Jurnal Eduhealth
Volume 15 , Number 03, 2024, DOI 10.54209/eduhealth.v15i03
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Literature Review: Curcumin Alternative Therapy For Breast Cancer

Tiara Nurayuni
Mahasiswa Program Studi Farmasi Fakultas Ilmu Kesehatan Universitas Singaperbangsa Karawang

Article Info
Keywords:
Curcumin,
Breast cancer,
Alternative Therapy,
Anticancer.

ABSTRACT
Breast cancer is a serious disease that affects millions of people worldwide every year. Risk factors include gender, age, family history, and genetic factors. Although there are treatment methods such as surgery, radiation, and chemotherapy, breast cancer management often brings various physical, social, psychological, and financial problems for patients. Therefore, alternative treatments like the use of herbal plants, particularly compounds like curcumin, have been researched as potential anticancer agents with minimal side effects. The aim of this study is to explore in depth the potential of curcumin in breast cancer. This article is compiled from various databases, including Pubmed and Google Scholar, using the keywords "curcumin, breast cancer, anticancer." The journals sought were published between 2015 and 2024, and five journals were identified as relevant to the topic for further discussion. Based on literature studies, several mechanisms of curcumin against breast cancer include the regulation of protein signaling pathways, inhibition of cancer cell proliferation, induction of apoptosis, and reduction of drug resistance. Additionally, curcumin can also inhibit metastasis and increase the sensitivity of cancer cells to other therapies. The combination of curcumin with other drugs like tamoxifen can enhance its effectiveness in treating breast cancer. Based on this, it can be concluded that curcumin can be used as an alternative therapy for breast cancer through its various mechanisms.

Corresponding Author:
Tiara Nurayuni
Mahasiswa Program Studi Farmasi Fakultas Ilmu Kesehatan Universitas Singaperbangsa Karawang
2010631210016@student.unsika.ac.id

INTRODUCTION

One significant global health issue is cancer. Every year, tens of millions of people are diagnosed with this disease. Breast cancer is among the most prevalent types of cancer globally. This cancer is characterized by uncontrolled growth of cells and the spread of abnormal cells. The causes of breast cancer are a combination of medical conditions that trigger genetic changes. Risk factors for breast cancer encompass being female, being over the age of 50, having a family history of the disease, and genetic factors, history of breast disease, late menopause (after age 55), reproductive history (not having children or not breastfeeding), and hormonal factors (Pulungan And Hardy 2020).

According to GLOBOCAN data in 2020, the number of breast cancer patients is higher compared to other types of cancer. Globally, there were 2.3 million new cases of breast cancer and 684,996 deaths. According to the International Agency for Research on Cancer (WHO),

Jurnal Eduhealth
Volume 15 , Number 03, 2024, DOI 10.54209/eduhealth.v15i03
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

it is estimated that 65,858 new cases of breast cancer occurred among women in Indonesia in 2020, resulting in 22,430 deaths due to the disease (Laza-Vásquez et al. 2022).

Several common treatments include surgery, radiation, and chemotherapy. The choice of treatment method depends on the type of cancer and its severity (Roihatul Mutiah 2015). Patients with breast cancer face physical, social, psychological, and spiritual challenges, as well as financial issues when diagnosing and choosing therapy. Chemotherapy side effects include drug resistance, hair loss, digestive problems, bone marrow suppression, neurological problems, and cardiac toxicity (Hosseini and Ghorbani 2015). Therefore, alternative cancer treatments are needed to reduce side effects.

Herbal plants do not have significant side effects, which is why they are considered an alternative choice for anticancer treatment (Zafrial and Amalia 2018). One compound with therapeutic effects as an anticancer agent is curcumin. Curcumin is a polyphenol extracted from the Zingiberaceae family. Curcumin demonstrates antioxidant, anti-inflammatory,antidiabetic, antiproliferative, antibacterial, anticancer, antifungal, and liver-protective properties (Tagde et al. 2021).

Other known pharmacological effects include anticarcinogenic, antimutagenic, anticoagulant, antifertility, antiprotozoal, antiviral, antifibrotic, antivenom, antiulcer, hypotensive, and hypolipidemic effects (Vigyan Kendra et al. 2018). Curcumin has been demonstrated to be an effective treatment for a variety of chronic conditions, such as inflammation, arthritis, metabolic syndrome, liver disease, obesity, neurodegenerative disorders, and several forms of cancer (Giordano and Tommonaro 2019). Breast cancer is the second leading cause of death among all cancer types worldwide. Despite various treatment methods such as chemotherapy, lumpectomy, endocrine therapy, and radiation therapy already in place, the mortality rate due to breast cancer remains high and continues to rise. Therefore, it is crucial to develop more effective therapeutic agents (Liu et al. 2017). In this article, a comprehensive and recent study was conducted on the potential of curcumin compounds as an alternative treatment for breast cancer and their mechanisms.

