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Phytochemical Profile of Jeevanthyadhi Ghritha and Its Probable Mode of Action in Evaporative Dry Eye (*Shushkakshipaka*) of Digital Screen Users: An Ayurvedic and Pharmacological Analysis

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Abstract

Background: Evaporative dry eye is common among people who use digital screens for long hours, because reduced blinking accelerates tear evaporation. In Ayurveda the picture corresponds to Shushkakshipaka, a Vata-Pitta-dominant Sarvagata Netra Roga. Jeevanthyadhi Ghritha, a fourteen-component medicated ghee described in Ashtanga Hridaya (Uttara Sthana, Timira Pratishedha), has been used in ocular care, but its chemistry and the way that chemistry could act on the ocular surface are rarely examined together.

Objective: To describe the Ayurvedic and phytochemical properties of the formulation's ingredients, to reason about what the finished ghee is likely to carry, and to propose a mode of action in evaporative dry eye that separates what is supported from what is speculative.

Methods: Narrative review of the Rasa Panchaka, constituents and reported pharmacology of the ingredients, interpreted against the pathophysiology of evaporative dry eye and against the results of a randomised comparative trial of Jeevanthyadhi Ghritha Aschyothana (Group A) versus Tarpana (Group B) with176 participants aged 20–40 years with evaporative dry-eye features and more than four hours of daily digital-screen exposure.

Findings: The formulation is a lipid-based system carrying lipophilic constituents (triacylglycerols, fat-soluble vitamins, carotenoids, phytosterols, triterpenoids, piperine-type amides, terpenes) together with water-soluble constituents transferred from the decoction, milk and paste drugs. The finished preparation has a lipid matrix and may retain some constituents extracted during processing. However, the extent to which individual polar and

lipophilic constituents are retained in the finished ghee has not been established analytically. Its composite properties are cooling (Sheeta Virya in most ingredients), unctuous and sweet, matching a Vata-Pitta pacifying profile. The most defensible modern hypothesis is that it provides a surface lipid coating and lubrication, a mixture of antioxidant and inflammation-modulating phytochemicals, which together may reduce evaporation, damp the evaporation-hyperosmolarity-inflammation cycle and improve comfort. In the trial, mean OSDI fell from 22.42 to 10.52 (Group A) and from 22.56 to 10.59 (Group B), TBUT and Schirmer-I values increased in both eyes in both groups, and overall response was about 41.31% (Group A) and 41.67% (Group B), in both groups with no significant intergroup difference. Because no vehicle or ghee-only control was used, the contribution of the herbal components cannot be separated from that of ghee, the procedure and natural variation.

Conclusion: Jeevanthyadhi Ghritha is best understood as a multi-constituent lipid system whose Ayurvedic rationale is coherent and whose modern mechanism is plausible but untested. Finished-product fingerprinting, ophthalmic quality testing and a vehicle-controlled trial are the necessary next steps.

Keywords: Jeevanthyadhi Ghritha; Shushkakshipaka; evaporative dry eye; Aschyothana; Tarpana; phytochemistry; mode of action; digital eye strain

1. Introduction

Sustained visual attention at digital screen lowers blink rate and increases incomplete blinking. The tear film is exposed for longer between blinks, its lipid layer is less effectively renewed, evaporation rises, and tear osmolarity increases. Hyperosmolar tears stress and inflame the ocular surface, and the resulting instability and inflammation feed one another [1]. Patients describe dryness, burning, grittiness, blurred vision and fatigue. Dry eye is defined internationally as a multifactorial disease of the ocular surface characterised by loss of tear-film homeostasis, with tear instability, hyperosmolarity, inflammation and neurosensory abnormalities as aetiological roles [2].

Ayurveda correlates this picture with Shushkakshipaka, in which Vata (dryness, instability, *Ruksha* and *Chala* qualities) and Pitta (burning, irritation) predominate and the ocular surface loses its physiological lubrication [1]. The Classical Ayurvedic management includes local ocular procedures such as Tarpana and Aschyothana, using appropriately selected drugs traditionally described as Sheeta, Snigdha and Chakshushya.

