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Review Article

A Comprehensive Review of *Drynaria quercifolia* (L.) J. Sm

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ABSTRACT

Drynaria quercifolia (L.) J. Sm is a young, fleshy rhizome can reach a maximum of 18 cm in length and 8 cm in width widely distributed throughout India, Malaysia, Southeast Asia, Indonesia, and Australia. It is traditionally used to treat pain, worm infections, skin ailments, fever, diarrhea, infertility and as an adjunct medication to treat diabetes. The evaluation of the phytochemical in different portions reported the existence of saponins, steroids, triterpenoids, phenolic compounds, alkaloids, flavonoids and tannins. According to pharmacological reports, it has antimicrobial, anti-inflammatory, antioxidant activity and anti-cancer properties. The current comprehensive review provides a summary of the pharmacological, phytochemistry, and traditional utilization of *Drynaria quercifolia* (L.) J. Sm as published in the literature. There are countless traditional uses for the herb *Drynaria quercifolia* (L.) J. Sm and it is also utilised in numerous folk treatments. To correlate this plant's traditional uses to the scientific literature that is available, a comprehensive review is thus necessary. There is a wide range of potential studies on this plant and investigations over a long period of time on its pharmacological effects, the discovery of potential lead compounds, and the standardization of different plant parts to prevent adulteration.

Keywords: *Drynaria quercifolia* (L.) J. Sm, Phytochemistry, Pharmacognosy, Pharmacology, Traditional uses.

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INTRODUCTION

Secondary metabolites from animal or plant sources are what we refer to as "natural products". The chemical elements that make up natural goods have pharmacological and biological effects. Medicinal plants extensively to treat a wide range of illnesses. A chemical component that benefits humans is the cause of the therapeutic properties of these plants. The civilizations of Akkadian and Sumerian, which flourished around the third millennium BC, are undoubtedly the first to have used plants therapeutically. Hippocrates (c. 460–377 BC), a well-known pioneer who researched medicinal natural remedies having both animal and plant origins, named about 400 different plant species. Ancient traditional medical systems, such as Chinese, Ayurvedic, and Egyptian, all included natural items as an essential component.[1]

Epiphyte plants that never take root in soil and spend their entire life attached to a host plant. They exclusively get mineral nutrients from non-terrestrial sources. Herbs limited to the ground, where there is less light and potential for increased herbivore activity, offer an advantage over epiphytic plants linked to their hosts high in the cover. Because the canopy acts to store water and less water should be applied to the soil, epiphytes can significantly alter the microenvironment of both their hosts and ecosystems where they are prevalent. The leptosporangiate system, which contains roughly 2800 species (10% epiphytes), is the second-largest category. In actuality, epiphytes make up around three-quarters of all ferns. Ferns are a non-flowering plant that is employed in a different type of Indian traditional medical practises. Ferns, also known as vascular cryptogams or free-living tracheophytes, are strategically located between spermatocytes that generate seeds and other cryptogams that do not.[2] Ferns are a member of the Polypodiaceae family. According to the pteridophyte phylogenetic group classification (PPG I) from 2016, the family consisted of approximately 65 genera and 1650 estimated species and is grouped with in order Polypodiales, suborder Polypodiineae.[3]

The plant *Drynaria quercifolia* (L.) J. Sm (Polypodiaceae) is commonly known as oakleaf fern or oakleaf basket fern. Other common names are Aswakarti in Sanskrit, Asvakatri in Hindi, Pankhiraj in Bangla, Pannakizhangu in Malayalam, Aattukal kilangu or Mudavaattukal kilangu in Tamil, Pakpak lawin in Philippines. A therapeutic fern termed *Drynaria quercifolia* (L.) J. Sm is used to cure a wide range of illnesses. As a result, an effort has been undertaken in this study to provide a thorough description of the rhizome's phytochemical characteristics. The pharmacological characteristics of *Drynaria quercifolia* (L.) J. Sm can be used as a foundation for further research. *Drynaria* ferns

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can be epipetric (which means they emerge on rocks) or epiphytic (which means they emerge on trees) or xerophytic (meaning they emerge on the ground). On the underside of the fronds, they are well-known for their nectar-secreting structures that can be seen at the base or on the sides of leaves.[4] The young, fleshy rhizome can reach a maximum of 18 cm in length and 8 cm in width. The dried rough rhizome is unevenly shaped, nearly flat in colour, and up to 12 cm x 6 cm x 2 cm in size. It is coated in velvet-like, supple scale leaves that are copper in colour. Inner surface is light reddish brown in colour with longitudinal creases that are evident; fracture is splintery; no distinctive odour or bitter taste.

