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An Examination of Daily Dietary Intake and Swallow Function in an Older Adult Population

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An Examination of Daily Dietary Intake and Swallow Function in an Older Adult Population

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Introduction

During the process of normal aging, structures such as the larynx may change and functions such as swallowing may be altered (Ergun & Miskovitz, 1992). More specifically, as the structures of the swallowing mechanism advance in age there is a loss in muscle strength and range of motion that negatively impact the reciprocal relationship of breathing and swallowing that serves as a function of the aerodigestive tract (Fucile et al., 1998; Logemann et al., 2012). Many studies involving older adult participants who have suffered from neurologic events, such as a stroke or Parkinson's disease, have reported screening protocols for assessing risk of swallowing impairment (Leder, Suiter, Warner, et al., 2012). Few studies have evaluated such screening measures in older adult participants living independently in the community. One study that will serve as a linchpin for navigating the current objectives, examined individuals between the ages of 65-94 years of age who also lived independently within the community. This sample was found to have a dysphagia rate of 36.7% (Stemple et al., 2007), 12.9% of this same sample also reported subscribing to a daily nutritional supplement regimen in order to reach adequate daily caloric intake (Stemple et al., 2007). This relationship between dysphagia and decreased daily caloric intake is an impending problem with this population; however, there is a need for further investigation into effective methods to assess dysphagia rates in independent community dwellers, as well as analyze the impact of dysphagia on nutrition and overall health.

Operational Definition:

For the purpose of this study, older adult community dwellers will be defined as persons 55 years of age or older residing independently within the community. Individuals who reside in

assisted living facilities, skilled nursing facilities, or group homes are excluded from this definition.

Purpose:

The following study aims to determine whether older adult community dwellers modify their diets due to concerns related to changes in their swallowing function. The primary objective of this investigation is to examine the potential relationship between self-imposed dietary modifications and signs/symptoms of dysphagia as measured by a 3-ounce water swallow challenge (Leder, Suiter, Warner, et al., 2012). Signs include any physical manifestation of dysphagia or pathological condition measured by the clinician. Symptoms include any self-reported indicators that the patient identifies as a possible problem or cause for concern.

Research Supporting Dietary Changes in the Elderly:

There is reason to believe that older adult community dwellers may be self-managing dysphagia by altering their own dietary intake (e.g., avoiding problematic foods or eating softer consistencies); studies have shown that older adult individuals typically consume fewer calories per day than younger adults (Wurtman, Lieberman, Tsay, et al., 1988; Wakimoto & Block, 2001). In a study by Wurtman and colleagues (1998) men and women were subcategorized into young adult and older adults groups. Over four days, researchers monitored the amount of caloric intake received from meals and from snacks for each of the groups. The conditions for each group were held constant and the results indicated that the older adult group received 85% of caloric intake from meals whereas the young adult group received 72% from meals. The younger adult group was found to eat more snacks, specifically carbohydrate-rich snacks, which differed from the older adult group. These differences resulted in the total consumption of fewer calories per day in the older adult group when compared to the young adult group (Wurtman et al., 1988).

There is a substantial difference between the daily intake patterns of younger adults and older adult individuals as evidenced in this study. The reason for this decrease in caloric intake and changing dietary intake pattern with increasing age is still unclear. It is possible that older adult individuals recognize difficulties with swallowing function and modify their diets to make swallowing less effortful. It is also possible that there is a lack of conscious awareness of overt swallowing difficulties and individuals begin to avoid foods for reasons that are unclear to them but may be associated with an underlying swallowing impairment.

A similar study supports the notion that older adult individuals have limited nutritional intake. This study examined geriatric community dwellers with and without dysphagia and found that 18.6% of participants with dysphagia had malnutrition or were at risk for developing malnutrition and 12.3% of participants without dysphagia had malnutrition or were at risk for developing malnutrition (Serra-Prat et al., 2012). Significant differences in these two subgroups persisted at a one-year follow-up (Serra-Prat et al., 2012). There is a substantial impact of dysphagia on independent community dwellers as evidenced by the increased rate of malnutrition with a diagnosis of oropharyngeal dysphagia. This study is similar to the current study due to the nature of the cohort of participants recruited. Similar procedures were also used for data collection in this study; a volume viscosity test was administered by a physician to determine the presence or absence of oropharyngeal dysphagia, similar to the 3-ounce water swallow task from the Yale Swallow Protocol used within the present study.