METHODS

Researchers chose the literature review method. Literature was obtained from scientific journals or articles downloaded from the PubMed and Google Scholar databases. The researchers then screened the articles based on certain criteria, namely the publication year between 2015-2024 and relevance to curcumin as an alternative therapy for breast cancer. Using several keywords such as "curcumin, breast cancer, anticancer" to search for articles. Based on the search, 952 journals were found. Then, 5 journals that were identified as appropriate and relevant to the topic were selected for further discussion. The collected data will be analyzed descriptively in the results and discussion section to gain deeper insights into curcumin therapy for breast cancer.

RESULTS AND DISCUSSION

Research on the potential of curcumin in breast cancer treatment has shown various significant results. Curcumin is a polyphenolic compound derived from the Curcuma longa plant, recognized for its anti-inflammatory, antioxidant, and anticancer effects (Sharifi-Rad et

Jurnal Eduhealth
Volume 15 , Number 03, 2024, DOI 10.54209/eduhealth.v15i03
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

al. 2020). In this section, we present key findings from various studies conducted to evaluate the effectiveness of curcumin against breast cancer.

Table 1. Results of Literature Review

No	Researchers	Types of curcumin	Mechanism of action	Result
1.	(Zoi et al. 2021)	Curcumin standard	Curcumin inhibits the translocation of NF-κB into the cell nucleus and decreases the levels of p100 and p52 in MCF-7 and MDA-MB-453 breast cancer cells. Additionally, it promotes cell death in MCF-7 breast cancer cells by modulating the NF-κB signaling pathway.	Curcumin has demonstrated the ability to inhibit NF-κB core activity and decrease the expression of p100 and p52 in MCF-7 and MDA-MB-453 breast cancer cells. Furthermore, curcumin triggers apoptosis in MCF-7 cancer cells by influencing the NF-κB signaling pathway. Additionally, it can increase the sensitivity of breast cancer cells to chemotherapy drugs such as cisplatin and paclitaxel by regulating the expression of genes associated with drug resistance
2.	(Giordano and Tommonaro 2019)	Curcumin from Curcuma longa Extract	Curcumin can inhibit the growth of breast cancer cells by regulating the HER2-TK and Akt protein signaling pathways, as well as stimulating autophagy and inhibiting the PI3K/Akt pathway.	Curcumin has been shown to inhibit the growth of breast cancer cells by regulating the HER2-TK and Akt protein pathways, as well as stimulating autophagy and inhibiting the PI3K/Akt pathway. Additionally, curcumin has also been proven effective in demonstrating anti-invasive activity on breast cancer cells.
3.	(Mock, Jordan, and Selvam 2016)	natural, semi-synthetic, and synthetic curcumin such as DMC, BDMC	Curcumin modulates key pathways such as PPAR, COX-2, EGFR, and NF-κB, as well as alters cytokine expression, transcription factors, and vital enzymes for cells.	Curcumin has the potential to be a preventive and therapeutic agent for breast cancer, inhibiting tumor growth, inducing apoptosis, and reducing tumor size in animal models. Curcumin targets various signaling pathways of cancer cells, resulting in anti-proliferative and cytotoxic effects.
4.	(Colacino et al. 2016)	Curcumin standard (98% murni)	Curcumin decreases the activity of genes associated with breast stem cells, including ALDH1A3, CD49f, PROM1, and TP63.	Curcumin shows promise as a cancer preventive substance in experimental models, particularly when combined with piperine to boost drug concentrations in the bloodstream.
5.	(Sianipar, Louisa, and Wanandi 2018)	Curcumin standard	Working by suppressing cancer cell growth and inducing apoptosis.	The combination of tamoxifen and curcumin can decrease the viability of breast cancer cells and inhibit the expression of P-gp and BCRP flux

Jurnal Eduhealth
Volume 15 , Number 03, 2024, DOI 10.54209/eduhealth.v15i03
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

No	Researchers	Types of curcumin	Mechanism of action	Result
				transporters. Curcumin can inhibit the BCRP flux transporter in tamoxifen-resistant MCF-7 breast cancer cells, thereby enhancing cell sensitivity to tamoxifen.

