Lactobacillus plantarum survives during osmotic dehydration and storage of probiotic cut apple

Kassandra Emser, Joana Barbosa, Paula Teixeira, Alcina M. M. B. Morais*

Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital, 172, 4200-374 Porto, Portugal

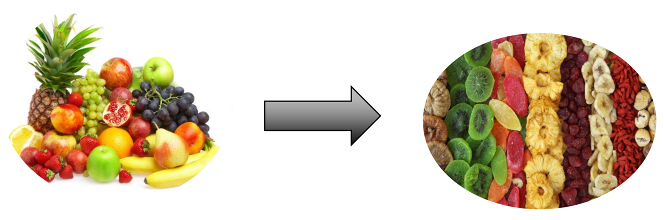
***corresponding author: abmorais@porto.ucp.pt**

MICRO BIOTEC 17 CONGRESS OF MICROBIOLOGY AND BIOTECHNOLOGY 2017

CATÓLICA ESCOLA SUPERIOR DE BIOTECNOLOGIA PORTO

Introduction

The dehydration consists of reducing the water content of food



water activity (a_w) ↓ → food stability ↑

The **osmotic dehydration** (OD) can reduce the a_w and increase the stability and, consequently, the shelf life of the product.

Osmotic agent → Sorbitol is a prebiotic with proven health properties and, in comparison with sucrose, is less caloric, less sweet and less cariogenic.

***Lactobacillus plantarum* 299v**

It has been extensively studied and, nowadays, is one of the most commonly used probiotic in the production of functional food.

Objectives

- To test the incorporation of *L. plantarum* 299v during OD of apple cubes;
- To study the effect of sucrose and sorbitol on the incorporation;
- To evaluate the viability of the probiotic in the apple cubes during storage;
- To test the viability after a gastrointestinal tract passage simulation of the probiotic apple cubes.

Methods

Apple (Royal Gala)
↓
Washed and sanitized
↓
Cut in cubes
↓
Immersed in Ringer's solution
↓
Osmotic dehydration ← (1013 or 150 mbar; 40 or 60 ºBrix sucrose or sorbitol solution with re-suspended *L. plantarum*; 37 ºC; 1:4; 50 rpm)
↓
Storage (4 ºC)
↓
Gastrointestinal tract passage simulation (2 h)

Results

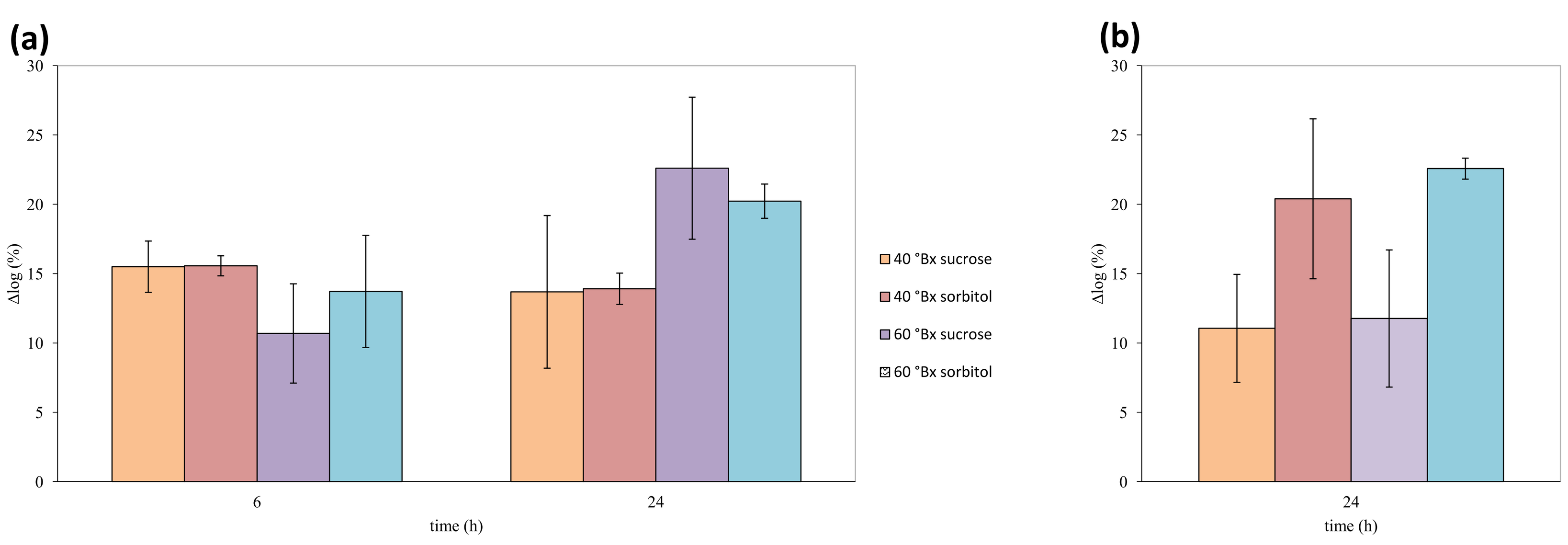


Figure 1. Viability of *L. plantarum* in apple cubes during/after OD with 40 or 60 ºBrix solutions of sucrose or sorbitol at 37 ºC at atmospheric pressure (**a**) and in vacuum of 150 mbar (**b**) in relation to the viability in the initial osmotic solution, expressed in Δlog (Δlog (%) = (log($N_{0,\ solution}$)- log(N))/ log($N_{0,\ solution}$)*100).

