

INFLUENCE OF PREBIOTIC PINEAPPLE JUICE ON THE COMPOSITION OF HUMAN COLONIC MICROBIOTA

Thatyane V. Fonteles¹*, Antônia Yvina S. Santos¹ & Sueli Rodrigues¹

Federal University of Ceara/Food Engineering Department/Biotechnology Laboratory, Fortaleza, Brazil.

* Corresponding author's email address: suelir@ufc.br

ABSTRACT

This study aimed to investigate the potential prebiotic effects of oligosaccharides and dextran produced by enzymatic synthesis in pineapple juice, cashew apple juice, and cajuina, on the composition and metabolites of human colonic microbiota. The complex carbohydrates in these fruit-based drinks, such as dextran and oligosaccharides, were resistant to acidity and enzymes in the gastrointestinal tract. After simulated colonic fermentation for 48 hours, the colonic microbiota metabolized the oligosaccharides at 82%, 94%, and 80% for prebiotic pineapple, cashew apple juices, and cajuina, respectively. The drinks also modulated the composition of human colonic microbiota, with an increase in *Alistipe* and *Fusobacterium* and a decrease in *Bacteroides* and *Escherichia/Shigella* after 48 hours of colonic fermentation of pineapple juice.

Keywords: Oligosaccharide 1. Dextran 2. *Ananas comosus* 3.

1 INTRODUCTION

Prebiotic foods are the most common dietary means influencing gut microbiota. Also, ingesting whole foods, such as fruits and vegetables, can confer health benefits on the host. The fruits and vegetables beneficial effects are due to their high levels of polyphenols and carbohydrates that are available to the microbiota (Barba et al., 2017). In this study, pineapple juice was used as raw material to produce prebiotic oligosaccharides and dextran by enzymatic synthesis using dextran-sucrase from *Leuconostoc mesenteroides* B512.

2 MATERIAL & METHODS

Prebiotic oligosaccharides were synthesized by the action of the enzyme dextran-sucrase, according to the methodology previously established by Fontes et al., (2015). The *in vitro* colonic fermentation of potentially prebiotic pineapple juice was carried out as previously described by (Leite et al., 2023). Dextran was precipitated by adding three volumes of ethanol 96% (v/v). The pellet was re-suspended in distilled water, and the dextran formed during the synthesis was assayed as the total carbohydrate (Fox & Robyt, 1991). The supernatant containing the residual sugars was assayed by HPLC. Glucose, fructose, and sucrose were quantified in an Infinity 1260 (Agilent®) system. For high-throughput sequencing, the V4 region of the 16S bacteria ribosomal RNA gene was chosen for amplification and sequenced by Illumina Miseq platform (Illumina Inc., USA). The taxonomic affiliation was carried out against the DADA2 database. The experimental procedure was submitted and approved by the Ethics Committee on Research (Federal University of Ceara, CEP/UFC, CAAE 51874021.0.0000.5054, 25/10/2021).

3 RESULTS & DISCUSSION

Fig. 1 shows the consumption of sugars and dextran during the colonic fermentation of prebiotic juices for 48 hours. The consumption of sugars during fermentation was closely associated with microbial metabolism. In addition to prebiotic carbohydrates, prebiotic juices presented simple sugars such as sucrose, glucose, and fructose after synthesis. Glucose and fructose were depleted at 24 h of fermentation. The colonic microbiota metabolized all the sucrose content and residual sugars within 48 hours of fermentation. At the same time, 22% of the dextran in the prebiotic pineapple juice was consumed, indicating that the human colonic microbiota could metabolize dextran. Complex carbohydrates present in prebiotic juices, such as dextran and oligosaccharides, were resistant to acidity and enzymes in the gastrointestinal tract.

