

## REVIEW ARTICLE

# Potential of Bamboo Shoots against Breast Cancer: A Review

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Breast cancer (Carcinoma mammae) is a malignancy that attacks the water glands, gland ducts, and breast supporting tissues. Breast cancer is ranked first as a malignancy that often occurs in the world. In the treatment of breast cancer, the individual will undergo several operations. Chemotherapy treatment is often combined with breast tissue surgery. However, the side effects of chemotherapy drugs can damage healthy cells. Bamboo shoots are one of the most promising sources of bioactive compounds for the pharmaceutical field in the treatment of breast cancer. This review article discusses several types of bamboo shoots and their anticancer activity. The results of a journal review found that several types of bamboo shoots with breast anticancer activity were *Dendrocalamus asper*, *Phyllostachys heterocycle* var. *pubescent*, with various activities such as cytotoxicity, antiproliferative, proapoptotic, and proinflammatory on the breast cancer cell line.

**Keywords:** Breast cancer, Bamboo shoot, Breast cancer activity, Cytotoxic, Apoptosis

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**INTRODUCTION**

Breast cancer is an uncontrolled and irregular growth of breast cells (1). Breast cancer can also spread to other organs. The incidence and mortality in breast cancer patients continue to increase every year. The prevalence of incidence of 8-9% of women experiences breast cancer. More than 250,000 new cases of breast cancer are diagnosed every year worldwide, in Europe approximately 175,000 cases and more than 165,000 patients die if not treated. Breast cancer claims the lives of 44,000 people in the United States each year (2).

According to the World Health Organization (WHO), 2.3 million women will be diagnosed with breast cancer in 2020, with 685,000 fatalities worldwide. Breast cancer will have been diagnosed in 7.8 million living women in the last 5 years by the end of 2020, making it the most frequent cancer in the world. More than half of breast cancer deaths occur in Asia, and 15 percent of them come from countries in Southeast Asia (3). More than 80% of breast cancer cases in Indonesia are found to be progressed, making treatment challenging (4).

The majority of tumor cells come from the epithelium of

the breast ducts and lobules, particularly in the terminal duct-lobular unit, and over 75% are invasive ductal carcinoma not otherwise defined (IDC-NOS). The most common sites of metastasis in breast cancer include the lung and pleura (15-20%), bones (20-60%), liver (5-15%), brain (5-10%), and local metastasis/regional (20-40%). (5, 6). Breast cancer is a diverse illness with a variety of tumor subtypes based on the expression of the hormone receptor (HR) and the human epidermal growth factor receptor (HER2), respectively (eg luminal, HER2, and triple-negative subtypes). These categories differ in biology, prognosis, treatment method, and pattern of metastasis (7). The causes of breast cancer are very multifactorial and influence each other, namely several endogenous and exogenous factors as well as the interaction of genetic factors (8). About 95% of cancers can be attributed to lifestyle and inflammation as the underlying cause (9).

It has long been known that the induction of apoptosis in cancer cells by natural compounds is the main target for cancer prevention and therapy. Apoptosis is a highly regulated and active form of cell death in which damaged and mutated cells, which may be hazardous to entire organisms, are naturally destroyed without creating any negative consequences. Therefore, the identification of natural products based on the mechanism of action can play an important role in the development of new alternative chemotherapy drugs. Natural products serve as important chemical

prototypes for the discovery of new molecules and continue to be the main source of the most promising drugs, especially in the anticancer field. Studies on natural products made from bamboo shoots as a source of drug candidates are still difficult to find. Bamboo shoots have been scientifically proven to contain several phytochemicals with significant anti-cancer properties. Dragon Bamboo Shoots (*Dendrocalamus asper*) and Moso Bamboo Shoots (*Phyllostachys heterocycle var. Puberty*) have been shown to contain high amounts of polyphenols and phytosterols which have strong radical scavenging activity and exert anti-carcinogenic effects by regulating Reactive Oxygen Species (ROS) levels, signal transduction cascade, angiogenesis, and cell proliferation in breast cancer cells (10-12).

In addition, several types of bamboo shoots were also found to have anti-cancer activity, namely Giant Timber Bamboo Shoots (*Phyllostachys bamboosoides*), and Henon Bamboo Shoots (*Phyllostachys nigra var. henonis*) which are scientifically proven to have strong antioxidant activity very high and successfully inhibited tumor growth in prostate cancer cell models (13).

This review article aims to provide information and education about several types of bamboo shoots that contain compounds and anticancer activity, namely *Dendrocalamus asper* and *Phyllostachys heterocycle var. Puberty*, which have potential as alternative treatments for breast cancer.