Taxonomical classification

Division – Polypodiophyta

Class – Polypodiopsida

Order – Polypodiales

Sub-order – Polypodiineae

Family – Polypodiaceae

Genera – Drynaria

Habitat and distribution

These species have their natural habitats in India, New Guinea, Malaysia, Southeast Asia, Indonesia, and Australia. The evergreen forests of Tamil Nadu and Kerala's western borders are where it is located in India. Tribal groups in Tamil Nadu's Kolli hills consume the rhizome of *Drynaria quercifolia* (L.) J. Sm as soup to treat pain and to have anti-inflammatory properties.[5] The rhizome (horizontal stem) of this epiphytic fern is thick, meaty, and covered in numerous scales, giving it a fuzzy look. Dark brown in colour, the scales gradually get smaller at the tip. Round and ex-indusiate sori characterize it. Both sides of the main veins have them organized in a regular row. The wind carries away its spores. Spores may help spread it.

Ethnomedical properties and uses

The rhizome is used mostly for medicinal purposes, besides the leaves of the whole plant. Tamil Nadu and Keralan tribal groups use the rhizome to treat a variety of diseases like phthisis and cough.[6] Along with other medicines, the herb is used to relieve rheumatic pain. The plant is utilized to alleviate headaches and bodily aches.[7] The entire plant is used as anthelmintic, expectorant and tonic, and also used to treat chest disease and loss of appetite.[8] *Drynaria quercifolia* (L.) J. Sm rhizome's antibacterial qualities are efficient at eradicating pathogens that affect the urinary system.[9] The plant rhizome used against typhoid fever and also used to treat jaundice,[10] anti-fertility agent[11] and also used to lowers body temperature (antipyretic agent).[12] Local tribal groups in Tamil Nadu use rhizomes from the kolli hills as an anti-inflammatory.[5] It is used very specifically to treat syphilis, diarrhoea, and migraines.[13] Traditional Chinese Medicine uses *Drynaria quercifolia* (L). J. Sm topically to promote hair growth and as part of a treatment for hyperthyroidism. Pain from traumatic damage is treated with a variety of herbs, including *Drynaria quercifolia* (L.) J. Sm.[14] The rhizome extract, which was employed, exhibits one of the probable sources of anti-diabetic[15] and antioxidant action.[16] One of a drug's twelve components, the rhizome of the fern *Drynaria quercifolia* (L.) J. Sm is used to cure cancer.[17]

Phytoconstituents in *Drynaria quercifolia* (L.) J. Sm

The simple phytochemical screening test provides the researcher with an immediate response to the different kinds of phytochemicals present in a mixture of compounds. These compounds are obtained from the different types of solvents.[18]

The early phytochemical screening of the *Drynaria quercifolia* (L). J. Sm rhizome, which was utilised in traditional medicine, identified the presence of sterols, tannins, proteins, and amino acids, as well as flavonoids, terpenoids, saponin, coumarins and alkaloids, while revealing the absence of glycosides, volatile oils, and fixed oils.[19] B-amyrin, β-sitosterol, 3, 4 dihydroxyl benzoic acid, 3-β-D-glucopyranoside, acetyl lupeol, naringinin aglycone, flavone glycosides like naringin, friedelin are found in dried rhizomes.[20]

Alkaloids

These are the secondary chemical constituents that are most frequently found and are primarily composed of nitrogen compounds, which are essentially nitrogen compounds made from amino acid building blocks with different radicals substituting one or more hydrogen atoms in the peptide ring. Most of these radicals have oxygen in them. Basic properties of the compounds cause them to react in an alkaline way, turning red litmus paper blue. In actuality, the atoms of nitrogen, often in the form of 1°, 2°, or 3° amines, contribute to the basicity of an alkaloid by being present in it. The degree of basicity varies considerably, depending on the structure of the molecule, and presence and location of the functional groups.[1]

The majority of alkaloids readily dissolve in alcohol, and while they are rarely soluble in water, however their salts are frequently soluble. Alkaloids have extremely bitter solutions. In nature, alkaloids are found in significant quantities in plant seeds and roots, frequently in conjunction with vegetable acids. Alkaloids have been utilized pharmacologically as CNS stimulants and anaesthetics. Only a tiny portion of the more than 12,000 alkaloids, which are found in around 20% of plant species, have been employed therapeutically. The enticing stimulants caffeine, nicotine, codeine, atropine, morphine, ergotamine, cocaine, nicotine, and ephedrine are among other significant plant-derived alkaloids.