Discussion

The WHO states that breast cancer occurs when abnormal breast cells develop and form a tumor (Seyfried and Huysentruyt 2013). The lobules of the breast are where breast cancer cells typically originate. In the early stages, these cancer cells are usually not harmful but can invade surrounding breast tissue and form a tumor, causing a lump or thickening. Cancer that has spread to other tissues is called invasive cancer, where these cancer cells can spread to lymph nodes or other nearby organs through the process of metastasis. Metastasis, where cancer cells spread from the original tumor to other areas of the body and develop into secondary tumors, can result in severe health risks and potentially be life-threatening. One treatment option for cancer is chemotherapy, but its success is limited due to frequent development of chemotherapy resistance (Yu et al. 2011). Therefore, better alternatives are needed to minimize side effects (Sharma et al. 2004).

Curcumin in breast cancer works through several mechanisms, including regulating HER2-TK and Akt protein signaling pathways, stimulating autophagy, inhibiting the PI3K/Akt pathway, and triggering apoptosis while reducing tumor size. Moreover, curcumin inhibits the nuclear translocation of NF-κB and lowers the levels of p100 and p52 in breast cancer cells, leading to cell death. Studies have demonstrated that curcumin effectively blocks the NF-κB pathway in breast cancer cells, potentially thereby diminishing their proliferation, invasion, and metastasis (Zoi et al. 2021).

According to Zoi et al.'s study (2022), curcumin has been shown to have effects in the treatment of breast cancer through several mechanisms. One of them is by increasing the sensitivity of breast cancer cells to chemotherapy agents such as cisplatin by reducing the regulation of Flap endonuclease 1 (FEN1) expression. Curcumin has shown promising potential in reducing drug resistance in breast cancer cells by decreasing the regulation of the multidrug resistance mutation 1 (MDR-1) gene expression (Zoi et al. 2021).

According to Giorgano et al. (2019), curcumin has effects on breast cancer through several mechanisms, such as inhibiting proliferation of breast cancer cells, inducing apoptosis, targeting the PI3K/Akt signaling pathway, downregulating Akt protein regulation, inducing autophagy, and blocking the NF-kB signaling pathway. Curcumin has demonstrated effectiveness in halting the proliferation of breast cancer cells and promoting natural cell death. Furthermore, curcumin has the ability to block the PI3K/Akt signaling pathway, which is pivotal in the progression of breast cancer (Giordano and Tommonaro 2019).

Curcumin is capable of influencing the activity of cancer-causing miRNAs and inhibiting the growth of breast cancer tumors. NF-kB, a transcription factor known for its pro-inflammatory properties, is crucial in the multiplication of breast cancer cells. It governs more

Jurnal Eduhealth
Volume 15 , Number 03, 2024, DOI 10.54209/eduhealth.v15i03
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

than 500 genes and oversees the production of proteins that impact cellular signaling pathways, influencing both cancer progression and inflammation. Compounds that inhibit NF-kB can be a therapeutic option in cancer treatment (Giordano and Tommonaro 2019).

According to the research by Mock et al. (2015), curcumin has potential as a breast cancer prevention agent due to its anti-proliferative, anti-inflammatory, and apoptotic properties. Additionally, curcumin can inhibit metastasis, regulate cancer stem cells, and sensitize cancer cells to other therapies. Chemical structure modifications of curcumin and the use of new delivery systems can enhance drug bioavailability, thereby increasing its effectiveness in breast cancer prevention. Curcumin influences breast cancer through modulation of key pathways such as PPAR, COX-2, EGFR, and NF-κB, as well as altering cytokine expression, transcription factors, and enzymes involved in cellular processes (Mock, Jordan, and Selvam 2016).

According to Colacino et al.'s study (2016), curcumin works in breast cancer prevention by targeting normal stem cells and cancer cells. This has the potential to hinder the renewal of breast stem cells and decrease the activity of genes linked to breast stem cells, such as ALDH1A3, CD49f, PROM1, and TP63. Additionally, curcumin targets lipid metabolism pathways like SCD that regulate breast stem cells. Collaboration with piperine also enhances curcumin's effectiveness in preventing breast cancer (Colacino et al. 2016).

In the study by Sianipar et al. (2018), it has been noted that curcumin can improve how breast cancer cells react to tamoxifen by lowering the activity of efflux transporters like P-glycoprotein (P-gp) and Breast Cancer Resistance Protein (BCRP). The combination of curcumin and tamoxifen has also been shown to be more effective in reducing the mRNA expression levels of P-gp and BCRP compared to the use of curcumin alone (Sianipar, Louisa, and Wanandi 2018).

