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Sustainable production of gluten free tigernut pasta and analysis of its functional and physicochemical characteristics

Sagar Pandappa Kalahal[1], Jenshinn Lin[2]
[1]Department of Tropical Agriculture and International Cooperation,
[2]Department of Food Science,
National Pingtung University of Science and Technology, Pingtung 91201, Taiwan.

Abstract

The goal of this research was to develop gluten free pasta product by utilizing the Tigernut (TN) tuber waste (generated post milk extraction). A key idea in sustainable and waste minimization applications is waste food valorization. Lab scale pasta extruder machine was used. The TN tuber waste was oven dried and grinded into flour. 100% semolina pasta was control sample. TN flour (10, 30, 50, 70%) was blended with red bean flour (20, 40, 60, 80%), Djulis flour 10%, corn starch 20%, Kappa carrageenan 1.5%, egg 30% and 20% water in the production of TN based pasta. On an evaluation of functional, and physicochemical analysis of pasta, the various flour compositions containing tigernut flour exhibited substantial variances in comparison with control sample. The ideal texture and consistency of flour was rendered attainable with the utilization of 1.5% kappa carrageenan. The color of the pasta was improved due to incorporation of djulis. The combination of TN flour, red bean flour, and djulis flour enhanced the functional and physicochemical characteristics of gluten free pasta. This research may offer insights into the way to process TN pasta while promoting sustainable production and consumption, which could help ensure food security and accomplish the requirements of a growing demographic.

Keywords: tigernut, pasta extrusion, gluten free pasta, sustainable production, food security

1. Introduction

- Pasta intake and manufacturing are increasing globally, with an anticipated yearly growth rate of 4.4% from 2019 to 2023 (Saget *et al*., 2020).
- The FAO (Food and Agricultural Organization of the UN) considers pasta to be a model of a sustainable, nutritious, and excellent diet.
- Waste food valorization is a significant notion in sustainable and waste minimization initiatives.
- The commercialization of tigernut offers prospects for developing novel and healthy products (Wongnaa *et al*., 2019).

2. Objectives

- Valorization of tigernut tuber waste in production of gluten free pasta.
- Evaluate functional and physicochemical characteristics of pasta.

3. Materials

- Tigernut (Tigernuts Traders Co., Ltd, L'Eliana, Spain), Red bean (Nian guan industry Co., Ltd, Taiwan), Djulis (Xinfong Agricultural Technology Co., Ltd, Taiwan). Semolina pasta was bought from the local market.
- Pasta extruder (La Monferrina, Italy). Oven (OV-50 Hipoint, Jin Her Tyan Scientific Co., Taiwan), Grinder (RT-04, Mill Powder Tech Solution, Taiwan).
- Chemicals of analytical grade.

