

## Combating Oxidative Stress-Mediated Colorectal Carcinogenesis by Herbal Plants

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### Abstract

Colorectal cancer (CRC) is the third most common type of cancer in terms of incidence and the fourth in cause of death worldwide. Clinical trials and observational studies continue to support the notion that CRC is a lifestyle-related syndrome in which oxidative stress is a cofactor. Several human-based randomized trials have confirmed that CRC can be prevented or delayed with various plants-based dietary intervention programs. Dietary antioxidants and phytonutrients combat free radicals and reactive oxygen species that cause oxidative damage of cell membranes moiety, cellular organelles lysis and nuclear DNA damage. There are many herbal plant species that can be used for therapeutic purposes based on their bioactive constituents; these plants are usually called medicinal plants. These herbal plants are less utilized and contain health beneficial functional components, yet their phytonutrients have not been reported. Accordingly, this editorial article is aiming to shed light on the efficacy of herbal plants in combating oxidative stress-mediated CRC carcinogenesis.

**Keywords:** *Oxidative Stress; Colorectal Cancer; Carcinogenesis*

### Introduction

The high rate of urbanization and a steady increase in the per capita income has improved the socio-economic status of the people in the developed and developing countries; this has resulted in drastic changes in their lifestyle and food consumption patterns [1]. Traditional foods are being replaced with more Western-style ready-made foods, and the consumption of fresh fruits and vegetables have decreased whereas the consumption of meat, milk and milk products, eggs, oils and fats, fast foods, savory and sweet snack foods as well as sugar has increased during the past years [2]. Case-control studies in different countries indicate that high daily caloric intake, refined carbohydrates and protein were associated with increased risk of colorectal cancer (CRC), with a higher incidence in urban population as compared to their rural counterparts [3]. It has been suggested that, CRC will continue to drain human and financial resources, if appropriate dietary intervention programs are not developed and introduced to current health care system. The world health organization (WHO) reported that the rate of CRC has increased dramatically as compared to other types of cancers and concluded that CRC is a major public health problem and modernization in food choices, sedentary life style and increased life expectancy are the major factors that might synergize with genetics for the epidemic of CRC worldwide [4].

Environmental oxidizing agents are one of the etiological factors for CRC; the carcinogenicity of these insults is mediated by oxidative stress in colonic cells that is mediated by glutathione (GSH) depletion and impairing total antioxidant capacity in colon tissues [5]. GSH is a tripeptide, and acts as a part of the defense system against the oxidative stress compounds like reactive oxygen and nitrogen species [6]. GSH acts as antioxidants since it is a carrier for the active thiol group and has a direct antioxidants effect through interacting with elec-

trophiles, reactive oxygen or nitrogen. Furthermore, GSH is the major intracellular antioxidant and it undergoes oxidation to the disulfide form (GSSG) and oxidized form, which scavenges reactive oxygen species (ROS) [7]. In healthy cells and tissues, more than 90% of the total glutathione pool is in the reduced form (GSH), and less than 10% exists in the disulfide form (GSSG), and a reduced GSH/GSSG ratio is considered an indication of oxidative stress. Oxidative stress is a condition under which GSH, antioxidant enzymes (glutathione peroxidase, superoxide dismutase, and catalase), and dietary antioxidants (vitamin C, selenium,  $\beta$  carotene and vitamin E) are not counterbalancing ROS, and subsequently induce cellular damage by carcinogenic pathogenesis [5-7].

Human cells, including colonic cells, are equipped with great defense systems that help alleviate oxidative stress by different types of antioxidants to maintain a balanced state of metabolisms and functions in the aerobic living organisms. Oxidative stress-mediated carcinogenesis process involves mutagenicity by initiating DNA damage in proliferated cells, induction of micronuclei cells, and aberrant crypt foci development which represents precursor lesions for colonic tumor. The traditional use of herbal plants throughout the world account for more than 80% in healthcare needs [8]. Bioactive components in herbal plants thought to be associated with the reduction of oxidative stress-mediated carcinogenesis include antioxidant nutrients ( $\beta$ -carotene, glutathione, selenium, and vitamins C), and phytonutrients (polyphenols, flavonoids, and carotenoids) [9]. Recent studies suggest that herbal plants have antioxidant potential properties and prevent CRC development by; providing precursors for production of several drugs against cancer, acting as a potent cytotoxic agent against malignant cancer cells, inhibiting uncontrolled cell proliferation [10,11].

Synthetic medicinal antioxidants are manufactured chemically and being used in the treatment of CRC, but their safety and doses threshold have raised some health concerns. Therefore, natural antioxidants isolated from herbal plants remain a valid option in the treatment of CRC. Nevertheless, the utilization of herbal plants is minimal and there is still a need for further studies that describe their specific biological active compounds in relation to the CRC pathogenesis.

## **Conclusion**

The primary prevention of chronic diseases such as cancer is a public health priority due to the exacting toll it places on peoples' health and on the healthcare system. Herbal plants act as dietary bioactive agents and prevent oxidative stress-associated CRC, through their potent antioxidant activities. CRC carcinogenesis is modifiable in accordance to certain dietary factors with potential anticancer properties, and the long-term use of herbal plants might be considered as an effective intervention for the primary prevention of CRC among high risk groups of adults' populations.

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