



Research Article

THERAPEUTIC CATEGORIZATION AND PHYSICOCHEMICAL PROFILING OF PROPRIETARY AYURVEDIC HERBAL BALMS AND OILS MARKETED IN INDIA

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ABSTRACT

Ayurvedic herbal balms and oils are widely employed in India for the topical management of pain, inflammation, musculoskeletal disorders, cold, and hair and skin care. Despite their extensive use, many proprietary formulations lack clearly defined physicochemical reference ranges, leading to challenges in quality evaluation. The present study compiles and analyzes long-term routine laboratory data to identify approximate physicochemical trends in commercially marketed Ayurvedic balms (n = 25) and oils (n = 91). Balms were evaluated for pH, water- and alcohol-soluble matter, total ash, and acid-insoluble ash, while oils were assessed for acid value, iodine value, saponification value, refractive index, and loss on drying using established pharmacopoeia methods. Selected formulations were further examined by thin-layer chromatography (TLC) to support botanical identity and compositional consistency. Balms exhibited pH values ranging from 2.43 to 7.30 with generally low ash and negligible acid-insoluble ash, indicating acceptable topical compatibility and purity. Alcohol-soluble matter showed wide variability (0.45-51.06%), reflecting differences in essential oil and resin content. Oils demonstrated saponification values predominantly within 150-300 and refractive index values mostly between 1.40 and 1.50, consistent with lipid-based *Sneha Kalpana*, while acid value (range from 0.1 to 20), iodine values varied from 10 to 130 and loss on drying (20 to 80%) displayed broad dispersion corresponding to volatile oil fortification and formulation intent. TLC profiles confirmed characteristic phytochemical signatures of selected botanicals. The observed variability represents purposeful formulation diversity rather than inconsistency and aligns with Ayurvedic principles of *Dosha*-specific tailoring and therapeutic intent. The proposed analytical ranges are intended as guidance benchmarks rather than rigid specifications and may support rational quality control, regulatory evaluation, and standardization efforts while respecting the inherent flexibility of Ayurvedic formulations.

INTRODUCTION

Quality assurance of medicinal products requires verification of identity, purity, and consistency through appropriate analytical evaluation. While pharmaceutical and food sectors rely on well-defined physicochemical specifications, many proprietary Ayurvedic formulations continue to be manufactured based on traditional knowledge,

empirical practices, and proprietary experience, often without clearly defined analytical benchmarks. Despite extensive market presence, systematic compilations of long-term physicochemical data for proprietary Ayurvedic topical formulations remain scarce.

Ayurvedic formulations are predominantly plant based, and their evaluation closely parallels food analysis in terms of compositional variability and raw material dependence. Although classical Ayurvedic texts and pharmacopoeias describe standardized preparation methods and analytical tests, explicit acceptable numerical ranges for key physicochemical parameters are often not defined. Variations in botanical sources, geographical origin, processing

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methods, and seasonal factors further influence formulation characteristics.

Classical wet chemistry methods, despite limited sensitivity compared with modern instrumental techniques, remain valuable due to their robustness, reproducibility, and relevance to regulatory quality control. Chromatographic techniques such as TLC and HPTLC further support botanical authentication and compositional consistency.

The present study compiles extensive routine laboratory data generated over several years for commercially marketed Ayurvedic balms and oils. The objective is to identify approximate physicochemical ranges, observe analytical trends, and interpret results in the context of Ayurvedic principles.

MATERIALS AND METHODS

Sample Collection

Commercially available Ayurvedic balms (n=25) and oils (n=91) were received by the laboratory from various manufacturers and customers across different regions of India for routine quality evaluation. Only samples with intact packaging and clear labelling were included.

Physicochemical Analysis

Balms were analyzed for pH, water-soluble matter (WSM), alcohol-soluble matter (ASM), total ash (TA), and acid-insoluble ash (AIA). Oils were evaluated for acid value (AV), iodine value (IV), Saponification value (SV), refractive index (RI), and loss on drying (LOD). All analyses were performed using established procedures described in official pharmacopoeial and reference texts.

Thin-Layer Chromatography (TLC) Profiling

TLC profiling was conducted for selected medicinal plants commonly used in Ayurvedic formulations, including *Azadirachta indica*, *Withania somnifera*, *Tinospora cordifolia*, and *Glycyrrhiza glabra*. Pre-coated silica gel plates were developed using appropriate solvent systems, followed by visualization under ultraviolet light or after spraying with vanillin-sulphuric acid reagent. R_f values and colour reactions were compared with authentic reference standards.

RESULTS

Integrative Ayurvedic Interpretation

Ayurveda does not endorse a 'one-formulation-fits-all' approach. Variability seen analytically reflects dosha-specific tailoring- Oils and balms are selected based on: disease (*Roga*), patient constitution (*Rogi*), season (*Kala*), region (*Desha*). Based on formulation composition and intended therapeutic utility, the analyzed balms and oils could be categorized into

distinct groups consistent with Ayurvedic principles of *Sneha Kalpana*, *Dravya Guna*, and *Dosha*-specific application. Such categorization aids in rational quality assessment without undermining classical therapeutic diversity.

Balms showed pH values ranging from 2.43-7.30 and alcohol-soluble matter from 0.45-51.06%, while oils exhibited saponification values predominantly between 150-300 with wide variability in loss on drying.

Balms panel - Clear visual grouping into: Menthol-camphor balms, herbal resin/traditional balms, petroleum-based hybrid balms, linked directly to pain, cold, inflammation, and *Sandhi-Shoola* utility.

Balms- Key Parameters : pH: mean 5.60, SD 1.18, min 2.43, max 7.30; Water-soluble matter (WSM): mean 3.45, SD 7.55, min 0.073, max 29.65; Alcohol-soluble matter (ASM): mean 15.00, SD 15.02, min 0.458, max 51.06; Acid-insoluble ash (AIA): all entries were BDL/NIL/NL; Total ash (TA): mean 0.167, SD 0.168, min 0.03, max 0.56 (15 entries were BDL/NIL). Balms show a moderately narrow pH distribution centred around mildly acidic to near-neutral values, while WSM and ASM are strongly right-skewed (few formulations with very high extractables), supporting heterogeneity in base composition and volatile content.

Balms- extremes: Highest WSM: Rahath Marham (29.65); Relief Pain Balm (20.4); Sanjivani Pain Balm (20.2) and Highest ASM: Vikas Balm (51.06); Amruth Rasanjan (45.42); Star Balm (44.84).

Oils panel- Visual separation of: Classical *Sneha Kalpana* oils, essential-oil fortified oils, hair and massage oils, connected to *Abhyanga*, *Vata-Vyadhi*, *Kesha-Raksha*, and muscle therapy.

Oils - Key Parameters: Acid value (AV): mean 8.66, SD 14.61, min 0.43, max 115.4; Iodine value (IV): mean 72.68, SD 43.98, min 1.46, max 202.6; Saponification value (Sap.V): mean 200.79, SD 74.55, min 1.50, max 382.12; Loss on drying (LOD): mean 12.66, SD 24.65, min 0.05, max 102.68; Refractive index (RI): mean 1.476, SD 0.057, min 1.33, max 1.965. The large SD for LOD and AV reflects wide variability among oils (volatile-oil fortified vs classical *Tailams* etc.), which is consistent with the diversity of formulations listed in the paper.

