



## Review article

# *Saurauia vulcani* (Korth.) as herbal medicine potential from North Sumatera, Indonesia: A literature review



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## ABSTRACT

According to some studies, two-thirds of the world's plant species have therapeutic worth. *Saurauia vulcani* (Korth.) is one of them. This is something that can be found in Indonesia. Traditionally, this herb was known as pirdot and was used to cure diabetes. This article examines the scientific activities of pirdot leaves as well as their safety for usage. This study used a literature review article as its design. Searching for related publications using data from Pubmed, Proquest, Ebsco, ScienceDirect, and Google Scholar for the last ten years (2011–2021) yielded 141 articles. There are 14 pertinent articles that explore their substance and application in health. The content of secondary metabolites that have been reported proves that pirdot has properties as an antidiabetic, immunostimulant, antidiarrhoea, anticholesterol, and hepatoprotective.

## 1. Introduction

Although Indonesia covers just around 1.3% of the earth's surface, it ranks seventh in the world in terms of flora diversity, with 20,000 species, 40% of which are native to Indonesia (Budiarti et al., 2020). The existence of indigenous flora is quite intriguing to research, particularly in the realm of health. Furthermore, research on herbs has increased in recent years, indicating that people's interest in traditional medicine using natural substances is growing (Illian et al., 2021). Natural resources have been used for medicinal purposes since ancient times, and the knowledge has been passed down through generations, earning it the title of "traditional medicine" among the community (Julsrigival et al., 2021; Liu, 2021).

Indonesia is known as a country that until now still uses traditional medicine (Fitmawati et al., 2017). Traditional Indonesian herbal medicine, which has been practiced for generations in Indonesian society, is still widely used for preserving health and treating ailments, owing to its perceived safety over chemical pharmaceuticals (Isnawati et al., 2019; Pengpid and Peltzer, 2018). Jamu is the common name for this type of traditional medicine (Elfahmi et al., 2014). But not only jamu, traditional Indonesian medicine can also be obtained from plants that specifically

grow in Indonesia (Jun et al., 2021). Traditional medicinal plants have a critical role in the development of curative and protective medications (Gao et al., 2019; Hasibuan et al., 2020). The community has been using medicinal plants that grow on communal property as part of the acquisition of traditional medicinal materials since ancient times such as Pirdot (*Saurauia vulcani* Korth.).

Pirdot (*Saurauia vulcani* Korth.) is a plant of the genus *Saurauia* that distributed in Indonesia (Figure 1). Pirdot is abundant in the Lake Toba Catchment Area of North Sumatera, Indonesia (Sitorus, 2015). This species may be found from Lumban Julu, Sipangan Bolon, Merek, and all the way to Sipiso-piso (Ali and Aminah, 2017). There has been a tremendous gathering of pirdot leaves in the previous two years since it is said to be effective in curing a variety of ailments. The trans-Sumatra route is where many of the leaves are exchanged (Anastasia et al., 2018). According to Karo's local viewpoint, pirdot is one of the woody plant species that has been utilized to treat diabetes (Puteri et al., 2019). Despite its lengthy history of usage, this plant still lacks a complete research evaluation. As a result, we give an updated overview of this essential plant in this work, with an emphasis on toxicity study and pharmacological characteristics that will help researchers find scientific knowledge in the future.

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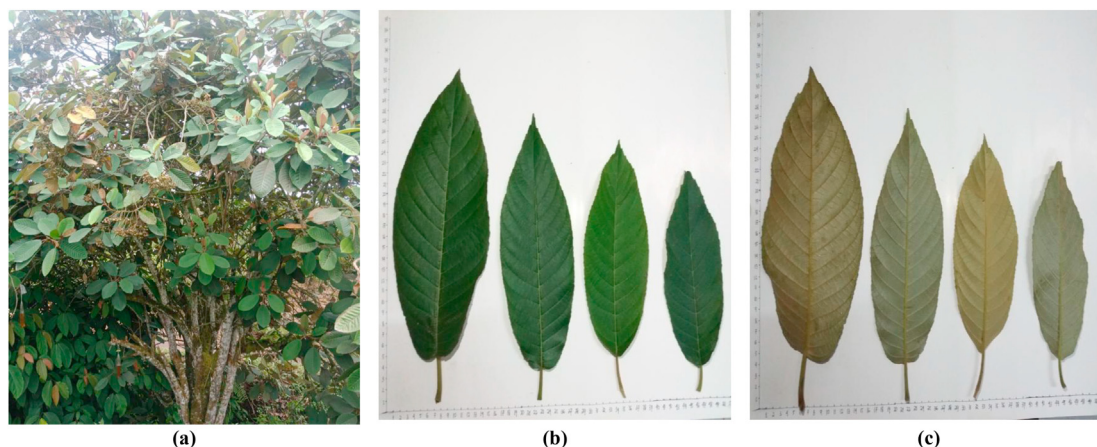


