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Editorial

Oral Probiotics

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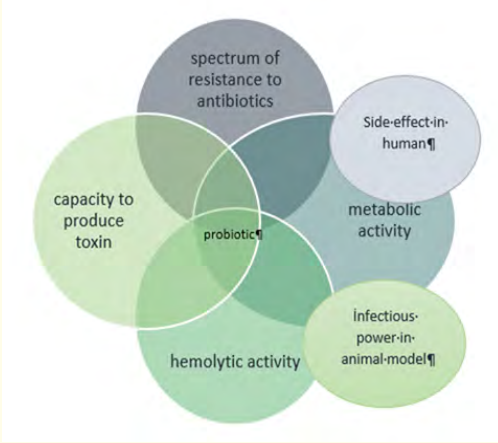
The term probiotic for life is used with different meanings, but today two main definitions are used. According to FAO/WHO Report (2002), probiotics are "Live microorganisms which, when administered in adequate amounts, confer a helth benefit on the host". International life Science Institute (ILSI) Europe suggests a definition according to which a probiotic is "a live microbial food ingrediaent that, when ingested in sufficient quantities, exerts health benefits on the consumer. The most commonly used probiotic bacterial strains belong to the group of lactic acid bacteria, especially lactobacilli, or to the genus Bifidobacterium [1].

How to characterize Probiotics?

A bacterial strain must be fully characterized to be determined as a probiotic [2]. The microorganism must be identified according to internationally accepted methods, and its nomenclature corroborated by reference to the Approved Lists of Bacterial Names [3]. In addition, the mechanism of action of the probiotic must be conducted with both in vitro and in vivo studies. Side effects and functions must be stated. The FAO and the WHO have recommended the followings in Figure 1 [3].



probiotic

Figure 1: *Probiotic characteristics.*

Clinical studies are then conducted with the probiotics that have been so characterized. Finally, improvement in participants' health and quality of life should be demonstrated.

Do all probiotics selected for production? (probiotic main)

After *in vitro* and preclinical research and/or after fullscale clinical trials, only the most effective strains should make it to the market [4]. The highest exopolysaccharide (EPS) production or the antioxidant activity could be the selection criteria. Most current probiotic bacteria shown in Figure 2. Although it seems large variety of species are determined as probiotics, large differences are seen among strains belonging to the same species, as they may exhibit distinct phenotypes and properties that can lead to various clinical effects [5].

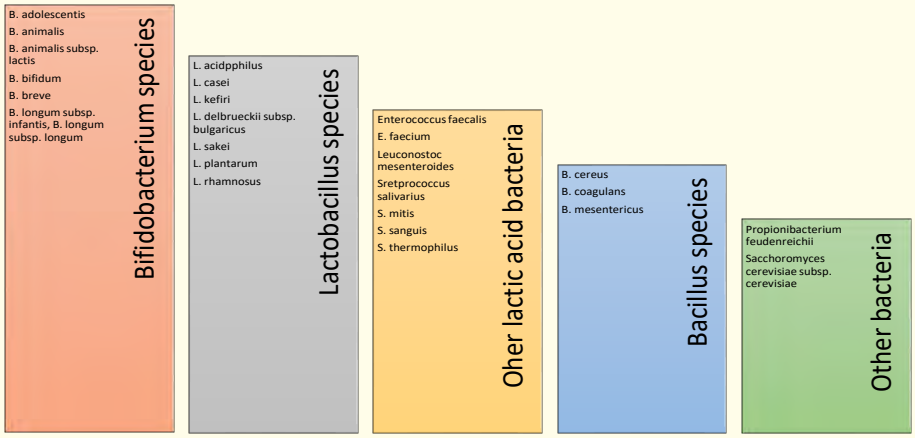


Figure 2: *Probiotic strains.*

A candidate probiotic strain should be manufactured in a large scale and give the possibility to guarantee an optimal shelf life under less easily controlled storage conditions [6]. Encapsulation reported to preserve the bacteria however survival of the bacterium inside the host and preservation of dedicated properties remain an issue [7]. Cell viability and probiotic functionality and stringent quality control of the fermentation (culture medium or food matrix, pH, carbon source composition, temperature and duration of fermentation) and post-fermentation processing (spray-drying, lyophilization, homogenization, blending and high-pressure tableting, packaging, etc.) should be planned in process optimization and product design [8].

What could probiotics do in oral cavity? (Probiotics treatment in the oral cavity)

A biofilm acting as a protective lining for oral tissues against oral diseases can be created by. probiotics Such a biofilm will keep the bacterial pathogens off from oral tissues by aggregation and coaggregation [9]. Also, probiotics could compete with the pathogens for Toll-like receptors.

How long can probiotics exist in the oral cavity? (Probiotics treatment in the oral cavity))

L. reuteri enriched yoghurt could manage to reduce the number of *S. mutans* after a two weeks use. The effects were still observed for a few days after discontinuation [10]. Wolf., *et al*. [11] showed a loss of *L. reuteri* colonization for two months after having discontinued probiotic use. *L. rhamnosus* GG, that has high EPS production ability [1], administration and oral cavity colonization was studied by Yli-Knuuttila., *et al.* [12]. It was concluded that permanent colonization in oral cavity was unlikely (although possible in some cases) and suggested the probiotic to be used on a regular basis. Binding strength of 17 *Lactobacillus* strains and 7 bifidobacteria strains to saliva and oral mucous membrane was studied [13]. It was shown that an increased residence time of probiotic in oral cavity varied among the strains. Horz., *et al*. [14] reported that probiotic when used as 3 tablets/day could be found on oral mucous membrane, tongue and in stimulated saliva for more than 3 weeks, with a gradually reduced *S. salivarius* K12 level being detected beginning 8 days after treatment withdrawal.

What should be done?

The association of certain diseases with a dysbiosis of the microbiota, may indicate possibilities for probiotic therapy. For instance, *Porphyromonas gingivalis*, periodontal pathogen, related cardiovascular diseases or diabetıs mellitus should be investigated.

In recent years, the genomes of several probiotic species have been sequenced, thus paving the way to the application of 'omics' technologies to the investigation of probiotic activities. Proteomics has contributed substantially to the study of the molecular mechanisms underlying probiotic effects [15].

There is no doubt that a tight regulatory framework is necessary. Therefore, between the legislator, the scientists and the food and pharmaceutical industry, a trustful and discerning interplay is necessary allowing a food product with good scientific substantiation to be marketed. This authorization will depend on well-controlled clinical trials and mechanistic studies according to rigorously defined criteria and using appropriate (physiological) end points.

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