Enhancing the Nutrient Content of French Fries Using Root Vegetables

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INTRODUCTION

Consistent consumption of deep-fat fried foods pose a significant risk in the development of cardiovascular disease, atherosclerosis, and a variety of other diseases related to obesity (Anderson et al ., 2011). In 2015-2016, the National Institute for Health Statistics estimated that approximately 40% of US citizens over the age of 20 years old fell in the obese BMI category and another 32% of the population were in the overweight category (CDC, 2018). Alternative methods of cooking methods to replace deep-fat frying is one strategy for reducing the fat, especially saturated fat. Key to acceptability however, is preserving the flavor and mouthfeel fat imparts in the food. Particularly, fried potatoes account for most vegetables consumed by the average US citizen, averaging roughly 50 pounds per person in 2017, according to the USDA facts sheet. For reference, most other vegetable consumption rates came in at less than 11 pounds per person for 2017 (USDA, 2017). The added fat imposed by deep-fat frying raises the overall fat content while significantly lowering the nutrient density of various food options (Gadiraju et al., 2015).

PURPOSE

To enhance the nutrient density and decrease the fat content of traditional fast food French fries using the following root vegetables that are low calorie and high in potassium and vitamin C: rutabaga, jicama, turnips.

METHODS

To control the variability, the vegetables were cut into 10mm X 10mm sticks and the same team member completed the same tasks for each laboratory experiment. Each vegetable variation was cooked separately using the air-fryer at 325°F for 25 minutes. The exception to this cooking method with the white potato French fry. It was deep-fat fried in 32 oz. of sunflower oil using the soak and twice fry method which was cooked until golden brown. The sensory panel was made up of fellow classmates ranging in age of 18-22 were used to assess selected sensory qualities that included appearance, texture, flavor and overall acceptability of the four samples presented for each lab. The panelists used a scorecard to assess their impression of the four samples presented and rated each sample from one to four using a scale (one representing very undesirable to four representing very desirable). Recipes for the next labs were adjusted according to the scores received and any comments provided by the panelists. The scorecard data was calculated using means and the nutritional content of each final recipe was determined using Esha Food Processor software. Cost per recipe and per serving were calculated using sales receipts and the ingredient amounts.

RESEARCH OBJECTIVES

- Reduce the fat composition of traditional French Fry using non-traditional root vegetables (turnip, jicama, rutabaga) and air-frying.
- Assess the overall acceptability of a French fry prepared using a non-traditional root vegetable and air-fried.
- Conduct a cost comparison per recipe and cost per serving of each recipe variation.

RESULTS

TABLE 1: NUTRIENT CONTENT

Variation	Calories (gram)[b]	Fat (grams)[b]	Carbohydrates (grams)[c]	Starch content (grams)[d]
Potato (control)	210.9	0.3	48.0	40.1
Rutabaga	58.1	0.2	12.1	2.7
Turnip	36.4	0.1	8.4	1.2
Jicama	49.4	0.1	11.5	2.8

TABLE 2: COST ANALYSIS

Item	Cost as Purchased	Cost Per Recipe	Cost Per Serving
Turnips	$1.28 / 1 lb	$2.12 / 1.66 lbs	$0.70
Russet Potatoes	$0.88 / 1 lb	$0.88 / 1 lbs	$0.29
Crisco Blends	$3.17 / bottle	$3.17	$0.01
Rutabagas	$0.98 / 1lb	$1.65 /1.68 lbs	$0.55
Jicamas	$1.28 / 1 lb	$2.15 /1.68 lbs	$0.72

Table 3: Sensory Score Card Average Ratings

Appearance		
Variation	Average Ratings[a]	Acceptability Range[b]
Potato	3.9/4	97.5%
Rutabaga	3.6/4	90%
Turnip	2.3/4	57.5%
Jicama	2.5/4	62.5%
Texture		
Potato	3.8/4	95%
Rutabaga	2.6/4	65%
Turnip	2/4	50%
Jicama	2.3/4	57.75%
Flavor		
Potato	3.6/4	90%
Rutabaga	3.5/4	87.5%
Turnip	3.1/4	77.5%
Jicama	2.9/4	72.5%
Overall Acceptability		
Potato	3.8/4	95%
Rutabaga	3.5/4	87.5%
Turnip	2.5/4	62.5%
Jicama	2.3/4	57.75%

RESULTS

The root vegetables had a significant reduction in calories, fat, and carbohydrate content when compared to the control (210 Calories, 48 grams carbohydrates, 40.1 grams starch, and 3 grams fat); rutabaga: 58 Calories per gram, 12.1 grams of carbohydrates, 2.7 grams of starch, and 0.2 grams of fat, turnip: 36.4 Calories per gram, 8.4 grams of carbohydrate, 1.2 grams of starch, and 0.1 gram of fat, and jicama: 49.4 Calories per gram, 11.4 grams of carbohydrate, 2.8 grams of starch, and 0.1 gram of fat. The French fry prepared with the white potato and deep-fat fried had an overall acceptability rating of 3.8 whereas the rutabaga acceptability score was 3.5 followed by the turnip and jicama had scores of 2.5 and 2.3, respectively. Finally, the cost analysis indicated that the French fry prepared with the white potato was the most inexpensive (.29/serving) of the all of the recipes with the rutabaga averaging $0.55 per serving followed by the turnips at .70 per serving and jicama at .72 per serving.

CONCLUSION

In the end, air-frying presented a viable alternative to deep fat frying in terms of overall acceptability by panelists. Further research is needed to assess the quality of vegetable replacements when held for extended periods of time as well exploring other cooking methods that would produce a high quality French fry alternative.