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Development of red flour from *Amaranthus caudatus* grains by solid-state fermentation by *Monascus ruber*

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INTRODUCTION & AIM

Amaranthus caudatus, known as amaranth or kiwicha, is a pseudocereal, and its grains are gluten-free. They are a rich source of high-quality nutrients, with a good amount of protein, lipids, and fiber; it also contains twice as much calcium as milk, making it an excellent input for the food industry [1]. This study aimed to produce kiwicha flour fermented by *M. ruber*, for this purpose, an optimization of factors such as sodium chloride, glucose and ratio (water:sample ratio) was carried out through a Box-Behnken experimental design because it comprises a specific set of 3k factorial combinations and is widely used in food processes due to its economical design [2]. The fermented flour was analyzed in the CIELAB color space (L*, a*, b*) [3]. The present study could provide a new and good source of flour with high added value in the food industry.

METHOD

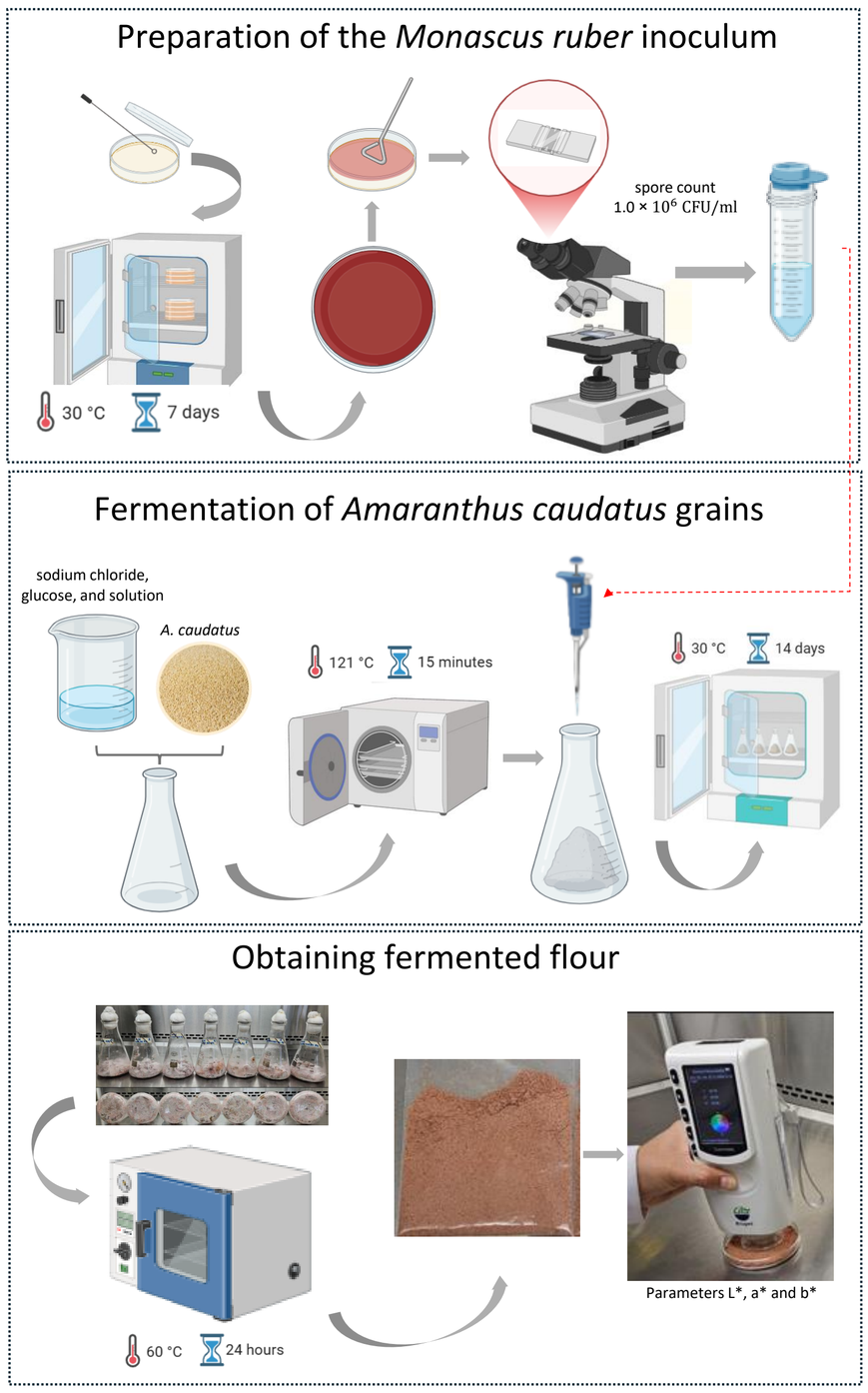

Figure 1. Methodology for obtaining fermented flour from kiwicha grains by *M. ruber*

