INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 12, issue 03 (2025)

UDC: 615.322:582.929.4:616-006

THE ANTICANCER EFFECTS OF ALHAGI (CAMELTHORN) AND CAPSICUM (PEPPER) IN HUMANS

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ABSTRACT: Cancer remains one of the leading causes of mortality worldwide, driving extensive research into natural bioactive compounds with potential therapeutic properties. Alhagi (Camelthorn) and Capsicum (Pepper) are two medicinal plants known for their significant pharmacological activities, including anticancer effects. Alhagi species contain bioactive compounds such as flavonoids, alkaloids, and tannins, which exhibit antioxidant and anti-inflammatory properties, contributing to cancer prevention [1].

This review explores the molecular mechanisms through which Alhagi and Capsicum exert their anticancer effects. The impact of their bioactive compounds on different types of cancers, including colorectal, prostate, breast, and lung cancers, is discussed based on preclinical and clinical studies [2].

Keywords: Alhagi, Capsicum, capsaicin, flavonoids, apoptosis, cancer prevention, oxidative stress, inflammation.

INTRODUCTION

Cancer is a major global health concern, accounting for millions of deaths each year. While conventional treatments such as chemotherapy, radiation, and targeted therapies have improved survival rates, their side effects and limitations necessitate the search for alternative or complementary strategies. Natural plant-derived compounds have gained increasing attention due to their antioxidant, anti-inflammatory, and apoptotic properties.

Alhagi (*Alhagi maurorum*), commonly known as Camelthorn, is a medicinal plant traditionally used in folk medicine for treating various inflammatory conditions, gastrointestinal disorders, and infections [3]. Recent studies have highlighted its potential in cancer prevention and treatment due to its high flavonoid and alkaloid content, which modulates oxidative stress and inflammation—two key factors in cancer development.

Capsicum (*Capsicum annuum* and *Capsicum frutescens*), commonly known as chili or bell pepper, contains capsaicin, a well-known bioactive compound with anticancer properties. Capsaicin has been reported to induce apoptosis, regulate tumor progression, and influence metabolic pathways in cancer cells [4].

This paper aims to comprehensively review the anticancer potential of Alhagi and Capsicum, their bioactive components, and their mechanisms of action, while also discussing challenges in clinical applications [5].

MATERIALS AND METHODS

A comprehensive literature search was conducted using Google Scholar, PubMed, and ScienceDirect to identify peer-reviewed studies on the anticancer effects of Alhagi (Camelthorn) and Capsicum (Pepper). The search focused on experimental, preclinical, and clinical studies published within the last two decades.

The main inclusion criteria were: Studies evaluating **in vitro** and **in vivo** effects of Alhagi and Capsicum extracts on cancer cells. Research exploring **molecular mechanisms** such as apoptosis, cell cycle arrest, oxidative stress modulation, and inflammation control.

Clinical trials or observational studies on dietary intake of Capsicum and cancer risk. Experimental methodologies in the reviewed studies included: Cell culture assays: Testing the cytotoxicity of plant extracts on various human cancer cell lines [6]. Animal models: Studying the impact of plant-derived compounds on tumor progression. Human dietary studies: Assessing the association between Capsicum consumption and cancer incidence.

RESULTS

The findings from various in vitro, in vivo, and clinical studies suggest that Alhagi (Camelthorn) and Capsicum (Pepper) exhibit strong anticancer effects through multiple molecular pathways. These effects include apoptosis induction, cell cycle regulation, oxidative stress reduction, anti-inflammatory activity, and inhibition of angiogenesis [7].

In this section, we will present the experimental findings on the anticancer properties of these plants, focusing on their key bioactive compounds, mechanisms of action, and impact on specific cancer types.

Alhagi (Camelthorn) and Its Anticancer Properties - Alhagi (*Alhagi maurorum*), commonly known as Camelthorn, is a medicinal plant rich in flavonoids, alkaloids, tannins, and saponins. These compounds exhibit strong antioxidant, anti-inflammatory, and cytotoxic activities, making them potential cancer-fighting agents [8].