Oils- extremes: Highest LOD: KGR Puttur Thailam (102.68); Zinda Tel Ayurvedic (99.48); Zinda Dhara (99.02) and Highest RI: Sri Parni Taila (1.965). These are excellent candidates to mention as "high-variability formulations" and link to composition (e.g., volatile oils with higher LOD).

Table 1: Balms - formulation and composition

S.No	Name	Composition of the formulation
Category 1 - Menthol Camphor Wintergreen Balms		
1	Relief Pain Balm	Each 10g contains extract of composition: 8% each of <i>Puteeha</i> and <i>Karpoor</i> , 15% <i>Gandhapura</i> oil, 2% <i>Tailaporna</i> oil, balm's Base - q.s.
2	Star Balm	20% menthol, 10% each of <i>Gaultheria</i> oil & camphor, Base q.s.
Category 2 - Essential Oil Rich Polyherbal Balms		
3	Sanjivani Pain Balm	0.5g each of <i>Lavanga</i> , <i>Pudina</i> , <i>Nilagiri</i> , <i>Ghanasora Thaila's</i> , and 8g <i>Sweta Siktha</i> .
4	Kobraa Balm	Peppermint Ka Phool 20 w/w, camphor 2 w/w, oil gaultheria 12 w/w, <i>Nilgiri Ka Tel</i> 1 w/w, base q.s.
Category 3 - Resin/Wax-Based Traditional Balms		
5	Rahath Marham	Each 20g contains: Bee wax 5g, clove oil (<i>Eugenia Caryopllata</i>) 1.25g, sesame oil (<i>Sesamum Indicum</i> Linn) 10g, benzoin (<i>Styrax Benzoon</i>) 1.25g and <i>Datura (Datura Strolmanilum)</i> 2.5g.
Category 4 - Resin/Wax-Based Traditional Balms		
6	Chatwal Pain Balm	Each 100g contains: <i>Citrus Lemon</i> 4g, <i>Zingiber Officinal</i> 1.5g, <i>Myristica Fragans</i> 1g, <i>Capsicum Frutescens</i> 0.50g, <i>Cinnamomum zeytanicom</i> 8g, <i>Gaultheria fragrantissima</i> 11g, <i>Mentha piperata</i> 13g, <i>Eucalyptus globulus</i> 9g, <i>Borneo Camphor</i> 10g, <i>Ocimum Sanctum</i> 4g, petroleum jelly 38g.
7	Pavitra's Mini Plus Balm	<i>Pudina Ka Phool</i> 18%, <i>Karpur</i> 6%, <i>Ajwain Ka Phool</i> 0.5%, <i>Nilgiri</i> oil 7%, <i>Gaultheria</i> 10%, <i>Tarping</i> 1.5%, <i>Lavang</i> 0.5% base q.s.
Category 5 - Low Ash/Low Extractive Mild Balms		
8	Amruth Rasanjan	Each 10g contains: Menthol 15%, turpentine oil, camphor, eucalyptus oil – each 10%; coconut oil 20%, Base Q.s.
9	Yuan Ban Dragon Jel	Menthol 4%, <i>Karpoor</i> 9%, eucalyptus oil 30% in Jell Base q.s.
10	Yuan Ban Dragon Cold Rub	Winter green tel 16%, menthol 6%, turpentine oil 4%, eucalyptus oil 3%, and ointment base q.s.

Table 2: Oils – Formulation and Composition

S.No	Name	Composition of the formulation
Category 1 - Classical Sneha Kalpana Tailas		
1	<i>Mahanarayana Taila</i>	960g each of <i>Bilva</i> , <i>Asvagandha</i> ; <i>Svadamstra</i> , <i>Syonaka</i> , <i>Brhati</i> , <i>Vatyalaka</i> , <i>Paribhadra</i> , <i>Ksudra</i> , <i>Kathilla</i> , <i>Atibala</i> , <i>Agnimantha</i> , <i>Sarani</i> , <i>Patali</i> , water for decoction 98.3L; reduced to 25L; <i>Taila</i> 6.1kg
2	<i>Ksheerbala Taila</i>	<i>Bala Kasaya (Sidda cordifolia)</i> & <i>Jala (water)</i> – each 16 parts, <i>Bala taila- (Sidda cordifolia)</i> – 1 part; 4 parts each of <i>Taila (Sesamum indicum)</i> and <i>Ksheera (cow's milk)</i> .
Category 2 - Essential Oil-Fortified Tailas		
3	Zinda Tel Ayurvedic	<i>Neelagri</i> 87%, <i>Rathanjoath</i> 7.4%, <i>Karpur</i> 2.6%, <i>Ajwain Ka Phool</i> 1.7%, <i>Pudine ke Phool</i> 1.3%.
4	Run Pain Oil	2ml each of <i>Mahanarayana</i> , <i>Ravipriya</i> , <i>Pinda Tailams</i> , 1ml each of <i>Erranda</i> seed, <i>Karpuraha</i> , <i>Eucalyptus</i> ; <i>Dalchini</i> & <i>Pudina</i> Oil – each 0.5ml.
Category 3 - Hair Nourishment Tailas		
5	Long Hair Oil	<i>Aloe vera</i> – 40%, <i>Bhringaraj</i> – 10%, <i>Brahmi</i> , <i>Menthulu</i> , <i>Henna</i> , <i>Yesthi</i> , <i>Vattivare</i> , <i>Neeli</i> , <i>Madhara</i> , <i>Tulasi</i> - 5% each.
6	<i>Kesaamrutha</i> Hair Tonic	<i>Arishtaka</i> – 3g, <i>Kumari</i> – 1g, <i>Japapushpa</i> , <i>Madayantika</i> – 0.5g each.