Figure 1. Appearance of the pirdot plant and its leaves. (a) Pirdot (*Saurauia vulcani* Korth.), (b) Top surface of pirdot leaves, (c) Bottom surface of pirdot leaves.

2. Method

2.1. Design

This research is a review of the literature. A literature review is a survey that combines information from scientific papers, books, and other relevant sources to create a synthesis that is informative, critical, and beneficial for a certain issue (Bolderston, 2008).

2.2. Article criteria

In order to narrow down the search for this review paper, the criteria for inclusion were established in this study. The inclusion criteria include: 1) Focus on pirdot (*Saurauia vulcani* Korth.), 2) In the subject of medicine, 3) Full texts, 4) Published between 2011-2021, 5) Original research article, and 6) English language articles. The exclusionary criterion: 1) Just abstract, 2) Incomplete text, and 3) Double

publication. The question of this study is how often scientifically sound the testing of *Saurauia vulcani* Korth on toxicity study and pharmacological effect.

2.3. Article search

In the search, the article uses the combination of specific words like “Pirdot”, “*Saurauia vulcani* Korth”, “Pharmacological”, “Phytochemical”, “Toxicity”. This search uses search engines like PubMed, ebsco, proquest, sciencedirect, and Google Scholar.

2.4. Study selection

The prism technique is used to pick articles, starting with identification, screening, eligibility, and ending with the Included item, as shown in Figure 2.

Pubmed	Science Direct	Ebsco	Proquest	Google Scholar
1	0	0	13	127

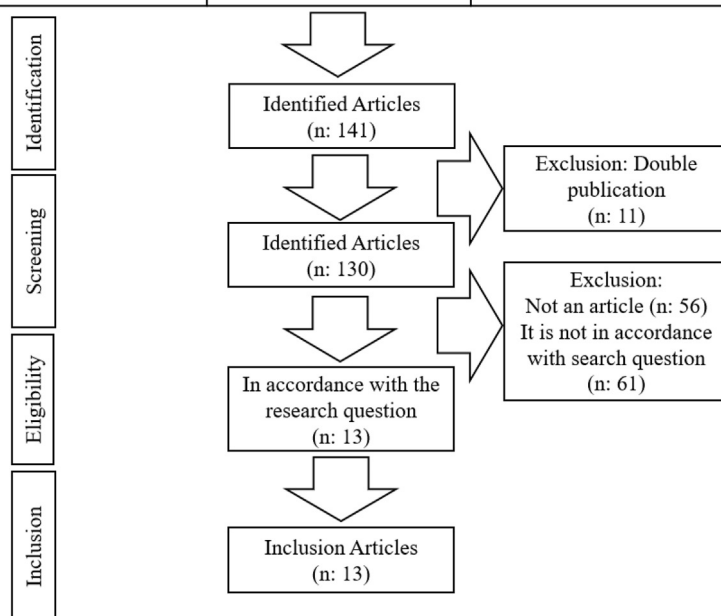


Figure 2. Flowchart of article selection and exclusion.

### 3. Results

In this systematic study, there are forty articles included. This article was published from 2011 to 2021. The research was conducted in various countries and was based on research within the laboratory. Articles that meet the criteria are then summarized. Based on search engine results, 13 articles were identified according to inclusion criteria. For more details, the results of this summary will be discussed.

