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Polyscias Scutellaria As Natural Plant

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Abstract

Polyscias scutellaria, commonly known as mangkokan in Indonesia or shield aralia, has long been used in traditional Southeast Asian medicine and is gaining attention for its diverse pharmacological properties. This plant exhibits significant antibacterial, antifungal, anti-inflammatory, antioxidant, galactopoietic, antidiabetic, and anticancer activities, making it a promising candidate for therapeutic and cosmetic applications. Ethanol and ethyl acetate extracts of Polyscias scutellaria show notable antibacterial effects against various pathogens, including Staphylococcus aureus, Escherichia coli, and Propionibacterium acnes. The plant's bioactive compounds, such as flavonoids, tannins, and saponins, contribute to these effects, indicating its potential as a natural antimicrobial agent. Additionally, studies have revealed its antifungal activity against Candida albicans, with minimum inhibitory concentrations above 6400 µg/mL, suggesting its therapeutic potential in treating fungal infections. The galactopoietic properties of Polyscias scutellaria are particularly noteworthy in maternal health, with research demonstrating increased prolactin and oxytocin levels in lactating rats, as well as improved mammary gland structure and enhanced offspring survival. These findings support the plant's potential as a natural supplement for promoting lactation. Moreover, its anti-inflammatory and antioxidant effects have been shown to mitigate oxidative stress and regulate pro-inflammatory cytokines, reinforcing its role in supporting immune health and managing inflammation-related conditions. In diabetic models, Polyscias scutellaria has demonstrated a capacity to significantly lower blood glucose levels in alloxan-induced rats, with higher doses showing the most pronounced effects, although not surpassing the efficacy of standard metformin treatment. The plant also promotes hair growth, with topical application of its extract resulting in hair length and weight improvements comparable to those of commercial hair growth treatments such as minoxidil. Virtual screening has also identified Polyscias scutellaria bioactive compounds as potential inhibitors of Bcl-2, a protein involved in cervical

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Volume 3 | Number 2 | June 2025 |

cancer, suggesting its anticancer properties. These findings underscore the diverse pharmacological activities of Polyscias scutellaria, positioning it as a valuable resource for developing natural therapeutic and cosmetic products. However, further clinical studies are needed to optimize its use, ensure safety, and evaluate its efficacy in human applications.

Keywords: Polyscias Scutellaria, Pharmacological Properties, Natural Products

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1. Introduction

Plant-based natural products have long been acknowledged for their richness in bioactive compounds with significant therapeutic potential. These compounds can be utilized directly or modified to enhance their therapeutic efficacy. These compounds such as alkaloids, glycosides, flavonoids, volatile oils, tannins, resins have been used in a wide range of commercial and industrial applications such as flavors, aromas and fragrances, enzymes, preservatives, cosmetics, bio based fuels and plastics, natural pigments and bioactive compounds can be utilized directly or modified to enhance their therapeutic efficacy (Abd Rashid et al., 2023; Abdullah et al., 2024; Kasmara et al., 2025; Sari et al., 2024) . Many modern drugs are derived from natural products. Aspirin, for example, was originally developed from salicylic acid found in willow bark. One such plant is Polyscias scutellaria, commonly referred to as mangkokan in Indonesia or shield aralia, which is widely used in traditional medicine across Southeast Asia. Recent research highlights its diverse pharmacological properties, including antibacterial, antifungal, anti-inflammatory, antioxidant, and galactopoietic activities, as well as its potential for promoting hair growth, treating cancer, and managing diabetes (Rosa, 2019).

The antibacterial activity of Polyscias scutellaria has been a focal point in various studies. Ethanol extracts of the plant have demonstrated notable efficacy against pathogens

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Volume 3 | Number 2 | June 2025 |

such as Staphylococcus aureus, Escherichia coli, Propionibacterium acnes, and Acinetobacter sp., suggesting its potential as a natural antimicrobial agent. These effects are primarily attributed to its secondary metabolites, including flavonoids, tannins, and saponins (Rosa, 2019; Nurbaya et al., 2021; Budiono et al., 2023). Beyond its antibacterial properties, the plant also exhibits anti-inflammatory and antioxidant effects. Its extracts have been shown to mitigate oxidative stress, suppress pro-inflammatory cytokines, and stabilize cellular membranes, underscoring its immunomodulatory potential. These characteristics make it a promising candidate for managing inflammation-related conditions and boosting immune health (Muhar et al., 2023).

