Indonesian Medicinal Plants for Anticancer

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ABSTRACT

The potential of Indonesia's natural wealth of plants to be developed as anticancer agents is enormous, thanks to its abundant biodiversity. Indonesia has become a "natural laboratory" with various plants traditionally used for treatment, including cancer, by local communities. This potential is supported by several primary factors: extensive biodiversity, bioactive compound content, and empirical use in traditional medicine. This article has been compiled through several steps, including formulating research questions, determining inclusion/exclusion criteria, conducting systematic literature searches in databases, screening articles, extracting data, and finally synthesizing the findings. Several studies have identified several Indonesian plants that show potential as anticancer agents: Tapak Dara (Vinca rosea), Taxol (Taxus sp), Lempuyang Wangi (Zingiber zerumbet), Temu Kunci (Boesenbergia pandurata), Melinjo/Tangkil (Gnetum gnemon), Soursop leaves (Annona muricata), Cloves (Syzygium aromaticum), and Typhonium flagelliforme (Typhonium flagelliforme). Despite its great potential, developing anticancer drugs from Indonesian plants faces several challenges: scientific proof, standardization, high research and development costs, and regulatory and patent aspects. To address these challenges, a comprehensive development strategy is needed, including: Enhancing collaboration between research institutions, universities, the pharmaceutical industry, and the government; Conducting ethnobotanical studies to document traditional knowledge of medicinal plants; Developing standardized herbal formulas (phytopharmaceutics) that have supporting scientific data; Strengthening basic research to identify and test specific bioactive compounds; and Encouraging innovation in the extraction and purification of active compounds.

Keywords: anticancer, extraxt, Indonesia, medicinal plants, secondary metabolite.

INTRODUCTION

The potential of herbal plants as cancer drugs is enormous, although there is no reliable scientific evidence that a single herbal remedy can cure cancer. Research shows that many plants contain bioactive compounds with anticancer properties that can be used as adjunct therapies or as base ingredients for conventional chemotherapy drugs (Nova, et.al, 2021). The benefits and potential of herbal plants in cancer treatment include promising anticancer agents, helping cancer patients manage the side effects of conventional treatments, helping patients tolerate chemotherapy and improving their overall quality of life. Moreover, combining herbal remedies with conventional therapies can help control cancer growth, especially when patients develop drug resistance (Jenča, et.al, 2024). Herbal plants contain compounds such as flavonoids, terpenoids, and polyphenols, which have various anticancer properties, including the ability to inhibit cancer cell proliferation, induce cell death (apoptosis), and reverse drug resistance (Kaur, et.al, 2023)

The potential of Indonesia's natural plant wealth for development as a cancer drug is enormous, supported by Indonesia's third-largest biodiversity in the world. Numerous studies have identified various plants and active compounds with anticancer potential, although further development still faces challenges. Some advantages of Indonesian herbal plants are as follows: Indonesia has more than 30,000 plant species, many of which have been used for generations in traditional medicine for various diseases, including cancer (Nasution, et.al, 2021). The history of Indonesian traditional medicine records the empirical (experience-based) use of certain plants to treat tumours or cancer. Many plants contain secondary metabolites such as flavonoids, terpenoids, and alkaloids with anticancer properties. These compounds can inhibit cancer cell growth, induce apoptosis (programmed cell death), or act as antioxidants. Multi-target effects: Herbal medicines based on plant extracts contain complex compounds, which allow for multi-target effects on cancer cells. This approach could be a promising alternative therapy

(Pesik, 2021). This paper aims to improve research on traditional Indonesian medicinal plants and to increase the development of native Indonesian phytopharmaceuticals.

