



From Fruit to Pharmacy: A Comprehensive Review on *Grewia asiatica* for its Current Knowledge and Future Prospectives.

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(Received: 05 January 2026

Revised: 15 February 2026

Accepted: 05 March 2026)

KEYWORDS

Grewia, Phalsa, Pharmacology, Phytochemistry, Flavonoids.

ABSTRACT:

Grewia asiatica Linn. (Phalsa) is an overlooked fruit shrub, treasured in Southern Asia for its nutritional and therapeutic properties. Over a decade of years, the plant seeks scientific attention, highlighting the plant's potential in nutraceutical, pharmaceutical and food industries. This study consolidates current knowledge on botany, pharmacognostical compositions, pharmacological and traditional applications of *Grewia asiatica*. All the research data on *Grewia asiatica* was gathered using PubMed, Google Scholar, ScienceDirect, Springer, Taylor & Francis, and Web of Science database. Review revealed the presence of flavonoid, anthocyanin, and various phenols as major bioactive components of various parts of the plant. Traditionally various parts of plant have been used in Unani, Ayurveda, and folk medicines for curing pyrexia, gastrointestinal tract and respiratory disorders, dermatitis, and hypovolemia. The core of the review focuses on the Pharmacological evaluation reveals by the scientific research such as strong antioxidants, anti-inflammatory, antidiabetic, neuroprotective, antimicrobial, antiemetic, radioprotective, anticancer, hepatoprotective, nephroprotective, etc. in both in vivo and in-vitro. Additionally, phalsa shows optimistic capability in reducing oxidative stress and related disorders, due to the presence of high phenolic content. Despite these promising findings, gaps remain regarding standardized extracts, clinical validations, limited safety data, and molecular-level investigation of the mechanism of action. This review emphasizes the need for advanced toxicological and pharmacological assessment for the development of phytopharmaceuticals.

Introduction

Plants are a very important and integral part of the universe. After Underutilised wild fruit species have great economic, nutritional as well as being a potential source of desirable quality traits (1). *Grewia asiatica*, a shrub of the Malvaceae family, is distributed in various regions of the world. Locally recognised as 'parusaka' or 'phalsa' in Hindi, 'shunkri' in Bengali, 'malai', 'po tao hai' in Thai, 'nhap' in lao, and phalsa as trade name (2). The word '*Grewia*' comes from the name of N. Grew (1641-1712), the father of plant anatomy, and covers almost 150 species (3). The *Grewia asiatica* originated in Asia and is the only food plant from this genus. Predominantly it's cultivated for its small, fleshy, reddish pomes. For agronomic frames, its highly versatile to the environment and abides a broad range of soil and climatic conditions with limited need of watering (4). Conventionally, all parts of the plants are

used for the treatment of inflammation, pyrexia, and lung disease by Ayurveda and the tribal community of India (5). In India, the demand of the fruit has been steadily increasing in markets due to its health benefits. *Grewia asiatica* contains the anthocyanin type cyanidin 3-glucoside, carotenes, niacin, minerals, vitamins B and C, dietary fibres, etc. (6). Studies show that the plant possesses antioxidant, hepatoprotective, antifungal, antimicrobial, analgesic, anticancer, litholitic and many more pharmacological activities (7).

Chromatographic techniques are mostly used for isolation of phytochemicals from extract. A wide range of sophisticated analytical technique such as UV-Visible, Fourier transform infrared (FTIR), Nuclear Magnetic Resonance (NMR) and Mass spectroscopy are used for characterization of a natural compound uses (8). The majority of literature mentions preliminary pharmacognostical and pharmacological properties of



plant (7) (3) (9) (10). This review aims is to provide an overarching overview of *Grewia asiatica*, covering its botanical peculiarities, ethno-medicinal uses, Phytochemistry, pharmacological activities and future possibilities in the food and pharmaceutical industries.

Materials and methods

An in-depth examination of previous studies on *Grewia asiatica* was conducted using all available sources, such as Research data were retrieved from the PubMed, Google Scholar, ScienceDirect, Springer, Taylor & Francis, Scopus, and Web of Science. For the literature survey keywords were combined in information retrieval system.

