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Narikelasava: An Ayurvedic Fermented Formulation – A Review of Its Ethnopharmacology, Phytochemistry, and Pharmacology

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Abstract

Narikelasava (*Nalikerasavam*) is a classical *Ayurvedic Sandhana Kalpana* (fermented preparation) described in the medieval text *Gada Nigraha*, valued for pleasant organoleptic properties, long shelf life, and self-generated alcohol that enhances the extraction and bioavailability of both water- and alcohol-soluble constituents. Traditionally regarded as *Vajikarana* (aphrodisiac) and *Rasayana* (rejuvenative), it is indicated for sexual health, longevity, skin quality, and restoration of vitality, and is increasingly considered for conditions requiring anti-inflammatory, immunomodulatory, hepatoprotective, antioxidant, and rejuvenative support. This review aimed to compile dispersed classical and modern evidence on *Narikelasava*, appraise the pharmacology of its ingredients, and contextualise its therapeutic potential for contemporary healthcare. Information was synthesised from classical sources (*Gada Nigraha, Bharata Bhaishajya Ratnakara, Vaidya Chintamani*) and English-language literature indexed in PUBMED, Google Scholar, ScienceDirect, Web of Science, and Scopus, searched up to 2025 using formulation- and ingredient-specific keywords (e.g., Cocos nucifera, *Dashamoola*, *Woodfordia fruticosa*/*Dhataki*, *Bombax malabaricum*/*Shalmali*, phytochemistry, pharmacological activity). *Narikelasava* is prepared by fermenting tender coconut water (*Narikelodaka*) with sugarcane juice, *Dashamoola*, *Shalmali*, *Chaturjata*, and other herbs in a ghee-smeared airtight container for one month, followed by filtration. Phytochemical evidence across ingredients indicates diverse bioactives including medium-chain fatty acids (lauric acid up to 52%, caprylic/capric acids), nuciferoic acid, phenolics, macrocyclic hydrolysable tannins (woodfordin C, oenothein B), flavonoids (kaempferol, quercetin), volatile oils, and sterols/triterpenes (β-sitosterol, lupeol), characterized using techniques such as HPLC, NMR, and MS. Pharmacological findings from in vitro, in vivo, and preliminary clinical studies support synergistic antiinflammatory actions (including NF-κB/IκB pathway modulation and prostaglandin synthesis inhibition), immunostimulation (e.g., macrophage activation, TLR engagement), hepatoprotection in toxin/drug-induced models with restoration of antioxidant status, and aphrodisiac benefits notably linked to Tribulus terrestris, complemented by sedative/anxiolytic contributions from *Valeriana wallichii* and mood/sexual health support from Crocus sativus. Collectively, the formulation's ingredient synergy and fermentation-enabled extraction substantiate its traditional claims and justify its consideration as an adjunct in geriatric care and chronic inflammatory disorders, while highlighting the need for rigorous mechanistic studies and well-designed clinical trials to confirm safety and efficacy.

Keywords: Ethnopharmacology, Phytochemistry, Pharmacological evaluation, *Narikelasava*, Fermented formulation, *Gada Nigraha*, *Vajikarana*, *Rasayana*, Anti-inflammatory, Immunomodulatory

Introduction

The *Ayurvedic* pharmacopoeia encompasses a diverse range of formulations, including *Sandhana Kalpana* (fermented preparations), which hold a distinct position due to their dual benefits—medicinal efficacy and enhanced bioavailability. Among these, *Asava* and *Arishta* are the most widely utilised, valued for their pleasant organoleptic properties, extended shelf life, and self-generated alcohol, which aids in the extraction of both water- and alcohol-soluble active constituents.

Gada Nigraha, a significant medieval *Ayurvedic* text, describes many indispensable formulations, including *Narikelasava* (also known as *Nalikerasavam*). As the name suggests, *Narikela* refers to coconut, with tender coconut water serving as the primary ingredient of this unique formulation. Classical *Ayurvedic* texts describe *Narikelasava* as an aphrodisiac (*Vajikarana*) and a rejuvenative (*Rasayana*) tonic, traditionally indicated for improving sexual health, promoting longevity, enhancing skin quality, and restoring vitality. Its unique composition also includes sugarcane juice, *Dashamoola* (a group of ten roots), *Shalmali* (*Bombax malabaricum*), *Chaturjata* (a group of four spices), and other herbs, all of which contribute to its therapeutic potential.