METHODS

The selection method for research articles related to Prospecting Indonesian medicinal plants as anticancer agents was conducted since October 2025 through Indonesian and English language journals. The search strategy used keywords, namely "anticancer", "extraxt", "medicinal plant", "Indonesia", and "Secondary metabolite." The method used was analytical through the process of collecting relevant data and information regarding the relationship between logical thinking and conclusion-making. Data sources for collecting scientific articles came from Google Scholar, PubMed, Elsevier, NCBI, and health journal websites (Brignardello-Petersen, et.al, 2025). A total of 80 articles were analyzed, with detailed inclusion criteria (the inclusion criteria for articles in this literature review include research topics focused on anticancer trials, experimental designs, publication dates within the last 6 years, English or Indonesian, and publication as an original journal article, not a review) of 50 articles and exclusion of 30 articles (Marzi, et.al, 2024). The article exclusion process was carried out in two stages: screening titles and abstracts, followed by reviewing the complete text, to ensure that only relevant and high-quality research was included in the analysis, with strict documentation for transparency (Nurhidayah, et.al, 2024).

RESULTS AND DISCUSSION

Native Indonesian plants have potential as cancer drugs due to their diverse bioactive compounds capable of fighting cancer cells. This potential is supported by Indonesia's rich biodiversity, making it a promising natural resource for discovering new drugs. Natural compounds found in Indonesian plants can exert anticancer effects through various mechanisms of action. Prospecting Indonesian medicinal plants as anticancer agents: Tapak Dara (Vinca rosea), Taxol (Taxus sp), Lempuyang Wangi (Zingiber zerumbet), Temu Kunci (Boesenbergia pandurata), Melinjo/Tangkil (Gnetum gnemon), Daun Sirsak (Annona muricata), Cengkeh (Syzygium aromaticum), dan Keladi Tikus (*Typhonium flagelliform).*

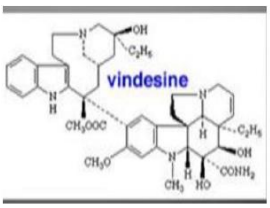
Tapak Dara (Vinca rosea)

Tapak dara (Vinca rosea L.), also known as the periwinkle plant (Catharanthus roseus), is a member of the Apocynaceae family, which is often found in Indonesia. The periwinkle plant (Catharanthus roseus) has enormous potential as a cancer treatment, and various scientific studies have proven this. This plant is an important source of anticancer compounds used in modern chemotherapy (Muslikh, et.al, 2024).

The anticancer potential of periwinkle comes from its alkaloid content, particularly vinblastine and vincristine, found in the leaves and other plant parts. These two compounds inhibit cancer cell growth by disrupting the process of cell division (mitosis). They work by binding to tubulin, a crucial protein that forms microtubules, which are necessary for normal cell division (Gholami, et.al., 2024). Vinblastine and vincristine have been isolated and used as standard chemotherapy drugs to treat various types of cancer, including leukaemia, Hodgkin's and non-Hodgkin's lymphoma, breast cancer, lung cancer, and cervical cancer (Khan, et.al., 2025).

Numerous in vitro (laboratory tests) and in vivo (animal tests) studies have demonstrated the effectiveness of periwinkle extract in fighting cancer cells. Ethanol extract from periwinkle has been shown to have strong cytotoxic properties against several types of cancer cells, such as breast cancer (MCF-7) and cervical cancer (HeLa) cells. Periwinkle extract can induce apoptosis, or programmed cell death, in breast cancer cells. Periwinkle leaf extract can also inhibit breast cancer cell metastasis (Kordkatouli, et.al, 2024).

Vinca



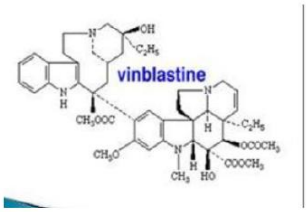


Figure 1. The periwinkle flower (Tapak dara) is an ornamental plant native to Indonesia.It has five petals in bright colors like white, pink, or purple. This plant contains alkaloids such as vinblastine and vincristine

Taxol (*Taxus sp*.)

