**Pharmacogn.** Mag.
A multifaceted peer reviewed journal in the field of Pharmacognosy and Natural Products
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EDITORIAL

# Sulforaphane *salads*

"Let food be thy medicine and medicine be thy food."

– Hippocrates

Advances in modern science and technology, health sciences in particular, have undoubtedly improved living conditions of humans all around the globe. Economic developments and ensuing prosperities have facilitated people live quality life. These developments have no doubt, added extra years in our life span. However, increasing incidences of lifestyle-related diseases are posing challenges not only to the aging population but also inflicting younger generations. Therefore, maintaining good health and living healthy life by consuming wholesome food, adapting healthy dietary habits and lifestyle has become central and leading social topic of research and discussions.

In ancient Indian classics, the *Upanishads, Taittiriya Upanishad* in particular, it is mentioned that "food is first for human survival and hence the first medicine." This fact was also endorsed by the Father of Modern Medicine Hippocrates, who said "Let food be thy medicine and medicine be thy food." Raw vegetables, the greens, have been consumed by humans since ancient times. The reason might have been that they were easily available in nature, required no fire to cook, were simple to eat and digest, and did not require any calorie calculation or the counts. Later on, those greens were named "salads" that probably first appeared in *Natural History* (XIX, 58) of Pliny the Elder. In *Acetaria: A Discourse of Sallets*, John Evelyn (1699) was the first to introduce *salads* and their importance in English language. Evelyn mentioned that particular composition of certain crude and fresh herbs may be safely eaten. Before John Evelyn, Hippocrates and Galen (370 BC) had envisaged that raw vegetables are easy to pass through digestive system without any disturbances and hence should be served first. Since then, edible raw vegetables are romancing the first milieu of our plates and are adorned by the name "Salads."

Vegetable of *Brassicaceae* family takes major shares as *salad* items. Broccoli (*Brassica oleracea* convar. *botrytis* var. *italica*), brussels sprouts (*Brassica oleracea* convar. *oleracea* var. *gemmifera*), cauliflower (*Brassica oleracea* convar. *botrytis* var. *botrytis*), celery cabbage or napa cabbage (*Brassica rapa* var. *pekinensis*), Chinese cabbage (*Brassica chinensis*), garden cress (*Lepidium sativum*), kale (*Brassica oleracea* var. *acephala*), kohlrabi (*Brassica oleracea* var. *gongylodes*), mougri (*Raphanus sativus* var. *mougri or caudatus*), mustard greens (*Brassica juncea*), radish (*Raphanus sativus, var. sativus, radiculata, niger, longipinnatus*), red cabbage (*Brassica oleracea* convar. *capitata* var. *capitata f. rubra*), rocket salad or arugula (*Eruca sativa* and *Eruca vesicaria*), rutuba or Swedish turnip (*Brassica napus* var. *napobrassica*), turnip (*Brassica rapa* var. *rapa*), water cress (*Nasturtium officinale*), and white cabbage (*Brassica oleracea* convar. *Capitata* var. *capitata f. alba*), etc. are used around global kitchen as *salads*.

The unique taste and smell of *Brassicaceae* plants originates due to the emergence of pungent isothiocyanate compounds when plant tissues are injured. In fact, sulfur compounds identified collectively as glucosinolates are stored in sulfur-rich cells of plant tissues. These cells are therefore called S-cells. A sulfonated oxime moiety, a β-D-thioglucose, and variable side chain derived from amino acids make fundamental structure of glucosinolates. These compounds are chemically stable but biologically inactive. When plant tissues are wounded, these compounds are released from their storage sites and are acted upon by thioglucoside glucohydrolase enzyme called "myrosinase." Myrosinases are localized in protein-rich idioblasts, epidermis, and vascular cambium called myrosin cells. Action of myrosinase on glucosinolates in the presence of water detaches glucose and releases number of compounds such as isothiocyanates, epithionitrile, nitrile, thiocyanate, and goitrin. The organosulfur compound "*sulforaphane*" is an isothiocyanates group of compounds. Although the glucosinolate-myrosinase system and release of compounds by this system was evolved by *Brassicaceae* plants as defense against herbivores and pathogens, the Pharmacognostic approach of Paul Talalay *et al.* from The John Hopkins University (1992) discovered that sulforaphane from broccoli is the major compound that induces detoxificating anticarcinogenic protective enzymes. Therefore, consumption of *Brassicaceae* vegetables or the sprouts may effectively protect against the risk of cancer.

Since then, a number of research papers have emerged claiming sulforaphanes wide range of therapeutic properties for obesity, diabetes, and, inflammatory disorders; the modern human society is facing with. Edible parts of *Brassica* vegetables contain glucosinolates. When crushed and chewed, the glucosinolate-myrosinase system gets activated and a number of bioactive therapeutics including sulforaphanes are released and absorbed through the gut. When consumed, the bacterial myrosinases present in the intestinal flora also help release bioactives and their absorption. The only problem with glucosinolate-myrosinase system is that when heated or cooked, enzyme gets denatured and system does not work. For, these vegetable have been consumed raw for eons, their humble inclusion in our dietary milieu as *salads* may provide enormous health benefits. Hippocrates also said, "Everything in excess is opposed by nature."

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Quick Response Code:

**Website:** www.phcog.com

**DOI:** 10.4103/0973-1296.225675

**Cite this article as:** Tiwari AK. Sulforaphane salads. Phcog Mag 2018;14:3.