

# Alternatives to antibiotics

## Commentary

For more than half a century, the human society has been relying primarily on antibiotics to treat infectious diseases caused by pathogenic bacteria. But the more use of antibiotics for the treatment of bacterial infection resulting in Multidrug-resistant bacterial infections.<sup>1</sup> After the development of antibiotics, a general belief arose that the problem of bacterial infections would be solved. Nonetheless, pathogens have evolved sophisticated mechanisms of drug resistance. Due to their high capacity to acquire resistance to antibiotics, there are not enough chemotherapeutics to destroy bacteria and to counteract the problem of infections in the human population.<sup>2</sup> The emergence of infectious disease caused by drug-resistant bacteria requires alternatives to conventional antibiotics.<sup>3</sup> The search for new drugs is becoming critical because of the growing concern over the failing antibiotic drug discovery pipeline. There is a great deal of interest to investigate alternatives and natural antimicrobial agents for the treatment.

Immunity play important role to treat infectious diseases. This may be defined as the body's ability to identify and resist large numbers of infectious and potentially harmful microorganisms, enabling the body to prevent or resist diseases and inhibit organ and tissue damage.<sup>4</sup> Certain type of immunomodulators are used to boost the immunity against infectious diseases. These are biological or synthetic substances that can stimulate, suppress or modulate any aspect of the immune system including both adaptive and innate arms of the immune system. They are a diverse array of recombinant, synthetic and natural preparations, often cytokines. Some of these substances, such as granulocyte colony-stimulating factor (G-CSF), interferons, imiquimod and cellular membrane fractions from bacteria are already licensed for use in patients. Others including IL-2, IL-7, IL-12, various chemokines, synthetic cytosine phosphate-guanosine (CpG), oligodeoxynucleotides and glucans are currently being investigated extensively in clinical and preclinical studies.<sup>5</sup> Micronutrients such as selenium, zinc, and vitamin A and macronutrient such as Protein, Fat, Carbohydrates known to modulate immunity. Vaccines play an important role in providing and improving immunity to a particular disease. A vaccine typically contains an agent that resembles a disease-causing microorganism, and is often made from weakened or killed forms of the microbe, its toxins or one of its surface proteins. The World Health Organization (WHO) reports licensed vaccines are currently available to prevent, or contribute to the prevention and control of, 25 vaccine-preventable infections.<sup>6</sup>

Monoclonal and Polyclonal antibodies are currently being developed against certain infectious agents, including cytomegalovirus and human immunodeficiency virus. Palivizumab is a humanised IgG1 monoclonal antibody licensed for respiratory syncytial virus (RSV) prophylaxis. RSV is the most important respiratory pathogen in infants and approximately 1% of infections require hospitalization.<sup>7</sup> Prebiotics and probiotics are used to promote the growth and multiplication of specific beneficial gut microflora. Prebiotics may be defined as "non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and or activity of one or a limited number of bacteria in the colon". Probiotics are defined as "live microorganisms which when administered in adequate amounts confer a health benefit on the host".<sup>8</sup>

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Bacteriophages, Bacterial cell wall hydrolases and Antimicrobial peptides are also used as alternative to antibiotics in certain bacterial infections. Bacteriophages are 'bacterium eaters' that kill bacterium by causing its lysis (bacteriolysis).<sup>9</sup> Bacterial cell wall hydrolases (BCWH) are enzymes that degrade peptidoglycan, the major component of the bacterial cell wall, and cause bacteriolysis. Different forms of BCWH can be used to treat infectious diseases, including purified native enzymes, denatured enzymes, partial digests, and recombinant proteins endogenously over-expressed in transgenic animals or plants for enhancement of host defense.<sup>10</sup> So all these can act as good alternatives to antibiotics in tackling with pathogenic bacteria without the problem of resistance posed by bacteria.

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