One of Indonesia's native plants with potential as a source of cancer drugs is the Sumatran Cypress (Taxus sumatrana), which contains the natural compound taxol (paclitaxel). Taxol is a well-known anticancer compound used clinically to treat various types of cancer. The Sumatran Cypress produces a diterpene compound called Taxol, an effective anticancer agent. Taxol (*Taxus sp*.), species *Taxus sumatrana* in Jambi (Gunung Kerinci, Gunung Tujuh, and Danau Belibis), in North Sumatra (Gunung Sibuaton), and in South Sumatra (Gunung Dempo). *T. sumatrana* contains Taxol (diterpenoid) as an anticancer agent. This compound is found in plant parts, especially the bark (Kurniawan, et.al., 2023). Taxol disrupts the formation and function of microtubules, which are important components in cell structure. Microtubules play a role in the process of cell division. By stabilizing microtubules, Taxol stops cancer cell division, thus causing cell death (Putri et al., 2023).

Taxol's unique structure allows it to interfere with cell division in three ways. The first way is stabilizing microtubules: Taxol binds to tubulin, a protein that makes up microtubules. Microtubules are essential filaments that play a role in various cellular processes, including cell division (wahyuni et al., 2024). The second way is preventing microtubule disassembly: Unlike many other anticancer drugs that damage DNA or RNA, Taxol excessively stabilizes microtubules. Taxol prevents them from disassembling again. The third way is by arresting the cell cycle: Cells exposed to Taxol cannot continue dividing. As a result, the cells are arrested in the G2/M phase of the cell cycle and apoptosis (Gallego-Jara, et.al, 2020).

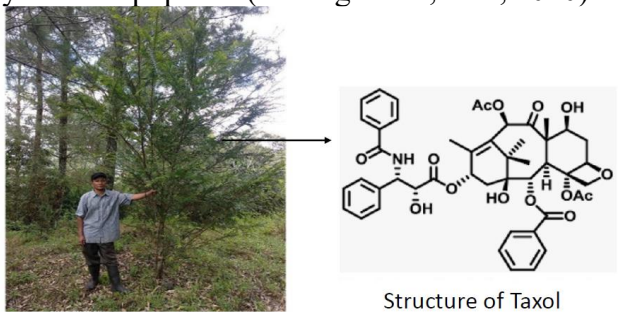


Figure 2. Left, A 7-year-old T. Sumatrana tree in Sipisopiso, North Sumatra. Right, the chemical structure of Taxol is rich in various functional groups, including acetate, benzoate, hydroxyl, and amide groups from the side chain.

Lempuyang wangi/lempuyang gajah (*Zingiber zerumbet* sin. *Zingiber aromaticum).*

The Zingiberaceae family mostly contains phenolic curcuminoid (one of them is curcumin) as an anticancer agent. Lempuyang wangi also contains zerumbone. It is used as traditional medicine for the treatment of dysentery, stomach pain, and diarrhoea. Some research revealed that lempuyang wangi extract could induce the apoptosis of cancer cells and showed cytotoxicity against breast cancer cells (Ashari et al., 2023).

Scientific research has shown that zerumbone can suppress cancer cell growth, spread, and survival through several mechanisms. The mechanisms of action of zerumbone as an anticancer agent are as follows: Zerumbone can trigger the process of apoptosis or programmed cell death in cancer cells. This compound can inhibit the spread of cancer cells to other organs by reducing the migration and invasion of cancer cells (Soroush et al., 2024). Zerumbone can stop the growth cycle of cancer cells at a particular stage, thereby preventing cells from replicating. Zerumbone can inhibit carcinogenesis by reducing inflammatory signals, such as the transcription factor NF-κB (nuclear factor-kappa B). Zerumbone modulates various signalling pathways involved in the growth and survival of cancer cells, such as the IL-6/JAK2/STAT3 and PI3K/AKT/mTOR pathways. This compound can also inhibit angiogenesis, which is the formation of new blood vessels needed for tumours to grow (Jamil et al., 2023).

Studies have shown that zerumbone is effective against various types of cancer cells in vitro (in a test tube) and in animal models, including: Brain cancer, Breast cancer, Colon cancer, Liver cancer, Lung cancer, and Cervical cancer (Girisa, et.al, 2019).

Figure 3. Lempuyang wangi, or Zingiber zerumbet, is a spice in the same family as ginger and turmeric. This plant is known for its fragrant flowers that produce a natural shampoo-like liquid (left) and its distinctively aromatic rhizome (center). The structure of zerumbone (right), a

complex cyclic skeleton with nine carbon atoms and one oxygen atom in the ketone group, as well as two double bonds and three methyl groups..

