

CHEMICALS USED IN HAIR SHAMPOO AND HAIR CARE PRODUCTS CAUSING HAIR FALL AND RISK OF CANCER - AN AYURVEDIC AND TOXICOLOGICAL REVIEW

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ABSTRACT

Background: Hair cosmetics and hair care products are extensively used worldwide for cleansing, beautification, and hair maintenance. Modern shampoos, conditioners, hair dyes, straightening agents, and styling formulations contain multiple synthetic chemicals such as sulfates, parabens, phthalates, formaldehyde-releasing preservatives, triclosan, coal tar dyes, and aromatic amines. Chronic exposure to these compounds has been associated with scalp irritation, hair fall, endocrine disruption, reproductive toxicity, mutagenicity, and carcinogenicity.^[11] Ayurveda emphasizes preservation of *Kesha* (hair) through maintenance of *Dhatu Samyata*, *Rakta Shuddhi*, and avoidance of *Visha Dravya*. The principles of *Agadtantra* provide insight into chronic low-dose toxicity resembling exposure to cosmetic chemicals. **Aim:** To critically analyze the toxicological effects of chemicals used in shampoos and hair

care products causing hair fall and cancer risk through Ayurvedic and contemporary scientific perspectives. **Materials and Methods:** This review-based analytical study was conducted using classical Ayurvedic texts including *Charaka Samhita*, *Sushruta Samhita*, and *Ashtanga Hridaya* along with modern scientific literature collected from PubMed, Scopus, Google

Scholar, WHO reports, IARC monographs, and toxicological journals. Keywords used included “hair cosmetics toxicity,” “parabens and cancer,” “hair dye carcinogenicity,” “Ayurveda and hair fall,” and “cosmetic toxicology.” **Results and Discussion:** The review revealed that many synthetic cosmetic ingredients induce oxidative stress, endocrine dysfunction, follicular inflammation, DNA damage, and carcinogenic changes. Ayurvedically, these pathological processes can be correlated with *Dushivisha*, *Garavisha*, *Pitta Prakopa*, *Rakta Dushti*, *Khalitya*, and *Dhatu Kshaya*. Long-term exposure to such chemicals may act as cumulative toxins leading to chronic disease manifestation. **Conclusion:** Frequent use of chemical-containing shampoos and hair products may contribute significantly to hair fall and long-term carcinogenic risk. Ayurvedic toxicology offers a comprehensive conceptual framework for understanding chronic cosmetic toxicity. Promotion of safer herbal alternatives, public awareness, and integrative research is essential for preventive healthcare.

KEYWORDS: Ayurveda; Agadtantra; Hair Fall; Cosmetic Toxicity; Dushivisha; Carcinogenic Chemicals; Hair Care Products.

INTRODUCTION

Hair is considered an important symbol of beauty, health, and vitality in both classical Ayurvedic literature and modern medicine. In Ayurveda, *Kesha* (hair) is regarded as the *Mala* or secondary product of *Asthi Dhatu*.^[1] Proper nourishment of *Dhatus*, balanced *Doshas*, healthy *Rakta*, and proper functioning of *Agni* are essential for maintenance of healthy hair growth.

Acharya Charaka states

“अस्थ्नां मलनाः केशलोम्बशमश्रूणि।”¹

Meaning: Hair, body hair, nails, and beard are considered waste products of *Asthi Dhatu*. In recent decades, extensive industrialization and cosmetic commercialization have resulted in widespread use of synthetic hair care products. Modern shampoos and cosmetic formulations contain numerous chemicals including surfactants, preservatives, emulsifiers, fragrances, dyes, and stabilizers. Many of these compounds possess irritant, allergenic, endocrine-disrupting, mutagenic, or carcinogenic potential.^[5,6]

Hair care products are directly applied to the scalp, a highly vascular and absorptive surface. Continuous exposure to toxic compounds may lead not only to local scalp disorders but also

systemic toxicity through dermal absorption. Scientific studies have reported associations between cosmetic chemicals and alopecia, scalp inflammation, allergic dermatitis, endocrine abnormalities, infertility, and hormone-sensitive cancers.^[7,8,11]

