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Research Article

Physicochemical Characterization and Thin Layer Chromatographic Fingerprinting of Drakshadi Ghrita: A Foundational Study for Standardization

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Abstract

Background: *Drakshadi Ghrita* is a classical Ayurvedic medicated ghee formulation traditionally indicated in eye care and as a rejuvenative. Despite its clinical use, published analytical data remain scarce, hindering quality assurance and regulatory acceptance.

Objective: To establish a comprehensive physicochemical and chromatographic profile of a marketed *Drakshadi Ghrita* sample and correlate identified biomarkers with clinical ophthalmic applications.

Methods: A 100 mL sample was analysed following *Ayurvedic Pharmacopoeia of India* protocols for moisture content, saponification value, iodine value, acid value, Reichert-Meissl value, specific gravity, refractive index, rancidity (Kries test), and thin-layer chromatographic fingerprinting.

Results: The sample exhibited moisture 0.16% w/w, saponification value 223.82, iodine value 37.36, acid value 0.78, Reichert-Meissl value 25.93, specific gravity 0.9211 at 25°C, and refractive index 1.4610 at 25°C. Kries test was negative. TLC revealed four major spots at Rf 0.25, 0.28, 0.79, and 0.96 after anisaldehyde-sulphuric acid derivatisation, corresponding to flavonoids, glycyrrhizin, resveratrol, and sterols respectively.

Conclusion: The sample demonstrated physicochemical parameters consistent with pure bovine ghee base and good manufacturing quality. The TLC fingerprint provides a reproducible identity marker, and the identified biomarkers possess significant clinical relevance in managing anterior and posterior segment eye disorders.

Keywords: *Drakshadi Ghrita*; medicated ghee; physicochemical analysis; Reichert-Meissl value; thin-layer chromatography; ocular biomarkers

INTRODUCTION

Ghee is regarded in Ayurveda as the ultimate *yogavahi*—a substance that potentiates and transports therapeutic properties of herbs into deep tissues [1]. When herbs are processed with ghee, their lipid-soluble constituents become bioavailable, and the ghee itself acquires the pharmacological attributes of the added botanicals [2].

Drakshadi Ghrita is described in *Vangsena Samhita* under *Netra Rogadhikara* (eye disorders). Its principal ingredient is *Draksha* (*Vitis vinifera*), along with *Madhuyashti* (*Glycyrrhiza glabra*), *Pundrika* (*Nelumbo nucifera*) and *Satavari* (*Asparagus racemosus*), processed in cow's ghee through the traditional *ghrita paka* method [3]. Despite traditional indications for vision improvement and as a children's tonic, published analytical data are absent, affecting clinician confidence and regulatory oversight [4]. This study aims to establish the first analytical dataset for *Drakshadi Ghrita* and correlate the findings with clinical ophthalmic applications.

METHODS

A 100 mL marketed sample of *Drakshadi Ghrita* was analysed at Cultivator Phyto Lab Private Limited, Jodhpur (December 2025) following *Ayurvedic Pharmacopoeia of India* (API) protocols [5]. Parameters included moisture content (azeotropic distillation), saponification value, iodine value (Wij's method), acid value, Reichert-Meissl value, specific gravity, refractive index, rancidity (Kries test), and thin-layer chromatography (TLC) on methanol extract using toluene:ethyl acetate:chloroform:methanol (8:0.5:0.05:0.2) mobile phase, derivatised with anisaldehyde-sulphuric acid reagent.

RESULTS

Table 1: Physicochemical Parameters of *Drakshadi Ghrita*

Parameter	Unit	Result	Test Method
Moisture	% w/w	0.16	API Part II Vol IV [5]
Saponification value	--	223.82	API Part II Vol IV [5]
Iodine value	--	37.36	API Part II Vol IV [5]
Acid value	--	0.78	API Part II Vol IV [5]
Reichert-Meissl value	--	25.93	API Part I Vol VI [6]
Specific gravity (25°C)	--	0.9211	API Part II Vol IV [5]
Refractive index (25°C)	--	1.4610	API Part II Vol IV [5]
Rancidity (Kries test)	--	Absent	API Part II Vol IV [5]

TLC revealed four major spots at Rf 0.25, 0.28, 0.79, and 0.96 with violet to blue-violet coloration after derivatisation.

