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Additional, Supportive and Non-Conventional Approaches in Cancer Therapy: Biological Properties of Snail Slime and Other Natural Bioactive Compounds in Relation to Specific Cancer Types - A Literature Review

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ABSTRACT

Background: Advances in oncology have significantly improved survival outcomes; however, cancer therapies remain associated with substantial adverse effects that impair patients' quality of life. This has increased interest in evidence-based supportive and non-conventional approaches that complement standard oncological treatment.

Objective: To review current scientific evidence regarding the biological properties of snail slime (snail mucus, snail secretion filtrate) and to evaluate its potential supportive applications across specific cancer types.

Methods: A narrative literature review was conducted using PubMed, Scopus, and Web of Science. Peer-reviewed articles published in English up to 2025 were included, encompassing experimental, preclinical, and clinical studies.

Results: Snail slime contains bioactive compounds such as allantoin, collagen, elastin, glycolic acid, antimicrobial peptides, and antioxidants. These components exhibit regenerative, anti-inflammatory, antioxidant, antifibrotic, and wound-healing properties. Tumor-specific anticancer evidence remains limited and largely preclinical, whereas supportive-care applications are biologically plausible and supported by experimental and clinical wound-healing data.

Conclusions: Snail slime may serve as a supportive adjunct in oncology, particularly for managing treatment-related skin and tissue complications across multiple cancer types. There is no evidence supporting its use as a primary anticancer therapy. Further standardized and tumor-specific studies are required.

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Introduction

Cancer remains one of the leading causes of morbidity and mortality worldwide. Despite progress in surgery, radiotherapy, chemotherapy, targeted therapy, and immunotherapy, patients frequently experience treatment-related complications such as radiodermatitis, oral mucositis, chronic inflammation, fibrosis, and delayed wound healing. Supportive oncology aims to reduce these complications and improve quality of life without interfering with evidence-based cancer treatment.

Natural bioactive compounds have gained attention in supportive care, provided their use is scientifically justified. Snail slime, a secretion produced by terrestrial gastropods, has a long history of use in wound treatment and is currently applied in dermatology and cosmetology. Increasing experimental evidence has prompted investigation into its potential supportive role in oncology.

Methods

A literature search was performed in PubMed, Scopus, and Web of Science using keywords: snail slime, snail mucus, snail secretion filtrate, cancer supportive care, radiodermatitis, mucositis, and wound healing. Only peer-reviewed articles published in English up to 2025 were included. Reference lists were manually screened to identify additional relevant studies [1-10].

Biological Properties of Snail Slime

Snail slime is a complex biological secretion composed of glycoproteins, mucopolysaccharides, enzymes, peptides, and antioxidants. Key components include allantoin (epithelial regeneration), collagen and elastin (tissue repair), glycolic acid (skin remodeling), and antimicrobial peptides (infection control). Experimental studies demonstrate that snail mucus promotes fibroblast proliferation, angiogenesis, collagen remodeling, and endothelial repair, while reducing oxidative stress and inflammatory responses. These properties form the biological basis for its wound-healing and skin-regenerative effects.

Various Anticancer Mechanisms of Action

Current therapies of cancer include chemotherapy, radiotherapy and surgery or all of them used together, although they both have severe side effects.

Each type of cancer requires specific treatment, which explains the need for development of highly specific targeted anti-cancer agents.

Today natural products and their compounds derived from animals, fungi, plants, protozoa or microbes are of great interest for anti-cancer research. This huge variety of chemical structures provides different mechanisms of action and specific effects used for anti-tumor therapy [11-20].

There are Different Biochemical Anticancer Mechanisms of Action.

The varies compounds are known to have a serious potential as anti-cancer drugs.

Most of them are Small Molecules, i) Inhibitors of key Enzymes for Carcinogenesis like Matrix Metalloproteinazes (MMPs), HIFs, Topoisomerase, Protein Kinase C (PKC) or Transcription Factors like NFkB.