### 4. Discussion

Pirdot is a plant that has been used traditionally by the people of Indonesia, especially in North Sumatra (Anastasia et al., 2018). But to be global it is necessary to study scientifically of this plant about its pharmacological activity. Not only that as a traditional medicine, the toxicity study cannot be forgotten. Not infrequently folk remedies show toxic effects when used for a long period of time. So the safety profile also needs to be considered through toxicity studies.

#### 4.1. Toxicity study of pirdot

The hazards of a substance's exposure in people may be determined by looking at cumulative effects, toxic dosages in humans, carcinogenic, teratogenic, mutagenic, and other factors (Hsu et al., 2021). In fact, this information can be gathered from studies using, such as oral acute toxicity tests, oral subchronic toxicity tests, oral chronic toxicity tests, teratogenicity, skin sensitization, eye irritation, acute dermal irritation, vaginal mucosa irritation, acute dermal toxicity, dermal subchronic toxicity tests, and carcinogenicity tests (Mielke et al., 2017; Silva Macedo et al., 2021). Toxicity studies in animals are carried out as a form of proof that a test preparation is safe. The test is chosen based on the purpose of the substance's use and the probability of dangers arising from human exposure (Strickland et al., 2018).

Extracts from plants are one type of preparation that must be tested for safety (Husori et al., 2018). Therefore, in this study will be explained the safety of the pirdot that has been done in the laboratory in accordance with applicable standards. There have been reported acute toxicity tests of ethanol extract ethanol leaves in mice. The extract was delivered to rats with a dose of 2000 mg/kg BW and 5000 mg/kg BW and observed any signs of acute toxicity for 14 days. There was no mortality as a result of the findings. When compared to normal control ( $P > 0.05$ ), the ethanol extract of pirdot leaves had no effect on hematological parameters such as red blood cells (RBC), hemoglobin, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), platelet, white blood cells (WBC), neutrophils, lymphocytes, monocytes, and eosinophils (Simanjuntak et al., 2020).

Subchronic toxicity information of pirdot has also been discussed. Based on the results of observations for 90 days in wistar rats with various test concentrations of 50, 250, 500, 1000 mg/kg of body weight (bw) did not get toxic symptoms from the use of pirdot for a long period of time. The biochemistry, hematology, macro pathology, relative organ weight and histopathology of liver, lung, kidney spleen, and heart were examined as a parameter in this study (Rosidah et al., 2021). Cytotoxic activity of pirdot has also been performed on brine shrimp. The test results were measured based on lethal concentration value 50 (LC50) of pirdots. The toxicity test findings for n-hexane, ethyl acetate, and methanol extracts were 365.19 ppm, 715.28 ppm, and 225.77 ppm, respectively (Pasaribu et al., 2021). This indicates that the extract possesses cytotoxic action, despite its tiny size (Niksic et al., 2021).

#### 4.2. Phytochemical contents and antioxidant properties of pirdot

The pharmacological activity of natural materials will not be separated from the secondary metabolite compounds contained in the material (Preininger et al., 2021). Therefore, it is very important to conduct

an assessment of the content of secondary metabolite compounds in pirdot. It will also be useful for the development of the drug. Identification of secondary metabolite compounds in pirdot leaves has been done qualitatively. It is reported that pirdot leaves ethanol extract contains flavonoids, glycosides, saponins, tannins, and steroids/triterpenoids (Gurning et al., 2020; Rosidah et al., 2021). Total phenolic of pirdot leaves extracts was carried out using Folin-Ciocalteu's method. Total content of phenol in n-hexane, ethyl acetate, and methanol extract are 7.155 mg GAE/g, 13.702 mg GAE/g and 16.560 mg GAE/g of dry weight of extract, respectively (Pasaribu et al., 2021). The total phenolic content value can be utilized as a predictor of antioxidant activity. In another study, total phenolic, total flavonoids, and antioxidant activity of water extract of pirdot leaves was reported. The results were showed that water extract has a total phenol content of  $96.75 \pm 0.02$  mg/g GAE, and total flavonoid content of  $39.50 \pm 0.02$  mg/g QE. While the antioxidant activity was determined using DPPH method with  $IC_{50}$  value as indicator.  $IC_{50}$  value of water extract of pirdot leaves was  $22.918 \pm 1.32$   $\mu$ g/mL (Lovenia et al., 2018).

