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Bioactivity of the *Colocasia Gigantea* Plant

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ABSTRACT

Colocasia gigantea or Talas Padang is a plant that has been widely used traditionally as food. Currently, both leaves, stems and roots have been known to have various activities from their secondary metabolites such as antioxidants, anti-bacterials and anti-cancer. This article aims to explore bioactivity information from the Colocasia gigantea plant from previous studies. The results of previous research were obtained from PubMed and Google Scholar, which then used the PRISMA diagram as a protocol in the article selection process. Based on the inclusion and exclusion criteria, 12 research articles were obtained. The test method used in previous studies is through in vivo and in vitro tests using leaves, stems or roots which show that there are antioxidant, anti-bacterial, anti-diabetic, anti-cancer and anti-inflammatory activities. The results of this literature study found that leaves are most widely used than roots or stems which pharmacologically Colocasia gigantea has benefits as an antioxidant, anti-bacterial, anti-cancer, anti-inflammatory and anti-diabetic.

Keywords: *Bioactivity, Colocasia gigantea, Pharmacology*

INTRODUCTION

Indonesia has many herbs that have been used hereditary, but documentation related to its efficacy only form of empirical data. Therefore, it is necessary to test the bio-activity to get scientific proof of efficacy the herbs (Artanti, 2019). Bioactive comes from the Greek, namely "bios" and "activas". Bios means life and activus means dynamic or full of energy (Saidi et al., 2022). One of the active food compounds that are functionally responsible for the occurrence of metabolic reactions that are good for health is bioactive components. These bioactive compounds can be found in various types of animals and plants. Examples are steroids, flavonoids, alkaloids, triterpenoids, tannins, and saponins. The various compounds mentioned above have various functions for the human body, including being a source of antioxidants, anticancer, antibacterial, and anti-inflammatory (Firdiyani et al., 2015).

Indonesia may be a nation wealthy in normal assets and has more than 400 ethnicities and sub-ethnics scattered all through Indonesian domain. Districts of Java, Sunda, Manado, Kalimantan, and different other regions still utilize plants as pharmaceutical convention which is passed down from era to era (Adiyasa & Meiyanti, 2021). One source of traditional medicine from nature comes from the taro tribe. One of the plants belonging to the taro tribe (*Araceae*) is *Colocasia gigantea*, it grows a lot in open places, at an altitude of 400–700 m above sea level with a height of up to 300 cm and has very large leaves (Asih & Kurniawan, 2019). Therefore, it is often referred to as "*giant elephant ear"* in English. *Colocasia* belongs to the Araceae family and is a flowering plant that can be found in the Indian subcontinent and

Southeast Asia. Tarul, taro, dasheen, eddoe, champadhupa, shavigegadde, elephant ears, and cocoyam are some of the many naturalized and cultivated species in both tropical and subtropical regions (Zilani et al., 2021). The taro plant generally grows wild in the field yard or garden without maintenance and cultivation in particular. Most of the root crops are only used as fodder, not for purposes commercial (Silaban et al., 2019). In Indonesia, *Colocasia gigantea* is known as" Talas Padang" or also called "Kemumu" which can be consumed daily as a vegetable even in other countries such as in Thailand, Vietnam, India and Japan with different local names.

Different supplements are contained in taro clears out such as calcium, protein, fat, press, phosphorus, vitamins A, B, and C, and carbohydrates. The supplement substance in taro takes off is 86.94% water substance, 17.24% fiber, 16.48% protein, 1.45% potassium, 0.4% phosphorus, 4.3t, 30.46TN and net vitality of 3966 kcal/kg (Suwitari *et al*., 2022). *Colocasia* leaves have several activities such as antihypertensive, neuroprotective, antidiabetic, anticarcinogenic, and immunoprotective. *Colocasia* leaf extract contains several phytochemical compounds which show active compounds in the form of catechins, anthraquinones, cinnamic, isovitexin, acid derivatives, vitexin, and acid derivatives which are useful because they are biological. *Colocasia* leaves are very useful and have the potential to be used as food products that are processed traditionally and in developing medicines (Gupta et al., 2019).