The galactopoietic effects of Polyscias scutellaria have attracted interest in maternal health research. Studies on lactating rats have revealed that the plant's extracts can enhance prolactin and oxytocin levels, improve the structure of mammary glands, and increase the survival rate of offspring. These findings indicate its potential as a natural supplement to support lactation (Budiono et al., 2023). Additionally, the plant's antifungal and anti-cancer properties further emphasize its therapeutic versatility. Its ethanol extracts have demonstrated inhibitory activity against Candida albicans, while its bioactive compounds show potential in suppressing the Bcl-2 protein, a crucial target in cervical cancer treatment. Furthermore, Polyscias scutellaria has proven effective in lowering blood glucose levels in diabetic rats, making it a viable natural option for diabetes management (Putri et al., 2020; Kurniawan & Humaedi, 2021; Nasution et al., 2021).

Given these multifaceted bioactivities, this study seeks to thoroughly explore the therapeutic potential of Polyscias scutellaria. Particular attention will be given to its antibacterial, anti-inflammatory, galactopoietic, and antioxidant properties, as well as other notable pharmacological effects. These insights could facilitate the development of innovative, plant-based treatments and health solutions.

2. Material And Method

This literature review aimed to consolidate and synthesize existing research on *Polyscias scutellaria*, focusing on its pharmacological properties and potential therapeutic applications. A comprehensive search strategy was employed, utilizing databases such as PubMed, Scopus, Google Scholar, and Web of Science, with keywords

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Volume 3 | Number 2 | June 2025 |

including "Polyscias scutellaria," "Mangkokan," "shield aralia," "antibacterial," "antifungal," "anti-inflammatory," "galactopoietic," "anti-cancer," "diabetes," and "hair growth." Studies published in the past 5 years that specifically addressed the plant's bioactive compounds, pharmacological activities, and therapeutic benefits were included. Data extraction focused on the plant's antibacterial, antifungal, anti-inflammatory, antioxidant, galactopoietic, anti-cancer, and anti-diabetic effects, along with its chemical composition, extraction methods, and mechanisms of action. The quality of the studies was assessed based on methodology, sample size, and statistical analysis, with randomized controlled trials and systematic reviews given more weight. The findings were synthesized and categorized by therapeutic area, comparing efficacy and safety while identifying any contradictions or gaps. Key bioactive compounds responsible for these effects, including flavonoids, tannins, saponins, and alkaloids, were also discussed. The review was limited by the availability of studies in English and the exclusion of unpublished data or non-peer-reviewed sources. Clinical trials and human studies were sparse, limiting the assessment of real-world effectiveness and safety. Overall, the review provides an integrated summary of Polyscias scutellaria's pharmacological potential and aims to support future clinical research into its therapeutic applications.

3. Result And Discussions

a. Result

Antibacterial Effects Against Propionibacterium Acnes

Antibacterial activity was tested using the agar diffusion method with disc paper. Phytochemical screening showed that both the simplicia and ethanol extract of Mangkokan leaves contained alkaloids, flavonoids, glycosides, tannins, saponins, and steroids/triterpenes. The antibacterial activity test indicated that the ethanol extract of Mangkokan leaves had antibacterial effects against Propionibacterium acnes at extract concentrations of 30% (6.74 mm), 35% (6.84 mm), 40% (7.26 mm), 45% (7.32 mm), and 50% (8.68 mm), producing medium resistance zones. As a positive control, 30 g chloramphenicol disc paper was used, which produced an inhibition zone of 21.89 mm, while the negative control, a 10% DMSO (Dimethyl Sulfoxide) solution, did not produce any inhibition zone. Additionally, the ethanol extract of basil leaves also

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Volume 3 | Number 2 | June 2025 |

demonstrated antibacterial activity against Propionibacterium acnes (Nurbaya et al., 2021).

Antibacterial agent against acinetobacter sp. On human armpit

Polyscias scutellaria Fosberg showed strong antibacterial activity against *Acinetobacter sp.* from the human armpit. Hexane and ethyl acetate fractions formed clear zones >20 mm at 400 mg/mL, while 225 mg/mL hexane and 250 mg/mL ethyl acetate reduced bacterial counts by 6 log cycles. The methanol fraction at 400 mg/mL was ineffective (Rosa, 2019).

