



Research Article

Pharmaceutico-analytical standardisation of Dugdhapashanadi Yoga: A quality control study

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Abstract

Background: *Dugdhapashanadi Yoga* is a classical herbo-mineral Ayurvedic formulation traditionally indicated in oral and dental disorders. It contains *Dugdhapashana* (hydrated magnesium silicate), *Bakula* (*Mimusops elengi*), *Khadira sara* (*Kattha*; extract of *Acacia catechu*), *Kankola* (*Piper cubeba*), and *Sukshma Ela* (*Elettaria cardamomum*). Standardization of such formulations is essential to ensure consistent quality, safety, and therapeutic efficacy. This experimental laboratory-based standardization study aimed to establish preliminary pharmaceutico-analytical quality control parameters for *Dugdhapashanadi Yoga*. **Methods:** In this experimental laboratory-based standardization study, *Dugdhapashanadi Yoga* was prepared according to classical Ayurvedic pharmaceutical procedures under *Churna Kalpana* (powder formulation). Analytical evaluation included organoleptic assessment and physicochemical analysis as per Ayurvedic Pharmacopoeial standards. Preliminary phytochemical screening of the aqueous extract was performed using standard qualitative tests. High-Performance Thin Layer Chromatography (HPTLC) was carried out to generate a characteristic fingerprint profile. **Results:** The formulation exhibited acceptable organoleptic characteristics with a pharmaceutical yield of 98.23%. Physicochemical analysis showed loss on drying of 2.12%, total ash value of 44.649%, acid-insoluble ash of 38.618%, water-soluble ash of 0.089%, water and alcohol-soluble extractive values of 13.8% and 12.8%, respectively, pH of 7.5, and volatile content of 1.8%. Phytochemical screening revealed the presence of tannins, alkaloids, glycosides, flavonoids, phenolic compounds, saponins, triterpenoids, phytosterols, and fixed oils and fats. HPTLC analysis demonstrated distinct peaks at 254, 366, and 540 nm. **Conclusion:** The study establishes preliminary pharmaceutico-analytical quality control standards for *Dugdhapashanadi Yoga*. The generated data and HPTLC fingerprint may serve as reference parameters for quality assurance, batch-to-batch consistency, and future research.

Keywords: Oral health, Ayurvedic standardization, *Churna kalpana*, Dentifrices

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Introduction

Oral health is integral to overall well-being, as the oral cavity constitutes a complex ecological niche harbouring diverse microorganisms, including bacteria, fungi, and viruses. (1) The oral microbiome plays a critical role in maintaining oral health;

therefore, preservation or restoration of microbial balance remains a major clinical challenge. (2) Disruption of this balance contributes to the development of dental caries, gingivitis, periodontitis, halitosis, and other oral infections, primarily mediated by pathogenic microorganisms organized within oral biofilms. (3) Despite advances in modern dentistry, the widespread and often indiscriminate use of antimicrobial agents has led to increasing antimicrobial resistance, undesirable adverse effects, and disturbance of normal oral flora. (4)

Consequently, there is increasing interest in identifying alternative, safe, and effective antimicrobial agents derived from natural sources for daily oral hygiene. (5) Medicinal plants are

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rich in bioactive secondary metabolites, including alkaloids, flavonoids, tannins, and phenolic compounds, which exhibit antimicrobial, anti-inflammatory, antioxidant, and plaque-inhibitory activities. (6) Ayurveda, the traditional system of medicine of India, describes several polyherbal and herbo-mineral formulations that have been traditionally employed as tooth powders (*Dantadhavana Churna*) for routine oral hygiene and management of dental and gingival disorders.

Dugdhapashanadi Yoga is a classical herbo-mineral formulation described in *Rasamritam* under *Sikatavijyaniya Adhyaya*. (7) It is formulated as a *Churna Kalpana* (powder formulation) and traditionally used as a tooth powder for brushing the teeth and gums. The formulation comprises *Dugdhapashana* (hydrated magnesium silicate), *Bakula* (*Mimusops elengi*), *Khadira* (*Acacia catechu*), *Kankola* (*Piper cubeba*), and *Sukshma Ela* (*Elettaria cardamomum*). Owing to its traditional mode of application, *Dugdhapashanadi Yoga* is indicated in disorders of the teeth and gums and is attributed with antimicrobial, anti-inflammatory, cleansing, deodorizing, and wound-healing properties.