Temu Kunci (*Boesenbergia pandurata*),

Temu Kunci (Boesenbergia pandurata), containing flavonoid pinostrobin, showed anti-breast cancer activity in vitro and in vivo, and showed cytotoxicity against cervical HeLa cells (Etti et al., 2025). Temu kunci is used as a spice in 'sayur bening/tumisan' and as traditional medicine for treating cough and sprue (Hayati et al., 2025). Pinostrobin works through various mechanisms to inhibit the growth and spread of cancer cells and has a low level of toxicity to normal cells (Adekonov et al., 2025)

Pinostrobin can induce apoptosis, or programmed cancer cell death, through various pathways. This compound can increase reactive oxygen species (ROS), which trigger apoptosis, decrease mitochondrial membrane potential, and regulate proteins involved in apoptosis, such as activating the pro-apoptotic protein (BAX) and suppressing the anti-apoptotic protein (Bcl2). Pinostrobin can arrest the cancer cell cycle at the G1 phase, halting proliferation and triggering cell death. It does this by increasing the levels of p21 and p27 proteins and suppressing cyclin D1. This compound has also been shown to inhibit cancer metastasis by disrupting cancer cells' migration, invasion, and adhesion. Pinostrobin also inhibits migration and suppresses the expression of N-cadherin, a mesenchymal marker. Molecular docking analysis also showed that pinostrobin may target N-cadherin with a higher binding affinity than the IKK complex and NF-κB p65. These findings suggest that pinostrobin may serve as a potential treatment for breast cancer (Jongjang, *et.al*, 2025).

Pinostrobin can suppress angiogenesis, the formation of new blood vessels needed for tumor growth. This compound reduces the expression of Vascular Endothelial Growth Factor (VEGF). Pinostrobin is effective in targeting cancer stem cells, which are often resistant to treatment and contribute to cancer recurrence (Alshahrani, et.al, 2025)

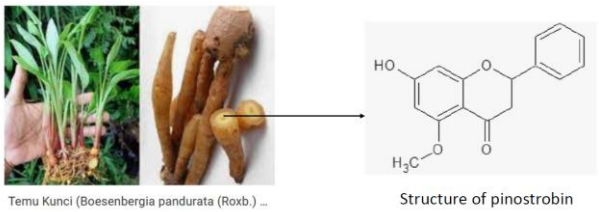


Figure 4. Temu kunci (Boesenbergia pandurata) is an aromatic spice from the ginger family (Zingiberaceae) used as a cooking spice and traditional medicine in Indonesia (left). The chemical structure of Pinostrobin, a flavonoid compound isolated from the rhizome of Boesenbergia pandurata (right).

Melinjo/Tangkil (Gnetum gnemon).

Melinjo contains potent antioxidant compounds with potential anticancer properties, particularly stilbenoid compounds. These compounds are found in the seeds, skin, and leaves of melinjo. Scientific studies have shown that gnetin C, found in melinjo, has potential as an anticancer agent through several molecular mechanisms. Gnetin C targets signaling pathways that regulate cancer cell growth, spread, and death (Sukohar, *et.al*, 2024).

Gnetin C may act as an anticancer agent by inhibiting signaling pathways that promote cancer growth. In prostate cancer, gnetin C effectively inhibits signaling pathways involving the MTA1 and mTOR proteins. These pathways play a role in promoting cell growth and survival. In leukemia cells, gnetin C can suppress tumor growth by inhibiting the ERK1/2 and AKT/mTOR pathways, both key pathways that are often overactive in cancer cells. Through bioinformatics analysis, gnetin C was found to potentially bind to the AKT1 protein, which is closely linked to the survival of breast cancer cells (MCF-7), thereby inhibiting proliferation and metastasis. Studies in colorectal cancer have shown that gnetin C can bind to the STAT3 protein, which is associated with cancer-promoting genes, making it a potential target for cancer therapy (Huong et al., 2025).