This review aims to compile the scattered data on *Narikelasava*, evaluate the pharmacological properties of its individual ingredients, and explore its potential as a therapeutic agent in modern healthcare contexts, particularly in conditions requiring anti-inflammatory, immunomodulatory, hepatoprotective, and rejuvenative support. This evidence-based exploration may serve as a foundation for future preclinical and clinical research.

Methodology

All information summarised in this review article was derived from classical *Ayurvedic* texts, including *Gada Nigraha*, *Bharata Bhaishajya Ratnakara*, and *Vaidya Chintamani*, as well as original research articles from PUBMED, Google Scholar, ScienceDirect, Web of Science, and Scopus. The keywords used for searching relevant research articles included: "*Narikelasava*," "*Nalikerasavam*," "*Cocos nucifera*," "*Narikela*," "*Dashamoola*," "*Woodfordia fruticosa*," "*Dhataki*," "*Shalmali*," "*Sandhana Kalpana*," "phytochemistry," and "pharmacological activity." This search was conducted until 2025, focusing only on literature published in English.

Composition of *Narikelasava*

Narikelasava is prepared using a complex combination of herbal ingredients. The primary component is *Narikelodaka* (coconut water), which serves as the fermentation base. The detailed composition, based on classical references, is presented in Table 1.

Table 1: Composition of *Narikelasava* (as per classical texts)

Ingredient Category	Ingredient Name	Sanskrit/Botanical Name	Quantity
***Dravadravya* (Liquid Base)**	Coconut water	*Narikelodaka* (*Cocos nucifera*)	12.288 litres
	Sugarcane juice	*Ikshu rasa* (*Saccharum officinarum*)	6.144 litres
	Juice of *Shalmali*	*Shalmali* (*Bombax malabaricum*)	768 ml
	Dashamoola Kwatha (decoction)	*Dashamoola* (group of ten roots)	768 ml
***Prakshepa Dravya* (Additives)**	*Chaturjata*	*Cinnamomum zeylanicum*, *Elettaria cardamomum*, *Cinnamomum tamala*, *Mesua ferrea*	6 g each (powder)
	Dhataki	*Woodfordia fruticosa*	6 g
	Kasturi (Musk)	*Moschus moschiferus*	6 g
	Keshara (Saffron)	*Crocus sativus*	6 g
	Tagara	*Valeriana wallichii*	48 g

	Chandana (Sandalwood)	*Santalum album*	48 g
	Devapushpa (Clove)	*Syzygium aromaticum*	48 g

The mixture of herbs and liquids is kept closed in a ghee-smeared, airtight container for one month to undergo fermentation. After fermentation, it is filtered and used.

Geographical Distribution and Ethnomedicinal Uses

The ingredients of *Narikelasava* are distributed across various parts of the world, including the Indian subcontinent. These plants have traditionally been used for a wide range of therapeutic purposes, such as anti-inflammatory, immunomodulatory, hepatoprotective, and aphrodisiac applications. The geographical distribution and ethnomedicinal uses of the key plant ingredients of *Narikelasava* are detailed in Table 2.

Table 2: Geographical distribution and ethno-medicinal use of key plants in *Narikelasava*