Colocasia gigantea contains tannins, flavonoids, steroids and phenolic which have potential as antibacterial specialists (Zahari, 2022). In addition, high dietary fiber, pyridoxine and nicotinamide are contained in the leaf stalks which are important in the biological organs of *Colocasia gigantea (*Liu et al., 2018*).* *Colocasia gigantea* has been utilized as medication to treat stoppage and tuberculosis in Hawaii (Irinmwinuwa et al., 2023). *Colocasia gigantea* home grown extricate which has been broadly expended as nourishment so distant, has noteworthy anti-inflammatory and pain-relieving action (Zilani et al., 2021). Takes off and midribs of *Colocasia* have tall antioxidant action since they have an IC50 esteem of less than 200 µg/ml (Hartati, 2020). According to (Pornprasertpol et al., 2015), a fraction extracted from *Colocasia gigantea* tuber parts contains powerful bioactive ingredients with anticancer properties. There are various studies on the potential of *Colocasia gigantea* related to antioxidants, antibacterial, anti-inflammatory and anticancer, so this literature study will discuss in detail the bioactivity of *Colocasia gigantea* based on previous research.

MATERIAL AND METHODS

The journal search method as a reference in this literature study is carried out by searching online through the PubMed and Google Scholar. International journals are used as primary literature sources and national journals as additional literature sources with publication time from 2013 to 2023. Keywords used in searching for literature sources namely "*Colocasia gigantea* and Pharmacology"; "*Colocasia gigantea* extract"; "*Colocasia gigantea* Bioactivity"; dan "Ekstrak Colocasia gigantea"; which was at that point physically chosen from the look comes about based on consideration and prohibition criteria. The writing included within the consideration criteria was fitting with catchphrases, distributed at the final of 10 a long time, inquire about on different models of testing the pharmacological action of *Colocasia gigantea* both in-vitro and in-vivo. While the incoming literature included in the exclusion criteria, namely literature on *Colocasia gigantea* that was published for more than 10 years ago and article review types. The PRISMA flowchart was also used to guide the article selection process (**Figure 1**).

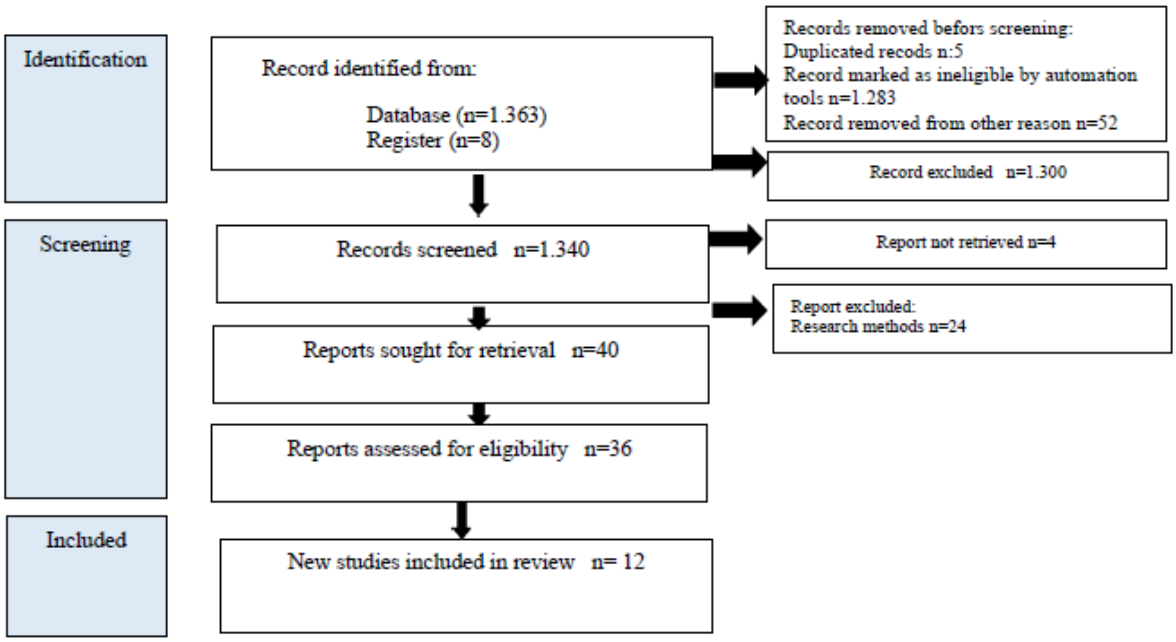

Figure. 1 PRISMA flowchart used as a guide for publication searches.