**METHODS**

**Data sources and searches**

The data used in writing this journal review was collected using the literature study method, both from primary and secondary libraries. The library search was carried out using online-based library search instruments such as NCBI-PubMed, Google Scholar, and Elsevier. The keywords used for the literature search were related to “breast cancer”, “bamboo shoots and breast cancer”, “anticancer activity bamboo shoots”, and “bamboo shoots and breast anticancer activity”.

**Study selection**

A library that has a flow chart of articles included in the review is illustrated in Figure 1. A total of 20 publications were identified in the database. Among the 20 selected articles, 2 were published by title and abstract because they did not meet the inclusion criteria: 2 were literature reviews (1, 14); 1 did not study bamboo shoots in breast cancer cell models and/or did not perform an in vitro toxicological analysis (1). After reading the full text 2 articles were included for their critical evaluation of the safety and effectiveness of in vitro breast cancer cell models (11, 12) which were obtained and then compiled according to the framework, data on bamboo shoots with anticancer activity were compiled in tabular form, and journal reviews were written. according to the

given format.

**DISCUSSION**

From the results of the literature study, 20 articles were obtained, and only 2 articles explained the potential of bamboo shoots against breast cancer (Figure 1). Besides, research on the potential of bamboo shoots as an anti-breast cancer agent is still rare. The 2 articles validated from 2020 and 2021 contain information about bamboo shoots with anticancer activity, which will be shown in Table as well as several sources containing information about the condition of breast cancer in Indonesia.

The IC50 value for a very strong cytotoxicity test is less than 10 g/mL, strong cytotoxicity is between 10 and 100 g/mL, and moderate cytotoxicity is between 100 and 500 g/mL (15). In addition to the cytotoxicity test, anticancer testing can also be carried out with antiproliferative tests, apoptosis tests, and antimetastatic tests. The test of anticancer activity with antiproliferative testing was carried out by the MTT Assay method (16, 17). Apoptotic testing was carried out by testing the level of cell death due to apoptosis induction by the chemotherapy agents used (18). Antimetastatic testing is carried out by suppressing cell growth so that it does not metastasize to other organs by counting the number of cell migrations (19).

Breast cancer is the most frequent invasive cancer in women globally and the second greatest cause of cancer death, after lung cancer (20). Breast cancer when it enters an advanced stage or stage III can lead to metastasis or the spread of cancer cells to other parts of the body so treatment is difficult, and until now there are still recurrences after surgery, this is due to the nature of cancer cells that spread easily (21). It is estimated that about one-third of newly diagnosed breast cancer patients may develop metastases and die as a result

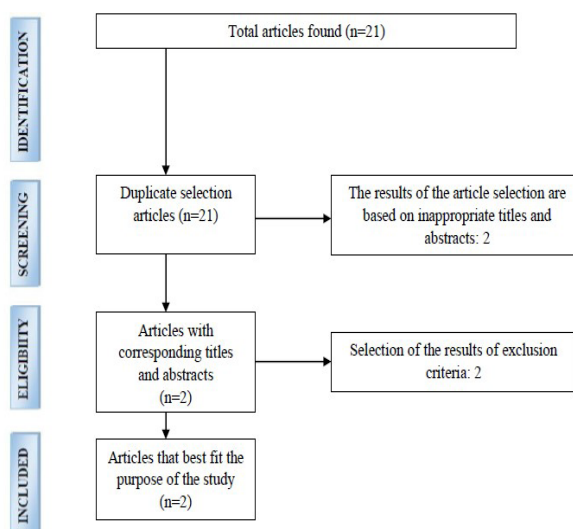


Fig. 1: PRISMA flowchart of the study selection process.

of them. The majority of women with breast cancer will have surgery. Radiation therapy, chemotherapy, hormone therapy, and/or targeted therapy are frequently used in conjunction with surgery (14).

Unwanted side effects will occur during chemotherapy. The side effects of chemotherapy appear because chemotherapy drugs are very powerful, and not only kill cancer cells, but also attack healthy cells, especially rapidly dividing cells. When the individual is doing chemotherapy various factors can cause dangerous side effects. In one study. The Side effects of chemotherapy are that it can cause pain, baldness due to the effects during chemotherapy, abnormalities in the bone marrow, namely reduced hemoglobin, platelets, and white blood cells, making the body weak, feeling tired, shortness of breath, bleed easily, and lower the individual's immune system so that individuals are easily exposed to disease infections. The efficacy of chemotherapy drugs also has an impact on impaired hormone production and has an impact on decreased sexuality. Various kinds of factors can affect the severity, for example, the type of chemotherapy drugs that are used during treatment, body condition, weight, the psychological condition of the patient, and up to age (21).

