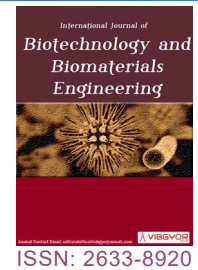


Potential of the Use of Functional Beverages from Plant By-Products in the Reduction the Damage to Human Health Caused by SARS-CoV-2 (COVID-19)



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Abstract

The COVID-19 pandemic is challenging the world's socio-economic and health systems and exemplifies the degree of global interdependencies. This opinion-paper reviews challenge, potential solutions for the COVID-19 coronavirus that focuses on Nutraceutical fermented beverages were intensively studied and promoted by various organizations in the field of food nutrition and health WHO (World Health Organization). In search of experimental confirmation of the numerous fermented beverages health-promoting aspects cited previously. Analysis of the literature data is carried out in correspondence to the recent concepts of health protection's requirements. It is shown that the fermented food can efficiently act in health prophylaxis and recovery due to their main properties: Detoxification, antioxidation, energizing potencies, analgesic effect, anti-inflammatory, antimicrobial action against pathogens, and promotion of depressed immunity. The development of bioprocess base on the lactic fermentation from medicinal plants, fruits, and vegetables to produce Nutraceutical's beverages could ameliorate the immune system in order the reduce the effects induced by SARS-CoV-2 coronavirus.

Keywords

Covid-19, Fermented-plant beverages (FPB), Nutraceuticals, Health nutrition, Lactic acid bacteria, Antioxidant

Introduction

The SARS-CoV-2 coronavirus is part of a family of viruses, known as coronaviruses, common in nature, with many potential natural primary, intermediate, and final hosts [1]. These coronaviruses cause respiratory infections, such as the severe acute respiratory syndrome - SARS (whose agent is SARS-CoV) and the Middle East respiratory syndrome -

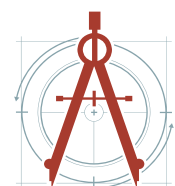
MERS (whose agent is MERS-CoV). COVID-19 has emerged as a multifaceted and multi-system disorder ranging from non-specific flulike symptoms, to pneumonia, acute respiratory distress syndrome (ARDS), multiple organ failure and death [2-4]. Other diagnostic clinical findings are: Septic shock, metabolic acidosis and coagulation dysfunction [3]. Fortunately, most patients have mild symptoms

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Table 1: The bioactive substances or compounds after fermentation.

Microbial strain	Bioactive substances/compounds after fermentation	References
<i>Bifidobacterium longum</i> , <i>L. acidophilus</i> , <i>L. mesenteroides</i>	↑ Gallic acid, caffeic acid, vanillic acid, 4-coumaric acid, trans-ferulic acid, caffeine	Weon, et al. [25]
<i>B. licheniformis subtilis</i> , <i>Pediococcus pentosaceus</i> , <i>L. gasseri</i>	↑ Total sugar content, acidic polysaccharides, total phenolic Compound, p-coumaric acid	Lee, et al. [26]
<i>Streptococcus thermophilus</i> , <i>L. helveticus</i> , <i>L. rhamnosus</i> , <i>L. acidophilus</i> , <i>B. longum</i> , <i>B. breve</i> , <i>Bifidobacterium bifidum</i>	Rutin, naringin, hesperidin, poncirin ↑ 5-HMF, paeoniflorin, glycyrrhizin, nodakenin and, nodakenetin, berberine and palmatine and hesperidin	Oh, et al. [27] Lee, et al. [28]

[4]. Coronavirus entry is mediated by the viral spike (S) glycoprotein. Then, SARS-CoV-2 binds to the angiotensin-converting enzyme 2 (ACE2) [5]. Binding to ACE2 allows the virus to invade cells in the oropharyngeal epithelia and the development of lung injury and hyperinflammation [6,7]. The COVID-19 induced respiratory syndrome, and inflammatory reaction, several authors described different methods to amelioration and activation of the immune system [3]. Now a days, the use of the Nutraceutical fermented beverages showed health benefits, has a high importance to treat several diseases such as diabetes, obesity, antimicrobial....

Traditional fermented foods have an important place in the food culture of human society worldwide, as the fermentation technology enhances the shelf life, texture, taste, aroma and nutritional value of the Function foods [8]. The fermentation technology can be improving the properties and quality of food products. The fermentation of the medicinal plants, fruits, and vegetable can be increased the extraction of secondary metabolite product such as the phenolic compounds, which proves the increase of antioxidant power [9,10]. Recently, this bioprocess has been applied to improve the bioactive compounds in functional beverages; it can be used in chemical and pharmaceutical field [8,11].

