

**COMPARATIVE EVALUATION OF MANJISTHADI TAILA AND ITS NOVEL SERUM
FORMULATION THROUGH PHARMACEUTICO-ANALYTICAL AND CELL LINE
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ABSTRACT

Background: Manjisthadi Taila is a classical Ayurvedic medicated oil traditionally used in skin disorders. Although classical Sneha Kalpana provides an effective lipid-based dosage form, its oily nature may limit cosmetic acceptability and ease of application. The present study explored the development of Manjisthadi Taila into a novel serum dosage form. **Aim:** To prepare Manjisthadi Taila, develop its novel serum formulation, and evaluate both formulations through pharmaceutico-analytical and cell-line studies. **Materials and Methods:** Sarshapa Taila was first subjected to Murcchana and was then used for the preparation of Manjisthadi Taila by the classical method. The prepared Taila was evaluated for physicochemical parameters. A novel oil-in-water serum was prepared and optimized for consistency, spreadability, and stability. Both Taila and serum were further evaluated by physicochemical analysis, HPTLC fingerprinting, microbial analysis, heavy-metal analysis, and cell-line study. **Results:** Murcchana and preparation of Manjisthadi Taila were successfully completed with attainment of Taila Siddhi Lakshanas. The physicochemical evaluation provided quality-control and standardization data for the formulation. The developed oil-in-water serum showed a homogeneous appearance, improved spreadability, reduced greasiness and better cosmetic acceptability compared with the classical Taila. HPTLC produced characteristic chromatographic profiles suitable for comparative quality assessment. Microbial and heavy-metal evaluation supported the quality and safety of the formulations. Cell-line evaluation demonstrated satisfactory cellular compatibility under the conditions studied. **Conclusion:** The study showed that Manjisthadi Taila can be successfully converted into a serum dosage form with improved spreadability, reduced greasiness, and better cosmetic acceptability. The serum showed satisfactory physicochemical, analytical, microbial, heavy-metal, and cellular findings. This formulation may be further evaluated for its use as a topical dosage form in skin disorders.

INTRODUCTION

Ayurveda is a traditional system of medicine that explains health and disease through the balanced state of *Dosha*, *Dhatu*, *Mala* and *Agni*. Treatment is selected according to the individual and may include appropriate *Ahara*, *Vihara* and different pharmaceutical preparations such as *Kashaya*, *Churna*, *Ghrita*, *Taila*, *Avaleha* and *Vati*. Among these preparations, *Taila Kalpana* has an important place in the management of several disorders, particularly those involving the skin.^[1,2]

In Ayurveda, skin disorders are described under the broad concept of *Kushtha*. Classical texts such as *Charaka Samhita*, *Sushruta Samhita* and *Ashtanga*

Hridaya.^[3,4] describe *Kushtha* as a disorder involving all three *Doshas*, with involvement of different *Dhatus*, especially *Twak*, *Rakta*, *Mamsa* and *Lasika*.^[5,6] Dietary and lifestyle-related factors such as *Viruddha Ahara*, excessive intake of heavy, oily and acidic foods, and improper habits are considered important in its development.^[7] From the modern perspective, skin disorders such as eczema, psoriasis, dermatitis and fungal infections are commonly associated with inflammation, immune disturbances, microbial involvement and oxidative stress. Although various topical treatments are available, prolonged treatment with some therapeutic agents may be associated with

unwanted effects and recurrence, leading to continued interest in herbal and plant-based topical preparations.^[8]

Manjisthadi Taila, described in *Yogaratanakara* under *Kushtha Chikitsa*, is a classical Ayurvedic formulation used in the management of skin disorders.^[9] The ingredients of the formulation are traditionally described with properties such as *Rakta Shodhana*, *Varnya*, *Krimighna*, *Kandughna* and *Kushthaghna*. The oil base also acts as a suitable medium for topical application and may facilitate the delivery of lipid-soluble herbal constituents to the skin. In the present formulation, *Murcchita Sarshapa Taila* is used as the base *Sneha Dravya*. *Murcchana* is a preliminary pharmaceutical process described for medicated oils and is intended to improve the quality and stability of the oil and reduce undesirable changes such as rancidity and unpleasant odour.^[10]