Antibacterial Activity Test Against Escherichia Coli And Staphylococcus Aureus

The extraction was performed through sequential maceration using three different solvents: n-hexane, ethyl acetate, and ethanol. Antibacterial activity was assessed using the agar diffusion method, by measuring the inhibition zone diameters of the ethanol extract of Mangkokan leaves at concentrations of 20%, 40%, 60%, and 80%. The test results for Escherichia coli showed average inhibition zone diameters of 5.9 mm (20%), 5.2 mm (40%), 5.9 mm (60%), and 7.03 mm (80%). For Staphylococcus aureus, the inhibition zones were 9.66 mm (20%), 10.71 mm (40%), 11.27 mm (60%), and 12.42 mm (80%). Based on these findings, the ethanol extract of Mangkokan leaves (Polyscias scutellarium (Burm.f.) Fosberg) displayed moderate antibacterial effects against Escherichia coli. In contrast, it showed strong antibacterial activity against Staphylococcus aureus at 60%, 80%, and 100% concentrations, while the activity was weaker at 20% and 40%.

The leaves of Polyscias scutellaria demonstrate potential as an antibacterial agent against various types of bacteria. The antibacterial activity has been evaluated using various methods, including agar diffusion and disk diffusion techniques. Here are the types of bacteria tested along with their antibacterial activity results:

1. Staphylococcus aureus: The 70% ethanol extract showed an inhibition zone of 12.33 mm, while the highest inhibition zone for the 96% ethanol extract reached 15.69 mm.
2. Escherichia coli: Research indicated that both the 70% and 96% ethanol extracts inhibited the growth of this bacterium, with inhibition zone diameters ranging from

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Volume 3 | Number 2 | June 2025 |

7.06 mm to 17.51 mm, depending on the concentration used.

3. Staphylococcus epidermidis: The 96% ethanol extract exhibited varying inhibition zones, reaching 13.20 mm at a concentration of 7000 µg/disk.
4. Pseudomonas aeruginosa: The 70% ethanol extract produced a maximum inhibition zone of 11.89 mm at a concentration of 16%.
5. Propionibacterium acne: The 70% ethanol extract showed significant inhibition, achieving a zone of inhibition of 24 mm at a concentration of 100%.
6. Salmonella gastroenterit: The 96% ethanol extract and ethyl acetate fraction displayed the ability to inhibit the growth of this bacterium, with inhibition zone diameters varying, reaching 9.66 mm at a concentration of 10%.
7. Lactobacillus rhamnosus: The 96% ethanol extract produced an inhibition zone of 7.80 mm at a concentration of 10%.
8. Bacillus subtilis: The 96% ethanol extract provided an inhibition zone of 10.8 mm at a concentration of 10%.

The Minimum Inhibitory Concentration (MIC) of these extracts indicates that antibacterial activity can be categorized as strong if the value is less than 500 µg/mL. The potential antibacterial activity is attributed to the presence of secondary metabolites, such as tannins, flavonoids, and saponins, found in the leaves of Polyscias scutellaria. Various studies support that these leaves can serve as a raw material for antimicrobial products, such as soap, due to their beneficial properties in inhibiting the growth of pathogenic microorganisms.

Galactopoietic Effect In Lactating Rats

The doses administered were 250 mg/kg body weight (BW) and 500 mg/kg BW, with the route of administration being oral, as indicated by treatments given with distilled water and Asifit, suggesting ingestion. The duration of administration lasted for 14 days, as the treatments were provided over two weeks. The subjects involved were lactating rats (LR), which were divided into four groups, while virgin rats were used as the control group. Key findings include no significant differences in total phenolic content (TPC), total flavonoid content (TFC), and antioxidant capacity between solvents. LC-HRMS analysis identified 22 compounds, such as flavonoids,

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Volume 3 | Number 2 | June 2025 |

terpenoids, phenolic acids, and lignan. Notably, pups demonstrated increased weight gain and survival rates after three weeks. Serum prolactin (Prl) levels were significantly elevated in rats treated with PSE at 250 mg/kg BW during the first and third weeks, while oxytocin (Oxt) serum levels were significantly higher in rats treated with PSE at 500 mg/kg BW during the first and second weeks. The conclusion drawn from the study suggests that PSE, which is rich in polyphenols, exhibits promising galactopoietic effects by enhancing prolactin and oxytocin levels, ultimately improving pup survival (Budiono et al., 2023).