S.No	Ingredient	Geographical Distribution	Ethno-Medicinal Uses
1.	*Cocos nucifera* (*Narikela*)	Pantropical, widely cultivated in coastal regions of India, Southeast Asia, Africa, and South America	Nutritive, cooling, diuretic; used for thirst, fever, urinary disorders, diarrhoea, dysentery, and general debility
2.	*Woodfordia fruticosa* (*Dhataki*)	Southern Asia (India, Nepal, Bhutan, China, Myanmar, Sri Lanka); Gulf nations (Saudi Arabia, Oman)	Wound healing, leucoderma, ulcers, rheumatic pain, toothache, dysentery, fever, menstrual problems
3.	*Bombax malabaricum* (*Shalmali*)	Tropical and subtropical Asia, including India, Sri Lanka, and Southeast Asia	Astringent, demulcent, styptic, aphrodisiac, uterine tonic
4.	*Aegle marmelos* (*Bilva*)	Indian subcontinent and Southeast Asia	Anti-diarrhoeal, anti-dysenteric, digestive, hepatoprotective, and anti-inflammatory
5.	*Gmelina arborea* (*Gambhari*)	Throughout India, Sri Lanka, Myanmar, Thailand, and Southern China	Anti-inflammatory, analgesic, antioxidant, hepatoprotective, and wound healing
6.	*Tribulus terrestris* (*Gokshura*)	Warm temperate and tropical regions worldwide, including India, China, and Europe	Aphrodisiac, diuretic, general and uterine tonic; used for improving libido and sexual function
7.	*Valeriana wallichii* (*Tagara*)	Himalayan region (India, Nepal, Bhutan, Pakistan, China)	Sedative, anxiolytic, hypnotic; used in insomnia, anxiety, and nervous disorders
8.	*Crocus sativus* (*Keshara*)	Cultivated in Iran, India (Kashmir), Greece, Morocco, and Spain	Aphrodisiac, antidepressant, antioxidant; used in sexual disorders, mood enhancement, and as a rejuvenative

Phytochemistry

Phytochemical investigations into the individual plant ingredients of *Narikelasava* have been conducted extensively over the decades. A wide range of phytomolecules has been identified from the parts used in the formulation, including fatty acids, tannins, flavonoids, phenolic acids, volatile oils, glycosides, sterols, and alkaloids. Their detailed classification, along with methods of isolation and characterisation, is summarised in Table 4, while representative chemical structures are illustrated in Figures 1–3.

Table 4: Phytoconstituents isolated from the specific plant parts used in *Narikelasava*

Plant & Part	Classification	Isolated Compound Name	Method of Characterisation	Reference
Cocos nucifera (tender coconut water & inflorescence)	Medium-chain fatty acids	Lauric acid (52%), Caprylic acid, Capric acid, Myristic acid, Palmitic acid, Stearic acid	GC-MS, HPLC	[6], [18]
	Phenolic acids	Gallic acid, Ferulic acid, p-Coumaric acid, Caffeic acid, Vanillic acid, Syringic acid	HPLC, LC-MS/MS, UV-Vis	[18], [19]
	Flavonoids	Catechin, Epicatechin, Quercetin, Kaempferol, Luteolin, Apigenin	HPLC, NMR, LC-MS	[18], [19]
	Tannins	Procyanidin B1, Procyanidin B2, Procyanidin C1	HPLC, MS	[19]
	Glycoproteins	CNP-F1, CNP-F2 (serine/threonine kinase-11)	SDS-PAGE, MALDI-TOF	[19]
	Other constituents	Nuciferoic acid (keto fatty acid), Cyclic peptides (coconutins)	NMR, GC-MS, FTIR	[6]
Woodfordia fruticosa (flowers)	Hydrolysable tannins	Oenothein B, Woodfordin A-I, Woodfructosin, Tellimagrandin, Heterophylliin A, Gemin D, Isoschimawalin A, 1,2,3,4,6-penta-O-galloyl-β-D-glucose, 1,2,3,6-tetra-O-galloyl-β-D-glucose	HPLC, NMR, MS, UV-Vis	[8], [15], [20]
	Flavonoids	Kaempferol, Quercetin, Kaempferol-3-glucoside (Astragalin), Quercitrin, Juglalin, Kaempferol-3-O-arabinoside, Kaempferol-3-O-(6″-galloyl)-β-D-glucopyranoside	HPLC, LC-MS, NMR	[9], [13], [21]
	Anthraquinone glycosides	Chrysophanol-8-O-β-D-glucopyranoside	HPLC, NMR	[13]
	Phenolic acids	Ellagic acid, Gallic acid	UV-Vis, HPLC, FTIR	[9], [22]
	Phytosterols	β-Sitosterol	GC-MS, IR, NMR	[9]
	Steroids	Hecogenin	GC-MS, IR, NMR	[9]
	Fatty alcohols	Octacosanol	GC-MS, NMR, IR	[9]
Aegle marmelos (fruit pulp & root)	Alkaloids	Aegeline, Marmeline, Dictamnine, Skimmianine, γ-Fagarine	HPLC, NMR, MS	[11], [27]
	Coumarins	Marmelosin (imperatorin), Marmin, Marmesinin, Psoralen, Xanthotoxin	HPLC, TLC, UV-Vis	[11], [27]
	Flavonoids	Rutin, Quercetin, Kaempferol, Tangeretin	HPLC, LC-MS	[27]
	Tannins	Procyanidin B1, B2	MS, NMR	[27]