Another mechanism by which gnetin C kills cancer cells is by triggering cell death (apoptosis) by increasing the activity of the caspase-3 protein, which is associated with the apoptosis process. Gnetin C can also reduce the expression of genes responsible for driving the breast cancer cell cycle (RUNX2 and CCND1 genes), thereby halting cell proliferation. In prostate cancer, gnetin C inhibits the activity of the MTA1 protein, which plays a key role in tumor spread. Gnetin C has also been shown to inhibit the formation of new blood

vessels (angiogenesis), which is necessary for cancer cells to grow and spread (Rahmawati et al., 2023).

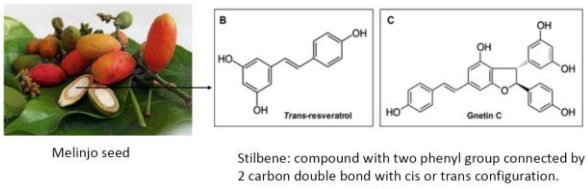


Figure 5. Melinjo/tangkil (*Gnetum gnemon*) seed, *containing* gnetin C and trans-resveratrol (stilbene polyphenol compounds), which demonstrated cytotoxic activity against prostate, breast, pancreatic, and colon cancer cells

Daun sirsak or soupsop leaves (*Annona muricata)*.

Daun sirsak or soupsop leaves (*Annona muricata)* are used as traditional medicine to treat hypertension, gout, and diabetes. The soursop leaves are usually boiled first, and then the boiled water is consumed as medicine (Qomaliyah, 2022).

Soursop leaves contain an active compound called acetogenin, which has shown potential as an anticancer agent in various laboratory and animal studies. Acetogenin attacks cancer cells in several ways, including: Acetogenin inhibits the enzyme NADH dehydrogenase, a crucial part of the electron transport chain in the cell's mitochondria. By disrupting this energy production, cancer cells die. This compound can trigger a series of biological processes that cause cancer cells to commit suicide (Hadisaputri et al., 2021). Anticancer effect is achieved by increasing proteins that promote cell death (e.g., Bax) and decreasing proteins that protect against it (e.g., Bcl-2). Acetogenin has selective cytotoxic (toxic to cells) properties against cancer cells, while being less harmful to normal cells (Hasan et al., 2022).

Several studies have demonstrated the positive effects of soursop leaf extract on cancer cells. Several laboratory studies have shown that soursop leaf extract can inhibit the growth and kill breast cancer cells. Research in mice has also shown that soursop leaf extract can suppress the development of colon and prostate cancer cells. In laboratory studies, acetogenin compounds are toxic to liver, cervical, bladder, and skin cancer cells (Qorina, *et.al*, 2020).

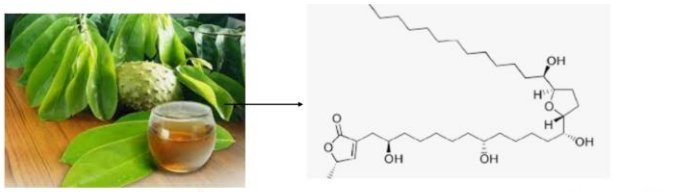


Figure 6. Soursop leaves and fruit (left). Soursop leaves containing bioactive compound of acetogenin polyketide which is demonstrated cytotoxic activity against cancer cells (right).

Cengkeh or clove (*Syzygium aromaticum).*

Clove essential oil (minyak cengkeh) is used as traditional medicine to treat toothache and headache. It also acts as an antiinflammation, antioxidant, and anti-nausea agent. Eugenol from clove (Syzygium aromaticum) has potential as an anticancer agent through various complex molecular mechanisms (Pandey et al., 2024).