Protein-Energy Malnutrition (PEM) is a serious medical condition in which a person is not adequately receiving the correct amounts of protein/ energy needed to sustain metabolic functions subsequently exposing these individuals to a higher risk of diseases and ailments in multiple body systems (including but not limited to the muscular system, immune system, etc.)

(Hudson et al., 2000). There is a direct correlation between dysphagia and PEM as evidenced in the literature discussed by Hudson and colleagues (2000) and the rate of dysphagia in the elderly is directly correlated with PEM. This occurrence of PEM in the elderly has also been correlated with increased rates of morbidity and mortality. Thus, Hudson and colleagues (2000) call for a more targeted focus on dysphagia in the elderly to prevent serious complications from PEM.

While dysphagia is often viewed as a secondary condition that is overshadowed by a primary causative condition, dysphagia requires an equal amount of attention from clinicians and physicians in elderly patients. With targeted intervention for dysphagia and nutrition, elderly individuals will have a better prognosis according to Hudson and colleagues (2000).

Additionally, Hudson and colleagues discuss a robust relationship between dysphagia and PEM that is bi-directional due to the causative nature of dysphagia resulting in PEM but also the causative nature of PEM resulting in dysphagia. Elderly individuals already suffering from PEM are at an increased risk for developing dysphagia due to the negative effects of PEM on the muscular system and the role of the muscular system in swallowing (Hudson et al., 2000). As mentioned previously, as laryngeal structures age, swallowing functions become increasingly more susceptible to impairment. PEM drastically impacts muscular function and could impact the same musculature needed for swallowing that has already been weakened by the aging process, thus causing dysphagia (Hudson et al., 2000). Furthermore elderly individuals with both PEM and dysphagia are at an increased risk for aspiration according to Hudson and colleagues (2000). With already weakened immune systems from PEM the increased rates of morbidity and mortality in the elderly population are substantiated because when bacteria filled aspirates enter the respiratory system, these individuals are unable to defend their bodies against harmful bacteria and overall health is further compromised. Thus, there are serious complications as a

result of dysphagia and PEM and both of these factors are quintessentially intertwined. The call for further investigation into these factors is apparent and the current study aims to delve deeper into the identification of dysphagia in elderly individuals of a specialized community-dwelling population.

However, it is important to acknowledge in this study that not all food avoidances occur secondary to dysphagia. In many adults, especially older adults, foods and liquids are avoided for personal reasons such as comfort, taste, texture, and preference. In a study by Savoca and colleagues (2011), data supports the idea that food avoidance is directly linked to denture wearing habits and patterns. In a cohort of 635 older adult participants, more frequent denture removal during meals was directly correlated with greater rates of food avoidance (Savoca et al., 2011). Similarly, Hildebrandt and colleagues (1997) also found a direct correlation between functional dental units (which include opposing tooth pairs) and avoidance of foods. Elderly persons over the age of 60 with less functional dental units were more likely to avoid stringy foods, crunchy foods, and dry solid foods (Hildebrandt et al., 1997). Additionally, Langmore and colleagues (1995) found that other organic factors could result in increased food avoidance in the elderly. These conditions include xerostomia, or dry mouth, and xerogenic medications, or dry mouth caused by pharmacologic interventions (Langmore et al., 1995). In this study 529 individuals over the age of 56 from institutions and the community were studied. 72% reported experiencing xerostomia at least once a day, 55% reported taking at least one xerogenic medication per day. Individuals who reported xerostomia were more likely to report avoiding dry foods, crunchy foods, and sticky foods secondary to reported trouble chewing and initiating a swallow. Researchers concluded that xerostomia affects the ability to chew and initiate a swallow and leads to increased food avoidance in older adults, which could contribute to

undernutrition in older persons (Langmore et al., 1995). Thus, there are a myriad of reasons older adults can avoid food/ liquids; however, undernutrition and malnutrition are documented as a serious concern for older adults and more research should focus on pinpointing the contributing factors that could ultimately prevent this condition from occurring in older adults.

