PROBIOTICS AND ALLERGY: CURRENT UNDERSTANDING AND APPLICATION FOR THE PCCP (PRIMARY CARE CHIROPRACTIC PHYSICIAN)

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ABSTRACT

The exceptional growth of allergies in recent years has been attributed to an increase in hygienic conditions which is linked to an under development of the immune system. This can be counteracted by the use of beneficial bacterial cultures (probiotics) which can provide a safe alternative for immune development. (J Chiropr Med 2003;2:131-133)

KEY WORDS: *Mesh:* Allergy; Immune system; *Non-Mesh:* Probiotics; Hygiene Hypothesis

INTRODUCTION

The prevalence of allergies in Western Culture is increasing at a rapid pace. It is doubtful that genetics are the primary causative factor because of the rapidity with which allergic disease has progressed. It may be due in part to the loss of microbial burden resulting from the more aseptic environment that has developed over time. In particular, antibiotics, Caesarian deliveries and the lack of fermentation of our foods may be compromising our body's ability to develop a strong immune system. In fact "the human diet once contained several thousand times more bacteria than it does today (1)."

At birth we all have the necessary blood cells which provide our "innate immunity" but interaction with foreign bodies (antigens) is required to provide antibodies, which is our "learned immunity." It is consistent with this idea that children with hygienic backgrounds and a limited exposure to antigens from bacteria have a greater predisposition to suffer from allergies, including asthma. This correlation between hygiene and allergy has been dubbed "The Hygiene Hypothesis." It may well be an over-simplification, but it has provided the starting point for a great deal of interesting recent research.

Probiotics may offer the primary care chiropractic physician a safe and efficacious method of treating allergy.

Probiotics are defined as "non-pathogenic microorganisms which when ingested exert a positive influence on the health or physiology of the host (2)." In practice, this includes most foods obtained by fermentation if the responsible bacteria are still in a live and active form. In particular, the functional cultures of yogurt, *L. Acidophilus*, *Bifidus*, *S. Thermophilus*, *L. Bulgaricus*, *L. Casei* and *L. Reuteri* have been widely studied. The first 2 strains are frequently marketed as a probiotic supplement. The literature cites numerous health conditions in addition to allergies which may be treated with probiotics such as diarrhea, *H. pylori* infection, cancer, necrotizing enterocolitis, inflammatory bowel disease, lactose intolerance, urinary tract infections, vaginal dismicrobism, and hypercholesterolemia (3,4). This paper however will be restricted to the discussion of probiotics and their effects on allergy. In particular those allergies where intestinal permeability is compromised and affects the expression of the allergy.

DISCUSSION

The Effects of Probiotics on the Gastrointestinal Mucosa and Immune System

The link between the gastric mucosa and allergy is becoming progressively clearer. The permeation of antigens across the gut lining has been the primary implicating factor in food hypersensitivities which manifest as allergic disease. Antigens cross at the junctions between epithelial cells (desmosomes) and cause our immune systems to react, creating antigen-antibody complexes. These areas of compromise in the integrity of the gastric mucosa are frequently brought about by inflammation. Oxidants produced from these antigen-antibody reactions can cause irritation and inflammation at distant sites in our bodies (5).

Increased intestinal permeability is caused by a number of factors, including pathogenic bacteria, viruses, antigens, alcohol, and medications (1,5). Clinical implications and treatment have been reviewed (6).

Probiotics positively affect the gastrointestinal mucosa in a number of ways, many of which are currently being clarified. To be effective, the bacteria used in probiotics

need to have certain distinctive features. They must be able to withstand stomach acidity, bile salts, pancreatic enzymes, and they must have properties of adhesion. Of course they must also be viable and have the ability to colonize (7).

Lactobacillus, *Bifidobacterium* and *Streptococcus* species are the main exemplifiers of these properties and are the most commonly used probiotics.

Some of the current research affirms the positive protective affects that probiotics have on the gastrointestinal lining. Specifically *Lactobacillus plantarum* stopped an *E. Coli*-induced increase in intestinal permeability (8), and *Lactobacillus brevis* reduced bacterial-induced intestinal permeability (9).

Bifidobacteria are found in the intestine from the first week after birth to the end of life. Their health benefits have been long accepted, and the mechanism has been the study of research. In a Finnish study (10), 2 *Bifidobacterium* strains, *Bifidobacterium bifidum* and *Bifidobacterium adolescentis* were assayed in both allergic and healthy infants.

The healthy children had a larger amount of the *Bifidum* strain with superior adhesive properties. The *Adolescentis* strain predominated in the allergic children with poorer adhesive properties. This suggests that the superior adhesive properties of *Bifidobacterium bifidum* may be contributing to a more secure gut barrier giving greater protection in the case of the healthy children.

Isolauri and Majamaa have shown that *Lactobacillus GG* in combination with whey hydrosylates clinically reduce the incidence of eczema in children (11). The authors hypothesized that the probiotic suppressed lymphocyte proliferation and IL 4. The effect of *Lactobacillus GG* on the immune system is not entirely understood but fecal alpha-1-antitrypsin and fecal TNF (a marker for intestinal inflammation) were both reduced in the study group.