RESULTS

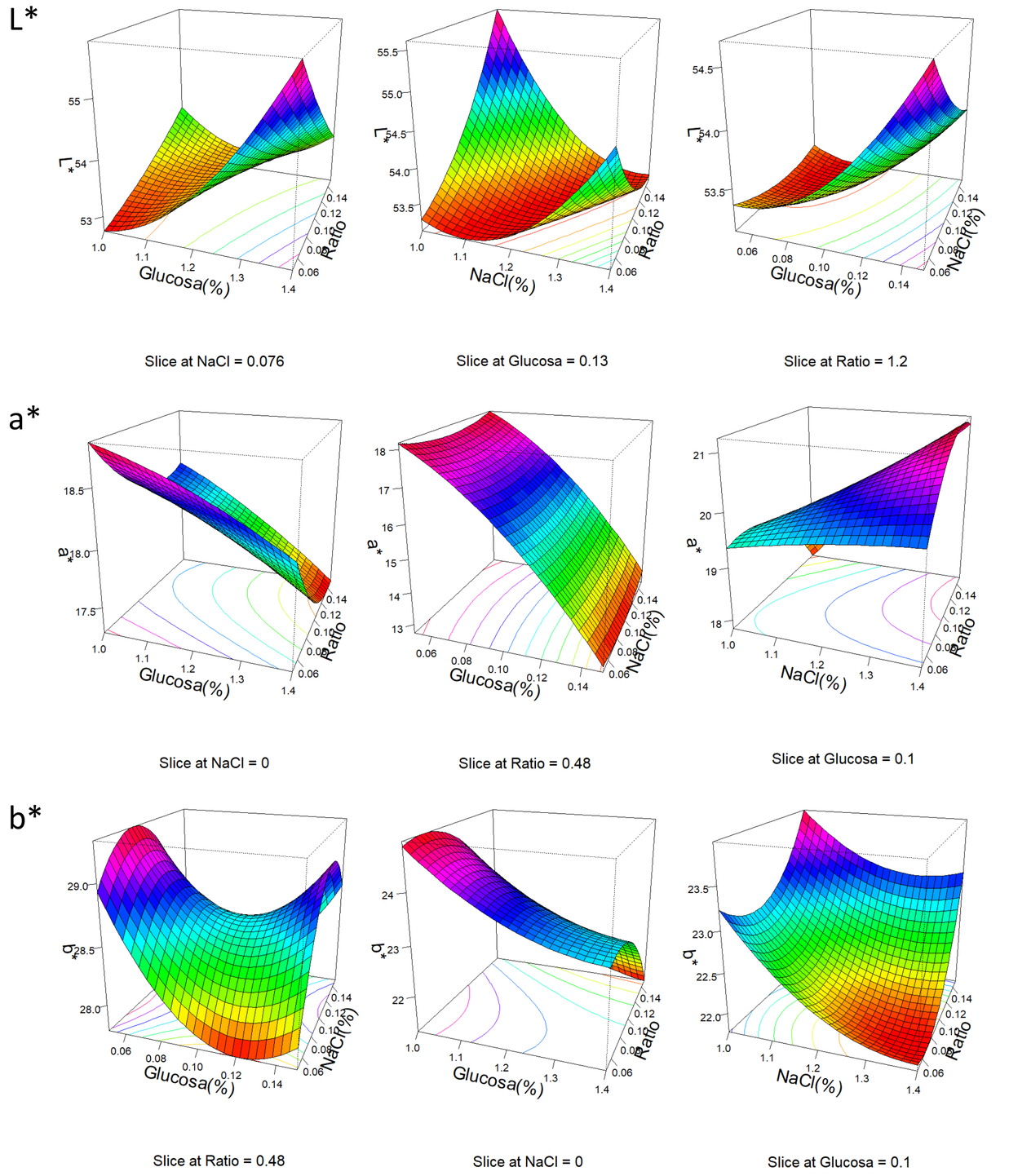

Figure 2. Response surface graphs showing the effects of the independent variables (sodium chloride, glucose and ratio) on the response of the dependent variables such as final weight, L*, a* and b*.

CONCLUSION

In the present work it is demonstrated that on day 14, the optimal value of a* was 21.66, being the best red flour obtained through the fermentation of kiwicha grains by *Monascus ruber*, where the optimal values of the factors were 0.11 g/g, 0.05 g/g and 1.38 water: sample for sodium chloride, glucose and ratio respectively.

REFERENCES

[1] Hu, F., Xiong, X., & Ogawa, Y. (2024). Effect of grain structure and cooking method on starch digestibility and antioxidant activity of amaranth (*Amaranthus caudatus* L.) grains during simulated gastrointestinal digestion. Food Chemistry Advances, 4, 100718.

[2] Yolmeh, M., & Jafari, S. M. (2017). Applications of response surface methodology in the food industry processes. Food and Bioprocess Technology, 10(3), 413-433.

[3] Huang, R., Huang, K., Guan, X., Li, S., Cao, H., Zhang, Y., Lao, J., & Wang, J. (2021). Effect of defatting and extruding treatment on the physicochemical and storage properties of quinoa (*Chenopodium quinoa* Wild) flour. LWT, 147, 111612.

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