THERMIC MODIFICATION OF PASSION FRUIT FLOUR TO PRODUCE FERMENTABLE SACCHARIDES

Débora Preceliano de Oliveira[1,2], Erica Cruz[1,2], João Paulo Fabi[1,2]

[1.] FCF/USP, Faculty of Pharmaceutical Sciences, University of São Paulo, Av. Prof. Lineu Prestes, 580 - Butantã, São Paulo - SP, 05508-000;
[2.] FoRC, Food Research Center, R. do Lago, 250 - bloco C - Cidade Universitária, São Paulo - SP, 05508-080;

The intestinal microbiota is a complex ecosystem comprising bacteria, fungi, viruses, archaea, and protozoa that metabolize available substrates through species-specific metabolic pathways. The products of these processes, including beneficial metabolites, contribute to host health, classifying the substrates as prebiotics. While many prebiotic candidates are low-molecular-weight compounds, insoluble dietary fibers indirectly modulate the microbiota by supporting fecal consistency and nutrient transport. A promising approach to enhancing prebiotic effects involves reducing the complexity of polysaccharides and lowering their degree of polymerization, thereby improving solubility and metabolic utilization by intestinal bacteria. Pectin represents nature\'s most structurally complex polysaccharides. When pectin is broken down (depolymerization to produce oligosaccharides), pectin-derived oligosaccharides (POS) are given rise. These oligosaccharides demonstrate enhanced solubility and metabolic potential as prebiotics. Passion fruit (*Passiflora edulis f. flavicarpa* O. Deg.) is widely cultivated in Brazil, rich in pectins and composed of soluble and insoluble fibers. The peel and albedo, byproducts of this fruit, have potential added value and are currently marketed as flour, with economic and environmental relevance. Therefore, the present study aims to evaluate the prebiotic potential of oligosaccharides obtained from modified passion fruit pectin, aiming at a sustainable formulation that uses passion fruit flour, allowing insoluble fibers to act synergistically with POS. To produce fermentable saccharides passion fruit flour is used through thermal hydrolysis. Passion fruit flour was treated at 121°C for 1 hour in the autoclave. The soluble fractions were dried using a spray dryer, while the insoluble fraction was lyophilized. The resulting samples were analyzed using high-performance size-exclusion chromatography (HPSEC) and *in vitro* colonic fermentation. Thermal treatment effectively reduced the average molecular weight of the polysaccharides, facilitating faster fermentation of the soluble fractions. Fermentation of these fractions occurred within 8 hours, demonstrating a profile comparable to the fructooligosaccharides (FOS) standard. The observed pH variation (6.85 to 5.89) and pressure changes (0 to 7.33 psi) during the fermentation of the soluble fractions closely mirrored those of FOS fermentation, where the pH ranged from 6.94 to 5.01 and pressure from 0 to 11.5 psi. These findings support the hypothesis that intestinal bacteria utilize lower molecular weight saccharides more efficiently. Further analyses, including short-chain fatty acid (SCFA) quantification and fecal microbiota composition assessment via 16S rDNA sequencing, will provide deeper insights into the fermentation dynamics, ecosystem interactions, and the role of the substrate. These data will help elucidate the prebiotic potential of modified passion fruit flour and its capacity to modulate the intestinal microbiota.

References

DE OLIVEIRA, D. P.; TODOROV, S. D.; FABI, J. P. Exploring the prebiotic potentials of hydrolyzed pectins: mechanisms of action and gut microbiota modulation. Nutrients, v. 16, n. 213689, 2024. DOI: https://doi.org/10.3390/nu16213689.
GIBSON, Y.; ROBERFROID, M. B. Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics. The Journal of Nutrition. Disponível em: https://academic.oup.com/jn/article-abstract/125/6/1401/4730723. Acesso em: 28 jan. 20
PEDROSA, L. F.; KOUZOUNIS, D.; SCHOLS, H.; DE VOS, P.; FABI, J. P. Assessing high-temperature and pressure extraction of bioactive water-soluble polysaccharides from passion fruit mesocarp. Carbohydrate Polymers, v. 335, 2024. DOI: https://doi.org/10.1016

SANDERS, M. E.; MERENSTEIN, D. J.; REID, G.; GIBSON, G. R.; RASTALL, R. A. Probiotics and prebiotics in intestinal health and disease: from biology to the clinic. Nature Reviews Gastroenterology and Hepatology, London: Nature Publishing Group, 2019. DOI:

Acknowledgements: The authors acknowledge the Coordination of Superior Level Staff Improvement (CAPES) for D.P.d.O. scholarship (#88887.747282/2022-00) and The National Council for Scientific and Technological Development (CNPq) for J.P.F.'s productivity scholarship (CNPq Proc. #307842/2022-3). The study was financially supported by grants #2013/07914-8 from the São Paulo Research Foundation (FAPESP) for J.P.F.