This review aims to discuss the importance of the fermented beverages from medicinal plants, fruits, and vegetables (Nutraceutical fermented beverages) against several diseases such as the reduction the damage to human health caused by SARS-CoV-2 (COVID-19) infection; we show scientific evidence on the possible role of consumption of Nutraceuticals fermented foods in promoting mucosal immunity to better face a possible infection.

Nutritional Benefits of Fermented Beverages from Lactic Acid Bacteria

The lactic acid bacteria (LAB) with antimicrobial characteristics have several potential advantages over antibiotics and food preservatives [12], lactic acid bacteria (LAB) are main organisms with beneficial technological use and for which a wide knowledge of use is available. Applying microbial selected cultures to suitable raw materials, the fermentation process can be modulated, also enhancing the content of bioactive metabolites (polyphenols flavonoids, tannins...), other compounds with antioxidant activity, and improving the food properties such as the probiotic and prebiotic in the product [9,10,13,14]. In particular, vegetables and fruits have been suggested as ideal for the growth of LAB [12,15,16]. Fermentation induces the increase of production and extraction of bioactive compounds, dietary fiber, and the mineral elements sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), phosphorus (P), chlorine (Cl) and nitrogen (N). Microelements are found in smaller quantities and include iron (Fe), copper (Cu), cobalt (Co), zinc (Zn), manganese (Mn), iodine (I), fluorine (F), sulfur (S) and selenium (Se) [14] from plant-based foods; it is a beneficial method for increasing the supply of natural antioxidants mention in the Table 1. The mineral elements such as the zinc have a high important to use for the Covid-19 treatment. The antioxidant potency generated by the bioactive compounds in the fermented beverages (Table 1) since they have the ability to scavenge free radicals and reactive oxygen species (ROS) [17], it can be generated by the cells due to the SARS-CoV-2 coronavirus.

Fermented Beverages and Health

Lactic fermentation is therefore a technological process for obtaining plant foods rich in anti-

