Review Article **CODEN: AJPCFF** **ISSN: 2321 – 0915**

Asian Journal of Phytomedicine and Clinical Research

Journal home page: www.ajpcrjournal.com

https://doi.org/10.36673/AJPCR.2023.v11.i02.A06

HEALTH PROMOTING BENEFITS OF PARAPROBIOTICS

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ABSTRACT

Para probiotics which are defined as nonviable inactivated microbial cells that confer a health benefit to the consumer have the capacity to modulate both the innate and adaptive immune systems possess anti-inflammatory antiproliferative and antioxidant characteristics and have an antagonistic effect on pathogens In fact, it has been proposed that nonviable probiotic cells as well as their metabolic by products also have the ability to provide benefits to the hosts health. The purpose of this review is to provide updated information on the types of probiotics and their bioactivities and mode of action when it comes to their potential to improve health.

KEYWORDS

Para probiotics, Non-viable, Health benefits and Biological response.

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INTRODUCTION

Probiotics have seen a significant increase in popularity since Metchnikoff's initial discovery more than a century ago[1]. Specifically, Para probiotics, which are described as "non-viable, inactivated microbial cells that confer a health benefit to the consumer," have the capacity to modulate both the innate and adaptive immune systems, possess anti-inflammatory, anti-proliferative and antioxidant characteristics and have an antagonistic effect on pathogens[2]. Furthermore, Para probiotics have the potential to improve safety, provide technological and practical advantages and be incorporated into goods meant for older adults and those with weakened immune systems. These characteristics present a significant chance to lead the industry with innovative, safer and more stable nutraceuticals or functional meals.

In addition to treating various diseases and syndromes, these microorganisms may be useful in the treatment of diarrhoea, lactose intolerance[3] colitis[4] irritable bowel syndrome[5], insulin resistance[6], decreased blood pressure[7], decreased cholesterol[8] and obesity[9]. However, these health advantages vary greatly depending on the strain and the ailment; as a result, a large body of research has been done on different probiotic strains to support their unique benefits, taking into account variables like dosage, mode of administ[10]. The use of inactivated microbial cells or cell fractions that help the host's health was coined the term "para probiotics" ration, and frequency of consumption."

Although the names para probiotics and postbiotics are relatively new, they have caught on quickly in a number of fields of research, such as food science, food microbiology, and animal and human health and nutrition. The kinds of para probiotics and postbiotics, however, are not well understood and there are still some questions concerning their bioactivities and mode of action when it comes to their potential to improve health. The goal of this review is to provide updated information on para probiotics. In fact, it has been proposed that inactivated or non-viable probiotic cells, as well as their metabolic byproducts ,also have the ability to provide benefits to the host' health[11].

The goal of employing non-viable microbes as para probiotics is to eliminate the numerous negative effects of delivering viable microorganisms. For example, because many probiotic microbes can lose their desired viability during storage, specific storage requirements are necessary for the viability of probiotic microorganisms. The population of dead cells may even outnumber the population of viable cells in feed preparations supplemented with probiotics, and the ratio of viable to non-viable microorganisms may vary[11]. Since they can lower the risk of microbial translocation, infection, or increased inflammatory responses-all of which probiotics have been shown to cause in consumers-non-viable microbial cells may be safer than live probiotics. The use of non-viable probiotic preparations, recently dubbed "para probiotics," has increased as recent research has demonstrated that even non-viable microorganisms may benefit consumers in a way comparable to that of their viable counterparts[11].

A variety of terms, including "para probiotics," "ghost probiotics," "inactivated probiotics," "non-viable microbial cells," "metabolic probiotics," "postbiotics," etc., have been proposed in relation to the use of probiotics' cell components and metabolites. The term "para probiotics" was coined to describe the application of inactivated microbial cells or cell fractions that benefit the host's health[11]. Certain probiotic cell wall components have been classified as para probiotics in certain studies[12]. A similar definition, "any released molecules capable of conferring beneficial effects to the host in a direct or indirect way," was provided by other researchers[13].

NOVEL IDEAS REGARDING PARAPROBIOTICS

According to available scientific data, customer may benefit from the use of inactivated or nonviable (dead) bacteria. In order indicate the use of inactivated microbial cells or cell fractions to confer a health benefit to the consumer, the term "para probiotics" has established[11]. Inactivated probiotics and ghost probiotics are two terms that have been used in literature to refer to para probiotic[14]. When given to a patient in sufficient quantities, para probiotics which are nonviable microbe cells they can be broken or intact as well as crude cell extract-can have a positive impact[11]. Probiotics may continue to benefit people's health even after they pass away, according to recent research. The term "probiotic paradox" refers to this phenomenon, which is most likely explained by the bio active substance that are released when bacterial cells break down in the digestive tract. Making a probiotic supplement with live probiotic microorganisms is still difficult[15].

