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Review Paper

Hibiscus Flowers: A Promising Natural Ally in Cancer Prevention and Treatment

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ABSTRACT

Hibiscus flowers, renowned for their vibrant colors and culinary uses, have garnered attention for their potential anti-cancer properties. This review explores the bioactive compounds present in hibiscus, such as flavonoids, anthocyanins, and organic acids, which contribute to its therapeutic effects. The mechanisms through which hibiscus exerts its anti-cancer effects are examined, including antioxidant activity, modulation of cell signaling pathways, and induction of apoptosis in cancer cells. Special emphasis is placed on the role of hibiscus in breast cancer, highlighting its efficacy in inhibiting tumor growth and metastasis. Furthermore, the consumption of hibiscus as a preventive measure against cancer is discussed, supported by traditional practices and emerging scientific evidence. Recent studies and clinical research are reviewed to provide a comprehensive understanding of hibiscus flowers as a viable option in cancer treatment and prevention strategies. This review aims to underscore the significance of hibiscus flowers in oncology and encourage further research into their therapeutic potential.

INTRODUCTION

A Hibiscus Flowers Promising Natural Remedy for Cancer Hibiscus flowers, belonging to the genus *Hibiscus* of the Malvaceae family, have long been celebrated for their beautiful colors and ornamental value [1]. However, in recent years, scientific research has increasingly focused on the medicinal properties of hibiscus flowers, particularly their potential in cancer prevention

and treatment [2]. Rich in bioactive compounds such as flavonoids, polyphenols, and anthocyanins, hibiscus flowers exhibit several promising pharmacological properties that contribute to their potential as anti-cancer agents [1].

Hibiscus Flowers:

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(Image No. 01 Hibiscus Flowers)

The hibiscus plant, widely cultivated in tropical and subtropical regions, boasts a variety of species with numerous health benefits [3]. *Hibiscus rosa-sinensis* and *Hibiscus sabdariffa* are the most commonly studied species for their therapeutic properties [4]. These species have been used in traditional medicine systems in Asia, Africa, and the Americas to treat a range of ailments, including high blood pressure, inflammation, and even cancer [5]. The bright red flowers of *Hibiscus rosa-sinensis*, known as the China rose, and the calyces of *Hibiscus sabdariffa*, known as Roselle, are the primary plant parts used for their medicinal properties [6,3]. These flowers are rich in anthocyanins, polyphenols, flavonoids, vitamins (especially vitamin C), and other antioxidants, which are believed to help in preventing oxidative stress a critical factor in the initiation and progression of cancer [7]. Recent research has shown that hibiscus flowers, particularly in the form of extracts, could offer promising chemopreventive properties [8].

Bioactive Compounds in Hibiscus Flowers

Hibiscus flowers contain several bioactive compounds that are crucial to their potential anti-cancer activities given below [1,9].

1. Anthocyanins: These pigments, responsible for the red, purple, and blue colors of many fruits and flowers, have demonstrated potent antioxidant and anti-inflammatory effects [10]. Studies show that anthocyanins can inhibit the growth of cancer cells by inducing apoptosis (programmed cell death) and preventing the spread of cancer cells [11].

2. Flavonoids: These compounds possess significant antioxidant properties that help neutralize free radicals in the body, which, if left unchecked, can contribute to cancer development [12]. Flavonoids such as quercetin and kaempferol, found in hibiscus flowers, have been linked to anti-cancer effects by regulating multiple signaling pathways involved in cell survival, proliferation, and apoptosis [13].

3. Polyphenols: Polyphenols are natural compounds found in plants that have strong antioxidant properties [14]. Hibiscus flowers contain polyphenols such as chlorogenic acid and caffeic acid, both of which have been shown to inhibit cancer cell growth and migration [13].

4. Vitamin C: Vitamin C is a potent antioxidant that plays a crucial role in protecting cells from oxidative stress [15]. Its ability to neutralize free radicals helps prevent the DNA damage that could lead to the initiation of cancer [11,12]. Additionally, vitamin C has been shown to enhance the effects of other anti-cancer treatments [16].

5. Tannins: Tannins are another class of polyphenolic compounds found in hibiscus flowers [17]. They possess anticancer properties, including the inhibition of tumor cell proliferation and the induction of apoptosis in cancer cells [18].

