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Review of Pharmacological Activities of Ingredients in Pun Purai Ennai, a New Polyherbal Siddha Formulation

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Abstract: ***"Pun Purai Ennai" is a new polyherbal Siddha formulation that incorporates the therapeutic benefits of various traditional herbs and natural substances. The formulation includes Thespesia populnea, Sulphur, Nigella sativa, Rubia cordifolia, Terminalia chebula, Acacia catechu, Quercus infectoria, Shorea robusta, and Cocos nucifera oil. This review aims to summarize the known pharmacological activities of each component of "Pun Purai Ennai" and highlight its potential wound healing and therapeutic benefits. Thespesia populnea exhibits anti-inflammatory and antioxidant properties. Sulphur is recognized for its antifungal and antibacterial effects. Nigella sativa provides immune-modulatory and antioxidant activities. Rubia cordifolia offers hepatoprotective and anti-inflammatory benefits. Terminalia chebula acts as a natural laxative and aids digestion. Acacia catechu has antidiabetic and antimicrobial properties. Quercus infectoria is valued for its astringent and wound-healing effects. Shorea robusta is known for its anti-inflammatory and analgesic properties. Finally, Cocos nucifera provides moisturizing and antimicrobial effects on the skin. The combination of these constituents in "Pun Purai Ennai" leverages the synergistic effects of Siddha medicine to offer promising wound-healing activity. This review highlights its potential therapeutic benefits, encouraging further research and clinical trials to validate its efficacy and safety in both traditional and modern healthcare contexts.***

Keywords: Pun purai ennai, Siddha formulation, pharmacological activities, wound healing activity

1. Introduction

The World Health Organization (WHO) defines a traditional drug as 'the health practices, approaches, knowledge, and beliefs incorporating plant, animal, and mineral-based drugs, spiritual therapies, homemade ways, and exercises, applied singularly or in combination to treat, diagnose and help illnesses or maintain well- being. In some Asian and African countries, up to 80 of the population relies on traditional drugs for their primary healthcare requirements. When adopted outside of its traditional culture, the traditional drug is frequently called complementary and alternative medicine (CAM).[1] Siddha drug, a traditional system of drugs that began in ancient South India, has been practiced for centuries and holds a wealth of knowledge on the remedial properties of various herbs and natural substances. Siddha is the mother drug of ancient Tamils/ Dravidians of peninsular South India.[2] " Pun Purai Ennai" is an innovative polyherbal Siddha formulation that exemplifies the integration of this ancient wisdom with contemporary healthcare practices. Combining a mix of traditional herbs and natural substances," Pun Purai Ennai" offers a promising approach to address various health conditions, particularly focusing on its wound-healing activity. The present review article aims to summarize the therapeutic activities of each ingredient of pun purai ennai for its prospects.

Table 1: Constituents of Pun Purai Ennai

Common name and Tamil name	Botanical name	Amount
Indian tulip tree (povarasampattai)	*Thespesia populnea*	1kg
Sulphur (gandhagam)	Sulphur	50gm
Black cumin seeds (karunjeeragam)	*Nigella sativa*	50gm
Indian madder (manjitti)	*Rubia cordifolia*	50gm
Chebulic myrobalan (kadhukkai thol)	*Terminalia chebula*	50gm
Black cutch (kaaichukatti)	*Acacia catechu*	50gm
Aleppo oak(masikkai)	*Quercus infectoria*	50gm
Sal tree (Ven kungiliyam)	*Shorea robusta*	50gm
Coconut oil (thengaai ennai)	*Cocos nucifera*	5litres

Figure 1: Pun Purai Ennai

2. Preparation of Pun Purai Ennai

Pun purai ennai is a Siddha medicine, prepared using many ingredients mainly *Thespesia populnea* (povarasampattai). Heat the oil and powdered ingredients except kungiliyam, in a sand gritty consistency. Unmount the stove add the kungiliyam finally and dissolve. In the present work, pun purai ennai was procured from the Government Siddha Medical College, Chennai.

3. Pharmacological Activities of Ingredients

3.1 Thespesia populnea [3,4]

3.1.1. Antimicrobial Marvel:

Thespesia populnea, a tree native to coastal regions, harbors within its botanical bounty a treasure trove of bioactive

compounds with potent antimicrobial properties. Extracts derived from this plant have shown significant antibacterial and antifungal activities, presenting a promising avenue for the development of novel treatments against bacterial and fungal infections. Furthermore, certain extracts exhibit antiviral effects, suggesting their potential in combating viral pathogens such as respiratory syncytial viruses, Coxsackie B4, and vesicular stomatitis virus.

