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Anticancer properties of soursop (*Annona muricata*): an updated review

Abstract

Cancer remains a major cause of mortality worldwide, highlighting the urgent need for the development of novel therapeutic agents with enhanced efficacy and improved safety profiles. *Annona muricata* (Soursop), which is endemic to tropical regions of the Americas, is well-known for its tasty fruit and traditional medicinal uses. Several portions of the plant, including the leaves, bark, and seeds, contain bioactive compounds. Several studies have reported that the leaves exhibit stronger anticancer activities against different types of cancer. Both wet lab and *In-silico* studies support the potential of soursop leaves as a beneficial alternative treatment for managing cancer. In the last 2–3 years, several researchers have reported highly significant anticancer effects against various cancer types when used either as a single dose or in combination with other therapeutic drugs. Overall, the current review highlights that *A. muricata* exhibits a promising anticancer profile. Nevertheless, further research, particularly clinical studies involving human subjects with different types of cancer, is required to confirm its safety and therapeutic efficacy.

Keywords: *Annona muricata*, anticancer, cancer, clinical studies, safety

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Introduction

Annona muricata (soursop) is an evergreen plant commonly grown in tropical and subtropical regions, especially in Central America, South America, the Caribbean, Southeast Asia, and parts of Africa. It typically grows to a height of about 5–8 meters, with a trunk diameter ranging from about 15 to 83 cm.[1] It belongs to the cotyledon group within the Magnoliideae subclass, the Magnoliales order, the Annonaceae family, and the Annona genus. It is native to the Caribbean and Central America but is now cultivated in various tropical regions, including Central and South Africa, China, Australia, and several parts of Asia such as India, Thailand, the Philippines, and the Pacific Islands.[2] Depending on the geographical region, *A. muricata* is referred to by various common names, such as graviola in the Caribbean, soursop in the Americas, and corossolier in France.[3] *A. muricata* has a white pulp that possesses a distinctive sweet taste and pleasant aroma, making it highly appealing for consumption.[2] These sensory attributes provide an additional advantage in terms of market acceptability, particularly when soursop pulp is used as a food product or as a co-ingredient in the food industry.[4,5]

The plant *A. muricata* contain key secondary metabolites, including alkaloids, megastigmanes, phenolic compounds, minerals, and acetogenins.[6,7] More than 120 different acetogenins have been identified in this plant, with their concentrations varying depending on the plant part and the time of harvest.[8,9] It is widely used in the pharmaceutical, cosmetic, and industrial sectors. The leaves, in particular, exhibit a broad range of pharmacological properties, including anti-arthritic, anti-diabetic, hypolipidemic, anticonvulsant, antioxidant, anti-inflammatory, antibacterial, and anticancer activities.[9] In parallel, increasing interest in plant-based therapies has encouraged the investigation of medicinal plants as complementary or alternative strategies for cancer management. *A. muricata*, recognized for its potential anticancer properties, is among the medicinal plants acknowledged by the World Health Organization guidelines for the safe use of herbal medicines.[10] Medicinal plants are widely used for the treatment of many diseases, including cancer.[11-17] In this article, we summarize the available data from last 2-3 years on the anticancer properties of an important medicinal plant, *A. muricata*. Kouki et al.[18] studied the synergistic anticancer activity of *A. muricata* leaf extract and Cisplatin in 4T1 Triple-Negative breast cancer cells. They found that the leaves of this plant have strong anti-tumor activity against 4T1 breast cancer cells and also induce autophagy-mediated cell death by mTOR downregulation and upregulate Beclin1 and LC3 expression. Combined treatment with cisplatin alters the mechanism of cell death by shifting it from intrinsic apoptosis to autophagy, thereby enhancing its anticancer effectiveness. The leaf extract attenuates cisplatin-induced inflammation by suppressing tumor necrosis factor-alpha (TNF-α) expression while upregulating interleukin-10 (IL-10) expression. The study by Tianing et al.[19] investigated the anticancer potential of 96% ethanol extract from soursop leaves against 4T1 breast cancer cells using the MTT assay. The 96% ethanol extract of leaves exhibits potential anticancer activity by reducing breast cancer cell viability and suppressing VEGF and HIF-1, suggesting possible anti-angiogenic and antioxidant effects. Prabowo et al.[20] conducted a study on the apoptotic pathway in a rat model of hepatocellular carcinoma using soursop leaf extract (SLE). Of the 48 rats initially included, 35 completed the trial. Rats treated with SLE (50 mg/kg or 100 mg/kg) in combination with sorafenib showed significant improvements in apoptotic markers, particularly caspase-8 ($p = 0.043$) and BCL-2 ($p = 0.018$), along with a reduction in AFP levels ($p = 0.001$). The findings of Rosdi et al.[21] also showed that the maceration and ultrasonic-assisted based extraction of *A. muricata* have anticancer activity against non-small cell lung cancer.

Samuel et al.[22] conducted an *in-silico* study to identify key anticancer compounds present in *A. muricata*. The study highlighted several important bioactive compounds, including annonacin, quercetin, coreximine, and kaempferol. Among these, coreximine was identified as the most promising compound, showing the strongest binding affinity with the target proteins 7SA9 and 4ZFI. It formed multiple hydrogen bonds (for example, with ARG97 at a distance of 1.99 Å), as well as π–π stacking interactions and metal chelation, indicating stable ligand–protein interactions. Based on these findings, the authors recommended further *in vitro* and *in vivo* studies to validate the anticancer potential of these compounds. In a similar study Ali et al.[23] evaluated the natural compounds of soursop leaves against colon cancer using *In-silico* and GC MS methods.

They identified key compounds with favourable binding affinities, drug-likeness properties, and ADMET profiles by using GC MS, molecular docking, DFT analysis, and MD simulations. Among the screened compounds, α-tocopherol emerged as the most promising lead candidate, exhibiting the strongest binding affinity to MLH1 (-9.1 kcal/mol) and maintaining stable interactions throughout molecular dynamics simulations.

Conclusion

The present review focuses the therapeutic promise of bioactive compounds derived from *A. muricata* (commonly known as soursop) against different types of cancer. Both wet lab and *in-silico* studies provides compelling evidence that compounds from *A. muricata* exhibit promising anticancer activities against breast cancer, lung cancer, liver cancer, and other types. As the field moves toward more personalized and less invasive cancer treatments, nature-derived molecules such as those from soursop hold significant potential to reshape therapeutic strategies, offering hope for more effective and safer interventions in the fight against cancer.

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None.

Conflict of Interest

None.

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