

# Natural antimicrobial agents and their potential on the preservation of food



CATÓLICA  
FACULTY  
OF BIOTECHNOLOGY

PORTO

Joana Gomes, Joana Barbosa, Paula Teixeira\*

CBQF - Centro de Biotecnologia e Química Fina, Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Porto, Portugal

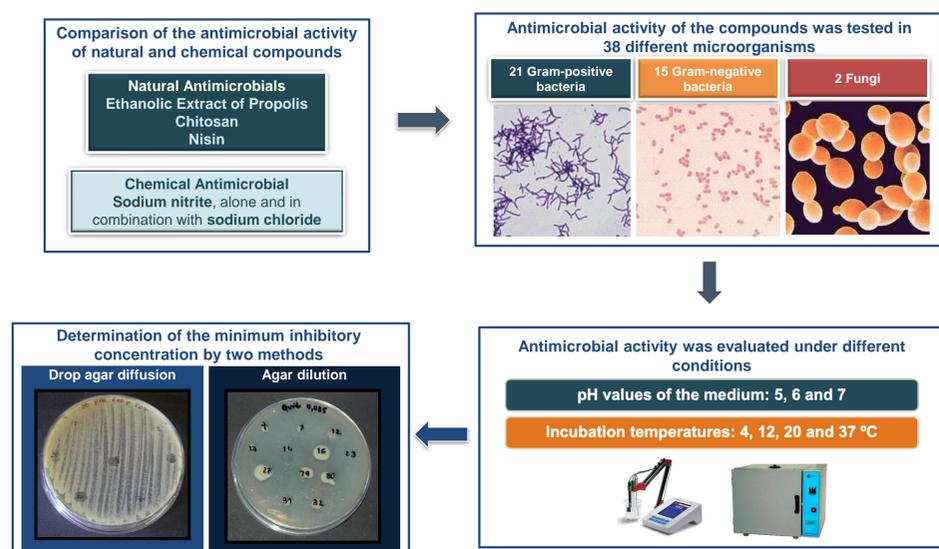
\*Corresponding author: pteixeira@porto.ucp.pt

## Introduction

Microbiological quality of food is of considerable concern to the food industry, since the activity of microorganisms can cause deterioration and, more seriously, affect the health of consumers [1]. Therefore, chemical additives are added to most of the foods with the purpose of maintaining certain properties or prolonging their shelf life [2]. However, there are several health-related problems associated with the use of these additives. Due to the problem of demonstrated or potential toxicity to the consumers, the number of chemical compounds allowed as food preservatives is limited [3]. Although, currently, most preservatives have no side effects and are classified as safe, there have been problems with the safety of some of these chemicals.

The objective of this work was to determine the minimum inhibitory concentrations of three natural antimicrobial agents (ethanolic extract of propolis, chitosan and nisin) against 32 microorganisms (15 Gram-positive and 15 Gram-negative bacteria and two fungi) in order to compare with the minimum inhibitory concentrations of the chemical compound sodium nitrite, alone and in combination with sodium chloride. The inhibition of microorganisms was also tested at different pH values and temperatures of incubation to simulate the presence of the pathogens in different foods stored at different conditions.

## Methodology



## Results

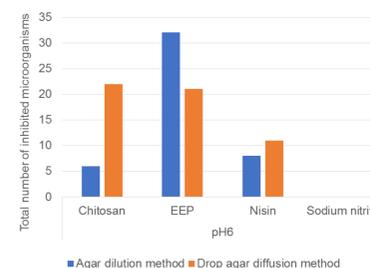


Figure 1. Comparison of the total number of inhibited microorganisms by the different compounds, by agar dilution method (blue) and drop agar diffusion method (orange), at pH 6 and 37 ° C.

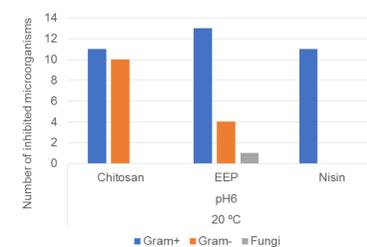


Figure 2. Number Gram + (blue), Gram - (orange) and fungi (gray) inhibited by the different compounds, at pH 6 and 20 ° C.

## Conclusions

The natural compounds tested had greater inhibitory effect against the various microorganisms compared with the sodium nitrite alone and in combination with sodium chloride, in the different conditions of pH and temperature. Chitosan at 0.65% (w/v) inhibited most of the tested microorganisms. At 10 mg/mL of propolis, fungi, most of the Gram-positive and some of the Gram-negative bacteria were inhibited. At 25 µg/mL of nisin it was possible to inhibit most of the Gram-positives. Sodium nitrite, individually or in combination with sodium chloride, did not inhibit most microorganisms. The minimum inhibitory concentrations of several microorganisms were different depending on the methodology.

With these *in vitro* results, it seems that the natural compounds investigated are good alternatives to chemical antimicrobials used in food production.

## References

- [1] Casquete R, Castro SM., Jácome S, Teixeira P. Antimicrobial activity of ethanolic extract of propolis in “Alheira”, a fermented meat sausage. *Cogent Food Agric* 2016a; 2: 7.
- [2] Branen AL, Haggerty RJ. Introduction to Food Additives. In: *Food Additives* (Eds. Branen, A.L., Davidson, P.M., Salminen, S. & Thorngate, J.H.), Marcel Dekker, Nova Iorque. 2002.pp. 1-9.
- [3] Russell AD. Mechanisms of bacterial resistance to non-antibiotics: food additives and food and pharmaceutical preservatives. *J Appl Microbiol* 1991; 71: 191-201.

## Acknowledgements

The authors acknowledge the financial support in the framework of the project “Biological tools for adding and defending value in key agro-food chains (bio – n2 – value)”, nº NORTE-01-0145-FEDER-000030, funded by *Fundo Europeu de Desenvolvimento Regional* (FEDER), under *Programa Operacional Regional do Norte - Norte2020*. We would also like to thank the scientific collaboration under the FCT project UID/Multi/50016/2013. Financial support for author J. Barbosa was provided by a post-doctoral fellowship SFRH/BPD/113303/2015 (FCT).



FCT  
Fundação  
para a Ciência  
e a Tecnologia

NORTE2020  
PROGRAMA OPERACIONAL REGIONAL DO NORTE

PORTUGAL  
2020



UNIÃO EUROPEIA  
Fundo Europeu  
de Desenvolvimento Regional