Despite its long-standing traditional use as a dentifrice, *Dugdhapashanadi Yoga* lacks systematic pharmaceutico-analytical evaluation using contemporary quality control parameters. Therefore, the present experimental laboratory-based study was undertaken to establish pharmaceutico-analytical standards for *Dugdhapashanadi Yoga*, thereby providing a scientific basis for its quality assurance, safety, and reproducible preparation.

Materials and Methods

Study Design

This study was designed as an experimental, laboratory-based pharmaceutico-analytical standardization study.

Ethical Approval

Ethical approval was not applicable, as the study did not involve human participants or animal experimentation.

Study Overview

The study was conducted in two phases:

(i) a pharmaceutical study carried out according to classical *Churna Kalpana* guidelines, and

(ii) an analytical study comprising evaluation of organoleptic characters, physicochemical parameters, preliminary phytochemical screening, and High-Performance Thin Layer Chromatography (HPTLC) fingerprinting.

Pharmaceutical Study

Pharmaceutical preparation was carried out in the Teaching lab of Department of *Rasa shastra* and *Bhaishajya Kalpana*. Sri Jayendra Saraswati Ayurveda College and Hospital, Chennai.

Procurement and Authentication of Raw Materials

Raw materials required for the preparation of *Dugdhapashanadi Yoga* included *Bakula* stem bark (*Mimusops elengi*), unripe dried fruits of *Kankola* (*Piper cubeba*), and seeds of *Sukshma Ela* (*Elettaria cardamomum*), which were procured from the local market of Chennai. Authenticated *Dugdhapashana* (hydrated magnesium silicate) was procured from an authorized supplier Associated Soapstone Distributing Co.Pvt.Ltd. Udaipur-313001 Rajasthan. Authenticated *Kattha* (Extract of *Acacia catechu*) was obtained from a certified manufacturer The Indian Wood Products

Co. Ltd. Izatnagar, Bareilly, Uttar Pradesh-243122. Herbal drugs were authenticated by experts in *Dravyaguna* (Ayurveda Pharmacognosy experts), and the mineral drug was authenticated by specialists in *Rasashastra* and *Bhaishajya Kalpana* (Ayurveda Mineralogist).

Composition of Dugdhapashanadi Yoga

Table 1: Composition of Dugdhapashanadi Yoga

S. No.	Ingredient	Botanical/ Chemical name	Part / Form used	Proportion (parts)	Weight (g.)
1	<i>Dugdhapashana</i>	Hydrated magnesium silicate	Stone/ Crystal	4	200
2	<i>Bakula</i>	<i>Mimusops elengi</i>	Stem Bark	2	100
3	<i>Khadira</i>	<i>Acacia catechu</i>	Heartwood extract/ <i>Kattha</i>	1	50
4	<i>Kankola</i>	<i>Piper cubeba</i>	Unripe dried seeds	1	50
5	<i>Sukshma Ela</i>	<i>Elettaria cardamomum</i>	Seeds	1	50
	Total			9 parts	450 g

Table 2: Rasa Panchaka of Dugdhapashana and its ingredients

Ingredients	Rasa Panchaka				
	Rasa	Guna	Veerya	Vipaka	Doshagnata
<i>Dugdhapashana</i>	<i>Madhura</i>	<i>Sheeta</i>	<i>Ishad ushna</i>		<i>Pittagna</i>
<i>Bakula</i>	<i>Katu, Madhura, kashaya</i>	<i>Guru, Snigdha</i>	<i>Anushna, Sheetata</i>	<i>Katu</i>	<i>Kapha-Pitta shamaka</i>
<i>Khadira</i>	<i>Tikta, Kashaya</i>	<i>Laghu, Ruksha</i>	<i>Sheeta</i>	<i>Katu</i>	
<i>Kankola</i>	<i>Katu, Tikta</i>	<i>Laghu, Ruksha, Teekshna</i>	<i>Ushna</i>	<i>Katu</i>	<i>Kapha-Vata Shamaka</i>
<i>Sukshma Ela</i>	<i>Katu, Madhur</i>	<i>Laghu, Ruksha, Tikshna, Sukshma</i>	<i>Sheeta</i>	<i>Katu</i>	<i>Vatakapha shamaka</i>

Method of Preparation

Dugdhapashanadi Yoga was prepared in accordance with the classical method of *Churna Kalpana* described in *Sharangadhara Samhita* (*Madhyama Khanda* 6/1). (8)

The preparation process involved two steps: size reduction with sieving and homogeneous mixing.