3.1.2. Healing Wounds, Healing Lives:
Compounds extracted from Thespesia populnea have demonstrated remarkable abilities in wound healing. Their high antibacterial activity makes them ideal candidates for inclusion in wound dressings to prevent or treat infections. Moreover, these extracts promote tissue regeneration and reduce inflammation, offering hope for the management of acute and chronic wounds.

3.1.3. Guardians of Gastrointestinal Health:
Thespesia populnea extracts show promise in treating gastrointestinal infections, thanks to their broad-spectrum antimicrobial activity. Their anti-secretory and anti-motility effects suggest potential benefits in managing gastrointestinal disorders caused by bacteria and fungi.

3.1.4. Bridging Tradition and Modern Medicine:
Studies have highlighted the integration of traditional medicinal plant extracts, like those from Thespesia populnea, into modern medicine. This integration offers new avenues for treating infectious diseases and underscores the importance of preserving and harnessing traditional knowledge.

3.1.5. Overcoming Resistance:
In the fight against drug-resistant bacterial pathogens, Thespesia populnea extracts emerge as potential alternatives to conventional antibiotics. Their efficacy against drug-resistant strains offers hope in combating the growing threat of antimicrobial resistance.

3.1.6. Promoting Preventive Healthcare:
Thespesia populnea extracts hold promise in preventive healthcare, finding potential applications in sanitizers, disinfectants, and personal care products. Their antimicrobial properties could help reduce the risk of infections and improve public health outcomes.

3.1.7. From Inflammation to Immunity:
Beyond their antimicrobial effects, Thespesia populnea extracts offer a myriad of health benefits. They exhibit anti-inflammatory, analgesic, antioxidant, and immunomodulatory properties, making them valuable allies in the management of various ailments, from arthritis to chronic inflammatory conditions.

3.1.8. Exploring Beyond Infections:
Thespesia populnea extracts showcase a diverse range of therapeutic applications, from combating infections to addressing chronic conditions. They hold promise in treating cancer, diabetes, liver damage, and skin disorders, among other ailments, offering new hope for patients worldwide.

3.2. Sulphur [5]

3.2.1. External use:
Topical application of pure sulphur, which converts into sulphide form or polythionic acid, has mild irritant and germicidal properties. It exhibits comedogenic (anti-acne) effects, making it useful for treating acne-prone skin. Sulphur has shown toxicity to the parasitic arthropod Sarcoptes scabiei, making it beneficial in the treatment of scabies. The antibacterial activity of sulphur may result from the inactivation of sulfhydryl groups in bacterial enzyme systems. Pentathionic acid, an oxidation product of sulphur, is germicidal and has bactericidal and fungicidal properties. Sulphur can also be bacteriostatic against gram-positive bacteria. In combination with other keratolytic agents (often 2% salicylic acid), sulphur is used in treating skin disorders such as psoriasis, seborrhoea, eczema, dermatitis, and lupus erythematosus.

3.2.2. Internal use:
Sulphur is insoluble in the stomach and intestine but is converted into alkaline sulphide and sulphurated hydrogen internally. This conversion stimulates peristalsis, giving sulphur a mild laxative effect. Sulphur has a soothing effect on blood vessels, relieving pain by softening the stool in conditions like hemorrhoids, fistula-in-ANO, and anal prolapse. It is used extensively in the treatment of arthritis and chronic cough.

3.3 Nigella sativa [6,7]

3.3.1. Anticarcinogenic and Mutagenic activity:
N. sativa seeds and their compounds show antitumor activity and prevent cancer or reduce the cytotoxicity of antineoplastic drugs. Thymoquinone inhibits fibrosarcoma and forestomach carcinogenesis in mice.

3.3.2. Nephroprotective action:
Thymoquinone attenuates nephrotoxicity induced by ifosfamide and cisplatin.

3.3.3. Immunomodulatory effects:
N. sativa seeds activate T-lymphocytes to secrete interleukin, suggesting a stimulator effect on macrophages. Certain proteins in *N. sativa* have both suppressive and stimulator properties in lymphocyte cultures.

3.3.4. Cardiovascular and Blood effects:
The volatile oil of *N. sativa* seeds decreases arterial blood pressure and heart rate in rats, possibly via central mechanisms. *N. sativa* oil decreases serum cholesterol, triglycerides, and glucose levels, and increases Hb and PCV levels in rats.

3.3.5. Antiulcer action:
N. sativa oil increases gastric mucin and glutathione content and reduces histamine content, suggesting a cytoprotective action.

3.3.6. Antiparasitic action:
N. sativa oil exhibits anticestodal and antinematodal properties comparable to piperazine. *N. sativa* oil is effective against Schistosoma mansoni worms and ova in mice.