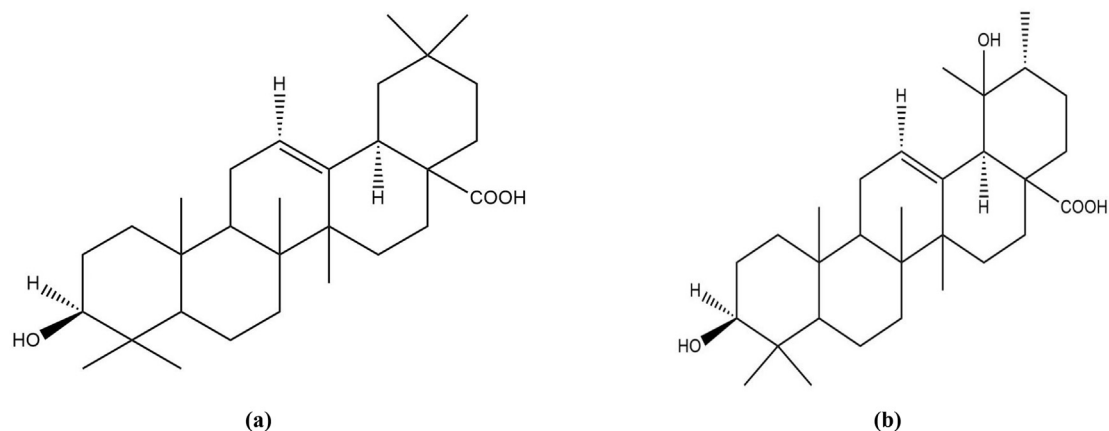
Pharmacological activity does not only tell about the group of phenols or flavonoids only. Terpenoids are also secondary metabolite compounds that have pharmacological activities such as antioxidant activity (Sepahvand et al., 2014). In vitro and in vivo research have revealed that terpenoids have anti-inflammatory, anti-oxidative, antiaggregatory, anti-coagulative, anti-tumor, sedative, and analgesic properties (Tetali, 2019; Zhao et al., 2016). It was reported, two triterpenoids acid from pirdot leaves success to identified. Gradient elution was used to chromatograph ethyl acetate extract over column chromatography packed with silica gel (70–320 mesh). The fractions were treated to reverse-phase column chromatography on a number of occasions, yielding two substances 1 and 2. Two triterpenoids (Figure 3), 3 $\beta$ -hydroxy-Olean-12-en-28-oic acid (a) and 3,19-Dihydroxyurs-12-en-28-oic acid (b) were isolated from the pirdot leaves (Musa et al., 2019). Data on secondary metabolites of pirdot is still very little. Therefore, this becomes a great opportunity to be traced by researchers.

#### 4.3. Pharmacological activity of pirdot

The pirdot plant is a plant that has a lot of potential bioactive chemicals. Bioactive chemical components detected in pirdot leaves Alkaloids, flavonoids, saponins, triterpenoids, and tannins are among the examples (Gurning et al., 2020). Pirdot leaves have been traditionally used as a diabetic treatment made from heated water, according to empirical data. The development of drugs and science is a strong reason for proving the efficacy of pirdot scientifically (Table 1). This article will discuss more clearly about the efficacy of pirdot scientifically.

It is very interesting to examine the pharmacological activity of pirdot leaves. So far based on the results of research reported that pirdot leaves efficacious as antidiarrhea, antibacterial, anticholesterol, antidiabetic, and immunostimulant. Of the 13 research results that have been published there are 6 studies related to the activity of pirdot leaves as anti-diabetics. This will certainly support the use of pirdot leaves traditionally as anti-diabetics (Hutahean et al., 2018). This information will greatly help researchers in exploring pirdot leaves. The study of pharmacological activity and the identification of active compounds is certainly very useful for developing standardized herbal remedies.