Anticancer Mechanisms of Hibiscus Flowers

The anticancer properties of hibiscus flowers have been attributed to several molecular mechanisms given below. [17]

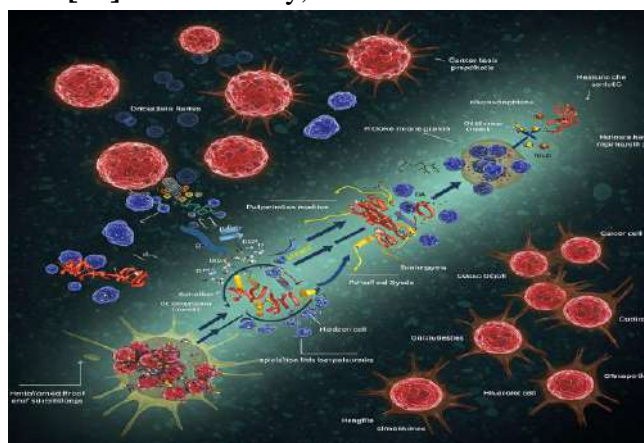
1. Antioxidant Activity: One of the primary mechanisms through which hibiscus flowers exert their anti-cancer effects is through their antioxidant activity [19]. Free radicals are highly reactive molecules that can cause DNA damage, mutations, and cellular damage, all of which are hallmarks of cancer [20]. Hibiscus flowers, rich in antioxidants, can neutralize these free radicals, thus protecting healthy cells and preventing the initiation of cancer [21].

The anthocyanins and polyphenols in hibiscus flowers help to reduce oxidative stress, which can impair the immune system and increase the risk of chronic diseases like cancer [22]. By counteracting oxidative damage, hibiscus compounds help maintain cellular health and prevent the progression of cancerous cells [23].

2. Induction of Apoptosis: Apoptosis, or programmed cell death, is a natural process through which the body eliminates damaged or mutated cells [24]. Cancer cells are known to evade apoptosis, allowing them to grow uncontrollably [25]. Several studies have suggested that hibiscus extracts can induce apoptosis in cancer cells [26]. For example, research has shown that hibiscus extracts can induce cell death in breast cancer and liver cancer cell lines by activating apoptotic pathways [27]. These pathways are crucial for eliminating damaged cells that could potentially transform into malignant ones [28]. Additionally,

hibiscus compounds like anthocyanins and flavonoids have been found to upregulate proapoptotic proteins while down regulating antiapoptotic proteins in cancer cells [29].

3. Inhibition of Cancer Cell Proliferation: Another important anticancer property of hibiscus flower is their ability to inhibit the proliferation (or growth) of cancer cells [30]. Cell proliferation is a key factor in the progression of cancer, and uncontrolled cell division leads to tumor formation and metastasis [31]. Studies have shown that hibiscus extracts can reduce the proliferation of cancer cells by affecting the cell cycle [32]. Hibiscus compounds such as flavonoids and anthocyanins have been found to arrest cancer cells at different stages of the cell cycle, thus preventing them from dividing and spreading [33]. By blocking cancer cell proliferation, hibiscus flowers help prevent the growth of tumors [34].



(Image no.2. Inhibition of Cancer Cell Proliferation)

4. Inhibition of Metastasis: Metastasis is the spread of cancer cells from the primary tumor to other parts of the body, and it is one of the leading causes of cancer-related deaths [35]. Several studies have found that hibiscus extracts can inhibit the migration and invasion of cancer cells, thus preventing metastasis [36]. The compounds found in hibiscus, particularly anthocyanins and flavonoids, have been shown to reduce the expression of proteins that are involved in cancer cell adhesion, migration, and invasion [37]. These

actions contribute to limiting the spread of cancer cells to other tissues and organs [38].

5. Anti-Inflammatory Effects

Chronic inflammation is a known risk factor for the development of cancer, particularly in tissues like the colon, liver, and lungs [40]. Hibiscus flowers have demonstrated potent anti-inflammatory properties, which help reduce the inflammatory environment that fosters the development of cancer [41]. Research has shown that hibiscus extracts can reduce the levels of pro-

inflammatory cytokines and enzymes, such as COX-2, which are commonly associated with tumor growth and metastasis [42]. By mitigating inflammation, hibiscus flowers help prevent the onset of cancer and support the immune system's ability to fight off malignant cells [43].

E. Studies and Research on Hibiscus Flowers in Cancer Treatment

Several studies have explored the anticancer potential of hibiscus flowers, especially in vitro and in vivo models [44]. Below are a few key findings [45].

