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Editorial

The Potential Use of Phenethyl Isothiocyanate for Cancer Prevention

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Cancer is a group of diseases characterized by abnormal cell growth as well as cell proliferation with the potential to invade the body and metastasize from the original site. When conditions are favorable (growth factors, free radicals, or inflammation), induction of DNA mutations, and in particular, the overexpression of oncogenes are two uncontrolled things within the cell cycle that can lead to cancer. In cancer therapy, traditional treatments are chemotherapy, radiotherapy, and surgery, procedures that are either relevant to immunotherapy or target therapy. Since the increase in incidence, as well as escalating problems with drug resistance, no single treatment has been able to cure this disease.

The WHO estimates that 30% to 50% of cancers can be prevented by reducing the main risk factors. Many foods and nutrients were reported to contain factors efficient in decreasing cancer risk or development. Chemicals that have demonstrated inhibitory effects on cancer cells include capsaicin, cucurbitacin B, isoflavones, catechins, lycopenes, benzyl isothiocyanate, phenethyl isothiocyanate, and piperlongumine. Many epidemiological studies also established the correlation between the increased consumption of vegetables that may reduce the risk of various types of cancer. Thus, the aforementioned phytochemicals are part of the wide range of alternatives for cancer prevention.

Research interest in chemoprevention involving natural, synthetic or biological agents has largely increased with growing investigations into cancer chemoprevention. Phenethyl isothiocyanate (PEITC) is one of many chemopreventive agents that inhibit malignant or premalignant cells (Fig. 1). PEITC is a metabolite of watercress (*nasturtium officinale*), and is generated by the hydrolysis of gluconasturtiin, with the final product being an isothiocyanate with phenethyl radical attached to nitrogen.[1] A plant produces PEITC as a biocidal activity response against stress. PEITC is a bioactive compound that assists the plant to withstand external various biotic stressors, such as pathogens, infections, and insects. In addition, many studies have predicted that the biological properties of PEITC are antioxidant, anti-inflammatory, and anti-cancer agents. Such studies have shown both immune modulations by PEITC in mice bearing breast tumor xenografts and the significant suppression of breast tumor growth *in vivo*. The activity of PEITC is demonstrated in different bioactive mechanisms, such as assuaging the generation of free radicals, reducing inflammation, and blocking carcinogenesis. In several types of tumors, PEITC was also predicted to reduce the expression of carcinogenesis, inhibit cell proliferation, down-regulate the cell cycle, and enhance tumor suppression via apoptosis and autophagy induction.[2] During clinical trials, it was found that isothiocyanate inhibits histone deacetylase (HDAC) activity in human colorectal and prostate cancer cells. After validating the biological properties of PEITC *in vivo*, there are now several hydrogel formulation products used in clinical and pharmaceutical industry settings. The bioactive properties of PEITC are still under investigation, which creates a need for clinical studies to prove the safety and effectiveness of PEITC in cancer prevention. The author expects that the use of synthetic, natural, or biological agents will minimize the occurrence of cancer in the future. Thus, the use of PEITC as an adjunct to existing drugs for cancer treatment may reduce the amounts of drugs administered reducing their potential side effects.

In the drug delivery system, conventional approaches are repeated dosing that is plagued with systemic toxicity. The advantages of hydrogels include convenient drug delivery, minimized disadvantages, and optimizing the therapeutic benefits of the drug. Hydrogels contain 90% water and a porous structure that is highly accommodating for drug delivery as it facilitates a controlled release. There were also many studies researching hydrogel-mediated drug delivery applications. The versatility of hydrogel application beyond targeted drug delivery extends to cancer therapy, wound dressings, contact lenses, and tissue engineering. However, the stable, controlled drug release feature could be suitably modified in many ways to achieve improved impact for the targeted delivery of different drugs. Enhancement of hydrogels in targeted drug delivery for specific disease areas offers drug protection from lability, including degradation, and could emerge as a more efficient drug delivery system. For instance, higher cellular uptake and potent anti-cancer activity were observed with hydrogels *in vitro* relative to the testing of known anti-cancer drugs. As such, hydrogels offer a platform for the therapy of several diseases. The water-containing nature of hydrogels with their physical structure that is open to modification in several applications means they are not just limited to a single use. Hydrogels have potential applications in tissue engineering, hygiene products, contact lenses, and wound

Abbreviations: HDAC, histone deacetylase; PEITC, phenethyl isothiocyanate.

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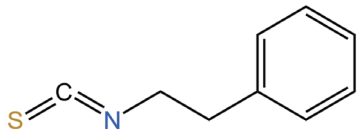

Fig. 1. Phenethyl isothiocyanate.

dressings. The hydrogels also can shrink and swell depending on several environmental delivery applications.

An intensive reading of the "Nutri-phenethyl Isothiocyanate Jelly Promotes Detoxification of a Tobacco-specific Oral Carcinogen in Male Active Cigarette Smokers" study, highlights that the authors constructed a PEITC fortification that generated a complete nutrition gel (Nutri-PEITC).[3] The result was that the Nutri-PEITC jelly significantly increased the level of total urinary concentration of a tobacco-specific oral carcinogen, n-nitrosonornicotine (NNN) metabolite, enhancing its detoxification by promoting glucuronide conjugation. The authors also discussed and explained that the detoxification mechanisms of Nutri-PEITC Jelly may be metabolized and ultimately eliminated through the urine of xenobiotics, on both phases I and II drug-metabolizing enzymes. Storage of xenobiotics can also trigger similar toxic effects as a protective mechanism. This study offers an option for tobaccos induced carcinogen screening and prevention. Noteworthy is the application of Nutri-PEITC Jelly though the hydrogel-based drug delivery was original. There are several hydrogel formulations in clinical use, with improvement and modification possibly enhancing their applications. The subtle modifications of the hydrogels could become an ideal drug delivery vehicle system. Such modification could overcome the disadvantages and limitations with the use of several conventional deliveries, and provide promising results for the therapy of several illnesses. Although the improvement of therapies remains an essential pathway for research, previous findings suggested that Nutri-PEITC jelly may increase the detoxification of smoking-derived carcinogens by promoting the tobacco-specific oral carcinogen, glucuronide conjugation of NNN, proving Nutri-PEITC Jelly as a potential treatment for the primary prevention of smoking-related oral cancer. It is also important to concentrate on cancer prevention, especially regarding phytochemicals' nutritional active ingredients. Let us look forward to reading such research.

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Conflict of interest

The author has no conflict of interest related to this publication.

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