Formaldehyde-releasing agents used in hair straightening treatments have been classified as carcinogenic to humans by the International Agency for Research on Cancer (IARC).^[7] Parabens and phthalates possess estrogenic activity and may interfere with hormonal homeostasis.^[5] Sulfates and synthetic fragrances disrupt scalp barrier integrity, promoting inflammation and oxidative stress.^[13]

Ayurveda explains chronic low-grade toxicity under the concepts of *Dushivisha* and *Garavisha*. Such toxins remain dormant within the body and gradually vitiate *Doshas* and *Dhatus*.

Acharya Sushruta Describes

“दूषीविषं नाम वीर्यानल्यं विषम्॥”²

Meaning: Dushivisha is a weak poison that remains in the body for prolonged periods and produces disease slowly.

Repeated application of chemical-laden cosmetic products resembles chronic exposure to *Dushivisha*. These toxic substances may vitiate *Rakta*, aggravate *Pitta*, obstruct *Srotas*, and eventually manifest as *Khalitya* (hair fall), *Palitya* (premature greying), and chronic systemic diseases.

The increasing incidence of premature hair loss and rising concerns regarding cosmetic-associated cancer risk make this review highly relevant in contemporary clinical practice.

AIM AND OBJECTIVES

AIM

To critically evaluate chemicals present in hair shampoos and hair care products causing hair fall and carcinogenic risk through Ayurvedic and modern toxicological perspectives.

OBJECTIVES

1. To identify hazardous chemicals commonly present in shampoos and hair cosmetics.
2. To analyze their toxicological and carcinogenic effects.

3. To correlate cosmetic toxicity with Ayurvedic concepts such as *Dushivisha*, *Garavisha*, *Khalitya*, and *Rakta Dushti*.
4. To explore Ayurvedic preventive and therapeutic principles for chronic chemical exposure.

MATERIALS AND METHODS

Type of Study

Conceptual, analytical, and narrative review study.

Sources of Data

Ayurvedic Sources

- *Charaka Samhita*^[1]
- *Sushruta Samhita*^[2]
- *Ashtanga Hridaya*^[3]
- Classical commentaries by Chakrapani, Dalhana, and Arunadatta

Modern Sources

- PubMed
- Scopus
- Google Scholar
- WHO publications
- IARC monographs
- Toxicology and dermatology journals

Search Terms

“Hair shampoo toxicity,” “parabens and breast cancer,” “formaldehyde carcinogenicity,” “phthalates endocrine disruption,” “hair dye cancer risk,” “Ayurvedic toxicology,” “Dushivisha,” and “cosmetic-induced alopecia.”

Conceptual Review

Ayurvedic Concept of Hair (Kesha)

Ayurveda describes hair as dependent upon proper nourishment of *Asthi Dhātu*. Disturbance in *Dhātu Poshana*, *Agni*, and *Dosha* balance directly affects hair health.

Causes of Hair Fall in Ayurveda

Ayurvedic texts describe several etiological factors responsible for *Khalitya*:

- Excessive *Pitta*

- *Rakta Dushti*
- Psychological stress
- Improper dietary habits
- Exposure to toxins
- Suppression of natural urges
- Viruddha Ahara
- Excessive heat exposure

Acharya Sushruta explains

"तेजसा सह वातेन रोमकूपान् प्रपीड्यते॥"²

Meaning: Aggravated *Pitta* associated with *Vata* affects hair follicles resulting in hair fall.

Dushivisha and Garavisha

Dushivisha

Dushivisha refers to low-potency toxins remaining in the body for prolonged durations.² These toxins produce delayed manifestations and become aggravated under favorable conditions.

Characteristics include

- Chronic accumulation
- Low-grade toxicity
- Delayed symptom manifestation
- Tissue degeneration

Continuous use of chemical-based shampoos and hair products closely resembles chronic *Dushivisha* exposure.