Jeevanthyadhi Ghrita is one such classical formulation used in ocular treatment. Its potential pharmacological properties are generally discussed based on the known properties of its individual ingredients. However, these properties cannot automatically be attributed to the finished formulation, as the extraction and retention of individual constituents during preparation have not been analytically established. It is therefore important to consider both the possible role of the lipid-based formulation in ocular surface lubrication and the limitations of the available pharmacological evidence. The present paper examines these aspects alongside the findings of a

comparative clinical trial evaluating Jeevanthyadi Ghrita administered through Aschyotana and Tarpana, to understand the clinical outcomes and the extent to which the proposed mechanisms can be supported.

2. The Formulation

The formula is given in Ashtanga Hridaya Uttara Sthana 13/2–3: a decoction of Jeevanti is combined with Ksheera and Ghritha and processed with a paste of Prapaundarika, Kakoli, Pippali, Lodhra, Saindhava, Shatahwa, Madhuka, Draksha, Sita, Daru and Triphala [1,3]. In the trial, a prepared formulation from a GMP-certified pharmaceutical source was used in both groups [1].

The working botanical identities adopted in the thesis are: Jeevanti, *Leptadenia reticulata*; Prapaundarika, a *Nymphaea* source ; Kakoli, *Roscoea purpurea* ; Pippali, *Piper longum*; Lodhra, *Symplocos racemosa*; Shatahwa, *Anethum graveolens* or *A. sowa*; Madhuka, *Glycyrrhiza glabra*; Daru, *Cedrus deodara* ; Draksha, *Vitis vinifera*; Triphala, the three-fruit compound; Sita, purified sucrose; Saindhava, rock salt (halite); with cow milk and cow ghee as processing media [1].

तुलां पचेत जीवन्त्या द्रोणेऽपां पादशेषिते ।
तत्क्वाथे द्विगुणक्षीरं घृतप्रस्थं विपाचयेत् ॥२॥
प्रपौण्डरीककाकोलीपिप्पलीलोध्रसैन्धवैः ।
शताह्वामधुकद्राक्षासितादारुफलत्रयैः ॥३॥
कार्षिकैर्निशि तत्पीतं तिमिरापहरं परम् । (A.H Uttara Sthāna, 13/ 2–3)

Ayurvedic Formulary of India (AFI), Part I mentions the ratio of Jeevanthyadhi Ghritha

Ingredient	Quantity
Jeevanti root	4.800 kg
Water for decoction	12.288 L, reduced to 3.072 L
Cow milk	6.144 L, twice the volume of the reduced decoction
Cow ghee	768 g

Prapaundarika, Kakoli, Pippali, Lodhra, Saindhava Lavana, Shatahva, Madhuka (Yashti), Draksha, Sita and Daru (Devadaru)	12 g each
Haritaki, Bibhitaka and Amalaki pericarps	12 g each, 36 g in total

3. Ayurvedic Pharmacology of the Ingredients

Ingredient	Rasa	Guna	Virya	Vipaka
Jeevanti	Madhura, tikta	Laghu, Snigdha	Sheeta	Madhura
Ksheera (cow milk)	Madhura	Guru, Snigdha, Mridu	Sheeta	Madhura
Ghritha (cow ghee)	Madhura	Guru, Snigdha, Mridu	Sheeta	Madhura
Prapaundarika	Madhura, Tikta,Kashaya	Snigdha, Picchila	Sheeta	Madhura
Kakoli	Madhura,tikta	Guru, Snigdha	Sheeta	Madhura
Pippali	Katu	Laghu, Snigdha, Tikshna	Anushna-sheeta	Madhura
Lodhra	Kashaya,Tikta	Laghu, Ruksha	Sheeta	Katu

Shatahwa	Katu, Tikta	Laghu, Ruksha, Tikshna	Ushna	Katu
Madhuka	Madhura, Kashaya	Guru, Snigdha	Sheeta	Madhura
Sita	Madhura	Guru, Snigdha	Sheeta	Madhura
Daru	Tikta, Katu	Laghu, Ruksha	Ushna	Katu
Triphala	Kashaya-predominant	Laghu, Ruksha	Anushna (composite)	Madhura
Draksha	Madhura, Kashaya	Guru, Snigdha, Mridu	Sheeta	Madhura
Saindhava	Lavana (Madhura anurasa)	Laghu, Snigdha, Sukshma	Sheeta	Madhura

Source: Rasa Panchaka tables of the thesis drug review [1].