3.3.7. Antimicrobial Marvel:
Nigella sativa, commonly known as black seed, emerges as a formidable contender in the realm of antimicrobial therapy. Its extracts have demonstrated robust activity against a spectrum of pathogens, including Salmonella typhi and Pseudomonas aeruginosa. Notably, sensitivity against Gram-positive bacteria such as Staphylococcus aureus and Vibrio cholerae is particularly potent. In vitro studies have even likened its efficacy to that of ampicillin. Moreover, Nigella sativa exhibits synergistic action with antibiotics like streptomycin and gentamicin, offering new avenues in combating drug-resistant strains.

3.3.8. Hepatoprotective Guardian:
Thymoquinone, a key constituent of Nigella sativa, unveils its hepatoprotective prowess by safeguarding hepatic cells against oxidative damage induced by tert-butyl hydroperoxide (TBHP). This protective effect is evidenced by a reduction in leakage of liver enzymes like alanine transaminase (ALT) and aspartic transaminase (AST), along with diminished trypan blue uptake, reflecting preserved hepatocellular integrity.

3.3.9. Antidiabetic Dynamo:
Nigella sativa emerges as a potential ally in the management of diabetes, with its essential oil demonstrating significant hypoglycemic activity. Clinical studies validate these findings, shedding light on the plant's antidiabetic potential, which holds promise for addressing glucose dysregulation and related complications.

3.3.10. Anti-inflammatory Arsenal:
Chronic inflammatory conditions like asthma and arthritis face a formidable opponent in Nigella sativa. Its seeds' fixed oil and thymoquinone exhibit potent anti-inflammatory properties, inhibiting eicosanoid generation and membrane lipid peroxidation. Moreover, Nigella sativa's antiasthmatic role is underscored by its ability to inhibit histamine release from mast cells, offering relief to sufferers of respiratory ailments.

3.3.11. Versatile Benefits:
Nigella sativa's therapeutic repertoire extends far beyond inflammation and infection. It boasts antifertility properties, inhibits oxytocin-induced smooth muscle contractions, exerts cytotoxic effects against tumors, and demonstrates analgesic actions. Additionally, reports suggest hypocholesterolemia, antihypertensive, and galactagogue effects, further solidifying its status as a multifaceted medicinal marvel.

3.3.12. Antioxidant Advantage:
Compounds isolated from Nigella sativa, including thymoquinone, carvacrol, and t-anethole, exhibit potent antioxidant effects. These substances scavenge free radicals and inhibit non-enzymatic lipid peroxidation, showcasing the plant's ability to counteract oxidative stress and mitigate cellular damage.

3.4 Rubia cardifolia [8,9]

3.4.1. Antibacterial Activity:
Rubia cordifolia exhibits significant antibacterial properties. The chloroform and methanol extracts of its root have shown specific effectiveness against gram-positive bacteria, such as Bacillus subtilis and Staphylococcus aureus, and also inhibit gram-negative Pseudomonas aeruginosa in a dose-dependent manner. These extracts demonstrate comparable activity to standard antibiotics like streptomycin and penicillin G.

3.4.2. Wound Healing Activity:
The wound-healing capabilities of Rubia cordifolia have been demonstrated in various studies. A polyherbal cream containing R. cordifolia promotes wound contraction and epithelialization in excision wounds. The plant is traditionally recognized in Ayurveda for its wound-healing properties, referred to as 'vranaropaka', and has shown effectiveness in experimental models.

3.4.3. Psoriasis and Skin Conditions:
Rubia cordifolia has the potential to treat psoriasis, a skin disorder characterized by abnormal keratinocyte differentiation and proliferation. The ethyl acetate fraction of Radix Rubiae promotes terminal differentiation and inhibits cell growth in cultured human keratinocytes, suggesting strong Antipsoriatic activity. It also shows effectiveness in reducing symptoms of eczema when applied topically.

3.4.4. Antioxidant Activity:
Rubia cordifolia extracts possess significant antioxidant properties. They inhibit lipid peroxidation and scavenge free radicals, which contributes to their potential in treating conditions like acne by inhibiting Propionibacterium acnes. The methanolic extract shows substantial lipid peroxidation inhibitory activity with an IC50 value of 138µg/ml, comparable to curcumin.

3.4.5. Anticancer Activity:
The methanol extracts of Rubia cordifolia exhibit potent anticancer activity, particularly against human cervical and larynx carcinoma cell lines, while being less cytotoxic to normal human kidney cells. Compounds like mollugin isolated from the plant have shown antiproliferative effects on various cancer cell lines, indicating its potential as a source of anticancer agents.

3.4.6. Anti-inflammatory and Analgesic Activity:
Rubia cordifolia demonstrates significant anti-inflammatory and analgesic properties. It reduces carrageenan-induced paw edema in rats and increases reaction time in the tail-flick test, indicating pain relief. The plant's extracts also inhibit the lipoxygenase pathway, reducing the production of inflammatory mediators involved in conditions like asthma and arthritis.