Research Supporting the Yale Swallow Protocol:

The Yale 3-ounce Swallow Protocol is a well researched screening measure for dysphagia. This screening tool uses behavioral measures, like failure to drink consecutively or coughing during or after swallowing, to determine the risk of swallowing impairment. The protocol has been found to have a low false-negative rate of <2.0% when studied in over 4,000 participants (Leder, Suiter, Green, 2010). Not only did this study find low false-negative rates, it also found that the screening measure was more sensitive than a 10-cc screening test when evaluating patients who silently aspirate on both liquid and puree consistencies. Thus, not only can a 3-ounce water swallow challenge provide information about an individual's swallowing mechanism when swallowing liquid, it can also provide information about the swallowing mechanism holistically in terms of other consistencies. This screening measure has been studied in a group of 3,000 participants with 14 different diagnoses who were given the 3-ounce water swallow challenge task. When compared to objective swallowing measures, this screening measure was found to be 96.4% sensitive (Suiter & Leder, 2007). This study was further validated in a double-blinded study using 25 participants with varying diagnoses, including: head and neck cancer, esophageal surgery, neurosurgery, general medicine issues, and neurologic disease/ incident (i.e., CVA & TBI). Using objective videofluoroscopic evaluation as the comparison measure, the Yale 3-ounce Swallow Protocol was found to be 100% sensitive when identifying participants within the populations listed above, who were at risk for aspiration

(Suiter, Sloggy, Leder, 2013). This study found that the Yale Swallow Protocol was also 64% specific and had a positive predictive value of 78% and a negative predictive value of 100%. Most importantly, all participants who passed the Yale Swallow Protocol did not aspirate under VFSS. This demonstrates a valid and reliable screening measure (Suiter, Sloggy, Leder, 2013).

Clinical Objectives:

The current study targets an independent, older population that could potentially benefit from early intervention for swallowing impairments. Detecting dysphagia in older adult community dwellers could prevent hospitalizations due to aspiration (Cabre et al., 2010). Cabre and colleagues (2010) completed a study that examined the rates of pneumonia and dysphagia in geriatric community dwellers. Researchers found that in a sample of 134 community dwelling individuals over the age of 70 who were admitted to an acute-care hospital for pneumonia, 55% also had clinical signs of oropharyngeal dysphagia as measured by a 10ml and 30ml water swallow task with increasing difficulty (Cabre et al., 2010). Additionally, a similar study examined a sample of geriatric community dwellers and found that 40% of lower respiratory tract infection-community-acquired pneumonia cases also presented with dysphagia (Sera-Prat et al., 2012). There is a benefit to understanding decreased daily dietary intake in older adults community dwellers with the goal of improving overall health, wellness, and quality of life. The literature supports a robust relationship between dysphagia status, nutritional status, and overall health in older adult individuals. According to Crary and colleagues (2012), swallowing intervention could lead to better outcomes in the areas of dysphagia, nutritional status, overall health, and mortality rates in older adult individuals. Further exploration into the identification process of at risk individuals is needed before a comprehensive evidence-based intervention plan can be created for older adult community dwelling individuals with dysphagia.

Interdisciplinary Research Regarding Individual Community Dwellers

While each study mentioned above included a population of independent, community-dwelling individuals, it is important to note that there is still a wide variety within this population. Some older adult, independent community dwellers have higher levels of activity than other older adult, independent community dwellers. In the field of occupational therapy, researchers attempted to use screening measures of Activities of Daily Living within the geriatric community dwelling population in order to predict cognitive impairment and dementia. In a study by Barberger-Gateau and colleagues (1992), questions relating to activities of daily living directly correlated with cognitive impairment independent of other variables such as age, gender, and education status (Barberger- Gateau et al., 1992). Thus, a seemingly homogeneous sample of older adult, independent community dwellers is actually more heterogeneous upon inspection. The levels of activity a person engages in can have a direct correlation to cognitive status. It is with this caveat that the current study must operate because the same may hold true for dysphagia rates and levels of activity. There is a need for screening older adult community dwellers for activities of daily living to provide insight into multiple areas of well-being including cognition and overall functioning. The impact of activity level and impact on dysphagia is not the target of this study but should be considered in future research. The current study will provide evidence to support the need for dysphagia screening within the older adult community dwelling population.

Methods

Participants

The participants in this six- month long study included 27 females and 19 males for a total of 46 participants. All participants qualified as older adult community dwellers as defined by the operational definition for this study delineated and supported by the above literature review (see *Operational Definition*). Objectively, these participants were quantified and qualified to determine eligibility criteria. The sample of participants recruited included an age range from 56-95 with a mean of 69.5 years of age with one participant who chose not to disclose his exact age but indicated he was over the age of 55. Participants were recruited from the Mansfield Community Center and Mansfield Senior Center through flyers posted in local meeting spaces, a display table in common areas, and by word of mouth. A total of 44 participants met the inclusion criteria and two participants did not meet the inclusion criteria for the study. All participants used English as their primary language, had no prior history of dysphagia, no diagnosis of degenerative disease, no history of gastrointestinal disease, and completed Activities of Daily Living (ADL's) independently, according to participant self-report during a pre-investigative screening. In order to participate in the study, each participant was required to pass the pre-investigative screening. A waiver of signed consent was obtained for this pre-investigative measure as to not misuse the time of potential participants who did not meet the inclusion criteria. The two potential participants who did not pass the screening, according to the categories listed above, were thanked for their time and dismissed from the study. Data was not collected on these participants who failed the pre-investigative screening.

