Edited by
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# IMMUNITY AND INFLAMMATION IN HEALTH AND DISEASE

## *Emerging Roles of Nutraceuticals and Functional Foods in Immune Support*

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## Emerging Roles of Nutraceuticals and Functional Foods in Immune Support

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CHAPTER

# 30

# Prebiotics and Probiotics in Altering Microbiota: Implications in Colorectal Cancer

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## 30.1. INTRODUCTION

The human microbiota, a pool of microbes, colonizing different parts of body including the gastrointestinal tract, oronasopharyngeal cavity, and skin and urogenital tract (Sommer and Bäckhed, 2013), comprises approximately $10^{14}$ bacterial cells and is thus, 10-times higher than the number of cells in the body (Sekirov et al., 2010). The human microbiota is dynamic in its composition with several species undergoing constant change. The changes to the population of the predominant species are mainly influenced by the feeding habit, environmental exposure and the alterations in the physiological conditions of the host. These changes in the microbial population dynamics range from the dominance of mutual/benign beneficial (symbionts), to commensals/opportunistic pathogens, and finally towards the dominance of a pathogenic species occuring during severe deviation in host conditions from the optimum to extreme as represented by microbial dysbiosis. The seeding and development of specific microbial flora, such as specific for local organs/tracts, happens from infancy and is influenced by genetic, epigenetic and environmental factors including birth conditions, antibiotic usage and feeding habits (Bermon et al., 2015). The mode of birth (natural or C-section) also plays a role in the initial microbial composition as it modulates postnatal immune system development (Min and Rhee, 2015). Overall there is an increasing awareness that gut microbial dysbiosis resulting from the prolonged/inappropriate antibiotic exposure, alcohol misuse/increased uptake, and inappropriate food consumption or diet, has been associated with various diseases such as inflammatory bowel disease (IBD), chronic fatigue syndrome, obesity, cancer, bacterial vaginosis, and colitis. As a result, research in the human gut microbiome has gained immense interest and has shifted the paradigm of our understanding and treatment of metabolic disorders to gut resident microbes and their functions (Aagaard et al., 2014).

Within this milieu, the current chapter focuses on the gut dysbiosis and associated colorectal cancer (CRC) and its prevention by pre- and probiotics. This is done from the standpoint of pre- and probiotic intervention leading to the establishment of benign beneficial microbiota on postoperative gut conditions. Usage of pre-/probiotics (live microbes and nondigestible carbohydrates with health beneficial effects) blossomed in late 1800 and early 1900. Thereafter, the accumulating evidence proved its use for the health effects stemming from intestinal microbial imbalance during CRC. These assist in CRC prevention through various mechanisms including fecal bulking, less resident time, short-chain fatty acid production, etc., which are detailed in subsequent sections.

## 30.2. COLORECTAL CANCER AND GUT MICROBIOTA: IMPLICATIONS OF METABOLITES

CRC is the third most widespread malignant neoplasm among men and women and the second leading cause of mortality in USA; the incidence of this deadly disease is escalating in the other parts of world (DeBarros and

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