8-2024

ASSESSMENTS OF THICKENERS FOR HOME COOKED PUREED DIETS MEALS FOR PATIENTS WITH DYSPHAGIA ON PUREED DIETS

Amy Rosales

ASSESSMENTS OF THICKENERS FOR HOME COOKED PUREED DIETS

MEALS FOR PATIENTS WITH DYSPHAGIA ON PUREED DIETS

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

Nutrition Science

---

by

Amy Rosales

August 2024

ASSESSMENTS OF THICKENERS FOR HOME COOKED PUREED DIETS

MEALS FOR PATIENTS WITH DYSPHAGIA ON PUREED DIETS

A Project

Presented to the

Faculty of

California State University,

San Bernardino

---

by

Amy Rosales

August 2024

Approved by:

Dorothy Chen-Maynard, PhD, RDN, FAND – Committee Chair

Marta Sovyanhadi, DrPH, RDN – Committee Member

ABSTRACT

Managing dysphagia can help prevent adverse outcomes for patients with swallowing issues. This project aims to identify the best thickener that holds food texture and to identify which thickener is most palatable and acceptable by evaluators. A Spoon Tilt test was used to as one of the objective tests to determine the best thickener that holds food texture. The three thickening agents used were: apple pectin powder, tapioca starch, and a commercial thickener. The three pureed food items used to test the thickening agents were baked chicken, broccoli, and rice. An audit tool by the International Dysphagia Diet Standardization Initiative (IDDSI), was used as an objective test due to its combination of testing methods and to determine if a modified diet or fluid meets the required properties of a food or beverage to be swallowed safely. This tool was used to determine the results of a Spoon Tilt Test to objectively measure the consistency of the products. To perform this spoon test, the process involved holding the spoon in a level plane with the desired pureed food e.g. (chicken , broccoli, rice) with added thickener and then tilting it to a 90 degree angle to observe how the sample behaves when the spoon is tilted (IDDSI.org). According to the IDDSI assessment criteria Level 4 (for pureed food) the samples should stay on the spoon, holding its shape, with minimal or no flow. The participants involved in the subjective taste test were ten hospital employees from the Food and Nutrition Department. They are cooks, diet aides, and dietitians at the hospital and all of the individuals have some knowledge of

dysphagia diets. Participants included were both males and females, with an age range from 25 to over 64 years. Of the 10 participants only one person reported difficulty swallowing and chewing.

An online Google survey form was used to evaluate the three thickened products to assess which is the most palatable and acceptable; and the evaluation included four categories of assessment (Appearance, Taste, Texture, and Overall quality). A Likerts rating scale of one to five (1=Terrible; 5= Tasty) was used to evaluate each product. All ten participants completed all of the surveys for each food product. Based on their evaluation of appearance, taste, texture, and overall quality, the majority of the participants preferred the products thickened with apple pectin. Additionally, the objective Spoon Tilt Test part of the study showed that the commercial thickener demonstrated superior performance in maintaining spoon shape and preventing food from becoming sticky or spreading throughout the plate.

Individuals with dysphagia are at a higher risk of malnutrition due to difficulties in swallowing, which can impact their ability to consume adequate nutrition. The study's findings suggest that alternative thickening agents can maintain texture stability in home-made pureed foods while enhancing their nutritional content and cost saving.

Word Count: 439

Keywords: Dysphagia, Swallowing Difficulty, Thickener, Acceptability, Palatability
Abbreviations: IDDS, International Dysphagia Diet Standardization Initiative; SLP, Speech-Language Pathologists

ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude to Dr. Dorothy Chen-Maynard and Dr. Marta Sovyanhadi for their guidance in bringing this project together. Thank you for always pushing me to reach my fullest potential during my undergraduate and graduate studies. The lessons you've taught me extend beyond academics and are applicable to my everyday personal and professional lives. This project is a testament of the profound impact of your teachings have had on me.

DEDICATION

I would like to dedicate my work to my family, in particular, my grandfather, whose quality of life has been impacted by dysphagia. His perseverance has been a motivating factor in my life and an inspiration for this project. I am forever grateful for the unconditional love and support my family has shown me through my academic journey.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Problem Statement

People with difficulty swallowing conditions are known to have dysphagia. Dysphagia may be acute or chronic, intermittent or persistent. It can result from abnormalities in the oropharyngeal or esophageal phases of swallowing, or it may be a mixed condition involving both phases. Dysphagia is an objective impairment or difficulty in swallowing, resulting in an abnormal delay in the transit of a liquid or solid bolus (Azer et al, 2023). The diagnosis of dysphagia, or swallowing difficulties involves a team of various healthcare specialists depending on the suspected cause. These specialists can include Gastroenterologist who treats digestive disorders that might contribute to swallowing difficulties. Otolaryngologists addresses issues related to the throat, voice box, and esophagus. A Neurologist to manage neurological conditions that can impair the swallowing process. A Certified Speech-Language Pathologists (SLP) to assess and treat swallowing and speech disorders. These specialists often work closely with other medical professionals such as dietitians, physicians, nurses, and occupational therapists to provide a comprehensive care. These professionals collaborate as a team to determine the most appropriate diagnosis and treatment plan for individuals experiencing swallowing difficulties.

Dysphagia can be described as a serious medical condition that affects between 300,000 and 700,000 individuals in the United States each year (Patel

et al, 2018). Patients diagnosed as having dysphagia can experience malnutrition, aspiration pneumonia, and dehydration (Thiyagalingam, et al.,2021). Other complications of dysphagia include prolonged hospital stays, hospital readmission, diminished quality of life, increased morbidity and mortality (Azer et al, 2023).

The American Speech-Language-Hearing Association and the American Speech-Language-Hearing Association report the occurrence of dysphagia in an acute healthcare setting as low as 3% in U.S. in patients age 45 years or older to as high as 22% in adults over 50 years of age (Lindgren & Janzon, 1991; National Foundation of Swallowing Disorders, n.d.; Patel et al., 2018; Tibbling & Gustafsson, 1991). The studies by Kawashima et al., (2004) and Serra-Prat et al., (2011) highlight the prevalence of this condition among the elderly, in which 13%–38% of elderly individuals with dysphagia are living independently. Therefore, there is a need to provide resources and education for caretakers and patients with dysphagia not living in a healthcare facility. These studies emphasized the importance of accessible resources of home healthcare and meal preparation for specific dietary needs such as those with dysphagia. Adequate resources can improve quality of life, nutritional intake, and overall health outcomes for these individuals.

