Crafting the Finest Nutritional Chip: Tortilla Chips with Whole Pulse Flours

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Introduction

- The popularity of Mexican food is increasing in today's market and eating habits.[1] Tortilla chips are usually comprised of 60% starch and low amounts of essential nutrients.[2]

- Over-consumption of high-starch foods can lead to adverse health effects.[1]

- Legumes and pulses have naturally high amounts of protein and fiber, which are lacking in today's consumer diets.[3]

- Research Objective: Understand the implications of pulse/legume flour substitution in tortilla chips and their physicochemical impacts.

Materials & Methods

| Procurement of Pulse/Legume Flour | Flours were given from local farms and from George F. Brocke & Sons, Inc. |

| Tortilla Chip Making | Following literature and instructions from manufacturer. Chips were made with 20%, 40%, 60%, and 80% substitution. |

| Chemical Composition & Functional Properties | Flours were analyzed for protein, fat, fiber, starch, and ash contents. Tests for pre- and post-frying consisted of texture profile analysis, and color. |

Figure 1: Sheeted triangle-cut chips

Figure 2: Chip frying after baking

Results

Table 1: Approximate chemical composition of each flour before frying

Sample	Fat (%)	Fiber (%)	Starch (%)	Protein (%)
Masa Flour	4.3	4.5 ↓	66.4 ↑	7.9 ↓
Lentil Flour	1.0	10.3 ↑	44.0 ↓	19.5 ↑
Chickpea Flour	6.5	15.4 ↑	50.1 ↓	20.7 ↑

Results

Table 2: Texture analysis/crispiness and oil uptake of each tortilla chip at 3:00 min and 5:00 min. frying times.

Sample	Frying Time (min)	TPA (g of force)	Oil Uptake (%)
Control	3:00	733.8	37.0
	5:00	1214.5	35.9
20% Lentil	3:00	1278.0	27.3
	5:00	760.2	27.2
40% Lentil	3:00	1159.3	23.1
	5:00	1746.4	23.7
60% Lentil	3:00	1303.1	18.7
	5:00	1263.7	25.3
80% Lentil	3:00	842.7	17.4
	5:00	1470.9	18.6
20% ChickP	3:00	756.6	38.4
	5:00	878.5	35.4
40% ChickP	3:00	1295.5	33.8
	5:00	911.8	30.5
60% ChickP	3:00	1269.6	29.0
	5:00	741.0	31.2
80% ChickP	3:00	979.2	28.0
	5:00	1350.4	27.1

