

## Role of Probiotics in Human and Animal Health Review

Rashid M\* and Sultana M

Faculty of Veterinary Science and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, RS Pura 181102, Jammu and Kashmir, India

\*Corresponding author: Rashid M, Faculty of Veterinary Science and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, RS Pura 181102, Jammu and Kashmir, India, Tel: 9469004793; E-mail: rashidvph03@yahoo.co.in

Received date: Mar 29, 2016; Accepted date: Apr 26, 2016; Published date: Apr 30, 2016

Copyright: © 2016 Rashid M, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

### Abstract

Probiotics as "Live microorganisms administered in adequate amounts, confer a health benefit on the host". The use of probiotics is not a new invention but in fact it exists in our traditional food such as preparation of Dahi, Yoghurt, Koumis, Leben, different types of cheese, beverages, alcoholic products etc., since time immemorial. Several scientists proved their role in disease prevention, improvement in feed control, increase in growth, production, raising of immune mechanism etc. Since that time the list of probiotics and their role in human, birds and animal health is increasing day by day. This article explores some of the important aspects in the role of probiotics in human and animal health.

**Keywords:** Probiotics; *Lactobacillus*; Intestinal microbiota; Microflora

### Introduction

Food and Agriculture Organization (FAO) of the United Nations/ World Health Organization [1] defined Probiotics as "Live microorganisms which, when administered in adequate amounts, confer a health benefit on the host". The use of probiotics is not a new invention but in fact it exists in our traditional food such as preparation of Dahi, Yoghurt, Koumis, Leben, different types of cheese, beverages, alcoholic products, etc. since time immemorial. But Metchnikoff [2] at the Pasteur Institute first spotted the role of probiotics. He simplified his statement by correlating the ruminants' digestion which is carried out by microbes in the rumen. Tisser [3] long back more than a century ago pointed out that gut microbes from healthy breast fed infants were dominated by rods with bifids shaped (Bifidobacteria) than the formula fed infants, suffering with diarrhoea. Since that time the list of probiotics and their role in human, birds and animal health is increasing day by day.

The microbes used as Probiotics include bacteria, yeast or mold. The most common species of each are as:

### Bacteria

***Lactobacillus*:** *Acidophilus*, *sporogenes*, *plantarum*, *rhamnosum*, *delbrueck*, *reuteri*, *fermentum*, *lactus*, *cellobiosus*, *brevis*, *casei*, *farciminis*, *paracasei*, *gasseri*, *crispatus*.

***Bifidobacterium*:** *Bifidum*, *infantis*, *adolescentis*, *longum*, *thermophilum*, *breve*, *lactis*, *animalis*.

***Streptococcus*:** *Lactis*, *cremoris*, *alivarius*, *intermedius*, *thermophilis*, *diacetyllactis*, *Leuconostoc mesenteroide*, *Pediococcus Propionibacterium*, *Bacillus Enterococcus*, *Enterococcus faecium*.

### Yeast and molds

*Saccharomyces cerevisiae*, *Saccharomyces boulardii*, *Aspergillus niger*, *Aspergillus oryzae*, *Candida pintolopesii*, *Saccharomyces boulardii*. The type of the microbes used as Probiotics increasing due to the increase in the research in this field. Some of the beneficial role of probiotics consumption include

### Role in competing with pathogenic bacteria

The probiotics maintain normal intestinal microbiota by competitive exclusion and antagonism. This role is exploited in maintaining health of man and animals or birds. The probiotic microbes attach to the intestinal epithelial lining of gut as a consequence pathogens are not allowed to attach and settled down in gut. This idea was exploited by Nurmi and Rantala [4] by applying probiotics in controlling severe outbreak of *Salmonella infantis* in Finnish broiler flocks. They administered probiotics and observed resistance to *Salmonella* infection. On the basis of this model number of probiotics were used in other studies that revealed encouraging results in terms of reduced colonization and shedding of *Salmonella* and *Campylobacter* infection [5].

Among the lactose fermenting bacterial probiotics like *Lactobacillus* species ferment the lactose and produce lactic acid which lowers pH of gut. So get environment becomes unfavourable for some pathogenic organisms to settle and multiply [6].