However, conventional medicated oils may have certain practical limitations, particularly their greasy nature, slower absorption and tendency to stain clothes. These factors may affect patient acceptability and regular use. Development of a serum dosage form can help overcome some of these limitations. An oil-in-water (O/W) serum provides a lighter and less greasy preparation and may offer improved cosmetic acceptability for topical application.^[11]

When a classical oil preparation is converted into an emulsion-based dosage form, changes in its physical characteristics may occur. Therefore, pharmaceutico-analytical evaluation is required to assess the quality, stability and consistency of the developed preparation. Parameters such as organoleptic characteristics, physicochemical properties, HPTLC fingerprinting, microbial quality and heavy-metal content can provide important information regarding the quality and safety of the formulation.

Along with pharmaceutical evaluation, biological assessment is important to determine the cellular safety of the novel preparation. The MTT cell viability assay is widely used as an in vitro method for assessing cellular metabolic activity and cytotoxicity.^[12] Neutrophil morphological evaluation can provide additional information regarding cellular response to the test formulation. Such investigations can therefore contribute to the preliminary assessment of cellular safety and cytocompatibility.

Considering these aspects, the present study was undertaken to compare classical *Manjisthadi Taila* with its novel oil-in-water serum dosage form through pharmaceutico-analytical evaluation and in vitro cell-line studies. The study aims to assess the feasibility of adapting a classical Ayurvedic oil into a more convenient and cosmetically acceptable topical dosage form while maintaining appropriate pharmaceutical quality and preliminary cellular safety.

AIM

To comparatively evaluate *Manjisthadi Taila* and its novel serum dosage form through pharmaceutico-analytical and in vitro cell-line study.

OBJECTIVES

1. To prepare *Murcchita Sarshapa Taila*, *Manjisthadi Taila* and its serum dosage form.
2. To evaluate and compare the physicochemical characteristics of *Manjisthadi Taila* and the developed serum.
3. To comparatively assess the cellular response of *Manjisthadi Taila* and serum through in vitro cell-line studies.

METHODOLOGY

The study was conducted in three phases: pharmaceutical preparation, analytical evaluation and in vitro cell-line study. The study was laboratory-based and did not involve human or animal subjects.

Study Plan

The study comprised a review of classical and contemporary literature, pharmaceutical preparation of *Manjisthadi Taila* and its novel oil-in-water (O/W) serum dosage form, comparative pharmaceutico-analytical evaluation, and in vitro cell-line assessment. The findings were compiled and interpreted to draw the final conclusions.

Literary Sources

The classical formulation of *Manjisthadi Taila* was referred from *Yogaratanakara*, while the procedure for *Sarshapa Taila Murcchana* was referred from *Bhaishajya Ratnavali*. Modern literature, pharmaceutical references, peer-reviewed journals and relevant databases were consulted for formulation development and analytical evaluation.

Pharmaceutical Study

Procurement and Authentication

The required raw materials were procured from authenticated commercial sources. The drugs were cleaned and freed from foreign matter before processing. Authentication of the herbal ingredients was carried out at the Department of Dravyaguna, Gomantak Ayurveda Mahavidyalaya and Research Centre, Shiroda, Goa.

Murcchana of Sarshapa Taila

Reference: *Bhaishajya Ratnavali*, *Taila Prakarana*^[13]

Date: 31/05/2025 to 02/06/2025

Total duration: 3 days (16 hours of active heating) Ingredients and quantities

Sr. No.	Ingredient	Quantity
1	Sarshapa Taila (mustard oil)	2.3 litres
2	Water	11.16 litres
3	Amalaki Kalka	57.5 g
4	Haridra Kalka	57.5 g
5	Musta Kalka	57.5 g
6	Bilva Kalka	57.5 g
7	Dadima Kalka	57.5 g
8	Nagakeshara Kalka	57.5 g
9	Krishna Jeeraka Kalka	57.5 g
10	Hribera Kalka	57.5 g
11	Nalika Kalka	57.5 g
12	Bibhitaki Kalka	57.5 g