Materials

The investigators used a study-specific questionnaire for the purpose of this research. The questionnaire was designed to include a series of open-ended and closed-ended questions to gather information regarding participant demographics and participant daily dietary intake.

Participants were required to respond to open-ended questions such as “describe a typical breakfast including all solids and liquids” and closed-ended questions such as “circle the number of meals you typically eat per day: 1, 2, 3, 4, 5+.”

Researchers also used the Yale Swallow Protocol to screen for the possibility of dysphagia. The Yale Swallow Protocol is an extensively researched screening measure for dysphagia as evidenced in the above supporting literature. The measure includes a brief assessment of confounding factors wherein the administrator observes alertness and assesses the patient for the presence or absence of a tracheostomy tube and/or a feeding tube, and notes any head of bed restrictions, consumption of thickened liquids, or nil per os (nothing by mouth) orders from a physician. For the purpose of this study, all participants were directly asked about the presence or absence of feeding tubes and whether or not they thickened their liquids at home. Due to the environment of the study, participants were able to independently walk into the facility where the study was conducted, thus, head of bed restrictions were not a factor and not directly asked. The researchers also observed the participants for the presence or absence of tracheostomy tubes, although that was not a direct question asked of the participants. If the participants responded no to these areas, a brief cognitive and oral mechanism screening were performed as part of the Yale Swallow Protocol. For the cognitive screening measure, the participants were asked questions to determine orientation status including their name, their current location, and the current year. For the oral mechanism screening, participants were assessed for labial range of motion (ROM) and asked to pucker and smile. Other structures of the oral mechanism were assessed through natural observation during unstructured conversation. The Yale Swallow Protocol screening utilizes a 3-ounce cup and thin-liquid water to assess swallowing function. Participants were instructed to drink 3-ounces of water from the cup

continuously without breaks or interruptions of drinking. Participants who showed behavioral signs of penetration/aspiration (i.e., coughing, or throat clearing) before, during, or after the swallow failed the screening and/or participants who were unable to drink continuously using consecutive swallows also failed the screening.

Procedures

To preserve confidentiality, each participant was assigned a random number between 1-100 prior to the pre-investigative screening. After participants passed the pre-investigative screening and were deemed to meet all inclusion and exclusion criteria for the study, informed consent was obtained. After the informed consent process, participants responded to the study-specific questionnaire. The participant number served to identify the results of the questionnaire and the results of the swallowing screening task. Following successful completion of the questionnaire, the Yale Swallow Protocol was administered according to screening procedures. Participants were assessed for exclusion criteria specific to the Yale Swallow Protocol screening measure, including presence of a tracheostomy tube or feeding tube. If participants met the criteria to continue the screening, a brief cognitive screen and oral mechanism screen were completed. The results of the cognitive and oral mechanism screenings did not exclude or include anyone from further participation due to the guidelines outlined in the Yale Swallow Protocol where cognition cannot be used to predict performance on this dysphagia screening measure. This information was solely collected for qualitative analysis. Finally, participants were asked to continuously drink 3-ounces of water. Behavior before, during, and after drinking water was assessed and the investigator subsequently assigned a pass/fail score. Following the 3-ounce water-screening task, participants were debriefed on the study. Participants who failed the study were offered a free, full dysphagia assessment at a local university clinic. This assessment was

optional and results of these evaluations were not included in this study but could inform directions for future studies.

Following data collection, statistical analysis was performed. Originally, spearman rank correlation was chosen in order to determine the relationship, if any, between foods/ liquids avoided and performance on the 3-ounce water swallow challenge. Because there was no pre-existing assumption based on the relationship of these variables, Spearman rank correlation was the most appropriate analysis. Due to the nature of correlational research, one would expect less variability with a larger sample size. However, due to the limited sample size and small failure rate, this analysis was not performed. Other measures of descriptive data were selected to best represent the data and unique sample of participants for this study. These descriptive data analyses include direct comparisons of means and percentages between subjects. The between-subjects measures approach to data analysis was used to highlight differences between sub-groups of the sample according to performance on each task. Some within-groups comparisons were also drawn to define differences in participant self-reporting with objective performance measures on individual tasks.