### Role in feed intake and digestion

Dierick [7] reported that probiotics increase activity of intestinal enzymes and digestibility of nutrients. Similarly Schneitz [8] reported that use of *Aspergillus oryzae* increase digestibility of dry matter with the production of amylolytic and proteolytic enzymes. Adams et al. [9], Fanelli et al. [10,11] reported that probiotics may improve health status of birds by reducing ammonia production in intestines. O'Sullivan et al. [12] reported that probiotics change complex foods into simpler forms in body and they are able to complement many deficiencies in

our digestive system such as production of vitamin K and absorption of certain ions.

### Role in control of diseases

*Lactobacillus* as probiotic secrete vitamins 'B', some essential aminoacids, enzymes that help in digestion. *Lactobacillus salivarius* produces high quantity of lactic acid can inhibit *Helicobacter pylori* so can prevent gastritis, peptic ulcers and gastric cancer in endemic areas of *H. pylori* can be prevented.

During the antibiotic therapy normal microflora are either killed or suppressed, encouraging the overgrowth of opportunistic or pathogenic strains. As a consequence mild to severe form of diarrhoea is caused. For instance cytotoxic strains of *Clostridium difficile* after antibiotic therapy damage the intestinal mucosa leading to diarrhoea, abdominal distension, vomiting, fever and leukocytosis. Hempel et al. [13] in a recent meta-analysis evaluated from the available evidence on probiotics for the prevention and treatment of antibiotic-associated diarrhoea and concluded that probiotic administration-(namely, *L. rhamnosus*, *L. casei* and the yeast *S. boulardii*) is associated with a reduced risk of the condition.

### Role in control of Rotavirus

Treatment and prevention of infectious diarrhoea are probably the most widely accepted health benefits of probiotic microorganisms.

Rotavirus is the most common cause of acute infantile diarrhoea in the world and a significant cause of infant mortality. The virus replicates in the highly differentiated absorptive columnar cells of the small intestinal epithelium and the normal microflora seems to play an important role in the host response to the infection. In well-controlled clinical studies conducted by Isolauri et al. [14] and Szajewska and Mrukowicz [15] it was revealed that probiotics such as *L. rhamnosus* GG, *L. reuteri*, *L. casei* Shirota and *B. animalis* Bb12 can shorten the duration of acute rotavirus diarrhoea with the strongest evidence pointing to the effectiveness of *L. rhamnosus* GG and *B. animalis* Bb12. Several studies have investigated the efficacy of probiotics in the prevention of traveller's diarrhoea in adults, *L. rhamnosus* GG, *S. boulardii*, *L. acidophilus*, and *B. bifidum* exhibit significant efficacy [16]. In some studies it was found that probiotics produce bacteriocines which have inhibitory effect on enteropathogens [17].

### Role in lactose intolerance

Lactose intolerance is a genetic defect due to deficiency of lactase enzyme resulting in the inability to hydrolyse lactose into the monosaccharides as glucose and galactose. So such deficient persons develop diarrhoea, abdominal discomfort and flatulence after consumption of milk or milk products when the bacterial enzymes  $\beta$ -galactosidase degrade the undigested lactose in the bowel. Probiotics play a role in overcoming this problem. For instance if milk products like yoghurt are prepared with the help of *S. thermophilus* and *L. delbrueckii* ssp. *Bulgaricus*, because of higher  $\beta$ -galactosidase activity lactose intolerance problem will be solved [18,19].

### Role in inflammatory diseases

Probiotics enhance the immune system, synthesise and enhance the bioavailability of nutrients. Several investigators demonstrated the immune modulation effect on feeding probiotics to birds and other animal models characterized by secretion of IFN $\gamma$ , IL-2 etc. [20].

Isolauri et al. [21] observed an immune modulating effect of *Lactobacillus rhamnosus* GG in dietary antigens leading to secondary intestinal inflammation and disturbances.

### Conclusion

There are number of scientific evidences that probiotics are useful in the prevention and treatment of certain conditions such as bowel disorders because of lactose intolerance, antibiotic associated diarrhoea and infectious diarrhoea and also in other disorders as allergy and stimulation of immune against some microbes, increase in growth performance. Consumer acceptance is increases day by day for the milk products having probiotics such as in India for Dahi and in other parts of globe Yoghurt. The food industry invests more on this growing market by development of new processes and products. So numbers of foods in the form of functional foods are coming up both for humans and animals or birds.