Procedure

- All herbal ingredients were weighed individually (57.5 g each; total 575 g) and ground with water to prepare a smooth Kalka (herbal paste).
- A measured quantity of 2.3 litres of Sarshapa Taila was heated gently until the initial frothing subsided.
- The prepared herbal Kalka was added to the warm oil and mixed thoroughly.
- A total of 11.16 litres of water was added gradually, with continuous stirring to ensure uniform mixing and prevent the paste from sticking to the vessel.
- The mixture was heated over mild-to-moderate heat for three consecutive days, with intermittent overnight standing:
 - Day 1 (31/05/2025): 6 hours of heating.
 - Day 2 (01/06/2025): 5 hours of heating.
 - Day 3 (02/06/2025): 5 hours of heating.
- Completion of Paka was assessed using classical Taila Siddhi Lakshanas, including proper Varti formation and absence of crackling during the Shabda Pariksha.
- The prepared oil was filtered through a clean, double-layered cotton cloth and stored in an airtight amber-coloured glass container.

Observations and final yield

- Colour: Dark amber/yellowish-brown.
- Appearance: Clear liquid.
- Odour: Characteristic herbal aroma.
- Texture: Snigdha (unctuous).
- Final yield of Murcchita Sarshapa Taila: 1.50 litres.

**Srashapa Taila Nirman****Preparation of Manjishthadi Taila^[14]**

Reference: *Yogaratanakara*, Taila Prakarana Date: 04/06/2025 to 06/06/2025

Duration: 3 days (12 hours of active heating) Ingredients and quantities:

Sr. No.	Ingredient	Botanical Name	Quantity
1	Manjistha	<i>Rubia cordifolia</i>	50 g
2	Kushta	<i>Saussurea lappa</i>	50 g
3	Haridra	<i>Curcuma longa</i>	50 g
4	Chakramarda	<i>Cassia tora</i>	50 g
5	Aragvadha	<i>Cassia fistula</i>	50 g
6	Gandhatruna Swarasa	<i>Cymbopogon citratus</i>	4000 millilitres
7	Murcchita Sarshapa Taila	—	1000 millilitres

Procedure

- Manjistha*, *Kushta*, *Haridra*, *Chakramarda* and *Aragvadha* were weighed at 50 g each, powdered and passed through Sieve No. 80.
- The powdered drugs were triturated with a small quantity of water to prepare a smooth and uniform *Kalka* (herbal paste).
- Fresh *Gandhatruna Swarasa* was prepared, filtered and measured as 4000 millilitres.
- A measured quantity of 1000 millilitres of previously prepared *Murcchita Sarshapa Taila* was taken in a wide-mouthed stainless-steel vessel.
- The prepared *Kalka* was added to the oil and mixed thoroughly.

6. *Gandhatruna Swarasa* was gradually added with continuous stirring.
7. The mixture was heated over mild heat (*Mandagni*) with continuous stirring to prevent settling and charring of the *Kalka*.
8. Day 1 (04/06/2025): The mixture was heated for approximately 4 hours and allowed to cool and stand overnight.
9. Day 2 (05/06/2025): Heating was resumed for approximately 4 hours with continuous stirring and the mixture was again allowed to stand overnight.
10. Day 3 (06/06/2025): Final heating was continued for approximately 4 hours until the *Taila Siddhi Lakshanas* were observed.
11. Completion was assessed by *Varti* formation and absence of crackling during *Shabda Pariksha*, indicating adequate removal of moisture.
12. The prepared *Manjisthadi Taila* was filtered through a clean cotton cloth while warm, collected in a clean airtight container and labelled appropriately.



Manjisthadi Taila Nirman

Observations and final product:

- Appearance: Clear liquid
- Colour: Dark reddish-brown
- Odour: Pleasant, characteristic aroma of lemongrass
- Texture: *Snigdha* and smooth
- Final yield: 850 millilitres

- Process loss: 150 millilitres

Preparation of Manjisthadi Serum^[15]

Reference: Harry's Cosmeticology Date: 09/05/2025

Duration: 1 day

Method: Oil-in-water (O/W) emulsion technique

Approximate processing time: 60–75 minutes

Ingredients and quantities

Phase	Ingredient	INCI Name	Quantity
Aqueous Phase (A)	Distilled water	Aqua	87.4 g
	Solagum AX	Acacia Senegal Gum & Xanthan Gum	0.1 g
	Glycerine	Glycerine	2.0 g
Oil Phase (B)	Manjisthadi Taila	<i>Rubia cordifolia</i> root extract	5.0 g
	PolyAqual 2W	Polyglyceryl-2 Stearate, Glyceryl Stearate & Stearyl Alcohol	1.5 g
Phase C	Repoly 415	Sodium Polyacrylate, C13-14 Isoalkane & Laureth-7	3.0 g
	Phenoxyethanol	Phenoxyethanol	1.0 g