Flavonoids

The plant flora contains a significant group of polyphenols known as flavonoids. They are composed structurally of several benzene rings (a variety of C15 aromatic compounds), and numerous studies have supported their utility as antioxidants or free radical scavengers.[21] The compounds are produced from parent compounds of the flavan-class. It is estimated that there are around 4,000 flavonoids, which include some pigments found in higher plants. Common flavonoids including quercetin, kaempferol, and quercitrin are found in around 70% of plants. Flavones, dihydroflavons, flavanflavonols, anthocyanidins, proanthocyanidins, calchones, catechin, and leucoanthocyanidins are other groups of flavonoids.

Phenolics

The components known as phenolics, phenols, or polyphenolics (or polyphenol extracts) are widely distributed as natural colour pigments that give colour to fruits of plants. The enzyme Phenylalanine Ammonia Lyase (PAL) primarily synthesises phenolics in plants from phenylalanine. They serve a variety of purposes and are crucial to plants. The most significant function may be in protecting plants against viruses and herbivore predators; as a result, they are used in the management of human pathogenic illnesses.[22] Phenolics are simply a variety of naturally occurring antioxidants that are utilised as nutraceuticals, have a powerful capacity to fight against tumour, and occasionally act as anti-inflammatory agents. Flavones, flavone glycosides like naringin and friedelin.

Saponin

The plant *Saponaria vaccaria* (also known as Quillaja Saponaria), which is rich in saponins and was historically used as soap, is where the word "saponin" originates. Therefore, saponins exhibit "soap like" behaviour that causes foam in water. An aglycone known as sapogenin is generated during hydrolysis. Steroid and triterpenoid sapogenins are the two varieties. Saponins hydrolyse to produce aglycones, just like glycosides, and are is water-soluble but ether-insoluble. Because they haemolyze blood and are known to poison cattle, saponins are particularly dangerous. They taste sour and caustic and irritate mucous membranes in addition to this. They primarily have an amorphous character and are water-soluble and alcohol-soluble but insoluble in non-polar organic solvents such as benzene and n-hexane. Since they have been shown to have anticancer and hypolipidemic action, saponins are also crucial in therapeutics. For cardiac glycosides to function, saponins are also essential.[23]

Tannins

These are found throughout the plant. They are highly molecular-weighted phenolic compounds. Plant tissue contains tannins that are soluble in both water and alcohol and are found in the root, bark, stem, and outer layers of the plant. They react acidic, and the presence of phenolics or carboxylic groups is thought to be the cause of the acidic reaction. They combine to form complexes with alkaloids, gelatin, proteins, and carbohydrates. The two kinds of tannins are hydrolysable tannins and condensed tannins. Hydrolysable tannins are classified as either gallotannins or egallitannins depending on the kind of acid that is produced. Gallic acid and ellagic acid are produced during the hydrolysis of hydrolysable tannins. Tannins have a phenolic group, which gives them their antibacterial properties.[24]

GC-MS analysis

The GC-MS analysis was carried out employing rhizome extracts in methanol and ethanol. Thirty bioactive compounds were found in the rhizome's methanolic extract; 1,2-Benzenedicarboxylic acid diethyl ester had the highest concentration and 1,3-diphenyl-1,3,5,5-tetramethyl-cyclotrisiloxane had the lowest. Eleven bioactive chemicals were isolated in the ethanolic extract of the rhizome; 2-myristynol-glycinamide was discovered to have the highest bioactivity (22.502%), while the compound 6-amino-5-cyano-4-(3-iodophenyl)-2-methyl-4H-pyron-3-carboxylic acid ethyl ester had the lowest bioactivity (4.505%).[25]

PHARMACOLOGY REVIEW

Hepatoprotective Agent (*In vivo method*)

Prior to experiment, male albino rats weighing 150–200 g have been kept in acrylic cages and maintained in standard conditions. For the first time, 3 mL/kg of CCl_4 was hypodermically introduced into Wistar rats and then 2 mL/kg of a 50% CCl_4 solution was delivered hypodermically twice a week for a period of 12 weeks. Silymarin served as the reference medication, while 1% Tween 80 served as the vehicle control. *Drynaria quercifolia* (L.) J. Sm ethanol was given to the animals at doses of 100 mg/kg. It has a remarkable hepatoprotective effect against CCl_4-induced rat liver fibrosis.[26]

