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Probiotics and Their Role in the Management of Diarrhoea (Review)

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ABSTRACT

I think the word "Diarrhoea" must have listened by everyone. It is the disease, responsible for 1.5 million deaths annually or 15% of death under of 5 years. [(A)] Majority of these deaths take place in the developing countries. In order to manage diarrhoea probiotics are being used very much nowadays. In this review I would like to bring notice about the efficacy of 'Probiotics' in the management of Diarrhoea.

INTRODUCTION

The old testament contains a passage, "Abrahm owed his longevity to the consumption of sour milk", PLINIUS - a Roman historian recommended treating gastroenteritis with fermented milk product in 76 BC. Noble Laureate ELI METCHNIKOFF - a Russian scientist and professor at the Pasture institute in Paris suggested in 1908 that the products of proteolytic bacteria's action on protein including phenols, indols and ammonia resulted in the intestinal autointoxication and contributed to the aging process. He said yogurt contains lactobacillus which reduces the number of toxin producing bacteria in the intestine. [(B)]

So from few decades research and use of probiotics got started.

Now let me explain diarrhoea first-

ACUTE DIARRHOEA

Diarrhoea also called Ishal in unani system, according to the unani theory diarrhoea results when epithelium of intestine gets damaged, which results in increased peristaltic movements. According to the unani concept- If there are more peristaltic movements then the frequency of passage of stools will be high, but if there is increase in "Turishiyat", then the quantity of stool will increase and if there is increase of both then frequency as well as quantity will increase. [(C)]

But on the whole diarrhoea can be defined as the passage of three or more unformed stool in a day. Meaning of unformed is that the type of stool which take the shape of container. During diarrhoea, net outflow of stool increases than the absorption of the fluid from the gastrointestinal tract.

In infectious diarrhoea an etiological classification more usefully distinguishes between non-inflammatory and inflammatory presentation. [(D)]

Of these non-inflammatory presentations conditions are more common. Wide range of viruses is responsible for diarrhoea of which 'Rotavirus' is the most important in young children.

Inflammatory diarrhoea may result either from the direct invasion of bacteria or protozoa' species or from the action of cytotoxins. Campylobacter Salmonella and Shigella are able to invade colonic epithelial cells or accesses the sub-epithelial spaces and interact with immune effectors. Both cytotoxic and invasive processes generate cytotoxic production from enterocytes and immune cells lead in to an inflammatory response, further mucosal damage, fever and other systemic systems.

In addition to viral and bacterial agents, a number of parasites including Giardia and Cryptosporidium have wide distribution. Entamoebae are more restricted and like other agents invade the distal intestine present with the symptoms of dysentery.

Although the action of Cholera & closely related ETEC toxins in increasing enterocyte, CAMP and chloride section are well described. There is controversy in other disease state about the importance of secretory fluid los via intestinal epithelial cells rather than by Para-cellular, vascular or other routes. [(E)]

PROBIOTICS

Now the question arises - 'what a Probiotic is':

WHO defines probiotic as a "Live organism which when administered in adequate amounts, confers a health benefits to the host."

But a more complete definition would be- "A product containing different microorganisms in sufficient numbers which alters the micro flora in a compartment of the host and there by exert beneficial effects on the host."

The use of the term 'Probiotic' came into practice in 1965 and was defined as "Substance secreted by one microorganism which stimulated the growth of another."

COMMON PROBIOTIC STRAINS

A) Bifidobacterium Spp.
B) Lactobacillus Spp.
C) Saccharomyces Spp.

A) Bifidobacterium Species of Probiotics:-

Henry Tissier first isolated Bifidobacteria from a breast fed infant, which was more present in its gut. And found that these bacteria are useful in the treatment of diarrhoea. The finding suggest that they have ability to produce vitamins especially vitamin B group and digestive enzymes such as casein phosphatase and lysosome, acids like acetate and lactate are produced by Bifidobacteria to lower the pH providing antibacterial effects. The survivability of Bifidobacterium depends on many factors including the degree of stomach acidity length of exposer to the acid, bile salts and the level of bile salt hydrolase activity.