Herbal Remedy Aimed At Boosting Breast Milk Production By Enhancing The Histological Structure Of Mammary Glands And Stabilizing Insulin Levels In Breastfeeding Mothers, Which Ultimately Leads To Increased Milk Supply

The extract was administered orally at doses of 250 mg/kg and 500 mg/kg body weight for a duration of 14 days. The subjects included five female unmated rats (UR) and twenty female lactating rats, divided into five groups: UR (unmated rats), LRO (lactating rats only), LRA (lactating rats treated with Asifit), LRPSAE 250 (lactating rats treated with PSAE at 250 mg/kg BW), and LRPSAE 500 (lactating rats treated with PSAE at 500 mg/kg BW). The findings indicated that the histoarchitecture of the mammary glands in the LRA and LRPSAE groups were similar. However, the LRPSAE 250 group exhibited higher plasma insulin levels and greater immunofluorescent expression of insulin compared to the LRA group. Additionally, PSAE did not significantly affect the levels of insulin receptor beta subunit (INSR-β) in the liver or muscle tissues of the lactating rats. The study concluded that Polyscias scutellaria extract may serve as a potential herbal treatment to enhance breast milk production by improving the histological structure of mammary glands and maintaining adequate insulin levels in the mother (Budiono et al., 2023).

Antifungal Activity Against Candida Albicans

The leaves were macerated using ethanol, and the resulting extract was prepared in various concentrations (100 µg/mL, 200 µg/mL, 400 µg/mL, 800 µg/mL, 1600 µg/mL, 3200 µg/mL, and 6400 µg/mL) dissolved in 1% DMSO. The antifungal activity was assessed using well dilution and diffusion disc methods, with fluconazole as a

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Volume 3 | Number 2 | June 2025 |

positive control. The findings revealed that the ethanol extract of P. scutellaria exhibited antifungal activity against Candida albicans, demonstrating a minimum inhibitory concentration (MIC) of above 6400 µg/mL and forming an inhibitory zone against the fungus. Thus, the study suggests that the ethanol extract of P. scutellaria has potential as an antifungal agent against Candida albicans (Putri et al., 2020).

The In Vitro Anti-Arthritic, Anti-Inflammatory, Thrombolytic, Membrane-Stabilizing, Antifungal, And Cytotoxic Activities Of The Methanolic Leaf Extract Of Polyscias Scutellaria (Mepsl)

Preliminary phytochemical screening of MEPSL revealed the presence of alkaloids, flavonoids, saponins, glycosides, carbohydrates, and reducing sugars, along with other secondary compounds. At a concentration of 1000 µg/mL, MEPSL demonstrated anti-arthritic activity with 94.59% inhibition and anti-inflammatory activity with 86.33% inhibition, which closely approached the activity of standard diclofenac sodium (98.19%) and acetylsalicylic acid (98.56%). Thrombolytic activity was also observed using the clot lysis method, showing a significant result of 97.32% compared to streptokinase as a standard (91.304%). Additionally, MEPSL exhibited membrane-stabilizing ability with a protection value of 58.87%, compared to diclofenac sodium (73.63%). Antifungal activity was found, with zones of inhibition ranging from 7-36 mm depending on the type of fungus tested. Finally, cytotoxicity was assessed using Artemia salina through a shrimp lethality assay, where MEPSL exhibited significant cytotoxic effects with an LC50 value of 1.057 µg/mL compared to vincristine sulfate (LC50 of 0.608 µg/mL). Based on these findings, the methanolic extract of Polyscias scutellaria shows great potential for use in drug discovery across various pharmacological fields (Akter et al., 2024).