Procedure

1. All glassware, stirrer shafts and homogenizer probes were sanitized with 70% Isopropyl Alcohol (IPA) and dried before use.
2. **Preparation of Phase A.**
87.4 g of distilled water was taken in a clean beaker. 0.1 g of Solagum AX was gradually dispersed into the water with gentle stirring. The mixture was allowed to hydrate for 10–15 minutes.

2.0 g of glycerine was added and mixed until a uniform hydrogel was obtained.

3. Preparation of Phase B.

5.0 g of *Manjisthadi Taila* and 1.5 g of PolyAqual 2W were taken in a separate beaker. The mixture was heated to 80 °C with gentle stirring until the emulsifier melted completely.

4. Emulsification

Phase A was simultaneously heated to 80 °C.

Phase B was gradually added to Phase A under high-shear stirring at approximately 1000 revolutions per minute (RPM).

Mixing was continued for 10–15 minutes at 80 °C to obtain a uniform emulsion.

5. Cooling and Phase C addition

The emulsion was cooled under slow stirring.

At approximately 35 °C, 3.0 g of Repoly 415 was added gradually.

1.0 g of Phenoxyethanol was then added with continuous gentle stirring.

6. pH adjustment

The formulation was checked for appearance, texture, emulsion stability and pH.

When required, the pH was adjusted using citric acid or sodium hydroxide solution to obtain a final pH of 6.0–6.5.

7. Packaging

The finished serum was filled into clean, light-resistant amber glass dropper bottles.

The containers were appropriately labelled with the product name, batch number, date of manufacture and storage conditions.



Manjisthadi Serum Nirman

Finished Product Characteristics

- Appearance: Homogeneous light emulsion
- Colour: Yellow

- Odour: Pleasant, mild herbal aroma
- Texture: Smooth, non-greasy and easily absorbable

ANALYTICAL STUDY

Table 1: Organoleptic Evaluation of Raw Ingredients.

Sr. No.	Ingredient	Appearance	Colour	Odour	Taste
1	Manjistha	Fine powder	Reddish brown	Faint	Characteristic
2	Kushtha	Fine powder	Brown	Strong aromatic	Slightly bitter
3	Haridra	Fine powder	Yellow	Pleasant	Sweet & astringent
4	Chakramarda	Fine powder	Light brown	Faint	Bitter
5	Aragwadha	Dry churna	Dark brown	Characteristic	Slightly bitter
6	Gandhatruna	Coarse powder	Greenish brown	Strongly aromatic	Pungent
7	Amalaki	Fine powder	Light brown	—	Sour & astringent
8	Bibhitaki	Fine powder	Yellowish brown	—	Astringent
9	Bilva	Dry powder	Light brown	Faint	Slightly bitter
10	Dadima	Fine powder	Reddish brown	Characteristic	Sweetish sour
11	Nagakesara	Fine powder	Brown	Fragrant	Slightly astringent
12	Krishna Jeeraka	Dry bharad	Greenish brown	Aromatic	Characteristic
13	Hribera	Fine powder	Brown	Characteristic	Slightly bitter
14	Ushira	Fine powder	Yellowish brown	Strong aromatic	Slightly bitter
15	Sarshapa Taila	Clear oil	Yellowish brown	Strong characteristic	Strong characteristic

Table no. 2: Physicochemical Evaluation of Raw Ingredients.

