC	1.2683	.03733	1.3770	.06235	-1.834	.083

**Table 2:** Mean, standard deviation, p-value, and t-value of independent t-test of young male vs female across the five parameters (OTT, No. Swallows, VPS, TPS and SC).

Parameters	Male		Female		t-value	p-value
	Mean	SD	Mean	SD		
OTT	15.2770	.88022	16.2300	.83991	-2.477	.023*
No. S	3.2000	.42164	3.3000	.48305	-.493	.628
VPS	3.1667	.35136	3.0833	.40254	.493	.628
TPS	4.8173	.41280	4.9890	.57753	-.765	.454
SC	.6565	.03768	.6176	.03111	2.520	.021*

**Table 3:** Mean, standard deviation, p-value, and t-value of independent t-test of geriatric males vs females across the five parameters (OTT, No. of swallows, VPS, TPS and SC).

Despite the difference in results among genders within the groups, young adults performed better in all five parameters than geriatrics ( $p < 0.05$ ).

### Discussion

Anatomical and Physiological alterations of the swallowing mechanism with age hinder an efficient swallow. It is essential to differentiate between a reduced efficacy of swallow in a healthy older adult and dysphagia in order to avoid mis-diagnosis and rehabilitation. The current study focused on evaluating five parameters related to swallowing thick liquids between young and older adults: a. Oral Transit Time (OTT), b. Number of Swallows, c. Volume per Swallow (VPS), d. Time per Swallow (TPS) and e. Swallow Capacity (SC).

The results of the current study are similar to the ones in a study conducted by Yoshida FS., *et al.* (2015). The study examined the influence of mastication on swallowing in healthy geriatrics and discovering a relation between mastication time and swallowing classification, concluding that the longer the time of mastication, the bigger the level of dysfunctional swallowing in elderly. However, mastication type and bolus formations did not have an influence on oropharyngeal swallowing [15].

These findings were extended by Zainab Ismail (2019), in a comparative analysis between young adults and geriatrics in the swallow capacities. The results suggested a significant variation among the swallowing capacity and time per swallow among the two groups. Similar results were concluded from the current study among swallowing efficacies of young and older adults for thick liquids.

However, potential limitations to the study should be noted. The numbers of subjects included in the study are limited and hence the concluded values cannot be generalized. The study also takes into consideration two distinct age group ranges. Having multiple

age ranges along with more variables with respect to intake consistencies can provide a more detailed baseline of swallowing efficacy related to age.

### Conclusion

The findings of the study demonstrate that 10 mL swallow test for thick liquids (honey) can be a tool to identify and monitor swallowing efficiency. This study shows the importance of considering the influence of age-related changes in elderly individuals before reaching a diagnosis and carrying out rehabilitation of geriatrics with swallowing dysfunction.

### Clinical Implication:

- Age related changes in the swallowing mechanism should be considered by professionals prior to concluding a diagnosis and a treatment plan of geriatrics with swallowing dysfunction.
- Age related changes in the swallowing mechanism can be reflected through parameter of oral transit time, swallowing capacity, volume per swallow, and time per swallow.
- OTT, VPS, TPS, SC and No. of swallows can be used for assessment and management of geriatric patients with dysphagia.

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### Volume 3 Issue 6 June 2021

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