The thesis summarises the formulation as Madhura-Tikta in Rasa, Guru, Snigdha and Mridu in Guna, Sheeta in Virya and Madhura in Vipaka, with the karmas Vata-Pitta Shamana, Snehana, Brimhana, Daha Prashamana and Chakshushya [1]. The ingredient-wise Rasa Panchaka profile is predominantly Madhura, with contributions from Tikta and Kashaya Rasa. Most listed ingredients are described as Sheeta or Anushna in Virya with few adds tikshna ushna quality . This pattern is consistent with the Vata-Pitta-pacifying interpretation presented in the thesis and should be understood as a classical qualitative interpretation, not a measured effect of the finished formulation. In Jeevanthyadhi ghrita, Jeevanti is used as the principal decoction drug in the classical preparation; which is madhura tiktha rasa and vata pitta shamaka in nature which adds to it.

4. Phytochemistry

4.1 Constituents by ingredient

Ingredient	Constituent classes and markers reported [1]
Jeevanti	Phenolic acids, flavonoids (rutin, quercetin, luteolin), triterpenoids (α- and β-amyrin), phytosterols (β-sitosterol, stigmasterol), alkaloids, glycosides, long-chain alcohols
Ksheera	Water, lactose, casein and whey proteins, milk lipids, minerals, vitamins; bioactive proteins including lactoferrin and immunoglobulins
Ghritha	Triacylglycerols (saturated, monounsaturated, some polyunsaturated), free fatty acids, cholesterol, fat-soluble vitamins A, D, E, K, carotenoids, volatile lactones, aldehydes and ketones
Prapaundarika (*Nymphaea* spp.)	Polyphenols, flavonoids, tannins (in *N. nouchali*: gallic acid, catechin, epicatechin gallate, caffeic acid, luteolin, kaempferol)
Kakoli	Carbohydrates, starch, proteins, lipids, phenolics and flavonoids; kaempferol, vanillic, protocatechuic, syringic and ferulic acids
Pippali	Piperine, piperlongumine, piperlonguminine, pellitorine, other amides, lignans, steroids, volatile oil
Lodhra	Alkaloids (loturine, loturidine, colloturine), phenolic glycosides, flavonoids, tannins, triterpenoids, sterols

Shatahwa	Volatile oil (carvone, limonene, dill apiol, anethole, estragole), flavonoids, phenolic acids, coumarins, fatty oil
Madhuka	Glycyrrhizin and glycyrrhetinic acid, liquiritin, isoliquiritin, glabridin, licochalcones, coumarins, polysaccharides, sterols
Daru	Sesquiterpenes (himachalenes, himachalol, atlantones, cedrol-related compounds), deodardione, lignans
Triphala	Gallic acid, ellagic acid, chebulagic and chebulinic acids, corilagin, emblicanin-type tannins, flavonoids
Draksha	Sugars, tartaric and malic acids, potassium, polyphenols (resveratrol, anthocyanins, proanthocyanidins, catechin, quercetin)
Sita	Sucrose (a physicochemical, not phytochemical, contribution)
Saindhava	Sodium chloride with trace potassium, calcium, magnesium, iron, sulfate

The thesis stresses that composition varies with plant part, season, geography, extraction method. Constituent data from one species or from a concentrated extract should be treated as supportive evidence only [1].