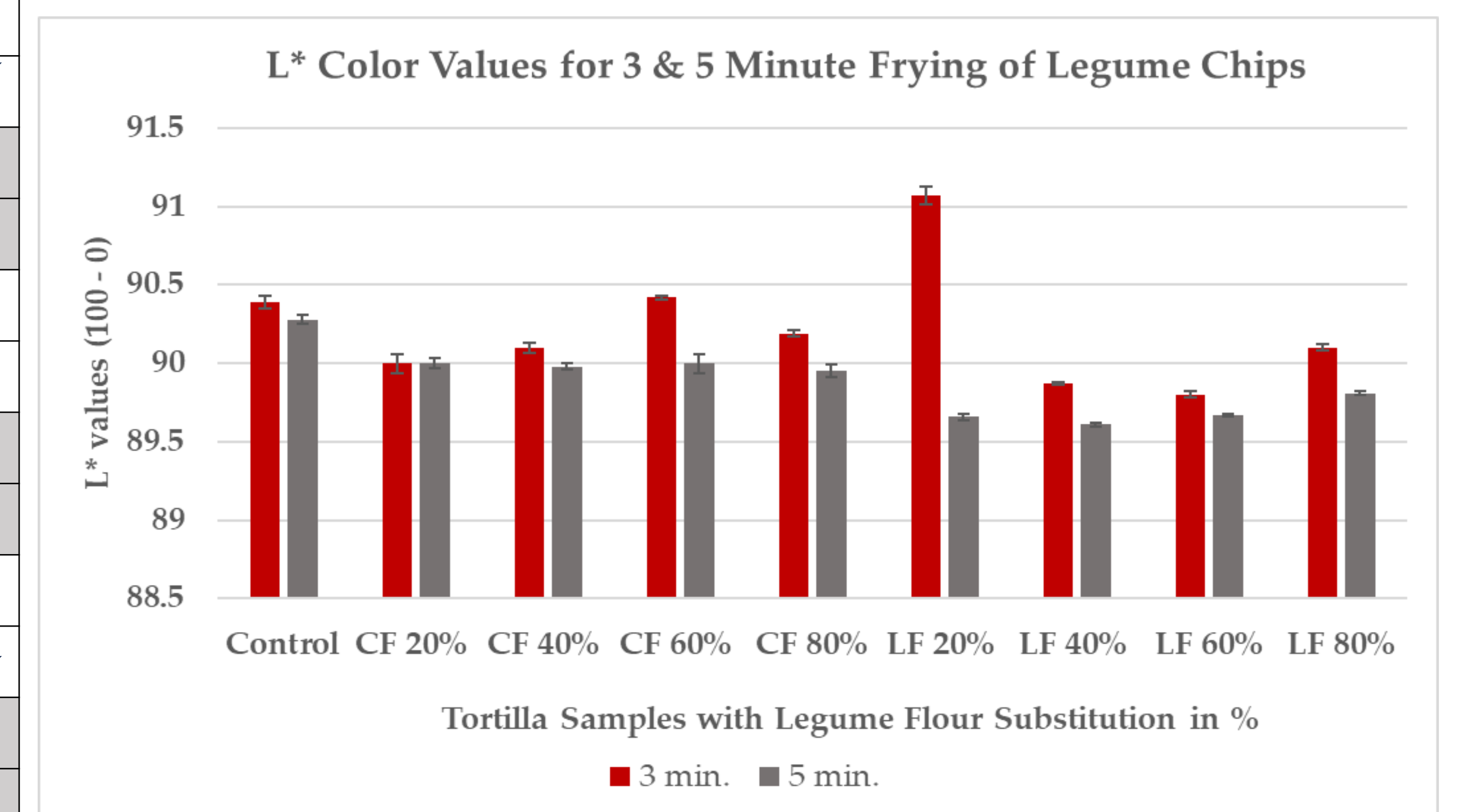Figure 3: Visual representation of lentil and chickpea chips fried for 3:00 min.

Figure 4: L*-values for legume chips fried at three and five minutes

Conclusion & Recommendations

- Pulse/Legume flours are shown to have higher amounts of fiber and protein contents.

- The inclusion of legume flours changed the texture and appearance of each chip.

- Oil uptake of each chip was constant regardless of the legume flour or substitution level.

- Dough hydration can be dependent on legume flour and substitution level.

- This research has applications for a healthier snack alternative or subsidizing low-nutritional foods.

- Potential future work can be done on nutritional profiling, sensory analysis, and tortilla chip processing.

Acknowledgments & References

[1]Gritsenko, M. (2009). Effects Of Composite Flours on Quality and Nutritional Profile of Flour Tortillas (Rooney Lloyd W., Castillo Alejandro, Miller Rhonda K., Sánchez-Plata Marcos X., & Keeton Jimmy, Eds.)[Thesis]. Texas A&M University

[2]U.S. Department of Agriculture (2018, July 9). FoodData Central Corn Tortilla Chips. Retrieved July 17, 2024, from https://fdc.nal.usda.gov/fdc-app.html#/food-details/358957/nutrients

[3]Buzgau, G., Marc, R. A., Muresan, C. C., Farcas, A., Socaci, S. A., Muresan, A., & Muste, S. (2023). The study of the quality parameters of the tortilla chips products formulated from mixtures of corn flour and legumes. Turkish Journal of Agriculture and Forestry, 47(5), 772–786. https://doi.org/10.55730/1300-011x.3126