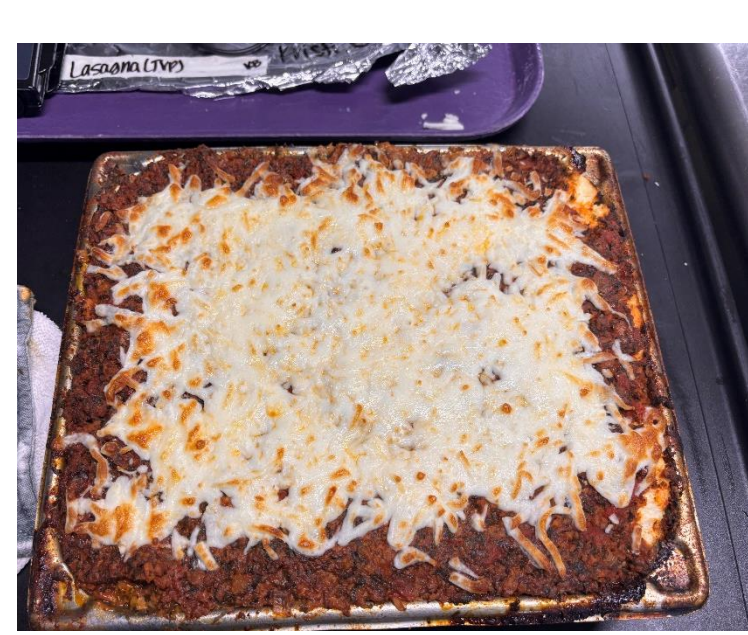




Formulation and Scale-Up of Plant-Based Lasagna

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Introduction

- The demand for plant-based options in university dining centers has increased, driven by growing consumer interest in health, environmental sustainability, and dietary inclusivity.
- Lasagna is a classic favorite dish consumed by many students at dining centers. However, K-State only serves a cream-based vegetarian lasagna.

Objectives

- To develop a vegetarian lasagna that mimics the sensory qualities of beef lasagna using texturized soy protein.
- To scale-up the lasagna in the Kramer dining center.
- To gain acceptability ratings of the product from university students dining in Kramer.

Materials and Methods

- Texturized soy protein (TSP) was used as a plant-based protein to replace ground beef. Different levels of spices were tested for optimal spice amount in the TSP.
- The lasagna was developed on the benchtop first in Call Hall with sensory feedback from students in the FDSCI740 Research and Development of Food Products course.
- Lasagna was initially made with a marinara sauce and then changed to have diced tomatoes, tomato paste, Italian seasonings, a blend of cheeses, and the TSP.
- The formulation with the diced tomatoes, tomato paste and additional spices in the TSP was preferred by the FDSCI740 class members.
- Scale-up procedures and consumer testing at the dining center (Figures 1-7).