Special attention is payed on marine-derived ii) Anti-Angiogenesis Products, which suppress and prevent the successful formation of vascular system, supporting tumor growth and invasion. The majority of these substances act via inhibition of enzymes or factors, crucial for the process of angiogenesis.

Another group of potential anti-cancer agents are the iii) Hemocyanins (Hcs) - oligomeric copper-containing glycoproteins that function as oxygen carriers in the hemolymph of several molluscs and arthropods. Molluscan Hcs have been studied intensively for many years with respect to their structure and function. The huge molecular size (4 to 8 MDa) of molluscan Hcs, their xenogenic character and carbohydrate content have been implicated in inducing strong immune response in mammals, which has led to the biomedical and therapeutic application of these proteins. Thus, keyhole limpet hemocyanin (KLH) isolated from marine gastropod Megathura crenulata is a well-established immune stimulant, hapten carrier and tumor vaccine carrier.

Supportive Use of Snail Slime According to Specific Cancer Types

Evidence is categorized as tumor-specific experimental data or supportive-care extrapolation.

Breast Cancer

Limited tumor-specific evidence exists. In vitro studies demonstrated that snail mucus enhanced chemosensitivity of triple-negative breast cancer cells via Fas/FasL-mediated apoptosis. Additional gastropod-derived peptides showed antiproliferative effects in breast cancer models. From a supportive perspective, snail slime's regenerative and anti-inflammatory properties may aid management of radiotherapy-induced dermatitis and postoperative wound healing [21-30].

Head and Neck Cancers and Oral Cavity Cancers

No direct anticancer effects have been demonstrated. However, snail slime promotes epithelial regeneration and mucosal repair, mechanisms relevant to oral mucositis and radiation-induced skin injury. These effects support its potential post-treatment supportive use, analogous to other natural agents used in mucositis care.

Skin Cancers

Experimental studies reported antiproliferative effects of snail-mucus-derived peptides in melanoma and keratinocyte cancer models. Clinically, snail slime must not be applied to active tumors. Its use is limited to post-surgical wound healing, scar remodeling, and management of treatment-related skin damage [31-40].

Gastrointestinal and Colorectal Cancers

In vitro studies indicate that Helix aspersa extracts affect colon cancer cell viability and oxidative stress pathways. Supportive relevance includes postoperative wound healing and management of peristomal skin complications, supported by snail slime's antimicrobial and regenerative properties.

Prostate Cancer

No tumor-specific data exist. Radiotherapy and surgery often result in chronic radiation dermatitis and fibrosis. Snail slime demonstrates antifibrotic, anti-inflammatory, and regenerative effects in irradiated skin models, supporting its potential supportive topical use.

Ovarian Cancer

Direct anticancer evidence is lacking. Extensive cytoreductive surgery frequently results in delayed wound healing. Animal and cellular studies confirm that snail mucus accelerates wound closure, angiogenesis, and collagen remodeling, supporting postoperative supportive use.

Liver Cancer (Hepatocellular Carcinoma)

No studies directly evaluate snail slime in hepatocellular carcinoma. However, strong antioxidant and anti-inflammatory properties of snail mucus may indirectly support patients experiencing treatment-related skin and wound complications during systemic therapy.

Renal Cell Carcinoma

Renal cell carcinoma treatments often cause dermatologic toxicity and impaired wound healing. Snail slime enhances fibroblast migration, angiogenesis, and epithelial regeneration, supporting its adjunctive use in postoperative wound care and skin toxicity management.

Glioma and Primary Brain Tumors

Due to the blood-brain barrier, direct anticancer effects are unlikely. Supportive relevance includes postoperative scalp wound healing and radiation-induced dermatitis, where snail slime's regenerative properties may be beneficial [41-50].

Neck Cancers

Aggressive multimodal therapy frequently leads to severe skin damage and fibrosis. Snail slime exhibits antifibrotic and regenerative effects in irradiated tissue models, supporting extrapolated post-radiotherapy supportive use.