Category 4 - Massage/Sports Oils		
7	Asra Massage oil	Sarsoon Oil – 1.72ml, Mohe Oil, Nilgiri Oil – 1.80ml; Oil of <i>Gel Theria</i> – 0.8ml, <i>Sat-E-Ajwain</i> , <i>Sat-E- Pudeena</i> , <i>Kaphur</i> , <i>Ratanjoth</i> – each 0.04ml; <i>Kaifal</i> – 0.08ml, Turpentine Oil – 0.25ml, <i>Laisen ka Tel</i> – 0.01ml.
Category 5 - Hybrid Proprietary Oils		
8	Ortho Fit Oil	Each 100ml contains: 0.0016g each of aqueous herbal extract of <i>Vacha</i> (Rhizome), <i>Haridra</i> , <i>Sunthi</i> , <i>Devar</i> , <i>Rasna</i> (root), <i>Lasuna</i> (pod), leaves - <i>Sigru</i> , <i>Arka</i> , <i>Nirgundi</i> , <i>Tintrini</i> , <i>Katuvira</i> (fruit), and blended with <i>Tarpin Ka Tel</i> (7ml), 9ml each of <i>Pudina Sat</i> , winter green oil, <i>Karpoor</i> ; 4ml each of <i>Ajwain</i> , <i>Salhki Oil</i> and <i>Nilgiri Tel</i> ; Sesame Oil – q.s.
Category 6 - Others		
9	Amrit Tailam	<i>Ashwaganda</i> , <i>Bala</i> , <i>Punarnava</i> , <i>Bilwa</i> , <i>Agnimantha Bilwa</i> , <i>Patha</i> , <i>Nimb-twak</i> , <i>Bruhati</i> , <i>Nigundi</i> with <i>Til thailma</i> .
10	M.S Tailam	100mg each of <i>Dashamoola</i> , <i>Balamula</i> , <i>Nirgundi</i> , <i>Errandamoolam</i> , <i>Ashwaganda</i> , <i>Patura</i> , <i>Vishamusti</i> – 50mg, <i>Kalka of Saraswathi</i> , <i>Kachur</i> , <i>Bhringaraj</i> – 10g, <i>Til Oil</i> q.s.
11	Painda Taila	<i>Madhuchista</i> 280g, 455g each of <i>Manjistha</i> and <i>Sariva</i> , <i>Sarja rasa</i> 16g, <i>Taila</i> 6L, water 24L
12	Brihat Saindavadya Taila	24g each of <i>Saindhava lavana</i> ; <i>Sreyasi</i> ; <i>Rasna</i> ; <i>Satapuspa</i> ; <i>Yamonika</i> ; <i>Sarjika</i> ; <i>Marica</i> ; <i>Kustha</i> ; <i>Sunthi</i> ; <i>Sauvarcala</i> ; <i>Vida Lavana</i> ; <i>Vaca</i> ; <i>Ajamoda</i> ; <i>Madhuka</i> ; <i>Jiraka</i> ; <i>Pauskora</i> ; <i>Kana</i> ; 768g each of <i>Eronda</i> and <i>Satapuspajambu</i> ; 1.6L each of <i>Kanjika</i> and <i>Mastu</i> .
13	Dhanvantari Taila	Composition 1: <i>Sidda Cordifolia</i> (<i>Bala</i>), <i>Tribulus Terrestris</i> (<i>Goleshura</i>), <i>Sanfalum Album</i> (<i>Chandana</i>), <i>Mentha Pipertia</i> (<i>Pudina</i>), <i>Trigonella Foenum</i> (<i>Menthulu</i>), <i>Glycyrrhiza Glabra</i> (<i>Yastimadhu</i>) <i>Citrus Aurantium</i> (<i>Nimba</i>), <i>Prunus amyofdalus</i> (<i>Badam</i>), <i>Asphaltum</i> . Composition 2: <i>Bala Mula</i> (<i>Sidda cordifolia</i>) 4.16kg; <i>Jala</i> (water) for decoction 36.86L; Reduced to 4.61L; <i>Payah</i> (cow's Milk) 4.61L; <i>Yava</i> (<i>Hardeum vulgare</i>), <i>Kola</i> (<i>Zizyphus jujuba</i>), <i>Kulattha</i> (<i>Dolichos biflorus</i>), <i>Syonaka</i> (<i>Oraxylum indicum</i>), <i>Bilva</i> (<i>Aegle marmelos</i>), <i>Gambhari</i> (<i>Gelina arborea</i>), <i>Patala</i> (<i>Stereos permum</i>), <i>Ganikorika</i> (<i>Clerodendrum phloides</i>), <i>Salaporni</i> (<i>Desmodium gangeticum</i>), <i>Prsniparni</i> (<i>Uraria picta</i>), <i>Brhati</i> (<i>Solanum indicum</i>), <i>Kantakari</i> (<i>Solanum surattense</i>), <i>Goksura</i> (<i>Tribulus terrestris</i>) 59g each; <i>Jala</i> (Water) for decoction 6.14L; reduced to 768ml; <i>Taila</i> (<i>Sesamem indicum</i>) 768ml; <i>Meda</i> (<i>Asparagus racemosus</i> official), <i>Maha</i> (<i>Asparagus racemosus</i> official), <i>Daru</i> (<i>Cedrus deodara</i>), <i>Manjista</i> (<i>Rubia cordifolia</i>), <i>Kakoli</i> (<i>Withania Somenifera</i> Official), <i>Ksiira Kakoli</i> (<i>Withania somenifera</i> official), <i>Candana</i> (<i>Pterocarpus santalinus</i>), <i>Sariva</i> (<i>Hemidesmus indiucus</i>), <i>Kustha</i> (<i>saussurea lappa</i>), <i>Tagara</i> (<i>Valeriana wallichii</i>), <i>Jivaka</i> (<i>Pueraria tuberosa</i> official), <i>Rsabhaka</i> (<i>Pueraria tuberosa</i>), <i>Saindhava lavana</i> (rock salt), <i>Kalarosari</i> (<i>Valeriana wallichii</i>), <i>Saileya</i> (<i>Parmelia portala</i>), <i>Vaca</i> (<i>Acorus calamus</i>), <i>Agaru</i> (<i>Aquilaria agallocha</i>), <i>Punarnava</i> (<i>Withania somenifera</i>), <i>Vari</i> (<i>Asparagus racemosus</i>), <i>Ksirasukla</i> (<i>Ipomoea digitata</i>), <i>Yasti</i> (<i>Glycyrrhiza glabra</i>), <i>Haritaki</i> (<i>Terminalia chebula</i>), <i>Amalaki</i> (<i>Phyllanthus emblica</i>), <i>Bibhitaka</i> (<i>Emblica officinalis</i>), <i>Satahva</i> (<i>Terminalia bellirica</i>), <i>Surpaporni</i> (<i>Teramnus labialis</i>), <i>Ela</i> (<i>Elettaria cordamomum</i>), <i>Tvak</i> (<i>Cinnamomum zeylanicum</i>), <i>Patra</i> (<i>Cinnamomum tamala</i>) each 6.0 g.
14	KGR Puttur Thailam	<i>Ajadugdha</i> & <i>Satavari rasa</i> – each 6.1kg; <i>Rasna</i> , <i>Asvagandha</i> , <i>Misi</i> , <i>Daru</i> , <i>Kustha</i> , <i>Salaparni</i> ; <i>Parnaparin</i> , <i>Mudgaparni</i> , <i>Masaparni</i> , <i>Agaru</i> , <i>Kesara</i> , <i>Sindhuttha</i> , <i>Mamsi</i> , <i>Haridra</i> , <i>Daruharidra</i> , <i>Saileyaka</i> , <i>Candona</i> , <i>Puskara</i> , <i>Ela</i> , <i>Asra</i> , <i>Yasti</i> , <i>Tagara</i> , <i>Abda</i> , <i>Patra</i> , <i>Bhrnga</i> , <i>Jivaka</i> , <i>Rsabhaka</i> , <i>Meda</i> , <i>ahameda</i> , <i>Kakoli</i> , <i>Ksira Kakoli</i> , <i>Vrddhi</i> , <i>Ambu</i> , <i>Vaca</i> , <i>Palasa</i> , <i>Sathauneya</i> , <i>Vrsciraka</i> – each 96g; <i>Coraka</i> , <i>Karpura</i> , <i>Kasmira</i> , <i>Mrgamada</i> – each 48 g
15	Stark Oil/Stead Oil/ Ere Oil	<i>Karpooram</i> 0.2ml. Each 10ml contains: <i>Withania Somnifera</i> & <i>Datura Metal</i> 500mg each, <i>Piper Longum</i> 150mg, <i>Curcuma Longa</i> 50mg, <i>Sesoma Oil</i> Q.S.

