Investigation on antigenotoxic properties of the probiotic Lactobacillus rhamnosus IMC 501® by gas chromatography-mass spectrometry

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INTRODUCTION

Food contaminants entering the body through the oral route are directly exposed to the action of gut microflora. Normal healthy intestinal microflora contains many strains of lactic acid bacteria (LAB), some of which have been isolated, ascribed health benefits, and termed probiotic strains [1]. Probiotic bacteria are used as ingredient in several foods. The protective effect of LAB against food mutagens such as heterocyclic amines, N-nitros compounds, and aflatoxins has been reported [2,3]. For this reason antigenotoxicity and antiangiogenicity begin to be considered in characterising the functional properties of probiotic bacteria.

The aim of the present work was to set-up a gas chromatography-mass spectrometry analysis able to point out the mechanisms involved in the LAB inhibition of 4-nitroquinoline-1-oxide (4-NQO), a direct-acting agent which produces strand scission and formation of charge-transfer adducts on DNA. Specifically, the 4-NQO antigenotoxicity of a probiotic strain (Lactobacillus rhamnosus IMC 501®) revealed by short-term biological assays (SOS-Chromotest and Comet assay [4]), was evaluated by GC/MS analysis.

MATERIALS AND METHODS

RESULTS

The mass spectral data from supernatants of the strain Lactobacillus rhamnosus IMC 501® treated with 4-NQO at different times of incubation evidence the gradual disappearance of the 4-NQO and the appearance of 4-aminoquinoline and 4-nitroquinoline at time 15 min. Also the concentration of these two products showed a gradual reduction at time 30 and 135 min. A high survival degree (90%) of the Lactobacillus rhamnosus IMC 501® was found after genotoxin exposure.

CONCLUSIONS

The data presented here show that Lactobacillus rhamnosus IMC 501® has a potential antigenotoxic activity revealed by GC mass spectrometry when co-cultivated with the reference 4-NQO genotoxin. Lactic acid bacteria have been reported to have antiangiogenic/antitumorogenic properties in vitro and in vivo. Different mechanisms for this effect may be hypothesized like a physical binding of the mutagenic compounds to the bacteria, genotoxin biocconversion or conjugation.

The GC/MS protocol set-up in this study is able to reveal the inhibition of 4-NQO genotoxicity for the strain Lactobacillus rhamnosus IMC 501® and to detect physiochemical modifications of the genotoxic agent obtained by bacterial bioprecipitation. The inhibition of the tested genotoxin was related to the maintenance of cell viability after co-incubation. Moreover the spectra evidence the appearance of 4-amino-quinoline as biocconversion product and this compound is known to be inactive.

Results suggest that GC/MS could be a good methodology to reveal the genotoxin deactivation by probiotic bacteria and it could be applied to different genotoxic compounds which may be present in foods.

In conclusion, the incorporation of Lactobacillus rhamnosus IMC 501® in the diet can suppress or reduce the genotoxic activity of potentially harmful compounds. Studies in humans, however, could be resulted in contradictory outcomes. So, further clinical trials to confirm these effects must be conducted.

REFERENCES