Botanical and Nutraceutical Description

Grewia asiatica is native to Nepal and India. In India, the plant are grown mostly in elevated regions of Himalayas, Punjab, Mumbai, Uttrakhand and Delhi. It's also cultivated in Laos, Sri Lanka, Pakistan, Cambodia, Bangladesh (2). The plants are grown to a height of 5-6 meters, with wide, ovoid and sharp-edged leaves approximately 6-18 cm in length. Phalsa have tiny yellowish flowers with 4-5 mm of five small petals and 12 mm of five large sepals (3). The fruit are oval, 1-2 cm in dia., 0.29-1.14 g in weight, appear in winters and ripen in hot summers. Unripe fruits are whitish - green in colour and becomes red, purple or black on ripening and taste sweet (5). The seeds are 4.71-6.51 mm in length and 3.94-6.09mm in width, having 0.04-

0.11 g of weight. Generally, 1-5 seeds per fruit is present (11). The plant is largely avoided in the trade market due to the large ripening period, regular harvesting, small size and short shelf life of fruit (12). It's cultivation near to cities, getting readily sale. The shelf life of fruit should be increased by the use of digestible coatings such as 1% olive oil, 0.40% HPMC, 20.25% potassium Sorbate and 3.45% soy protein isolate so it can easily reached to market (13). Local and Sharbati are the two varieties found in India, mostly in Haryana and Kanpur (3).

Phalsa are a calorie-deficient fruit (209 Kcal.) that contain a lot of nutrients. According to the studies, fruits possess protein, carbohydrate, Ascorbic acid, niacin, fibre, fat, iron, phosphorus, calcium, minerals. (14), (10). The detail of nutritional profile of plant is depicted in Table 1. Fibre helps to manage diabetes, obesity, hypertension, digestion, tumors and cholesterols mediated gall stones. Vitamins reduce oxidation, ageing, sterility, and boost collagen, wound healing, iron absorption, blood formation and body defense mechanism. Mineral such as Sodium (fluid and pH balance), potassium (Strong muscles), calcium (strong bones and muscles, nerve signaling) are important for proper functioning of organelles (15). Seeds have yellow colored oil that covers fatty acids (5%), stearic acid (11%), unsaponifiable material (3%), linolic acid (64.5%), oleic acid (13.4%), palmitic acid (8.3%) (16).

Table 1 Nutritional composition of different parts of *Grewia asiatica*.

Nutrient	Fruit		Seeds	Leaves	
Carbohydrate (g)	21.1	-	39.07	3.7	-
Fibre (g)	5.53	-	26.1	-	-
Ash (g)	1.1	5.25	5.08	2.70	2
Moisture (%)	7.30	32.93	-	10.83	28.18
Protein (g)	1.57	-	17.4	-	-
Lipid (g)	<0.1	-	11.1	-	-
Cobalt (%)	0.99	-	-	-	-
Copper (%)	0.48	-	-	-	-
Nickel (%)	2.61	-	-	-	-



Iron (%)	140.8	-	-	-	-
Vit A (g)	16.11	-	-	-	-
Vit B1 (mg)	0.02	-	-	-	-
Vit B2 (mg)	0.264	-	-	-	-
Vit B3 (mg)	0.825	-	-	-	-
Vit C (mg)	4.385	-	-	-	-
pH	-	5.36	-	-	6.48
Ref.	(17)	(18)	(5)	(10) (14)	(18)

Biologically Active Compounds

Phalsa is rich in various phytoconstituents. The stems, roots, seed, flower, fruit, bark and leaves of phalsa possess different saponins, flavonoids, tannins, terpenoids, phenol, glycoside and alkaloids, extracted using various solvents. The quantity of constituents fluctuates in seeds, leaves and flowers and also by the concentration of solvents (19). The chloroform, petroleum ether, methanol and aqueous soluble extractives of leaves are 13.0%, 23.3%, 19.01%, 23%, respectively (20). Additionally, the plant also contains various secondary metabolites. Phalsa fruit shows the presence of caffeic acid (957 µg/g), morin (130 µg/g), catechin (1230 µg/g), chlorogenic acid (491 µg/g), cerotic acid as a biologically active metabolite (21) (22). Vijay Lakshmi et al. isolate a δ -lactone (3,21,24-trimethyl-5,7-dihydroxyhentriacontanoic acid) from the flower of phalsa, Table 2 (23).

Anthocyanin

The acidified methanolic extract contains the highest (1193.8 µg/g) amount of anthocyanin. Phalsa fruit contains Cyanidin-3-O-(6''-acetyl glucoside) (695 µg/g), delphinidin-3-O-glucoside (6.5 µg/g), peonidin-3-O-glucoside, pelargonidin-3-O-malonyl glucoside,

Peonidin-3-O-(6''-acetyl glucoside) (163.6 µg/g), pelargonidin-3-O-(6''-acetylglucoside) (140.4 µg/g), malvidin-3-O-glucoside pyruvic acid (24) and Petunidin (0.40 µg/g) (7).