Ingredient	Moisture/ LOD (%)	Total Ash (%)	AIA/WSA (%)	ASE (%)	WSE (%)	Other Parameter
Manjistha	3.90	4.78	0.45	5.89	19.85	—
Kushtha	3.52	2.65	0.48	13.49	21.63	—
Ingredient	Moisture/ LOD (%)	Total Ash (%)	AIA/WSA (%)	ASE (%)	WSE (%)	Other Parameter
Haridra	3.20	5.42	0.58	8.54	12.42	Volatile oil: 4%
Chakramarda	3.60	2.31	0.12*	9.04	16.86	—
Aragwadha	3.80	4.21	0.67	17.38	48.52	—
Gandhatruna	8.40	9.15	1.20	6.82	—	Volatile oil: 0.9%
Amalaki	3.45	4.57	0.74	41.45	52.44	—

Bibhitaki	3.66	5.25	0.45	9.16	36.49	—
Bilva	—	5.22	0.73	5.36	10.16	—
Dadima	4.40	2.30	0.14	21.45	36.65	—
Nagakesara	4.11	4.98	1.02	15.78	12.39	—
Krishna Jeeraka	4.00	5.33	0.81	4.04	14.34	Volatile oil: 3.5%
Hribera	3.60	6.23	1.15	6.17	10.88	Fixed oil: 5%
Ushira	3.90	5.07	1.19	5.24	6.54	Volatile oil: 1%
Sarshapa Taila	—	—	—	—	—	SG 0.968; RI 1.460; AV 7.7; IV 8.4; pH 7.0; viscosity 117.5; SV 124; rancidity: NIL

Table no. 3: AAS Analysis of Raw Ingredients.

Sr. No.	Ingredient	Pb (ppm)	Cd (ppm)	As (ppm)	Hg (ppm)	Ni (ppm)	Cr (ppm)	Cu (ppm)	Zn (ppm)	Fe (ppm)
1	Manjistha	0.117	0.054	0.131	0.089	1.205	0.961	3.249	15.052	59.770
2	Kushtha	1.090	0.057	0.378	0.056	1.796	0.380	1.291	7.185	54.521
3	Haridra	1.169	0.069	0.075	0.046	2.129	0.410	1.284	18.032	53.506
4	Chakramarda	0.176	0.066	0.823	0.044	1.841	0.951	4.615	15.849	61.520
5	Aragwadha	1.317	0.023	0.539	0.009	0.283	1.305	3.519	10.179	5.378
6	Gandhatruna	2.108	0.059	0.232	0.064	1.788	1.472	2.707	11.356	26.559
7	Amalaki	2.900	0.024	0.911	0.026	2.162	1.250	3.160	23.921	53.748
8	Bibhitaki	2.657	0.077	0.658	0.049	1.024	0.419	2.601	17.938	41.600
9	Bilva	2.328	0.054	1.158	0.026	2.466	0.602	1.390	10.295	27.096
10	Dadima	2.913	0.066	1.077	0.029	1.026	0.158	4.752	6.445	64.005
11	Nagakesara	2.638	0.063	0.294	0.068	1.072	1.411	3.741	8.690	37.564
12	Krishna Jeeraka	1.214	0.050	1.082	0.033	2.022	0.109	3.249	14.222	41.889
13	Hribera	0.693	0.020	0.230	0.010	1.711	1.043	1.373	18.146	72.593
14	Ushira	2.429	0.066	0.539	0.046	1.370	0.788	2.676	15.979	55.068

Table no. 4: Summary of Analytical Evaluation of Raw Ingredients.

Sr. No.	Ingredient	Moisture/LOD (%)	Total Ash (%)	AIA/WSA (%)	ASE (%)	WSE (%)	Special Parameter
1	Manjistha	3.90	4.78	0.45	5.89	19.85	—
2	Kushtha	3.52	2.65	0.48	13.49	21.63	—
3	Haridra	3.20	5.42	0.58	8.54	12.42	Volatile oil 4%
4	Chakramarda	3.60	2.31	0.12	9.04	16.86	—
5	Aragwadha	3.80	4.21	0.67	17.38	48.52	—
6	Gandhatruna	8.40	9.15	1.20	6.82	—	Volatile oil 0.9%
7	Amalaki	3.45	4.57	0.74	41.45	52.44	—
8	Bibhitaki	3.66	5.25	0.45	9.16	36.49	—
9	Bilva	—	5.22	0.73	5.36	10.16	—
10	Dadima	4.40	2.30	0.14	21.45	36.65	—
11	Nagakesara	4.11	4.98	1.02	15.78	12.39	—
12	Krishna Jeeraka	4.00	5.33	0.81	4.04	14.34	Volatile oil 3.5%
13	Hribera	3.60	6.23	1.15	6.17	10.88	Fixed oil 5%
14	Ushira	3.90	5.07	1.19	5.24	6.54	Volatile oil 1%

IN VITRO CELL LINE STUDY – MTT ASSAY**Cell line and culture conditions**

L929 mouse fibroblast cells were used for the in vitro cytotoxicity evaluation of Manjisthadi Taila and its serum formulation.