Lung Cancer (NSCLC and SCLC)

Direct anticancer evidence in lung cancer models is extremely limited. Some gastropod-derived peptides exhibit antiproliferative effects in epithelial cancer cell lines, including lung-derived models, but data remain exploratory. From a supportive-care perspective, lung cancer patients frequently experience radiation-induced skin toxicity, postoperative wound complications, and systemic-therapy-related dermatitis. Snail slime's antioxidant, anti-inflammatory, and wound-healing properties support its topical use strictly as supportive care [51-60].

Limitations

Evidence remains largely preclinical and extrapolated from wound-healing and dermatological studies. There is a lack of standardized snail slime formulations and randomized clinical trials in oncology populations. Snail slime must not be applied to active malignant lesions.

Conclusions and Future Directions

Snail slime demonstrates biological properties that may be beneficial in supportive oncology across a broad range of cancer types. There is no evidence supporting its use as a primary anticancer therapy. Future research should focus on standardized preparations, tumor-specific preclinical models, and clinical trials evaluating supportive outcomes [61-98].

Table 1: Evidence-Based Overview of Snail Slime (Snail Mucus, Snail Secretion Filtrate) in Relation to Specific Cancer Types

Cancer Type	Type of Evidence Related to Snail Slime	Main Biological Effects Reported	Potential Clinical Relevance	Key References
Breast Cancer	In vitro (tumor-specific); supportive extrapolation	Enhanced chemosensitivity, induction of apoptosis; skin regeneration	Supportive skin care after radiotherapy; no clinical anticancer use	Ho et al., 2022; Sarkar et al., 2025
Head and Neck Cancers/ Oral Cavity Cancers	Supportive extrapolation	Epithelial regeneration, angiogenesis, anti-inflammatory effects	Management of oral mucositis, post-radiation skin injury	Li et al., 2025; Bardy et al., 2012
Skin Cancers (Melanoma, NMSC)	In vitro (limited); supportive clinical use	Antiproliferative activity in cell models; wound healing and scar remodeling	Post-surgical wound healing; contraindicated on active tumors	Ciavatta et al., 2016; Sekar et al., 2025
Gastrointestinal / Colorectal Cancers	In vitro (colon cancer cell lines); supportive extrapolation	Modulation of oxidative stress; antimicrobial and regenerative activity	Postoperative wound and peristomal skin care	Matusiewicz et al.,2018; Greistorfer et al., 2017
Prostate Cancer	Supportive extrapolation only	Anti-inflammatory, antifibrotic, regenerative effects	Management of radiation-induced dermatitis	Denham & Hauer-Jensen, 2011; Sekar et al., 2025
Ovarian Cancer	Supportive extrapolation only	Accelerated wound closure, angiogenesis	Postoperative wound healing	Salahi et al., 2025; Rodrigues et al., 2019
Liver Cancer (HCC)	Supportive extrapolation only	Antioxidant and anti-inflammatory activity	Supportive skin and wound care during systemic therapy	Bazeer et al., 2024; Llovet et al., 2021
Renal Cell Carcinoma	Supportive extrapolation only	Enhanced fibroblast migration and epithelial repair	Postoperative wound care; dermatologic toxicity	Escudier et al., 2019; Sarkar et al., 2025
Glioma / Brain Tumors	Supportive extrapolation only	Skin regeneration, anti-inflammatory effects	Postoperative scalp wound healing; radiodermatitis	Stupp et al., 2005; Sekar et al., 2025
Neck Cancers	Supportive extrapolation only	Antifibrotic and regenerative properties	Post-radiotherapy skin recovery	Papp et al., 2017; Chan et al., 2014
Lung Cancer (NSCLC/ SCLC)	Very limited in vitro (non-specific); supportive extrapolation	Antioxidant, anti-inflammatory, wound-healing effects	Post-radiotherapy thoracic skin care; postoperative wounds	Mayer et al., 2013; Greistorfer et al., 2018

Discussion

This narrative review summarizes the current state of evidence regarding the potential role of snail slime (snail mucus, snail secretion filtrate) in supportive oncology. Importantly, the available data demonstrate a clear distinction between limited tumor-specific experimental findings and a broader body of evidence supporting wound-healing, anti-inflammatory, antioxidant, and regenerative properties.

