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Introductory Chapter: Phytochemicals and Disease Prevention

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1. Introduction

Phytochemicals, the nonnutritive chemical compounds derived from plants, play a significant role in human disease prevention. Phytochemicals such as secondary metabolites and antioxidants have important medicinal properties. This chapter will briefly outline the source of phytochemicals, their role in disease prevention, phytochemicals produced due to stress conditions, and accumulation of bioactive compounds in fruits and vegetables. It will also discuss the role of allelochemicals as phytochemicals that produced under stressed environment in the plant rhizosphere and neighboring plants leaving significant ecological role. The purpose of this chapter is to provide a general description of phytochemicals and their roles in major diseases prevention.

2. Role of phytochemicals in disease prevention in human

Phytochemicals present in medicinal plants, such as alkaloids, tannins, saponins, flavonoids, phenols, steroids, carotenoids, etc., have several disease prevention activity [1]. These plant-derived chemical compounds play important preventive activities mainly anti-inflammatory, antidiabetic, antiaging, antimicrobial, antiparasitic, antidepressant, anticancer, antioxidant, and wound healing [2]. They also have great role in stress tolerance of plants and accumulation of many important bioactive compounds in fruits and vegetables.

Flavonoids are the most common bioactive compounds found in medicinal plants [3]. They have several preventive activities in human disease such as antimicrobial, antioxidant, anticancer, anti-inflammatory, and wound-healing capacity [4–6]. Anticarcinogenic flavonoids

have been reported to be found in a number of fruits and vegetables [7, 8]. Apple and berries found to have cardioprotective properties and showed positive impact on blood pressure [9].

Anthocyanins are the flavonoid constituents abundant in cell vacuole responsible for pigmentation in flowers, fruits, and vegetables and produced generally during plant under environmental stress [10, 11]. *In vitro* studies showed antioxidative activities of anthocyanins in cell culture systems such as colon, liver, breast, leukemic cell, and keratinocytes [12–15].

Carotenoids are considered as the potential natural antioxidant found in fruits and vegetables. They include xanthophyll and carotenes having scavenging of peroxy radical [16]. Lycopene is common in tomato and berries, while β -carotenes are orange-colored carotenoids abundant in yellow-orange and dark-green leafy vegetables [17].

3. Allelochemicals as phytochemicals in the plant rhizosphere and its ecological role

Plant releases a numerous phytochemicals in order to protect it from environmental stresses such as drought, submergence, chemical pollution, UV exposure, pest and disease infection, and several other unfavorable conditions [18, 19]. Through this process, plant produces secondary metabolites and bioactive compounds having potential antioxidative roles [20]. In general, under natural ecosystem, plant releases numerous chemical compounds to the environment from its body and maintains its normal growth and development. However, plant produces several other chemicals/allelochemicals under environmental stress conditions [21–23]. The released allelochemicals create both heterotoxic and autotoxic conditions for the plant and its neighboring species [24]. Under replanting conditions and recycled hydroponics, plant found to produce a number of allelochemicals that inhibit its own growth and development, and this phenomenon has been reported in beans, taro, strawberry, lettuce, several other leafy vegetables, and ornamentals [25–29]. On the other hand, these allelochemicals may play a significant ecological role in controlling weeds, pests, and plant diseases [30, 31].

4. Conclusion

Fruits and vegetables are the great source of phytochemicals that play protective role in many age-related diseases. Phytochemical supplementation can benefit human health through supplying specific antioxidative/bioactive compounds which have preventive role in several diseases. Flavonoids are the most common phytochemicals that provide antimicrobial, antioxidant, anticancer, anti-inflammatory, and wound-healing activities. Plant under stress also produces allelochemicals that can inhibit either its own growth or neighboring plant species. Under stress condition, plant-produced allelochemicals may also play significant ecological roles through controlling weeds, plant disease, and insect pests.

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