The cells were maintained in Dulbecco's Modified Eagle Medium (DMEM) with high glucose (Cat. No. 11965-092), supplemented with fetal bovine serum (FBS; Gibco,

Invitrogen; Cat. No. 10270106) and 1X antibiotic–antimycotic solution (Thermo Fisher Scientific; Cat. No. 15240062).

Cells were incubated at 37°C in a humidified atmosphere containing 5% CO₂.

MTT assay

L929 cells were seeded in 96-well tissue culture plates at a density of approximately 1×10^4 cells/well and incubated for 24 h. Manjisthadi Taila and Manjisthadi Serum were tested at concentrations of 20, 40, 60, 80 and 100 µg/mL.

The samples were tested in triplicate. Following 24 h of treatment, MTT reagent (5 mg/mL in phosphate-buffered

saline) was added and the plates were incubated for 4 h. The resulting formazan crystals were dissolved using dimethyl sulfoxide (DMSO), and absorbance was measured at 550 nm using a microplate reader.

Percentage viability and percentage inhibition were calculated in comparison with the control.

Table no. 5: Effect of Manjisthadi Taila and Manjisthadi Serum on L929 Fibroblast Cells.

Sample	Concentration (µg/mL)	Mean OD	% Inhibition	% Viability	IC ₅₀ (µg/mL)
Control	–	1.377	–	–	–
Standard (Ethanol)	20	1.025	25.56	74.44	57.93
	40	0.845	38.63	61.37	
	60	0.660	52.07	47.93	
	80	0.433	68.55	31.45	
	100	0.292	78.79	21.21	
Manjisthadi Taila	20	1.354	1.67	98.33	NE
	40	1.324	3.85	96.15	
	60	1.310	4.87	95.13	
	80	1.287	6.54	93.46	
	100	1.249	9.30	90.70	
Manjisthadi Serum	20	1.368	0.65	99.35	NE
	40	1.350	1.96	98.04	
	60	1.336	2.98	97.02	
	80	1.324	3.85	96.15	
	100	1.309	4.94	95.06	

NE – Not estimable within the tested concentration range.

RESULT

The MTT assay showed a concentration-dependent increase in percentage inhibition for all tested samples. The standard exhibited marked inhibition, increasing from 25.56% at 20 µg/mL to 78.79% at 100 µg/mL, with an IC₅₀ of 57.93 µg/mL.

Manjisthadi Taila showed comparatively low inhibition, ranging from 1.67% to 9.30%, with cell viability remaining between 98.33% and 90.70% across the tested concentrations. Manjisthadi Serum demonstrated still lower inhibition, ranging from 0.65% to 4.94%, while cell viability remained between 99.35% and 95.06%. The IC₅₀ values for both Manjisthadi Taila and Manjisthadi Serum were not estimable within the tested concentration range.

DISCUSSION

The analytical evaluation of the raw ingredients used for the preparation of Manjisthadi Taila showed acceptable physicochemical characteristics. The moisture content/loss on drying ranged from 3.20% to 8.40%, with Gandhatruna showing the highest value (8.40%), indicating relatively low moisture levels in most of the raw materials. Total ash values ranged from 2.30% to 9.15%, while acid-insoluble ash ranged from 0.14% to 1.20%, suggesting limited contamination with siliceous or earthy matter. The variation in alcohol- and water-

soluble extractive values reflected differences in the soluble constituents of individual drugs. Amalaki showed comparatively high alcohol- and water-soluble extractive values (41.45% and 52.44%), while Aragwadha showed a high water-soluble extractive value (48.52%).

Volatile oil was observed in Haridra (4%), Krishna Jeeraka (3.5%), Gandhatruna (0.9%) and Ushira (1%), whereas Hribra showed a fixed oil content of 5%. These variations correspond to the different chemical characteristics of the individual ingredients. Elemental analysis by AAS showed that lead, cadmium, arsenic, mercury and chromium were within the permissible limits reported in the analytical report, indicating no excessive contamination by the tested toxic elements.