The primary sources behind these constituent data, as cited in the thesis drug review, are: Jeevanti [4-6]; cow milk and lactoferrin [7,8]; ghee [9,10]; *Nymphaea* [11]; *Roscoea purpurea* [12,13]; *Piper longum* [14]; *Symplocos racemosa* [15]; *Anethum graveolens* [16]; *Glycyrrhiza glabra* [17,18]; *Cedrus deodara* [19]; Triphala [20,21]; *Vitis vinifera* [22].

4.2 What does the finished ghee likely carry?

The thesis contains no chromatographic, spectroscopic or other analytical profile of the finished ghee. What follows is inference from the process, flagged as such.

In Sneha Paka the paste drugs (*Kalka*), the decoction (*Kwatha*) and the milk are heated with ghee until the water is gone. The finished product is a lipid. Constituents that dissolve in or are carried by lipid are likely to be enriched: phytosterols, triterpenoids, carotenoids, tocopherols and vitamins, piperine and related amides, terpenes and volatile oil components from Shatahwa and Daru, and the lipid-soluble parts of milk. Highly polar constituents, such as the hydrolysable tannins of Triphala and Lodhra, anthocyanins, glycosides, sugars, salts and most milk proteins, may be retained to varying degrees in the ghee and may be largely left in the residue or present only as suspended particles which undergo filtration process.

Much of the anti-inflammatory and antioxidant literature on the formulation's ingredients concerns precisely the polar polyphenol fractions (Triphala tannins, grape and *Nymphaea* polyphenols). Whether those activities survive into a ghee is an open question. By contrast, the lipophilic fraction (sterols, triterpenoids, amides, terpenes, fat-soluble vitamins) is more likely to be present, and for some of these constituents, notably the volatile terpenes of Daru and Shatahwa and the amides of Pippali[1].

5. Pharmacological Correlates

The thesis summarises preclinical evidence, mainly in vitro and animal studies, of anti-inflammatory, antioxidant and antimicrobial activity for Jeevanti, Pippali, Lodhra, Shatahwa, Madhuka, Triphala, Draksha and Daru source, immunomodulatory activity for Jeevanti [23], and anti-inflammatory and antioxidant effects of milk-derived proteins such as lactoferrin [1]. It assigns Ksheera, Ghritha, Sita and Saindhava mainly in processing, nutritional or physicochemical roles.[1].

Component	Reported preclinical activity [1]	Possible relevance to the dry eye surface	Caution
Jeevanti	Anti-inflammatory, antioxidant, immunomodulatory	Dampening of surface inflammation and oxidative stress	Largely in vitro and animal data

Pippali	Anti-inflammatory	Possible contribution via amides and piperine	Amides can irritate; ocular tolerability unknown
Lodhra	Anti-inflammatory, antimicrobial; astringent tannins	Mucosal protection, reduced redness	Polar tannins may not transfer into ghee
Shatahwa and Daru	Antioxidant, anti-inflammatory, antimicrobial (volatile oils)	Anti-inflammatory and antimicrobial support	Essential-oil components need dose and ocular-safety control
Madhuka	Anti-inflammatory, antioxidant	Soothing of inflamed surface	Glycyrrhizin overexposure has systemic effects; dose control
Triphala, Draksha	Antioxidant and anti-inflammatory polyphenols	Reduction of oxidative stress on the surface	Concentrated extracts are not equivalent to dried fruit in a ghee
Ksheera	Antioxidant and anti-inflammatory bioactive proteins (lactoferrin)	Possible local protective effect	Mostly polar and may be poorly retained; isolated-component data
Ghritha	Lipid vehicle; fat-soluble vitamins and carotenoids	Surface coating, lubrication, prolonged contact	Needs purity, sterility, particle-free filtration and oxidative stability for ocular use

Sita, Saindhava	Physicochemical roles (viscosity, osmolarity, tonicity)	Effect on formulation properties only	No ingredient-specific pharmacology claimed

Evidence is predominantly preclinical and ingredient-specific. It does not establish ocular penetration, clinical efficacy or activity of the finished Jeevanthyadhi Ghritha.