Research on pirdot leaves as anti-diabetics goes so far as to be done by in vivo methods in mice or rat (Table 1). To determine its efficacy as an anti-diabetic, observations were made on several parameters such as blood glucose (Hutahean et al., 2018; Sitorus and Satria, 2018; Surbakti et al., 2019), HbA1c value, insulin amount, SOD value (Surbakti et al., 2019), amount of sRAGE (Sitorus et al., 2020), and pancreatic histopathology (Hutahaean et al., 2020). Ethanol extract of pirdot leaves at a dose of 100 mg/kg bw was able to reduce the blood glucose levels of rats induced by NA and STZ ( $p < 0.05$ ) and increase insulin expression than the control group was  $31.00 \pm 0.31$  and  $7.55 \pm 0.06$ , respectively ( $p < 0.05$ ) (Surbakti et al., 2019). In other studies, a dose of 50 mg/kg bw was



**Figure 3.** New triterpenoid compounds from pirdot leaves. (a) 3 $\beta$ -hydroxy-Olean-12-en-28-oic acid, (b) 3,19-Dihydroxyurs-12-en-28-oic acid.

**Table 1.** Efficacy of pirdot base on scientific data.

Sample	Efficacy	Method	Result	Reference
Pirdot leaves ethanol extract	Antidiarrheal	In vivo, the mice induced with 0.5 mL oleum ricini to get diarrhea by oral	The extract has antidiarrheal activity	(Gurning et al., 2020)
Active compound of pirdot leaves	Anticholesterol	Cholesterol level was determined by the LB colorimetric assay using UV Vis spectrophotometer.	The active compounds can decrease a cholesterol rate	(Musa et al., 2019)
Pirdot leaves ethanol extract	Hypoglycemic	In vivo, the rats induced with streptozotocin (STZ)	The extract has hypoglycemic activity ( $p < 0.001$ )	(Sitorus and Satria, 2018)
Pirdot leaves ethanol extract	Hypoglycemic	In vivo, the rats induced with streptozotocin (STZ) and nicotinamide (NA)	The extract shown a significantly ( $*p < 0.05$ ) reduced in blood glucose levels and HbA1c level, increased SOD level and secretion insulin.	(Surbakti et al., 2019)
Pirdot leaves ethanol extract	Hypoglycemic	In vivo, the mice induced with alloxan	After treatment with extract, the blood glucose level was lower than in the diabetes mellitus control group.	(Hutapea et al., 2018)
Pirdot leaves ethanol extract	Antihyperglycemic	In vivo, the mice induced with alloxan	The result showed the pirdot leaves extract has the potential as antihyperglycemic	(Hutahaean et al., 2018)
Pirdot leaves ethanol extract	Antidiabetic	In vivo, the rats induced with STZ	The research reported extract has down regulation level of sRAGE	(Sitorus et al., 2020)
Pirdot leaves ethanol extract	Antidiabetic	In vivo, the mice induced with alloxan	The extract can promotes cell regeneration in pancreatic islands	(Hutahaean et al., 2020)
Pirdot leaves ethanol extract	Antibacterial	The antibacterial activity was performed with agar diffusion method.	The extract has bacterial inhibitor zone to <i>Staphylococcus aureus</i> and <i>Escherichia Coli</i> which are 0.33 mm and 0.49 mm respectively	(Silalahi et al., 2021)
Pirdot leaves ethanol extract	Immunostimulant	In vivo, the rats induced sheep red blood cell as a antigen	The extract enhancement of erythrocyte value and lymphocyte. It was also obtained a good histologic spleen	(Sinaga et al., 2019)
Pirdot leaves extracts	Immunomodulator	In vitro on RAW cells line	The extracts can reduce NO production and inhibit gene expression such as TNF- $\alpha$ , IL-6, COX-2, IL-1 $\beta$ , and iNOS.	(Rosidah et al., 2019)
Pirdot leaves ethanol extract	Immunostimulant	In vivo, the rats induced sheep red blood cell as a antigen	The extract can increase lymphocytes, reduce of IL-2, and protect liver tissue	(Sinaga et al., 2020)
Pirdot leaves ethanol extract	Hepatoprotective	In vivo, the rats induced sheep red blood cell	The results show SGOT and SGPT value significantly ( $p < 0.05$ ) decreased on treatment group	(Sinaga et al., 2021)

able to lower blood glucose the same as metformin ( $p < 0.05$ ) (Sitorus and Satria, 2018). Pancreatic tissue histopathology has also been seen in mice treated with alloxan. Observations of mice that were not treated with the extract revealed a reduction in the number of cells, uneven island borders, and pyknotic cell damage. This was not observed in mice given the extract (Hutahaean et al., 2020).