1. Hibiscus and Breast Cancer

Breast cancer is one of the most prevalent cancers worldwide, and researchers continue to explore various potential treatments to complement conventional therapies [46]. Among these, natural remedies like hibiscus (*Hibiscus rosa-sinensis*) have garnered interest due to their antioxidant, anti-inflammatory, and anti-cancer properties [47].

(a) Chemical Composition of Hibiscus: Hibiscus flowers are rich in bioactive compounds, including anthocyanins, flavonoids, polyphenols, and vitamin C, which are believed to play a significant role in their anticancer activity [48]. These compounds have demonstrated a variety of health benefits, including the inhibition of oxidative stress, which is a contributing factor to cancer development, and the regulation of cell growth [45,49].

(b) Mechanisms of Action in Breast Cancer

- **Induction of Apoptosis:** Hibiscus extracts have been found to induce programmed cell death (apoptosis) in breast cancer cells [50]. Apoptosis is a natural process that eliminates damaged or mutated cells, preventing them from proliferating and forming tumors [51].
- **Inhibition of Cell Proliferation:** Hibiscus compounds, particularly flavonoids, have been shown to reduce the growth and proliferation of breast cancer cells by interfering with key

signaling pathways involved in cell division [52].

- **Antioxidant Activity:** The high levels of antioxidants in hibiscus, such as anthocyanins, play a critical role in reducing oxidative stress, which can damage cells and DNA, thereby contributing to cancer initiation [53].
- **Inhibition of Metastasis:** Some studies suggest that hibiscus extracts may help prevent the spread of breast cancer cells to other parts of the body, thus potentially reducing metastasis [54].

(c) Scientific Studies: Several in vitro (laboratory) studies have examined the effects of hibiscus on breast cancer cells [55]. These studies have consistently shown that hibiscus extracts can decrease the viability of breast cancer cells and induce apoptosis [56]. For instance, a study published in the *Journal of Medicinal Food* found that hibiscus extract significantly reduced the growth of breast cancer cells and improved cell cycle arrest at the G1 phase, preventing the cells from progressing through the cell cycle and proliferating [57]. Another study in 2017 demonstrated that the anthocyanins in hibiscus might inhibit the proliferation of MCF-7 breast cancer cells (a widely used breast cancer cell line in research) [58]. The study showed that hibiscus extracts not only reduced cell growth but also decreased the expression of oncogenes, which are genes that can promote the formation of cancer cells [59].

(d) Potential as a Complementary Treatment

Although hibiscus has shown promising anti-breast cancer properties in preclinical studies, it should not be used as a sole treatment for breast cancer [60]. It is best used as a complementary therapy alongside standard treatments like chemotherapy, radiation, or surgery [61]. Additionally, it is essential for patients to consult healthcare professionals before incorporating hibiscus or any herbal remedy into their treatment



plan, as it may interact with other medications [62].

2. Hibiscus and Colon Cancer

In a study published in 2016, hibiscus extract was found to inhibit the proliferation of colon cancer cells [63]. The research also highlighted the plant's ability to induce cell cycle arrest and apoptosis, further confirming its potential as a natural cancer remedy [64]. The anti-inflammatory properties of hibiscus were also noted, which may help reduce the chronic inflammation associated with colon cancer [65].

3. Hibiscus and Liver Cancer

A 2017 study demonstrated the hepatoprotective effects of hibiscus extract in a liver cancer model [64]. The extract showed a significant reduction in liver cancer cell proliferation, and the study suggested that hibiscus may help prevent liver cancer development by inducing apoptosis and suppressing oxidative stress [63,66].

F. Consumption of Hibiscus for Cancer Prevention

While research on the anti-cancer effects of hibiscus flowers is promising, it is important to note that hibiscus should not be considered a standalone treatment for cancer [67]. Rather, it may serve as a complementary therapy alongside conventional cancer treatments such as chemotherapy and radiation [68].

1. Hibiscus Tea: It is made from the dried petals of the Hibiscus sabdariffa plant, and has gained attention for its potential health benefits, including its possible anti-cancer properties [69]. Hibiscus contains various bioactive compounds such as flavonoids, anthocyanins, and polyphenols, which have been studied for their antioxidant and anti-inflammatory effects [68,69]. These compounds are believed to play a role in reducing oxidative stress, which is linked to the development of cancer cells [70]. Some studies suggest that hibiscus tea may have potential in preventing cancer by inhibiting the growth of cancer cells,

inducing apoptosis (programmed cell death), and reducing the spread of cancerous growth [70]. Research has specifically explored the effects of hibiscus on breast, liver, and colon cancer cells [71]. It has been found to exert cytotoxic effects on cancer cells while exhibiting little to no toxicity on healthy cells [68,69]. Additionally, hibiscus tea's anti-cancer properties may be attributed to its ability to modulate cancer-related pathways, such as those involved in cell cycle regulation, apoptosis, and anti-metastasis [72]. However, while promising, more clinical research is needed to establish its efficacy and safety as a cancer treatment [68,69].