Table I explained the results of research by Abdelhameed RFA, et al (12), which found that shoot extracts of *Phyllostachys heterocycle* var. *pubescent* contain the active chemical compound (6'-O-octadec-8",11"-dienoyl)-sitosterol-3-O-d-glucoside which is cytotoxic to cancer cells and is pro-apoptotic to increase breast cancer cell death internally. *in vitro* as well as the anti-proliferative properties found in bamboo shoots can inhibit the proliferation of cancer cells. Meanwhile, in a study conducted by Ontaha Y, et al (11) using the type of *Dendrocalamus asper* bamboo shoots, it was found that an active flavonoid compound, namely triterpenoids, was able to increase breast cancer cell death. Both of these studies were conducted *in vitro* using MCF-7 type breast cancer cells. The results showed that the bioactive compounds of bamboo shoots in 2 different types of bamboo shoots had strong cytotoxicity to kill breast cancer cells (11, 12).

Bamboo shoots contain potential chemical compounds for reducing and killing cancer cells. This plant contains phenolic compounds, phytosterols, flavonoids, and triterpenoids, which are known to trigger cancer cell death. The content of phytosterols and flavonoids in

bamboo shoots can inhibit the expression of reactive oxygen species (ROS), thereby increasing antioxidant enzymes that can increase cancer cell death. Bamboo shoots also contain phenolic compounds that play a pro-apoptotic role by increasing the expression of caspases 3 and 8. Increased expression of caspases 3 and 8 increases cancer cell apoptosis, resulting in cancer cell death. Cancer cells will increase their progression by decreasing the expression of pro-apoptotic proteins such as caspase 8 and caspase 3 and increasing anti-apoptotic proteins to increase the progression of cancer cells. The presence of phenolic compounds will reduce the expression of anti-apoptotic proteins so that they interfere with the development of cancer cells (Figure 2) (10-12).

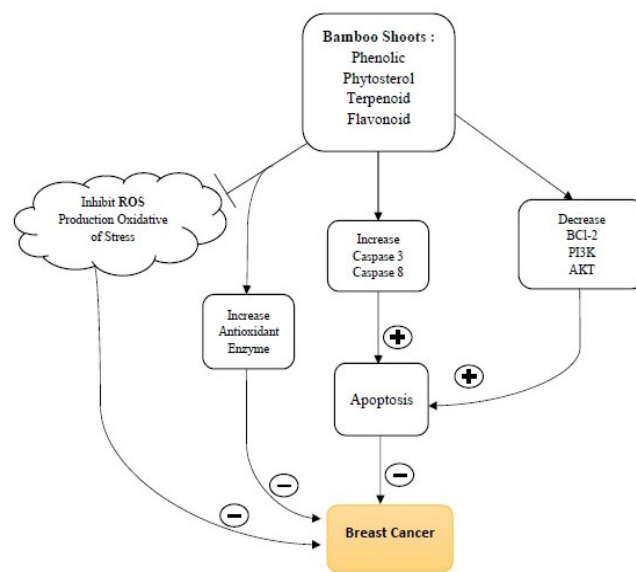


Fig. 2: Anticancer mechanism.

This study had several limitations including this study had limited scientific literature and some scientific articles that are not relevant to the research objectives. The potential of anti-cancer chemicals in bamboo shoots has not been discussed in any review that specifically focuses on bamboo shoots as an inhibitor of breast cancer cell growth and boosting breast cancer cell death. This is the reason why this article was compiled. Because bamboo shoots contain several biochemical compounds that have the potential as anti-cancer such as phenolics, flavonoids, phytosterols, and triterpenoids which have been shown to have high toxicity to breast cancer cells and can inhibit cancer cell growth, and

Table I: Bamboo shoots and anti-breast cancer activity

No	Class	Types Of Bam-boo	Metabolites (Compound Content)	Cell Line	Mechanism	Sources
1	Monocotyledone-ae	<i>Dendrocalamus asper</i>	Triterpenoid, Polyphenol	MCF-7	Cytotoxic effect	Ontaha Y,et al., 2021 (11)
2	Monocotyledone-ae	<i>Phyllostachys heterocyclā var. pubescens</i>	6'-O-octadeca-8",11"-dienoyl)-sitosterol-3-O-d-glucoside	MCF-7	Cytotoxic effect, antiproliferative activity, and cell proapoptotic.	Abdelhameed RFA, et al., 2020 (12)

increase breast cancer cell death, future research, both in the form of a review and in the form of laboratory research, is needed to better understand the efficacy of bamboo shoots as an alternative to breast cancer treatment.

## CONCLUSION

Bamboo shoots that have been studied have breast anticancer activity such as *Dendrocalamus Asper*, *Phyllostachys heterocycle var. pubescent* with various activities such as antiproliferative, proapoptotic, and proinflammatory in MCF 7 breast cancer cell line.

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