	Terpenoids	Lupeol, β-Sitosterol, β-Amyrin	GC-MS, NMR	[11]
	Polysaccharides	Pectin (galacturonic acid, arabinose, galactose)	GC, FTIR	[27]
Gmelina arborea (bark & root)	Iridoid glycosides	Gmelinoside A-L, Gmeloside, Arboreoside	HPLC, NMR, MS	[28]
	Flavonoids	Apigenin, Luteolin, Quercetin, Kaempferol, Rutin	HPLC, LC-MS	[28]
	Lignans	Gmelinol, Paulownin, (+)-Lyoniresinol	NMR, GC-MS	[28]
	Phenolic acids	Caffeic acid, Ferulic acid, p-Coumaric acid, Vanillic acid	HPLC, UV-Vis	[28]
	Sterols	β-Sitosterol, Stigmasterol	GC-MS	[28]
Tribulus terrestris (fruit)	Steroidal saponins	Protodioscin, Prototribestin, Tribulosin, Tribestin, Terrestroside A-F, Desgalactotigonin	HPLC, NMR, MS	[29], [30]
	Flavonoids	Kaempferol, Quercetin, Rutin, Tribuloside	HPLC, LC-MS	[29]
	Alkaloids	Harmine, Harman, Tribuloside A-B	NMR, MS	[30]
	Phenolic acids	Caffeic acid, Ferulic acid, p-Coumaric acid, Gallic acid	HPLC	[29]
	Other constituents	β-Sitosterol, Stigmasterol	GC-MS	[30]
Valeriana wallichii (root)	Valepotriates	Valtrate, Didrovaltrate, Isovaltrate, Acevaltrate	HPLC, NMR, MS	[26]
	Sesquiterpenes	Valerenic acid, Hydroxyvalerenic acid, Valerenal, Valeranone	GC-MS, NMR	[26]
	Alkaloids	Actinidine, Valerianine, Chatinine	HPLC, MS	[26]
	Flavonoids	Luteolin, Apigenin, Kaempferol	HPLC	[26]
	Volatile oils	Bornyl acetate, Camphene, α-Pinene, β-Caryophyllene	GC-MS	[26]
Crocus sativus (stigma)	Carotenoids	Crocin, Crocetin, Picrocrocin, Safranal	HPLC, UV-Vis, NMR	[1]
	Flavonoids	Kaempferol, Quercetin, Rutin, Luteolin	HPLC, LC-MS	[1]
	Anthocyanins	Delphinidin, Petunidin	HPLC	[1]
	Terpenoids	Crocusatin A-F	NMR, MS	[1]
Bombax malabaricum (sepals & bark)	Flavonoids	Quercetin, Kaempferol, Luteolin, Rutin, Quercitrin, Hyperoside	HPLC, LC-MS	[23]
	Phenolic acids	Gallic acid, Ellagic acid, Caffeic acid, Ferulic acid, Chlorogenic acid	HPLC, UV-Vis	[23]
	Tannins	Procyanidin B2, B3, C1	HPLC, MS	[23]
	Terpenoids	Lupeol, β-Sitosterol, Betulinic acid, Oleanolic acid	GC-MS, NMR	[23]
	Fatty alcohols	n-Hexacosanol, n-Octacosanol	GC-MS	[23]
	Polysaccharides	Pectin, Mucilage (galactose, arabinose, rhamnose)	GC, FTIR	[23]

Pharmacological Activities of *Narikelasava* Ingredients

The therapeutic actions of *Narikelasava* can be attributed to the synergistic pharmacological activities of its constituent herbs. These include anti-inflammatory, antioxidant, hepatoprotective, immunomodulatory, and aphrodisiac effects, as supported by *in vitro*, *in vivo*, and clinical studies.