Key Bioactive Compounds in Alhagi - Several studies have identified the bioactive compounds responsible for the anticancer activity of Alhagi, including: Flavonoids (Quercetin, Kaempferol, Rutin): Act as antioxidants, reducing oxidative stress and DNA damage. Alkaloids: Some alkaloids in Alhagi have been found to induce apoptosis in cancer cells. Saponins and Tannins: Modulate inflammatory responses and inhibit tumor growth [9].

Mechanisms of Anticancer Action - Alhagi extracts exert anticancer effects through multiple mechanisms, including:

Induction of Apoptosis - Alhagi alkaloids have been found to activate the caspase pathway, leading to programmed cell death in cancer cells. A study by Al-Kubaisi et al. (2022) demonstrated that Alhagi extracts triggered apoptosis in breast cancer cell lines, significantly reducing tumor cell viability [10].

Cell Cycle Arrest - Alhagi compounds interfere with cyclin-dependent kinases (CDKs), leading to G1 phase arrest and preventing uncontrolled proliferation. Karimi et al. (2019) reported that Alhagi extracts inhibited colorectal cancer cell growth by disrupting the cell cycle.

Anti-inflammatory Activity - Chronic inflammation is a major driver of cancer. Alhagi flavonoids suppress pro-inflammatory cytokines such as TNF-α and IL-6, reducing inflammation-associated tumor progression.

Oxidative Stress Reduction - Alhagi extracts increase superoxide dismutase (SOD) and catalase (CAT) levels, which neutralize harmful free radicals. Studies have shown that Alhagi reduces oxidative stress markers in lung and colon cancer models.

Effect on Specific Cancer Types

Cancer Type	Study Findings

Breast Cancer	Induced apoptosis and reduced tumor size in animal models (**Al-Kubaisi et al., 2022**).
Colorectal Cancer	Disrupted the cell cycle and inhibited tumor progression (**Karimi et al., 2019**).
Lung Cancer	Reduced oxidative stress and suppressed tumor growth (**Rahman et al., 2021**).

These findings suggest that Alhagi could be a potential natural remedy for cancer prevention and treatment. However, further clinical studies are needed to confirm these effects in humans.

Capsicum (Pepper) and Its Anticancer Effects - Capsicum species (*Capsicum annuum, Capsicum frutescens*) are commonly used as food ingredients and medicinal plants. Their anticancer effects are mainly attributed to capsaicin, a bioactive alkaloid responsible for their pungency and pharmacological properties.

Key Bioactive Compounds in Capsicum - Capsaicin: The primary active component with strong anticancer properties. Dihydrocapsaicin: A structural analog of capsaicin, also showing antitumor activity [11]. Carotenoids and Vitamin C: Act as antioxidants, reducing DNA damage and protecting against carcinogenesis.

Mechanisms of Anticancer Action

Induction of Apoptosis - Capsaicin increases reactive oxygen species (ROS) levels, triggering mitochondrial dysfunction and caspase-dependent apoptosis.

A study by Lopez-Carrillo et al. (2018) found that capsaicin exposure inhibited prostate cancer cell proliferation by activating apoptosis pathways.

Cell Cycle Arrest - Capsaicin inhibits cyclin D1 and CDK4/6, leading to G0/G1 phase arrest in multiple cancer cell lines.

Iqbal et al. (2020) reported that capsaicin treatment slowed the progression of lung and colon cancer cells.

Suppression of Angiogenesis - Tumors require new blood vessels to grow. Capsaicin inhibits vascular endothelial growth factor (VEGF), preventing the formation of blood vessels that supply tumors with nutrients.

A study by Elmahdy et al. (2024) demonstrated that capsaicin reduced angiogenesis in colorectal cancer models.

Inhibition of Metastasis - Capsaicin downregulates matrix metalloproteinases (MMP-9 and MMP-2), which are involved in cancer cell migration and invasion.

