Visualisation and quantification of fumonisins bound by lactic acid bacteria isolates from traditional African maize-based fermented cereals, ogi and mahewu

Pranitha Dawlal, Catherine Brabet, Mapitsi S. Thantsha & Elna M. Buys

Abstract

Consumption of fumonisin-contaminated foods has a negative influence on the health of humans (carcinogen; oesophageal cancer in Eastern Cape in South Africa). Lactic acid bacteria (LAB) have emerged as a promising natural detoxification agent against mycotoxins. The aim of this study was to visualise the interaction between fumonisins (FB1 and FB2) and LAB: Lactobacillus plantarum FS2, L. delbrueckii subsp. delbrueckii CIP 57.8T and Pediococcus pentosaceus D39, isolated from traditional fermented maize-based products (ogi and mahewu) using confocal laser scanning microscopy (CLSM) and to then quantify the LAB-bound fumonisin using high performance liquid chromatography (HPLC). The objective was to obtain a physically visible and quantifiable binding interaction between fumonisins and LAB strains with the aim of utilising LAB as a possible detoxifying agent. Fumonisins were derivatised using naphthalene-2,3-dicarboxaldehyde (NDA) and then combined with non-fluorescent LAB cells (viable and non-viable). For the quantification of bound fumonisins, viable and non-viable cells were incubated in the presence of predetermined concentrations of fumonisins and the level of fumonisin in the suspension was determined. CLSM showed the derivatised green fluorescent fumonisins binding to the surface of each of the LAB cells. For viable cells, L. plantarum FS2 bound FB1 most effectively while P. pentosaceus D39 bound the least level of FB1. The highest levels of FB2 were bound by L. plantarum R 1096 and the least by L. delbrueckii CIP 57.8 T. For non-viable cells, L. plantarum FS2 was also the most effective for binding both fumonisins with P. pentosaceus D39 and L. delbrueckii CIP 57.8 T being the least effective for FB1 and FB2, respectively. To our knowledge, this is the first study to visualise the interaction between LAB and fumonisins. We demonstrate that LAB isolates from indigenous fermented maize-based beverages bind fumonisins and thus present a potential strategy for their reduction in these traditional foods.