16	Sudha Lime Cool Oil	Each 100ml contains: <i>Khachurus</i> & fenugreek 1g, <i>Khushkus</i> 1.8g, <i>Menthol</i> 0.5g, <i>Amla</i> 3g, lime 4g & coconut oil.
17	Suvaradhini Hair Oil	<i>Aloevera</i> , <i>Emblica officinalis</i> , <i>Hibiscus Rosa Sisensis</i> , <i>Terminalia Chebula</i> , <i>Centella asiatica</i> , <i>Bacopa Monnieri</i> , <i>Lawsonia Inermis</i> , <i>Citrus Arantifolia</i> , <i>Vetiveria Zizanioides</i> , <i>Eclipta Prostrate</i> , <i>Psoralea Corylifolia</i> .
18	Sri Parni Tailam	<i>Vetiveria Zizanioides</i> , <i>Santalum Album</i> , <i>Pterocarpus Santalinus</i> , <i>Curcuma Zedorea</i> , <i>Vernonia Antheimintica</i> , <i>Cyperus Rotendus</i> - each 1/6part; Coconut & Gingeli Oil 2parts each, Vegetable Oil 1part.
19	Palasha Beejadi Tailam	<i>Palasha</i> , <i>Udumbara</i> , <i>Tila taila</i>
20	Keshatone Hair Oil	<i>Pillanthus Emblicalmnias</i> , <i>Hibiscus Rosa Sinesis</i> & <i>Eclipta alba</i> - 200mg each, <i>Vativeria G.G Naidis</i> & <i>Centella Asratica</i> - 100mg each.
21	KPR Hair Oil	<i>Prunus Amygdalus</i> 20g, <i>Cocas Nucifera</i> 30ml, <i>Styrax Benzoin</i> 20ml, <i>Kur kuna Zedonia</i> & <i>Cyperus Longus</i> 5g each, <i>Hibiscus Rosacenacea</i> & <i>Amina Sominefera</i> 10g each.
22	KPR Massage Oil	<i>Ricinnis commuins</i> & <i>Struchnos Noxumica</i> 40g each, <i>Dhatura Sramonium</i> & <i>Vitex (Trifolia)</i> 5g each, <i>Bute Prondosa</i> 10g
23	KPR Muscle Oil	<i>Purunules</i> 25g, <i>Cocas Nucifera</i> 40g, <i>Styrax Benzoin</i> 25g, <i>Vitex (Trifolia)</i> 10g.
24	KPR Cold Drops Oil	<i>Neelgiri Oil</i> 25ml, <i>Menthol Sps</i> 25ml, <i>Puycotis Ajwan</i> & <i>Cinnamomum</i> 25g each.
25	Bawan Booty Herbal Hair Oil	<i>Valeriana Wallichii</i> , <i>Apum Grave Eolens</i> , <i>Aquilaria Agallociha</i> , <i>Juneperus Communis</i> , <i>Psoralea corylifolia</i> , <i>Terminalia Belerica</i> , <i>Santalum Ablbum</i> , <i>Cinnamomum</i> , <i>Eletaria</i> , <i>Cardamomum Terminalia</i> , <i>Chebula</i> , <i>Nardostachys</i> , <i>Jatamans</i> , <i>Myristica</i> , <i>Fragrans</i> , <i>Nutmeg</i> , <i>Andropogon Muricatus</i> , <i>Nigella Sativa</i> , <i>Curcuma Zedoaria</i> , <i>Cyperus</i> , <i>Pertenius</i> , <i>Mesuaferrea</i> , <i>Alpinia Galanga</i> , <i>Flacourtia Cataprracta</i> , <i>Adiantum Capillus Veneris</i> , <i>Rubia Cordifolia</i> , <i>Trigonella Foenum</i> , <i>Cinnamomum Cassia</i> , <i>PipperChaba</i> , <i>Lavadula Stoechas</i> , <i>Hibiscus</i> , <i>Abelmoschus</i> , <i>Michelia Chompaca</i> , <i>Viola ororata</i> , <i>Rosa Damascena</i> , <i>Wardfordia Floribunda</i> , <i>Artemisa</i> , <i>Absinthum Myrtuscommunis</i> Linn, <i>Matricoria Chamomilla</i> Linn, <i>Mimusopselengi</i> , <i>Hibiscus Rosa</i> , <i>Sinesis</i> Linn, <i>Pouyppodium Vulgare</i> Linn, <i>Shikkakai</i> , <i>Carthamus Tinctorius Flower</i> , <i>Hydrocotyle Abbiajaca</i> <i>Petercarpus Santlinus</i> Linn.
26	No Pain oil / Dard Nash Herbal pain oil	Each 10ml Contains: <i>Metina arphoria Roxburg</i> & <i>Cymbidium Tessaloides</i> - 300mg each, <i>Asparagus Resimonus</i> , <i>Solamum Indicum</i> & <i>Ricinis Communis</i> - 400mg each, <i>Gingily Oil</i> .
27	Nervolin Oil	<i>Delonixalata</i> , <i>Cardiospermum Halicacabum</i> & <i>Clerodendron Phlomodies</i> 800mg each, castor oil 5.0ml, <i>Lavanga Thaila</i> 0.25ml, <i>Mahanarayana Thaila</i> 0.5ml, camphor oil 2.25ml, gingelly oil Q.S.

Table 3: Balms - trends in analytical test parameters in Ayurvedic compositions

S.No	Name of the Formulation	pH	WSM	ASM	AIA	TAsh
Category 1 - Menthol Camphor Wintergreen Balms						
1	Relief Pain Balm	6.72	20.40	29.80	BDL	0.18
2	Star Balm	5.52	1.36	44.84	BDL	0.37
3	Tiger Head Balm	5.45	1.50	18.11	NIL	NIL
Category 2 - Essential Oil Rich Polyherbal Balms						
4	Sanjivani Pain Balm	5.85	20.20	21.00	BDL	0.07
5	Kobraa Balm	5.74	1.54	29.44	BDL	0.27
Category 3 - Resin/Wax-Based Traditional Balms						
6	Rahath Marham	4.79	29.65	20.58	BDL	0.03