Flavonoids

Aqueous extract of phalsa shows 9.9 ± 0.5 (mg QE/g DW) of total flavonoid (25). Acetone extract of leaves shows 4 mg QE/g DW. Fruit contains Apigenin-6-C-galactoside-8-C-arabinoside, Apigenin-7-O-apiosyl-glucoside, Luteolin-4'-glucoside, Luteolin-7-O-(2-apiosyl-6-malonyl)-glucoside, 6-Hydroxyluteolin, 6-Methoxyluteolin/Nepetin and Narirutin (7).

Phenols

The methanolic extract of fresh stem bark of phalsa contain 90.163 ± 0.341 mg GAE/g of phenols and confirms the presence of 7 polyphenols, i.e., campesterol, stigmasterol, γ -sitosterol, 13-oxabicyclo[11.1.0]tridecane, n-hexadecanoic acid, falcariol, 2-chloroethyl carbonate, 1,2-dichloropropane having molecular weights of 400.7, 412.7, 436.6, 182.30, 256.42, 244.37, 187.02, 112.98 g/mol, respectively. Total phenolic content in acetone extract of leaves is 8.2 mg GAE/g (26).

Table 2 compound isolated from *Grewia asiatica* (22) (27).

S.no	Plant part	Compound
Flavonoids		
1.	Fruit	(-)-Epigallocatechin-7-O-glucuronide
2.		3-O-L-rhamnopyranosyl(1,2)- β -D glucopyranosylkaempferol



3.	6,7,3',4'-Tetrahydroxyisoflavone	5,7,8,3',4'-Pentahydroxyisoflavone
4.	6-Aldehydeisooophiopogonone	
5.	6-Hydroxyluteolin	
6.	6-Methoxyluteolin	
7.	7-Hydroxyflavanone	
8.	Apigenin-6-C-galactoside-8-C- arabinoside	
9.	Apigenin-7-O-apiosylglucoside	
10.	Calycosin	
11.	Catechin	
12.	Cyanidin 3-galactoside	
13.	Cyanidin-3-O-(6''-malonyl-3''- glucosyl-glucoside)	
14.	Cyanidin-3-O-arabinoside	
15.	Cyanidin-3-O-sambubioside	
16.	Delphinidin 3-O-glucoside	
17.	Delphinidin-3-O-arabinoside	
18.	Delphinidin-3-O-sambubioside	
19.	Dihydrodaidzein-7-O-glucuronide	
20.	Dihydroquercetin	
21.	Dihydroquercetin-3-O-hexoside	
22.	Epicatechin	
23.	Epigallocatechin	
24.	Genistein	
25.	Hesperetin-3'-O-glucuronide	
26.	Isorhamnetin 3-glucoside-7- xyloside	
27.	Kaempferol	
28.	Kaempferol-3-O-galactoside-7-O- rhamnoside	
29.	Kaempferol-3-O-glucoside	
30.	Kaempferol-3-O-xylosyl- glucoside	
31.	Liquiritigenin	
32.	Luteolin-4'-glucoside	
33.	Luteolin-7-O-(2-apiosyl-6- malonyl)-glucoside	
34.	Malvidin-3-O-glucoside pyruvic acid	



35.		Methylgalangin
36.		Morin (3, 5, 7, 2, 4- pentahydroxyflavone)
37.		Myricetin
38.		Myricetin-3-O-arabinoside
39.		Myricetin-3-O-galactoside
40.		Myricetin-3-O-rhamnoside
41.		Narirutin
42.		Pelargonidin 3-O-(6''-malonyl- glucoside)
43.		Pelargonidin-3-O-(6''acetyl glucoside)
44.		Petunidin
45.		Quercetin
46.	Stem and roots	Quercetin-3-(caffeoyl- diglucoside)-7-glucoside
47.	Fruit	Quercetin-3-O-(6''-malonyl- glucoside)
48.		Quercetin-3-O-(6''-malonyl- glucoside)-7-O-glucoside
49.		Quercetin-3-O-galactoside-7-O- rhamnoside
50.		Quercetin-3-O-glucosyl-xyloside
51.		Quercetin-3-O-xyloside
52.		Quercetin-4'-O-glucoside
53.		Quercetin-7-O-glucoside
54.		Rhamnetin
Phenol and phenolic acids		
55.	Fruit and root	Caffeic acid
56.		Chlorogenic acid (5- Caffeoylquinic acid)
57.		Ellagic acid
58.	Fruit	Gallic acid
59.		Mangiferin
60.		P-Coumaroyl glycolic acid
61.		Umbelliferone
62.		Vidalenolone
Other compound		
63.	Fruit	Quinic acid
64.	Leaves and fruit	A-Amyrin