Results

A total of 44 participants successfully completed the study and were included in the data analysis. Due to the limited sample size, a correlational measure between failure on the Yale Swallow task and avoidance of solids and/or liquids may not accurately represent the population. In order to better characterize the cohort studied, data from all screening procedures collected will be reviewed.

Demographic Information

Table 1 displays averages of demographic information by gender for participants who passed the Yale Swallow task. Averages were obtained for age and average number of meals per day. Percentage values were calculated for number of participants who passed the orientation questions and the oral mechanism-screening task.

Gender	Number of Participants	Average Age	Average Meals/ day	Percentage Avoid Solids	Percentage Avoid Liquids	Orientation	Oral Mechanism
<i>Female</i>	23	68.4	3.0	22%	22%	100%	100%
<i>Male</i>	17	68.1	3.2	6%	35%	100%	100%

Note. This data was collected over a 6 month period at two different locations (a Senior Center and a Community Center). All participants were independent community dwellers with no prior history of dysphagia. Age, gender, and average number of meals per day were self-reported by participants on a questionnaire. Orientation, oral mechanism screening, and Yale Water Swallow Protocol task were assessed by a trained graduate student clinician. For average number of meals, a close-ended question was required with the choices of 1, 2, 3, 4, 5+. Two participants in the male group indicated a choice of 5+. This data was analyzed as 5 for the averages listed in this table.

The demographic information of the participants who failed the Yale Swallow screening task are detailed in Table 2. This table includes a list of the participants' age, gender, and performance on orientation questions and oral mechanism screening. It is important to note that each participant is identified by a random number to preserve confidentiality.

Participant No.	Age	Gender	Average Meals/ day	Orientation	Oral Mechanism	Yale Water Swallow Protocol
75	82	Male	3	Pass	Pass	Fail
41	83	Female	2	Pass	Pass	Fail
80	68	Female	4	Pass	Pass	Fail
40	95	Female	3	Fail	Pass	Fail

Note. This data was collected over a 6 month period at two different locations (a Senior Center and a Community Center). All participants were independent community dwellers with no prior history of dysphagia. Age, gender, and average number of meals per day were self-reported by participants on a questionnaire. Orientation, oral mechanism screening, and Yale Water Swallow Protocol task were assessed by a trained graduate student clinician. Participant numbers were assigned randomly and do not hold value.

Overall, there were three females and one male who failed the Yale Swallow screening task. The ages of the participants ranged in age from 68-95 with a mean of 82 years of age,

which is significantly higher than the mean of the entire sample for this study (69.5 years of age). The average number of meals consumed each day ranged from 2-4 with an average of 3 meals per day. Three of four participants passed the orientation questions. A pass is indicated by answering all 3-orientation questions correctly; oriented to person, location, and time. A fail is indicated by oriented to two or fewer.

Cognitive Screening

The results of the cognitive screening portion of the Yale Swallow Protocol are illustrated in Table 3. While the pass rate for orientation was high in this study, the single participant who failed the Yale Swallow Protocol task and also failed the orientation screening provides informative insight. This participant was asked to participate in the study by her daughter who accompanied her that day. Her daughter had concerns for her mother's swallowing safety at home and noticed increased coughing during meals. Although this woman lived independently and relied on her daughter for minor support, it was suspected that she was unable to swallow safely on her current diet consistency. Additionally, this participant had a history of a Zenker's Diverticulum. She indicated a history negative for gastrointestinal disease during the pre-investigative screening measure but reported this condition during the significant past medical history section of the study questionnaire. The reported medical history is further detailed in table 7. In the case of this participant, the failure on the cognitive screening measure and failure on the Yale Swallow Protocol task would indicate a need for a more thorough assessment for dysphagia and potential diet consistency modifications.

Table 3. Percentage of Patients Oriented related to Performance on Yale Water Swallow Protocol task	
	% of Participants Oriented
<i>Passed Yale Water Swallow Task</i>	100%
<i>Failed Yale Water Swallow Task</i>	75%
<i>Total for all participants</i>	98%

Note. These percentages are based on n= 44. Caution should be applied when interpreting results based on a the limited sample size. Additional data to support these trends can be found in the supporting literature provided.

