

# In vitro assessment of immunomodulatory properties of *Bacillus*-based probiotics

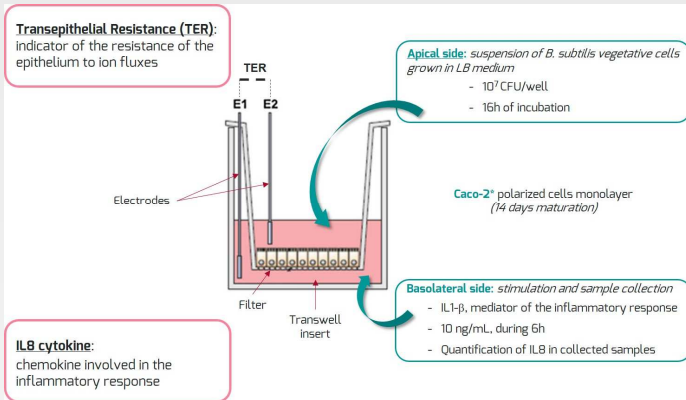
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## Introduction

Efficacy of antibiotic growth promoters (AGPs) has long been only thought to be due to their antibiotic activity. However, more and more evidence shows that AGPs have also a strong role in inhibiting intestinal inflammation (Niewold, 2007). Thus, non-antibiotic compounds showing immunomodulating properties, such as probiotics, could be good candidates to replace AGPs. The immunomodulatory properties of probiotics are well recognized, but they are strain specific. **The objective of this study was to investigate the immunomodulating properties of the new *Bacillus subtilis* probiotic strain 29784 in comparison with two other commercially available *Bacillus subtilis* strains (Bs A and Bs B).**

## Materials and Methods

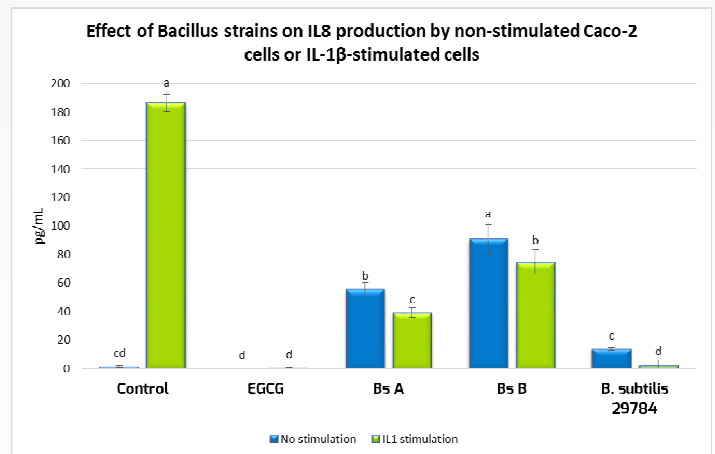
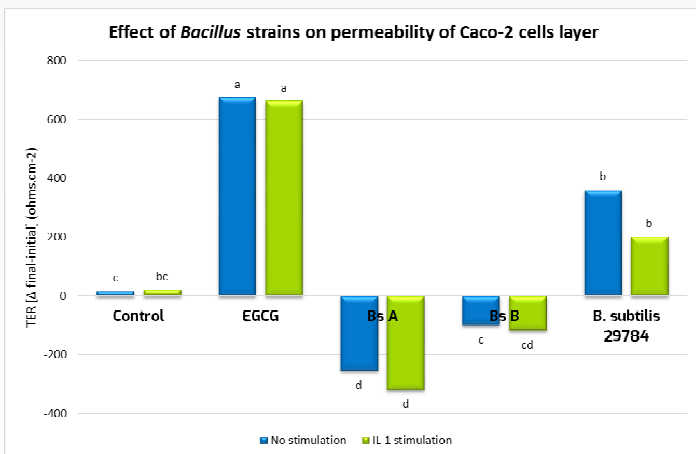


- Human intestinal epithelial cells (Caco-2 cells) were used to evaluate the ability of *B. subtilis* strains to prevent inflammation in stimulated and non-stimulated conditions.
- Vegetative cells of each *B. subtilis* strains, or a positive control, epigallocatechin gallate (EGCG) known for its anti-inflammatory properties (Kim et al., 2006), were applied overnight to a 14-day differentiated Caco-2 cell monolayer established in a transwell system.
- Caco-2 cells were then exposed, or not, to the inflammatory mediator IL-1 $\beta$  during 6 hours.
- Transepithelial Resistance (TER) and IL-8 production were then monitored as indicators of intestinal permeability and inflammation, respectively (Maresca et al., 2008).

## Results

- TER, as indicator of tight junction cohesiveness, was improved by the positive control EGCG in both standard and IL-1 $\beta$  stimulation conditions.
- Interestingly, the 3 *B. subtilis* strains had different impacts on TER. Whereas Bs A decreased TER, Bs B had no effect and *B. subtilis* 29784 increased it as did the positive control EGCG.

- IL-1 $\beta$  induced inflammation as shown by an increase in IL-8 production.
- All strains tested were able to significantly reduce IL-8 level.
- However, *B. subtilis* 29784 was the only strain able to fully reduce the inflammatory response to the level of what was observed for the non-stimulated cells, and for the EGCG treated cells.



## Conclusions

Our results clearly show that different *B. subtilis* strains can have different levels of efficacy to modulate inflammatory response and intestinal permeability. *B. subtilis* 29784 thus appears an efficient probiotic solution as it both enhances intestinal barrier cohesiveness and reduces intestinal inflammatory status.

### References:

- Niewold TA. 2007. The nonantibiotic anti-inflammatory effect of antimicrobial growth promoters, the real mode of action? A hypothesis. Poultry Sci. 86:605-609
- Kim IB, Kim DY, Lee SJ, Sun MJ, Lee MS, Li H, Cho JJ, Park CS. 2006. Inhibition of IL-8 production by green tea polyphenols in human nasal fibroblasts and A549 epithelial cells. Biol Pharm Bull. 29:1120-5.
- Maresca M., Yahi N, Younés-Sakr L, Boyron M, Caporiccio B, Fantini J. 2008. Both direct and indirect effects account for the pro-inflammatory activity of enteropathogenic mycotoxins on the human intestinal epithelium: stimulation of interleukin-8 secretion, potentiation of interleukin-1beta effect and increase in the transepithelial passage of commensal bacteria. Toxicol. Appl. Pharmacol. 228,84-92.