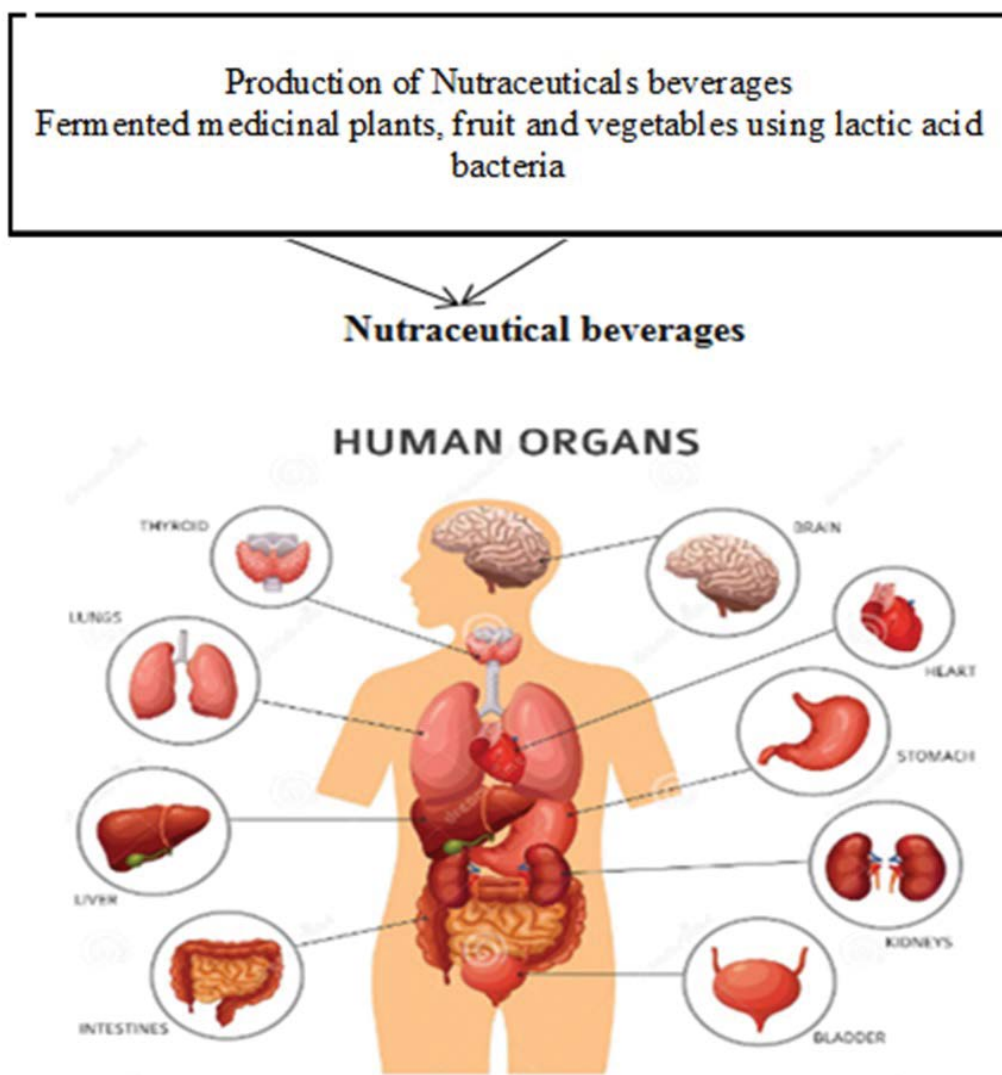


Figure 1: Schematic representation that shows the different human systems on the human body.

oxidants and fits perfectly into the concept of the fight against several diseases such as diabetes and obesity [18], also constituting an alternative route for the transformation of plants Figure 1. The first, the beneficial properties of probiotics include: Improvement of intestinal microbiota and antimicrobial action against pathogens, not being recognized as a foreign body by the host's immune system, possessing antimutagenic and anticarcinogenic properties, and improving intestinal transit [19]. In addition, the functional beverages have a high important in the detoxification, anti-hyperglycemic, and anti-inflammatory effects [20] (Table 2). The benefit of the fermented beverages can be using to moderate the inflammatory symptom induced by SARS-CoV-2 coronavirus. Fermentation induces the release of flavonoids from plant-based foods; it

is a beneficial method for increasing the supply of natural antioxidants. Moreover, since the fermentation leads structural breakdown of the cereal cell walls, it may also liberate and/or induce the synthesis of various bioactive compounds (Table 1 and Table 2) [21,22]. Several authors mention that the Nutraceuticals fermented beverages has a potency biological activity; analgesic effect, anti-inflammatory, detoxification of the functional organs in body, and Antimicrobial action against pathogens [19,20,23,24]. The richness of the Nutraceuticals fermented beverages in bioactive compounds can be a solution of many diseases such as induced by pathogenic bacterial and Virus (Table 2). The interesting biological activity possess by the fermented food can be using as a solution to reduce the symptoms due to the coronavirus.

Table 2: Microorganisms and their fermented herbal products and associated beneficial impact on health.

Microorganism used in fermentation	Herbal formulation	Effects	References
<i>L. fermentum</i> NUC-C1	Red ginseng	Antidiabetic effect	Kim, et al. [29]
<i>B. subtilis</i> NUC1 (KCCM 10839P)	<i>Achyranthes japonica nakai</i>	Anti-inflammatory and Anti-osteoarthritis	Lee, lee, et al. [30]
<i>L. plantarum</i> M1	Red ginseng	Anti-diabetic effect associated with changes in ginsenosides in Korean red ginseng	Kim, et al. [29]
<i>L. fermentum</i> , <i>L. gasseri</i> , or <i>L. casei</i>	<i>Ssanhwa-tang</i>	Hepatoprotective effect Effect against hydrogen peroxide production	Eum, et al. [31] Park & Kim [32]
<i>L. casei</i>	<i>Lonicerae Flos</i>	Anti-viral effect on A type Influenza virus	Suhr & Jung [33]
<i>Eurotium cristatum</i>	<i>Camellia sinensis</i> L <i>Fuzhuan tea</i>	Anti-bacterial activity	Keller, et al. [34]

B: *Bifidobacterium*; L: *Lactobacillus*.

Conclusion

Traditional fermented foods containing probiotic microorganisms have expressed beneficial health effects. The use of *in vivo* and *in vitro* assays includes modulation of the host immune response and reduction of oxidative damage; fermented nutrients. Moreover, as natural antioxidants are not in sufficient amount, people are using synthetic antioxidants. However, these materials are associated with side effects and toxicities; both investigators and consumers thus focus on natural antioxidants. The main benefits of using of the Nutraceuticals fermented beverages are anti-inflammatory, anti-diabetes, Anti-viral effect, Anti-bacterial activity, and improving the immune system on human body it can be used as alternative in order the reduce the effects induced by SARS-CoV-2 coronavirus. While the results are promising, the most significant evidence for the benefit effects of fermented foods is obtained from more studies, with evidence from human studies are still limited in numbers. There have not been enough human trials to test these products.

In order to find the high solution using functional food for protection and amelioration of immune system response against COVID-19, the organization of research and education in universities and academic settings to dedicated and generic research calls and programmers as well as international collaboration.

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Conflict of Interest

The authors of this manuscript certify that they have NO affiliation with or involvement in any organization or entity with any financial interest. I certify that I am submitting the manuscript on behalf of all the authors.

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