3.4.7. Hepatoprotective Activity:
Rubia cordifolia provides hepatoprotective effects against acetaminophen and CCl4-induced liver damage. Pretreatment with its extract significantly reduces serum levels of liver enzymes (SGOT and SGPT), indicating protection against hepatic damage. It also prevents prolongation in pentobarbital-induced sleep, further confirming its hepatoprotective properties.

3.4.8. Antiplatelet Activating Factor Activity:
Rubia cordifolia inhibits platelet aggregation induced by platelet-activating factor (PAF), suggesting its use in

conditions like thrombosis and allergic reactions. It blocks the action of PAF at its receptor level, either by blocking or desensitization, demonstrating its potential in treating platelet aggregation disorders.

3.4.9. Anti-acne Property:
Rubia cordifolia shows promise as an anti-acne agent by suppressing reactive oxygen species (ROS) and pro-inflammatory cytokines induced by Propionibacterium acnes. This activity helps in reducing inflammation associated with acne, making it a valuable addition to acne treatment regimens.

3.4.10. Anxiolytic Activity:
The triterpenes isolated from Rubia cordifolia exhibit anxiogenic activity, while the ethanolic extract shows anxiolytic effects. This dual activity suggests potential applications in managing anxiety disorders, with the ethanolic extract increasing open-arm occupancy in behavioral tests.

3.4.11. Anti-allergic Activity:
Rubia cordifolia inhibits passive cutaneous anaphylaxis in mice and rats, indicating its potential in treating allergic reactions. This anti-allergic property makes it a candidate for developing treatments for various allergic conditions.

3.4.12. Radio Protective Property:
Rubia cordifolia demonstrates significant radioprotective effects, increasing survival rates in animals exposed to radiation. The alcoholic root extract protects against radiation-induced lipid peroxidation, hemopoietic injury, and genotoxicity, making it a potential agent for mitigating radiation damage.

3.4.13. Anti-HIV Activity:
Rubia cordifolia shows promising anti-HIV potential. Various extracts from the plant reduce viral production in HIV-infected human CD4+ T-cells. This activity highlights its potential in developing treatments for HIV and AIDS.

3.4.14. Anti-Adipogenic Activity:
The anti-adipogenic activity of Rubia cordifolia involves apoptosis and inhibition of adipogenesis in preadipocytes. This property suggests potential applications in managing obesity and related metabolic disorders.

3.4.15. Gastro-protective Activity:
Rubia cordifolia exhibits significant gastro-protective effects, reducing gastric ulcer formation more effectively than ranitidine. It enhances mucosal defenses and has antioxidant properties that contribute to its gastro-protective activity, making it beneficial in treating ulcers and inflammatory bowel diseases.

3.4.16.Anti-convulsant Activity:
Rubia cordifolia shows anti-convulsant effects by raising brain GABA and serotonin levels. The triterpenes isolated from the plant inhibit seizures induced by chemoconvulsants and electric shock, indicating its potential in treating epilepsy.

3.4.17. Immunity Enhancing Activity:
Rubia cordifolia enhances both cell-mediated and humoral immunity. It improves immune responses in rats treated with immunosuppressive drugs and potentiates delayed-type hypersensitivity reactions, suggesting its use as an immunomodulator.

3.4.18. Nephroprotective Activity:
Rubia cordifolia protects against nephrotoxicity induced by drugs like cisplatin and ethylene glycol. It reduces serum creatinine and urea levels, indicating its potential to prevent kidney damage and promote renal health.

3.4.19. Cardioprotective Activity:
Rubia cordifolia exhibits cardioprotective effects by acting as a calcium channel blocker and showing diuretic activity. It may benefit conditions like congestive heart failure and diabetic cardiomyopathy, highlighting its role in cardiovascular health.

3.5 *Terminalia chebula* [10]

3.5.1. Antidiabetic Activity:
Terminalia chebula has demonstrated significant antidiabetic activity. Studies have shown that its fruit extract inhibits intestinal maltase without affecting sucrase or isomaltase, suggesting its efficacy in managing type 2 diabetes through the inhibition of α-glucosidase. Additionally, both short-term and long-term experiments indicate that T. chebula fruit and seeds reduce blood glucose levels in streptozotocin-induced diabetic rats in a dose-dependent manner, also displaying Reno's protective behavior.

3.5.2. Anticarcinogenic Activity:
The phenolics in Terminalia chebula, including chebulinic acid, tannic acid, and ellagic acid, exhibit strong growth-inhibitory effects on cancer cell proliferation. These compounds have shown significant inhibitory effects on human and mouse breast cancer cell lines, human osteosarcoma cells, and human prostate cancer cells, suggesting a potential role in cancer therapy.