Category 4 - Petroleum Jelly-Based Hybrid Balms						
7	Chatwal Pain Balm	7.30	0.13	2.41	NIL	BDL
Category 5 - Low Ash/Low Extractive Mild Balms						
8	Doctor Balm Strong	4.25	0.08	0.50	NIL	NIL
9	Sudha Balm	4.23	0.08	0.53	NIL	NIL
Category 6 - Others						
10	Pavitra's Mini Plus Balm	7.24	0.82	16.26	NIL	0.09
11	Amruth Rasanjan	5.22	0.84	45.42	NIL	0.08
12	Yuan Ban Dragon Jel	3.50	1.66	8.56	BDL	0.07
13	Yuan Ban Dragon Cold Rub	2.43	0.96	13.92	BDL	0.56
14	Cochine Pain Balm	6.25	1.10	0.50	NL	NIL
15	Ekno Ayurvedic Balm	5.93	0.30	1.00	NIL	NIL
16	Komal's Zinda Balm	4.83	0.50	1.20	NIL	NIL
17	Sando Balm	4.60	0.72	0.68	NIL	NIL
18	Zundo Balm	4.82	0.07	0.46	NIL	NIL
19	Ellisin Pain Balm	6.18	0.48	18.14	NIL	0.03
20	Dillu Balm	6.74	0.64	14.08	BDL	BDL
21	Vikas Balm	6.08	1.46	51.06	BDL	BDL
22	Kaneri's Ayur Pancha Ratna Pain Balm	6.05	0.40	0.54	NIL	BDL
23	Sun Shine Balm	6.04	4.00	13.27	NIL	NIL
24	Sun Shine Vaporizer	5.94	0.11	22.36	NIL	NIL
25	Swarna Pain Relief Balm	7.13	0.31	7.31	NIL	0.09

Table 4: Oils - trends in analytical test parameters in Ayurvedic compositions

S.No	Name of the Formulations	A.V	I.V	Sap.V	LOD	R.I
1	Amrit Tailam	4.95	102.45	213.35	0.06	1.480
2	Zinda Tel Ayurvedic	4.40	88.50	14.78	99.48	1.474
3	Run Pain Oil	4.52	112.09	173.90	12.78	1.481
4	Long Hair Oil	3.04	28.00	240.60	0.18	1.467
5	Ortho Fit Oil	5.55	102.45	160.40	26.79	1.486
6	M.S Tailam	8.88	115.72	221.00	2.00	1.481
7	Kesaamrutha Hair Tonic	10.15	15.25	245.30	5.33	1.478
8	Asra Massage oil	8.97	126.05	382.12	17.38	1.480
9	Painda Taila	11.05	75.99	204.80	3.31	1.485
10	Mahanarayana Taila	16.23	88.18	250.40	0.29	1.480
11	Ksheerbala Taila	22.27	202.60	202.60	1.49	1.479
12	Brihat Saindavadya Taila	10.33	80.09	245.20	1.22	1.485
13	Dhanvantari Taila	2.81	90.64	249.80	2.43	1.487
14	KGR Puttur Thailam	5.40	5.48	181.38	102.68	1.478
15	Stark Oil/Stead Oil/ Ere Oil	8.38	125.72	225.40	1.46	1.482
16	Sudha Lime Cool Cool Oil	1.40	50.38	288.90	0.83	1.464
17	Suvaradhini Hair Oil	2.81	29.97	314.60	1.44	1.464
18	Sri Parni Tailam	1.49	113.57	227.00	2.93	1.965

19	Palasha Beejadi Tailam	115.40	109.18	237.70	3.42	1.498
20	Keshatone Hair Oil	12.58	43.43	265.30	0.21	1.47
21	KPR Hair Oil	18.17	190.50	190.50	0.29	1.489
22	KPR Massage Oil	11.17	80.46	360.30	0.45	1.492
23	KPR Muscle Oil	24.19	82.54	145.90	0.42	1.493
24	KPR Cold Drops Oil	1.393	68.80	133.20	53.13	1.482
25	Bawan Booty Herbal Hair Oil	1.12	14.38	232.90	0.47	1.483
26	No Pain oil/Dard Nash Herbal pain oil	11.42	94.53	195.40	2.43	1.390
27	Spasmonil Oil	2.50	18.75	201.70	69.38	1.480
28	Taj Pain Oil	1.10	56.45	1.50	16.48	1.492
29	THP Dent Care	5.28	39.00	178.50	13.64	1.472
30	THP Stomach Care	4.02	29.00	241.10	8.27	1.469
31	Cenna Herbal Hair Tonic	10.18	104.35	202.40	0.05	1.480
32	Vardhan Hair Oil	6.34	8.70	229.90	0.61	1.472
33	Vajra Valli Oil	42.78	102.65	190.80	0.69	1.481
34	Parivar Noni Hair Oil	14.92	102.00	156.800	Nil	1.480
35	Nice Cure Oil	3.13	8.26	155.06	0.62	1.480
36	Janta Hair Oil	8.01	92.65	202.60	0.68	1.477
37	Myofit Oil	6.80	119.35	116.25	41.35	1.485
38	Zinda Dhara	4.42	88.50	27.00	99.02	1.450
39	Laxminarayan Tail	2.93	112.42	122.90	29.53	1.484
40	Ritu Herbal Hair Oil	0.57	104.48	107.17	0.42	1.466
41	Amruth Muzze Oil	2.486	96.46	6.932	47.42	1.490
42	Vivithi sarongathi Thailam	3.34	84.86	185.50	84.80	1.480
43	Vivithi Pure Herbal Thailam	1.92	8.40	261.20	0.12	1.460
44	Rubarb Massage Oil	8.01	102.85	186.50	76.93	1.485
45	Keshnon Oil	10.75	92.20	202.10	5.82	1.478
46	Painon Oil	7.10	96.80	186.8	4.96	1.480
47	Parirvar Massage Oil	6.95	98.95	180.61	4.25	1.480
48	Orthostan Oil	3.33	104.00	204.00	9.12	1.478
49	Stanglow Oil	3.80	74.00	201.93	4.30	1.480
50	Pain Drop Oil	BDL	47.01	10.06	58.70	1.484
51	Nayagara Herbal Hair Oil	8.50	13.60	245.10	0.60	1.460
52	Askhayakesh Hair Oil	6.52	9.07	240.8	2.72	1.462
53	Arniflex/Capflex/Moveaz Oil	3.74	91.89	219.4	4.62	1.476
54	Lazin	2.15	76.85	186.00	0.64	1.486
55	Emu Oil	0.49	70.12	168.20	7.37	1.472
56	Itch Head Hair Oil	4.60	27.80	251.20	0.32	1.467
57	Dr.Rao's Keshovin Kool-kool	3.74	12.66	268.10	2.30	1.463
58	Pylori Lepam	41.35	119.85	204.7	3.82	1.488
59	Ritu Anti Dandruff Hair Oil	0.49	1.46	21.18	6.05	1.462
60	Sussrutha Pain Reliever	64.88	108.98	166.5	0.65	1.477