Table 1. Logarithmic reduction of *L. plantarum* incorporated in apple cubes after OD (24 h) with 40 or 60 ºBrix solutions of sucrose or sorbitol at 37 ºC and atmospheric pressure throughout a quick digestion simulation of the passage through the gastro-intestinal tract (2 h)

	log $(N/N_0)^a$		
Osmotic solution	**0 minutes**	**60 minutes[b]**	**120 minutes[c]**
40 °Bx sucrose	NR[d]	NR[d]	-0.50 ± 0.10
40 °Bx sorbitol	NR[d]	-0.10 ± 0.10	-0.20 ± 0.10
60 °Bx sucrose	NR[d]	0.10 ± 0.10	-0.10 ± 0.00
60 °Bx sorbitol	NR[d]	-0.30 ± 0.30	-0.40 ± 0.20

[a]Logarithmic reduction: log (N/N0) ± the standard error of the mean
N is the cfu/ml at each sampling time
N0 is the cfu/ml at time zero after exposure to pH 7.0
[b]Logarithmic reduction after exposure to pH 3.0 in the presence of pepsin
[c]Logarithmic reduction after exposure to pH 3.0 in the presence of pepsin and subsequent exposure to bile salts at pH 7.0
[d]NR- No loss of cell viability occurred

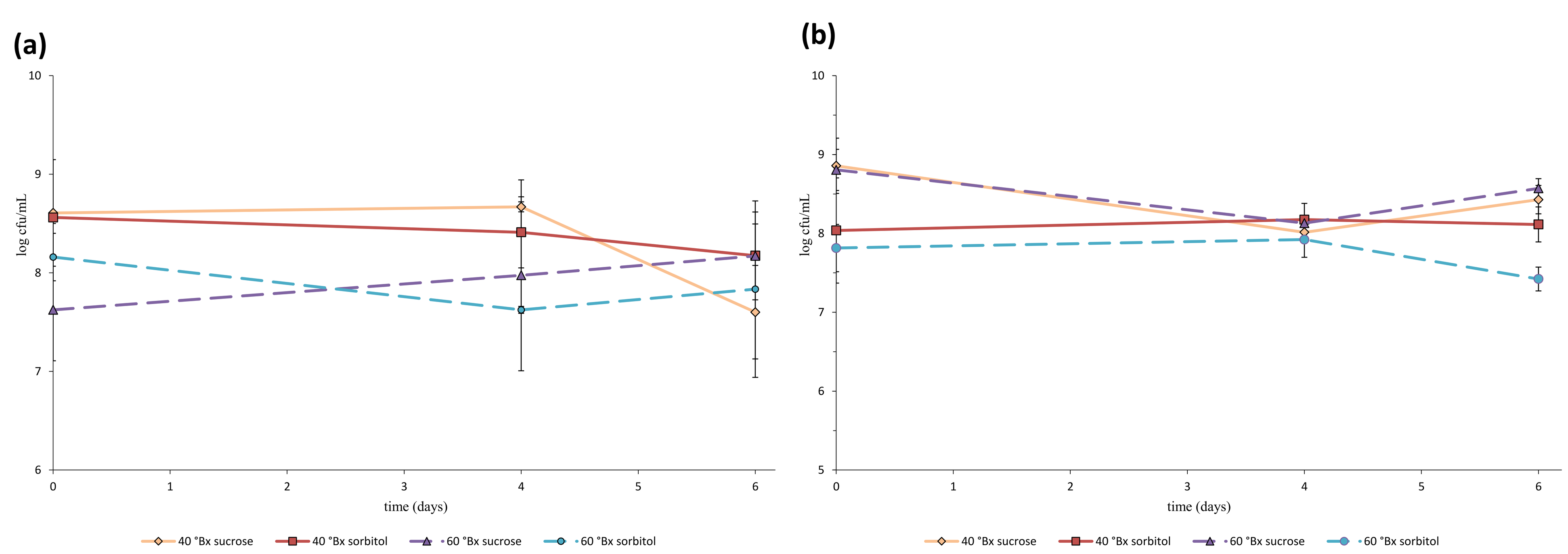


Figure 2. Survival of *L. plantarum* in apple cubes during storage at 4 ºC after the OD (24 h) with 40 or 60 ºBrix solutions of sucrose or sorbitol at 37 ºC and atmospheric pressure (**a**) and in vacuum of 150 mbar (**b**).

Conclusions

- *Lactobacillus plantarum* 299v (10^7 – 10^8 cfu/g) was successfully incorporated in apple cubes during the OD process (24 h) at 37 ºC and normal atmosphere, as well as in vacuum, using 40 and 60 ºBrix sucrose or sorbitol solutions.
- *L. plantarum*, incorporated in apple cubes, survived over a storage period of 6 days at 4 ºC maintaining constant values of 10^7 cfu/g.
- The viability of *L. plantarum* did not decrease during a quick simulation of the passage through the gastro-intestinal tract (2 h), which is essential for the beneficial effect of a probiotic.

Acknowledgements

This work was supported by National Funds from FCT – Fundação para a Ciência e Tecnologia through project UID/Multi/50016/2013 and by the European M.Sc. in Food Science, Technology and Business (BiFTec). J. Barbosa acknowledges the support provided by the post-doctoral fellowship SFRH/BPD/113303/2015 (FCT). The authors also acknowledge Campotec for graciously supplying the apples for this study.