In vitro inhibition of Clostridium difficile and Clostridium perfringens by commercial probiotic strains

Probiotics have gained importance in human and veterinary medicine to prevent and control clostridial enteric disease. Limited information is available on the ability of different probiotic bacteria used in food products to inhibit Clostridium difficile and Clostridium perfringens. The objective of this study was to examine the in vitro inhibitory effects of selected commercial bacterial strains on pathogenic clostridia and their growth characteristics under simulated gastrointestinal conditions. The inhibitory effects of 17 commercial strains of Lactobacillus (n = 16) and Bifidobacterium (n = 1) on the reference strains of C. difficile and C. perfringens were assessed by an agar well diffusion assay and by a broth culture inhibition assay using cell-free supernatant harvested at different growth phases, with and without pH neutralization. To study growth characteristics, probiotic strains were cultivated in different acid and bile environments, and growth in the modified media was compared to growth in standard medium. In the agar well diffusion assay, supernatant obtained from two probiotic strains inhibited the growth of both reference and clinical strains of C. perfringens. This effect as seen when supernatant was assessed with and without pH neutralization. Supernatants obtained from 10 probiotic strains inhibited C. difficile only when supernatant was added without pH neutralization. In the broth culture inhibition assay, growth of C. perfringens and C. difficile was inhibited by supernatant without pH neutralization from 5 and 10 probiotic strains, respectively. All potential probiotic strains were able to grow at pH 4.0 and in the presence of 0.15% and 0.3% bile but none were able to grow or survive at pH 2.0. Altogether five probiotic strains [Lactobacillus plantarum (n = 2), Lactobacillus rhamnosus (n = 2), Bifidobacterium animalis lactis (n = 1)] were shown to inhibit all strains of C. difficile and C. perfringens. The inhibitory effect was probiotic strain-specific. Two strains showed a pH-independent inhibitory effect likely due to production of either antibiotics or bacteriocins inhibiting C. perfringens only. These strains have favourable growth characteristics for use as probiotics and their efficacy as prophylactic or therapeutic measures against clostridial enteric disease should be further evaluated by clinical trials in animals.

General information
Publication status: Published
Organisations: National Veterinary Institute, Section for Bacteriology, Pathology and Parasitology, National Food Institute, Communications and Management Secretariat, Sacoo srl, University of Copenhagen
Contributors: Schoster, A., Kokotovic, B., Permin, A., Pedersen, P. D., Bello, F. D., Guardabassi, L.
Pages: 36-41
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Anaerobe
Volume: 20
ISSN (Print): 1075-9964
Ratings:
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.68 SJR 1.105 SNIP 1.059
Web of Science (2013): Impact factor 2.364
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Original language: English
Keywords: Clostridium difficile, Clostridium perfringens, Lactobacillus ssp, Probiotics, Inhibition
DOIs: 10.1016/j.anaerobe.2013.02.006
Source: dtu
Source-ID: n:oai:DTIC-ART:elsevier/384933060::27776
Research output: Contribution to journal → Journal article – Annual report year: 2013 → Research → peer-review