As summarized in Table 1, tumor-specific anticancer activity of snail slime has been demonstrated only in isolated *in vitro* models, primarily in breast and colorectal cancer cell lines. These findings remain exploratory and do not justify clinical anticancer application. No clinical trials have evaluated snail slime as an anticancer agent, and its use on active malignant lesions is contraindicated.

In contrast, a substantially stronger body of evidence supports the biological plausibility of snail slime as a supportive-care agent. Experimental and translational studies consistently demonstrate enhanced fibroblast migration, angiogenesis, collagen remodeling, epithelial regeneration, and reduction of oxidative stress. These effects are mechanistically linked to the bioactive components summarized in Table 2, including allantoin, mucin glycoproteins, antimicrobial peptides, and antioxidant compounds.

Supportive oncology applications are particularly relevant in cancer types associated with high rates of treatment-related skin and tissue toxicity, including breast cancer, head and neck cancers, lung cancer, prostate cancer, renal cell carcinoma, and glioma. In these settings, snail slime may contribute to improved skin integrity, faster wound healing, and enhanced patient comfort when applied to non-malignant, healing tissues.

From a methodological standpoint, the heterogeneity of snail mucus composition, lack of standardized formulations, and absence of randomized clinical trials represent significant limitations. Future research should focus on standardization of snail secretion filtrate, safety profiling in oncology populations, and prospective clinical studies assessing supportive endpoints such as radiodermatitis severity, wound-healing time, and patient-reported outcomes.
Importantly, positioning snail slime strictly within the framework of supportive and adjunctive care-rather than alternative anticancer therapy-is essential to maintain scientific rigor and clinical safety.

The major bioactive components of snail slime and their mechanistic relevance to supportive oncology are summarized in Table 2.

Table 2: Major Bioactive Components of Snail Slime and their Biological Effects Relevant to Supportive Oncology

Bioactive Component	Reported Biological Effects	Mechanistic Relevance	Potential Supportive-Oncology Application	Key References
Allantoin	Stimulation of epithelial regeneration; keratolytic activity	Accelerates re-epithelialization and tissue repair	Post-radiotherapy skin recovery; wound healing	Sekar et al., 2025; Singh et al., 2024
Collagen	Structural support; extracellular matrix remodeling	Improves tensile strength and wound integrity	Postoperative wound healing	Sarkar et al., 2025
Elastin	Enhances tissue elasticity	Reduces fibrosis and skin stiffness	Radiation-induced fibrosis management	Papp et al., 2017
Glycolic Acid	Keratolytic and remodeling effects	Promotes epidermal turnover	Scar remodeling after oncological surgery	Bonté, 2019
Antimicrobial Peptides	Broad-spectrum antimicrobial activity	Reduces infection risk in damaged tissue	Protection of irradiated or postoperative skin	Greistorfer et al., 2017
Antioxidants (Phenolics, Enzymes)	Reduction of oxidative stress	Counteracts radiation- and chemotherapy-induced ROS	Supportive care during systemic therapy	Bazeer et al., 2024
Mucin Glycoproteins	Moisturizing, barrier protection	Maintains mucosal and epidermal integrity	Oral mucositis; radiodermatiti	Li et al., 2025