Arthritis, ulcerative colitis, asthma, allergies, parasite disorders, cancer, and viral diseases are all caused by immune system malfunction (Mahassni and Bukhari, 2019). As a result, the debate about the effects of pirdot on the immune system must be quite fascinating. The use of pyredots as immunostimulants has received a lot of attention. This test was performed both in vitro and in vivo. Pirdot leaves extracts was

shown to suppress nitrit oxide levels at a concentration of 25  $\mu\text{g}/\text{mL}$  in vitro in RAW 246.7 cells ( $p < 0.05$ ). It is also able to inhibit the expression of several genes involved in inflammatory processes such as TNF- $\alpha$ , IL-6, COX-2, IL-1 $\beta$ , and iNOS (Rosidah et al., 2019). The immunostimulating effects of pirdot leaves were also evaluated in vivo in rat induced sheep red blood cells. It is proven that pirdot extract at 500 mg/kg bw is able to increase the amount of erythrocytes ( $7.16 \pm 0.82$ ) compared control ( $6.39 \pm 0.82$ ) ( $p > 0.05$ ), and increase lymphocytes ( $74.83 \pm 3.19$ ) versus controls ( $74.00 \pm 2.92$ ) ( $p < 0.05$ ) (Sinaga et al., 2019). The effect of the extract inhibiting the expression of interleukin 2 (IL-2) has also been observed at a dose of 500 mg/kg bw. As a result, there was a decrease in IL-2 expression of  $106.72 \pm$



20.38 compared to the control of  $348.05 \pm 482.29$  ( $p < 0005$ ) (Sinaga et al., 2020).

Other pharmacological activities of pirdot that have been reported are antidiarrhorre, anticholesterol, and hepatoprotective. The different doses of extract shown that activity might greatly reduce the incidence of diarrhea. 21.43%–34.29% ( $p < 0.05$ ). These results were obtained from observation of the effects of pirdot in rats induced oleum ricini (Gurning et al., 2020). Pirdot activity as an antiolesterol was tested using a colorimetric method. 2 compounds resulting from isolation from pirdot leaves show activity to lower cholesterol values. At concentrations of 10, 20, 40, 60, and 80 ppm, the cholesterol levels were about 67%, 56%, 40%, 27%, and 24% for 1 and 73%, 65%, 61%, 52%, and 37% for 2 (Musa et al., 2019). The most recent reported is the activity of pirdot as hepatoprotective. Ethanol extract of pyredot leaves at a dose of 500 mg/kg bw successfully decreased the value of SGOT and SGPT in test rat induced sheep red blood cells ( $p < 0.05$ ). The bioactive components of pirdot, such as pomolic acid and ursolic acid, have a strong binding affinity of  $-14.6$  kcal mol<sup>-1</sup> with COX-2 protein, while cis-3-O-p-hydroxycinnamoyl ursolic acid has a binding affinity of  $-15.1$  kcal mol<sup>-1</sup> with TNF- $\alpha$  protein (Sinaga et al., 2021).

## 5. Conclusion

Pirdot (*Saurauia vulcani* Korth.) is a plant native to North Sumatra, Indonesia. The content of secondary metabolites that have been reported proves that pirdot has properties as antidiabetic, immunostimulant, antidiarrhoea, anticholesterol, and hepatoprotective. However, no one has presented in this report on the chemicals they contain precisely, and because the plant is still in the laboratory test phase, a further in-depth study is required to obtain more thorough information about this plant.

## Declarations

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All authors listed have significantly contributed to the development and the writing of this article.

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### Data availability statement

Data included in article/supplementary material/referenced in article.

### Competing interest statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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