Purpose of Study

The project design is a qualitative research study aimed to provide an education and information resource for caretaker and individuals with dysphagia

diet by including recipes along with the comparison of the cost and nutritional benefits of using different thickening agents. This study aims to offer alternative methods to prepare homemade meals for people with dysphagia, specifically those on pureed texture-modified diets. Three thickening agents used to evaluate the finished products were apple pectin powder, tapioca starch, and a commercial thickener. The objective of the study is to develop thickened products using three types of thickening agents that are available for public to use in homemade recipes that will be acceptable in appearance, texture, taste, and overall acceptability.

CHAPTER TWO

REVIEW OF LITERATURE

Overview of Dysphagia

Dysphagia or difficulty in swallowing can be classified into four types based on the location of the impairment. 1. Oral dysphagia affects the oral phase of the swallowing mechanism which could mean difficulty with the lips, tongue, jaw, or other oral structures. Some conditions that could lead to oral dysphagia include stroke, Bell's Palsy, Oral Cancer with post-op anatomical changes of the tongue, lips, or palate, and Parkinson's disease. 2. Pharyngeal phase dysphagia indicates one or several impairments related to the pharyngeal and laryngeal structures related to the pharyngeal bolus transit and airway protection. This can be caused by structural, neurological, or strengths and motor deficits. 3. Esophageal dysphagia indicates an impairment or disruption anywhere along the esophagus between the upper esophageal sphincter and lower esophageal sphincter that results in difficulty swallowing with, sensations of foods getting stuck in your throat or chest, which impairs the person's ability to keep undigested food down the esophagus. This can be caused by upper esophageal sphincter dysfunction and other obstructive and motility disorders. 4. Paraoesophageal dysphagia occurs when there is either physical impingement on the esophageal wall and lumen or infiltration of the esophageal wall leading to obstruction. This can result from various conditions such as tumors, enlarged lymph nodes, or external compression from other structures in the chest. The

obstruction can interfere with the normal passage of food and liquids through the esophagus, leading to difficulty swallowing and associated symptoms.

In a hospital setting, patients with dysphagia work with an interdisciplinary team consisting of a speech-pathologist and a dietitian. If a patient is showing signs of difficulty swallowing or pocketing food by holding food inside mouth without swallowing, a nurse or other clinical care staff will let the physician know that the patient can benefit from a bedside swallow evaluation to be done by a speech-language pathologist (SLP). The bedside swallow exam is conducted by the SLP who checks the patient's reflex for gagging and coughing as well as to test their ability to swallow different food textures and thin or thickened liquids (John Hopkins Medicine, 2024). Another known exam for diagnosing dysphagia is a barium swallow study. The exam is a video fluoroscopic evaluation of the functional anatomy and physiology of swallowing that permits visualization of bolus flow throughout the upper aerodigestive tract. This fluoroscopic video visualization helps distinguish the type and severity of swallowing impairment. Results of the exam assist the healthcare team in determining the safety of oral intake, by testing the effect of evidence-based frontline interventions and formulating oral intake recommendations and treatment plan. (Martin-Harris et al, 2020)

With such a high number of reported cases, it is important to review the type and extent of education that is provided to patients with dysphagia during and upon discharge. There are no concrete studies that showed quantitative representation of the number of patients in the United States who receive

dysphagia education. However, there was a pilot study completed on post discharge education of malnourished patients at the Christiana Care Value Institute in Newark, Delaware (Brooks et al. 2019). These researchers reviewed 76 electronic medical records (EMR) charts of patients and they found that five patients (6.6%) received EMR-documented discharge instructions to consume oral nutritional supplements (ONS). Twenty-three (30.3%) received new or changed prescriptions for vitamins/noncaloric supplements. Finally, 10 patients (13.2%) did not have any diet discharge instructions documented in the EMR. The most common discharge diet instructions provided include general information (given to 47.4% of patients), cardiac diet information (given to 25.0% of patients) and modified consistency/texture diet information (given to 21.1%of patients). Only nine (11.8%) patients received diet instructions specific to prevent malnutrition. Almost half (44.8%) received cardiac, renal, or low carbohydrate diet instructions that are inappropriate for malnourished patients because these diets limit the intake of energy- and nutrient-dense foods (Brooks et al. 2019). This study showed that there is a need for extensive education information on dysphagia education to patients upon discharge from the hospital.

International Dysphagia Diet Standardization Initiative, IDDSI Framework

Another topic to explore in order to better understand dysphagia and swallowing difficulties are to review the available resources for patients with dysphagia such as home delivery meals programs, home health services, or other educational resources. A reputable online site available to everyone is the

International Dysphagia Diet Standardization Initiative (IDDSI, www.iddsi.org). This initiative provides common terminology and standards for describing food textures and thickness of beverages to improve safety for individuals with swallowing difficulties. The IDDSI was created in 2013 to provide a worldwide resource for those living or caring for individuals with dysphagia. The IDDSI framework consists of a continuum of 8 levels (0 - 7) of food consistency, texture, and transition process to consume regular food. The beverages are measured from Levels 0 – 4 with varying level of thickness and foods are measured from Levels 3 – 7 with varying level of thickness and texture. Figure 1 describes the IDDSI Framework that provides a common terminology and standards to describe the thickness, texture, and consistency of food and beverage.