Oral Mechanism Screening

Table 4 illustrates the pass rate of the brief oral mechanism screening as a function of pass/fail status on the Yale Swallow Protocol task. A pass was indicated by the ability to pucker and smile with full range of motion and symmetry, as well as no overt signs/ symptoms of weakness during natural conversation.

Table 4. Percentage of Patients who Passed the Oral mechanism Screening related to Performance on Yale Water Swallow Protocol task	
	% Pass on Oral Mechanism Screening
<i>Passed Yale Water Swallow Task</i>	100%
<i>Failed Yale Water Swallow Task</i>	100%
<i>Total for all participants</i>	100%

Note. These percentages are based on n= 44. Caution should be applied when interpreting results based on a the limited sample size. Additional data to support these trends can be found in the supporting literature provided.

Dietary Avoidances

The avoidance of foods and liquids were tallied for participants according to pass/ fail rate on the Yale Swallow Protocol. These results are detailed below in table 5. While a direct association cannot be drawn between dysphagia and avoidance of certain foods or consistencies with the limited sample size, this self-reported information provides insight into the self-imposed dietary restrictions of older adults community dwellers. Participants who failed the Yale

Swallow Protocol task were more likely to avoid liquids than the participants who passed; however, they were less likely to report avoiding any solids. A total of 0 out of the 4 participants who failed the water-swallowing task reported avoiding solids. These measures can be viewed below in table 5.

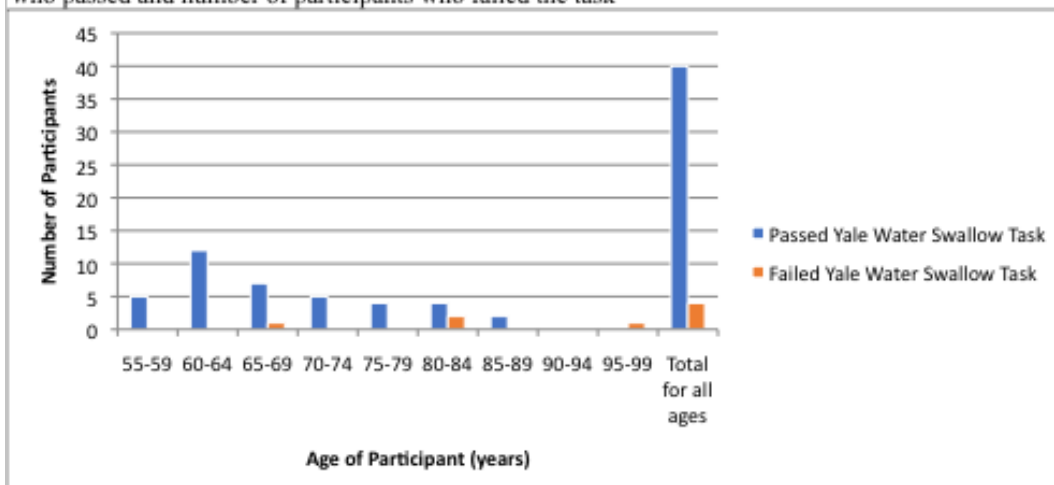
	Percent Avoid Solids	Percent Avoid Liquids
<i>Passed Yale Water Swallow Task</i>	15%	28%
<i>Failed Yale Water Swallow Task</i>	0%	50%
<i>Total for all participants</i>	15%	30%

Note. These percentages are based on n= 44. Caution should be applied when interpreting results based on a the limited sample size. Additional data to support these trends can be found in the supporting literature provided.

Yale Swallow Protocol

The summary of results of the Yale Swallow Protocol as a function of age is listed in Figure 1. This is a direct measure of performance on the 3-ounce water swallow challenge task. These results are inconsistent with the current literature; however, this could be due to a limited sample size or a robust sample. These inconsistencies are explored further in comparison to the existing literature in the discussion section.

Figure 1. Results of the Yale Water Swallow Protocol as measured by age and number of participants who passed and number of participants who failed the task



Note. The total for all ages represents the total for all participants who completed the study. This total does not match the number of participants listed in the breakdown of pass/fail results by ages due to the fact that one participant chose not to specify his age. Thus the number of participants listed in the breakdown of ages totals 39 for pass but the overall total for the study was 40.