Based on preclinical studies on cancer cells, eugenol exhibits anticancer activity through the following main pathways: First, eugenol can trigger apoptosis, or programmed cell suicide, in various types of cancer cells, such as breast, cervical, colon, leukaemia, and melanoma cancer cells. The mechanism involves gene modulation by increasing the expression of pro-apoptotic genes (e.g., Bax, p53) and reducing the expression of genes that support cell survival (e.g., Bcl-2) (Surducan et al., 2022). Eugenol can also activate the mitochondria-dependent apoptosis pathway, releasing cytochrome c, an apoptosis-inducing molecule. The second mechanism of action of eugenol can inhibit the cancer cell cycle. An uncontrolled cell cycle is a hallmark of cancer cells. Eugenol can stop the cancer cell cycle at various stages, preventing these cells from dividing and multiplying. Another mechanism of action of eugenol is by inhibiting growth and metastasis. Eugenol has been shown to prevent the spread of cancer by suppressing overall cancer cell growth, disrupting the formation of new blood vessels needed to feed tumours, and reducing the ability of cancer cells to move and invade other tissues (Zari et al., 2021).

Eugenol can also modulate cellular signalling pathways and enhance the effectiveness of chemotherapy. Eugenol can target key signalling pathways involved in tumor development, including the NF-κB pathway, which regulates immune responses and inflammation, which is often activated in cancer cells; the PI3K/Akt/mTOR pathway, which is associated

with cancer cell survival, growth, and proliferation; and the MAPK pathway, which is involved in signaling from cell surface receptors to the nucleus (Padhy et al., 2022).

Research suggests that eugenol can be used as an adjunct therapy to conventional chemotherapy. This combination can enhance treatment effectiveness, reduce resistance, and decrease the toxicity of chemotherapy drugs. Eugenol can act as a dual antioxidant at low doses (protecting cells from damage) and as a pro-oxidant at high doses (producing reactive oxygen species that harm cancer cells) (Issa et al., 2024).

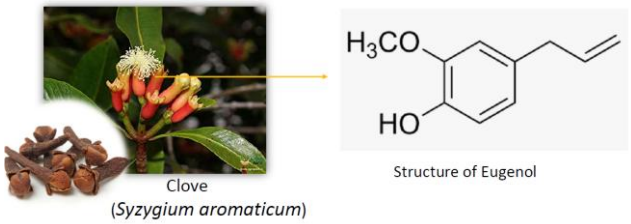


Figure 7. Clove (left). Clove containing bioactive compound of Eugenol which is cytotoxic to cancer cells (right).

Keladi tikus or rodent tuber (*Typhonium flagelliform),*

Keladi tikus (Typhonium flagelliforme) is an Indonesian herbal plant traditionally widely known for its medicinal properties, especially as an anticancer drug. Typhonium flagelliforme shows potential as an anticancer agent through various mechanisms studied in preclinical studies (in vitro and in vivo), although clinical studies in humans are still limited (Malita et al., 2023). Typhonium flagelliforme contains terpenoids, alkaloids, saponins, steroids, glycosides, and polyphenols. Some specific compounds found include Ribosome-inactivating proteins (RIPs), which can cut cancer cell DNA or RNA, stop growth, and trigger cell death and flavonoids, which have significant cytotoxic activity and can target specific cancer cell receptors. Saponins, terpenoids, and polyphenols in Typhonium flagelliforme leaves are believed to have cytotoxic activity against cervical cancer cells (Ng, et.al, 2023).

Typhonium flagelliforme works against cancer cells by inducing apoptosis. Bioactive compounds in Typhonium flagelliforme can trigger apoptosis in cancer cells, causing them to "commit suicide" without harming healthy cells. This process involves several pathways, including activating the enzymes caspase-3 and caspase-9, which play a key role in apoptosis; reducing the expression of anti-apoptotic proteins such as Bcl-2; and triggering the release of cytochrome c from mitochondria, which activates the apoptosis cascade (Sadikin et al., 2024).

Typhonium flagelliforme also inhibits proliferation (cell growth). Typhonium flagelliforme extract can stop cancer cell growth by inhibiting the cell cycle, preventing cancer cells from dividing (Meher et al., 2025).

Various preclinical studies have evaluated the effectiveness of Typhonium flagelliforme on various types of cancer, including breast, cervical, leukaemia, colorectal, lung, liver, and lymphoma cancer. Several studies have shown that Typhonium flagelliforme can reduce the ability of cancer cells to invade other tissues and spread throughout the body (metastasis). Typhonium flagelliforme may also exhibit anti-angiogenic effects (inhibiting the formation of new blood vessels in tumours) when combined with interferon. The results of the anticancer activity test have an IC50 value of rodent tuber mutant plant extract was 2.35 µg mL-1, and the F22 has an IC50 value of 1.89 µg mL-1 against MCF-7 breast cancer cells (Sianipar et al., 2021).

