# I INTRODUCTION AND OBJECTIVES

The capability of vegetables and fruits in reducing the risk of some diseases, including cancer, is highly commendable and appropriate for reducing the health care cost and improving the quality of life.[1-5] Nevertheless, the most recent World Health Organization World Cancer Report continues to emphasize the importance of improved nutritional functionality as a means of controlling certain disease event, is expected 50% rise in global cancer incidence over the first two decades of this century.[6] Cancer is not one disease, but a group of many related diseases. All types of cancer, though, have one thing in common: they begin in the cells, the body's basic units of life, and are characterized by uncontrolled growth of abnormal cells. The various types of cancer behave differently and require different types of treatment.[7]

In many respects, dietary cancer chemoprevention is an ideal approach. Cancer chemoprevention is defined as pharmacological intervention with synthetic or naturally occurring compounds that may prevent, inhibit, or reverse carcinogenesis, or prevent the development of invasive cancer.[2] Based on such concepts, additional public health campaigns have been directed toward improvement in dietary habits with special emphasis on enhanced consumption of fruits and/or vegetables. Many fruits and vegetables have been found to contain active cancer chemopreventive agents. These include allicin in gallic, isoflavones in soybean, lycopene in tomatoes, flavonoids in green and black tea, etc.[1-5]

Several lead compounds that are implicated in the beneficial effects of cruciferous vegetables are the isothiocyanate derivatives of certain glucosinolates and their enzymatic degradation products are strong candidates, due to their generally high bioactivity and the variety of derived-compounds that can be obtained.[8-30]

Glucosinolates are most prominently represented in the family Brassicaceae (Cruciferae) which is one of the 10 most economically important plant families in the world which includes such vegetables as broccoli, Brussels sprouts, cabbage, cauliflower, kale, radish and various mustards.[11, 22-23] The content in plants is about 1% of dry weight in some tissues of the *Brassica* vegetables, although the content is highly variable, and can approach 10% in the seeds of some plants.[11,22-23,31-33] Among the cultivated Brassicaceae, broccoli attracted attention after the discovery that it contains high levels of the isothiocyanate sulforaphane [4-(methylsulfinyl)butyl isothiocyanate], produced from the breakdown of the glucosinolate glucoraphanin [4-(methylsulfinyl)butyl glucosinolate] and shown great potential anticarcinogenic properties. Sulforaphane is the most potent naturally-occurring Phase II enzyme inducer, considered to play an important role in the detoxification of xenobiotic compounds assimilated with diet.[9-10,14,16,20-21,23-24,28,30,34]

Numerous observation studies indicated that sulforaphane has been reported to reduce the size, delay the appearance of, and/ or reduce the incidence of tumors in a rat mammary tumor model,[27] serves as an indirect antioxidant,[34] exerts selective cytostatic and cytotoxic effects on human colon cancer cells *in vitro*,[35-36] inhibits enzymes cytochrome P450,[37-39] in particular CYP2E1[40] (to play a major role of

the toxicity and carcinogenicity of numerous halogenated hydrocarbons metabolism) and induces cell cycle arrest and apoptosis in human colon cancer cells *in vitro*.[41-42] Recent evidence suggests that sulforaphane is a potent extracellular, intracellular and antibiotic-resistant strains of *Helicobacter pyroli* inhibitor[43] and prevents benzo[a]pyrene-induced stomach tumours.[43-45] Accordingly, highly significant cancer risk reduction with increasing dietary broccoli was observed in breast cancer,[46-50] bladder cancer,[51] colorectal cancer,[52-53] liver and intestines cancer,[44,54-57] lung cancer,[44,58-59]non-Hodgkin's lymphoma,[60] and prostate cancer.[61-64] Other study noted that prior treatment of human retinal epithelial cells, keratinocytes [65] and murine leukemia cells[65-66] with sulforaphane provides highly effective protection against the toxicity of several very different types of oxidant stressors. A different study showed that consumption of broccoli was strongly associated with a reduced risk of coronary heart disease death in postmenopausal women.[67] Moreover, sulforaphane against numerous human pathogens for example, *Escherichia coli*, *Salmonella typhimurium*, Candida sp.[68-69]

Last but not least, there are studies which indicated broccoli boosts genes that protect against heart disease. The name of gene is glucosinolates and isothiocyanates function by producing the body's master antioxidant, glutathione. Therefore, and the logn-term effect, the additional glutathione helps keep arteries healthly.[8,70] Broccoli naturally contains many antioxidants, including carotenoids, tocopherols, ascorbic acid and flavonoids.[22,70-71] Based on the perceived beneficial effects, not surprisingly, broccoli has received widespread attention as a medicinally significant food. Today the investigation of glucosinolates is

expanding into areas and disciplines undreamed of even a few years ago. It is appropriate that this be undertaken from a horticultural perspective, since addressing opportunities for enhancing their anticarcinogenic properties and exploiting "nutraceutical and/or functional food" market niches untimately depend on the success of the crop scientist and primary producer.

Thus, the objectives of this study were:

1) To determine and investigate total and individual glucosinolates content of broccoli seed cultivars widely grown in Thailand.
2) To evaluate individual and total antioxidant capacities of different Thai broccoli seeds.
3) To statistically investigate the inter-relationship between cultivars and antioxidant activity or glucosinolates.