Significant Medical History

Table 6 details the percentage of participants who listed a significant medical history/condition. For the purposes of this study, each medical condition was summarized into major categories of disorder, including: cardiovascular, pulmonary, neurological, orthopedic, muscular, ocular, endocrine, gastrointestinal, reproductive, cancer, and other. The NSMH category represents participants who did not indicate any significant medical history. Of significance, it is important to acknowledge the differences between the percentages of reported muscular conditions in the Yale water swallowing task failure group and the Yale water swallowing task pass group. A higher percentage of muscular impairments was reported in the failure group than in the passing group. This could be linked to the impairment of swallowing musculature that is integral for swallowing function as mentioned in the above supporting literature.

Table 6. Medical Condition as a function of performance on Yale Water Swallow Protocol

Medical Condition	Percent Reported Passed Yale Water Swallow Task	Percent Reported Failed Yale Water Swallow Task	Total Percent Reported
<i>Cardiovascular</i>	15%	25%	16%
<i>Pulmonary</i>	8%	0%	8%
<i>Neurologic</i>	3%	0%	3%
<i>Orthopedic</i>	30%	75%	34%
<i>Muscular</i>	5%	25%	7%
<i>Ocular</i>	8%	25%	9%
<i>Endocrine</i>	10%	0%	10%
<i>Gastrointestinal</i>	20%	75%	25%
<i>Reproductive</i>	18%	50%	20%
<i>Cancer</i>	13%	50%	16%
<i>Other</i>	8%	0%	8%
<i>NSMH</i>	25%	0%	25%

Note. Each condition was assessed individually so each presentage is representative of the entire sample of participants who passed the Yale Water Swallow task. Participants who listed multiple conditions were counted in each category. Participants who listed multiple conditions within the same category were only counted once for that category.

Table 7 illustrates the medical conditions listed by the participants who failed the Yale Swallow Protocol. These medical conditions are listed side by side with self-reported avoidance of solids and liquids for the purposes of comparison.

Table 7. Avoidance of Solids and Liquids and Significant Medical History for Participants who Failed the Yale Water Swallow Protocol						
Participant No.	Gender	Age	Avoid Solid	Avoid Liquid	Reason for Avoiding	Significant Medical History
75	Male	82	No	Yes	Taste Preference	Prostate Removal, Hernia
41	Female	83	No	No	N/A	Hip Replacement, Breast Cancer, Bleeding Operation (unspecified), cataract surgery x2
80	Female	68	No	Yes	Carbonated drinks lead to gas and are too sugary	Total knee replacement, both shoulder rotator cuff, sleeve gastrectomy, hiatal hernia repair
40	Female	95	No	No	N/A	Cancer, Goiter, Diabetes, Zenkers Diverticulum, Knee Surgery

Two out of the four participants who failed the Yale Swallow Protocol task, reported a history of hernia(s). 3 out of the 4 participants listed orthopedic surgeries. No other commonalities were discovered among medical history between these participants. Two of the four participants indicated that they avoided liquids. One participant listed a taste preference and the other participant indicated that carbonated drinks lead to increased gas and are too sugary. No participant listed swallowing difficulty as a reason for avoidance in this subgroup of the participant pool; however, as previously discussed the one participant who failed the cognitive

screening measure and the water swallowing task also reported a history of a Zenker's Diverticulum despite responding negatively to a history of gastrointestinal disease or impairment during pre-investigative screening.

Discussion

The literature reviewed discusses a robust relationship between age and dysphagia and age and nutritional status (Cabre et al., 2010; ...Hudson et al., 2000). The results of the current study did not reveal similar trends, due in part to the limited sample size; however, the descriptive data provide a foundation for further research. The current study yielded a 9 percent failure rate (4/44 participants) on the Yale Swallow Protocol measure; however, conservative estimates of dysphagia prevalence in the older adult population indicate a rate of approximately 15 percent according to Crary and colleagues (2012). More specifically, estimates of dysphagia prevalence in older adult community dwellers range from 13-38 percent or 36.7% respectively (Crary et al., 2012; Stemple et al., 2007). These estimates of prevalence were higher than that which was noted in the current study. The 9 percent rate observed may have been the result of a confounding factor within the participant sample. The participants in the current study included individuals that may have represented a more active and healthy subset of older adults community dwellers. The community center, where many participants were recruited, includes a series of workout classes designed for older adults individuals, as well as exercise facilities for these individuals to utilize independently. Other participants were also recruited from a senior center where individuals participate in classes, clubs, and day trips. Additionally, most of the participants for the current study drove themselves to the locale each day. Thus, the data may have been skewed in favor of a more active subset of older adults community dwellers and thus atypical of the older adults population as a whole. While this information cannot be known with

certainty, due to the limited sample size, it is worth examining in future research studies in order to determine if the degree of physical activity or performance, on an activities of daily living screening, in older individuals may impact the rate of dysphagia.