Sarshapa Taila, used as the base oil, showed a yellowish-brown appearance with characteristic pungent odour and taste. Its specific gravity (0.968), refractive index (1.460), acid value (7.7), saponification value (124), iodine value (8.4) and viscosity (117.5) provided baseline physicochemical characteristics. The negative rancidity test indicated absence of detectable oxidative deterioration at the time of use.

Manjisthadi Taila was prepared by the classical Sneha Kalpana method using the Kalka, Sneha and Drava Dravya ratio of 1:4:16. The process involved heating and

stirring until the characteristic Taila Siddhi Lakshanas were obtained, indicating completion of the pharmaceutical process. The classical oil was subsequently developed into an oil-in-water serum formulation to improve topical acceptability, reduce greasiness and enhance spreadability. During formulation development, phase separation, excessive oiliness, unsuitable viscosity and difficulties in maintaining uniformity were observed. Optimization of the emulsifying system, homogenization and processing conditions resulted in a uniform serum formulation.

The comparative analytical evaluation of Manjisthadi Taila and its serum formulation provided information regarding their physicochemical characteristics and chromatographic profiles. The HPTLC evaluation further supported comparison of the formulations based on their respective chromatographic fingerprints. The antimicrobial evaluation provided additional quality-related information for the prepared formulations.

The in vitro MTT assay using L929 fibroblast cells showed a concentration-dependent increase in percentage inhibition in the tested samples. The standard showed markedly higher inhibition, increasing from 25.56% at 20 µg/mL to 78.79% at 100 µg/mL, with an IC₅₀ of 57.93 µg/mL. In comparison, Manjisthadi Taila showed low inhibition ranging from 1.67% to 9.30%, with cell viability ranging from 98.33% to 90.70%. Manjisthadi Serum showed still lower inhibition, ranging from 0.65% to 4.94%, with cell viability ranging from 99.35% to 95.06%. At 100 µg/mL, the cell viability was 90.70% for Manjisthadi Taila and 95.06% for Manjisthadi Serum. The IC₅₀ of both formulations was not estimable within the tested concentration range. Thus, both formulations showed low cytotoxicity toward L929 fibroblast cells under the conditions of the present study, while the serum demonstrated comparatively lower inhibition and higher cell viability than the oil.

Overall, the findings demonstrate the feasibility of converting classical Manjisthadi Taila into a novel serum dosage form while maintaining comparable quality characteristics. The physicochemical, HPTLC, antimicrobial and in vitro cell-line findings collectively provide supportive evidence for the quality assessment and preliminary cell compatibility of the developed formulation. However, the cell-line findings represent in vitro observations within the tested concentration range and should not be directly extrapolated to clinical safety or therapeutic efficacy.

CONCLUSION

The present study demonstrated the feasibility of developing a novel serum formulation from the classical Ayurvedic preparation Manjisthadi Taila.

Murcchana of Sarshapa Taila and subsequent preparation of Manjisthadi Taila were successfully carried out by the classical pharmaceutical method, with attainment of

Taila Siddhi Lakshanas confirming completion of the process.

The physicochemical, HPTLC, microbial and elemental evaluations provided useful quality-control data for the raw materials and prepared formulations. A stable and homogeneous oil-in-water serum was successfully developed through optimization of the formulation and processing conditions. Compared with the classical Taila, the serum showed improved spreadability, reduced greasiness and better cosmetic acceptability.

The in vitro MTT assay on L929 fibroblast cells showed low cytotoxicity for both Manjisthadi Taila and Manjisthadi Serum within the tested concentration range.

The serum showed comparatively higher cell viability and lower percentage inhibition than the oil, indicating better cell compatibility under the conditions of the study.

Overall, the study supports the pharmaceutical feasibility and preliminary cell compatibility of converting Manjisthadi Taila into a novel serum dosage form. The generated pharmaceutico-analytical data may serve as preliminary reference data for further standardization and investigation of Manjisthadi Serum for topical applications. Further studies are required to establish its long-term stability, clinical efficacy and in vivo safety.

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