3.5.3. Antiviral Activity:
Terminalia chebula also possesses notable antiviral properties. It has shown moderate effectiveness against HSV-1, HIV-1, and CMV, and when combined with acyclovir, it enhances the treatment of HSV-1 infections. The fruit contains compounds that inhibit HIV-1 integrase and reverse transcriptase, highlighting its potential in managing HIV infections. Moreover, preliminary studies suggest its potential against SARS-CoV-2.

3.5.4. Cardiotonic and Cardioprotective Activity:
Various extracts of Terminalia chebula have demonstrated cardiotonic effects by increasing cardiac output and the force of contraction without altering heart rate. Pretreatment with T. chebula extract has been observed to mitigate the effects of isoproterenol-induced heart injury in rats.

3.5.5. Antibacterial Activity:
Terminalia chebula exhibits broad-spectrum antibacterial activity against various bacterial species, including Helicobacter pylori, which is associated with gastritis, ulcers, and stomach malignancies. Its extracts have been effective against a wide range of pathogens, including those causing ear

infections and several human pathogens like S. aureus and E. coli.

3.5.6. Antifungal Activity:
The plant's antifungal efficacy has been demonstrated against several yeasts and dermatophytes. The extracts are effective against pathogens like Aspergillus niger and Candida albicans, making it a valuable resource for treating fungal infections.

3.5.7. Antioxidant Activity:
Terminalia chebula fruits are rich in antioxidants, which protect against oxidative damage. They exhibit radioprotective and antioxidant properties in cultured rat primary hepatocytes and rat liver, making them beneficial for managing oxidative stress-related conditions.

3.5.8. Cytoprotective Activity:
The ethanolic extract of Terminalia chebula fruit has shown strong cytoprotective effects against oxidative damage induced by UVB radiation. The active ingredients, gallic acid, and caffeic acid prevent cytotoxicity and have been linked to inhibiting age-dependent shortening of telomere length.

3.5.9. Antimutagenic, Radioprotective, and Chemo preventive Activity:
Terminalia chebula's aqueous extract and hydrolyzable tannins exhibit antimutagenic activity against Salmonella typhimurium and protect DNA from gamma radiation-induced damage. This radioprotective effect extends to reducing radiation-induced lipid peroxidation and DNA damage in human cells.

3.5.10. Antiprotozoal Activity:
In combination with other herbs, Terminalia chebula has shown significant anti-amoebic and anti-plasmodial activity, effectively treating amoebic liver abscess in hamsters and caecal amoebiasis in rats.

3.5.11. Anti-inflammatory and Anti-arthritic Activity:
Terminalia chebula's dried fruit extract demonstrates anti-inflammatory properties by inhibiting the production of inducible nitric oxide. It has also shown efficacy in reducing arthritis progression in animal models, making it a potential treatment for inflammatory and arthritic diseases.

3.5.12. Adaptogenic and Antianaphylactic Activities:
Terminalia chebula has potent anti-anaphylactic activity, demonstrated by its ability to reduce serum histamine levels in anaphylactic shock-induced rats. It enhances the production of tumor necrosis factor-alpha, confirming its potential in managing anaphylactic conditions.

3.5.13. Hypolipidemic and Hypocholesterolemic Activity:
The plant's extract has established hypolipidemic efficacy, reducing experimentally induced atherosclerosis and hypercholesterolemia in animal models, suggesting its use in managing cardiovascular diseases.

3.5.14. Gastrointestinal Motility Improving and Antiulcerogenic Activity:
Terminalia chebula fruit has been traditionally used as a laxative. Studies confirm its ability to improve gastrointestinal motility and protect against duodenal ulcers by enhancing the secretory state of Brunner's glands.

3.5.15. Antispasmodic Activity:
Research indicates that Terminalia chebula can reduce abnormal blood pressure and intestinal spasms, supporting its traditional use in treating digestive issues such as spastic colon.

3.6 *Acacia catechu* [11]

3.6.1. Antidiabetic Activities:
α-Amylase and α-Glucosidase Inhibition: A. catechu extracts show significant inhibitory effects on porcine pancreatic α-amylase (IC50 of 49.9 µg/mL) and α-glucosidase (IC50 of 0.4977 mg/mL).
Improvement of Glucose Tolerance: Ethanol extracts improved glucose tolerance in streptozotocin-induced diabetic rats and high-fructose high-fat diet-fed low-dose STZ-treated rats by 17-27%.
Management of Diabetic Complications: Ethanolic and aqueous extracts managed diabetic complications by inhibiting aldose reductase with IC50 values of 9.30 µg/mL and 4.70 µg/mL, respectively, against normal eye lens enzymes, and slightly different values against enzymes from STZ-induced diabetic rats.

