# PROSPECTS FOR THE USE OF APIGENIN IN BREAST CANCER THERAPY

**Azimova D.F.**
**Azimova B.J.**
Tashkent Pharmaceutical Institute, Tashkent city, Republic of Uzbekistan
e-mail: dazimas347@gmail.com
https://doi.org/10.5281/zenodo.17342075

**Relevance:** Breast cancer (BC) continues to represent one of the most pressing health challenges of modern oncology, ranking as the leading cause of cancer-related morbidity and mortality among women globally. According to recent international epidemiological projections, by the year 2040 the overall incidence of BC is expected to rise by more than 40%, thereby placing an even greater burden on healthcare systems and highlighting the urgent necessity for novel and more effective therapeutic strategies. A particularly problematic subtype is triple-negative breast cancer (TNBC), which accounts for approximately 15% of all diagnosed cases. TNBC is distinguished by its highly aggressive clinical course, rapid metastatic potential, lack of responsiveness to conventional hormonal or HER2-targeted therapy, and unfavorable survival outcomes. Although chemotherapy currently remains the principal therapeutic option for such patients, its widespread use is restricted by severe drawbacks including systemic toxicity, the emergence of multi-drug resistance, and the occurrence of debilitating side effects. This situation underscores the need to investigate alternative therapeutic approaches, particularly those based on natural bioactive compounds characterized by multitarget activity and relatively low toxicity. Among these agents, the plant-derived flavonoid apigenin—abundantly found in parsley, chamomile, celery, and other dietary plants—has attracted substantial scientific interest due to its pronounced antioxidant, anti-inflammatory, and anticancer properties.

Notably, recent studies have also revealed its ability to modulate microRNA expression and regulate epigenetic mechanisms that influence tumor initiation, progression, and metastasis, making apigenin a highly promising candidate for innovative strategies in BC therapy, including TNBC management.

**Purpose of the study:** To analyze and summarize current data on the mechanisms of apigenin action and to evaluate the prospects for its use in breast cancer therapy, including TNBC.

**Materials and methods:** An analytical review of publications from 2015–2025 was conducted, including preclinical (in vitro, in vivo) and experimental studies. The review considered breast cancer cell lines (MCF-7, MDA-MB-231), animal models, as well as novel nanotechnology-based formulations of apigenin.The methods used in the analyzed studies included MTT assays for assessing cell viability, flow cytometry for apoptosis and immune cell infiltration, immunohistochemistry for the expression of proteins (Bcl-2, Bax, Ki-67, MMP-2, MMP-9), and molecular biology techniques for studying gene expression involved in angiogenesis and metastasis.

**Results:** Apigenin demonstrated antioxidant, anti-inflammatory, and pronounced antiproliferative effects against BC cell lines. It was established that apigenin induces cell cycle arrest, activates the caspase cascade, downregulates anti-apoptotic proteins (Bcl-2), and upregulates Bax expression. Moreover, it inhibits NF-κB and PI3K/Akt signaling pathways, leading to decreased production of pro-inflammatory cytokines.

Additional findings highlight its ability to suppress epithelial–mesenchymal transition (EMT), reduce matrix metalloproteinase activity (MMP-2, MMP-9), and block angiogenesis. Innovative studies revealed that nanostructured formulations of apigenin increase its bioavailability

and enhance the antitumor immune response, particularly in combination with immune checkpoint inhibitors (aPD-1).

**Conclusions:** Apigenin is a promising candidate for breast cancer therapy, including the triple-negative subtype. Its use both as monotherapy and in combination regimens may enhance treatment efficacy and reduce toxicity compared to conventional chemotherapy. Further preclinical and clinical studies are required to confirm its therapeutic potential.