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Review of Phytochemical and Pharmacological Activities of *Physalis minima*

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ABSTRACT: This review aims to provide basic knowledge about the medicinal plant *Physalis minima*. Currently, *Physalis minima* are considered as a medicinal plant for diabetes mellitus and kidney stones. Natural compounds for treating both diseases are the most alternative therapies because of their various biological and therapeutic properties. We performed a limited search throughMendeley, Google Scholar, Researchgate, and Pubmed databases for all available literature from 2000-2020, using terms related to phytochemical, pharmacological, and *Physalis minima* compounds. The phytochemical properties and pharmacological activities of *Physalis minima* provide a factual basis for developing new treatments. *Physalis minima*has several bioactive components related to health benefits, including flavonoids, steroid alkaloids, ellagic acid, catechol, gallic acid, catechins, vitamin C,free amino acetamide, cyclopentane, palmitic acid, stearic acid, octadecanoic and linoleic acids. Pharmacologically this plant is reported as anti-inflammatory, analgesic, ~~antipyretic~~, antidiuretic,antioxidant, ~~smooth muscle relaxation, immune enhancing~~,antidiabetic,and antibacterial.

Keywords:*Physalis minima*, Phytochemicals, Pharmacological, review

I. INTRODUCTION

Physalis minima is an annual plant species belonging to the Solanaceae family, a yearly pantropical herb 20-50 cm high. The leaves are soft and smooth (not hairy), with intact or serrated edges, 2.5-12 cm long. Flowers are cream to yellowish. This fruit has a cherry tomato-like flavor, which is delicious when ripe or ripe.[1]*Physalis minima*is a plant from America that are widespread to other tropical regions. This plantcan grow in the highlands, so it is easy to find.[2]

Figure 1. Fruit of *Physalis minima*[3]

Figure 2. Inside of the *Physalis minima*'s fruit [4]

Physalis minima have short stems, yellow flowers, round fruit, and yellowish-green when young, but ripe fruit is old brown with a sweet and sour taste. The inside of the fruit is protected by a fruit covering veil. Single leaf, stemmed, underside scattered, above in pairs, leaf blade oval, elongated, lanceolate and pointed tip, unequal tip, blunt pointy, flat or wavy edge. The inside of the fruithas many uses, including antitumor, an inhibitor of cancer growth, especially colon cancer, antioxidants, and thyroid cancer.[5]

Scientific Classification[6]

Kingdom : Plantae
Division : Spermatophyta
Subdivisions : Dicotyledonnae

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Class : Angiosperms
Order : Solanales
Family : Solanaceae
Genus : Physalis
Species : *Physalis minima*
Binominal name : *Physalis minima* Linn

II. DATA COLLECTION

In compiling this review article, the technique used is to use literature studies by looking for sources or literature in the form of primary data or the form of official books and international journals in the last 20 years (2000-2020). In addition, in making this review article, data search was carried out using online media with keywords, namely *Physalis minima*, phytochemical, and pharmacology through Google scholar, ResearchGate, Mendeley, and other published and trusted journal sites.

III. PHYTOCHEMICAL REVIEW

The raw *Physalis minima* fruit was extracted with methanol and filtered to determine the active group of chemical constituents using primary phytochemical tests. The extracts showed positive results for alkaloids, steroids, tannins, phenol glycosides, carbohydrates, and anthocyanins. The results of HPLC analysis at 330 nm showed the presence of active constituents, as evidenced by the chromatograms obtained at the retention times of 1.548, 1.797, 2.117, 6.217. HPLC is combined with different detection methods, e.g., UV, MS provides preliminary information on the content and properties of the constituents found in active extracts, namely steroid alkaloids.[7]

The bioactive components of *Physalis minima* leaves were evaluated using GCMS, HPLC, UV VIS and FTIR. The GC / MS results indicated the presence of thirty one phytochemical constituents, namely Heneicosanoic acid, Bicyclo [4.1.0] Hepta-2, 4-dien, Octadecanoic acid (CAS), stearic acid and Octadeca-9, 12-dienoic acid. HPLC analysis identified and quantified four phenolic compounds such as Ellagic acid, Catechol, Gallic acid and Catechin present in *Physalis minima* leaves. The UV-VIS analysis showed that the absorption at wavelengths of 315.09 nm, 408.09 and 676.50 nm were respectively 0.247, 0.106 and 0.003. The presence of phenolic compounds, alkanes, aldehydes, secondary alcohols, amino acids, aromatic amines and halogen compounds was confirmed by FTIR analysis. The results of this study indicate the potential use of *Physalis minima*leaves as a herbal alternative for various diseases,including diabetes, cardiovascular etc.[8]