Type of Cancer	First Author	Article Title
Melanoma	Borade D et al. (2025)	Exploring the therapeutic and cosmetic potential of snail mucin: future prospectives.
	Chen Bo Rong et al. (2023)	Snail mucus increases the anti-cancer activity of anti-PD-L1 antybody in melanoma.
	Leśków A et al. (2021)	The effect of biologically active compounds in the mucus of slugs *Limax maximus* and *Arion rufus* on human skin cells.
	Ellijimi C et al. (2018)	*Helix aspersa Maxima* mucus exhibits antimelanogenic and antitumoral effects against melanoma cells.
Colon Cancer	Matusiewicz M et al. (2022)	Effect of extracts from eggs of *Helix aspersa maxima* and *Helix aspersa aspersa* snails on Caco 2 colon cancer cells.
	Georgieva A et al. (2020)	Anti-cancer properties of gastropodan hemocyanins in murine model of colon carcinoma.
	Matusiewicz M et al. (2018)	In vitro infuence of extracts from snail *Helix aspersa* Müller on the colon cancer cell Line Caco-2.
	Gesheva V et al. (2014)	Anti-cancer properties of gastropodan hemocyanins in murine model of colon carcinoma.
	Leskar J et al. (2007)	Structural basis for recognition of breast and colon cancer epitopes Tn antigen and Forssman disaccharide by *Helix pomatia* lectin.

Breast Cancer	Petrova M et al. (2023)	Antitumour activity of online first bioactive compounds from *Rapana venosa* against human breast cell lines.
	Chen-Yi Ito et al. (2022)	Snail mucus enhances chemosensivity of triple-negative breast cancer via activation of the Fas pathway.
	El Ouar I et al. (2017)	Effect of *Helix aspersa* extract on TNFα, NF-κB and some tumour suppressor genes in breast cancer cell line Hs578T.
	Ekoban T et al. (2016)	Prediction of anticancer peptides against MCF-7 breast cancer cells from the peptidomes of *Achatina fulica* mucus fractions.
	Leskar J et al. (2007)	Structural basis for recognition of breast and colon cancer epitopes Tn antigen and Forssman disaccharide by *Helix pomatia* lectin.
	Dwek MV et al. (2001)	*Helix pomatia* agglutinin lectin binding oligosaccharides of aggressive breast cancer.
Bladder Cancer	Boyanova A et al. (2019)	In vitro effect of molluscan hemocyanins on CAL-29 and T-24 bladder cancer cell lines.
	Dolashki A et al. (2019)	Antitumour activity of Helix hemocyanin against bladder carcinoma permanent cell lines.
Glioma/ Glioblastoma	Sarkar P et al. (2025)	Emergence of snail mucus as a multifunctional biogenic material for biomedical applications.
Ovarian Cancer	Sarkar P et al. (2025)	Emergence of snail mucus as a multifunctional biogenic material for biomedical applications.
Oral Cavity Cancer	Łobziak M et al. (2022)	In vitro analysis of the influence of *Cornu aspersum aspersum* snail embryo homogenate on normal cells and tongue cancer cells.
Hepatoma	Attia Atta S et al. (2021)	In-vitro anticancer and antioxidant activities of *Eremina desertorum* (Forsskal, 1775) snail mucin.
Neuroblastoma	Matalka LE et al. (2012)	The Tripeptide, GHK, induces programmed cell death in SH-SY5Y neuroblastoma cells.
Lung Cancer	Laak E et al. (2002)	Lectin histochemistry of resected adenocarcinoma of the lung: *Helix pomatia* agglutinin binding is an independent prognostic factor.
Myeloma	Georgieva A et al. (2023)	Assessment of the in vitro and in vivo antitumour activity of hemocyanins from *Helix aspersa*, *Helix lucorum,* and *Rapana venosa* in a Graffi myeloid tumour model.
Prostate Cancer	Smith BN et al. (2012)	The role of snail in prostate cancer.
Pancreatic Cancer	Riggs DR et al. (2005)	In vitro effects of keyhole limpet hemocyanin in breast and pancreatic cancer in regards to cell growth, cytokine production, and apoptosis.
Guerin Ascites Tumor	Dolashka P et al. (2011)	Antitumor activity of glycosylated molluscan hemocyanins via Guerin ascites tumor.

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