RESULTS

The researcher selected the articles obtained and extracted data on each article obtained from each database. The results of the article reviewed regarding the bioactivity of the *Colocasia gigantea* plant are shown in **table 1**.

DISCUSSION

Colocasia gigantea is one of the plants that have the potential as a medicinal ingredient, so several researchers conducted a study of the content and efficacy of this plant. *Colocasia gigantea* is often used as a pond decoration and as a food ingredient and also been widely used for traditional medicine in various areas such as treating respiratory disorders, digestive disorders, and skin disorders (Raju, 2018). The tubers and leaves of taro are traditionally used as a medicine for liver disease. *Colocasia gigantea* leaves are used for the treatment of snake bites and scorpion stings and are also used in the treatment of poisoning by the food of plant origin. Previous literature studies showed that *Colocasia gigantea* stalk extract has the property of accelerating the healing of cuts, has antibacterial activity, can reduce the number of leukocytes, is also used to treat diarrhea, hives, dysentery, muscle and joint pain, kidney inflammation, cancer, the digestive system, ulcers. and antioxidants (Paull et al., 2022).

Colocasia gigantea contains primary metabolites and secondary metabolites. Examples of primary metabolites contained in taro are carbohydrates and proteins, while the content of secondary metabolites is saponins, flavonoids, steroids, and tannins. The tuber part of the taro plant is very good for the body if consumed because it is rich in vitamins C, B1, B2, and B3, starch, protein, and fiber. However, taro leaves also contain good content such as alkaloids, saponins, tannins, triterpenes, terpenes, flavonoids, flobatamines, anthraquinone, cardiac glycosides, and polyphenols. *Colocasia gigantea* leaf stalks also contain secondary metabolites such as tannins, flavonoids, alkaloids, steroids and saponins. Several studies have described that *Colocasia gigantea* has pharmacological effects as an antimicrobial, analgesic, and cytotoxic against Artemia salina. *Colocasia gigantea* can act as an antibacterial, and the root part is proven as an antipyretic, antimicrobial, and insecticide. *Colocasia gigantea* can provide purgative, procoagulant, and wound healing effects. *Colocasia gigantea* stems have a hepatoprotective effect (Phuong, 2019).