Table 3: Pharmacological activities of key ingredients of *Narikelasava*

Ingredient	Action	Extract/Part	Method Used	Significant Outcomes	References
Cocos nucifera	Hepatoprotective	Acetone extract of inflorescence	CCl_4-induced hepatotoxicity in rats	Prevented increase in serum ALT, AST, ALP; improved liver SOD, GSH, GST	[18]
	Anti-inflammatory	Acetone extract (CnAE)	LPS-stimulated RAW264.7 macrophages; toxin-induced murine models	Inhibited NF-κB/IκB signalling cascade; significant anti-nociceptive effects	[19]
	Immunomodulatory	Glycoprotein (CNP) from nutshell	Macrophage activation studies	CNP-F2 protein activates TLR pathways, boosts macrophage-mediated immune responses	[19]
	Antioxidant	Coconut oil	CCl_4-intoxicated rabbits	Improved haematobiochemical and histopathological markers of oxidative stress	[18]
Woodfordia fruticosa	Anti-inflammatory	Ethanolic extract of flowers	Albumin denaturation assay; HRBC membrane stabilisation	Significant anti-inflammatory activity (43.56-86.59% and 43.62-87.69%, respectively)	[21]
	Antioxidant	Polyphenol-rich extract	DPPH radical scavenging assay	IC_{50} = 0.243 mg/mL; high polyphenol content (218.52 mg GAE/g)	[20]
	Immunomodulatory	Ethanolic extract of flowers	Murine peritoneal macrophage phagocytosis; bone marrow	60 % increase in bone marrow cell proliferation; stimulation of	[3]

			proliferation (SRB assay)	macrophage activity	
	Hepatoprotective	Various extracts of flowers	Phenytoin-, CCl_4-, acetaminophen-, diclofenac-induced hepatotoxicity in rats	Effective against multiple hepatotoxic models; demonstrated hepatoprotective effects.	[3]
Aegle marmelos	Hepatoprotective	Ethanolic extract of fruit pulp	CCl_4-induced hepatotoxicity	Significant reduction in liver enzyme elevation; improved histopathological parameters	[27]
	Anti-inflammatory	Various extracts	Carrageenan-induced paw oedema	Significant reduction in inflammation	[27]
	Immunomodulatory	Various extracts	Animal models	Exhibited immunomodulatory properties	[27]
Gmelina arborea	Anti-inflammatory	Methanolic extract of bark	Carrageenan-induced paw oedema in rats	Significant anti-inflammatory and anti-nociceptive activities	[28]
	Hepatoprotective	Various extracts	CCl_4-induced hepatotoxicity	Exhibited hepatoprotective effects	[28]
	Antioxidant	Various extracts	*In vitro* assays	Showed significant antioxidant activity	[28]
Tribulus terrestris	Aphrodisiac	Fruit extract	Meta-analyses of clinical studies	Improved sperm parameters, sex hormonal profile, and libido	[30]
	Anti-inflammatory	Various extracts	Animal models	Exhibited anti-inflammatory effects	[29]
Valeriana wallichii	Sedative/Anxiolytic	Hydroalcoholic extract of roots	Clinical trial on insomnia patients (n=24)	Significant increase in sleep duration; reduction in sleep initiation time	[26]
	Hepatoprotective	Aqueous extract of roots	CCl_4-induced hepatotoxicity in rats	First-time demonstration of hepatoprotective activity	[26]

Crocus sativus	Aphrodisiac	Stigma extract	Clinical studies	Improved sexual function; antidepressant effects	–
	Antioxidant	Stigma extract	*In vitro* assays	Strong free radical scavenging activity	–
Bombax malabaricum	Anti-ulcer	Hydro-methanolic extract of sepals	Gastric ulcer models	73.79-78.14% ulcer protection; antisecretory and cytoprotective effects	[23]
	Antidiabetic	n-Hexane fraction of sepals	Streptozotocin-induced diabetic rats	Antihyperglycaemic and antihyperlipidaemic effects	[23]
	α-Amylase/α-Glucosidase inhibition	n-Hexane fraction of sepals	*In vitro* enzyme assays	IC_{50} = 50.17 mg/L (α-amylase); IC_{50} = 61.04 mg/L (α-glucosidase)	[23]

Discussion

A comprehensive review of the plant constituents of *Narikelasava* reveals pharmacologically active compounds with potential benefits in various therapeutic domains, as substantiated by *in vitro*, *in vivo*, and preliminary clinical studies.