Cytotoxicity Assay (MTT assay)

In this assay, Hepatic carcinoma cell line (HepG2 cell line) were used and it is cultured at 37°C in humidified atmosphere of 95% air and 5% CO_2 in tissue culture flasks with RPMI-1640 medium. Separately, Distilled Dimethyl Sulfoxide (DMSO) was used to dissolve the extract of *Drynaria quercifolia* (L.) J. Sm 2% inactivated Fetal Bovine Serum (FBS) was added to the medium. The following four lower dilutions were developed [5.0, 10.0, 20.0, and 40.0 µg/mL] from stock solution. 3-(4,5, dimethythiazol-2yl)-2,5-diphenyl tetrazolium bromide (MTT) was diminished by mitochondrial succinate dehydrogenase, that can be evaluated using a calorimeter. HepG2 cells were planted into 6 well cells at a density of 2*105 cells. For 24 hr, the extract was applied. The effect of plant extracts on inhibiting cell growth was measured as a percentage of cell viability using concentrations of the extract ranging from 25 to 400 µL/mL.[27] The percentage of viability

was found to be 85.8 ±5.4, 76.7±6.9, 68.1±5.3, 58.3±4.9 and 35.6±2.8 respectively at 25, 50, 100, 200, and 400 µg/mL, 24.3±1.5 µg/mL for standard drug. The standard drug doxorubicin has also been investigated to determine the efficacy of anticancer activity in plant extract. In the concentration 25 µL/mL shows increased cell viability then it was greatly reduced with increased concentration of extract. *Drynaria quercifolia* (L.) J. Sm is ability to induce apoptosis in cancer cells with relatively low toxicity to normal cells and it may be a potential chemotherapeutic or a chemopreventive agent.[15]

Anti-Inflammatory Activity

The rats were put into five groups of six individuals each. Thirty minutes before the carrageenan administration, group 1 animals received an intraperitoneal injection of 10% Tween-80 as a control. IM-10mg/kg of an aqueous indomethacin solution was given orally to animals in group 2 as control group. Groups 3,4, and 5 animals were given 125,250,500 mg/kg of *Drynaria quercifolia* (L.) J. Sm p.o., respectively. The carrageenan-induced paw oedema and Cotton pellet granuloma formation in rat's method was employed to determine the anti-inflammatory action in *Drynaria quercifolia* (L.) J. Sm. Paw volume was determined before and 3 hr after carrageenan injection. The treated standard drug group (indomethacin solution) was shows maximum inhibition (88.24%) of oedema formation. Carrageenan-induced paw oedema is inhibited by *Drynaria quercifolia* (L.) J. Sm at dosages of 125, 250, and 500 mg/kg, respectively, in a dose-dependent manner. i.e., 80.00%, 83.53%, and 85.88% respectively. *Drynaria quercifolia* (L.) J. Sm at 500mg/kg showed almost equal inhibition of oedema compared to indomethacin group.[28]

Rats' dorsum had a 1-cm-long midline incision created in them, and sterile cotton pellets were put on each side of it in the inter-scapular area. *Drynaria quercifolia* (L.) J. Sm extract was given intraperitonially at doses of 125, 250, and 500 mg/kg every day starting on the day of implantation. On the eighth day, the animal group was slaughtered. The cotton pellets were then taken out, weighed, and dried in a hot air oven for 24 hr at 80°C. *Drynaria quercifolia* (L.) J. Sm was shown to suppress the production of granulomas in a dose-dependent manner. *Drynaria quercifolia* (L.) J. Sm produced 55.56% inhibition during the exudative phase and 62.83% inhibition during the proliferative phase at a dose of 500 mg/kg. Indomethacin almost equally inhibits the exudative and proliferative stages of granuloma growth as compared to *Drynaria quercifolia* (L.) J. Sm.[28]

Analgesic Activity

Acetic acid-induced writhing

There were six sets of six swiss albino mice altogether. All the groups received 0.5% aqueous acetic group solution. Twenty minutes before the acetic acid administration, group 1 animals received an intraperitoneal injection of 10% Tween-80 (0.5mL) as a control. Group 2, acetyl salicylic acid (AS-100mg/kg) administered to the standard control group. Groups 3, 4 and 5, 100, 200 and 300 mg/kg of *Drynaria quercifolia* (L.) J. Sm was administered p.o., respectively, 20 min before the acetic acid injection. The acetic acid control group produce 54.0 ± 2.0 writhes. The groups were pre-treated with *Drynaria quercifolia* (L.) J. Sm (100, 200 and 300 mg/kg) and aspirin (100mg/kg) shows a similar percent inhibition of writhing in mice, i.e. 77.41%, 79.81%, 83.15%, and 88.33% respectively.[28]