3.6.2. Antioxidant Activities:
Radical Scavenging: A. catechu demonstrates potent antioxidant activities in various assays, such as DPPH (IC50 of 15.52 ± 0.46 µg/mL), hydroxyl radicals, superoxide radicals, and nitric oxide scavenging.
Methanol Extracts: Show significant scavenging activities across different assays including DPPH, ABTS, and reducing power assays with IC50 ranges from 92.48 to 529.30 µg/mL.
Polyphenol Content: High levels of polyphenols like catechin and epicatechin contribute to antioxidant activity, potentially aiding in diabetes management by reducing oxidative stress.

3.6.3. Antimicrobial Activities:
Broad-Spectrum Activity: Aqueous extracts of A. catechu inhibit various bacteria, such as Staphylococcus aureus, Escherichia coli, and Klebsiella pneumonia, with zones of inhibition (ZoI) ranging from 8.0 to 17.66 mm.
Resin and Leaf Extracts: Show inhibitory effects with minimum inhibitory concentrations (MICs) as low as 20 µg/mL against Bacillus subtilis and varying MICs for other bacteria.

Potential Against Gingivitis: More effective than chlorhexidine, a common antibacterial agent for gingivitis treatment.

3.6.4. Anticancer Activities:
Proliferation Inhibition: Seed extracts inhibit the proliferation of human oral squamous cell carcinoma and breast adenocarcinoma cells by increasing pro-apoptotic markers and decreasing anti-apoptotic gene expressions.

Cytotoxicity: Exhibits cytotoxicity against various cancer cell lines, including lung, prostate, and colon cancer, with IC50 values ranging from 9.0 to 251.33 µg/mL depending on the extract and cell line.

3.6.5. Antiviral Activities:
Anti-HIV Activity: Aqueous and ethanolic extracts show potent anti-HIV-1 activity with IC50 values as low as 1.7 µg/mL, inhibiting viral protease and Tat activities.
Dengue Virus Inhibition: Peptides from A. catechu inhibit dengue virus foci formation with an IC50 of 0.18 µg/mL and are effective against all four serotypes.

3.6.6. Antidiarrheal Activities:
Spasmolytic and Antispastic Effects: Extracts show beneficial effects in Guinea pigs by interacting with calcium channels and muscarinic receptors, reducing diarrhoea by 20-40% in castor oil-induced diarrhoea models.

3.6.7. Anti-Inflammatory Activities:
Reduction of Inflammatory Markers: Controls nitric oxide production, increases IL-10 secretion, and inhibits TNF-α production. Additionally, combined extracts with Scutellaria baicalensis inhibit COX-1, COX-2, and 5-LOX activities, reducing pro-inflammatory cytokines.

3.6.8. Hepatoprotective Activities:
Liver Protection: Ethyl acetate extract shows hepatoprotective effects against tetrachloride-induced liver toxicity in rats, reducing lipid peroxidation and cellular damage while increasing antioxidant enzyme activities.

3.6.9. Immunomodulatory Activities:
Antibody Production: Treatment with A. catechu extracts increases the number of antibody-producing cells in the spleen, highlighting its potential for enhancing immune responses.

3.7 *Quercus infectoria* [12]

3.7.1. Anti-inflammatory activity:
Quercus infectoria gall (QIG) possesses diverse anti-inflammatory effects, inhibiting paw edema induced by carrageenan, histamine, serotonin, and PGE_2, as well as ear inflammation induced by Phorbol Myristate Acetate. QIG extract modulates macrophage and neutrophil functions relevant to inflammation and scavenges nitric oxide (NO) and superoxide (O2−), reducing inducible nitric oxide synthase (iNOS) and neutrophil degranulation. In ulcerative colitis (UC), QIG regulates multiple pathways, particularly the NF-κB pathway, ameliorating UC in mice.

3.7.2. Anticancer activity:
Gallic acid (GA) main constituent of QIG exhibits anti-tumor effects, inhibiting growth and inducing apoptosis in various cancers, including pancreatic, lung, prostate, and skin cancer. GA also suppresses tumor metastasis by reducing cell adhesion, migration, and invasion. In colon cancer cells, QIG extract inhibits proliferation and promotes autophagy at low and medium concentrations, while inducing apoptosis-like changes at high concentrations.

3.7.3. Antioxidant activity:
Both QIG and GA demonstrate potent antioxidative effects, scavenging free radicals, and protecting against oxidative stress-induced damage.
In the liver, GA selectively induces oxidative stress in hepatic stellate cells, leading to their death without harming hepatocytes, while enhancing antioxidant capacity and protecting against liver injury.

GA enhances the brain's antioxidant defense system, protecting against neurodegenerative diseases like Alzheimer's and Parkinson's diseases, and exhibits analgesic properties.