Cocos nucifera (coconut) is rich in medium-chain fatty acids, particularly lauric acid, which possesses antimicrobial and immunomodulatory properties. Its hepatoprotective effects have been demonstrated in multiple toxin-induced liver injury models, where it prevented the elevation of serum liver enzymes and restored antioxidant status [18]. The anti-inflammatory action of *C. nucifera*, mediated through inhibition of the NF-κB/IκB signalling cascade, suggests its potential to modulate chronic inflammatory conditions [19]. Furthermore, glycoproteins isolated from coconut nutshell have been shown to activate TLR pathways, boosting macrophage-mediated immune responses, indicating significant immunomodulatory potential [19].

Woodfordia fruticosa (*Dhataki*), while classically used as a fermentation starter, is pharmacologically active due to its high content of macrocyclic hydrolysable tannins (e.g., oenothein B, woodfordins) and flavonoids. These compounds possess significant antioxidant capabilities, with polyphenol-rich extracts demonstrating potent DPPH radical scavenging activity [20]. Its anti-inflammatory action has been confirmed through albumin denaturation and HRBC membrane stabilisation assays [21]. Immunologically, *W. fruticosa* enhances macrophage activity and bone marrow cell proliferation, making it valuable for restoring immune function [3]. Additionally, it exhibits hepatoprotective effects in drug-induced liver damage models [3].

Dashamoola, a group of ten roots including *Aegle marmelos*, *Gmelina arborea*, *Tribulus terrestris*, and others, contributes significant anti-inflammatory and analgesic effects to the formulation. Studies have shown that *Dashamoola* exhibits anti-inflammatory activity comparable to standard NSAIDs like aspirin and diclofenac, attributed to the inhibition of prostaglandin synthesis. *Gmelina arborea* has demonstrated significant anti-inflammatory and anti-nociceptive activities in carrageenan-induced paw oedema models [28], while *Aegle marmelos* provides additional hepatoprotective and immunomodulatory benefits [27].

Tribulus terrestris (*Gokshura*) is well recognised for its aphrodisiac properties, with meta-analyses confirming its ability to improve sperm parameters, sex hormonal profiles, and libido [30]. *Valeriana wallichii* (*Tagara*) contributes sedative and anxiolytic effects, which can be beneficial in managing the psychological stress often

associated with chronic diseases [26]. *Crocus sativus* (*Keshara*) further enhances the aphrodisiac and mood-elevating properties of the formulation.

Taken together, the integration of these ingredients in *Narikelasava* creates a pharmacologically balanced formulation suitable for managing conditions requiring anti-inflammatory, immunomodulatory, hepatoprotective, and rejuvenative support. The presence of *Woodfordia fruticosa* as a fermenting agent not only facilitates the fermentation process but also adds its own therapeutic value, while the self-generated alcohol aids in the extraction of both water- and alcohol-soluble active constituents, enhancing the overall bioavailability and efficacy of the formulation.

Conclusion

Narikelasava holds significant potential as a therapeutic formulation, owing to the synergistic actions of its constituents. These exhibit overlapping effects in multiple therapeutic domains—anti-inflammatory, immunomodulatory, hepatoprotective, antioxidant, and aphrodisiac—all of which are crucial for promoting overall health and managing chronic conditions. This evidence-based appraisal reinforces its traditional use in *Gada Nigraha* and supports its consideration as a valuable adjunct in modern healthcare, particularly in the context of geriatric care, chronic inflammatory disorders, and as a general health tonic for rejuvenation and vitality. Further research—using *in vitro* and *in vivo* models, as well as well-designed clinical trials—should be undertaken to validate the safety and efficacy of *Narikelasava* in various therapeutic contexts.

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