Table 1. Bioactivity of the *Colocasia gigantea* Plant

Plant part	Bioactivity	Test Models	Dose/Concentration	Measured Parameters	Results	Author
Root	Anti-inflammatory	GCMS and HPLC tests were performed on Colocasia gigantea extract by carrying out an in-vivo balance test	Most extreme concealment of edema 42.37% and 48.72% at the fourth hour at 250 and 500 mg/kg body weight, separately.	Erythrocyte membrane stabilizing activity Paw diameter (% inhibition), COX-2 protein binding affinity	The results obtained from the in vivo anti-inflammatory test through a formalin induction process by suppressing maximum edema were 42.37% and 48.72% with body weights of 250 and 500 mg/kg per at the fourth hour. The results of in-vivo pain modulation showed significant results in the trial and the doses are given. Moreover, within the docking consider, it was found that (*f*)-epicatechin was more dynamic than other compounds distinguished as having a solid authoritative liking for COX-2 protein.	(Zilani et al., 2021)
Stem	Antibacterial	Agar diffusion method, Brine Shrimps Lethality Test (BSLT) method and Phytochemicals test	n-Hexane and Ethanol extract of Colocasia gigantea 20%, 40% and 60% against the growth of Escherichia coli bacteria. BSLT: konsentrasi 1000, 100, 10 µg/ml d	Inhibition zone LC50 value	The ethyl acetate extract has antibacterial activity with a concentration of 40% with a 17.5 mm inhibition zone. This LC50 value has the highest yield of 7.14 ppm. Meanwhile, the results of this phytochemical test showed that secondary metabolites were contained in the kemumu stem extract. The subtances are contain of steroids, alkaloids, terpenoids, steroids, flavonoids, and tannins.	(Marliza et al., 2021)
Leaf	Anti-diabetic	Tried in vitro through hindrance of the α-glucosidase chemical.	Measure the resistance of the extract using a chemical in the form of α-glucosidase through an in vitro process. This is done to test its anti-diabetic action.	The presence of p-nitrophenyl-α-D-glucopyranoside and protein substrate responses through P-nitrophenol measurements	Substances contained in Colocasia gigantea leaf extract play an active role in warding off diabetes or anti-diabetic. This is because the active substance can slow down the work of the α-glucosidase enzyme.	(Marliza, Hasni & Suhaera, 2021)
Leaf	Anti-cancer	Brine Shrimp Lethality method Test (BSLT).	The ethanol extract used was at concentrations of 500 ppm, 250 ppm, 125 ppm, 25 ppm, 12.5 ppm and 0 ppm (control)	The ethanol extract used then observed within 24 hours.	Results of research on cytotoxicity activity of the ethanol extract of Colocasia gigantea against Artemia salina Leach and cytotoxic, then it has the potential as an anti-cancer.	(Marliza & Oktaviani, 2021)
Leaf	Anti-cancer	MTT test	Maximum cytotoxicity was observed in ethanol extracts of 300 and 200 µg/ml Colocasia gigantea for HeLa and V79 cells, respectively.	Catalase activity observed at 6 hours post-treatment.	Colocasia gigantea leaf extract can reduce Hela cell reproduction and can induce cytotoxicity	(Devi & Jagetia, 2017)
Leaf	Antioxidant	Using in vivo castor oil 30, method, diffusion method and DPPH scavenging.	Induction of plant extracts (200 and 400 mg/kg, b.w, p.o), oil mediators were minimized by 19.05% ($p < 0.05$) and 42.86% ($p < 0.001$), respectively.	Antioxidant and from methanol soluble extract of Colocasia gigantea.	There is a possibility to cure diarrhea because Colocasia gigantea extract which dissolves in methanol has the potential to be a source of antioxidants and can be considered as a new drug product.	(Alam et al., 2020)
Leaf	Antioxidant	1 H-NMR and 13 C-NMR techniques.	-	Flavonoids and several other phyto compounds	A total of seven compounds from plants, namely penduletin (1), 7,8-(3",3"-dimethylpyrano)-4'-hydroxyflavonol (2), 7,8-(3' from C. affinis). ',3"-Dimethyl-pyrano)-4'-hydroxyflavonols	(Alam & Haque, 2020)

					and mixtures of α-amyrin and β-amyrin (3), penduletin (5), stearic acid monoglyceride from Colocasia gigantea (6).	
Leaf	Antioxidants and antimicrobials	In vivo induced diarrhea method while antimicrobial and antioxidant investigations	200 and 400 mg/kg is the induction of plant extracts by reducing mediators and basic control in the form of oil which causes diarrhea by 16.96%.	Antidiarrheal, antimicrobial and antioxidant potency	Colocasia gigantea methanol-soluble extracts are safe, can be used for diarrhea relief, and may be a potential source of antioxidants and antimicrobials that could be considered as an alternative source for new drug research in the near future.	(Alam et al., 2021)
Leaf	Anti-inflammatory	In vivo	K (-) was given distilled water, K (+) was given aspirin, and doses of 0.028 g/kg body weight, 0.056 g/kg body weight, and 0.084 g/kg body weight were given to P1, P2, and P3. of C. gigantea petiole extract. Each.	Aspirin-induced male Mus musculus leukocytes	The number of M.musculus leukocytes that had been induced using aspirin could be reduced by using Colocasia gigantea leaf extract.	(Asri et al., 2019)
Leaf and root	Anti-cancer	GC-Mass spectrometry, Hela in vitro and bioassayguided fractionation	Fractions: 1T, 2T, 3T, 4T, 5T, 6T, 7T, 1L, 2L and 3L	IC50 (µg/ml)	The ingredients contained in the Colocasia gigantea extract are Diazoprogesterone, hexyl ester, 4,22-Stigmastadiene-3-one, Oleic Acid, and 9-Octadecenoic acid (Z) which are part of Fr. Another result is the presence of cytotoxic potential and potential in treating cervical cancer.	(Pornpra-sertpol et al., 2015)
Stem	Antimicrobial	Disc diffusion	-	MIC (Minimum Inhibitory Concentration) and MKC (Minimum Kill Concentration)	This MIC was obtained at a concentration of 20%, and 80% concentration in the form of MKC to grow Salmonella typhi and Staphylococcus aureus bacteria in inoculation media.	(Zahari, 2022)
Leaf	Anti-cancer	Chemical characterization using UHPLC-DAD-ESI-MS/MS analysis; experimental in vivo design; in vitro study of HCC cell lines	Experimental in vivo design: HCC-induced mice with 150 mg/kg body weight methanol extract. In vitro studies of HCC cell lines: Colocasia gigantea extract and doxorubicin (DOX) at 500, 250, and 125 g/ml (as standard drug).	Anti-HCC effects by modulation of autophagy signaling pathways (expression of autophagy suppressor (mTOR) and induction of autophagy markers (AMPK, Beclin-1, LC-3)); liver histology	There is an HCC effect that occurs due to modulation with 8 isomers of luteolin and C-glycosyl flavone	(Kasha et al., 2022)