2. Hibiscus Extracts: Hibiscus extracts, particularly those derived from Hibiscus sabdariffa, have garnered significant attention in recent years for their potential anti-cancer properties [73]. Rich in bioactive compounds such as anthocyanins, flavonoids, and polyphenols, hibiscus extracts exhibit antioxidant, anti-inflammatory, and anti-carcinogenic effects, which make them a subject of interest in cancer research [74]. Several laboratory studies have indicated that hibiscus extracts may help inhibit the growth of various types of cancer cells, including those in breast, colon, and liver cancer [75]. These extracts are believed to exert their anti-cancer effects by promoting apoptosis (programmed cell death) in malignant cells, suppressing tumor growth, and limiting metastasis [76]. Moreover, hibiscus extracts can enhance the body's immune response and neutralize harmful free radicals, reducing oxidative stress, which is a key factor in cancer development [77]. The mechanism of action of hibiscus extracts in cancer therapy includes the modulation of cancer-related signaling pathways, such as the suppression of NF- κ B (a protein complex linked to inflammation and cancer progression) and the activation of tumor-suppressor genes [74,75]. While these findings are promising, most studies have been conducted in



vitro (in the lab) or in animal models, so more clinical trials involving human participants are needed to validate the therapeutic efficacy and safety of hibiscus extracts as an adjunct to conventional cancer treatments [78].

G.Safety and Precautions

While hibiscus flowers, particularly Hibiscus sabdariffa, show promise due to their antioxidant, anti-inflammatory, and anti-carcinogenic properties, it is essential to consider certain safety and precautions before using them in cancer treatment or as a supplement [79].

1. Consultation with Healthcare Providers:

(a) Important Reminder: Before using hibiscus flowers or hibiscus-derived products (like tea or extracts) as part of a cancer treatment regimen, it is crucial to consult with a qualified healthcare provider [80]. This is especially important for cancer patients who may be undergoing chemotherapy, radiation, or other medical treatments [81].

(b) Interactions with Medications: Hibiscus may interact with certain medications, especially those related to blood pressure, diabetes, or chemotherapy [82]. It could enhance the effects of some medications or interfere with others [83].

2. Potential Allergic Reactions: While hibiscus is generally safe for most people, some individuals may experience allergic reactions such as rashes, itching, or digestive discomfort when consuming hibiscus products [84]. A patch test or small initial dose may help identify any sensitivity [85].

3. Effect on Blood Pressure: Hibiscus has been known to lower blood pressure [86]. For individuals who are already on blood pressure medication, this could result in an overly low blood pressure (hypotension) [87]. Monitoring blood pressure closely is recommended when using hibiscus as part of a supplement regimen [86].

4. Pregnancy:

Pregnancy Concerns pregnant women are advised to avoid using hibiscus-based supplements or teas,

as it may have uterine-stimulating properties, potentially leading to premature contractions [87]. There is insufficient research regarding hibiscus safety during pregnancy, so caution is advised [88].

5. Effect on Blood Sugar: Hibiscus has shown the potential to lower blood sugar levels, which could be beneficial for people with diabetes [89]. However, if someone is on anti-diabetic medications, using hibiscus in excess may cause hypoglycemia (low blood sugar) [82]. Monitoring blood glucose levels is recommended in such cases. [90].

CONCLUSION:

The Hibiscus flowers emerge as a significant natural resource with promising anti-cancer properties. The diverse bioactive compounds found in hibiscus, including flavonoids and anthocyanins, play a crucial role in mediating its therapeutic effects. Through various mechanisms, hibiscus demonstrates the ability to inhibit cancer cell proliferation, induce apoptosis, and modulate critical signaling pathways, particularly in breast cancer. The consumption of hibiscus, whether in the form of tea, extracts, or supplements, offers a practical approach to cancer prevention, aligning with traditional practices and modern dietary recommendations. As research continues to unveil the potential of hibiscus in oncology, it is imperative to conduct further studies to establish standardized protocols for its use in cancer treatment.

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