

Probiotic Pineapple Juice: A Modern-Day Supplement for Improvement of Gut Health

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“Let food be thy medicine and medicine be thy food”

- Hippocrates

Abstract

The internal environment of the host is primarily modulated through symbiotic interaction by thousands of microbial species in the human gut that form the human gut microbiome. Probiotics present in the gut have an adverse effect on certain pathogens that reach the gastrointestinal tract. However, the current scenario of lifestyle has led to a number of diseases that disrupt the natural microflora of the gut and lead to certain unhealthy conditions in the body. To cope up with this, there are a number of products supplemented with probiotic bacteria available in the market. One such product in trend is the probiotic fruit juice. It renders a variety of advantages over other probiotic products and hence is the topic of research in the probiotic market.

Keywords: Microbiome, Nutrient supplement, Pineapple juice, Probiotic,

Introduction

A healthy gut microbiome is essential for the overall health of a human being. However, the diet and lifestyle of people in the modern world are the two main factors that lead to the damage to gut health resulting in disruption of the gut microbiome and causing conditions like dysbiosis. The increasing modernization and sedentary lifestyles limit the physical use of human body that has resulted in an increase in the number of diseases like obesity,

inflammatory bowel disease, insulin resistance, colorectal cancer, even in the young age groups (Conlon and Bird, 2015). Probiotics are live yeast and bacterial cells that are present within the human gut naturally and are responsible for encouraging gut health (Markowiak and Śliżewska, 2017). Owing to the potential health benefits provided by probiotics, they are popular among the health-conscious group of people. Due to this, the demand of probiotics has increased and gained popularity significantly.

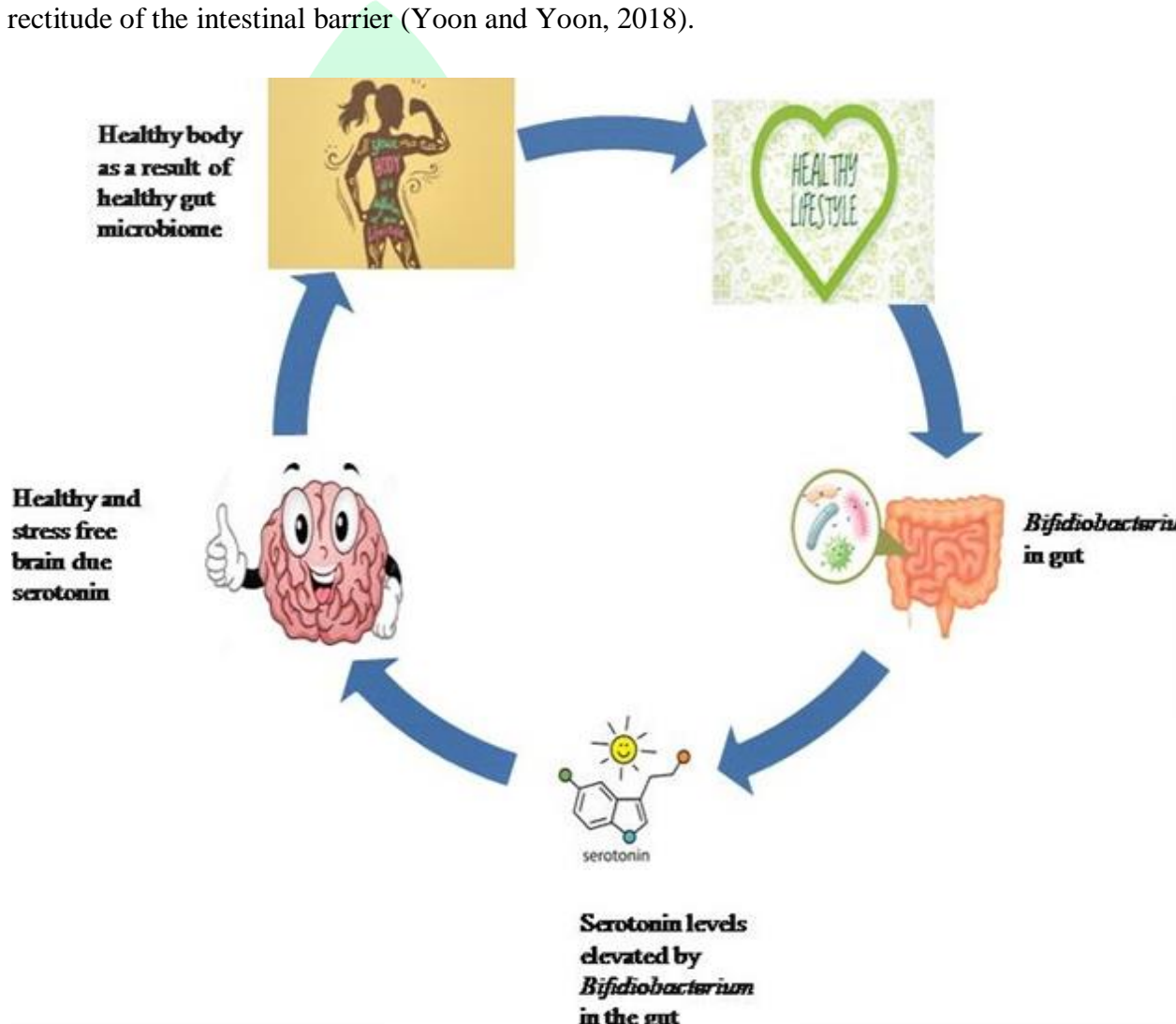
There are different types of bacteria that can be classified as probiotics but the concentration of anaerobes mainly, *Bifidiobacterium*, *Bacteroides* and *Lactobacillus* is predominant in the gut microbiome. *Bacteroides* constitute approximately 30% of all the gut microbiota. There are about 10^{13} - 10^{14} microbes in the human gut that belong to 1,000-35,000 different species (Thursby and Juge, 2017). Conditions like stress, anxiety and depression can cause variation in the gut microbiome that slows down the gut health causing dysbiosis. The presence of probiotic bacteria *Bifidiobacterium* spp. leads to an increase in the concentration of tryptophan, the precursor of serotonin, in the blood plasma. Serotonin is a chemical that is responsible for elevating the happy feelings in humans. Therefore, higher concentration of *Bifidiobacterium* in the gut naturally helps a person feel stress free. Hence, the gut health directly influences the mental health in a human being (Clapp *et al.*, 2017).