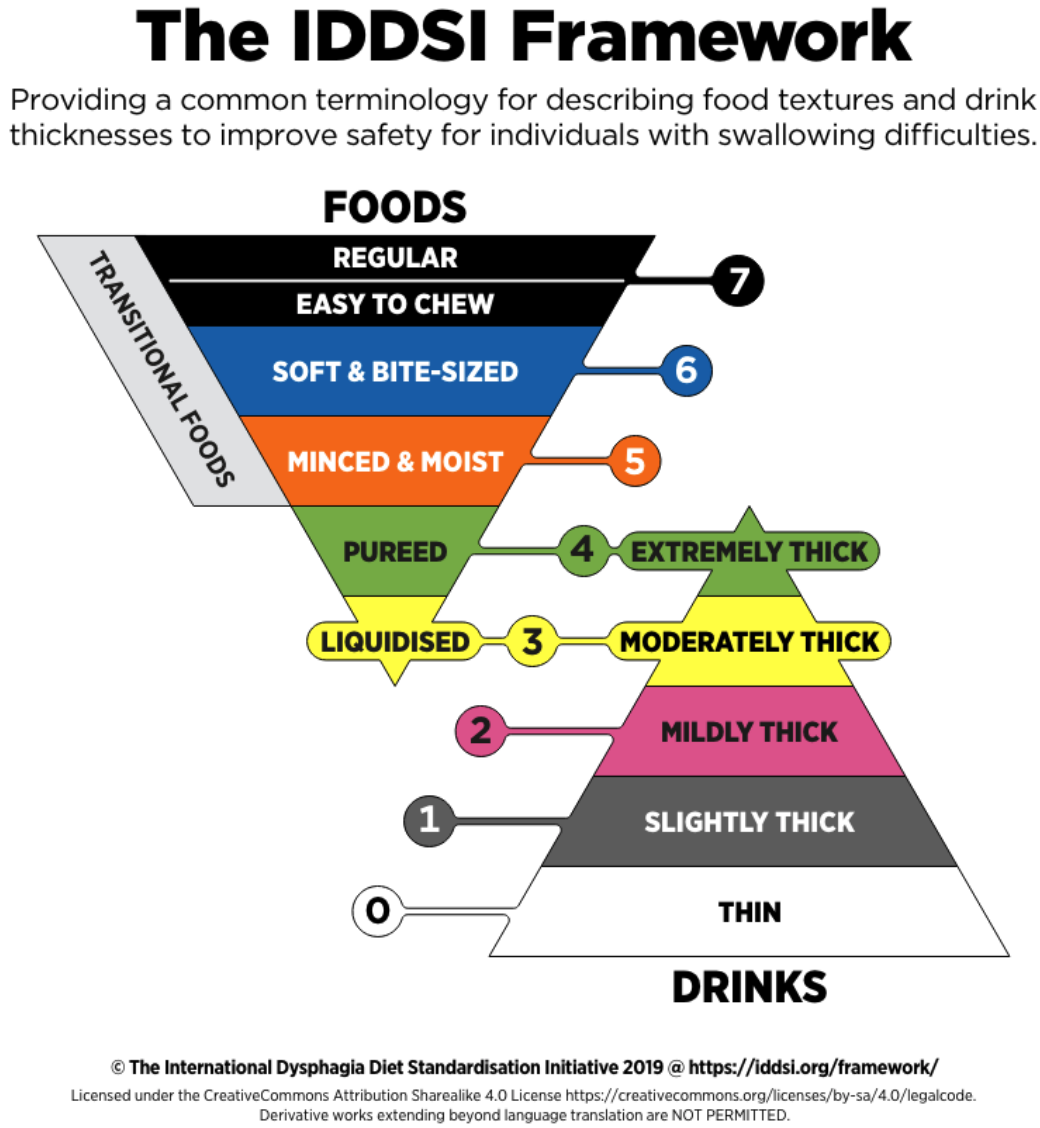


Figure 1. International Dysphagia Diet Standardization Initiative (IDDSI) Framework Pyramid and Testing Methods (IDDSI 2.0, July 2019)

Thickening agents for modified texture diets

Foods and liquids can be thickened or gelatinized with a combination of a variety of different ingredients that mainly contain starches and gums. Starches and gums are used in the food, pharmaceutical, and cosmetic industries for their

ability to gel and bind water (Cichero 2013). When preparing meals for patients on dysphagia diets, it is important to explore the thickening agents used to achieve the desired texture for pureed food. Popular thickening agents use gum or starch-based additives. Some commercial brands that are available are Nestlé Resource ThickenUp® Clear, Hormel Thick & Easy®, and Simply Thick® Instant Food Thickener. Hadde et al. (2021) compared thickening agents and they reported that in many cases xanthan gum-based thickeners are superior to starch-based because of perception of having a better texture, more cohesive, better stability (e.g., time or temperature), and better resistance to salivary amylase. In addition, this study by Hadde et al. (2021) also found liquid or powder thickeners to be clinically safe and effective in improving the swallow safety in individuals with oropharyngeal dysphagia. Another ingredient for possible use is rice flour jelly. Rice is a staple grain in Japan and many Asian countries and the study reported that rice-flour jelly was easier to prepare when compared to mashed rice-porridge used in some of these cultures (Hadde et al, 2021).

In food applications, starch and flour are multifunctional ingredients and have been used as a texturizer, a binder, an emulsion stabilizer, a moisture retainer, or a coating agent, and they are relatively affordable. The ingredients in the commercial product used to thicken food and beverages, SimplyThickgel® thickener are water, soluble fiber, xanthan gum, glucono delta-lactone, gellan gum, potassium sorbate, calcium chloride, citric acid, sodium citrate, sodium citrate, guar gum, and pectin (SimplyThick, 2024). Tapioca starch contains about

17% amylose, which contributes as a good binder by absorbing water and forming a thick gel with high viscosity; thereby, improving moisture retention and cooking yield (Nimitkeatkai, Hataitip et al. 2022). Apple-derived pectin is the main soluble fiber in apples and can be fermented by gut microbiota in the colon to produce metabolites with local intestinal and systemic effects. Apple-derived pectin may also help to maintain the balance of gut microbiota (Jiang et al. 2016).

Table 1. Cost and nutrient content of commonly used thickeners

Thickener	Nutritional Value	Cost
SimplyThick ® Commercial Thickener 55 fl oz.	**Serving size:** 6 g **Calories:** 5 **Total Fat:** 0g **Sodium:** 20 mg **Total Carbohydrate:** 1 g **Total Sugar:** 0g **Protein:** 0 g	$72.15 Cost per serving: $0.26
Best Botanicals Apple Pectin Powder 1 lb.	Best Botanicals 10 g per serving Nutritional information not available	$29.95 Cost per serving: $0.67
*Fruit Pectin Powder® 12.34 oz	**Serving size:** 9 g **Calories:** 30 **Total Fat:** 0g **Sodium:** 0 mg **Total Carbohydrate:** 8 g **Dietary Fiber:** <1 g **Total Sugar:** 7g **Added Sugars:** 7 g **Protein:** 0 g **Vitamin D:** 0 mcg **Calcium:** 0 mg **Iron:** 0mg **Potassium:** 0mg	$11.99 Cost per serving: $0.29
ERAWAN® Tapioca Starch 1lb.	**Serving size:** 10 g **Calories:** 35 **Total Fat:** 0g **Sodium:** 0 mg **Total Carbohydrate:** 9 g **Dietary Fiber:** 0 g **Total Sugar:** 0g **Added Sugars:** 0 g **Protein:** 0 g **Vitamin D:** 0 mcg **Calcium:** 5 mg **Iron:** 0mg **Potassium:** 0mg	$9.99 Cost per serving: $0.02

CHAPTER THREE

METHODS

The goal of this project is to test the different thickening additives/ ingredients and assess acceptability using an online survey with rating of the products on a Likert scale. This project was approved by the California State University Institutional Review Board, IRB-FY2024-252 (Appendix A). An online Google survey was created to conduct a survey to subjectively assess acceptability of each thickener in three pureed products (chicken, broccoli, rice). The participants were recruited using a flyer posted in the department's bulletin board and by words of mouth. Ten participants were recruited for the taste evaluation; and they were hospital employees from the Food and Nutrition Department. The participants were cooks, diet aides, and dietitians, all of them have some knowledge of dysphagia diets. Participants included both males and females, with an age range from 25 to over 64 years. Of the 10 participants, only one reported to have difficulty swallowing and chewing. Evaluation survey data were collected through the online survey on three products: puree chicken, broccoli, and rice, each was thickened with apple pectin powder, tapioca starch, or a commercial thickener .