Garavisha

Garavisha refers to artificial or compound poisons formed through combinations of substances.^[2] Modern cosmetic formulations containing multiple synthetic chemicals parallel this concept. Chronic exposure can result in cumulative toxic burden.

Toxic Chemicals in Hair Care Products

1. Sulfates

Examples

- Sodium Lauryl Sulfate (SLS)
- Sodium Laureth Sulfate (SLES)

Toxicological Effects

- Scalp irritation
- Barrier disruption
- Follicular dryness
- Hair fragility
- Oxidative stress^[13]

Ayurvedic Correlation

Sulfates may aggravate

- *Pitta*
- *Vata*
- *Rakta Dushti*

Manifestations include

- Dry scalp
- Burning sensation
- Itching
- Hair thinning

2. Parabens

Examples

- Methylparaben
- Propylparaben
- Butylparaben

Toxicological Significance

Parabens are preservatives with estrogenic activity. Studies suggest associations with:

- Endocrine disruption
- Hormonal imbalance
- Breast cancer^[5,6]

Ayurvedic Correlation These effects resemble

- *Pitta Dushti*
- *Rakta Dushti*
- *Shukra Vaigunya*

3. Formaldehyde and Formaldehyde-Releasing Agents

Commonly found in

- Hair smoothening agents
- Keratin treatments

Health Hazards

- Respiratory irritation
- DNA damage
- Nasopharyngeal cancers
- Scalp inflammation
- Carcinogenicity^[7,8]

Ayurvedic Perspective

These chemicals may act as potent *Visha Dravya* causing:

- *Rakta Dushti*
- *Dhatu Kshaya*
- *Pitta Prakopa*

4. Phthalates

Used in fragrances and stabilizers.

Toxic Effects

- Endocrine disruption
- Reproductive toxicity
- Hormonal imbalance
- Oxidative stress^[11]

Ayurvedic Correlation Can be correlated with

- *Beeja Dushti*
- *Shukra Dushti*

- *Ojas Kshaya*

5. Coal Tar Dyes and Aromatic Amines

Used in hair coloring formulations.

Toxicological Concerns

- Allergic dermatitis
- Mutagenicity
- Bladder cancer risk
- Hematological malignancies^[10]

Ayurvedic Interpretation

May behave as

- *Tikshna Visha*
- *Rakta Pradoshaja Hetu*

6. Triclosan

Harmful Effects

- Hormonal interference
- Thyroid dysfunction
- Immune dysregulation
- Antibiotic resistance^[11]

Ayurvedic Correlation Contributes to

- *Ama*
- *Agni Vaishamya*
- *Tridosha Dushti*

7. Synthetic Fragrances

Effects

- Allergic reactions
- Neurotoxicity
- Hormonal effects
- Headache

Ayurvedic Correlation May aggravate

- *Vata*
- *Rajas*
- *Manovaha Srotas Dushti*

Samprapti (Pathogenesis)

Nidana

- Repeated use of chemical products
- Exposure to toxins
- Heat-generating cosmetic procedures
- Stress
- Improper diet

Dosha Involvement

- Predominantly *Pitta* and *Vata*
- Secondary *Kapha Kshaya*

Dushya

- *Rakta*
- *Mamsa*
- *Asthi*
- *Majja*

Srotas Involved

- *Raktavaha Srotas*
- *Asthivaha Srotas*
- *Swedavaha Srotas*

Samprapti Ghataka

Chemical exposure → *Dushivisha Sanchaya* → *Rakta Dushti* → *Pitta Prakopa* → Follicular inflammation → *Asthi Dhatu Kshaya* → *Khalitya*

Lakshana

Common manifestations include

- Hair fall

- Premature greying
- Scalp irritation
- Dryness
- Itching
- Burning sensation
- Hair thinning
- Allergic dermatitis

Systemic manifestations

- Fatigue
- Hormonal imbalance
- Headache
- Respiratory irritation
- Menstrual abnormalities