61	Sussrutha Hair Oil	0.99	13.65	270.50	0.40	1.463
62	Arthe-Ease Oil	3.08	111.18	156.50	12.56	1.478
63	Aloevera Hair Oil	0.54	8.20	291.20	0.14	1.462
64	Sheetal Herbal Hair Oil	3.76	12.05	2.55	0.31	1.464
65	Kalonji Massage oil	1.62	112.04	186.66	1.17	1.479
66	Zam - Zam -E-Bahar Hair oil	1.01	11.03	271.00	1.20	1.464
67	Arthomove Oil	11.36	34.12	292.69	7.60	1.479
68	Rudhima Oil	9.46	35.12	183.20	8.24	1.480
69	Achal Coconut Oil	0.72	11.65	273.48	0.48	1.330
70	Kapi Coconut Oil	0.43	12.74	233.75	0.11	1.460
71	Prakash Coconut Oil	1.20	10.01	227.81	0.10	1.350
72	Sunshine Coconut Oil	1.04	10.05	282.50	0.14	1.340
73	Shabnam Keshtone Hair Oil	2.46	20.30	267.60	3.01	1.461
74	Shabnam's Dardnash Herbal Pain Oil	11.16	109.32	211.30	3.85	1.477
75	W20 Weight Loss Oil	6.45	106.05	186.07	2.58	1.476
76	Sainee's Hair Oil	1.58	24.22	267.40	1.93	1.465
77	Sainee's Pain Oil	2.81	109.20	174.30	1.23	1.481
78	Swarna Herbal Hair oil	3.65	15.40	290.00	2.29	1.482
79	Keshnatural Hair Oil	0.84	87.45	276.10	0.25	1.471
80	Masaznatural Oil	1.93	117.99	244.90	1.184	1.480
81	Myorelax (Muscle Oil)	5.39	75.56	188.64	12.41	1.480
82	Indobull Oil	12.50	94.85	216.00	0.83	1.478
83	Samartho Oil	10.47	111.76	259.00	0.10	1.478
84	Komal's Zinda Tel	4.47	94.99	30.86	91.33	1.480
85	Jofit Oil	9.50	105.07	162.70	19.85	1.488
86	Nayagara Herbal Hair Oil	3.07	57.69	267.90	0.28	1.484
87	Ortho Pain Oil	4.74	60.92	130.60	1.82	1.482
88	No Cold Rub Oil	14.39	48.57	172.90	44.85	1.412
89	Kalonji oil	34.94	114.19	184.90	11.32	1.420
90	Yeppa Rayudu Hair Oil	4.18	69.42	234.10	0.80	1.484
91	Roghan-E-Gesudaraz	1.17	17.26	250.60	10.52	1.472

Discussion/Overview of Analytical Trends

Despite wide differences in formulation composition, definable analytical trends were observed across most physicochemical parameters evaluated in balms and oils. The values generated in this study should be interpreted as guidance ranges rather than rigid specifications, and formulations showing extreme values are best viewed as high-variability formulations that warrant verification of composition or processing practices rather than being immediately considered non-compliant.

Interpretation of results in the context of Ayurvedic practice

Ayurveda recognizes that medicinal formulations derive their therapeutic action from the inherent qualities (*Guna*) such as taste (*Rasa*), potency (*Virya*), post-digestive effect (*Vipaka*), and specific action (*Prabhava*) of the constituent substances (*Dravyas*). The observed variability in physicochemical parameters such as pH, solubility, ash content, and lipid indices among balms and oils reflects differences in formulation composition and dominance of specific substances (*Dravyas*) in proprietary preparations.

Rather than indicating inconsistency alone, this variability mirrors the Ayurvedic principle that

medicines are tailored for different *Dosha* predominance (*Vata*, *Pitta*, *Kapha*) and therapeutic objectives. For example, formulations rich in volatile and penetrating substances (*Tikshna*, *Sukshma gunas*) naturally exhibited higher alcohol-soluble matter and loss on drying values.

Categorization of Balms

Based on formulation composition and analytical behavior, balms were grouped into the following categories:

Category 1- Menthol-Camphor-Wintergreen Balms: Containing menthol, camphor (*Karpura*), gaultheria oil and eucalyptus oil; characterized by *Tikshna*, *Ushna*, *sukshma* qualities; indicated for *Vata-Kapha shamana*.

Category 2- Essential oil- Rich polyherbal balms: Containing clove oil, peppermint, eucalyptus, ajwain and turpentine; primarily used for pain and inflammation relief (*Vata vyadhi*, *Sandhi shoola*); associated with moderate pH and high alcohol-soluble matter.

Category 3- Resin/Wax-Based traditional balms: Containing beeswax, benzoin and sesame oil;

exhibiting *Snigdha* and *Guru* properties; supportive of tissue protection and *Vata shamana*.

Category 4- Petroleum Jelly-Based Hybrid Balms: Containing mineral jelly combined with herbal actives.

Category 5- Low-Ash/Low-Extractive Mild Balms: Showing near-neutral pH and low extractive values; intended for mild daily use, preventive or supportive care, including cold and cough; associated with *Kapha-pradhana vikara* and higher volatility with low inorganic residue.

Physicochemical Evaluation of Balms

Twenty-five balms used primarily for pain relief, cold, and inflammation were evaluated. pH values ranged from 2.43 to 7.30, indicating general suitability for topical application. Water-soluble matter was typically low (0.07-2%), while alcohol-soluble matter demonstrated wide variability (0.45-51.06%), reflecting essential oil and resin content. Total ash values remained mostly below 1.0%, and acid-insoluble ash was absent or below detection limits in most samples, indicating minimal inorganic contamination.

Figure 1. Boxplot representation of key physicochemical parameters of balms

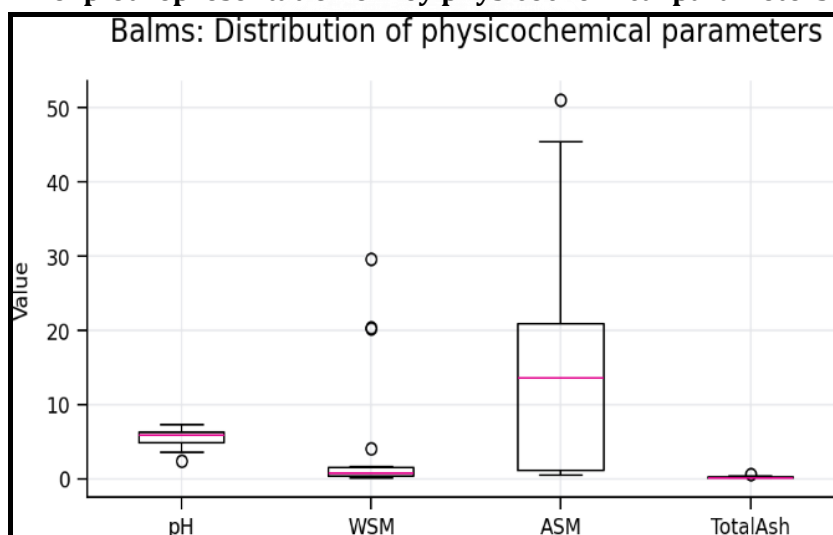


Figure 2. Distribution of pH values of Ayurvedic balms (n = 25)