Testing in different ponders portrayed in **table 1**, the larger part was carried out utilizing the dissemination strategy. The choice of this strategy is since it features a straightforward working strategy, the fetched is generally cheap, and it is simple to decipher the results gotten. The test was carried out employing a paper circle with a breadth of ± 6 mm containing the test compound which was put on the surface of the agar media which had been immunized with the test microscopic organisms. The nearness of antibacterial action was shown by the nearness of a clear zone around the plate paper. Not as it were utilizing the dissemination strategy but too screening phytochemicals (Paull et al., 2022).

A phytochemical screening examination was carried out to determine the secondary metabolite compounds contained in the ethyl acetate extract of *Colocasia gigantea* stalk. This examination was carried out on compounds belonging to the class of flavonoids, phenolics, saponins, tannins, alkaloids, terpenoids, and steroids. The results of the examination showed that the ethyl acetate extract of *Colocasia gigantea* stalks contained flavonoid, phenolic, tannin, and steroid compounds. These results are in accordance with the literature review in table 1 which shows the presence of flavonoids, phenolics, tannins, and steroids in the ethyl acetate extract of *Colocasia gigantea*. One of these chemical ingredients, such as tannins, is a plant/plant polyphenolic compound. Tannins are widely used for applications in the field of medicine which have many pharmacological activities such as hemostatic, burn dressing, antimicrobial, antidiarrheal, anti-inflammatory, anticancer, antioxidant, and atheroprotective. So that the presence of flavonoids, phenolics, tannins, and steroids is thought to have antibacterial activity (Devi & Jagetia, 2017).

Antimicrobial activity tests have been carried out on several and the comes about appeared that the methanol extricate of clears out and tubers restrained bacterial development. The methanol extricates of the takes off of this plant too has more grounded antioxidant movement compared to other tuber extricates. The polyphenol content in taro root, namely quercetin, can be a very strong antioxidant to protect and free the body from free radicals that damage and cause cancer (Bhat, 2022; (Devi & Jagetia, 2017). Broadly speaking, Colocasia gigantea has the two most pharmacological activities. dominant namely antioxidant and antibacterial. However, there are some activities that exist in several previous studies such as anti-inflammatory, anti-cancer and anti-diabetic which can be used as a basis for the development of new drugs (table 1).

CONCLUSIONS

Existing activity test studies in this literature study can show that the secondary metabolite content of *Colocasia gigantea* has the potential to become a new drug compound. Based on various activity test results both in vitro and in vivo that have been carried out, *Colocasia gigantea* has the potential to be formulated into dosage forms, both in the form of herbs, standardized herbal medicines, and phytopharmaca due to the activity of secondary metabolites from leaves, stems to roots of this plant such as antioxidants, anti-bacterial, anti-cancer, anti-inflammatory and antidiabetic. In addition, from this literature study, it was found that leaves are used most often than roots or stems to see their bioactivity. Data regarding the compound content and bioactivity of this plant can be used as a reference in further research.

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