6. Probable Mode of Action

6.1 Ayurvedic mode of action

In Shushkakshipaka the aggravated Vata dries and destabilises the ocular surface, Pitta produces burning and irritation, and physiological lubrication, which is associated with balanced Kapha, is lost. The thesis explains the action of the ghee as follows [1]:

1. **Opposition of qualities.** The Snigdha, Guru and Mridu Guna oppose the Ruksha and Chala qualities of Vata, giving *Snehana* and *Brimhana*. This is correlated with the improvement in tear-film stability.
2. **Cooling.** The Sheeta Virya and sweet-astringent Rasa pacify Pitta (*Daha Prashamana*), correlated with relief of burning and irritation.
3. **Restoration of physiological lubrication.** Support of normal ocular moisture corresponds to restoration of the lubricating function of Kapha, without heaviness or excess secretion.
4. **Mahabhuta reading.** Jala and Prithvi Mahabhuta support moisture and stability, regulation of Vayu reduces evaporation, and moderation of Agni reduces local irritation, with Akasha permitting uniform spread of the medicine.
5. **Chakshushya karma.** The nourishing effect on the ocular tissues is described as improving the functional state of the surface.

6.2 Modern pharmacological mode of action

The disease pathway described in the evaporative dry eye is: reduced blinking → tear-film instability and evaporation → hyperosmolarity → surface damage and inflammation → further instability [1]. The ghee could plausibly act at four points in this loop. The evidence status of each is stated.

Proposed mechanism	Point in the loop	Evidence status
Lipid coating and lubrication. A lipid film on the surface may reduce evaporation, lubricate lid and cornea and prolong contact.	Evaporation and instability	Physically plausible, and consistent with the use of lipid-based drops in evaporative dry eye. Not measured in the trial (no lipid-layer thickness or osmolarity assessment).
Antioxidant and anti-inflammatory phytochemicals. Lipophilic and any transferred polar constituents may reduce oxidative stress and inflammatory mediator activity.	Inflammation	Plausible from ingredient literature. Not shown for the finished ghee or at ocular concentrations.
Fat-soluble vitamins and carotenoids. Vitamin A and carotenoids from ghee may support surface epithelial and goblet-cell function.	Epithelial integrity	Biologically reasonable for vitamin A. Amounts in the product are unknown.
Comfort and reduced irritation. Cooling, demulcent effects and reduced friction may lessen burning and reflex irritation.	Symptoms	Consistent with symptom improvement (OSDI). Cannot be separated from non-specific effects.

6.3 Why the two procedures performed alike

Tarpana retains the ghee over the eye for about 10 minutes once a day, giving prolonged contact. Aschyothana delivers three drops three times a day, giving shorter but repeated contact that may repeatedly restore the protective lipid layer, so that the shorter contact of each dose is compensated by repetition [1]. That the two

schedules gave almost identical results is compatible with a largely local, surface-mediated action in which total contact matters more than the route. It is equally compatible with a mainly non-specific benefit.

7. What the Clinical Trial Adds, and What It Cannot Show

Of 176 patients (88 per group, block randomisation, block size four) aged 20–40 years with more than four hours of daily screen use, Group A received three drops in each eye three times daily for five days and Group B received Tarpana for about 10 minutes daily for five days, with assessments baseline to Day 30 [1].

Outcome	**Group A: Day 0 → Day 30**	**Group B: Day 0 → Day 30**	**Intergroup p (Day 30)**
OSDI	22.42 → 10.52	22.56 → 10.59	0.9663
TBUT, left eye (s)	5.916 → 10.10	5.793 → 9.998	0.5602
TBUT, right eye (s)	5.924 → 10.18	5.891 → 10.09	0.8322
Schirmer-I, left eye (mm)	7.439 → 11.50	7.324 → 11.37	0.6225
Schirmer-I, right eye (mm)	7.274 → 11.18	7.335 → 11.46	0.263
Overall response	41.31%	about 41.7%	All non-significant

TBUT showed a significant improvement by Day 6 in the right eye of Group A ($p = 0.0004$), whereas OSDI scores showed statistically significant improvement at later assessment points. This indicates that objective tear-film changes and subjective symptom improvement followed different patterns during the treatment period; On Day 30, all participants in both groups reported satisfaction scores of 6 or above on the 0–10 VAS scale. Mean

VAS scores were 7.90 ± 1.313 in Group A and 8.14 ± 1.358 in Group B (Mann–Whitney U, p=0.2263) on day 30. Scores ranged from 6 to 10 in both groups. The difference was not statistically significant.