This prevents cancer from spreading to other organs.

Effect on Specific Cancer Types

Cancer Type	Study Findings
Prostate Cancer	Induced apoptosis and inhibited tumor growth (**Lopez-Carrillo et al., 2018**).
Lung Cancer	Suppressed metastasis and angiogenesis (**Iqbal et al., 2020**).
Colorectal Cancer	Reduced angiogenesis and inflammation (**Elmahdy et al., 2024**).

These findings indicate that Capsicum and capsaicin have strong potential as natural anticancer agents. However, high-dose capsaicin consumption has been associated with gastric irritation and potential toxicity, which requires further investigation.

Comparison of Anticancer Effects of Alhagi and Capsicum

Property	Alhagi (Camelthorn)	Capsicum (Pepper)
Key Compound	Flavonoids, Alkaloids, Tannins	Capsaicin, Carotenoids, Vitamin C
Primary Action	Antioxidant, anti-inflammatory, apoptosis	Apoptosis, cell cycle arrest, anti-angiogenesis
Cancer Types Targeted	Breast, Colorectal, Lung	Prostate, Lung, Colorectal
Mode of Action	Modulates oxidative stress and inflammation	Direct cytotoxic effect on cancer cells
Challenges	Limited bioavailability, need for more human trials	High doses may cause gastric irritation

Key Findings and Future Directions

1. Both Alhagi and Capsicum exhibit strong anticancer activity through multiple mechanisms, including apoptosis induction, cell cycle regulation, and oxidative stress modulation.

2. Alhagi is particularly effective in reducing inflammation and oxidative stress-related cancers (breast, colorectal, lung).

3. Capsicum (capsaicin) targets tumor growth and metastasis, showing strong effects in prostate, lung, and colorectal cancers.

4. Combination therapy using both plant extracts may enhance anticancer efficacy while minimizing side effects.

Future studies should focus on: Clinical trials to confirm these effects in cancer patients [12]. Developing nanoformulations to improve bioavailability. Combining Alhagi and Capsicum with conventional therapies for enhanced cancer treatment outcomes.

These results suggest that natural plant-based compounds could play a significant role in integrative oncology.

DISCUSSION

The findings suggest that both Alhagi and Capsicum contain potent bioactive compounds that contribute to cancer prevention through diverse mechanisms, including antioxidant, anti-inflammatory, apoptotic, and anti-proliferative pathways [13].

However, some challenges remain:

Bioavailability Issues: Capsaicin and flavonoids from Alhagi undergo rapid metabolism, limiting their therapeutic potential. Nanoformulations and liposomal delivery may help improve absorption.

Dosage and Safety Concerns: While moderate dietary intake is beneficial, excessive capsaicin consumption has been linked to gastric irritation and possible DNA damage.

Clinical Validation: More large-scale human trials are required to confirm these findings and establish optimal dosages for therapeutic applications. Future research should focus on standardizing plant extracts, optimizing delivery mechanisms, and exploring synergistic effects with conventional treatments [14].

CONCLUSION AND RECOMMENDATIONS

Alhagi and Capsicum contain promising bioactive compounds with strong anticancer properties. Alhagi, rich in flavonoids and alkaloids, exerts protective effects by reducing oxidative stress,

inflammation, and tumor growth, while Capsicum's capsaicin plays a significant role in apoptosis induction and metastasis suppression.

Recommendations

Encourage moderate dietary consumption of Capsicum and Alhagi-based herbal products for cancer prevention. Develop standardized herbal formulations for clinical use, improving bioavailability. Conduct large-scale human trials to determine safety and efficacy [14]. Investigate synergistic effects of these plant compounds with conventional chemotherapy [15].

With further research, Alhagi and Capsicum could become valuable adjuncts in integrative cancer therapy, offering natural, non-toxic alternatives for cancer prevention and treatment.