### References

1. Food and Agriculture Organization/World Health Organization (FAO/WHO) (2001) Health and nutritional properties of Probiotics in food including powder milk with live lactic acid bacteria, Report of a Joint FAO/WHO Expert Consultation on Evaluation of Health and Nutritional Properties of Probiotics in Food including Powder Milk with Live lactic acid bacteria, Co' rdoaba, Argentina.
2. Metchnikoff II, Mitchell PC (1910) Nature of Man or Studies in Optimistic Philosophy. Kessinger Publishing, Whitefish, MT, USA.
3. Tisser MH (1899) La reaction chromophile d'Escherichia et le Bacterium coli. CR Soc Biol 51: 943.
4. Nurmi E, Rantala M (1973) New aspects of Salmonella infection in broiler production. Nature 241: 210-211.
5. Line EJ, Bailey SJ, Cox NA, Stern NJ, Tompkins T (1998) Effect of yeast-supplemented feed on Salmonella and Campylobacter populations in broilers. Poultry Sci 77: 405-410.
6. Macfarlane GT, Cummings JH (2002) Probiotics, infection and immunity. Curr Opin Infect Dis 15: 501-506.
7. Dierick NA (1989) Biotechnology aids to improve feed and feed digestion: enzymes and fermentation. Arch Tierernahr 39: 241-261.
8. Schneitz C (2005) Competitive exclusion in poultry-30 years of research. Food Control 16: 657-667.
9. Adams MC, Luo J, Rayward D, King S, Gibson R, et al. (2008) Selection of a Novel Direct-fed Microbial to Enhance Weight Gain in Intensively Reared Calves. Anim Feed Sci Technol 145: 41-52.
10. Fanelli A (2012) Direct-Fed Microbials (DFMs) in horses and poultry: effects on digestibility, nutritional value of animal products and animal health. Graduate School of Veterinary Sciences for Animal Health and Food Safety. Doctoral Program in Animal Nutrition and Food Safety. Università degli Studi di Milano.
11. Chiang SH, Hsieh WM (1995) Effect of direct feed microorganisms on broiler growth performance and litter ammonia level. Asian Aust J Anim Sci 8: 159-162.
12. O'Sullivan MG, Thornton G, O'Sullivan GC, Collins JK (1992) Probiotic bacteria: myth or reality. Trends Food Sci Technol 3: 309-314.
13. Hempel S, Newberry SJ, Maher AR, Wang Z, Miles JN, et al. (2012) Probiotics for the prevention and treatment of antibiotic-associated diarrhea: a systematic review and meta-analysis. JAMA 307: 1959-1969.
14. Isolauri E, Kirjavainen PV, Salminen S (2002) Probiotics: a role in the treatment of intestinal infection and inflammation? Gut 50 Suppl 3: III54-59.
15. Szajewska H, Mrukowicz JZ (2001) Probiotics in the treatment and prevention of acute infectious diarrhea in infants and children: a systematic review of published randomized, doubleblind, placebo-

- 
- controlled trials. *Journal of Pediatric Gastroenterology and Nutrition* 33: S17–S25.
16. McFarland LV (2007) Meta-analysis of probiotics for the prevention of traveler's diarrhea. *Travel Med Infect Dis* 5: 97-105.
17. Moslehi-Jenabian, Salomeh, Finn Kvist Vogensen, Lene Jespersen (2011) Erratum to "The quorum sensing luxS gene is induced in *Lactobacillus acidophilus* NCFM in response to *Listeria monocytogenes*". *International Journal of Food Microbiology* 149: 269-273.
18. Almeida CC, Lorena SLS, Pavan CR, Akasaka HMI, Mesquita MA (2012) Beneficial Effects on Long-Term Consumption of a Probiotic Combination of *Lactobacillus casei* Shirota and *Bifidobacterium breve* Yakult May Persist After Suspension of Therapy in Lactose Intolerant Patients. *Nutrition in Clinical Practice* 27: 247-251.
19. He T, Priebe MG, Zhong Y, Huang C, Harmsen HJM, et al. (2008) Effects of Yogurt and Bifidobacteria Supplementation on the Colonic Microbiota in Lactose-Intolerant Subjects. *Journal of Applied Microbiology* 104: 595-604.
20. Dalloul RA, Lillehoj HS, Tamim NM, Shellem TA, Doerr JA (2005) Induction of local protective immunity to *Eimeria acervulina* by a *Lactobacillus*-based probiotic. *Comp Immunol Microbiol Infect Dis* 28: 351-361.
21. Isolauri E, Majamaa H, Arvola T, Rantala I, Virtanen E, et al. (1993) *Lactobacillus casei* strain GG reverses increased intestinal permeability induced by cow milk in suckling rats. *Gastroenterology* 105: 1643-1650.