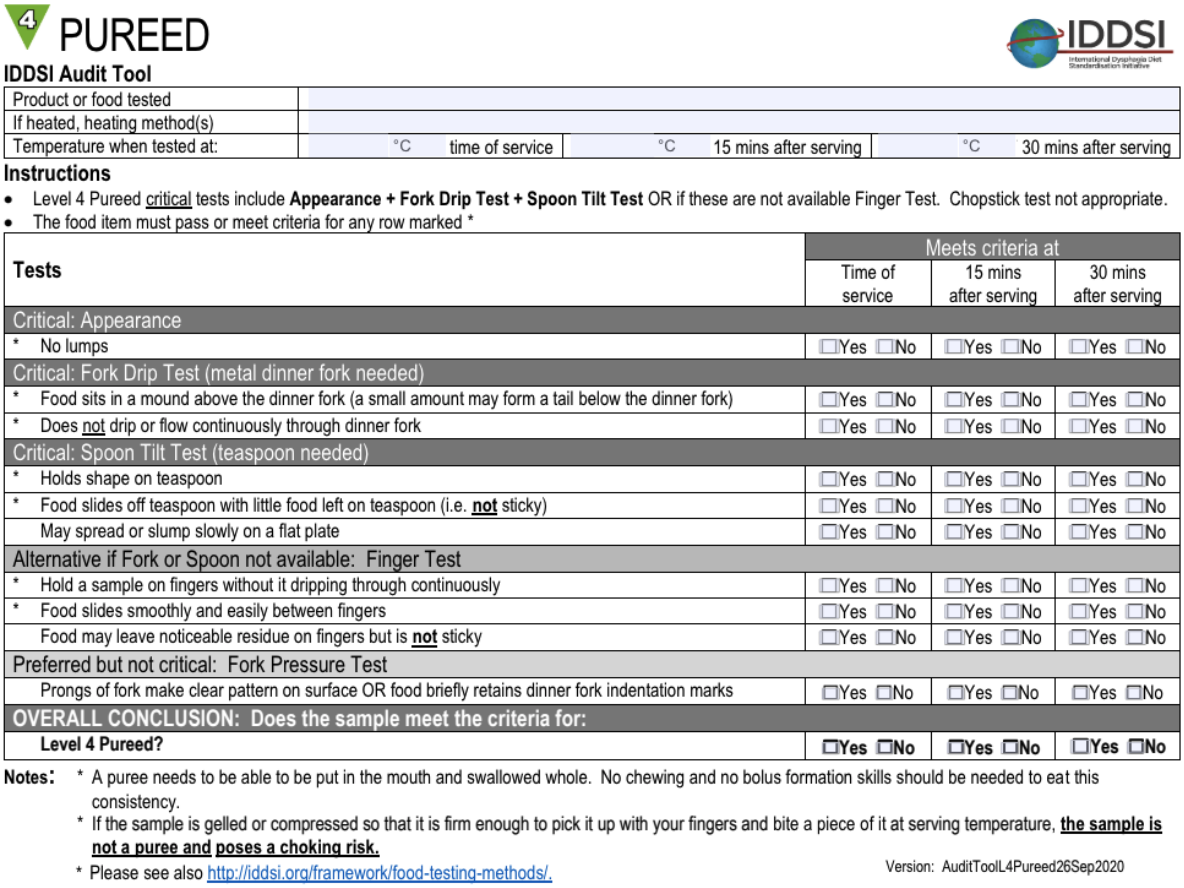
The four seasoned chicken breasts were baked to 165 °F (1 tablespoon of melted butter, 1 teaspoon kosher salt, ½ teaspoon of black pepper, ½ teaspoon of garlic, and ½ teaspoon of paprika) (Ali 2022). To puree the ingredients and to add the thickener, the amount of thickener and liquid used were based on a

recipe provided by Simply Thick® puree chicken recipe (Regan 2024). This recipe was used as a guidance to blend the chicken in the food processor to produce a desired pureed consistency. To prepare the rice, 2 cups of long grained white rice along with 1 teaspoon kosher salt, ½ teaspoon of garlic and the mixture was cooked in an electric rice cooker. For the broccoli dish, 2 pounds of raw broccoli was steamed and seasoned with 1 teaspoon kosher salt, ½ teaspoon of black pepper, ½ teaspoon of garlic. For each entree, 4 oz. of chicken broth and 1-2 tbsp of the thickening agent was added in the food processor to the desired consistency. The three thickening agents used in the three products were Best Botanicals® apple pectin powder, ERAWAN® tapioca starch, and SimplyThick®, a commercial thickener. To conduct the Spoon Tilt Test, the DDSI Audit tool was used. The Spoon Tilt test is an objective tool used to evaluate the consistency of thickening agent in food for three different thickeners and it assesses how well the thickening agent holds food in the shape of a teaspoon, how easily it slid off the teaspoon, and whether the thickened food would spread or slump on a plate. This test provides an insight into the thickening agent's ability to hold a puree texture consistency to be used in dysphagia meal recipes.

Data Analysis

The survey for evaluation of the products assesses four areas: Appearance, Taste, Texture, and Overall quality. The puree foods were rated on a Likert scale of one to five (1=Terrible; 5= Tasty). The taste test survey allows

the researchers to determine the quality and palatability of each thickening agent used in each of the food product. The objective evaluation test was conducted using the audit tool provided by the International Dysphagia Diet Standardization Initiative, which was a Spoon Tilt Test (Fig. 2). Performing the spoon test involved holding the spoon in a level plane with a teaspoon scoop of the pureed food (chicken, broccoli, rice) with one of the three thickening ingredients. The spoon is then tilted it to a 90-degree angle to assess how the sample behaves when the spoon is tilted 90 degree and when it is slid off the spoon onto a plate. According to the IDDSI assessment criteria for Level 4 (Pureed) the samples should stay on the spoon while tilted and holds its shape in a plate with minimal or no flow at the time of service.