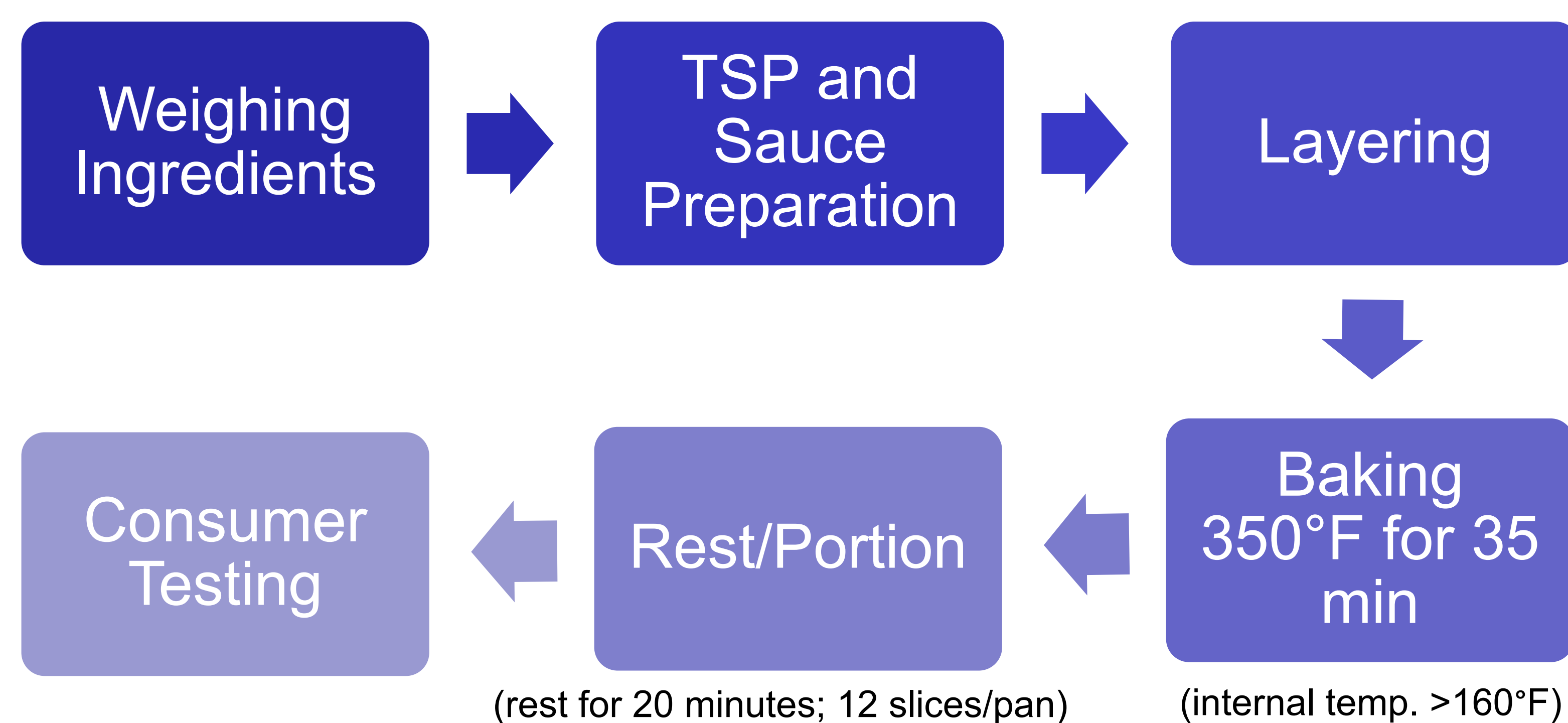


Figure 1. Ingredient Weigh Up



Figure 2. Sauce Preparation



Figure 3. Baking in Combi oven

Results

Category: Master Ref:	Entree:Vegetarian 0.709 pounds	Yield: Portion: 12 1 square
Ingredients	Amount	Method
Protein,Vegetable,Textured for Research.....	1.1023 lb	1 1. Soak TVP in hot water and base for 15-20 min.
Water.....	1.3 lb	
Base,Vegetarian,Refrig.....	0.0277 lb	2 2. Heat oil in skillet. 3. Add hydrated protein and seasonings. Stir to combine. 4. Cook until browned, 10-20 minutes. Set aside.
Oil,Olive,Blend.....	0.001 lb	
Herb,Oregano Leaves,Dried.....	0.0689 lb	
Herb,Basil, Dried.....	0.1033 lb	
Herb,Thyme Leaves,Dried.....	0.095 lb	
Herb,Rosemary,Dried.....	0.061 lb	3 5. Heat oil in pot. Sautee onions and garlic for 7-8 minutes on low heat. 6. Add tomatoes and seasonings. Increase heat to medium-high. Cook to 170-180 Deg. F. 7. Add water. Simmer 8-10 minutes. 8. Add the TVP mixture to the sauce. Stir to combine.
Herb,Parsley,Dried.....	0.011 lb	
Seasoning,Italian.....	0.069 lb	
Salt.....	0.033 lb	
Pepper,Black,Table Ground.....	0.035 lb	
Oil,Olive,Blend.....	0.001 lb	
Garlic,Fresh,Minced.....	0.017 lb	
Onions,Fresh,Chopped.....	0.678 lb	
Tomatoes,Chopped,CND.....	1.505 lb	
Tomato Paste,CND.....	0.9418 lb	
Salt.....	0.0378 lb	
Pepper,Black,Table Ground.....	0.0026 lb	
Herb,Oregano Leaves,Dried.....	0.003 lb	
Herb,Basil, Dried.....	0.009 lb	
Spice,Paprika.....	0.0035 lb	
Seasoning,Garlic Powder,5.25LB.....	0.003 lb	
Herb,Parsley,Fresh,AP.....	0.025 lb	
Water.....	1 lb	

Cost per portion = \$2.17

Figure 4. Example of Dining Center Procedures

“Thank you! I’ve never had a lasagna this good before!”