3.7.4. Antibacterial activity:
QIG exhibits antibacterial activity against pathogens like Streptococcus mutans, Pseudomonas aeruginosa, and Shiga toxin-producing Escherichia coli (STEC). GA has bacteriostatic effects on foodborne pathogens and exhibits antiviral activities against hepatitis C virus (HCV), human papillomavirus (HPV), Newcastle disease virus (NDV), and HIV.

3.7.5. Cardiac activity:
GA protects the cardiovascular system by increasing nitric oxide (NO) content, inhibiting angiotensin-converting enzyme (ACE), and preventing myocardial infarction injury and vascular calcification.

3.7.6. Antidiabetic activity:
GA regulates glucose and lipid metabolism, improves insulin secretion, and protects islet cells from damage, making it an antidiabetic agent.

3.7.7. Antiprotozoal activity:
Both QIG and GA have anti-protozoan parasite effects, inhibiting parasites such as Leishmania major, Blastocystis hominis, and Entamoeba histolytica.

3.8 *Shorea robusta* [13,14]

3.8.1. Analgesic Activity:
Shorea robusta demonstrates significant analgesic properties. A 70% ethanol extract of its dried powder resin, when administered intraperitoneally at doses of 30, 100, and 300 mg/kg, increased reaction time in hot plate and tail flick tests, indicating central and peripheral analgesic effects. Similarly, methanolic and aqueous leaf extracts, at doses of 200 and 400 mg/kg, reduced acetic acid-induced writhing and enhanced tail-flick response in rodents, confirming their analgesic activity.

3.8.2. Antipyretic Activity:
The antipyretic potential of a 70% ethanolic extract of Shorea robusta resin was assessed using Brewer's yeast-induced pyrexia in rats. The study involved five groups of rats, with groups II-IV receiving 30, 100, and 300 mg/kg of the extract orally, respectively, and group V receiving 10 mg/kg of etoricoxib as a standard. The extract demonstrated significant antipyretic activity, validating its traditional use in treating fever.

3.8.3. Anti-inflammatory Activity:
The anti-inflammatory effects of Shorea robusta were evaluated using various models. The aqueous leaf extract, at concentrations of 100, 200, and 500 µg/ml, was compared with standard anti-inflammatory drugs such as Diclofenac and

Aspirin in the HRBC membrane stabilization and heat-induced hemolysis models. The extract at 500 µg/ml showed notable anti-inflammatory effects. Additionally, methanolic and aqueous leaf extracts (200 and 400 mg/kg) exhibited significant anti-inflammatory activities in carrageenan and dextran-induced paw edema, as well as in the cotton-pellet-induced granuloma model.

3.8.4. Antinociceptive Activity:
Methanol extracts of Shorea robusta leaves were tested for antinociceptive activity. Doses of 200 and 400 mg/kg orally demonstrated dose-dependent effects in various pain models, including the hotplate test, acetic acid-induced writhing, formalin-induced paw licking, tail clip, and tail flick tests. The extract significantly reduced pain responses, indicating strong antinociceptive properties.

3.8.5. Antibacterial Activity:
Aqueous extracts of Shorea robusta floral parts were tested against Gram-positive (Staphylococcus aureus, Bacillus subtilis) and Gram-negative (Klebsiella pneumoniae, Serratia marcescens) bacteria using the good diffusion method. The extract showed significant antibacterial activity. Phytochemical analysis revealed tannins, flavonoids, cardiac glycosides, and steroids, which contribute to its antibacterial effects.

3.8.6. Anti-obesity Activity:
Hydro-alcoholic extracts of Shorea robusta leaves were tested for anti-obesity effects in monosodium glutamate-induced obese rats. Doses of 200, 400, and 600 mg/kg were administered orally for 41 days. The extract significantly reduced body weight, organ and adipose tissue weight, and improved biochemical parameters related to lipid profile, suggesting its potential as an anti-obesity agent.

3.8.7. Antiulcer Activity:
Shorea robusta resin (150 and 300 mg/kg) was evaluated for gastroprotective effects in ethanol and pyloric ligation-induced gastric ulcer models in rats. The resin exhibited significant inhibition of gastric mucosal damage and normalized antioxidant markers. It also reduced gastric juice volume, acidity, pepsin, and protein levels while increasing carbohydrate and mucin content, indicating strong gastroprotective activity.

3.8.8. Antimicrobial Activity:
Various extracts (aqueous, methanol, petroleum, and benzene) of Shorea robusta resin showed inhibitory activity against several microorganisms. The methanol extract exhibited the most significant antimicrobial activity, while petroleum ether and benzene extracts showed less inhibitory effects. The resin's broad spectrum of antimicrobial activity is supported by the presence of various phytochemicals.

3.8.9. Immunomodulatory Activity:
Ethanolic extracts of Shorea robusta bark were tested for immunomodulatory effects in mice at doses of 100 and 300 mg/kg orally for 14 days. The higher dose significantly stimulated immunomodulatory responses, indicating the bark's potential as a natural immune system modulator.

