

Kefir: Complex Beneficial Universe, Combining Sophisticate Nutritional Matrix and Well Established and Balanced Microbial Consortium

Cristina Stewart Bogsan¹ and Svestolav Dimitrov Todorov^{2*}

¹Department of Biochemical and Pharmaceutical Technology, São Paulo University, Sao Paulo, SP, Brazil

²Advanced Green Energy and Environment Institute (AGEE), Handong Global University, Pohang, Republic of South Korea

*Corresponding Author: Svestolav Dimitrov Todorov, Advanced Green Energy and Environment Institute (AGEE), Handong Global University, Pohang, Republic of South Korea.

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In the last decade, the renaissance of the different traditional products attracts the attention of the consumers based on their nutritional and health-promoting beneficial properties. Consumers start to evaluate more critically what they eat and why they eat, taking into consideration that food is not only a pleasure and way of cover nutritional needs, but food can be a major factor for wellbeing and can be a direct link to the general health. The perception of a direct relationship between nutrition and health was proposed a long time ago by Hippocrates; he stated his dream that “One day our food will be a medicine and medicine will be food”.

Kefir is one of the oldest fermented dairy products, most probably originated from the Caucasus region of Asia. The procedure of preparation is simple; it is made by the inoculation of fresh milk with the “kefir grain” and left to ferment. The product is characterized as a middle alcoholic fermented dairy beverage with a refreshing taste, lightly carbonated and a slightly acidic [1].

From a microbiological point of view, kefir is a complex symbiotic matrix that comprises a mixture of bacteria and yeasts. The product is rich of acid lactic bacteria (LAB) as *Lactobacillus*, *Lactococcus*, *Leuconostoc* and *Streptococcus* and yeasts, *Kluyveromyces* and *Saccharomyces*. As an effect of metabolite processes performed by the complex microbiological consortium, different beneficial metabolites were produced, including bioactive peptides, derivates of milk proteins, low allergenicity, antimicrobial peptides, and other low molecular antimicrobial molecules, vitamins, organic acids, diacetyl, etc. All of them combined, no doubt, why kefir can be considered as a realization of Hippocrates’ dream.

A part of nutritional benefits of kefir, this fermented dairy beverage is well described to be possessing antimicrobial characteristics with activity against a different variety of Gram-positive and Gram-negative bacteria, as well to some fungi [2-4] and even against *Mycobacterium tuberculosis* [4], a pathogen causing tuberculosis. Antimicrobial properties and effect on significant reduction and even total repression of specific coliforms and different pathogenic bacteria such as *Shigella* spp. and *Salmonella* spp., was documented in kefir products [5]. Antimicrobial metabolites produced by kefir isolated *Lactobacillus acidophilus* been evaluated as a significant factor in the inhibition of several Gram-positive and Gram-negative bacteria [6-8]. Inhibitory activity against *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, *Clostridium tyrobutyricum* and *Listeria monocytogenes* were reported by Van Wyk [9] as effect of kefir isolated LAB. Moreover, not only LAB, but some yeasts as well, isolated from kefir, including some *Torulaspora* spp. were shown to be presenting antimicrobial activity against coliforms [5,10]. Inhibitory activity of kefir can understand as a complex action of different antimicrobial compounds produced by microorganisms incorporated in the kefir grains.

As suggested by Gibson., *et al.* [11], Naidu., *et al.* [10] and Powell [4], LAB incorporated in the kefir grains, most probably plays a primary role in the production of antimicrobials and are essential in the inhibitory relations. Different antimicrobial metabolites are most likely involved in this process, including lactic acid or other volatile acids, hydrogen peroxide, carbon dioxide, acetaldehyde and diacetyl,

bacteriocins and other antimicrobial peptides, polysaccharides [4,12,13]. Moreover, bioactive peptides, derivatives from milk proteins as results of enzymatic cut down by LAB, can be produced. Some of them can be with antimicrobial properties; however, others can be involved in different health-promoting processes [14]. Production of various exopolysaccharides is essential for keeping the structure of the kefir grains. However, to be characterized as prebiotics, the produced exopolysaccharides by LAB incorporated to kefir grains should be previously reported, deeply studied and shown that are essential to maintain the functional properties of the probiotic strains.

Recently antimicrobial proteins (bacteriocins) produced by LAB, including that isolated from kefir, were intensively studied. According to Todorov, *et al.* [15], bacteriocins are polypeptides with bactericidal or bacteriostatic activity against closely related species. Bacteriocins are primary metabolites and are expressed via ribosomal machinery of the bacterial cells spontaneously; however, some of them need to be induced. Generally, the mode of activity of bacteriocins produced by LAB is due to pore formation in the cytoplasmic membrane and has been suggested that occurs through the “barrel-stave” mechanisms [16].

Some examples about antimicrobial activity of bacteriocins produced and related to LAB isolates from kefir includes reports of Rodrigues, *et al.* [17] with activity against *Candida albicans* and *Streptococcus pyogenes*; Yuksekdag, *et al.* [18] against *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa*; Atanassova, *et al.* [19] against *Listeria innocua*; Santos, *et al.* [20] against *Salmonella typhimurium*; Powell [4] against *Enterococcus* spp. and *Listeria* spp.

Kefir could also be used as an adjuvant treatment to diabetes and some inflammatory diseases. Punaro, *et al.* [21] had shown that in diabetes subjects, the kefir intake resulted in a significant reduction of water intake, diuresis, and oxidative stress and, an increase in mass body gain and better glycemic control [21-23]. The reduction of blood pressure and serum cholesterol, as the incidence of stroke, was observed by intake of an exopolysaccharide isolated from kefir, the kefiran [22].

The microbe’s consortium present in kefir promotes benefits to metabolic syndrome subjects without changes in the microbiota [24]. The intestinal immune system increases IgA expression and anti-inflammatory cytokines [25] and increases the intestinal barrier through improving mucin secretion, better performance of tight junctions and prevent apoptosis of epithelial cells [26].

However, even if we have built considerable knowledge about kefir and his beneficial properties, this is only a small part of all the enormous treasure that kefir can offer to consumers. Kefir is an excellent source of knowledge, ready to be explored and applied for human wellbeing. The complex universe, combining sophisticate nutritional milk matrix and well established and the balanced microbial consortium is maybe more appropriate words to be describing kefir. This product can be clearly stated as beneficial, nutritional, and health-promoting products with potential in the realization of Hippocrates’ dream.

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Svestolav Dimitrov Todorov.