Testing the levels of vitamin C, phenol compounds, and free amino acids were carried out based on fruit maturity. Fruit with the right level of maturity (almost ripe) contains higher vitamin C levels than young or ripe fruit. Besides, ripe fruit has the highest levels of phenolic compounds and free amino acids. *Physalis minima* fruit is divided based on the level of maturity, then crushed or milled, and then tested. Tests were carried out using a handheld refractometer and tested using Duncan's Multiple Range Test (DMRT). The data obtained included the total phenol of very young (2.92), pre-young (5.67), young (6.06), pre-ripe (7.53), and ripe (4.89). Total free amino acids are very young (4.51), pre-young (3.05), young (3.92), pre-ripe (4.61), and ripe (7.56). Total Vitamin C Fruit is very young (36.22), pre-young (43.34), young (46.67), pre-ripe (34.23), and ripe (31.78).[9]

The content of phenolic compounds, flavonoids, and antioxidants was carried out on *Physalis minima* herbs (stems, leaves, fruits, roots, and whole plants) extracted using 95% ethanol solvent. The Folin-Ciocalteu method is used to determine phenolic levels expressed in milligrams gallic acid equivalent (mgGAE/g). All parts of the*Physalis minima*plant have the highest phenolic content starting from the leaves (1125.42), all plants (941.61), fruit (784.70), stems (569.97), and roots (223.08). The highest levels of flavonoids started from all plants (1161.03), stems (294.46), leaves (28.92), fruit (11.90), and roots (8.42)obtained by staining with aluminum chloride and milligram gallic acid equivalent (mgGAE/g).Antioxidant testing using the DPPH method showed the highest IC_{50} results starting from the roots (825.86), stems (150.99), fruit (3.46), leaves (1.70), and all plants (1.28).[10]

GCMS analyzed the content of secondary metabolites found in the leaves, roots, and fruit of *Physalis minima*. The leaves contain acetamide (7.20%), cyclopentane (3.83%), palmitic acid (29.81%), stearic acid (5.04%), octadecanoic acid (3.55%), linoleic acid (12.47%) and octadecatrienoic acid (14.63%). At the root, there is a palmitic acid compound (4.06). The fruit contains acetamide (3.90), octadecanoic (3.35%), palmitic acid (28.98%), octadecanoic acid (9.15%), linoleic acid (16.09%), and octadecatrienoic acid. (3.47%).[11]

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IV. PHARMACOLOGICAL REVIEW

Analgesic

In analgesic testing, the *Physalis minima*plant's methanol extract is divided into two parts: crude and chloroform fraction extract. In analgesic testing, rats were injected with formalin as a contraction and aspirin as a control. Rats were injected with *Physalis minima* methanol extract (200-400 mg/kgPO) 60 minutes before injecting with formalin and aspirin (10 mg/kg, IP) 30 minutes before injecting formalin. The response calculation started from 0-5 minutes (initial phase) after being injected with formalin as many as 65.40 and 64.43 responses from crude extract, 62.75, and 58.95 responses from chloroform fraction 51.34 responses from aspirin. The reduction in licking and biting responses occurred in the final phase (15-40 minutes), 42.85 and 35.50 responses from crude extract, 29.70, and 22.40 responses from chloroform fraction 12.65 from aspirin.*Physalis minima* extract showed an analgesic effect in mice starting from the first 15 minutes onwards.[12]

The analgesic effect test of the water extract of *Physalis minima* flowers and leaves was carried out using the hot plate method at 55^{o}C with the dosage used at 100mg/kgbodyweight, 200mg/kgweightand 400mg/kgbodyweight. Data were analyzed using ANOVA (analysis of variance). The analgesic effect of the water extract of *Physalis minima* flowers shows a significant impact at doses of 200mg/kgbody weight and 400mg/kgbodyweight. A decrease in the response of writhing and licking occurred at doses of 200 mg/kgbodyweight starting at 60 minutes (12.5),90 minutes (9), and 120minutes(5.6). At a dose of 400mg/kgbodyweight starting from 60 minutes (12.3)to 90 (10.1) and 120 minutes (7.3). The test results using the water extract of *Physalis minima* leaves decreased the response of writhing and biting at a dose of 400 mg/kgbodyweight starting from 60 minutes(9.8) to 90 (9.1) and 120 minutes (7.3).[13]