65.	Fruit	Cerotic acid
66.		2,10-Dimethyl-6-methylene dodecan-1-oic acid
67.	Flower	3,21,24-trimethyl-5,7- dihydroxyhentriacontanoic acid d-lactone
68.	Fruit	Vit A
69.		Vit C

Traditional uses

The study reveals that the whole plant is used in ancient medicine as having multiple health benefits, Table 3. The fruit are consumed in various forms such as juices, pies, jams, squashes, and chutneys especially in hot summers. Fruit juice and decoctions are used for dehydration, spermatorrhoea, anorexia, gastric issues, tuberculosis, sterility, and diarrhoea. Leaves decoction provide relief in cancer, emesis, dermatitis and microbial infection. Root and root bark extract used to cure simple fractures and arthritis and Urinary infections respectively. Seeds are used to prevent pregnancy (3). Additionally, stem, bark, leaves and fruit are used as fodder, make ropes and their extract used during calf birth as it aids the release of placenta in animals (4).

Table 3 Traditional application of *Grewia asiatica* (28)

Plant part	Application
Stem and roots	Calf delivery (Boiled with water and ajwain and give to cattle (aid to release placenta)
Ripe fruit	Cardiovascular, stomatitis, eyes, blood related problems, tuberculosis, dehydration, fever and headache
Leaves and fruit	Piles and joint pain
Fruit	Stomach cools, Wound healing and rheumatism, Diabetes control, Controlling urinary tract infections, Controlling nausea and vomiting, Fever control, Morning and motion sickness and diarrhoea

Root bark	Diarrhoea, aphrodisiac
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Pharmacological Applications

The study investigated that methanolic and aqueous extract of leaves and fruit contain maximum phytoconstituents; hence show maximum physiological response, compared to other solvent extracts. Leaves and fruits have significant antioxidant, anti-inflammatory, antitumor, hepatoprotective, and radioprotective activity. The therapeutic response of *Grewia asiatica* extract are depicted in Table 4.

Antioxidant activity

The petroleum ether extract of leaves shows the highest in-vitro DPPH ($249.60 \pm 7.37 \mu\text{g/mL}$) (29). Fruit extract of phalsa shows $\text{IC}_{50} = 218.47 \mu\text{g/ml}$ and DPPH scavenging activity in mice testis (30). Aqueous extract of phalsa have 11.7 ± 1.0 and 18.3 ± 4.1 Vit C equal mg/g DW total antioxidant and free radicle scavenging capacity respectively (25). Acetone extract of leaves possesses strong antioxidant activity due to the presence of a high amount of polyphenols and alkaloids (31). Alcoholic extracts of leaves show low IC_{50} in superoxide, DPPH and NO radical inhibition; the data are 35.59 ± 1.68 , 151.80 ± 1.79 and 9.16 ± 1.05 mg/ml, respectively (32).

Antiplatelet activity

A study on leaf extract of phalsa showed arachidonic acid-induced platelet aggregation inhibition in a dose-dependent manner (33).

Antilithiatic activity

Phalsa contain flavonoid and triterpenoids that may be responsible for blocking the formation of calcium



oxalate crystal by ethanolic extract of leaves (400 mg/kg) in rats kidney (34).

Antiemetic activity

The ethanolic fruit extract at 120 mg/kg body weight orally significantly stops Apomorphine-induced emesis in a dogs model, within 3 hrs (35). Leaves of phalsa show antiemetic activity in chicks against anhydrous copper sulphate induced emesis (36).

Anticancer

A study on fruit of phalsa (hydroalcoholic fraction) shows IC₅₀ against HEP-2 (51.4 µg/mL), NCI-H522 (63 µg/mL), MCF-7 (26.2 µg/mL) cancer cells (21). Study suggested that the hydro extract of fruit and leaves of phalsa reduce MCF-7, NCI-H522 and HEK-293, liver and breast cancer cell lines (37). Study suggested that 500 mg/kg methanolic extract of phalsa leaves prevents the Ehrlich's ascites induced carcinomic tumour formation by 61.06% and shows 50% anti-cytotoxicity activity (in-vitro) against MCF-7, Hela, HL-60 and K-562 cell lines (38).