4 PUREED

IDDSI

IDDSI Audit Tool

Product or food tested					
If heated, heating method(s)					
Temperature when tested at:	°C	time of service	°C	15 mins after serving	°C 30 mins after serving

Instructions

- Level 4 Pureed critical tests include **Appearance + Fork Drip Test + Spoon Tilt Test** OR if these are not available Finger Test. Chopstick test not appropriate.
- The food item must pass or meet criteria for any row marked *

Tests	Meets criteria at		
	Time of service	15 mins after serving	30 mins after serving
Critical: Appearance			
* No lumps	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Critical: Fork Drip Test (metal dinner fork needed)			
* Food sits in a mound above the dinner fork (a small amount may form a tail below the dinner fork)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
* Does not drip or flow continuously through dinner fork	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Critical: Spoon Tilt Test (teaspoon needed)			
* Holds shape on teaspoon	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
* Food slides off teaspoon with little food left on teaspoon (i.e. **not** sticky)	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
May spread or slump slowly on a flat plate	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Alternative if Fork or Spoon not available: Finger Test			
* Hold a sample on fingers without it dripping through continuously	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
* Food slides smoothly and easily between fingers	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Food may leave noticeable residue on fingers but is **not** sticky	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Preferred but not critical: Fork Pressure Test			
Prongs of fork make clear pattern on surface OR food briefly retains dinner fork indentation marks	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
OVERALL CONCLUSION: Does the sample meet the criteria for:			
Level 4 Pureed?	**☐Yes ☐No**	**☐Yes ☐No**	**☐Yes ☐No**

Notes:

* A puree needs to be able to be put in the mouth and swallowed whole. No chewing and no bolus formation skills should be needed to eat this consistency.
* If the sample is gelled or compressed so that it is firm enough to pick it up with your fingers and bite a piece of it at serving temperature, **the sample is not a puree and poses a choking risk.**
* Please see also http://iddsi.org/framework/food-testing-methods/.

Version: AuditToolL4Pureed26Sep2020

Figure 2. Pureed IDDSI Audit Tool (September 2020)

Food texture was evaluated using a condensed version of the IDDSI audit tool to evaluate which thickening agent yielded the best results for each criteria. listed. (Fig. 3)

Product Tested	Chicken Apple Pectin		
If heated, heating method	Baked		
Temperature when tested at	177° F Time of service	156°F 15 mins after serving	143°F 30 mins after serving
Holds shape of teaspoon			
Spoon Tilt Test	Meets criteria at:		
4 tsp broth , 1 tsp AP (grainy , sweet)	Time of service:	15 mins after serving:	30 mins after serving:
Holds shape on teaspoon	Yes	Yes	Yes
Food slides off teaspoon with little food left on teaspoon (not sticky)	No	No	No
May spread or slump slowly on a flat plate	No	No	Yes

Figure 3. IDDSI Condensed version of Puree Audit Tool

The IDDSI describes how the Spoon Tilt Test is used to determine the stickiness of foods (adhesiveness) and the ability to hold together (cohesiveness) of a food consistency to be deemed safe to swallow without difficulty. The survey results from the acceptability (quality) and palatability (taste) of the dysphagia meals survey will be analyzed using IBM SPSS Statistics software. However, due to a small sample size, no statistical test was completed for this qualitative study.

CHAPTER FOUR

RESULTS

The original aim of the study was to recruit at least twenty participants; however, due to time constraints and availability of participants, only ten participants were recruited and completed the taste test (N=10). The participants included three males and seven females. The participants aged from 18 years to over 64 years and the average age was 25 years. Of the ten participants, only one person reported difficulty swallowing and chewing. When asked to evaluate which thickener participants thought held up the best in texture and flavor for all three entrees (chicken, broccoli, rice), two chose tapioca starch, three chose commercial thickener, and five chose apple pectin (Fig. 4). These results demonstrated that the thickener based on appearance, taste, texture, and overall quality was apple pectin (Table 2).

Table 2. Survey results of the Likert scale

Thickener added to chicken, broccoli, and rice	**Appearance**	**Taste**	**Texture**	**Overall**
Apple Pectin	Ratings: 3,3,3,3,4,4,4,4,5,5 Average Rating: 3.8	Ratings: 3,3,4,4,4,4,4,4,4,5 Average Rating: 3.9	Ratings: 3,3,3,3,4,4,4,4,4,4 Average Rating: 3.6	Ratings: 2,3,3,3,4,4,4,4,5,5 Average Rating: 3.7
Tapioca Starch	Ratings: 1,2,2,3,3,3,3,3,5,5 Average Rating: 3	Ratings: 2,2,2,3,3,3,3,5,5,5 Average Rating: 3.3	Ratings: 1,2,2,2,3,3,4,5,5,5 Average Rating: 3.2	Ratings: 1,2,2,2,3,4,4,5,5,5 Average Rating: 3.3

Commercial	Ratings: 2,3,3,3,3,3,3,4,4,5 Average Rating: 3.3	Ratings: 2,2,2,3,3,3,3,3,4,5 Average Rating: 3	Ratings: 2,2,2,3,3,3,3,4,4,5 Average Rating: 3.1	Ratings: 2,2,3,3,3,3,3,4,4,4, Average Rating: 3.1

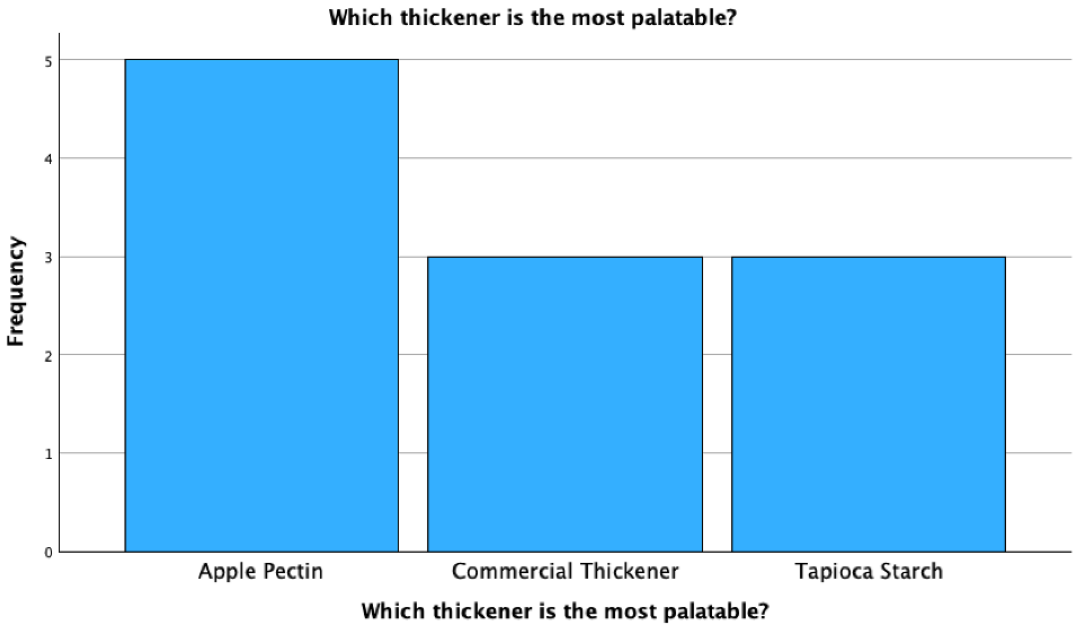


Figure 4. Results of Thickener Palatability Survey

Additionally, during the Spoon Tilt Test part of the study, the commercial thickener demonstrated superior performance in maintaining spoon shape and preventing food from becoming sticky or spreading throughout the plate.