Production of probiotic fruit juice is a research that has been considered only in the recent years. Addition of probiotics in fruit juice proves to be a great nutrient supplement since fruits already contain a lot of nutrients and addition of probiotics will make the drink even healthier. Also, the taste of the fruit juice is pleasing to a wide spectrum of age groups.

Importance of Probiotics for Gut Health

The probiotic bacteria in the gut play an imperative role in the host metabolic processes wherein, the bacterial disaccharides ferment the unabsorbed starch, soluble dietary fibres and certain vitamins. The final products of the fermentation process are Short Chain Fatty Acids (SCFA), comprising mainly of propionate, butyrate, acetate and pentanoate, amino acid derived metabolites like Gamma amino butyric acid (GABA) and biogenic amines. SCFA act as substrate for energy production in the host. Butyrate is the main substrate for ATP production by colonocytes. The ability of the intestinal epithelial cells to proliferate and differentiate is regulated by these SCFA (Busnelli *et al.*, 2019).

Intake of antibiotics leads to the killing of good bacteria in the gut that results in various conditions, the most common being the antibiotic associated diarrhoea. The bacterial imbalance caused in the gut can be offset by Probiotics. The mechanism by which probiotics maintain a healthy gut micro biome and the overall health is the production of such bioactive molecules that suppress the growth of undesirable microorganisms in the gut. Different probiotic bacteria perform different functions within the gut microflora. For example, probiotic *Lactobacillus* maintains the unification of the microflora and encourage the rectitude of the intestinal barrier (Yoon and Yoon, 2018).



Probiotic Fruit Juice

Fruits are already an essential source of nutrients like vitamins, dietary fibre and other under consumed nutrients like potassium (K), manganese (Mn) and magnesium (Mg). They also contain certain antioxidants and enzymes that render protection against cancer and provide

anti-inflammatory effects. Fruit juices can carry probiotic bacteria and serve as an ideal matrix for their transport into the gastrointestinal tract. However, there are some parameters like pH of the fruit juice, acids, anthocyanins and presence of some other natural nutrients within the fruit juice that can impede the survival of the probiotic bacteria and limit their stability (Fenster *et al.*, 2019). Probiotics in fermented dairy products like fermented milk and yoghurt are already popular around the globe. The probiotic fruit juice is an alternative supplement for that segment of population requiring nutrient supplements devoid of milk, like those following vegan diets; cholesterol limited diets or those suffering from conditions like lactose intolerance.

Pineapple (*Ananas comosus*) belongs to the family *Bromoliaceae* and is a tropical fruit. It is considered to be the third most important fruit crop in the tropical regions of the world. Pineapple contains a lot of beneficial nutrients including carbohydrates, vitamins (vitamin K, niacin, thiamin, riboflavin, and vitamin C), minerals and certain phenolic compounds. High concentration of vitamin C and sugar in pineapple juice make it an ideal matrix for the cultivation of probiotics. Production of probiotic fruit juice has been carried out by two ways that have been considered in various researches:

- Production through fermentation of pineapple juice through a specific probiotic strain.
- Production without fermentation of pineapple juice.

Some studies have successfully accomplished the production of fermented probiotic pineapple juice by using certain probiotic strains like *Bifidiobacterium lactis*, *Lactobacillus acidophilus*, *Lactobacillus plantarum* (Nguyen *et al.*, 2019).

A study at the University of Ibadan in Nigeria depicted that the use of specific strains of lactic acid bacteria (*Pediococcus pentosaceus* LaG1, *Pediococcus pentosaceus* LBF2, *Lactobacillus rhamnosus* GG) resulted in the successful production of probiotic pineapple juice. The juice even had antagonistic action towards certain pathogens and was able to maintain the viability of probiotic bacteria by maintaining a reduced pH. Also, there was no change detected in the aroma, taste or flavor of the juice during the storage period (Tayo and Akpeji, 2016). There are two main factors upon which the health benefits of the probiotic fruit juices depends i.e.

- The ability of probiotics to survive through the gastrointestinal tract.
- Concentration of the probiotics in the fruit juice.

There must be atleast 10^6 - 10^7 cells/ml that should be viable in the probiotic fruit juice. There should be an optimum pH that can vary between the range of 5-9. Presence of a low pH environment around the cells results in a high requirement of energy to maintain ATP levels and intracellular pH. Failure to maintain the required energy results in a reduction in the cell viability and cell death. However, cell death might also occur as a result of oxidative damage to the probiotic bacteria since they are mostly microaerophilic or anaerobic and lack the enzyme catalase and electron carrier chain. Hence, the intrinsic food parameters, processing parameters and the microbiological parameters need to be kept in the check during manufacture (Chaudhary, 2019).

Conclusion

The modern lifestyle takes a toll upon the lives of people around the globe by rendering a lot of serious diseases, the most common being the disruption of human gut microbiome. But probiotic bacteria have the ability to restore the normal flora. Hence a lot of research is considering the development of foods supplemented with probiotic bacteria since many people want to get rid of the “pill fever”.

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