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The Potential Value of Curcumin in Breast Cancer: A Systematic Review and Meta - analysis of Preclinical Studies

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 1 July 2025 and was last updated on 1 July 2025.

INTRODUCTION

Review question / Objective Systematically evaluate the anti-tumor efficacy and safety of curcumin and its derivatives in breast cancer animal models, and analyze their potential mechanisms to provide a theoretical basis for clinical translation.

Rationale Breast cancer is the most prevalent malignancy worldwide and the leading cancer diagnosis among women, with an increasing incidence observed in younger populations. The disease arises from the malignant transformation and uncontrolled proliferation of mammary epithelial or ductal cells, driven by diverse oncogenic factors. Current clinical management employs a multimodal approach integrating surgery, radiotherapy, chemotherapy, molecular targeted therapy, endocrine therapy, immunotherapy, and traditional Chinese medicine . Nevertheless, persistent challenges include complex mechanisms of therapeutic resistance, significant treatment-related toxicities, and the need to improve long-term survival rates while maintaining patient quality of life.

Condition being studied Previous studies have demonstrated that curcumin can inhibit breast cancer cell proliferation and metastasis, and enhance chemosensitivity. However, significant heterogeneity exists across these studies regarding experimental models, dosing regimens, and outcome measures. This variability has led to inconsistent findings on the effects and mechanisms of curcumin in breast cancer and a lack of consensus regarding its clinical translation potential. Despite numerous studies suggesting beneficial effects of curcumin in breast cancer treatment, a systematic summary and quantitative assessment consolidating the existing preclinical evidence are lacking. Therefore, to provide a more comprehensive and objective evaluation of curcumin's potential therapeutic efficacy in breast cancer and to establish a stronger evidence base for subsequent clinical research, this study aims to conduct a systematic review and meta-analysis focused specifically on preclinical (animal) studies.

This approach will enhance the robustness of the evidence and provide a solid scientific foundation for the further development of curcumin as a potential therapeutic or adjunctive agent for breast cancer.

METHODS

Search strategy The key search terms include "breast cancer", "malignant breast tumor", "curcumin", "curcumin yellow compound", "curcumin-like compounds", and "plant compounds containing curcumin". The search was accomplished by combining the subject terms with free words and using the Boolean symbols "AND" and "OR" for combination and connection.

Participant or population Rodent models of breast cancer, including in situ transplantation, subcutaneous transplantation, transgenic models, and carcinogen-induced models, etc.

Intervention Curcumin monomers or their derivatives, curcumin delivery systems (liposomes, nanoparticles, polymer micelles, etc.), curcumin combined with other drugs.

Comparator With blank control or carrier control (such as the DMSO solvent group).

Study designs to be included Randomized controlled trial.

Eligibility criteria Inclusion Criteria
(1) Study subjects: Rodent breast cancer models, including orthotopic transplantation, subcutaneous transplantation, transgenic models, and carcinogen-induced models; (2) Interventions: Curcumin monomer or its derivatives, curcumin delivery systems (liposomes, nanoparticles, polymer micelles, etc.), curcumin combined with other drugs (must have a separate curcumin group vs control group); (3) Controls: Must include blank controls or vehicle controls (e.g., DMSO solvent group); (4) Study outcomes: Tumor suppression indicators (Tumor weight, Tumor volume), mechanistic evidence (Ki-67, TUNEL), safety indicators (ALT, AST, Creatinine, BUN, RBC, WBC), and systemic tolerance (Body weight, Liver weight); (5) Study design: Randomized controlled trials.
Exclusion Criteria
(1) Case reports, reviews, conference abstracts;(2) Clinical trials (unless they include an independent preclinical data module) and in vitro experiments; (3) Studies without a control group;(4) Non-breast cancer-specific animal models; (5) Curcumin-containing formulations (where curcumin cannot be isolated, potentially affecting study results due to drug combinations);
(6) Duplicate, off-topic, or full-text inaccessible studies or data.

Information sources A comprehensive electronic search was conducted in four databases (PubMed, Web of Science, Embase, and Cochrane Library).

Main outcome(s) Tumor weight, tumor volume, Ki-67 positive rate, TUNEL positive rate, liver function, kidney function, hematological indicators.

Additional outcome(s) Final weight, liver weight.

Data management Endnote.

Quality assessment / Risk of bias analysis SYRCLE Animal Experiment Risk of Bias Assessment Tool.

Strategy of data synthesis The data were analyzed using statistical software Review Manager 5.4. The tree diagrams were also generated by the same software. The effect sizes were expressed as standardized mean difference (SMD) and its 95% confidence interval (CI).

Subgroup analysis Not reported.

Sensitivity analysis Not reported.

Language restriction Not reported.

Country(ies) involved China.

Keywords curcumin, breast cancer, angiogenesis, apoptosis.

Dissemination plans None.

Contributions of each author
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