Formalin-induced paw licking in mice

Six groups of mice were created (6 animals per group). Tween-80 was given to the control group in group 1 by mouth. Group 2, Sodium salicylate (SS-100 mg/kg) administered to the standard group of animals. Group 3, 4 and 5, 100,200 and 300 mg/kg of *Drynaria quercifolia* (L.) J. Sm extract was administered p.o., respectively, 30 min before injecting formalin. Injection of 20 µL of 1% formalin into the mice's left hind paw's dorsal surface. The duration of licking the injected paw was monitored. *Drynaria quercifolia* (L.) J. Sm at 100, 200 and 300 mg/kg lowered the nociception in this phase in a dose-dependent manner (52.06%, 56.29%, and 61.63%). In the delayed phase of formalin test, SS produced solely 63.55% inhibition, while *Drynaria quercifolia* (L.) J. Sm decreased the nociception appreciably, i.e., 77.48%, 90.60% and 93.87% dose dependently.[28]

Anti-pyretic Activity

Rats subjected to yeast-induced pyrexia were used to test *Drynaria quercifolia* (L.) J. Sm ability to provide antipyretic effect. Rats were put into five groups of six each after a 19-hr fast, Group 1, the control group, was given only saline. Yeast was given to Groups 2, 3, and 4 at a dose of 100 mL/kg body weight, and oral doses of *Drynaria quercifolia* (L.) J. Sm methanol extract (100, 250, and 500 mg/kg) were given. Group 5, yeast (10 mL/kg b.w) and oral administration of normal medication (paracetamol) 200 mg/kg. In the animal's dorsum region, 20% w/v brewer's yeast suspension treated subcutaneously to induce pyrexia. Each rat's rectal temperature was assessed 19 hr after injection using a digital thermometer. The rectal temperature was monitored every 1, 2, and 3 hr. At 3 hr, *Drynaria quercifolia* (L.) J. Sm extract as given 100, 250, and 500 mg/kg showed decreased rectal temperature, were 37.74°C, 37.10°C and 37.09°C respectively. When compared to the industry-standard medication paracetamol (37.24°C), *Drynaria quercifolia* (L.) J. Sm extract dosed at 500 mg/kg demonstrated significant anti-pyretic efficacy.[29]

Anti-Fertility Activity (*Ex-vivo* method)

Metaoestrus stage is induced in female rat (300-500 g). De Jalon's Solution (DJS) was used to mount one uterine horn. Its components were as follows (in mmol): NaCl 154.0, KCl 5.6, $CaCl_2$ 0.5, $NaHCO_3$ 6.0 and glucose 2.8. An aerator was used to continuously aerate this solution. Before the experiment began,

the bath temperature was set at 32±2°C, and the uterine section was subjected to an ideal resting tension of 0.75 g and adjusted for 45 min. Every 10 min during the equilibration period, the tissue preparation was rinsed with DJS.[30] The combination between oxytocin (0.01 mL) and the extracts of *Drynaria quercifolia* (L.) J. Sm (50 mL) in ethyl acetate, acetone, methanol, and aqueous was then evaluated. When combined with oxytocin, the extracts intrinsic activity was increased. Calculations show that the agonistic effects of the extracts of *Drynaria quercifolia* (L.) J. Sm in ethyl acetate, acetone, methanol, and aqueous are 9%, 25%, 87%, and 68%, respectively.[31]

Antioxidant Activity

Natural antioxidants can be found in abundance in *Drynaria quercifolia* (L.) J. Sm. Many living things depend on oxidation and reduction reactions to provide energy for their metabolic processes. Oxygen free radicals and other Reactive Oxygen Species (ROS) that are constantly produced in living beings cause cell death and tissue damage. These organisms have the ability to interact with biological materials including DNA and proteins, causing a variety of illnesses include cancer, diabetes, cardiovascular diseases, ageing, and arthritis.[16] Using *Drynaria quercifolia* (L.) J. Sm significant DPPH scavenging activity as a benchmark, assessed the antioxidant activity of several rhizome fractions.[32] Stated that the methanol extract of *Drynaria quercifolia* (L.) J. Sm was evaluated for DPPH assay, hydroxyl ion radicals (OH), Nitric Oxide (NO), Hydrogen Peroxide (H_2O_2), and 2, 2'-Azinobis (3-ethylbenzothiazoline sulphonic acid) ABTS scavenging. When compared to other medicinal ferns, the extract's antioxidant capabilities were greater than those of the antioxidant standard, butyl hydroxy toluene (BHT). Antioxidants are causing more and more concern, especially those that are said to protect against the reported harmful effects of free radicals on public health and to stop the degradation of lipids and other nutritional ingredients. In both situations, antioxidants derived from natural sources are preferred over those derived from synthetic sources.[33]