Anti-inflammatory

The anti-inflammatory test of the *Physalis minima*plant's methanol extract was carried out by injecting carrageenan on the rat's right leg. The methanol extract and chloroform fraction were given orally, and aspirin used as a control was administered 1 hour before injection with carrageenan. After injection with carrageenan, the feet were measured plethysmometrically by dipping. The highest inhibition of rat foot edema occurred in the third hour of the experiment at a dose of 400 mg crude extract (66.67%), chloroform fraction (68.25%). At a 200 mg dose, the highest inhibition of rat leg edema was crude extract at the fourth hour (57.81%), and the chloroform fraction occurred at the third hour (61.90%).[12]

Antidiuretic

The antidiuretic test of the methanol extract of *Physalis mini*ma leaves was carried out by the oral method. Rats were prohibited from eating and drinking for 18 hours. The methanol extract of *Physalis minima*leaves was given at 100mg/kg and 200mg/kgdoses. The dose of 100mg/kg bodyweight shows the volume of urine (7.46) and electrolyte Na^{+} (86.23), K^{+} (540.7),while the dose of 200mg/kg bodyweightshows the volume of urine (9.82) and electrolytes Na^{+} (108.18) and K^{+} (635.2). *Physalis minima*leaf extract has been shown to increase urine elimination and increase Na^{+} and K^{+} excretion.[14]

Antioxidants

The antioxidant activity of the ethanol extract of *Physalis minima* leaves was carried out to prove its usefulness in free radical-mediated diseases including diabetes, cardiovascular, cancer, and others. ~~The ethanol extract was filtered for antioxidant activity in vitro by scavenging nitric oxide radicals, DPPH removal, total antioxidant test, metal chelation, and iron reducing activity different concentrations.~~Throughout the study, leaf extracts showed marked antioxidant activity. Half of the inhibitory concentration (IC_{50}) of plant extract and ascorbic acid measured at 517 nm were 63.86 µg ml-1 and 34.91 µg ml-1, respectively. The DPPH test activity approximates the standard as ascorbic acid. The antioxidant activity was found to be concentration-dependent and may be related to bioflavonoids in *Physalis minima* leaves. Overall, plant extracts are a great source of natural antioxidants, which can help prevent the development of various diseases mediated by oxidative stress, including aging.[15]

The antioxidant activity of the crude extracts of *Physalis minima* stems and leaves was carried out using four different solvents (methanol, acetone, ethyl acetate, and chloroform). Antioxidant activity was determined by two methods of DPPH test (1,1-diphenyl-2-picryl hydrazyl) and reduction power test. The DPPH free radical scavenging activity of *Physalis minima* stems and leaves was determined at different concentrations (200 µg/mL, 400 µg/mL, 600 µg/mL, and 800 µg/mL) and vitamin C as a control.

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The test results of crude stem extract with a concentration of 200 µg/mL obtained % inhibitionof methanol extract (63.01), ethyl acetate extract (58.33), acetone extract (59.75), chloroform extract (53.87), and vitamin C (92.95). The concentration of 400 µg/mL obtained % inhibition of methanol extract (65.62), ethyl acetate extract (64.73), acetone extract (64.22), chloroform extract (55.42), and vitamin C (93.68). The concentration of 600 µg/mL obtained % inhibitionof methanol extract (72.76), ethyl acetate extract (68.60), acetone extract (70.73), chloroform extract (57.75), and vitamin C (94.16). Concentrations of 800 µg/mLobtained% inhibitionof ~~include~~methanol extract (76.02), ethyl acetate extract (71.71), acetone extract (72.76), chloroform extract (59.11) and vitamin C (94.65).[16]

In crude leaves extract with a concentration of 200 µg/mL, % inhibitionwere obtained on methanol extract (68.78), ethyl acetate extract (59.10), acetone extract (61.54), chloroform extract (50.70) and vitamin C (92.95).~~).~~ Concentrations of 400 µg/mLobtained% inhibitionof methanol extract (70.59), ethyl acetate extract (63.37), acetone extract (66.06), chloroform extract (55.35) and vitamin C (93.68). The 600 µg/mL concentration obtained% inhibitionof methanol extract (72.85), ethyl acetate extract (64.73), acetone extract (69.23), chloroform extract (58.14) and vitamin C (94.16). Concentrations of 800 µg/mLobtained% inhibitionof methanol extract (78.29), ethyl acetate extract (74.61), acetone extract (75.57), chloroform extract (66.51) and vitamin C (94.65).All testedsamples showed lower scavenging activitythan standard. Methanolic extract of leaves showed higher antioxidant activity compared to the others. [16]