The living microorganisms are added to the food products after they have undergone thermal processing. Nevertheless, introducing living microorganisms into heated sterile items may

unintentionally result in contamination[15]. Utilising inactivated probiotic bacteria has the benefit of being technologically feasible since it eliminates the possibility of contamination because the microbes can be put to food products prior to thermal processing. When opposed to probiotics, nonviable materials with a microbial origin provide noticeable advantages for safer and reliable product development[15,16].

POSITIVE IMPACT OF PARA PROBIOTICS ON HEALTH

One of the main mechanisms by which probiotics improve the health of both humans and animals is the modulation of the host's innate and adaptive immune systems. This is especially true when it comes to the prevention and treatment of conditions like atopic dermatitis, gastrointestinal and respiratory disorders, infections and allergies, as well as virally induced infectious diseases[17]. The interplay between intercept nucleotide-binding oligomerization domain (NOD) proteins, which sense MAMPs in the cytoplasm[18,17] and identify pathogens that replicate intracellularly and transmembrane pattern recognition receptors (PPRs), such as Toll-like receptors (TLRs) of the host epithelial and immune cells (neutrophils, monocytes, macrophages, dendritic cells and natural killer cells), is what drives the innate immune response[18,17]. It is evident that the biological response modifying properties of dead probiotic cells bear similarities to the oral delivery of an immunization vacci. When a live salmonella typhimurium vaccine was given to calves, it provided exceptional defence against a virulent strain of the disease. Enterotoxigenic E. coli cells were killed by formalin treatment, and the killed cells were able to induce a strong immune response when they were used as a vaccine in human subjects. Similarly, it was observed that oral administration of inactivated whole- cell pseudomonas aeruginosa vaccine was safe for human participants[17,11].

Chuang *et al*, for example, investigated the effects of three heat-killed Lactobacillus strains on the proliferation of mouse splenocytes and the activation of mouse dendritic cells, indicating their effectiveness in regulating the secretion of interleukin[17]. Studies have demonstrated that products made from both living and non-living cells can result in advantageous biological reactions[14,15]. Para probiotics, which are derived from heat-inactivated cells, can be used to improve immunological responses (immunomodulatory activities). In the gastrointestinal tract, dead cell components exhibit an anti-inflammatory response (GIT)[12,13].

In actuality, elderly people often experience anxiety, stress, and depression, which adds to the risk factors already associated with poor health. For this reason, the potential use of para probiotics as a natural remedy to reduce symptoms of anxiety, stress and depression may be especially significant for the elderly, who are more vulnerable to the negative effects of medications[17]. In healthy adults, including a small subgroup of elderly subjects, heat-killed Lactobacillus plantarum L-137 cells have been shown to enhance immune functions and improve health-related quality of life (QOL) in a strict manner[93]. Recent research has shown that long-term ingestion of ADR-159, a product made from co-fermented Lactobacillus fermentum and Lactobacillus delbrueckii that underwent a lengthy, high-temperature post-production treatment, can improve social behaviour and lower baseline corticosterone levels (a stress hormone) in healthy mice. These results raise the possibility of para probiotics having anxiolytic and antidepressant properties[11].

CONCLUSION

For example, because many probiotic microbes can lose their desired viability during storage, specific storage requirements are necessary for the viability of probiotic microorganisms. The population of dead cells may even outnumber the population of viable cells in feed preparations supplemented with probiotics, and the ratio of viable to non-viable microorganisms may vary. Since they can lower the risk of microbial translocation, infection, or

increased inflammatory responses all of which probiotics have been shown to cause in consumers-non-viable microbial cells may be safer than live probiotics. The use of non-viable probiotic preparations, recently dubbed and para probiotics, has increased as recent research has demonstrated that even non-viable microorganisms may benefit consumers in a way comparable to that of their viable counterparts. The term and para probiotics. Was coined to describe the application of inactivated microbial cells or cell fractions that benefit the hosts health. Certain probiotic cell wall components have been classified as para probiotics in certain studies. A similar definition, any released molecules capable of conferring beneficial effects to the host in a direct or indirect way, and was provided by other researchers. Probiotics may continue to benefit people and health even after they pass away, according to recent research. The term “probiotic paradox" refers to this phenomenon, which is most likely explained by the bio active substance that are released when bacterial cells break down in the digestive tract. Making a probiotic supplement with live probiotic microorganisms is still difficult.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Department of Pharmacology, Kondapally, Karnamamidi, Mancherial Kondapalle, Andhra Pradesh, India for providing necessary facilities to carry out this review work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