CONCLUSION

Curcumin significantly influences the treatment of breast cancer through various mechanisms, such as regulating protein signaling pathways, inhibiting cancer cell growth, inducing apoptosis, and reducing drug resistance. Additionally, curcumin can inhibit metastasis and enhance cancer cell sensitivity to other therapies. Combining curcumin with drugs like tamoxifen can enhance its effectiveness in treating breast cancer.

REFERENCE

Colacino, Justin A et al. 2016. “Transcriptomic Profiling of Curcumin Treated Human Breast Stem Cells Identifies a Role for Stearoyl Coa-Desaturase in Breast Cancer Prevention.” *Departement Of Health & Human Services* 349(1): 29–41.

Giordano, Antonio, and Giuseppina Tommonaro. 2019. “Curcumin and Cancer.” *Nutrients* 11(10).

Hosseini, Azar, and Ahmad Ghorbani. 2015. “Cancer Therapy with Phytochemicals: Evidence from Clinical Studies.” *Avicenna journal of phytomedicine* 5(2): 84–97. http://www.ncbi.nlm.nih.gov/pubmed/25949949%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC4418057.

Laza-Vásquez, Celmira et al. 2022. “Views of Health Professionals on Risk-Based Breast

Cancer Screening and Its Implementation in the Spanish National Health System: A Qualitative Discussion Group Study." *PLoS ONE* 17(2 February): 1–22.

Liu, Yufei et al. 2017. "Curcumin Inhibits Growth of Human Breast Cancer Cells through Demethylation of DLC1 Promoter." *Molecular and Cellular Biochemistry* 425(1–2): 47–58.

Mock, Charlotta, Brian Jordan, and Chelliah Selvam. 2016. "Recent Advances of Curcumin and Its Analogues in Breast Cancer Prevention and Treatment." *PMC* 176(5): 139–48.

PULUNGAN, Rafiah Maharani, and Fathinah Ranggauni HARDY. 2020. "Edukasi 'Sadari' (Periksa Payudara Sendiri) Untuk Deteksi Dini Kanker Payudara Di Kelurahan Cipayung Kota Depok." *Diseminasi: Jurnal Pengabdian kepada Masyarakat* 2(1): 47–52.

Roihatul Mutiah. 2015. "Evidence Based Kurkumin Dari Tanaman Kunyit (Curcuma Longa) Sebagai Terapi Kanker Pada Pengobatan Modern." *Jurnal Farma Sains* 1(1): 28–41. https://ejournal.uin-malang.ac.id/index.php/jip/article/view/4178/5588.

Seyfried, Thomas N., and Leanne C. Huysentruyt. 2013. "On the Origin of Cancer Metastasis." *Critical Reviews in Oncogenesis* 18(1–2): 43–73.

Sharifi-Rad, Javad et al. 2020. "Turmeric and Its Major Compound Curcumin on Health: Bioactive Effects and Safety Profiles for Food, Pharmaceutical, Biotechnological and Medicinal Applications." *Frontiers in Pharmacology* 11(September): 1–23.

Sharma, Ricky A. et al. 2004. "Phase I Clinical Trial of Oral Curcumin: Biomarkers of Systemic Activity and Compliance." *Clinical Cancer Research* 10(20): 6847–54.

Sianipar, Erlia Anggrainy, Melva Louisa, and Septelia Inawati Wanandi. 2018. "Kurkumin Meningkatkan Sensitivitas Sel Kanker Payudara Terhadap Tamoksifen Melalui Penghambatan Ekspresi P-Glikoprotein Dan Breast Cancer Resistance Protein." *Jurnal Farmasi Galenika (Galenika Journal of Pharmacy) (e-Journal)* 4(1): 1–11.

Tagde, Priti et al. 2021. "The Multifaceted Role of Curcumin in Advanced Nanocurcumin Form in the Treatment and Management of Chronic Disorders." *Molecules* 26(23).

Vigyan Kendra, Krishi et al. 2018. "Medicinal Properties of Turmeric (Curcuma Longa L.): A Review." *~ 1354 ~ International Journal of Chemical Studies* 6(4): 1354–57.

Yu, Liang Liang et al. 2011. "Curcumin Reverses Chemoresistance of Human Gastric Cancer Cells by Downregulating the NF-ΚB Transcription Factor." *Oncology Reports* 26(5): 1197–1203.

Zafrial, Rizki Muhammad, and Riezki Amalia. 2018. "Artikel Tinjauan : Anti Kanker Dari Tanaman Herbal." *Farmaka* 16(1): 15–23.

Zoi, Vasiliki et al. 2021. "The Role of Curcumin in Cancer Treatment." *Biomedicines* 9(9): 1–19.