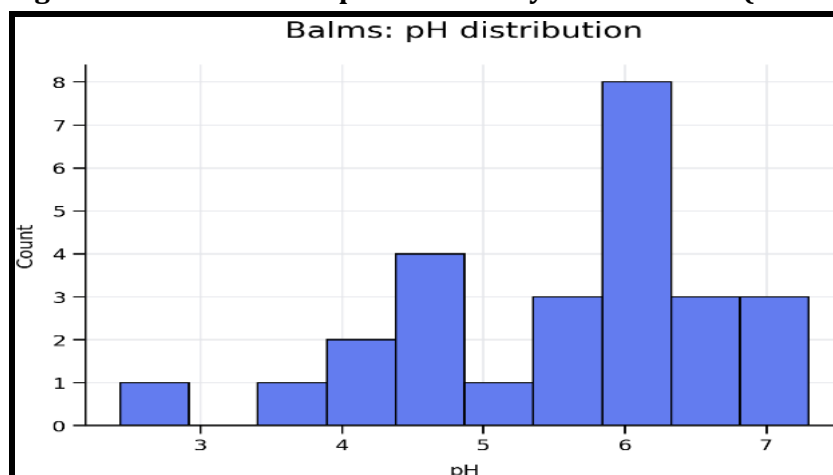
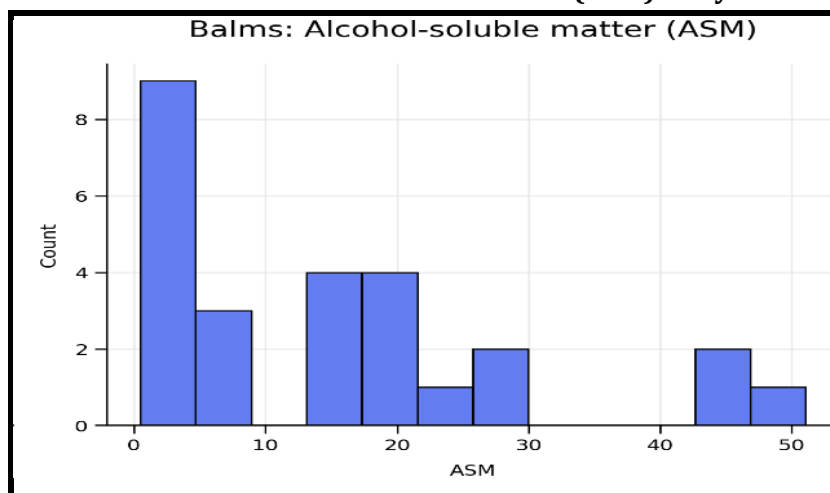
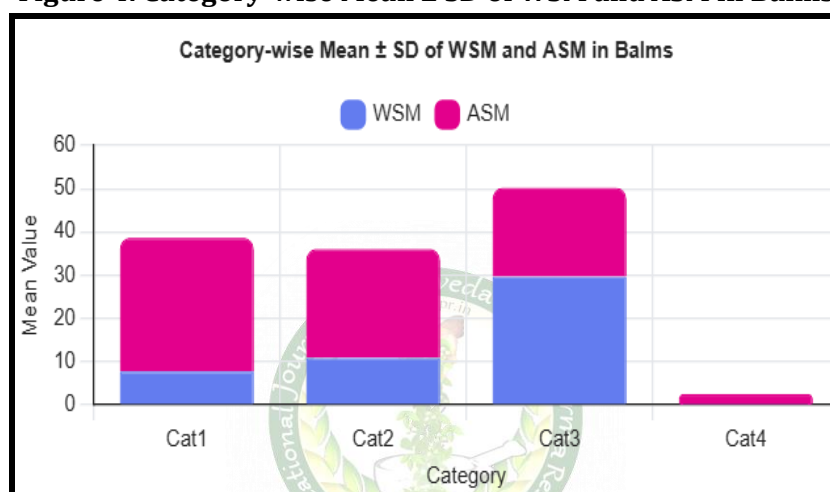


Figure 3. Distribution of alcohol-soluble matter (ASM) in Ayurvedic balms**Figure 4. Category-wise Mean $\pm$ SD of WSM and ASM in Balms****pH and skin compatibility (*Twak Sahishnuta*)**

The pH range observed for balms, about 4.0-7.3, aligns well with Ayurvedic topical application principles. Ayurveda emphasizes that formulations applied externally should be non-irritant and compatible with skin, which is considered a site predominantly governed by *Vata* and *Pitta*. Slightly acidic to near-neutral pH supports deep penetration (*Sukshma guna*) without aggravating tissue irritation (*Pitta*). Extreme alkalinity (*Ati kshara*) is avoided in classical formulations due to its potential to damage tissues. Thus, the observed pH ranges support the safe and rational topical use of these balms.

Purity Indicators: Ash and Acid-Insoluble Ash

The consistently low total ash and negligible acid-insoluble ash values observed across balms indicate satisfactory purity of raw materials and appropriate processing. Classical Ayurvedic texts emphasize the importance of *Shuddhi* (purity) of inputs, and the present findings support acceptable purity levels in most formulations tested.

Categorization of Oils (*Tailas*)**Composition-Based Categorization (Oils) and Ayurvedic interpretation.**

Category 1 - Classical *Sneha Kalpana Tailams* are made as a Decoction plus *Kalka* plus sesame oil with dominant composition pattern such as *Mahanarayana Taila*, *Ksheerbala Tailam* and sesame oil base for *Vata-hara*, *Yogavahi*. Cooling/*Pitta-Shamana* oils - Burning, heat conditions with Ayurvedic clinical use and supporting analytical findings such as- Lower iodine value, lighter oils.

Category 2- Essential Oil-Fortified *Tailams*- Volatile oils added to base oil with dominant composition pattern - Zinda Tel, Run Pain Oil - volatile oils for *Srotoshodhana*. *Vata-Vyadhi*/ Pain Oils- *Abhyanga*, local application with Ayurvedic clinical use and supporting analytical findings such as Moderate acid value and high saponification.

Category 3- Hair Nourishment *Tailams* - *Bhringaraj*, amla, aloe, hibiscus with dominant composition pattern such as Long Hair Oil, Kesaamrutha Hair Tonic. Hair oils (*Kesha Raksha*) - *Kesha vardhana*, *Twak poshana* with Ayurvedic clinical use and supporting analytical findings such as Stable refractive index, low LOD.

Category 4- Massage/Sports Oils- Castor oil, turpentine, eucalyptus with dominant composition pattern such as Asra Massage Oil - Castor oil which is *Snigdha plus Tikshna* for deeper penetration. Massage/Muscle Oils- *Mamsa-dhatu bala* with ayurvedic clinical use and supporting analytical findings such as - higher volatility, variable LOD.

Category 5 - Hybrid Proprietary Oils - Classical plus modern actives with dominant composition pattern for Ortho Fit Oil.

The saponification (150-300) and refractive index (1.40-1.50) ranges are consistent with *Sneha Kalpana* principles, supporting deep tissue action (*Vyavayi*, *Vikasi*).

Physicochemical Evaluation of Oils

Ninety-one oil samples encompassing pain relief oils, massage oils, hair oils, and medicated oils were analyzed of which only twenty-eight of them declared formulation compositions. Saponification

values generally ranged between 150 and 300, consistent with lipid-based formulations. A few near 1.5 or 6 to 15 (e.g., Taj Pain Oil, Amruth Muzze Oil) are atypical and may be composition-driven anomalies or possible non-lipid dominant products.