Chikitsa Siddhanta

Management principles include

1. Nidana Parivarjana

Avoidance of toxic cosmetic products

2. Dushivisha Chikitsa

Detoxification therapies and elimination of accumulated toxins

3. Pitta-Rakta Shaman

Cooling and blood-purifying therapies

4. Rasayana Therapy

Restoration of tissue integrity and immunity

5. Keshya Dravyas

Herbs beneficial for hair

- *Amalaki*
- *Bhringaraja*
- *Nimba*
- *Yashtimadhu*

6. Panchakarma

- *Nasya*
- *Shirodhara*
- *Raktamokshana* (where indicated)

Modern Correlation

Modern biomedical studies demonstrate that cosmetic chemicals induce oxidative stress, inflammation, endocrine disruption, and genetic mutations.^[5,6,8]

Oxidative Stress and Follicular Damage

Hair follicles are highly susceptible to oxidative injury. Sulfates, dyes, and preservatives generate reactive oxygen species causing:

- Cellular apoptosis
- Follicular miniaturization
- Premature aging^[9]

This Resembles *Pitta-induced Dhatu Paka*.

Endocrine Disruption

Parabens and phthalates mimic hormonal activity and interfere with endocrine pathways.

These changes contribute to:

- Hair loss
- Infertility
- Metabolic dysfunction
- Hormone-sensitive cancers^[5,6]

Ayurvedically, these effects correlate with:

- *Shukra Dushti*
- *Artava Dushti*
- *Ojas Kshaya*

Carcinogenesis

Several cosmetic chemicals produce

- DNA damage
- Epigenetic alterations
- Chronic inflammation

- Free radical injury^[7,8]

This resembles chronic *Dushivisha* accumulation leading to tissue degeneration and disease manifestation.

DISCUSSION

The modern cosmetic industry has expanded dramatically, increasing dependence on shampoos, conditioners, hair dyes, and straightening agents. However, prolonged exposure to synthetic chemicals present in these products may produce significant local and systemic toxicity.

Hair fall associated with cosmetic use is frequently overlooked because the toxic effects are gradual and cumulative. Ayurveda provides a comprehensive explanation for such chronic toxicity through the concepts of *Dushivisha* and *Garavisha*. Unlike acute poisoning, these toxins remain dormant and gradually impair tissue function.

From an Ayurvedic perspective, repeated exposure to chemical products aggravates *Pitta* and vitiates *Rakta*, leading to follicular inflammation and *Asthi Dhātu Kshaya*. Modern toxicological findings regarding oxidative stress, endocrine disruption, and inflammatory damage closely parallel Ayurvedic concepts of *Dhātu Dushti* and *Srotorodha*.

The carcinogenic potential of formaldehyde, coal tar derivatives, aromatic amines, and endocrine-disrupting chemicals is particularly concerning. Long-term exposure may increase susceptibility to hormone-sensitive cancers and chronic inflammatory disorders.

Ayurvedic management emphasizes prevention through *Nidana Parivarjana*. Use of herbal formulations possessing antioxidant, anti-inflammatory, and *Rasayana* properties may provide safer alternatives. Herbs such as *Bhringaraja* and *Amalaki* possess established antioxidant and follicle-protective effects.

An integrative approach combining toxicology and Ayurveda may contribute significantly toward preventive healthcare, patient education, and safer cosmetic practices.

CONCLUSION

Hair shampoos and cosmetic hair care products contain multiple synthetic chemicals capable of causing scalp irritation, endocrine dysfunction, follicular damage, and carcinogenic effects.

Chronic exposure to sulfates, parabens, phthalates, formaldehyde-releasing agents, coal tar dyes, and synthetic fragrances may result in cumulative toxicity.

Ayurvedic toxicology, particularly the concepts of *Dushivisha* and *Garavisha*, offers a valuable framework for understanding chronic low-dose chemical exposure. The pathogenesis involves *Pitta Prakopa*, *Rakta Dushti*, *Dhatu Kshaya*, and manifestation of *Khalitya*.

Public awareness regarding cosmetic toxicity should be improved, and safer herbal alternatives should be promoted. Further interdisciplinary research integrating Ayurveda, toxicology, dermatology, and molecular biology is necessary for evidence-based preventive and therapeutic strategies.

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