The antioxidant test on the reduction power ~~test~~ method is divided into several concentrations, including 200, 400, 600 and 800µg/mL. Increased absorbance of the reaction mixture indicated increase in reducing power.*Physalis minima*stem extract with a concentration of 200 µg/mL obtained absorbanceof methanol extract (0.419), ethyl acetate extract (0.219), acetone extract (0.233), chloroform extract (0.145) and vitamin C (0.668). Concentration of 400 µg/mL obtained absorbanceof methanol extract (0.403), ethyl acetate extract (0.260), acetone extract (0.295), chloroform extract (0.226) and vitamin C (0.719). Concentration of 600 µg/mLobtained absorbanceof methanol extract (0.472), ethyl acetate extract (0.306), acetone extract (0.389), chloroform extract (0.325) and vitamin C (0.754). The concentration of 800 µg/mL obtained absorbanceof methanol extract (0.516), ethyl acetate extract (0.398), acetone extract (0.414), chloroform extract (0.362) and vitamin C (0.839).[16]

In the leaves extract with a concentration of 200 µg/mL, absorbancewas obtained from methanol extract (0.412), ethyl acetate extract (0.265), acetone extract (0.289), chloroform extract (0.196) and vitamin C (0.668). Absorbanceat a concentration of 400 µg/mLwere methanol extract (0.467), ethyl acetate extract (0.300), acetone extract (0.318), chloroform extract (0.248) and vitamin C (0.719). Concentrations of 600 µg/mLobtained absorbanceinclude methanol extract (0.526), ethyl acetate extract (0.377), acetone extract (0.394), chloroform extract (0.311) and vitamin C (0.754). The concentration of 800 µg/mL obtained absorbanceof methanol extract (0.612), ethyl acetate extract (0.426), acetone extract (0.456), chloroform extract (0.390) and vitamin C (0.839). Thus from above it is clear that *Physalis minima* will be applicable as a potential source of antioxidant for future researches. [16]

Antimicrobial

Testing the bacterial inhibition of *Physalis minima* fruit is carried out based on fruit maturity level using several solvents. Young fruit with diethyl ether as a solvent has an inhibitory power on the bacteria *Bacillus cereus* 8 MIC. Pre-young fruit with methanol solvent had an inhibitory power on the bacteria*Micrococcus luteus* 2 MIC. Ripe fruit with ethyl acetate solvent has inhibitory power on *Micrococcus luteus* 4 MIC, and *Bacillus subtilis* 4 MIC, acetone solvent has inhibitory power on *Escherichia coli* 4 MIC bacteria, methanol solvent has inhibitorypower on *Bacillus cereus* bacteria, 1 MIC and *Micrococcus luteus*0,25 MIC. Pre-ripe fruit with di-ethyl acetate solvent has inhibitory potency on the bacteria *Bacillus cereus* 4 MIC, and *Micrococcus luteus* 8 MIC, acetone solvent has inhibitory potencyon the bacterium *Bacillus subtilis*4 MIC. Ripe fruit with acetone solvent has an inhibitory power on *Bacillus cereus* 4 MIC and 4 MIC *Staphylococcus epidermidis*, diethyl acetate solvent in *Bacillus subtilis* 1 MIC, ethyl acetate solvent in *Bacillus subtilis* bacteria 0.5 MIC, methanol solvent *Escherichia coli* 4 MIC. This study showed a prominent inhibitory effect using methanol and ethyl acetate extracts of *Physalis minima* fruit at ripe and ripe stages.[17]

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Antidiabetic

The effect of *Physalis minima* Linn (PML) methanol extract on blood glucose levels and sperm quality of normoglycemic mice has been investigated. Twenty-four ICR male rats were randomly divided into four groups and fed with a maintenance diet (commercial rat diet, 5 g/head/day, and water ad-libitum). Group A (n = 6) served as control and received an additional 2 ml/kg bodyweight of distilled water. Groups B, C, and D were given 50, 100, and 200 mg/kg bodyweight PML supplements, respectively. Bodyweight and blood glucose levels are monitored weekly. After four weeks of treatment, all animals were sacrificed,treated with cervical dislocation, their epididymis was removed, and sperm analysis was performed. Bodyweight increased ($p < 0.05$) over time, but no difference ($p > 0.05$) was observed between treatments.The results of the decreased percentage of blood sugar in mice included levels of 50mg/kg BW (21.54%), levels of 100mg/kg BW (32.81%), levels of 200mg/kg BW (33.87%). Blood glucose decreased significantly ($p < 0.05$) in the PML treatment group (dose-dependent method) compared to the control. Current data also show that PML administration has no significant effect on sperm quality in normoglycemic mice.[18]

V. CONCLUSION

Based on the results of the review, *Physalis minima* plants contain many secondary compounds, including flavonoids, steroid alkaloids, phenolic compounds as ellagic acid, catechol, gallic acid and catechin, vitamin C, free amino acids, acetamide, cyclopentane, palmitic acid, stearic acid, octadecanoic and linoleic acids. *Physalis minima*have various pharmacological effects, including antidiuretic, anti-inflammatory, analgesic, antioxidant, antidiabetic, antimicrobial, and antibacterial.