Another study by the same authors (12) showed a reduction of inflammatory activity through a reduction in CD4 in the serum and eosinophils in the urine. *Lactobacillus GG* is thought to modulate the immune system by elevating anti-inflammatory cytokines (IL 10) and reducing pro-inflammatory cytokines IL4 (13–15).

Probiotics then, affect the host defense mechanisms in 3 important ways. First they promote structural integrity of the gastrointestinal barrier through its adhesive properties. When probiotics attach to enterocytes they "in-

hibit the binding of pathogens by a process of competitive exclusion (16)." Second they bind antigens, reducing their immunogenicity (17), and third they cause a reduction of inflammation of the gut by the balancing of pro vs. anti-inflammatory cytokines (1).

Safety of Probiotics

The safety profile of probiotics in healthy adult and pediatric populations is considered good (2,18). This includes primarily *lactobacillus* and *bifidobacterium* species. Dosage is typically in the range of one million to one billion colony-forming units daily.

However, 1 of the concerns that is mentioned frequently in the literature is the lack of standardization and regulation of nutritional supplements. As health care providers we must be diligent in our research for purity and potency in the supplements we dispense. Various independent laboratories test these products and publish their results. Another concern was the use of probiotics in immunocompromised patients (19).

CONCLUSION

Recent research on probiotics and their effect on the gastrointestinal mucosa and immune system argues for their judicious use in allergic reactions characterized by increased intestinal permeability, in the non-immunocompromised patient.

REFERENCES

1. Isolauri E. Probiotics in human disease. *Am J Clin Nutr* 2001;73(suppl.): 1142S–6S
2. Marteau PR. Probiotics in clinical conditions. *Clin Rev Allergy Immunol* 2002;22:255–73
3. Teitelbaum JE, Walker AW. Nutritional impact of pre- and probiotics as protective gastrointestinal organisms. *Annu Rev Nutr* 2002;22:107–38
4. Mombelli B, Gismondo MR. The use of probiotics in medical practice. *International J Antimicrobial Agents* 2000;16:531–6
5. Lipski E. Digestive wellness. 2nd Ed. Los Angeles, CA: Keats Publishing; 2000. p. 97
6. Miller AL. The pathogenesis, clinical implications and treatment of intestinal hyperpermeability. *Alt Med Rev* 1997;2:330–45
7. Rolfe R. The role of probiotic cultures in the control of gastrointestinal health. *J Nutr* 2000;130:396S–402S
8. Mangell P, Nejdfor P, Wang M, Ahme S, Westrom B, Thorlacius H, Jepsen B. *Lactobacillus plantarum* 299v inhibits *E. Coli* induced intestinal permeability. *Dig Dis Sci* 2002;47:511–6
9. Garcia-Lafuente A, Antolin M, Guarner FI, Crespo E, Malagelada JR. Modulation of colonic barrier function by the composition of the commensal flora in the rat. *Gut* 2001;48:503–7
10. He F, Ouwehand AC, Isolauri E, Hashimoto H, Benno Y, Salminen S. Comparison of mucosal adhesion and species identification of *bifidobacterium* isolated from healthy and allergic infants. *FEMS Immunol Med Microbiol* 2001;30:43–7
11. Majamaa H, Isolauri E. Probiotics: a novel approach in the management of food allergy. *J Allergy Clin Immunol* 1997;99:179–85
12. Isolauri E, Joensuu J, Suomalainen H, Luomala M, Vesikari T. Probiotics in the management of atopic eczema. *Clin Exp Allergy* 2000;30:1604–10

13. Jack RW, Tagg JR, Ray B. Bacteriocines of gram positive bacteria. *Microbiol Rev* 1995;59:171–200
14. Bell MJ, Shackelford P, Feigin RD, Ternberg JL, Brotherton T. Epidemiologic and bacteriologic evaluation of neonatal necrotizing enterocolitis. *J Pediatr Surg* 1979;14:1–4
15. Pessi T, Sutas Y, Hurme M, Isolauri E. Interleukin-10 generation in atopic children following oral *Lactobacillus rhamnosus* GG. *Clin Exp Allergy* 2000;30:1804–8
16. Beena A., Prasad V. Effect of yogurt and bifidus yogurt fortified with skim mild powder, condensed whey and lactose-hydrolyzed condensed whey on serum cholesterol and triacylglycerol concentrations in rats. *J Dairy Res* 1997;64:453–7
17. Aso Y, Akazan H. Prophylactic effect of *Lactobacillus casei* preparation on the recurrence of superficial bladder cancer. *Urol Int* 1992;49:125–9
18. Saavedra JM. Clinical applications of probiotic agents. *Am J Clin Nutr* 2001;73(suppl):1147S
19. Murch SH. Toll of allergy reduced by probiotics. *Lancet (Commentary)* 2001; 357:1057–9