Fusiwara etal identified 1,000,000 k da protein exposed by Bifidobacteria that appears to inhibit adhesion of pathogenic E. coli. [(F)]

B) Lactobacillus Species as Probiotics:-

It is resistant to gastric acid and bile digestion as well as its ability to colonize human colon, Lactobacilli have no plasmids thus antibiotic resistance is stable and make only L-Lactic acid.

Lactobacillus rhamnosus strain GG was discovered in 1985. On developing a list of ideal probiotics its benefits has proven on intestinal immunity. LGG augments the number of IgA & other immunoglobin secreting cells in the intestinal mucosa. It stimulates local release of interferon and facilitates antigen transport to underlying lymphoid cells which increases uptake in peyer's patches. [(G)]

C) Saccharomyces Species as Probiotics:-

Saccharomyces boulardii was discovered by a French microbiologist Henry Bocilard in 1920. He was able to isolate & identify the agent responsible from tropical fruits Lychee and Mango steins.

The growth of pathogenic bacteria both in vivo & vitro has been shown to be inhibited by Saccharomyces boulardii. Optional temperature for its survival is 37^0 C. & it can resist digestion at low temp. It is resistant to bile salt and unaffected by antibiotics.

MECHANISM OF ACTION

It shows its action in three main areas -
Trophic action,
Luminal action and
Mucosal anti-inflammatory action

S. boulardii within the intestinal lumen may interfere with pathogenic toxins, preserve cellular physiology, interfere with pathogen attachment, interact with normal micro-biota and assist in re-establishing short chain fatty acid levels.

S. boulardii also may act as an immune regulatory both within the lumen and systemically. [(H)]

Although the molecular studies have generated so much data, most theories remain speculative and confirmations of finding in vivo and in human clinically have been talking to date. Single strain may operate using different mechanism in different disease processes, just as different strains using different methods to eliminate a single disorder. It is now clear that the commensal micro-biota play a crucial role in the function and development of a variety of host systems and that interaction between host cells and intestinal organisms are fundamental to an understanding of the role of probiotics in diverse stats of health and disease. [(I)] Effects can be evinced on the basis of the place of action of microbes.

Luminal: - Probiotic metabolic activity may have useful nutritional and clinical activity. It has long been appreciated that the enzyme β-galactosidase produced by lactobacilli (Yogurt) may be useful in preventing diarrhoea among individuals with acquired deficiency of the enzyme. [(J)] Many organisms with probiotic potential are able to elaborate protein known as 'Bacteriocins'. These are a group of peptides or small proteins with antibacterial activity restricting the growth or pathogenicity of non-homologous strain.

Some other probiotics produce lactic acid, short chain fatty acid and hydrogen peroxide which lower the intra luminal pH and help in the growth of other microorganisms.

Mucosal: - some probiotics binds with invasive species and thus disrupt their ability to bind to endothelial receptors. Probiotic agents stimulate parent cells to induce defensives which are catholic proteins and insert themselves into microbial membrane which acts as anionic to form destructive pores. Also probiotics have ability to reduce absorption of harmful macromolecules and shifts the luminal pathogens to sub mucosal space.

Sub mucosal: - On the surface of microbial species molecules like lipopoly saccharides, peptidoglycans and nucleic acids are found. The pattern recognition receptors on the surface of the host cell are key determinations of detection and host interaction directing subsequent effector receptors. [(K)]

It is likely that host microbe signalling take place continuously. The potential for probiotics to influence this series of interactions though the activation of NF-KB thereby controlling DNA transcription, the pro-inflammatory response and the balance of $T_{H1} \setminus T_{H2}$ activation, holds executing promise for the ability of these agents to influence chronic inflammatory processes such as IBD, RA and allergic diseases. [(L)]

Such affects are important immune response to acute infection with gastrointestinal tract.

Probiotics uses have also shown to stimulate immuneglobins IgA production and modulate the development and activity of regulators T-Lymphocytes. Similarly probiotics are known to influence the pattern of cytokine release from activated cellular effectors roved in both innate and specific immunity.

CONCLUSION

Probiotics can bring revolution in medical field, as our understanding improves, probiotics can be skilfully manipulated to contribute as a part of a healthy micro-biota to the myarid of stimuli interpreted by intestinal epithelial cells and the mucosal immune system. Hopefully its use will be made beyond the gastrointestinal tract and bacterial vaginosis.

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