Limits that restrict what can be concluded about mechanism:

1. **No vehicle or no-treatment control.** Both groups received the active formulation with improvement over 30 days therefore the independent contribution of the herbal components could not be distinguished from the ghee, the therapeutic procedures, or natural fluctuation in dry eye symptoms. Therefore the observed outcome should be interpreted as the overall effect of the respective treatment intervention. [1].
2. **No mechanistic endpoints.** Tear osmolarity, lipid-layer thickness, meibography, inflammatory markers and surface staining were not measured.

8. Quality and Safety Considerations for Ophthalmic Use

The thesis lists the controls that a formulation intended for the eye needs: authenticated raw materials, freedom from visible particles, microbial contamination and unacceptable oxidation, and testing of pH, viscosity, spreadability, osmolality, acid value, peroxide value, marker compounds and stability [1]. Specific points raised are that food-grade ghee is not automatically suitable for ophthalmic use, that Saindhava's contribution to tonicity must be measured, not estimated from the classical quantity, that glycyrrhizin-rich preparations need dose control, and that essential-oil-rich Daru and Shatahwa need careful dose control because ocular tolerability cannot be inferred from traditional use [1]. Preservative-free preparations are generally preferred on a dry eye surface, but without a preservative, sterility and microbial limits become critical. Ocular drug delivery is limited by rapid precorneal loss and the barrier properties of the eye, so the retention, viscosity and tonicity of the vehicle are central design variables [24].

9. Recommendations for Future Research

1. **Fingerprint the finished ghee.** Use HPLC or HPTLC for markers (gallic acid and chebulagic acid for Triphala, piperine for Pippali, glycyrrhizin and liquiritin for Madhuka, β-sitosterol and stigmasterol, tocopherols, carotenoids) and GC-MS for volatile terpenes (carvone, cedrol-type compounds), then compare ghee, residue and plain ghee processed without herbs.
2. **Measure ophthalmic quality attributes.** pH, osmolality, viscosity, acid and peroxide values, particulate load, sterility and stability over the shelf life.
3. **Test ocular safety.** In vitro corneal and conjunctival epithelial models and appropriate irritation assays before further clinical expansion.
4. **Run a vehicle-controlled randomised trial.** Include a plain-ghee arm and, ideally, a preservative-free lubricant arm, to separate the herbal contribution from the ghee and from standard care.

5. **Add mechanistic endpoints.** Tear osmolarity, tear lipid-layer thickness, meibography, ocular surface staining and an inflammatory marker such as MMP-9.
6. **Extend follow-up.** Record recurrence, adherence and quality of life beyond Day 30.

10. Conclusion

Jeevanthyadhi Ghritha combines a cooling, sweet-bitter and unctuous composite of Rasa and Guna, which accounts for its classical Vata-Pitta pacifying and Chakshushya reputation, with a mixed phytochemical load in which lipophilic constituents are likely to predominate in the finished ghee. The most defensible modern account is that it coats and lubricates the ocular surface and supplies antioxidant and inflammation-modulating phytochemicals that may interrupt the evaporation-hyperosmolarity-inflammation loop. The comparative trial shows that Aschyothana and Tarpana give similar improvements in symptoms, tear-film stability and ocular wetting, which supports the practical value of the simpler procedure. Profiling of the finished product, ophthalmic quality and safety testing and a vehicle-controlled trial would convert a plausible rationale into evidence.

Declarations

Conflict of interest, funding and acknowledgements to be completed by the author.

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