Student Comment

Consumer Acceptability (n=48)

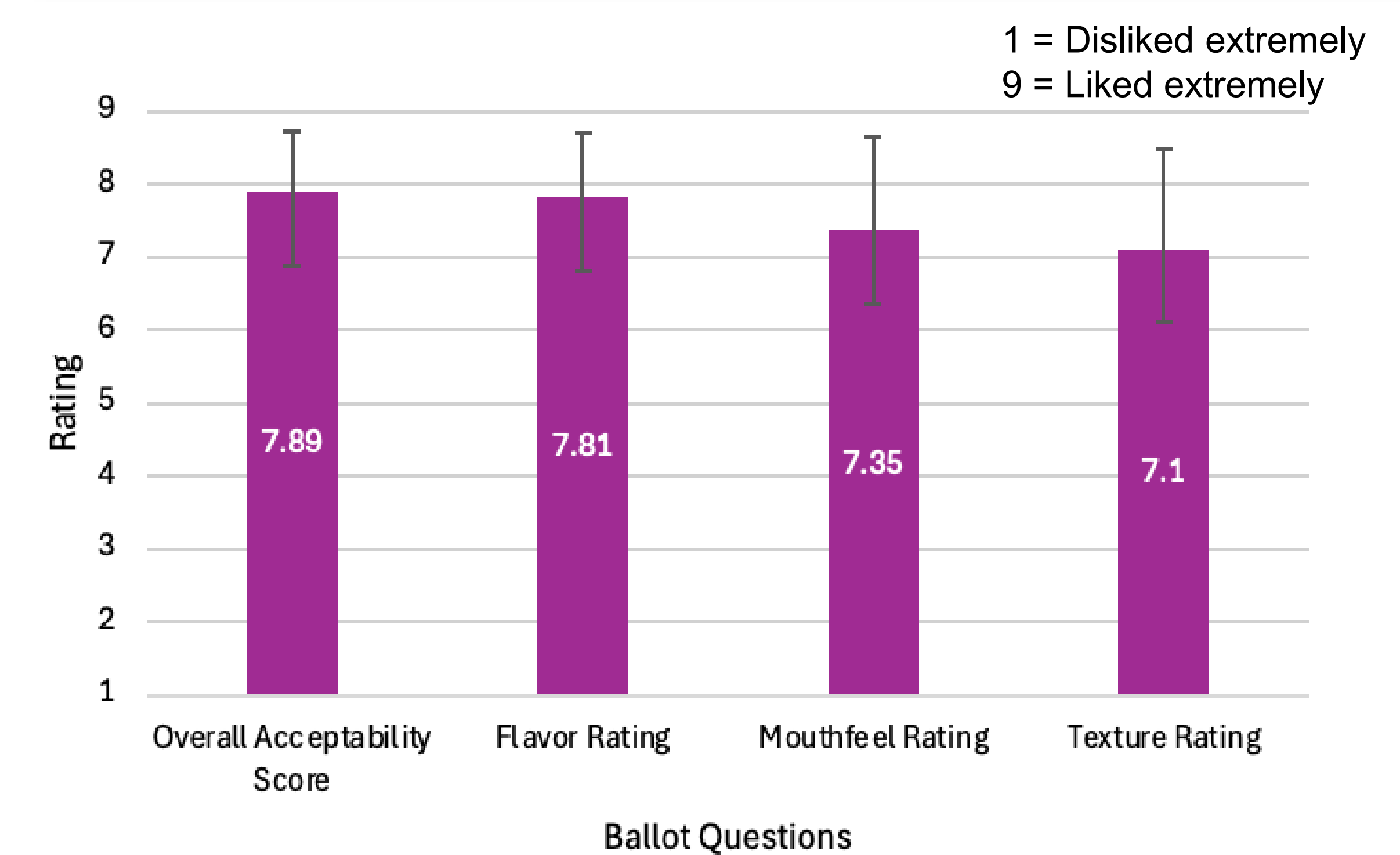


Figure 6. Consumer Sensory Results

Nutrition Facts	
1 serving per container	
Serving size	1 square (466g)
Amount per serving	660
Calories	
% Daily Value*	
Total Fat	22g 28%
Saturated Fat	13g 66%
Trans Fat	0g
Cholesterol	70mg 23%
Sodium	2030mg 88%
Total Carbohydrate	63g 23%
Dietary Fiber	15g 55%
Total Sugars	10g
Added Sugars	0g 0%
Protein	59g
Vitamin D	0% • Calcium 80%
Iron	90% • Potassium 10%
*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.	