Anti-inflammatory

A 500mg/kg dose of methanolic and aqueous extract of fruit shows significant reduction in inflammation by 36.12% and 32.44% inhibition of carrageenan induced paw oedema, respectively (39).

Analgesic/ antipyretic activity

The aqueous extract in a dose of 400 mg/kg reduces the pyrexia (lipopolysaccharide-induced) within min, and in a dose of 300 mg/kg inhibits the pain induced by the hot plate (40). Aqueous and methanolic fruit extracts of phalsa decrease acetic acid induced writhing to 55.34% and 61.81%, respectively. Study suggested that fruit extract also reduces brewer's yeast induced pyrexia in a dose dependent manner (39).

Anti-hyperlipidaemic / antidiabetic activity

It is investigated that oral administration of ethanolic extract of phalsa bark (400m/kg) restores hepatic glycogen and significantly decreases SGOT (dose-dependent manner) in alloxan induced diabetic rats (41). study (streptozotocin-induced diabetic rats) found that fruit extract (100 or 200 mg/kg/day) reduced serum glucose, MDA, IL-1 β , TNF- α and increased liver glycogen, pancreatic GSH and SOD enzyme activity

(42). Ethanolic extract of leaves at 200 mg/kg body weight has proven the reduction in glycaemic index ($p < 0.01$) alloxan induced hypo-glycemic rats (43).

Cognitive activities

The fruit extract reduces acetylcholinesterase and malondialdehyde and increases SOD and GSH levels. Extract also improved transfer latency, discrimination index ($P < 0.05$), escape latencies ($P < 0.05$), etc. when tested in a scopolamine-induced cognitive impairment in Sprague-Dawley rats (44).

Nephroprotective and hepatoprotective activity

A recent study investigates that polysaccharides isolated from phalsa leaves show a significant amelioration in ALP, AST and ALT levels in carbontetrachloride-induced hepatotoxicity in rats (10). Administration of alcoholic extract of phalsa at 400 mg/kg significantly increase CAT and SOD and reduce TBARS level in carbontetrachloride control liver and kidney (32).

Radioprotective activity

A study done on liver and testis (Swiss albino mice) observes that the phalsa fruit protects RNA and DNA (45) and Increases the number of spermatocytes and sperm from the exposure of 5G gamma radiation (30). Fresh fruit extract of phalsa (700 mg/kg) protects mice cerebellums from 5 Gy and 10Gy irradiation by increasing GSH, RNA, DNA and protein content and reducing lipid peroxidation in 15 -10 days (6)(46)(47).

Other activities

Phalsa fruit shows vasodilator and antispasmodic activity by increasing nitric oxide from vascular endothelium and blocking the potassium channel in rabbit jejunum, respectively (48). Ethanolic extract of fruit show immunostimulant activity against cyclophosphamide induced myelosuppression. The activity was seen at 400 mg/kg in Swiss albino mice (9). Acetone extract of leaves inhibits the growth of *Trichophyton* spp., *Candida* spp., *Aspergillus* spp. and *Microsporum* spp. Extract show the maximum zone of inhibition (32 mm) for *Aspergillus fumigatus*, showing a potent antifungal activity (31).

Toxicology

Administration of an alcoholic extract of leaves at a dose of 2000 mg/kg proves nontoxic in an acute toxicity



study (34). alcoholic fruit extract was administered to albino rats and mice at doses of 50-600 mg/kg; no toxicity was observed in acute oral toxicity (35).

Methanolic fruit extract at did not induce any toxic symptoms up to a dose of 1000mg/kg (46)

