

## Chapter 29

# Probiotics as an Alternative Food Therapy:

### A Review on the Influence of Microbial Nutraceuticals in Disease Management

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#### ABSTRACT

*Antibiotics have been responsible for the evolution of multidrug-resistant microbes. The side-effects of existing drugs and increased treatment costs have led to nutraceuticals gaining popularity. Nutraceuticals have therapeutic applications due to the ability of the probiotics to be viable in encapsulated pills and drinks. Due to their ability to exclude carcinogenic microorganisms by limiting the nutrients available and by competing for receptors nutraceuticals are useful against cancers. Nutraceuticals are useful against diabetes by controlling the genes involved in the insulin-signaling pathway. The future perspective for nutraceuticals includes an increase in production, reduction in manufacturing cost, and enhanced benefits.*

DOI: 10.4018/978-1-6684-3546-5.ch029

## INTRODUCTION

The word “Nutraceutical” was coined in 1989 by Stephen DeFelice from the two words ‘nutrition’ and ‘pharmaceutical’. Nutraceuticals are “food (or a part of food) that provide medical or health benefits, including the prevention and/or treatment of disease” (Kalra, 2003). This is a term that is used for products obtained from dietary supplements, herbal products and other food sources which are beneficial not only nutritionally, but also medicinally (Nasri et al., 2014). They also fall under the category of “functional foods” since they are foods reserving bioactive compounds that are likely to have beneficial effects on the body beyond the basal nutritional ingredients (i.e. carbohydrates, protein, and fat). The food sources that are classified as nutraceuticals are categorized into dietary fibers, probiotics, and prebiotics (Das et al., 2012). Among the supplements included under these definitions, probiotics and probiotic food sources are of importance (Ku et al., 2016). Currently, the global market for nutraceuticals is estimated to reach a trade worth of 241 billion dollars (Brower, 1998). American Veterinary Medical Association (AVMA) describes nutraceuticals as micronutrients, macronutrients and other nutritional supplements that could be used as an alternative to the therapeutic antibiotics (Claudia, 2011).

Nutraceuticals are broadly classified into traditional and non-traditional nutraceuticals (Newman & Cragg, 2007). Traditional nutraceuticals include naturally available chemical constituents, probiotic microorganisms, and secretory enzymes. Non-traditional nutraceuticals include fortified and recombinant food products. Based on the source of synthesis, nutraceuticals are further grouped as plant-based, animal-based, and microbial-derived products. Recent advances in the field of microbial genetic engineering provide tools to design microbes as cell factories for nutraceutical production. Globally, the usage of nutraceuticals as an alternative to therapeutic drugs has increased over the last 25 years (Singh & Sinha, 2012). Natural bioactive compounds obtained from microbial sources are receiving a huge reception in the health sectors for their medicinal benefits. These products have wide applications as food preservatives, coloring agents and as therapeutic drugs to treat diseases such as cardiovascular disease, osteoporosis, tumor, diabetes, and oxidative stress.

The increased use of antibiotics and synthetic therapeutics has resulted in the evolution of multidrug-resistant microbes (Magiorakos et al., 2012). Several pathogens have been categorized under various degrees of drug-resistance by the World Health Organization based on their resistance to drugs (WHO, 2017). Bacteria such as *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacteriaceae* were categorized as critically resistant. *Enterococcus faecium*, *Staphylococcus aureus*, *Helicobacter pylori*, *Campylobacter* spp., *Salmonellae*, and *Neisseria gonorrhoeae* were grouped as highly resistant. *Streptococcus pneumonia* and *Haemophilus influenza* were placed in the medium category because of their acquired resistance against beta-lactam antibiotics (WHO, 2017). Pan Drug Resistance (PDR) organisms display resistance to all the antibiotics and other useful agents from plant origin (Magiorakos et al., 2012). Adaptation pattern of these PDR organisms is the real challenge in front of the pharmaceutical companies. Though newer antibiotics can serve a temporary solution in controlling the drug-resistant pathogenic organisms, the safety of the antibiotic-associated immune regulations is not guaranteed. Hence, nutraceutical products are now gaining more attention to combat the illness caused by the PDR organisms. Over the years, nutraceuticals are used to treat lifestyle-related diseases such as arthritis, gastroenteritis, bowel syndrome, and some disorders like lactose intolerance and vitamin deficiencies (Chanda, Tiwari, Kumar, & Singh, 2019). Apart from being used for therapeutic applications, they are also utilized in the food industry for bio-coloration, stabilization of food, and as a flavoring and thickening agent (Srinivasan, 2005; Takao Ojima et al., 2018).

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