

**Designing probiotic and prebiotic products for seniors.** By L. Valdés, N. Salazar, C. G. de los Reyes-Gavilán, P. Ruas-Madiedo and M. Gueimonde, *Probiotics and Prebiotics Group, Department of Microbiology and Biochemistry of Dairy Products, Dairy Products Institute of Asturias (IPLA-CSIC), Villaviciosa, Asturias, Spain (lvaldes@ipla.csic.es)*

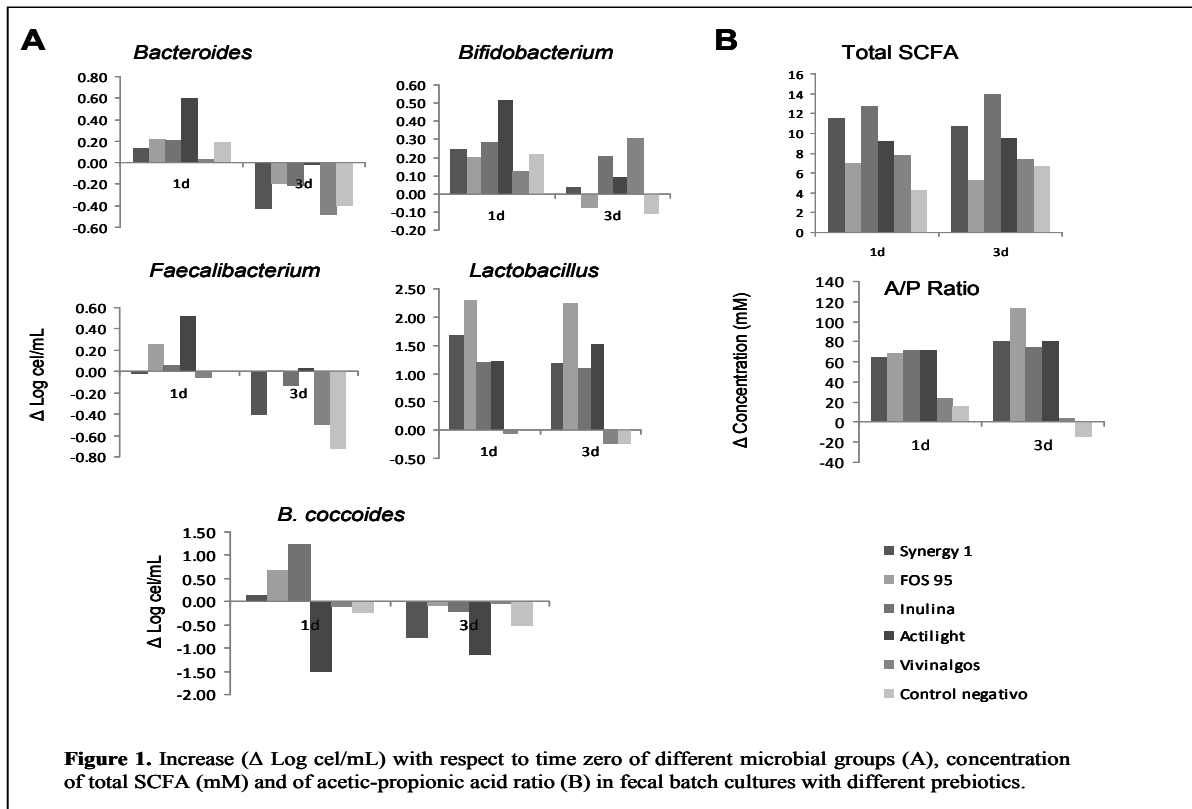
The gut microbiota plays an important role in the health of the host. The ageing process affects the composition of this microbial community and, therefore, the use of probiotic/prebiotic food products constitutes an interesting strategy for its modulation in elderly. However, the development of these products requires a previous identification of the specific alterations present in the gut microbiota of seniors, allowing a rational selection of probiotic microorganisms and/or prebiotic substrates. Previous work carried out in our group determined the levels of different bacterial populations (*Akkermansia*, *Bacteroides*, *Bifidobacterium*, *Blautia coccooides* group, *Clostridium leptum* group, *Lactobacillus* group and *Faecalibacterium prausnitzii*) in faeces of elderly (mean 84 years-old) and compared them with those of a control group (middle-aged subjects; mean 62 years-old)<sup>1</sup>. These analyses indicated that seniors presented, in general, lower levels of most of the microbial groups tested, the differences reaching statistical significance ( $p < 0.05$ ) for *Bacteroides*, *B. coccooides* group and *F. prausnitzii*. In contrast, members of *Lactobacillus* group were present at higher level in seniors. The analyses of SCFA performed evidenced a reduced level of total SCFA in faeces from elderly volunteers when compared with those found in the adult group. Remarkably, elders presented a significantly higher ( $p < 0.05$ ) acetate to propionate ratio in faeces. These differential results obtained were considered targets for the modulation of the microbiota in elderly and used as a criteria to select specific prebiotics and probiotics for this population. Thus, on the basis of these results the following criteria were used for the selection of probiotics and prebiotics for elders: 1- To increase levels of *Bacteroides*, *B. coccooides* and/or *Faecalibacterium*, 2- To decrease levels of *Lactobacillus* group and 3- To increase levels of *Bifidobacterium* whenever possible due to the special relevance of strains

from this genus as probiotics. Likewise, in accordance with the results of SCFA in seniors vs. adults the following selection criteria were also considered: 4- To increase of total SCFA (acetate + propionate + butyrate) and 5- To decrease of acetic to propionic ratio.

To identify the best candidates in terms of microbiota modulation, fecal batch cultures added with prebiotic substrates and/or probiotic strains were carried out, using elders as fecal donors. Stabilized fecal cultures were inoculated with different *Bifidobacterium* strains at a final concentration of  $1 \times 10^6$  cfu/mL or with 0.3% (w/v) of different prebiotic substrates. Samples were taken at different times of incubation (24 and 48 h) for quantification of selected bacterial populations by qualitative PCR and analysis of SCFA by gas chromatography<sup>(2)</sup>.

The results of *in vitro* fecal cultures indicated that none of the prebiotics tested was able to reduce the levels of *Lactobacillus*. Actilight promoted the highest rise of *Bacteroides*, *Faecalibacterium* and *Bifidobacterium* populations whereas cultures with inulin resulted in the highest increase of *B. coccoides* levels (Figure 1). On the other hand, inulin was the best enhancer of the SCFA synthesis followed by Synergy 1 and Actilight. None of prebiotic substrates was able to decrease the acetic/propionic ratio.

Our preliminary results regarding the effect of different strains of *Bifidobacterium* in the fecal batch culture model is also allowing to identify strains with appropriate microbiota modulation ability in the elderly.



In this study, the specific differences in the composition of intestinal microbial community of elderly compared to middle-aged adults were considered as targets for the development of prebiotic and probiotic products. Our results allow us to identify and propose the use of specific prebiotics and *Bifidobacterium* strains with great potential for the modulation of the gut microbiota of elderly towards a healthy adults-like microbiota profile.

## References

1. Salazar et al. (2013) *J Am Coll Nutr* **32**, 399-406
2. Salazar et al. (2008) *Appl. Environ. Microbiol* **74**, 4737-4745.