Table 4 Biological activities Grewia asiatica extracts

Extract	Dose	Result	Ref
Analgesic			
Methanolic and aqueous fruit	125, 250, 300, 500 mg/kg	Showed significant analgesic activity	(39)(40)
Antidiabetic			
Ethanollic fruit and leaves	100, 200, 400 mg/kg	Showed antidiabetic activity by improving serum glucose and pancreatic beta-cells	(28)(43)
Ethanollic barks	200, 400 mg/kg	Improve normal cellular population size of islets in rats	(41)
Methanolic leaves	100,250,500 mg/kg		(36)
Anti-inflammatory			
Methanolic, 50% hydro-methanolic and aqueous fruit	125, 250, 500 mg/kg	Extracts showed significant anti-inflammatory activity in dose dependent manner	(39)(49)
Anticancer			
Methanolic leaves	250 and 500 mg/kg	Show significant cytotoxic effect against HL – 60, K – 562, MCF – 7, hep-2, NCI-H522 and Hela cancer cell lines and antitumor activity	(38)
50% hydro-methanolic fruit	0.5–200 µg/ml		(49) (21)
Aqueous fruit and leaf	0.01-100 µg/ml	Shows cytotoxic activity on kidney, lung, cervical, laryngeal, prostate and breast cancer cell line	(37)
Ethanollic leaf	20, 40, 80, 160 µg/ml		(14)
Antiemetic			
Methanolic leaves	50, 100 mg/kg	Control Apomorphine induced emesis within 3 h.	(36)
Alcoholic fruits	120 mg/kg body		(35)
Antimalarial			
Methanolic leaves	50, 100 mg/kg	Extract showed antimicrobial activity against tested pathogens.	(36) (28)
Ethanollic fruit, barks and leaves	5mg/ml		
Spasmolytic effect			
70% methanolic fruit	10 mg/ml	Shows antispasmodic (kco mechanism in git)and vasodilator activities (release of no)	(48)



Antinociceptive			
Methanolic, 50% hydromethanolic fruit	200, 400 mg/kg	Showed antinociceptive activity	(49)
Antifertility			
Seeds	500mg/kg	Seed oil act as early abortifacient, antiembryonic, anti-implantation	(50)
Antioxidant			
Methanolic fruit	5-50 ppm	Show strong hydrogen donating, radicle scavenging activity	(28)
Ethanolic bark and leaves	25 - 250 µg/ml		(51)(41)(14)
Acetone leaves	100 µl/ml		(31)
Antimicrobial			
Acetone leaves	100 µl/ml	Potent against aspergillus spp., candida spp., microsporium spp. And trichophyton spp.	(31)
Aqueous extract	-	Inhibit the growth of bacteria without rupturing cell	(25)
Methanolic leaves	1000,1500,2000 µg/ml	Inhibit urdbean leaf crinkle virus	(3)
Antiplatelet			
Metanolic leaves	1-10 mg/ml	Showed potent platelet aggregation inhibition activity	(33)
Hepatoprotective			
Methanolic fruit	700 mg/kg	Extract significantly reduce ALP, SGOT and SGPT in rat	(45)
Ethanolic leaves	100, 200 mg/Kg		(51)
Neuroprotective			
Petroleum ether, chloroform and methanolic berry	200mg/kg	Modulate acetylcholinesterase, oxidative stress and monoamines in rats.	(52)
Methanolic fruit	10-30% dilution	Show effect via gabaergic, serotonergic, and cholinergic mechanism in neurons	(44)
Radioprotective			
Methanolic fruit	700 mg/kg	Showed significant prophylactic action against metabolic disorders in mice cerebrum, intestine and testis	(47)(6) (53) (30)
		Provide significant modulation in blood constituents GSH, sugar, and protein, LPO and cholesterol levels against radiation-induced	(54) (46)



		alterations in mice	
Immunomodulatory			
Ethanollic fruits	200 and 400 mg/kg	Showed significant increase in WBC, neutrophil, hemoglobin and phagocytic index	(9)
Antihyperlipidemic			
Ethanol bark	200 and 400 mg/kg	Show dose dependent reduction in SGOT and CK-MB and increase liver glycogen level	(41)

Future Directions

Phalsa is a food and also a medicinal plant, but the nutraceutical and pharmacological boundaries should not be clarified in a regulatory context. Most of the studies include crude extracts; isolated active components, dose standardization, and long-term toxicity profiles are lacking. The majority of studies are preclinical, and few are in human subjects. Safety, tolerability and translational data could be envisioned. The molecular target for biological activities is not fully elucidated. More pharmacokinetic studies, standardization and quality control would help in the development of phytopharmaceuticals of phalsa.

Conclusion

Phalsa is a promising medicinal plant with both nutritional and therapeutic potential. The traditional uses of the plant (cooling, demulcent, inflammation, rheumatism, etc.) are backed by increasing Pharmacognostical (phenolic/flavonoids/anthocyanins) and pharmacological evidence (antioxidant, anti-inflammatory, antidiabetic, neuroprotective, Nephroprotective activities). While the body of evidence is growing, translation toward clinical application requires further standardisation, safety/efficacy trials and mechanistic work. The current study will provide the basic data to the researcher for the establishment of future research on the hidden potential of the phalsa plant.

Conflict of Interest

Authors must not have any conflict of interest.

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