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Editorial Open Access

Epigenetic Food: A New Approach for Cancer Prevention and Therapy

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Editorial

Bioactive dietary components enriched in natural fruits and vegetables of our daily food have been showing great preventive and therapeutic potential in a wide variety of human diseases such as cancers. These bioactive components include polyphenol, (-)-epigallocatechin-3-gallate (EGCG), from green tea; isoflavone, genistein, in soybean products; isothiocyanate, sulforaphane (SFN), in cruciferous vegetables such as broccoli sprouts and resveratrol from berries, etc. Therefore, the natural foods are not only excellent sources of fiber, vitamins and minerals, but also contain bioactive components that may serve more important biological functions for human health. Various studies have demonstrated potential mechanisms by which the bioactive dietary components prevent and treat human cancers may involve effectively influence tumor-related gene expression profiles via, at least in part, epigenetic mechanisms [1]. Epigenetic processes, which literally mean outside conventional genetics and do not involve mutations of DNA itself, have been described to influence patterns of gene expression through at least two main mechanisms: DNA methylation and histone modification [2]. Dietary components such as EGCG, genistein and SFN with properties in influencing epigenetic processes are also believed to have effects on cancer prevention and specific foods such as green tea, soybean and broccoli sprouts that are enriched with these compounds are called "epigenetic food".

How dose epigenetic foods affect tumor development? Although the causes for initiation of carcinogenic procedures are not fully understood, a body of evidence has demonstrated that epigenetic aberration-induced gene expression profile changes in tumor-suppressor genes and oncogenes play a major role in initiating tumorigenesis process. In fact, epigenetics is typically defined as a heritable change but can be dynamically reversible and influence gene expression under certain circumstances such as environmental stimuli including nutritional factors. Studies in our laboratory and others showed that dietary epigenetic compounds transcriptionally repress oncogenes and activate tumor-suppressor genes, which normally function to control cellular proliferation or cellular safeguard mechanisms such as apoptosis and senescence [3-5]. The mechanisms by which these dietary components regulate gene expression may involve direct inhibitory effects on epigenetic enzymes including DNA methyltransferases (DNMTs) and/or histone deacetylases (HDACs) that affect DNA methylation status or chromatin structure of the regulatory region of genes leading to transcriptional repression, and indirect effects on transcriptional factors binding capacities resulting in signaling pathway changes. For example, the green tea polyphenol, EGCG, is believed to be a key active ingredient for cancer inhibition through epigenetic control. It has been found that EGCG can reverse CpG island hypermethylation of various methylation-silenced genes and reactivate these gene expressions through inhibition of DNMT1 enzymatic activity [6]. Moreover, EGCG has been proposed to regulate gene expression through the mechanism of chromatin remodeling [7]. Other well-known bioactive dietary compounds such as soybean genistein and broccoli sprouts SFN are also found to inhibit tumorigenesis through epigenetic control in several cancers *in vitro* and *in vivo* [4-8]. More strikingly, some studies indicated that the maternal epigenetic diets may affect cancer incidence in the offspring suggesting a potential transgenerational effects of epigenetic diet on cancer prevention [9].

The recent comprehensive identification of bioactive food provides the first insights into the possible mechanisms underlying the function of nutritional targets in prevention and therapy for various human diseases including cancer. The previous studies imply a far more dynamic role of the bioactive components enriched in food for their impact on genetic and epigenetic changes in tumor-related genes. Cancer initiation involves multistep processes and many survival pathways may prevail over normal cells to promote carcinogenesis. Therefore, bioactive components obtained from daily food aimed at numerous molecular targets and multiple cellular pathways show strong translational potential for cancer prevention and treatment in future human clinical practice. Future research will focus on investigating more specific epigenetic modulators and molecular targets involved in anti-cancer properties of epigenetic food, and human clinical trials are urgently needed as well.

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