Chapter 1
Anticancer Activity of Flavonoids: Past, Present, and Future

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ABSTRACT

Flavonoids like the synthetic flavone, flavopiridol; the soy isoflavonoid, genistein; the tea catechin epigallocatechin gallate; or the common dietary flavonol, quercetin, are emerging as prospective anticancer drug candidates and some of them have already entered in clinical trials. A positive correlation between flavonoids-rich diet and lower risk of colon, prostate and breast cancers lead to a question that whether flavonoids mediate the protective effects as chemopreventive agents or can interact with different genes and proteins to play role in chemotherapy. Flavonoids modulate reactive oxygen species (ROS)-scavenging enzyme activities, participate in arresting the cell cycle, induce apoptosis, autophagy, and suppress cancer cell proliferation and invasiveness. Flavonoids have dual action regarding ROS homeostasis—they act as antioxidants under normal conditions and are potent pro-oxidants in cancer cells triggering the apoptotic pathways and downregulating pro-inflammatory signaling pathways.

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INTRODUCTION

The cancer refers a collection of carcinogenic illness that proliferate uncontrollably and propagate to faraway locations (Gurunathan et al., 2018). This diverse condition is the top contributor to mortality worldwide (Huang et al., 2017) Unfortunately, cancers that are malignant are expanding worldwide, with an estimated 47% rise anticipated between 2020 to 2040, representing 28.4 M cases (Sung et al., 2021). The fact is indisputable as there is a critical requirement for novel and effective methods of therapy to combat this catastrophic condition. Presently utilized numerous chemotherapy medicines were initially extracted from various nature-based habitats (Kashyap et al., 2021). Scientifically licenced and commonly used plant-based cytotoxic medicines (Lichota et al., 2018). In recent years, scientists worldwide have become increasingly interested in phytochemicals with biological activity, particulary polyphenolic substances. Flavonoids, which constitute a sizeable class of plant derived polyphenols; they are prevalent in cereals, vegetables, fruits, seeds nuts, tea and medicinal plants (Sak, 2014). Among the many bioactivities displayed by those plant-derived secondary metabolic components are active against inflammation, immunomodulation, proliferation, migration, invasion, metastasis, and angiogenesis in a wide range of cancerous cells (Kashyap et al., 2019). This is because flavonoids act on several internal routes within the cell while simultaneously modulating numerous target molecules (Wu et al., 2022). An attractive tactic for combatting the paradigm linked alongside rising cancer chemoprevention, which involves utilization of fabricated, nutritional or natural substances which may halt, slow or revert carcinogenesis (Tsao et al., 2004). Research investigation demonstrate that, following a diet packed with vegetable and fruit lessens the chance of persistent illnesses, including carcinoma (Patel, 2008). These dietary regimens may minimize levels of harmful compouds, prevent the formation of components that may lead to cancer as well as increase the intake of good micronutrients (Johnson, 2004).

Taxonomy and Topological Understanding

In the year of 1930, novel compounds were extracted from oranges, which possesses a capacity to decrease the permeation of capillaries. Initially it was thought to belong to a newly discovered group of nutrients and was named Vitamin P. Nevertheless, further research revealed that this particular compound is actually a flavonoid known as rutin. Even though the Mediterranean community consumed higher amounts of saturated fat- a trend linked to red wine consumption-flavonoids gained more focus due to the reduced prevalence of cardiac illnesses (Ververidis et al., 1992). Flavonoids help trees pollinate, disperse seeds, produce pollen tubes, resorb minerals, tolerate environmental hazards, shields themselves from ultraviolet & allelopathic connections and more. (Ververidis et al., 2007). There are about 8,000 identified polyphenol chemicals which may again again cn be broken down into 10 broad categories (Chahar et al., 2011). Flavonoids, which belong to this family, encompass about 4,000 different types (Harborne, 1994). In addition, isoflavonoids, which are phytoestrogen or non-steroidal oestrogens, are being recognized by scientists as having therapeutic value, especially when used in the context abut safeguarding human health. Examples of the isoflavones are genistein and daidzein, which are derived from soy (Ogbuewu et al., 2010). A multitude of variables, including species, diversity, environment, maturation level as well as after-harvesting preservation, impact the flavonoid levels found in foodstuffs (Modak et al., 2011). The lipid lowering and protein-interacting abilities of Flavonoids are quite extraordinary (McRae and Kennedy, 2011).