Oils containing volatile components such as eucalyptus oil exhibited higher loss on drying values (20 to 80%) as oils differ in their formulations as observed from Table 2, other values range from 0.1 to 20%. Refractive index values remained within a narrow range (1.40-1.50, Sri Parni Tailam is an extreme outlier 1.965), indicating compositional consistency among most formulations. Acid value values range from 0.1 to 20 and iodine values varied depending on the type and proportion of fatty acids present in the oils and ranged from 10 to 130. The broad dispersion, especially for LOD and AV, is consistent with differences in volatility and hydrolytic breakdown across formulations.

Figure 5. Scatter plot of acid value vs iodine value coloured by loss on drying

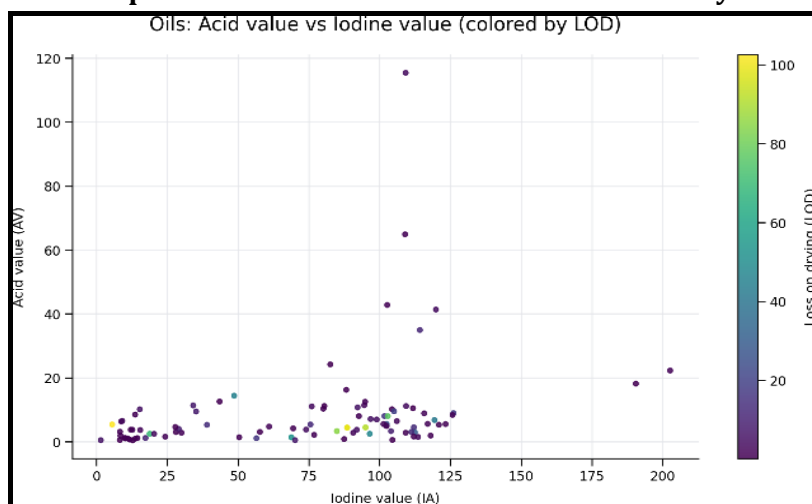
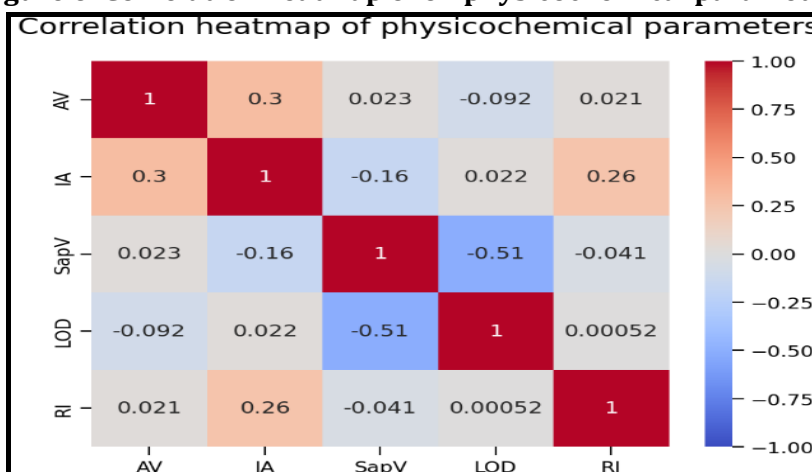


Figure 6. Correlation heatmap of oil physicochemical parameters



Oil Parameters and the Ayurvedic Concept of lipid-based formulations (*Sneha Kalpana*)

Oils or *Tailas* occupy a central role in Ayurveda, particularly in *Vata*-dominant disorders, pain management, and nourishment of tissues (*Dhatu poshana*). The saponification, iodine, and acid values

obtained in this study reflect the fatty acid composition and stability of *Sneha kalpanas*. Saponification values (150–300) indicates the presence of medium to long-chain fatty acids, supporting deep tissue penetration (*Vyavayi*) and sustained action (*Vikasi*). Iodine values correlate with unsaturation (*Snigdha*), useful in

conditions requiring mobility and flexibility (*Laghu* action). Acid values within moderate ranges suggest controlled hydrolysis and acceptable shelf stability, aligning with classical recommendations for properly prepared *Tailas*. These findings support the Ayurvedic understanding that lipid-based formulations (*Sneha*) act not merely as a base but as an active therapeutic carrier (*Yogavahi*).

Formulations showing values outside the identified ranges should not be immediately viewed as inferior. Ayurveda allows for intentional deviation based on therapeutic intent, such as increased volatility for channel cleansing (*Srotoshodhana*) and stronger (*Tikshna*) action for severe *Vata-kapha* conditions. However, such deviations must be justified by formulation composition and intended indication.

The approximate ranges proposed in this study are a guidance ranges and qualitative indicators (*Lakshanas*) rather than absolute numerical limits. The observed physicochemical ranges, when interpreted through Ayurvedic principles of *Dravya Guna*, *Sneha Kalpana*, and *Shuddhi*, support the rational and safe use of these formulations in clinical practice.

Statistical Interpretation of Physicochemical Variability

Descriptive statistical analysis revealed wide dispersion for several physicochemical parameters, particularly alcohol-soluble matter in balms and loss on drying and acid value in oils. This variability reflects intentional formulation diversity rather than random inconsistency. Parameters directly influenced by volatile oils and resinous components exhibited distributions, indicating the presence of distinct formulation sub-groups within the dataset.

The relatively narrow distribution of pH values among balms (mean 5.60 ± 1.18) supports overall topical compatibility, whereas the high standard deviation observed for water- and alcohol-soluble matter reflects differences in extraction-based versus lipid-dominant formulations. Similarly, oil formulations showed stable refractive index values across most samples despite wide disparity in acid value and loss on drying, indicating preservation of bulk lipid characteristics even in highly volatile preparations. This suggests that while manufacturers vary active and volatile components to achieve therapeutic objectives, base formulation characteristics remain broadly conserved.

For oil formulations, correlation analysis among physicochemical parameters (AV, IV, Sap.V, LOD, and RI) was conducted. A correlation heatmap was used for visual representation of these relationships. Scatter plots were further employed to examine associations between acid value and iodine value, with loss on drying represented as a color gradient to highlight the influence of volatile

components. The absence of strong linear correlations supports that the formulation behavior is determined by the collective properties of constituent substance or the entity, rather than by isolated numerical parameters.

Extreme values identified represent “high-variability formulations” rather than quality failures, and are best interpreted in relation to declared composition, particularly the presence of essential oils, camphor, menthol, or fermented decoctions. Accordingly, the statistical findings reinforce the conclusion that approximate analytical ranges are more appropriate than rigid limits for the quality evaluation of Ayurvedic topical formulations.

TLC Profiling and Authentication (*Dravya Abhijnana*)

TLC fingerprints of selected botanicals confirmed characteristic Rf values and colour reactions corresponding to reference standards, supporting correct botanical identification (*Dravya abhijnana*) and preservation of bioactive principles. This serves as a modern analytical complement to classical Ayurvedic authentication.

CONCLUSIONS

The present study establishes approximate physicochemical ranges for commercially marketed Ayurvedic balms and oils based on extensive laboratory data. Despite compositional diversity, consistent analytical trends were observed across key parameters. TLC profiling further supported formulation authenticity. These findings may serve as a preliminary reference framework for quality control and future standardization efforts, while respecting the inherent flexibility of Ayurvedic therapeutic design. The study provides a pragmatic analytical framework that bridges regulatory quality control and classical Ayurvedic therapeutic rationality.

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