3.8.10. Kairomonal Activity:
Compounds isolated from the bark of Shorea robusta were found to attract the sal borer pest, Hoplocerambyx spinicornis. Behavioral assays indicated positive responses, suggesting the presence of Kairomonal compounds in the bark, which could be used for pest management.

3.8.11. Free Radical Scavenging and Antioxidant Activities:
Shorea robusta bark extract (500 mg/kg) was tested for antioxidant effects in diethyl nitrosamine-induced liver cancer in rats. The extract significantly attenuated alterations in serum marker enzymes and oxidative stress markers, demonstrating potent anticancer and antioxidant properties. The extract's antioxidant activity is attributed to its phytochemical content, including flavonoids and polyphenols.

3.8.12. Wound Healing Activity:
Ethanolic extracts of Shorea robusta resin applied topically in excised and incised wound models in rats, accelerated wound contraction and increased hydroxyproline content and tensile strength, indicating effective wound healing properties. The extract's effectiveness was dose-dependent, and the presence of phytochemicals like flavonoids and terpenoids likely contributed to its wound-healing activity.

3.9 *Cocus nucifera* [15]

3.9.1. Anti-oxidant activity:
Virgin coconut oil supplementation in rats increases antioxidant enzymes, improving antioxidant defense mechanisms. Coconut oil extracted under hot conditions contains more phenolic substances, enhancing antioxidant benefits compared to coconut oil extracted under cold conditions.

3.9.2. Anti-hyperlipidemic activity:
Virgin coconut oil lowers total cholesterol, triglycerides, phospholipids, LDL, and VLDL while increasing HDL. Lauric acid and capric acid in coconut oil show activity against gram-positive and gram-negative organisms and Candida. Coconut oil feeding in rats produces lower pre-beta lipoproteins (VLDL) and higher alpha-lipoproteins (HDL) compared to sunflower oil.

3.9.3. Anti-viral activity:
Monolaurin, a derivative of lauric acid in coconut oil, exhibits virucidal effects on enveloped RNA and DNA viruses. Certain medium-chain fatty acids like lauric acid and their derivatives have adverse effects on various microorganisms, including enveloped viruses.

3.9.4. Anti-microbial activity:
Lauric acid and capric acid in coconut oil are active against gram-positive and gram-negative organisms and Candida. Coconut oil in water emulsions shows antimicrobial effects against bacteria and fungi in vitro.

3.9.5. Healing activity:
Virgin coconut oil-treated wounds heal faster due to increased collagen and antioxidant enzyme activities, leading to improved wound healing.

3.9.6. Moisturizing activity:
Coconut oil is as effective and safe as mineral oil in moisturizing dry and rough skin.

3.9.7. Immunomodulator activity:
Virgin coconut oil enriched with zinc increases certain immune cells and cytokines while maintaining neutrophils and NK cells.

3.9.8. Anti-diabetic activity:
Virgin coconut oil possesses insulinotropic effects and hypolipidemic effects, reducing blood glucose and lipid levels. Coconut oil extracts reduce blood glucose and lipids and elevate antioxidant enzyme activities in diabetic rats. *Cocos nucifera* flower extract and coconut oil exhibit anti-hyperlipidemic and anti-diabetic effects in diabetic rats. Monounsaturated fatty acids in coconut oil improve β-cell secretory function and decrease β-cell apoptosis.

3.9.9. Anti-obesity properties:
Virgin coconut oil reduces visceral adiposity in obese men. Coconut oil elevates HDL levels and reduces abdominal obesity in women.

3.9.10. Anti-Cancer activity:
Coconut oil exhibits anti-cancer effects in various studies. Coconut oil shows protective effects against chemically induced colon and breast cancers.

3.9.11. Antithrombotic properties:
Virgin coconut oil has significant antithrombotic effects over copra oil. A coconut oil-based diet with high saturated fatty acids lowers postprandial t-PA antigen concentration, potentially affecting the fibrinolytic system and Lp-a concentration.

4. Conclusion

The integration of traditional medicine, such as Siddha medicine, with contemporary healthcare practices, has led to the development of innovative formulations like "Pun Purai Ennai." This polyherbal Siddha formulation comprises various natural substances, including Indian tulip tree, sulphur, black cumin seeds, Indian madder, chebulic myrobalan, black cutch, Aleppo oak, Sal tree, and coconut oil. Each constituent offers a plethora of pharmacological activities, such as anti-inflammatory, analgesic, hepatoprotective, wound-healing, antioxidant, immunomodulatory, antimicrobial, and anti-cancer properties. The formulation exemplifies the rich knowledge of traditional medicine and holds promise in addressing various health conditions, with a particular focus on wound healing.

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