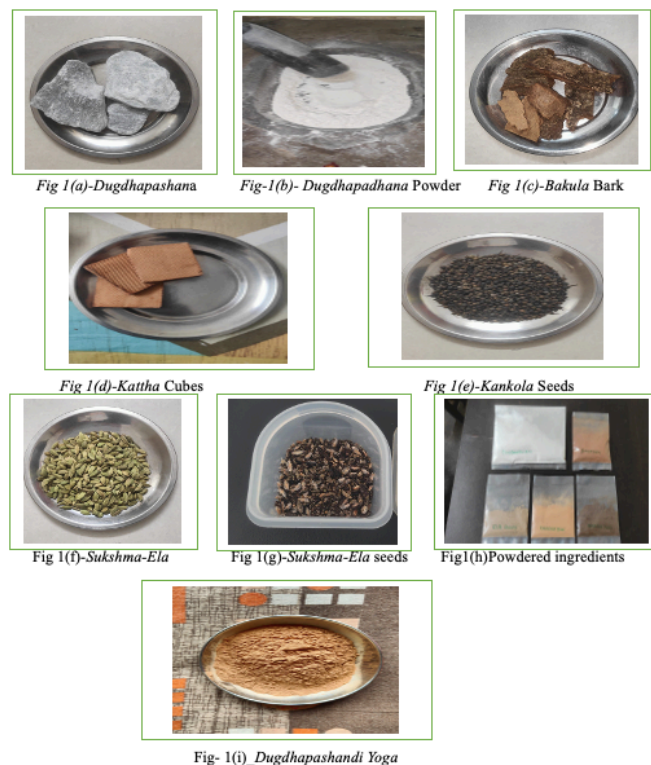
For size reduction, physical impurities were removed from all raw materials prior to processing. *Bakula* bark was washed to eliminate adhering impurities, oven-dried, and pulverized into a fine powder. *Kankola* dried berries were gently dry roasted with mild flame to remove residual moisture and then powdered. Well-formed black seeds of *Sukshma Ela* were separated and finely powdered. *Kattha* blocks were crushed and powdered. *Kankola* dried berries, seeds of *Sukshma Ela*, and crushed *kaththa* were

powdered separately using mixer grinder. *Dugdhapashana* lumps were pounded using *Ulukhala Yantra* (Mortar and pestle) to obtain a fine powder. Each powdered drug was sieved through 85# mesh sieve to ensure uniform particle size and stored separately in clean, airtight containers to prevent contamination and moisture absorption.

For mixing, accurately weighed quantities of each powdered ingredient were transferred into a stainless-steel vessel and mixed thoroughly to obtain a homogeneous formulation. The final formulation was stored well in an airtight stainless-steel container until further analysis.

Images of the Pharmaceutical Study

Figure 1 (a-i): Images of Pharmaceutical Study



Analytical Study

Analytical evaluation of *Dugdhapashanadi Yoga* was carried out to assess organoleptic characteristics, physicochemical parameters, preliminary phytochemical composition, and chromatographic fingerprinting.

Analysis of Organoleptic Characters, Physicochemical parameters and Preliminary Phytochemical Screening were done in Quality control laboratory of SJSACH, Chennai and State government Drugs Testing Laboratory, Arumbakkam, Chennai. HPTLC analysis was conducted from Ashtagiri herbal Research Institute, Perungudi, Chennai.

Organoleptic Evaluation

The prepared formulation was evaluated for colour, odour, taste, and texture using standard sensory evaluation methods to assess preliminary quality and acceptability.