Antidiabetic Effect On Alloxan-Induced Male Wistar Rats

A total of 25 male Wistar rats were divided into five groups: a control group (Na-CMC), a standard group (Metformin), and three extract groups receiving doses of 125 mg/kg BW, 250 mg/kg BW, and 500 mg/kg BW of Polyscias scutellaria extract, administered orally. All rats were induced with diabetes using an intraperitoneal injection of 10% alloxan monohydrate at 175 mg/kg BW. The parameters measured

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Volume 3 | Number 2 | June 2025 |

included fasting blood glucose levels before induction, after induction, and after treatment, as well as body weight before treatment. The results showed significant reductions in blood glucose levels in all extract-treated groups. The 125 mg/kg BW group had a blood glucose level of 495.00 mg/dl, the 250 mg/kg BW group 317.00 mg/dl, and the 500 mg/kg BW group 126.00 mg/dl. The 500 mg/kg BW dose was found to be the most effective (P-value = 0.001), although it did not match the efficacy of the standard Metformin treatment. This suggests that Polyscias scutellaria has the potential to lower blood glucose levels in diabetic rats (Nasution et al., 2021).

Anti-Inflammatory Compounds For Health

The duration of administration consisted of an initial exposure of the extract to RAW 264.7 cells for 4 hours, followed by stimulation with lipopolysaccharide (LPS) for an additional 20 hours. The subject of the study was the RAW 264.7 cell line, which originates from murine macrophages. The findings indicated significant antioxidant activity, assessed through DPPH scavenging activity, with results presented as percentage scavenging. Additionally, total phenolic content (TPC) was measured using the Folin-Ciocalteu method, while total flavonoid content (TFC) was determined through a simplified methodology, both quantified in milligrams per gram of dry extract. Cell viability was evaluated using the MTT assay to assess the impact of the extract and LPS stimulation on cell survival. Furthermore, nitric oxide (NO) production was quantified post-LPS stimulation using Griess reagent, and the levels of tumor necrosis factor-α (TNF-α), interleukin (IL)-6, IL-1β, and IL-12 were measured through ELISA, demonstrating the immunomodulatory effects of the extract (A. M. Muhar et al., 2023).

Hair Growth In Male White Rats

Using concentrations of 10% for long bean leaf extract and 15% for mangkokan leaf extract, along with a 1:1 combination of both, the extracts were applied topically to the backs of male white rats (1 ml per application, twice a day for 21 days). Results showed that long bean leaf extract produced hair growth of 1.97 cm in length and 0.4 g in weight, while mangkokan leaf extract resulted in 2.08 cm in length and 0.41 g in weight. The combination of both extracts led to the best outcomes, with hair growth

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Volume 3 | Number 2 | June 2025 |

measuring 2.65 cm in length and 0.58 g in weight, outperforming the negative control but not surpassing the positive control (Triyani, Sumiati. Anna P., Roswiem. Ayu Kusuma, 2022).

Aimed to determine the effectiveness of a 50:50, 70:30, and 80:20 concentration ratio of ethanol extract from mangkokan leaves and pandan wangi leaves as a hair grower on male rabbits. The treatments were applied daily with an application volume of 1 ml for each concentration over a duration of 14 days. Results indicated that Formula II, which combined these extracts, exhibited the same effectiveness as the positive control containing 2% minoxidil, with mean hair growth values of 1.99 mm in Group I, 1.98 mm in Group II, and 1.96 mm in Group III, demonstrating comparable efficacy in promoting hair growth across all tested groups (Christin Aprillian , Beama. Maria Ekarista, Klau. Natalia Godinho de, 2021).

Inhibitors In Cervical Cancer With A Virtual Screening Approach

Focuses on the inhibitory activity of bioactive compounds from the Polyscias scutellaria plant against the Bcl-2 protein, which is known to be overexpressed in cervical cancer. Using an in silico or virtual screening approach, the research aimed to analyze how these compounds could inhibit Bcl-2, a protein involved in the regulation of apoptosis. The docking analysis revealed that the bioactive compounds from Polyscias scutellaria demonstrated inhibitory activity, with Gibbs energy values of -6.07, -5.18, -5.43, and -6.02. These findings suggest that these compounds have the potential to serve as Bcl-2 inhibitors, providing a possible therapeutic approach for treating cervical cancer (Kurniawan & Humaedi, 2021).