Figure 5. Nutrition Label

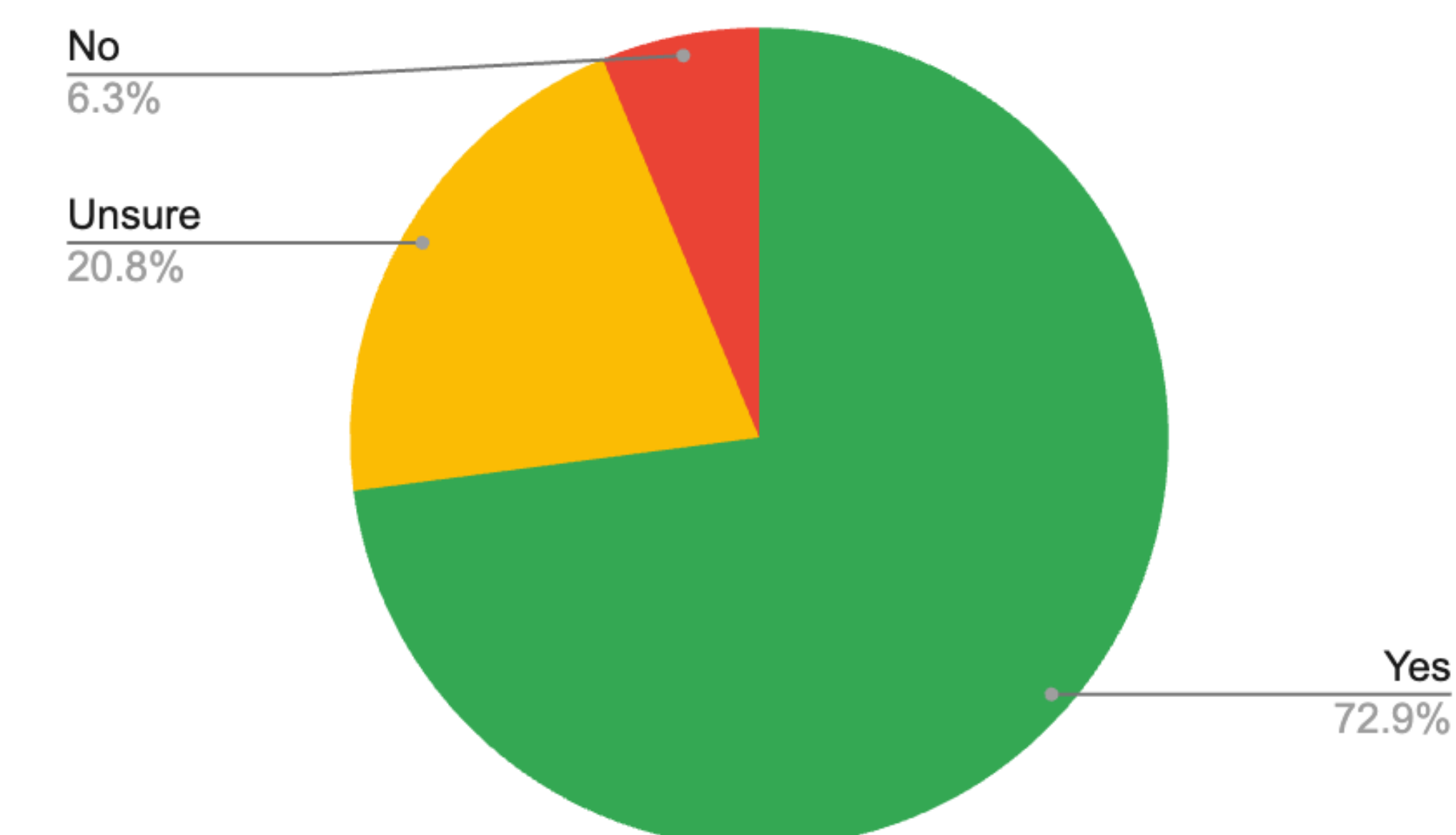


Figure 7. Breakdown of Who Would Purchase

Sample	TSP before (lbs)	TSP after (lbs)	Moisture Uptake (%)
1	1.37	3.86	180.95
2	0.69	1.98	187.79

Figure 8. Moisture Uptake of Texturized Soy Protein (TSP)

Consumer Testing at Kramer



Conclusions

- Based on consumer testing, the **vegetarian lasagna was a success** due to high acceptability ratings and comments such as they couldn't tell there was a difference between regular lasagna and the plant-based one.
- A pan of **frozen/thawed/reheated lasagna** was served at the dining center the following week, and **all portions were gone** within an hour of serving.