Physicochemical Analysis

Physicochemical parameters, including loss on drying, total-ash value, acid-insoluble ash, water-soluble ash, water-soluble extractive value, alcohol-soluble extractive value, pH, and volatile

content, were determined in accordance with the procedures and standards prescribed in the Ayurvedic Pharmacopoeia of India. (9) All measurements were performed using standardized analytical protocols.

Preliminary Phytochemical Screening

Qualitative phytochemical screening of the aqueous extract of *Dugdhapashanadi Yoga* was carried out using standard chemical tests to detect the presence of major phytoconstituents, including alkaloids, carbohydrates, glycosides, flavonoids, tannins, phenolic compounds, saponins, steroids, phytosterols, and triterpenoids, following established procedures. (10)

HPTLC Fingerprinting

High-Performance Thin Layer Chromatography (HPTLC) was performed to develop a characteristic chromatographic fingerprint profile of *Dugdhapashanadi Yoga* at Ashtagiri herbal Research Institute, Perungudi, Chennai. An ethyl acetate extract of the formulation (20 μ L) was applied onto pre-coated silica gel GF₂₅₄ aluminium plates. Plate development was carried out in a twin-trough chamber using an optimized mobile phase consisting of toluene:ethyl acetate:formic acid (6:4:0.5, v/v/v). Densitometric scanning was performed using a CAMAG HPTLC scanner, and chromatograms were documented at 254 nm, 366 nm, and 540 nm. (11)

Pharmaceutical Study

The pharmaceutical preparation of *Dugdhapashanadi Yoga* was carried out as per classical *Churna Kalpana* procedures. An initial quantity of 450 g of raw materials was used for formulation. The final yield obtained after processing was 442 g, indicating a loss of 8 g during preparation. The percentage loss in weight was 1.77%, and the overall yield of the formulation was 98.23%.

Analytical Study

Table 3: Organoleptic Parameters of *Dugdhapashanadi Yoga*

Sr.No.	Organoleptic	Result
1	Colour	Light brown to beige
2	Odour	Characteristic- aromatic
3	Taste	Astringent, mild Bitter, Sweet
4	Touch	Fine, Soft, Smooth

Table 4: Physicochemical Parameters of *Dugdhapashanadi Yoga*

Sr.No.	Physico-chemical Parameters	Result
1	Loss on Drying	2.12%
2	Total Ash value	44.649%
3	Acid insoluble ash	38.618%
4	Water soluble ash	0.089%
5	Water soluble extractive	13.8%
6	Alcohol soluble extractive	12.8%
7	pH Value	7.5
8	Volatile content	1.8%

Table 5: Tooth powder criteria evaluation

Sr.No	Parameter	Result
1	Abrasiveness	Mild
2	Hardness	1.5
3	Fineness (90 micron)	75%
4	Foam test	Not present

Table 6: Phytochemical Constituents Detected in Aqueous Extract

Sr. No.	Phyto- constituents	Test name	Result
1	Alkaloids	Dragendroff's test	Positive
2	Carbohydrates	Resorcinol test	Positive
3	Glycosides	Conc. H ₂ SO ₄ test	Positive
4	Flavonoids	Ferric chloride test	Positive
5	Phenolic compounds	Ferric chloride test	Positive
6	Tannins	Braymer's test	Positive
7	Saponins	Foam test	Positive
8	Phytosterols	Hesse's response	Positive
9	Triterpenoides	Salkowski's test	Positive
10	Fixed oils and fats	Spot test/ Stain test	Positive

(Positive = Presence of phytoconstituent confirmed after testing three times)