BIBLIOGRAPHY

1. Zucko J, Starcevic A, Oros D, Mortazavian A M, Putnik P. Probiotic–friend or foe? *Curr. Opin. Food Sci,* 32, 2020, 45-49.
2. Sharma M, Shukla G. Metabiotics: One step ahead of probiotics; An insight into mechanisms involved in anticancerous effect in colorectal cancer, *Frontiers in Microbiology,* 7, 2016, 1940.
3. Oak S J, Jha R. The effects of probiotics in lactose intolerance: A systematic review, *Critical Reviews in Food Science and Nutrition,* 59(11), 2018, 1675-1683.
4. Chibbar R, Dieleman L A. Probiotics in the management of ulcerative colitis, *Journal of Clinical Gastroenterology,* 49(1), 2015, S50-S55.
5. Whelan K, Quigley E M M. Probiotics in the management of irritable bowel syndrome and inflammatory bowel disease, *Current Opinion in Gastroenterology*, 29(2), 2013, 184-189.
6. Kijmanawat A, Panburana P, Reutrakul S, Tangshewinsirikul C. Effects of probiotic supplements on insulin resistance in gestational diabetes mellitus: A double-blind randomized controlled trial, *Journal of Diabetes Investigation*, 10(1), 2018, 163-170.
7. Sudha R, Upadrasta A. Probiotics and blood pressure: Current insights integrated, *Blood Pressure Control,* 9, 2016, 33-42.
8. Sivamaruthi B S, Kesika P, Chaiyasut C. A mini-review of human studies on cholesterol-lowering properties of probiotics, *Scientia Pharmaceutica,* 87(4), 2019, 26.
9. Ejtahed H S, Angoorani P, Mortazavian A M, *et al*. Probiotics supplementation for the obesity management; A systematic review of animal studies and clinical trials, *Journal of Functional Foods,* 52, 2019, 228-242.
10. Oelschlaeger T A. Mechanisms of probiotic actions: A review, *Int J Med Microbiol,* 300(1), 2010, 57-62.
11. Taverniti V, Guglielmetti S. The immunomodulatory properties of probiotic microorganisms beyond their viability (ghost probiotics: Proposal of paraprobiotics concept), *Genes and Nutrition,* 6(3), 2011, 261-274.
12. Posadas G A, Broadway P R, Thornton J A, Carroll J A, Lawrence A, Corley J R, *et al*. Yeast proand paraprobiotics have the capability to bind pathogenic bacteria associated with animal disease, *Transl Anim Sci,* 1(1), 2012, 60-68.

13. Tsilingiri K, Rescigno M. Postbiotics: What else? *Benef Microbes,* 4(1), 2013, 101-107.
14. De Almada C N, Almada C N, Martinez C R R, Sant Ana A S. Paraprobiotics: Evidences on their ability to modify biologicalresponses, inactivation methods and perspectives on their application in foods, *Trends Food Sci. Technol,* 58, 2016, 96-114.
15. Adams C A. The probiotic paradox: Live and dead cells are biological response modifiers, *Nutr. Res. Rev,* 23(1), 2010, 37-46.
16. Sarkar S. Efficacy of dead probiotic cells, *Int. J. Food Sci. Nutr. Diet,* 5(2e), 2016, 1.
17. Westendorf A M, Fleissner D, Hansen W, Buer J. T cells, dendritic cells and epithelial cells in intestinal homeostasis, *Int. J. Med. Microbiol*, 300(1), 2010, 11-18.
18. Bermudez-Brito M, Plaza-Díaz J, Munoz-Quezada S, Gomez-Llorente C, Gil A. Probiotic mechanisms of action, *Ann. Nutr. Metab,* 61(2), 2012, 160-174.
19. Chuang L, Wu K G, Pai C, Hsieh P S, Tsai J J, Yen J H, Lin M Y. Heat-killed cells of lactobacilli skew the immune response toward T helper 1 polarization in mouse splenocytes and dendritic cell-treated T cells, *J. Agric. Food Chem,* 55(26), 2007, 11080-11086.
20. Suganya K, Koo B S. Gut-brain axis: Role of gut microbiota on neurological disorders and how probiotics/prebiotics beneficially modulate microbial and immune pathways to improve brain functions, *Int. J. Mol. Sci,* 21(20), 2020, 7551.
21. Warda A K, Rea K, Fitzgerald P, Hueston C, Gonzalez-Tortuero E, Dinan T G, Hill C. Heat-killed lactobacilli alter both microbiota composition and behaviour, *Behav. Brain Res*, 362, 2019, 213-223.

Please cite this article in press as: Gaddam Susmitha Reddy *et al*. Health promoting benefits of paraprobiotics, *Asian Journal of Phytomedicine and Clinical Research,* 11(2), 2023, 50-54.