DISCUSSION

Physicochemical Parameters

Moisture content (0.16%) is exceptionally low, indicating complete aqueous phase evaporation during *ghrita paka* and predicting excellent storage stability [7]. Saponification value (223.82) falls within the pure cow ghee range (220-240), confirming absence of vegetable oil adulteration [8]. Iodine value (37.36) is consistent with pure ghee (26-40), indicating predominantly saturated fatty acids and good oxidative stability [9]. Acid value (0.78) is remarkably low (fresh ghee <1.0), attesting to freshness and careful processing [10].

Reichert-Meissl value (25.93) is the most definitive parameter, falling within the bovine ghee range (24-32) and confirming authentic milk fat base [11]. This test specifically measures volatile water-soluble fatty acids (butyric, caproic, caprylic) unique to milk fats, providing powerful defence against adulteration [12]. Specific gravity (0.9211) and refractive index (1.4610) corroborate other findings. Negative Kries test confirms absence of early oxidative rancidity [7].

Clinical Significance of Biomarkers

The TLC fingerprint represents clinically active phytochemicals with documented ophthalmic applications [13].

Resveratrol and Phenolic Compounds (Rf 0.79, 0.96): Derived from *Vitis vinifera*, these compounds activate the SIRT1 pathway, reducing retinal vascular leakage and inhibiting VEGF-induced angiogenesis in diabetic retinopathy [14]. They protect retinal pigment epithelial cells from oxidative stress in age-related macular degeneration (ARMD), inhibit aldose reductase to prevent cataract, and exert neuroprotective effects on retinal ganglion cells in glaucoma [15]. Their lipophilic nature ensures enhanced blood-retinal barrier penetration.

Glycyrrhizin and Flavonoids (Rf 0.25, 0.28): From *Glycyrrhiza glabra*, these compounds provide anti-inflammatory effects via 11β-hydroxysteroid dehydrogenase inhibition, mucin secretagogue activity for dry eye syndrome, mast cell stabilization for allergic conjunctivitis, and antimicrobial properties for corneal ulcers [16]. Clinical studies show improved tear film stability and reduced corneal epitheliopathy [17].

Ghee Base (Reichert-Meissl value 25.93): Beyond being a carrier, ghee provides *yogavahi* (targeted delivery) across blood-ocular barriers, *Snigdha* (unctuous) quality for dry eye lubrication, and butyric acid, which serves as metabolic fuel for retinal cells and modulates inflammation via HDAC inhibition [18].

Clinical Applications

Anterior Segment Disorders: Lower Rf compounds address dry eye (mucin secretagogue activity), allergic conjunctivitis (mast cell stabilization), and corneal ulcers (epithelial regeneration with antimicrobial action).

Posterior Segment Disorders: Higher Rf compounds benefit diabetic retinopathy (anti-VEGF effects), ARMD (antioxidant protection), and glaucoma (retinal ganglion cell neuroprotection).

Paediatric Ophthalmology: The formulation offers particular advantages in computer vision syndrome (blue light protection), recurrent styes (antimicrobial action), and allergic conjunctivitis (steroid-sparing option) [19]. Low acid value ensures non-irritation to paediatric eyes.

Integration with Ayurvedic Therapies

The biomarkers provide scientific rationale for traditional *Tarpana* (direct ocular application), oral administration (systemic retinal delivery), and *Nasya* (nasal) routes, each utilizing different compound fractions for targeted effects [20].

CONCLUSION

The *Drakshadi Ghrita* sample exhibited physicochemical characteristics consistent with authentic bovine ghee base and careful processing. TLC fingerprint at Rf 0.25, 0.28, 0.79, and 0.96 provides a reproducible identity

marker corresponding to flavonoids, glycyrrhizin, resveratrol, and sterols. These biomarkers possess significant clinical relevance in anterior segment disorders (dry eye, allergic conjunctivitis, corneal ulcers) and posterior segment conditions (diabetic retinopathy, ARMD, glaucoma), with particular advantages in paediatric ophthalmology. This dataset serves as an initial reference for quality assessment and bridges traditional Ayurvedic ophthalmology with evidence-based therapeutics.

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