HPTLC Fingerprint Analysis

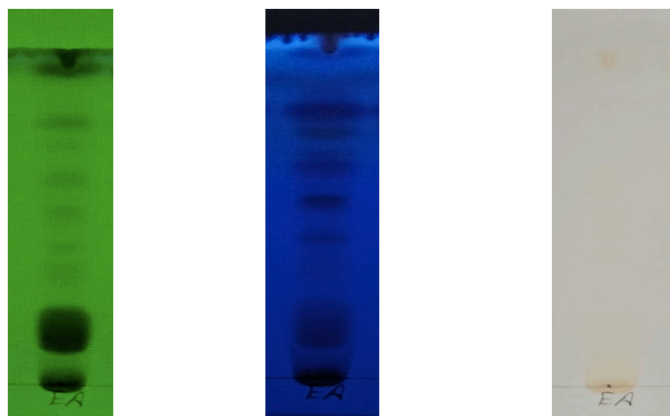
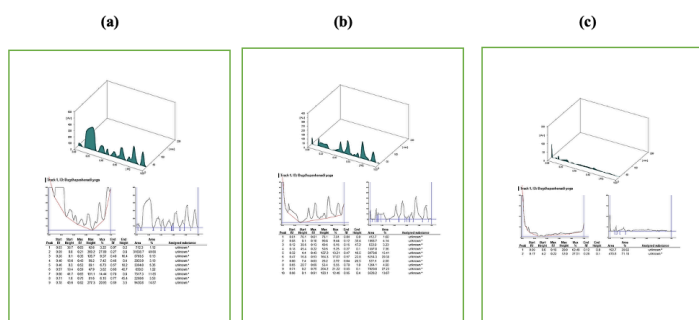
Table 7: HPTLC Profile of *Dugdhapashanadi Yoga*

Wavelength	Number of Peaks	Rf Range
254 nm	9	0.03 to 0.82
366 nm	10	0.01 to 0.9
540 nm	2	0.10 to 0.22

Visualization at 254nm; Visualization at 366 nm; Visualization at 540 nm

Figure 2: TLC document of *Dugdhapashanadi yoga* at different wavelengths

Visualization at 254nm Visualization at 366 nm Visualization at 540 nm

**Figure 3: HPTLC Chromatogram of *Dugdhapashanadi yoga* at 254 nm, 366nm and 540nm**

Discussion

The present study was designed to establish pharmaceutico-analytical standards of *Dugdhapashanadi Yoga*. Establishing such parameters is essential for ensuring quality, safety, and reproducibility of classical Ayurvedic formulations when used in contemporary clinical practice.

Individually, the ingredients of *Dugdhapashanadi Yoga* have been reported to possess significant antibacterial, wound healing, taste-enhancing and anti-inflammatory properties. The mineral, *Dugdhapashana* (talc) composed of magnesium and silica, supports dental health by promoting enamel formation, preventing cavities, and reducing gum inflammation. (12) The four herbal ingredients *Bakula*, *Khadira*, *Kankola*, and *Sukshma Ela* are known for their oral health benefits. *Bakula* and *Khadira* are well-established *Dantiya* (suitable to teeth) drugs with proven efficacy in oral infections. (13,14) While *Kankola* and *Sukshma Ela* exhibit antimicrobial and deodorizing actions. The compound magnesium silicate, which constitutes the major portion in this tooth powder, is considered physiologically inert, as it is neither absorbed nor metabolized in the human body, and therefore no Acceptable Daily Intake (ADI) has been established. (15) Regulatory authorities, including the U.S. FDA and European agencies, have listed it as Generally Recognized as Safe (GRAS) and included it in the FDA Inactive Ingredients Guide. (16)

By summarizing *Rasapanchaka* of individual ingredients in the formulation, it can be inferred that *Dugdhapashanadi yoga* is predominant with *katu*, *tikta*, *kashaya rasa*; *laghu*, *ruksha*, *tikshna guna*; *katu vipaka*, *sheeta veerya* and *kapha-pitta shamak karma*.

The formulation exhibits *Kashaya*, *Tikta* and *Madhura rasa*, which align with *Kapha-Pitta* pacifying actions, reducing inflammation, gum bleeding, and halitosis. *Sheeta Virya* of *Bakula* and *Khadira* pacifies *Pitta*, reducing gingival inflammation and mucosal irritation. While aromatic and *Ushna-virya* component *Kankola* and *sheeta veerya* component *Ela* pacify *kapha* and *Vata*, stimulating salivation and promoting oral freshness and mucosal integrity. *Katu vipaka* of the formulation helps in removal of excessive doshas, stimulates mouth and *krimighna* activity. *Laghu guna* helps in *strotoshodhana*, *ruksha* and *Tikshna guna* of the formulation helps in *lekhana* property, thus helpful in removing plaque and reduces bacterial growth. The ingredients have *Kapha pitta shamak* and *kapha vata shamak* properties, facilitates removal of ama and kapha doshas. This combination ensures *tridosha* balancing in the oral cavity, selectively inhibiting pathogenic microbes without disturbing beneficial flora.