Antioxidants And Anti-Inflammatory Compounds

Polyscias scutellaria (PS) has emerged as a promising natural source of antioxidants and anti-inflammatory compounds. This study analyzed its ethanol (EEPS), ethyl acetate (EAPS), and n-hexane (nhPS) extracts, demonstrating notable antioxidant properties and anti-inflammatory effects. These include the ability to alleviate oxidative stress, reduce nitric oxide production, and suppress pro-inflammatory cytokines in RAW 264.7 cells, emphasizing its potential as a therapeutic agent for addressing inflammation and supporting immune health. This highlights PS

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Volume 3 | Number 2 | June 2025 |

as a valuable resource for developing health and wellness applications (A. M. all Muhar, 2023).

b. Discussions

Polyscias scutellaria (Mangkokan) has demonstrated a broad spectrum of pharmacological activities that position it as a promising natural resource for therapeutic and cosmetic applications. Its antibacterial properties have been extensively studied, with extracts showing moderate to strong inhibitory effects against various pathogens, including *Staphylococcus aureus*, *Escherichia coli*, and *Propionibacterium acnes*. The presence of secondary metabolites such as flavonoids, tannins, and saponins contribute to these antimicrobial effects. In addition, the plant exhibits significant anti-inflammatory and antioxidant properties, as it can alleviate oxidative stress, reduce nitric oxide production, and suppress pro-inflammatory cytokines. Its galactopoietic effects are particularly notable, with studies showing that Polyscias scutellaria extract can enhance prolactin and oxytocin levels, improve the histology of mammary glands, and increase offspring survival in lactating rats. Furthermore, the plant has demonstrated antifungal activity, particularly against *Candida albicans*, and has shown promise in promoting hair growth, with results comparable to those of minoxidil in topical applications. The extract also exhibits potential in managing diabetes by lowering fasting blood glucose levels, with higher doses showing significant effects. In anticancer research, bioactive compounds from Polyscias scutellaria have been identified as potential inhibitors of the Bcl-2 protein, a key target in cervical cancer treatment. Overall, the diverse pharmacological properties of Polyscias scutellaria, driven by its rich content of bioactive compounds, underscore its potential in the development of innovative health and wellness products. Further research is needed to optimize its therapeutic applications and evaluate its safety and clinical efficacy.

4. Conclusion

Polyscias scutellaria (Mangkokan) demonstrates significant pharmacological potential, encompassing antibacterial, antifungal, antidiabetic, anti-inflammatory, antioxidant, galactopoietic, and anticancer properties, as well as applications in promoting

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International Journal of Health Sciences (IJHS)
Journal Homepage: https://jurnal.agdosi.com/index.php/IJHS/index
Volume 3 | Number 2 | June 2025 |

hair growth. Its ethanol and ethyl acetate extracts exhibit moderate to strong antibacterial activity against Propionibacterium acnes, Staphylococcus aureus, and Escherichia coli, among other pathogens, while also showing antifungal effects against Candida albicans and other fungi. The plant's galactopoietic properties are particularly promising, as studies reveal increased prolactin and oxytocin levels, improved mammary gland histology, and enhanced offspring survival in lactating rats treated with the extract. Anti-inflammatory and antioxidant studies highlight its ability to reduce nitric oxide production, suppress pro-inflammatory cytokines, and alleviate oxidative stress, supporting its potential in managing inflammation and promoting immune health.

Additionally, topical applications of the extract promote hair growth, comparable to the efficacy of minoxidil, suggesting its potential in hair care formulations. In diabetic models, the extract significantly reduced fasting blood glucose levels, with higher doses demonstrating notable effects, although not surpassing standard metformin treatment. Virtual screening further identifies bioactive compounds from Polyscias scutellaria as potential Bcl-2 protein inhibitors, highlighting its potential as an anticancer agent, particularly against cervical cancer. The plant's pharmacological activities are attributed to its rich content of secondary metabolites, including flavonoids, tannins, and saponins. Collectively, these findings position Polyscias scutellaria as a promising natural resource for developing therapeutic and cosmetic products. Further studies are recommended to optimize its use, ensure safety, and evaluate its efficacy in clinical applications.

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Publish: Association of Indonesian Teachers and Lecturers
International Journal of Health Sciences (IJHS)
Journal Homepage: https://jurnal.agdosi.com/index.php/IJHS/index
Volume 3 | Number 2 | June 2025 |

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