4. Pasta production process

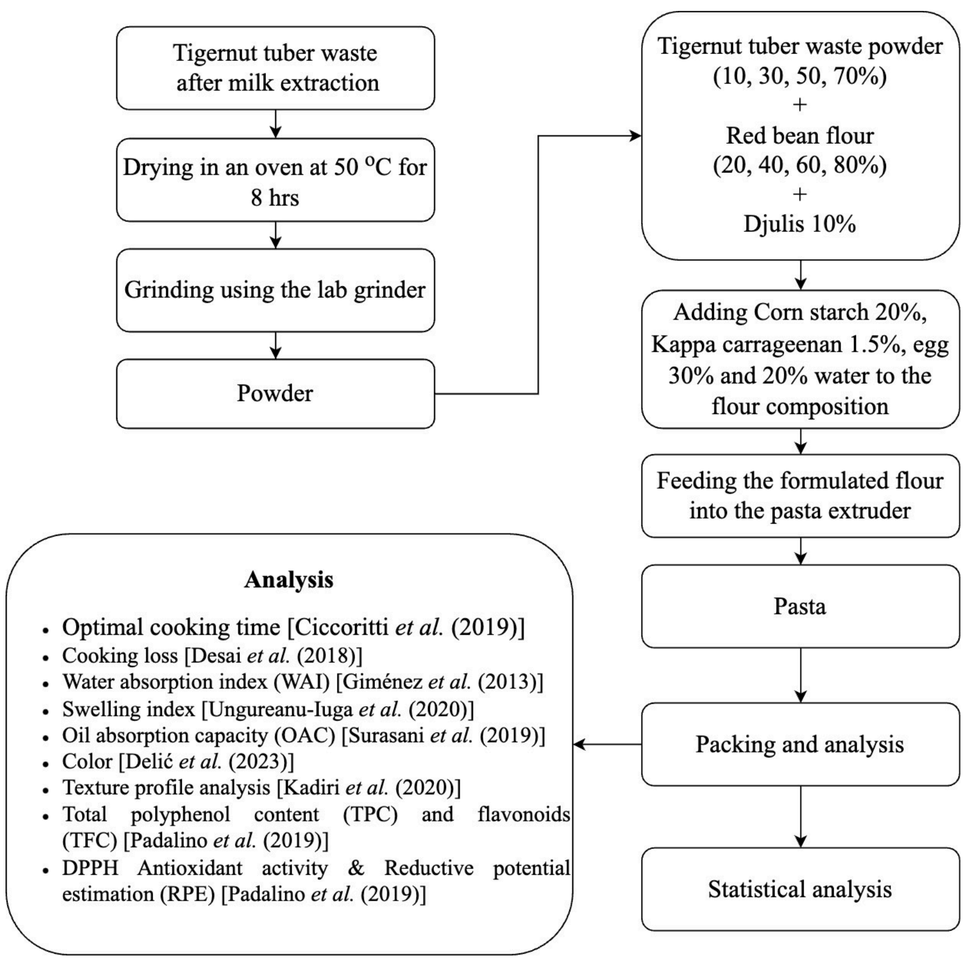

Figure 1. Flow chart of pasta production

5. Results

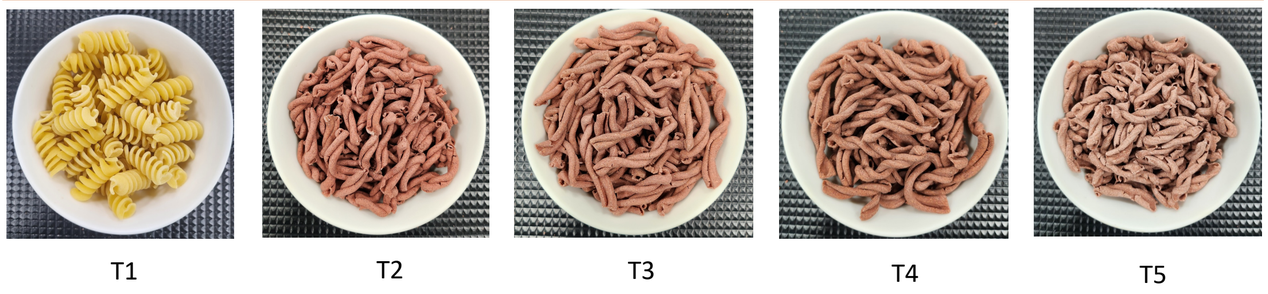

Figure 2. Pictorial representation of pasta

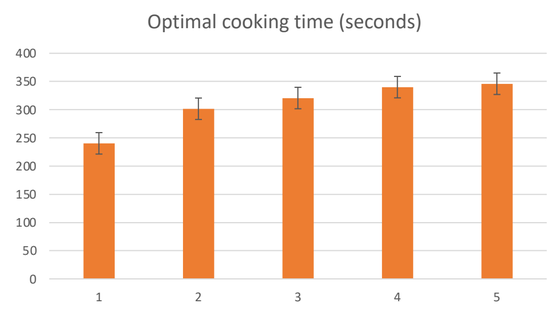

Figure 3. Optimal cooking time

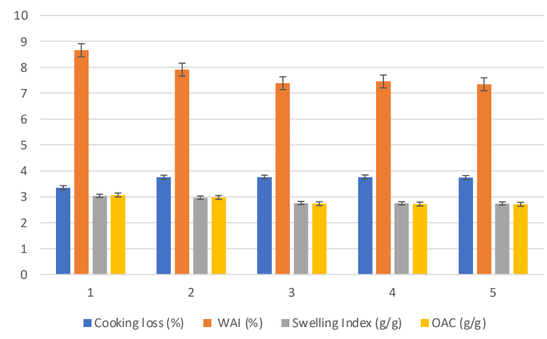

Figure 4. Functional properties

Table 1. Color values of pasta

Treatment	L*	a*	b*
T1	72.69±0.58^{a}	2.07±0.01^{c}	8.29±0.05^{a}
T2	67.57±0.75^{b}	3.80±0.16^{a}	1.23±0.01^{d}
T3	67.61±0.49^{b}	3.62±0.04^{b}	1.73±0.01^{c}
T4	67.62±0.59^{b}	3.54±0.03^{b}	1.78±0.03^{bc}
T5	67.72±0.23^{b}	3.53±0.05^{b}	1.81±0.02^{b}

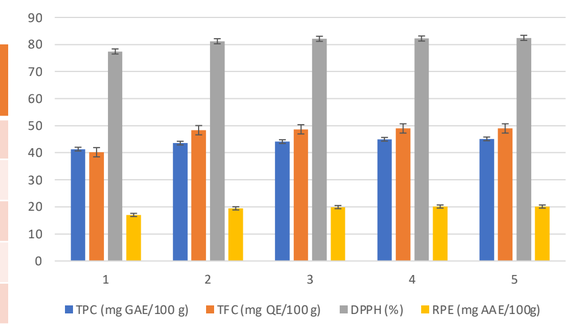

Figure 5. TPC, TFC and antioxidant activity

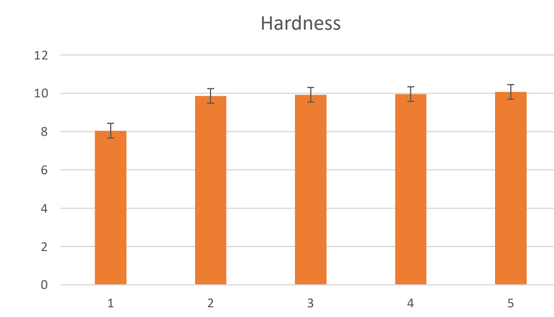

Figure 6. Hardness of pasta

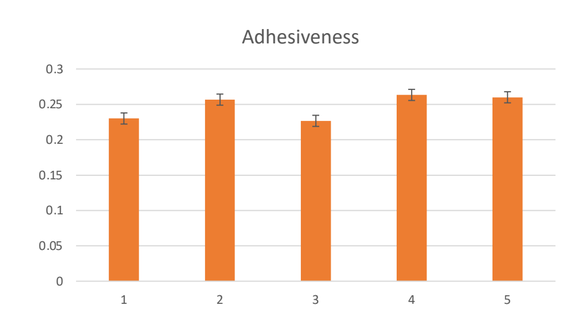

Figure 7. Adhesiveness of pasta

Note: WAI- water absorption index, OAC- oil absorption capacity, L* -whiteness/darkness, a*-redness, and b*-yellowness, TPC- total phenolic content, TFC- total flavonoid content, RPE-reductive potential estimation.

6. Conclusion

- The combination of tigernut, red bean and djulis improved the physicochemical and functional properties of gluten-free pasta.
- This study could offer information on how to produce tigernut pasta while encouraging environmentally friendly production as well as consumption, which might assist in ensuring food security.
- This study could help encourage the utilization of tigernut in development of novel and nutritive tigernut based products.

7. References

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