Figure 8. Keladi tikus (Latin: Typhonium flagelliforme) is a plant species in the Typhonium genus of the taro family (Araceae). It is known as an ornamental plant. It thrives in humid areas, grows about 25–30 cm tall, has fresh green, elongated lanceolate leaves with pointed tips, and produces small, round, oval tubers.

The development of Indonesian medicinal plants.

The development of Indonesian medicinal plants as anticancer agents follows a rigorous scientific process, from initial studies to clinical trials, to ensure their effectiveness and safety. Indonesia boasts abundant biodiversity, making it a potential

source for discovering new anticancer drugs (Widyastuti et al., 2021).

The following are the main steps in developing anticancer drugs from Indonesian medicinal plants. First, empirical studies and literature searches are conducted. Researchers begin by identifying plants traditionally used to treat cancer or related diseases. Next, they conduct literature searches and scientific databases to gather information on the anticancer potential of these plants, such as their ability to inhibit cancer cell proliferation (Amin et al., 2021). The second step is the isolation and identification of active compounds. Plants with potential medicinal properties are extracted to obtain their active compounds. Compounds exhibiting anticancer activity are then isolated and chemically identified. The third step is the intensive preclinical testing. The isolated extracts or active compounds are tested on laboratory-cultured cancer cells. The goal is to determine its cytotoxic effects (the ability to kill cancer cells) and its mechanism of action (mechanism of action), such as inducing apoptosis (programmed cell death). If the in vitro test results are promising, testing is continued in animal models, such as mice. This testing is carried out to determine the compound's effectiveness, appropriate dosage, and potential side effects (Adiyasa et al., 2021). Research also focuses on molecular mechanisms, such as targeting signalling pathways that control cancer cell growth, for example, by suppressing the expression of specific genes or proteins. The fourth step is formulation development and clinical trials. If the active compound is proven safe and effective in the preclinical stage, the next stage is the development of a drug formulation, such as a tablet or capsule, that is easy to consume. This stage is carried out in humans through three phases: Phase I, testing safety and appropriate dosage in a small group of healthy volunteers. Phase II, testing effectiveness and side effects in cancer patients. Phase III, comparing the new drug with standard treatments to ensure its benefits are better or at least equivalent. The final step is registration as a phytopharmaceutical. If the clinical trials are successful, the product can be registered as a phytopharmaceutical, a traditional medicine that has been clinically and scientifically tested (Saputra et al., 2022).

CONCLUSION

Due to its rich biodiversity, the potential for Indonesian plants to be developed as anticancer agents is enormous. Various scientific studies have identified many native Indonesian herbal plants that contain bioactive compounds with anticancer properties. Prospective Indonesian medicinal plants as anticancer agents include Tapak Dara (Vinca rosea), Taxol (Taxus sp), lempuyang wangi (Zingiber zerumbet), Temu kunci (Boesenbergia pandurata), Melinjo/Tangkil (Gnetum gnemon), Soursop leaves (Annona muricata), Cloves (Syzygium aromaticum), and Keladi tikus (Typhonium flagelliforme). The best plant to be developed as an anticancer agent from the list provided is Vinca rosea. Vinca rosea is the best plant to be developed as an anticancer agent because it has been scientifically proven to produce active anticancer compounds used in modern medical treatment. This plant contains potent alkaloids such as vincristine and vinblastine, which are life-saving drugs widely used in chemotherapy to treat various types of cancer, including leukemia. The development and use of drugs from Vinca rosea are well-established and globally recognized in the medical world, making it the most tested and successful candidate among other options. Indonesia's biodiversity offers extraordinary potential for discovering and developing new anticancer drugs. With strong research support, product standardisation, and mastery of extraction technology, Indonesian herbal plants could become a valuable resource for future cancer treatments.

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