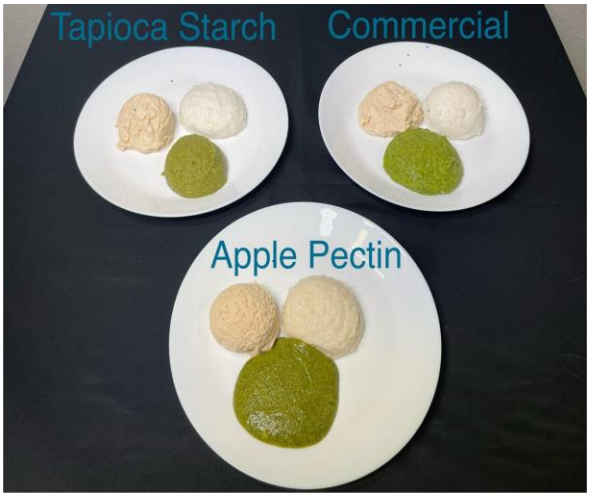


Figure 6. Consistency textures of tapioca starch, commercial thickener, and Apple Pectin, when added to chicken, broccoli, and rice (left)

Figure 5. Brands of thickening agents used in the study (right).

CHAPTER FIVE

DISCUSSION

The project aims to provide resources for home prepared dysphagia diet recipes, compare costs and nutritional benefits of the thickening agents, and offer alternatives methods for preparing homemade pureed meals for individuals with dysphagia and swallowing difficulties. A possibility of the apple pectin was a preferred thicker from the taste test could be that it is produced from many fruits or other plant tissues such as beetroots. Most commercial pectin products are derived from citrus peels by precipitating the pectin from solution with alcohol. Pectin is a reversible colloid and it may also be dissolved in water, precipitated, dried, then redissolved without alteration of its physical properties (Smith, D.A. 2003).

Strengths and Limitations

The project strength is that it explored naturally food derived thickening agents that can maintain texture stability in pureed foods while enhancing their nutritional content for individuals with swallowing disorders. This project can be applied to other food-based thickening agents that can be tested to add nutritional value, cost saving, and to explore ways to make pureed foods more visually appealing and be more acceptable to puree food. Food molds are commercially available to shape the puree food into its original shape for visual effect.

The project limitations included not recruiting enough participants to obtain a significant data set. Another limitation was that the survey questionnaire only included closed ended rating scale for the questions; however, a comment section would allow participants to explain their score and to provide reasoning for their selection of a product. Assisting participants while completing the survey, especially if they are non-native speakers, can be helpful; however, it can also introduce potential bias into their responses. It is crucial to ensure that the assistance provided does not lead the participant to answer in a specific way or influence their response. Future studies should include a larger sample size with the inclusion of participants that have been diagnosed with dysphagia**.** Future studies could also incorporate different variety of foods and entrees and different types of additives that may be of lower cost, as well as to conduct a more detailed evaluation of the nutritional content of thickening agents used.

Conclusion

Individuals with dysphagia are at a higher risk of malnutrition due to difficulties in swallowing and fear of choking, which can impact their ability to consume adequate nutrition. The findings in the project suggest that alternative thickening agents can maintain texture stability in pureed foods while enhancing their nutritional content. The results of this study may reduce the complications of dysphagia such as malnutrition, aspiration pneumonia, and dehydration by providing alternative methods of preparing puree dishes that are acceptable to the individuals with dysphagia and may be of lower costs. The findings could

provide valuable information for individuals and caretakers to further explore the use of natural thickening agents in developing home recipes tailored to the ethnic or preferred foods that are more familiar to the individuals with dysphagia, potentially improving their dietary options and nutritional intake.

APPENDIX A

IRB APPROVAL LETTER

CALIFORNIA STATE UNIVERSITY
SAN BERNARDINO

March 14, 2024

CSUSB INSTITUTIONAL REVIEW BOARD
Expedited Review
IRB-FY2024-252
Status: Approved

Prof. Dorothy Chen, Prof. Marta Sovyanhadi, and Ms. Amy Rosales
CNS - Health Science
California State University, San Bernardino
5500 University Parkway
San Bernardino, California 92407

Dear Prof. Dorothy Chen, Prof. Marta Sovyanhadi, and Ms. Amy Rosales

Your application to use human subjects, titled "Home Cooked Meals for Puree Texture Diets" has been reviewed and approved by the Institutional Review Board (IRB) of CSU, San Bernardino. The CSUSB IRB has weighed the risk and benefits of the study to ensure the protection of human participants. The study is approved as of March 14, 2024. The study will require an annual administrative check-in (annual report) on the current status of the study on March 13, 2025. Please use the renewal form to complete the annual report.

This approval notice does not replace any departmental or additional campus approvals which may be required including access to CSUSB campus facilities and affiliate campuses. Investigators should consider the changing COVID-19 circumstances based on current CDC, California Department of Public Health, and campus guidance and submit appropriate protocol modifications to the IRB as needed. CSUSB campus and affiliate health screenings should be completed for all campus human research related activities. Human research activities conducted at off-campus sites should follow CDC, California Department of Public Health, and local guidance. See CSUSB's COVID-19 Prevention Plan for more information regarding campus requirements.

If your study is closed to enrollment, the data has been de-identified, and you're only analyzing the data - you may close the study by submitting the Closure Application Form through the Cayuse Human Ethics (IRB) system. The Cayuse system automatically reminders you at 90, 60, and 30 days before the study is due for renewal or submission of your annual report (administrative check-in). The modification, renewal, study closure, and unanticipated/adverse event forms are located in the Cayuse system with instructions provided on the IRB Applications, Forms, and Submission Webpage. Failure to notify the IRB of the following requirements may result in disciplinary action. Please note a lapse in your approval may result in your not being able to use the data collected during the lapse in the application's approval period.

You are required to notify the IRB of the following as mandated by the Office of Human Research Protections (OHRP) federal regulations 45 CFR 46 and CSUSB IRB policy.

- **Ensure your CITI Human Subjects Training is kept up-to-date and current throughout the study.**
- **Submit a protocol modification (change) if any changes (no matter how minor) are proposed in your study for review and approval by the IRB before being implemented in your study.**
- **Notify the IRB within 5 days of any unanticipated or adverse events are experienced by subjects during your research.**
- **Submit a study closure through the Cayuse IRB submission system once your study has ended.**

The CSUSB IRB has not evaluated your proposal for scientific merit, except to weigh the risks and benefits to the human participants in your IRB application. If you have any questions about the IRBs decision please contact Michael Gillespie, the IRB Compliance Officer. Mr. Michael Gillespie can be reached by phone at (909) 537-7588, by fax at (909) 537-7028, or by email at mgillesp@csusb.edu. Please include your application approval number IRB-FY2024-252 in all correspondence. Any complaints you receive regarding your research from participants or others should be directed to Mr. Gillespie.