Additionally, the pass rate on the cognitive screening measure in the present study was higher than expected according to the existing literature. In a retrospective study inclusive of over 4,000 participants, aspiration risk was greater for individuals not oriented to person place and time, as well as patients who were unable to follow single-step commands (Leder & Suiter, 2014). These results are consistent with the trend in the current study; however, with a larger sample size, one would expect to see a greater degree of correlation between these two variables. According to Leder and colleagues (2014), a clinician should consider performance on the cognitive screening, oral mechanism exam, and water swallow challenge task prior to recommending oral diets. It is with consideration of all three factors that clinicians should base their recommendations for diet consistencies.

Of note, the present study did accomplish the clinical objective set forth by the researchers. The purpose of this study was to examine the relationship between self-imposed dietary restrictions and performance on a 3-ounce water-swallowing task. The data for the participants who passed the Yale Swallow Protocol task possesses great insight into this targeted relationship. The passing group reported avoidance of some solids (15%) and some liquids (20%) as compared to the group that failed, which reported no avoidance of solids (0%) and more avoidance of liquids (50%). It is possible that avoiding some solids and some liquids demonstrates good insight into dietary needs and limitations. Just as Hudson and colleagues (2000) discusses, dysphagia and PEM are bi-directionally related (Hudson et al., 2000). A more detailed picture of the solids and liquids avoided by the passing group may reveal that they

avoided less nutritious foods and overall their nutritional status was better than those in the failing group. It may benefit patients who have dysphagia to avoid certain foods and liquids to improve overall nutritional status and ultimately improve their dysphagia. Additionally, this avoidance pattern between participants who passed the screening and participants who failed the screening should be taken into context with the results of reported muscular conditions. As mentioned in the literature, presbyphagia is the result of aging musculature and physiological changes to the swallowing mechanism (Ergun & Miskovitz, 1992). The increased rate of reported muscular impairments in the failure group as compared to the passing group could indicate that the muscular impairments may have extended to the swallowing mechanism and ultimately contributed to a decline in swallowing function. While the current study only provides preliminary evidence to support these findings, further investigation into this relationship can be explored in the context of dysphagia and nutritional status in future research. However, the avoidance of solids and liquids must also be considered in the context of oral health and other organic factors that contribute to food avoidances. Food and liquid avoidance does not necessarily indicate the presence or absence of dysphagia; rather, food avoidance could be the result of a texture preference or other organic factor as mentioned in Langmore and colleagues (1995) and Hildebrant and colleagues (1997) (Langmore et al., 1995; Hildebrant et al., 1997). Thus, the current study only provides insight into one-dimension of a multi-dimensional issue in the older adult community dwelling population. The most important factor in the area of food avoidance is the resulting nutritional status of older adults. Thus, ultimately determining dysphagia from preference or organic factors could improve overall nutritional status. Thus, there is significant value in further exploration into identifying avoidances caused by dysphagia from avoidances caused by outlying factors.

Future studies should also focus on dividing older adults community dwellers into subcategories based on level of activity and provide control groups with older adults individuals in assisted living facilities and skilled nursing facilities. These samples will yield a more valid comparison between variables and provide more insight into the rates of dysphagia and the impacts on daily dietary intake for individuals over the age of 55. Additionally, future studies should examine the types of foods avoided by individuals with and without dysphagia and compile data to suggest which foods should be avoided and which foods do not need to be avoided to improve nutritional status and dysphagia within this population.

Conclusion

The previous research analyzed found documentation of a robust relationship between dysphagia and overall respiratory health and nutritional health in older adult community dwellers (Wurtman et al., 1988; Serra-Prat et al., 2012; Cabre et al., 2010; Hudson et al., 2000). While the current study was limited by the participant sample size, the data collected provides preliminary insight into the notion that older adult community dwellers are in fact not a homogeneous population. This study is a call for future research to focus on this population with the addition of control groups in the context of varying levels of care as documented by independent activities of daily living completion. These control groups should include subgroups of independent community dwellers based on ADL completion, as well as older adults individuals in assisted living and skilled nursing facilities. For now, this data can be used to represent a small sample of independent community dwellers to inform future research directions.

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