Preparation of *Dugdhapashanadi Yoga* was carried out in accordance with the classical guidelines of *Churna Kalpana* (powder formulation) described in *Sharangdhara Samhita*, ensuring standardization and reproducibility. *Dugdhapashana* (Magnesium silicate), the mineral component of the formulation was cleaned and pounded in *khalwa yantra* (mortar and pestle) to make it fine powder. *Bakula* stem bark (*Mimusops elengi*) was washed, oven-dried and powdered, ensuring removal of moisture and enhancing shelf life. *Khadira* (*Acacia catechu*) cubes were processed to yield fine powder. *Kankola* dried unripe berries (*Piper cubeba*) were dry roasted for 3-5 minutes on a low flame to remove residual moisture, to enhance aroma and to facilitate fine grinding. This helps in preserving high volatile content. *Sukshma Ela* (*Elettaria cardamomum*) black seeds were taken from the fruit ensuring its high volatile oil content. For the study 50 gm seeds of yield obtained from an average 100 gm of fruits. Disintegrator and

pulveriser were used for the grinding of Bakula bark, While Mixer grinder was used for grinding *Kattha* cubes, *Kankola* seeds and *Sukshma ela* seeds.

Each drug was separately powdered and kept in a separate air tight container to prevent contamination and moisture absorption. Use of fine sieving (85# mesh) and homogeneous mixing ensured consistency, uniform distribution of ingredients, and suitability for oral application. Storage of each powdered drug and the final formulation in airtight containers minimized moisture absorption, contamination, and loss of active constituents. Loss in the quantity observed during processing. Overall, the pharmaceutical process confirms that *Dugdhapashanadi Yoga* can be prepared in a controlled manner while maintaining its classical formulation integrity and quality.

Organoleptic evaluation of *Dugdhapashanadi Yoga* revealed desirable sensory attributes, indicating good quality and patient acceptability. The fine, soft, and smooth texture reflects effective homogenization, ensuring uniform dosage, ease of application in the oral cavity, and better dissolution of active constituents. The uniform light brown to beige colour suggests consistent blending of herbal and mineral components. A slightly aromatic odour confirms the preservation of volatile oils from *Sukshma Ela* and *Kankola*, contributing to *Durgandhahara* (deodorizing) action. The mild astringent, subtle bitter-sweet taste and overall palatability make the formulation comfortable for oral use.

Physicochemical parameters further supported the quality, stability, and suitability of the formulation. The pH of cold infusion of *Dugdhapashanadi yoga* is 7.5 indicates a neutral to mildly alkaline nature, ensuring compatibility with saliva and oral mucosa and minimizing irritation. Loss on Drying (LOD) obtained is 2.12%. It indicated that formulation contain 2.12% moisture content/volatile substances. The reason for high LOD may be due to volatile oils present in *Sukshma ela* and *Kankola*. It is also observed that even higher LOD values obtained when the sample is kept in open for longer duration. This may be due to the main ingredient Magnesium silicate which possess hygroscopic property. Hence it is essential to store the formulation in air tight containers as excess moisture would compromise texture and allow spoilage. LOD influences stability, shelf-life, and susceptibility to microbial growth. Total Ash value obtained is 44.649 %. Ash Value indicates total inorganic content left after burning the sample at high temperatures. Higher ash value indicates higher inorganic content. Many times it may be due to adulteration of soil which is rich in salicaceous content. Which is undesirable. But *Dugdhapashanadi yoga* is a herbomineral formulation which possess mineral ingredient magnesium silicate which contain four parts out of nine parts of total ingredients. It comes around 45% of the total ingredients. Obtaining 44.649% is rationale as per the ingredients and LOD obtained. It represents total mineral content of original sample, thereby suggesting of its purity. Acid Insoluble Ash obtained is 33.618 %. It refers to inorganic residue, primarily sand and silica, that remains after sample is incinerated and treated with dilute acid. Hence higher acid insoluble ash is undesirable and indicates adulteration in pure herbal drug. But here higher value is due to the silicate mineral ingredient (*Dugdhapashana*) not due to any adulteration. Water Soluble Ash obtained is 0.089%. It refers to the portion of ash that dissolves in water indicating the water-soluble inorganic mineral content like Na, K etc. Extractive values in water (13.8%) and alcohol (12.8%) demonstrate the presence of both water- and alcohol-soluble bioactive constituents, supporting therapeutic efficacy. Volatile Matter of 1.8% reflects the presence and evaporation of essential oils or volatile actives. Low volatile