Best of luck with your research.

Sincerely,

King-To Yeung

King-To Yeung, Ph.D., IRB Chair
CSUSB Institutional Review Board

KY/MG

APPENDIX B

TASTE TEST SURVEY

Home Cooked Meals for Puree Texture Diets

Principal Investigators: Dr. Dorothy Maynard-Chen & Amy Rosales

IRB-FY2024-252

You are invited to participate in the taste test portion of the study conducted by California State University, San Bernardino. The study design is qualitative research aimed to provide a resource for dysphagia diet recipes and compare nutritional benefits of using different thickening agents. This study aims to offer alternatives ways to make homemade meals for people with dysphagia diet, specifically puree texture modified diets. There will be three thickening agents to be used which are, apple pectin powder, tapioca starch, and commercial thickener.

Data will be collected through surveys in which participants will respond after trying puree foods. The taste survey will include four categories (Appearance, Taste, Texture, and Overall quality) in which puree foods will be rated on a scale of one to five (1=Terrible; 5= Tasty) This taste test survey will determine the quality and palatability of each thickening agent used. Your name will not be associated with your survey responses and data. Your participation in this study is completely voluntary. Only the research team will have access to the data , and your personal information.

The duration of the study is expected to take no more than 30 minutes. The prescreening questionnaire will take 5 minutes. The post taste test survey will take 5 minutes. The in person taste test will take no longer than 20 minutes. Participation in this study involves minimal risk. During the taste test part of the study, participants may experience a mild taste discomfort due to food texture or flavor.

*

CONFIRMATION STATEMENT: I understand that I must be 18 years of age or older to participate in your study, have read and understand the consent document and agree to participate in your study.

- ( ) Agree

What is your gender orientation?

- Female
- Male
- Non Binary
- Prefer not to say

How old are you? *

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- Above 64

Do you have any difficulty with chewing or swallowing?

- Yes, chewing
- Yes, swallowing
- Yes, both
- None

\

How was the apple pectin appearance?

	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious

How was the apple pectin taste?

	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious

How was the apple pectin texture?

	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious

How was the apple pectin overall?

	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious

How was the tapioca starch appearance?

	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious

How was the tapioca starch taste?

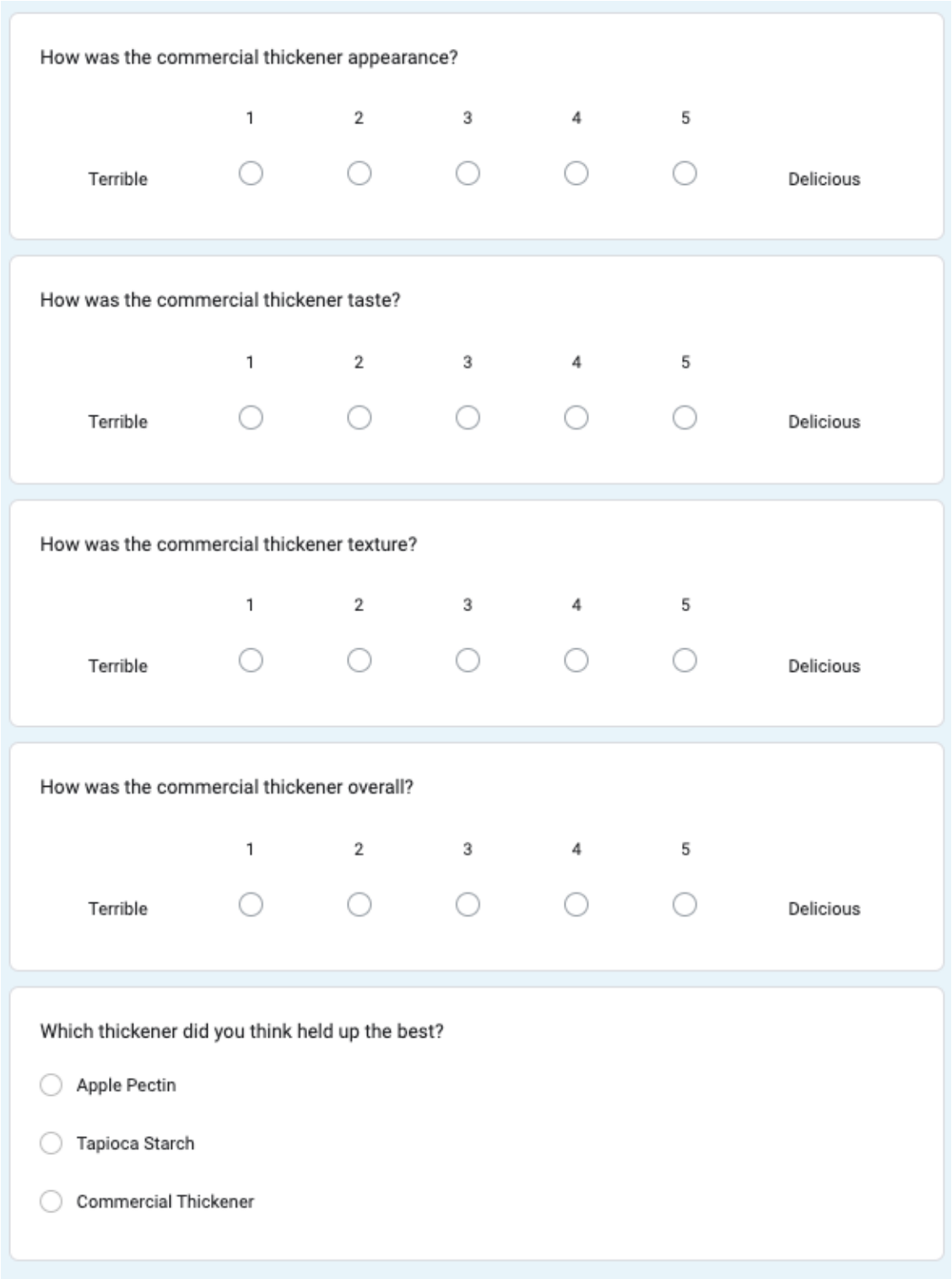
	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious

How was the tapioca starch texture?

	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious

How was the tapioca starch overall?

	1	2	3	4	5	
Terrible	○	○	○	○	○	Delicious



https://docs.google.com/forms/d/1XuDeM70N9aEmTXJ8PX8WCcVBHEbe2vg5_aasED2-YYM/edit

APPENDIX C

RECRUITMENT FLYER

Study Participants Needed

WHO CAN PARTICIPATE ?