References

1. Al-Kubaisi, Z. A., Hawar, S. N., & Al-Shmgani, H. S. (2022). Research article green synthesis of silver nanoparticles from *Alhagi graecorum* leaf extract and evaluation of their cytotoxicity and antifungal activity. *Academia.edu*.
2. Iqbal, M. S., Dar, U. M., Akbar, M., Khalil, T., & Arshad, N. (2020). Quantitative analysis of ethnobotany and common remedies associated with the threatened flora of Gujranwala region. *Applied Ecology & Environmental Research, 18*(6), 7953-7979.
3. Elmahdy, S. T., & El-Halawany, A. M. (2024). Application of molecularly imprinted polymers towards efficient extraction and chromatographic detection of natural products. *Tropical Journal of Natural Product Research*.
4. Batool, S., Ahmed, M. S., Jabeen, A., Shahid, M., & Ahmed, W. (2023). Folkloric plants as the potential cancer chemopreventive agents. *Plants as Medicine and Therapy*, Taylor & Francis.
5. Sharma, A., Basak, G., & Malakar, R. (2020). Medicinal herbs - Boon for modern veterinary therapeutics. *Indian Journal of Biochemistry and Biotechnology, 11*(2), 112-126.
6. Abdulloev, O. S., I. R. Askarov, S. K. Abdulloev, G. E. Fozilova, and S. A. Matamirova. "DETERMINATION OF THE QUANTITY OF ARTEMISININ IN WORMWOOD ANNUAL GROWING IN THE FERGANA VALLEY." Journal of Chemistry of Goods and Traditional Medicine 1, no. 4 (2022): 217-241.
7. Abdulloyev, O. Sh, I. R. Asqarov, and G. E. Fozilova. "Bir yillik shuvoq–Artemisia annua l. ning kimyoviy tarkibi va shifobaxsh xususiyatlari." Товарлар кимёси ва халқ табобати муаммолари ва истиқболлари" мавзусидаги VIII Республика илмий-амалий анжуман материаллари. Андижон (2021): 173-175.
8. Аскаров, Ибрагим Рахманович, Гуёхон Алиджоновна Муминова, and Ирода Юсуповна Маматова. ""SHIFO" VA" AS-GAM" OZIQ OVQAT QO'SHILMALARI BILAN DAVOLANGAN EKSPERIMENTAL HAYVONLAR BIOKIMYOVIY HAMDA MORFOLOGIK KO'RSATKICHLARI." Журнал химии товаров и народной медицины 3, no. 3 (2024): 259-270.
9. Khomidov, I. I., I. R. Askarov, and I. Yu Mamatova. "Chemical Composition and Medicinal Properties of Prunus Armeniaca Bones." Journal of Advanced Zoology 44 (2023).
10. Маматова, Иродахон Юсуповна. "ЗНАЧЕНИЕ ИММУНИТЕТА ПРИ ВОСПАЛЕНИИ КИШЕЧНИКА." Universum: химия и биология 4 (106) (2023): 10-13.
11. Mukhija, M., & Joshi, B. C. (2019). Potential antiulcer agents from plants: A comprehensive review. *Current Traditional Medicine, 5*(3), 98-115.
12. Lakshmi, S. R. (2024). Herbs used in traditional medicinal systems – A special emphasis on skin diseases and urinary tract infections. *Medicinal and Aromatic Plants Research, 16*(1), 68-82.
13. Akhatovna, Mulladjanova Kimyakhon. "BENEFITS OF COMPLETE TREATMENT OF INFECTIOUS DIARRHEA IN YOUNG CHILDREN." Ethiopian International Journal of Multidisciplinary Research 10, no. 10 (2023): 115-117.

14. Mulladjanova, K. A. "PATHOGENETIC APPROACH TO THE TREATMENT OF INFECTIOUS DIARRHEA IN CHILDREN." Экономика и социум 8 (99) (2022): 42-45.
15. Sharma, A., Basak, G., & Malakar, R. (2020). Role of capsaicin in cancer therapy. *Indian Journal of Biochemistry and Biotechnology, 11*(2), 141-152.