content value of 1.8 % ensures long-term stability, indicating minimal loss of aroma and essential oils during processing. Overall, the findings confirm the formulation's purity, stability, and suitability for oral application.

Preliminary phytochemical screening of *Dugdhapashanadi Yoga* revealed the presence of tannins, alkaloids, carbohydrates, glycosides, flavonoids, phenolic compounds, triterpenoids, saponins, phytosterols, and fixed oils and fats. Tannins are the astringent compounds responsible for strengthening gums and useful in bleeding gums. It possesses anti-microbial, anti-inflammatory, antioxidant property. Alkaloids, Flavonoids, Phenolic compounds, Phytostreols possess anti-microbial, anti-inflammatory, antioxidant property. Glycosides have antibacterial, anti-inflammatory and wound healing properties. Triterpenoids possess anti-inflammatory, anti-bacterial, and anticancer property. Saponins exhibit anti-inflammatory, anti-bacterial property. It acts as antibiofilm agent. Fixed oils and fats are responsible for taste perception, texture and flavour release. Identification of above phytoconstituents supports the therapeutic claim of the formulation as antimicrobial, anti-inflammatory, antioxidant, antiplaque, astringent.

HPTLC or High-Performance Thin-Layer Chromatography was carried out to establish the fingerprint of *Dugdhapashanadi Yoga* at 254 nm, 366 nm and 540 nm UV regions wavelength, HPTLC analysis of *Dugdhapashanadi Yoga* revealed the presence of multiple phytoconstituents at different wavelengths. At 254 nm, nine peaks were observed with Rf values ranging from 0.03–0.82, among which peak 2 showed the highest area (49.88%), indicating a predominant compound. At 366 nm, ten peaks were detected with Rf values between 0.01–0.91; peak 9 exhibited the maximum area (27.23%). At 540 nm, two peaks were observed (Rf 0.10–0.22), with peak 2 contributing the highest area (71.18%). Common Rf values at 254 nm and 366 nm were 0.43 and 0.75, while Rf values 0.10 and 0.22 were common to both 366 nm and 540 nm, suggesting shared phytoconstituents across wavelengths. To interpret the exact components/phytoconstituents of the given sample, the standard markers are required. So, it is challenging to comment on the HPTLC pattern observed in the present study, without standard markers. Hence, the HPTLC photo documentation can be anticipated as a Fingerprint to develop the preliminary standards.

The integrated analytical findings provide a scientific basis for the classical efficacy of *Dugdhapashanadi Yoga*. Physicochemical parameters confirm appropriate processing and preservation of active ingredients. High water-soluble extractives indicate abundant polar bio actives, facilitating mucosal absorption and antimicrobial action. HPTLC fingerprinting, can serve as quality control markers, ensuring batch-to-batch consistency.

Conclusion

Pharmaceutical standardization validated that *Dugdhapashanadi Yoga* may be reproducibly prepared in a controlled setting while preserving its classical honesty. Analytical evaluation established organoleptic and physicochemical stability. It substantiated its essential quality control parameters, including alkaline pH, acceptable moisture content, high mineral integrity, characteristic HPTLC fingerprinting and Phytochemical richness. The generated pharmaceutico-analytical data provide a reliable reference framework for quality assurance, batch-to-batch consistency, and large-scale production. Overall, the study supports the rational integration of this classical formulation into contemporary oral

healthcare practices and lays a foundation for further experimental and clinical investigations.

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