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The wake of COVID-19 has shown us that human and scientific efforts are required to combat diseases. However, the sudden outbreak of a pandemic like COVID-19 could also divert attention of researchers and scientists from focusing on existing and ongoing research to the new enemy of humanity. One area we hope will not be pushed aside is the role of probiotics and nutraceuticals in nutrition, health, and wellbeing and of course, cure for some for some diseases. This article focuses on probiotics and potentials for the treatment of ulcers.

PROBIOTICS

Probiotics are living organisms that confer health benefits on the host when administered in the adequate amount. This definition has been accepted by the World Health organization and the Food and Agriculture Organisation Joint Working Group in 2002. Probiotics comprises of species such as *Saccharomyces cerevisiae*, a yeast; *Lactobacillus*, *Streptococcus* and *Enterococcus*, the Lactic Acid Bacteria; *Bifidobacterium*, *Propionibacterium*, *Bacillus* and *Escherichia coli*.

There are key attributes that make these species to be considered as probiotics and they include: a normal inhabitant of a healthy intestinal tract, ability to survive the upper digestive tract and/or grow in the intestine and safe for human consumption, production of antimicrobial substance and ability to adhere and colonize human intestine. A recently added characteristic is the stability of the genetic components and the inability to develop antibiotic resistance.

Ditu *et al* (2018) also highlighted the benefits conferred by probiotics on the host as: prevention and/or reduction of duration of rotavirus induced and antibiotics-related diarrhea; alleviation of symptoms of lactose intolerance; reduction of the concentration of cancer promoting enzymes in the gut; alleviation of unknown gastro-intestinal issues in healthy guts; positive effect on the gastro-intestinal tract inflammation, *Helicobacter pylori* infection and bacterial overgrowth; relief from severe constipation and irritable colon; prevention and or

relief from allergies in infants; and prevention of respiratory tract infection such as common cold and influenza as well as the treatment of urogenital infection. Other benefits identified by Nagpal *et al* include reducing cholesterol and triacylglycerol plasma concentrations, lowering blood sugar, positive effect on bone density and stability and prevention of osteoporosis.

Nagpal *et al* (2014) collated evidence from different sources on how probiotics works. Their findings showed that probiotics work by producing bacteriocins, hydrogen peroxides, and some organic acid which exhibit inhibitory properties against gram-positive and gram-negative bacteria. Probiotics were also found to inhibit pathogenic bacteria through competition by adhering to epithelial surfaces that would otherwise have occupied the pathogens and competing for nutrients with them. Immunostimulatory properties and degradation of the toxin receptor in the intestinal mucosa also makes probiotics beneficial to the host.

PEPTIC ULCER

Peptic Ulcer is the lesion in the inner lining of the gastro-intestinal tract due to gastric acid secretion or pepsin which usually occurs in the stomach and duodenum. The location determines whether it is a gastric (stomach) or duodenal ulcer. Pains from gastric ulcer occur between 15-30 minutes after a meal and that of duodenal ulcer occurs 2-3 hours after meal. Other signs and symptoms of peptic ulcer include epigastric abdominal pain, bloating, abdominal fullness, nausea, weight amongst others. Common cause of peptic ulcer is *Helicobacter pylori* infection and the use of non-steroidal anti-inflammatory drugs (NSAIDs) like aspirin and ibuprofen.

According to Neto *et al* (2017), *H. pylori*, a spiral shaped, ureolytic gram-negative bacterium, is one of the normal microbiomes of the gastric with the ability to escape the acidic nature of the stomach; by producing urease enzyme that converts urea to ammonia thereby neutralizing the acid and creating an alkaline environment that can enhance bacteria survival or by penetrating the viscous mucous layer before colonizing itself. A healthy human

stomach has *Streptococcus*, *Prevotella*, *Veillonella*, *Rothia*, *Fusobacterium*, *Haemophilus*, *Neisseria*, *Porphyromonas*, *Pasturellaceae*, *Propionobacterium* and *Lactobacillus* species. However, the findings from gastric biome analysis showed that subjects who had tested positive for *H. pylori* infection had it as 72% of the total microbiome while those that tested negative had it as 11%.

According to UK NHS, medical treatment of stomach ulcer includes a course of antibiotics such as amoxicillin, clarithromycin and metronidazole, proton pump inhibitors (PPIs) such as omeprazole, pantoprazole and lansoprazole, H₂-receptor antagonists such as ranitidine, antacids and alginates, and review of the use of NSAIDs. For the ulcer caused by *H. pylori* or a combination of *H. pylori* and NSAIDs, a course of antibiotics and PPIs are recommended for treatment.

PROBIOTICS AS A TREATMENT OPTION

Resistance to antibiotics, side-effects of antibiotics and PPIs and high cost of antibiotics are bringing to fore possible use of probiotics in the prevention and treatment of gastric ulcer. *Lactobacillus* and *Bifidobacterium* species have been found through studies to have impact on preventing and treating gastrointestinal diseases. The review by Khoder *et al* showed that individual probiotic strains such as *L. rhamnosus*, *L. gasseri*, *L. acidophilus*, or a probiotic mixture have healing effect on rats; with the probiotic mixture demonstrating better effectiveness in clinical studies for improving characteristics of gut microflora.

Saccharomyces boulardii has shown positive effect on ibuprofen-induced gastric ulcer in rat model. To enhance the survival of some probiotics, microencapsulated or coated strains have been utilized. Sodium and calcium alginate have been proposed to coat the probiotic strains. Non-viable or ghost probiotics have also been found to be useful in surviving the stomach acid and having beneficial effects on the host.

Probiotics have shown positive effects through prophylaxis against *H. pylori*, inhibition of its colonization and alleviation of its associated gastric inflammation. For example, they have shown the capacity to prevent gastric ulcer in asymptomatic *H. pylori* infected patients,

thereby reducing its colonization. As observed in vitro studies, using epithelial cells and different probiotic strains, probiotics inhibits *H. pylori* through immunological and non-immunological mechanisms.

In the study by Chenoll *et al* (2010), a *Bifidobacterium bifidum* strain showed *in vitro* inhibition against *H. pylori* up to 81.94% using supernatant and 94.77% using supernatant purified through a cationic exchange. In vivo studies showed that this strain partially relieves damaged tissue due to *H. pylori* and decreases its pathogenicity ratio. This strain also fulfills the main criteria of a probiotic.

Following findings from *in vitro* studies, pre-clinical and clinical trials have not shown the full efficacy of probiotics for inhibiting or killing *H. pylori*. Its efficacy is only enhanced by standard treatment for *H. pylori*. So far, it has only shown utility as a complementary treatment. In a similar manner, Boltin (2016) found that eradication of *H. pylori* of up to 32.5% using probiotics monotherapy, however, the likelihood of recurrence is possible. Reviewing eleven meta-analyses, probiotics have also been found to improve efficacy of antibiotics when used as an adjuvant. It has also been found to reduce the adverse effect of antibiotics, with high impact on diarrhea, when treating *H. pylori* with antibiotics regimen.

Conclusion

Probiotics, especially *Lactobacillus* and *Bifidobacterium* species, have capacity for use in prophylaxis, reduction of colonization and alleviation of inflammation from *H. pylori* infection, thereby having potential for the treatment of peptic ulcer. However, the role of probiotics as the sole treatment in the eradication of *H. pylori* induced peptic ulcer is still emerging with few clinical trials showing partial efficacy. Further research needs to be carried on using probiotics and means of enhancing its efficacy.

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