Anti-Bacterial Activity

Drynaria quercifolia (L.) J. Sm plant extract (10%) was added to the disc prior to it being grown on nutrient agar medium. As a positive and negative control, standard and blank discs were employed. The plates were maintained at a low temperature (4°C) for 24 hr to allow for maximal diffusion. The plates were then kept at 37°C for 24 hr to promote the organism's maximal growth. *Drynaria quercifolia* (L.) J. Sm has an antibacterial action on microorganisms that cause urinary tract infections, including *Streptococcus pyrogens, Enterococcus faecalis*, and *Pseudomonas aeruginosa. Drynaria quercifolia* (L.) J. Sm inhibited the growth of the microorganisms and a clear zone of inhibition was visualized surrounding the medium.[9]

Anti-Diabetic Property *(In vitro method)*

In hypotonic buffer, the L6 rat myogenic cells were cultured. Methanolic extract from *Drynaria quercifolia* (L.) J. Sm was diluted in Distilled Dimethyl Sulfoxide (DMSO). The medium received 2% inactivated Fetal Bovine Serum (FBS) added to it. The following four lower dilutions were developed [5.0, 10.0, 20.0, and 40.0 µg/mL] from stock solution and a glucose uptake test is performed. Metformin (0.01 mM) used as standard drug. Alpha-amylase solution (0.5 mg/mL) was added to 500 µL of plant extract and 500 µL of a 0.02 M sodium phosphate buffer with a pH of 6.9 and 0.006 M sodium chloride during the 10 min incubation period at 25°C. Using 1 mL of DNSA, the reaction was stopped. The absorbance at 540 nm was measured after diluting the resulting combination with 10 mL of distilled water.[34] Alpha-amylase inhibition experiment was performed on *Drynaria quercifolia* (L.) J. Sm methanolic extract. The plant extracts produced dose dependent alpha-amylase inhibitory action. Six of the 96-well plate with L6 rat myogenic cells were left empty. The medium with plant extract in different concentration (5.0, 10, 20, and 40 µL/mL), metformin (0.01mM) as control and DMSO were added whether there was insulin (1 µmol/L) present or not in all the cells. The glucose present in the medium was determined using glucose-oxidase method after 48 hr treatment.[35] Results showed that *Drynaria quercifolia* (L.) J. Sm rhizome extract had a positive effect on glucose uptake. The study showed that in both the presence and absence of insulin, the conventional medication metformin markedly (p<0.001) increased glucose uptake activity, which was higher than plant extract. The plant extracts exhibited dose-dependent glucose uptake action. Plant extract of *Drynaria quercifolia* (L.) J. Sm controls lipid metabolism, thereby effectively prevents hyperglycemia.[15]

CONCLUSION

The use of herbal medicines in tribal groups to treat a variety of illnesses is growing in popularity worldwide. To uncover the mysteries hidden in plants, more efforts must be focused on methodical scientific evaluation for their safety and efficacy through rigorous preclinical investigations and clinical trials. This method will assist in determining the true therapeutic value of these herbal pharmacotherapeutics. There are many herbal products available to support health, treat symptoms, and prevent diseases. However, the majority of these products lack pharmacological scientific confirmation. Most herbal formulations cannot be advised for the treatment of many diseases due to a lack of pharmacological data supported by science. The extensive literature review and experimental data analysis lead to the conclusion that *Drynaria quercifolia* (L.) J. Sm is used as traditional treatment for anti-inflammatory, and antipyretic, employing diverse applications in analgesic and others. The herb is helpful in preventing bacterial infections, typhoid fever, loss of appetite, skin problems, and liver cancer. Additionally, it is quite

helpful for body aches, headaches, and rheumatic pain and worm infections. Considering the plant's beneficial properties, it can be recommended as a reliable, essential, and therapeutic plant for all people. Thus, this review collects much more current research, with a specific emphasis on various strategies for extracting and isolating phytoconstituents found in plants.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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