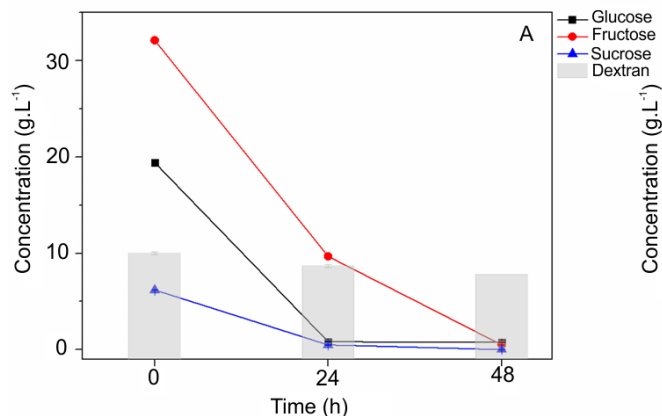


Fig. 1 Glucose, fructose, sucrose, and dextran consumption during colonic fermentation of prebiotic pineapple juice.

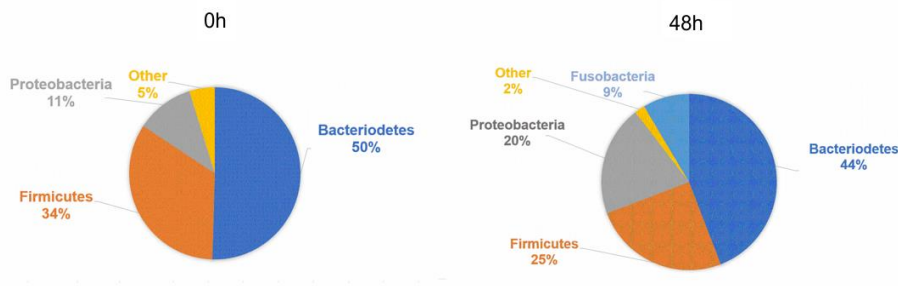


Figure 2 Composition of different bacterial phyla of samples at 0h and 48h fermentation as determined by 16S rRNA gene sequencing.

At the phylum level, all donors' initial dominant bacterial communities (0h) were *Bacteroidetes* and *Firmicutes* (Fig. 4). After colonic fermentation (48h) and consumption of oligosaccharides and dextran from pineapple juice, there was a decrease in the relative abundance of *Bacteroidetes* (-6%) and *Firmicutes* (-9%). The order *Lactobacillales* represented 11.90%, while *Bifidobacteriales* accounted for 0.87% of the total microbiota reads after 48 hours of fermentation of pineapple juice. *Alistipes onderdonkii* was the predominant species in prebiotic pineapple ferments, with $22 \pm 0.5\%$ of the total reads. The degradation of polysaccharides by *B. thetaiotaomicron* produces oligosaccharides utilized by other bacterial populations through cross-feeding mechanisms (Gotteland et al., 2020).

4 CONCLUSION

This study demonstrated that the oligosaccharides obtained from enzymatic synthesis are metabolized by human colonic microbiota and remarkably influence its composition, mainly by promoting the growth of potentially beneficial microorganisms.

REFERENCES

2. Fontes, C. P. M. L., da Silva, J. L. A., Rabelo, M. C., & Rodrigues, S. (2015). Development of low caloric prebiotic fruit juices by dextransucrase acceptor reaction. *Journal of Food Science and Technology*, 52(11), 7272–7280. <https://doi.org/10.1007/s13197-015-1836-x>
3. Fox, J. D., & Robyt, J. F. (1991). Miniaturization of Three Carbohydrate Analyses Using a Microsample Plate Reader. *Analytical Biochemistry*, 195, 93–96.
4. Leite, A. K. F., Fonteles, T. V., Godoy Alves Filho, E., Andrea da Silva Oliveira, F., & Rodrigues, S. (2023). Impact of orange juice containing potentially prebiotic ingredients on human gut microbiota composition and its metabolites. *Food Chemistry*, 405. <https://doi.org/10.1016/j.foodchem.2022.134706>

ACKNOWLEDGEMENTS

The authors thank the financial support of the Brazilian funding agency CNPq through the National Institute of Science and Technology of Tropical Fruit, FUNCAP, and CeGenbio/UFC for the 16S rRNA sequencing. This study was financed in part by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Finance code 001 Brasil (CAPES)*.