REFERENCES

[1]. http://en.m.wikipedia.org/wiki./Physalis_minima
[2]. Fatmawati, S., 2019. Bioaktivitas dan Konstituen Kimia Tanaman Obat Indonesia. Yogyakarta: CV Budi Utama
[3]. https://en.m.wikipedia.org/wiki/Physalis_minima
[4]. https://www.dreamstime.com/photos-images/physalis-minima.html
[5]. Kementrian Kesehatan Republik Indonesia. 2016. Formularium Obat Herbal Asli, Indonesia. Jakarta: Kemenkes Republik Indonesia
[6]. Kementrian Kesehatan Republik Indonesia. 2011. Formularium Obat Herbal Asli, Indonesia. Jakarta: Kemenkes Republik Indonesia
[7]. Sunitha K, M. Nagulu, K. Srisailam. Evaluation of Methanolic Extract of *Physalis minima* Fruit for Immunomodulatory Activity.International Journal of Pharmacy and Biological Sciences,2018; 8(4): 394-401
[8]. Karpagasundari. C.S., Kulothungan. Analysis of Bioactive Compounds in *Physalis minima* Leaves Using GC MS, HPLC, UV-VIS and FTIR Techniques. Journal of Pharmacognosy and Phytochemistry, 2014; 3(4): 196-201
[9]. Patel R.P, Neeta B. Gol, Tadapaneni V. Ramanom. Physiochemical Change in Sunberry (*Physalis minima* L,) Fruit During Growth and Ripening.International Society for Horticultural Science,2009; 66(1): 37-44
[10]. Nurhaslina C.R., Mealianny, A.N Mustapa, C.Y Mohd Azizi. Total Phenolic Content, Flavonoid Concentration and Antioxidant Activity of Indigenous Herbs, *Physalis minima* Linn. Journal of Physics: Conference Series, 2019; 1349: 1-7. DOI:10.1088/1742-6596/1349/1/012088
[11]. Norhanizan U, Nur Ashikin Psyquay Abdullah, Siti Hajar Ahmad, Ghizan Sale. Preliminary Phytochemical Screening and GC-MS Analysis of Ethanol Extract of *Physalis minima* L. (Solanaceae). Journal of Advanced Agricultural Technologies, 2014; 1(2):100-103
[12]. Murad A.K, Haroon Khan, Sarwar Khan, Tahira Mahmood, Pir Mohammad Khan, Abdul Jabar. Anti Inflammatory, Analgesic and Antipyretic activities of *Physalis minima* Linn. Journal of Enzyme Inhibition and Medicinal Chemistry, 2009; 24(3): 632-637
[13]. Rajitha M, Balu. J, Althaf Shaik, Simpson GB. Evaluation of Analgesic Effect of Aqueous Extract of *Physalis minima* Flower and Leaves in Albino Mice.International Journal of Research in Pharmacology & Pharmacotherapeutics, 2019; 8(2): 137-140
[14]. JyothibasuT, K. Venkata Ramana, Sreenu Thalla, Ch Narasimha Raju Bh.

DiureticActivity of Methanolic Extract of P*hysalis minima* Leaves. Scholars Research Library, 2012; 4(6) : 1832-1834

[15]. Karpagasundari. C, S. Kulothungan. Free Radical Scavening Activity of *Physalis minima*Linn. Leaf Extract (PMLE). Journal of Medicinal Plants and Studies, 2014;2(4): 59-64

[16]. Shweta S., Poonam Prakash. Evaluation of Antioxidant Activity of *Physalis minima*. Chemical Science Transactions, 2014; 3(3): 1179-1185

[17]. Prakash R. Patel, T.V. Ramana Rao. Influence of Growth and Ripening of *Physalis minima* L. Fruit on its antibacterial Potential.Research Journal of Medicinal Plants, 2012; 6(4): 326-333

[18]. Daud D., Siti Fatimah Elias, Fatimah Sarah Mohamad Hassan, Mohammad Noor Jalil, Alene Tawang. *Physalis minima* Linn Methanolic Reduces Blood Glucose Level without Compromising Sperm Quality in Normoglycaemic Mice. Journal of Applied Pharmaceutical Science, 2016; 6(6): 008-011