

Dietary Phytochemicals and Microbes

Amlan K. Patra
Editor

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 Springer

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Preface

Plants produce an enormous array of phytochemicals arising from various biosynthetic pathways. More than 200,000 defined structures of phytochemicals have been recognized¹ and about 20,000 phytochemicals have been identified from edible plant sources such as fruits, vegetables and grains.² The phytochemicals are used for various purposes such as pharmaceuticals, agrochemicals, flavours, fragrances, colouring agents, biopesticides and food additives. These plant bioactive compounds are not essential for normal physiological functions, but the importance of certain plant bioactives has been well recognized for health promoting activities such as immuno-modulation, prevention of cancer and cardiovascular diseases, anti-aging and anti-diabetics.³

Humans have utilized the bioactive principles of different plants for various beneficial physiological properties including antimicrobial properties for many centuries. The ancient records provide evidence of their use by Chinese, Indian, Egyptian, Greek, Roman and Syrian dates back to about 5,000 years. However, interests of using medicinal plants declined in the twentieth century with the availability of effective synthetic antimicrobial drugs. The growing concerns over bacterial resistance to antibiotics and chemical residues in animal derived foods have led to a resurgence of interests to use phytochemicals as alternatives to antibiotics, other chemotherapeutic agents, and chemical and growth promoting antibiotic feed additives. Consequently, the trends of market sales of natural plant products have been rising tremendously in recent years. Phytochemicals exhibit antibacterial, anti-viral and antifungal activities against a wide range of pathogenic and non-pathogenic

¹Hartmann T (2007) From waste products to ecochemicals: fifty years research of plant secondary metabolism. *Phytochemistry* 68:2831–2846

²Scalbert A, Andres-Lacueva C, Arita M, Kroon P, Manach C, Urpi-Sarda M, Wishart D (2011) Databases on food phytochemicals and their health-promoting effects. *J Agric Food Chem* 59:4331–4348

³Traka MH, Mithen RF (2011) Plant science and human nutrition: challenges in assessing health-promoting properties of phytochemicals. *Plant Cell* 23:2483–2497

microorganisms.⁴ The antimicrobial properties of phytochemicals are being explored to utilize as potential antimicrobial drugs for prevention and cure of microbial diseases including methicillin resistant *Staphylococcus aureus* and multiple resistant strains of bacteria, and also as feed additives in livestock production system. The *in vivo* evaluation of safety and efficacy of emerging plant bioactives is essential for an extended period of time before they can be recommended for use. Identification of particular genes for the target phytochemicals and the genetic engineering of the biosynthetic pathways could overexpress the targeted genes to produce greater concentrations of phytochemicals,⁵ and could meet the growing demands of plant bioactive substances.

Recently, the number of publications focusing the investigation of phytochemicals as antimicrobial compounds has been increasing exponentially. For instance, a PubMed search on the ‘antimicrobial’ or ‘antiviral’ or ‘antibacterial’ properties of ‘plant’ in the title/abstract provides an estimate of 689 articles until 2000, 2,186 articles during 2001–2010 and 400 articles in 2011 (November 25, 2011). Recognizing the beneficial health effects of phytochemicals, a number of books have been published, but there is no book published exclusively on the antimicrobial properties of phytochemicals. Emphasizing the importance of phytochemicals as an antimicrobial agents and the possibility of dietary phytochemicals and microbial interactions in the gastrointestinal tracts, this book provides the current knowledge on the effects of dietary plant secondary metabolites on beneficial and pathogenic microbes so that researchers, professors and students could get comprehensive information in these areas. The recent updates on the antimicrobial and antiviral properties of numerous recently reported phytochemicals and their mechanisms of antimicrobial actions have been provided comprehensively in several chapters. Some of the chapters have critically discussed the beneficial and adverse effects of antimicrobial and stimulatory activities of dietary phytochemicals on the rumen microbial populations, and gut microbial populations of humans and animals. Microbial adaptation and resistance of microbes to phytochemicals have also been highlighted. The synergistic interactions of phytochemicals and antimicrobial drugs have been discussed in some parts of the chapters. On the applied aspects, the use of phytochemicals against drug resistance microbes, to treat microbial diseases, for food preservation, to inhibit methanogenic archaea in the rumen, and to modulate lipid biohydrogenating microbial populations to increase conjugated linoleic acids in animal-derived foods have been presented in different chapters of this book. The well-known researchers in their respective fields have written the chapters of this book, and the information included in this book would be extremely valuable to the researchers, professors, pharmacists and postgraduate students in clinical microbiology, pharmacology and animal sciences including agriculture and pharmaceutical industry.

⁴Reichling J (2010) Plant-microbe interactions and secondary metabolites with antibacterial, antifungal and antiviral properties. In: Wink M (ed) Functions and biotechnology of plant secondary metabolites, 2nd edn, Annual plant reviews, vol 39. Wiley-Blackwell, Chichester

⁵Li JW, Vederas JC (2009) Drug discovery and natural products: end of an era or an endless frontier? Science 325:161–165

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Kolkata, India

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