

## Alpha and omega of microbes

### *Antibiotics and probiotics: judicious use is the key*

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#### Health benefits of antibiotics

The discovery of antibiotics ranks as one of the most important developments of modern medicine. The word antibiotic is derived from the Greek term “biotikos” and is literally translated as “against life.”

Using agents with anti-infective potential has gone on for thousands of years. The Chinese were aware of the therapeutic effects of moldy soybean curd applied to carbuncles and furuncles. The ancient Greeks, including Hippocrates, used agents with antimicrobial properties routinely, including myrrh and inorganic salts, to treat infected wounds.<sup>1</sup> Using antibiotics to treat infections was based on observed effect until the discovery of the microbiologic basis of infectious diseases in the 19th century. The discovery of penicillin by Fleming in 1928 followed by the discovery and clinical use of sulfonamides in the 1930s heralded the age of modern antibiotherapy.<sup>1,2</sup> Penicillin use became widespread in the 1940s during the war years, and by the 1950s the “golden era” of antibiotic development and use was well under way.

#### Health benefits of probiotics

At the other end of the spectrum are probiotics and prebiotics. Their history is just as interesting.<sup>3-5</sup>

The word probiotic is also derived from the Greek term biotikos and means “for life.” Probiotics are live microbes used to alter either the composition or metabolic activities of the microbiota or modulate immune system reactivity in a way that benefits health.<sup>3,4</sup> Probiotics have been used for many years in the animal feed industry but are now available in many forms and can be purchased over-the-counter as freeze-dried preparations in health food stores. Prebiotics are food ingredients, usually oligosaccharides, that escape digestion in

the upper gastrointestinal tract and stimulate the growth of selective bacterial genera, such as bifidobacteria and lactobacilli in the colon.<sup>4,5</sup>

Modulation of the normal microflora to benefit the host can be achieved through use of prebiotics and probiotics. In ancient times, the benefits and health potential of foods containing live bacteria were recognized, and fermented foods were quite common. The historical perspective on concepts related to intestinal microecology date back to Elie Metchnikoff in the early part of the 20th century, however, and he is considered the inventor of probiotics.

Metchnikoff proposed a scientific rationale for the beneficial effects of bacteria in yogurt and attributed the long life of Bulgarian peasants to their eating yogurt containing *Lactobacillus* species. Many properties of probiotics have been suggested as protective factors in the digestive system against microorganisms, such as enteropathogenic *Escherichia coli*, *Salmonella*, *Listeria* species, and *Helicobacter pylori*.<sup>3</sup> Probiotics have been used to prevent and treat diarrheal diseases in adults and children; vaginitis and urinary tract infections in adults; food allergies; and tumours in the gut, bladder, and cervix.

Evidence of the benefits of probiotics, prebiotics, and “immunobiotics”<sup>6</sup> is increasing. Huff (page 583) describes the growing role of probiotics in clinical practice and cites evidence from randomized controlled trials about their benefit in reducing the duration of infectious diarrhea and in ameliorating antibiotic-associated diarrhea in children. She also mentions that the concept of probiotics and their benefits to human health are not new. Only recently have the scientific knowledge and tools become available to properly evaluate their effects on normal health and well-being and

their potential for preventing and treating disease.

Before 1990, only 22 articles on probiotics were cited on MEDLINE. More than 1000 articles have been published in the past 10 years. Some have advocated use of probiotics as a means of reducing or eliminating colonization with antibiotic-resistant microbes,<sup>3</sup> but this area needs more study. Given the relatively high frequency of probiotic use, the study by Huff highlighted one of the major concerns with currently available products in Canada. None of the 10 commercially available products matched their claims, and differences were both quantitative and qualitative. Although the study was small, and we must be careful not to generalize all products and batches of probiotics in Canada, the findings corroborate those of another study<sup>7</sup> conducted in Britain. The study highlights the need for better quality control of these products, particularly if they are used to reduce antibiotic-resistant bacteria.

### Antibiotic resistance on the rise

During the 1990s, antibiotic resistance increased dramatically and is acknowledged to be one of the most serious threats to the treatment of infectious diseases.<sup>8-13</sup> Because of this, the World Health Organization issued a stark warning in its recent report, "Overcoming Antimicrobial Resistance."<sup>14</sup> In addition to large increases in costs and greater toxicity of newer drugs, antibiotic-resistant organisms are continuously eroding current drugs, leaving few or no alternative agents.

Controlling antimicrobial resistance is difficult and requires a multifaceted approach,<sup>12</sup> including reducing unnecessary drug prescribing for both humans and animals, reducing transmission of resistant organisms through enhanced infection control and environmental hygienic practices, and identifying trends in resistance through surveillance. Overuse of antibiotics is considered the major factor in the emergence and spread of antibiotic resistance. Many factors lead to unnecessary

antimicrobial prescribing, including patient expectations and demands, physicians' desire to give the best possible treatment regardless of costs or downstream effects, failure to consider alternative treatments, inappropriate use of diagnostic laboratory studies, adequate knowledge and management of patients with infectious diseases, medicolegal considerations, and the belief that newer and broad-spectrum agents provide the most effective treatment.

In a prospective study of Canadian family physicians' current prescribing habits for lower respiratory tract infections, McIsaac and To (page 569) reveal a prescribing rate of 77.9% for adult patients with acute bronchitis. The finding is disconcerting

given the evidence that antibiotics should not be given to adults for acute bronchitis, a condition that is almost always viral. Reasons for this unnecessary prescribing included uncertainty about the need for antibiotics (69.6%), the possibility that illness

would intensify (36.1%), and pressure from patients to prescribe (32.8%). McIsaac and To suggest that diagnostic labeling might have been a factor in clinical uncertainty and cite a randomized trial that showed that use of alternative diagnostic labels reduced antibiotic use.

Demographics of the physician study population (younger physicians, with fewer years in practice and who volunteered) suggests the study might be biased in favour of better prescribing. Although there is evidence<sup>12</sup> that overall prescribing rates are decreasing in Canada, this study suggests that the need to continue educating both physicians and the general public about the judicious use of antibiotics must continue. Additional strategies should be employed, including the collation and dissemination of prescribing trends and the development of practice-specific guidelines and additional educational programs for specific groups.<sup>15</sup> More than 80% of all oral antibiotic prescriptions are written

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by general or family practitioners who represent approximately 50% of the prescribing physician population in Canada,<sup>8</sup> and this group must be specifically targeted.

Pennie et al (page 577) describe their experience with using short-course parenteral ceftriaxone as initial treatment of moderate-to-severe infections from cat and dog bites, followed by step-down to oral antibiotics. All the patients had a favourable outcome, and none required hospitalization. Use of cephalexin as an oral step-down agent might be questionable given the lack of activity of this agent versus *Pasteurella* species, but the idea of using a specific management protocol to optimize the choice and duration of therapy for a rare clinical problem shows judicious prescribing.

Concerns over antibiotic resistance have not and should not wane. As stated previously in *Canadian Family Physician*,<sup>8</sup> with increasing awareness and a collective desire to provide optimal antibiotic prescribing, physicians, pharmacists, and the general public will recognize the importance of judicious use of antibiotics and probiotics. ❁

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