- ADULTS 18 YEARS AND OLDER
- PEOPLE WITH & WITHOUT SWALLOWING DIFFICULTIES
- CSUSB STUDENTS AND NON-CSUSB STUDENTS

WHAT WILL TAKE PLACE?

- A TASTE TEST WILL BE CONDUCTED IN WHICH PARTICIPANTS WILL FILL OUT A SURVEY OF OVERALL QUALITY AND TASTE OF MEALS.

IF INTERESTED PLEASE EMAIL
DR. CHEN CHEN-MAYNARD (PI)
EMAIL:DCHEN(at)CSUSB.EDU
OR
AMY ROSALES (CO-PI)
EMAIL: 006095046(at)COYOTE.CSUSB.EDU

CSUSB

THIS STUDY HAS BEEN APPROVED BY THE CSUSB IRB
IRB-FY2024-252

REFERENCES

"Adult Dysphagia." *American Speech-Language-Hearing Association*, American Speech-Language-Hearing Association, www.asha.org/practice-portal/clinical-topics/adult-dysphagia/#collapse_1. Accessed 16 Oct. 2023.

Azer, Samy A., et al. "Dysphagia." *National Center for Biotechnology Information*, U.S. National Library of Medicine, 20 Feb. 2023, pubmed.ncbi.nlm.nih.gov/32644600/.

BestBotanicals. "Apple Pectin Powder." BestBotanicals, bestbotanicals.com/collections/bulk-herbs/products/apple-pectin. Accessed 12 July 2024.

Berger, Laurie, et al. "Modern Dysphagia Cooking: Turn Family Favorites into Dysphagia-Friendly Dishes." *Simply Thick*, 24 Jan. 2023, www.simplythick.com/Online-Recipes/Pureed-Chicken-2023.

Bottle: Large Bottle & Pump - 1 Each, www.simplythick.com/ST2LBOTTLE. Accessed 10 July 2024.

Brooks, M., et al. “Malnourished adults’ receipt of Hospital Discharge Nutrition Care Instructions: A pilot study.” *Journal of Human Nutrition and Dietetics*, vol. 32, no. 5, 2019, pp. 659–666, https://doi.org/10.1111/jhn.12662.

Cichero, Julie A Y. “Thickening Agents Used for Dysphagia Management: Effect on Bioavailability of Water, Medication and Feelings of Satiety.” *Nutrition Journal*, U.S. National Library of Medicine, 1 May 2013, www.ncbi.nlm.nih.gov/pmc/articles/PMC3660277/.

D A Patel, et al. “Economic and Survival Burden of Dysphagia among Inpatients in the United States. Diseases of the Esophagus.” *Diseases of the Esophagus*, 1 Jan. 2018, doi.org/10.1093/dote/dox131.

“Dysphagia: What Happens during a Bedside Swallow Exam.” *Johns Hopkins Medicine*, 22 Mar. 2024, www.hopkinsmedicine.org/health/treatment-tests-and-therapies/dysphagia-what-happens-during-a-bedside-swallow-exam.

“Erawan Tapioca Starch 400g.” Onelink, 7 May 2024, www.onelink.pt/en/products/erawan-tapioca-starch-400g/.

Hadde, Enrico K., et al. “The safety and efficacy of Xanthan Gum-based thickeners and their effect in modifying bolus rheology in the therapeutic medical management of Dysphagia.” *Food Hydrocolloids*

for Health, vol. 1, 2021, p. 100038, https://doi.org/10.1016/j.fhfh.2021.100038.

Jiang, Tingting, et al. “Apple-Derived Pectin Modulates Gut Microbiota, Improves Gut Barrier Function, and Attenuates Metabolic Endotoxemia in Rats with Diet-Induced Obesity.” Nutrients, U.S. National Library of Medicine, 29 Feb. 2016, www.ncbi.nlm.nih.gov/pmc/articles/PMC4808856/.

Martin, Ali. “Baked Chicken Breast.” *Gimme Some Oven*, 23 June 2022, www.gimmesomeoven.com/baked-chicken-breast/.

Martin-Harris, Bonnie, et al. “Best Practices in Modified Barium Swallow Studies.” *American Journal of Speech-Language Pathology*, U.S. National Library of Medicine, 10 July 2020, www.ncbi.nlm.nih.gov/pmc/articles/PMC7844340/.

Nimitkeatkai, Hataitip, and Jarerat. “Incorporation of Tapioca Starch and Wheat Flour on Physicochemical Properties and Sensory Attributes of Meat-Based Snacks from Beef Scraps.” Foods (Basel, Switzerland), U.S. National Library of Medicine, 2 Apr. 2022, www.ncbi.nlm.nih.gov/pmc/articles/PMC8997522/.

Smith, D.A. “Pectin.” Pectin - an Overview | ScienceDirect Topics, 2003, www.sciencedirect.com/topics/nursing-and-health-professions/pectin.

"The IDDSI Framework." *IDDSI*, iddsi.org/framework/. Accessed 16 Oct. 2023.

Thiyagalingam , Shanojan, et al. "Dysphagia in Older Adults." *Mayo Clinic Proceedings*, Elsevier, 3 Feb. 2021, www.sciencedirect.com/science/article/abs/pii/S0025619620309022.

Tippett, Donna Clark. "Dysphagia: What Happens during a Bedside Swallow Exam." *Johns Hopkins Medicine*, 27 Feb. 2023, www.hopkinsmedicine.org/health/treatment-tests-and-therapies/dysphagia-what-happens-during-a-bedside-swallow-exam#:~:text=The%20SLP%20may%20check%20your,problems%20chewing%2C%20swallowing%20or%20breathing.

Wolf, Douglas C. "Dysphagia." *Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd Edition.*, U.S. National Library of Medicine, 1 Jan. 1990, www.ncbi.nlm.nih.gov/books/NBK408/#:~:text=Dysphagia%20can%20be%20classified%20into,separate%20but%20continuous%20anatomic%20areas.

The American Speech-Language-Hearing Association and the American Speech-Language-Hearing Association https://www.asha.org/

Recipe Resources:

Chicken Recipe

Ali. “Baked Chicken Breast.” Gimme Some Oven, 23 June 2022, www.gimmesomeoven.com/baked-chicken-breast/.

https://www.myplate.gov/recipes/supplemental-nutrition-assistance-program-snap/baked-chicken

Simply Thick Chicken Recipe

https://www.simplythick.com/Online-Recipes/Pureed-Chicken-2023

Regan, Jen. “Pureed Chicken .” New Simplythick Pureed Diet and Thickened Beverage Recipes., www.simplythick.com/Online-Recipes. Accessed 11 Mar. 2024.