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INTEGRATIVE APPROACH TO KHALITYA: BRIDGING AYURVEDA AND MODERN SCIENCE

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ABSTRACT

Hair loss, referred to as *Khalitya* in Ayurveda, represents a complex and multifactorial disorder that has significant implications for physical appearance, psychological well-being, and social confidence. Classical Ayurvedic texts describe Khalitya as a manifestation of vitiated *Pitta* and *Vata* doshas, which disturb the nourishment of hair roots and lead to premature shedding. The condition is further linked to *Asthi Dhatu kshaya* (depletion of bone tissue), since hair is considered an *Upadhatu* (secondary tissue) of Asthi Dhatu. This conceptual framework highlights the deep interconnection between systemic health, dietary practices, and hair physiology. Modern biomedical science, in parallel, identifies hair loss as a condition influenced by nutritional deficiencies, hormonal imbalances, psychological stress, and environmental exposures. Micronutrients such as calcium and phosphorus are essential for cellular signaling, keratinocyte adhesion, and follicular integrity. Deficiency of calcium, in particular, has been associated with impaired hair follicle function and thinning of hair shafts, while phosphorus levels generally remain stable unless systemic disease is present. Stress, endocrine dysregulation, and lifestyle factors such as poor diet and excessive use of chemical hair products further exacerbate the condition, creating a multifaceted pathogenesis that resonates with the Ayurvedic emphasis on multiple hetus (causative factors). The present observational study was conducted on 40 participants clinically diagnosed with Khalitya, integrating both Ayurvedic diagnostic principles and modern biochemical assessment. A structured questionnaire was employed to identify classical hetus, while venous blood samples were analyzed for serum calcium and phosphorus levels using standardized laboratory methods. The most frequent hetus identified were *Viruddha Ahara* (incompatible food combinations, reported in 85% of participants), *Lavana Rasa Atisevana* (excessive salt intake, 75%), and *Kshara Atisevana* (excessive alkaline food intake, 62.5%). Biochemical analysis revealed that 55% of participants had serum calcium levels below the normal reference range, whereas phosphorus levels remained within normal limits in all cases. Comparative analysis of these findings demonstrates strong parallels between Ayurvedic constructs and biomedical risk factors. The predominance of dietary hetus corresponds with modern evidence linking poor nutrition and mineral imbalance to hair loss. The observed calcium deficiency supports the Ayurvedic concept of *Asthi Dhatu kshaya*, reinforcing the relevance of classical theory in contemporary contexts. This integrative model underscores the importance of prevention through *nidana parivarjana* (avoidance of causative factors), dietary regulation, stress management, and biochemical monitoring. By bridging traditional Ayurvedic wisdom with modern scientific evidence, the study provides a holistic framework for understanding and managing Khalitya, offering valuable insights for clinicians, researchers, and individuals seeking comprehensive approaches to hair health.

KEYWORDS: *Lavana Rasa Atisevana, nidana parivarjana, Asthi Dhatu kshaya, Kshara Atisevana.*

INTRODUCTION

Hair loss, or *Khalitya* as described in Ayurveda, is a condition that has attracted increasing attention in recent decades due to its rising prevalence across diverse age groups. Traditionally, hair loss was considered a natural sign of aging, associated with gradual decline in tissue

strength and vitality. However, the growing incidence of Khalitya among younger populations suggests that the condition is no longer confined to senescence but is instead shaped by modifiable lifestyle factors, nutritional imbalances, and psychosocial stressors. This shift in epidemiological patterns has prompted renewed interest in both classical Ayurvedic explanations and modern biomedical research, with the aim of developing integrative strategies for prevention and management.

Ayurvedic Perspective on Khalitya

Ayurveda situates Khalitya within the category of *Kshudraroga* (minor diseases), yet its impact on quality of life is far from minor. The condition is primarily attributed to the vitiation of *Pitta* and *Vata* doshas, which disturb the nourishment of hair roots and weaken the scalp's ability to sustain healthy follicles. Classical texts such as the *Charaka Samhita*, *Sushruta Samhita*, and *Madhava Nidana* describe Khalitya as a disorder closely linked to *Asthi Dhatu kshaya* (depletion of bone tissue), since hair (*Kesha*) is considered an *Upadhatu* (secondary tissue) of Asthi Dhatu. This conceptual framework highlights the systemic nature of hair health, emphasizing that disturbances in deeper tissues manifest externally as hair loss.

The diagnostic framework of *Nidana Panchaka*—comprising *Nidana* (causes), *Purvarupa* (prodromal signs), *Rupa* (clinical features), *Samprapti* (pathogenesis), and *Upashaya* (palliative tests)—provides a comprehensive lens through which Khalitya can be understood. Among these, *Hetu* (causative factors) are considered paramount.

Classical hetus include *Viruddha Ahara* (incompatible food combinations such as milk with fish, curd with hot foods, or fruit with dairy), *Lavana Rasa Atisevana* (excessive salt intake), and *Kshara Atisevana* (excessive consumption of alkaline substances).

Psychosocial factors such as *Krodha* (anger), *Shoka* (grief), and *Shrama* (exertion) are also recognized as contributors, reflecting Ayurveda's holistic view of mind–body interactions. Lifestyle practices such as poor scalp hygiene and excessive heating of hair further aggravate dosha imbalance, leading to progressive follicular damage.

Biomedical Perspective on Hair Loss

Modern science approaches hair loss through the lens of dermatology, endocrinology, and nutrition. The hair growth cycle consists of three phases: *anagen* (active growth), *catagen* (regression), and *telogen* (resting). Disruption of this cycle due to hormonal imbalance, nutritional deficiency, or environmental stress can result in premature shedding and thinning. Micronutrients such as calcium and phosphorus are essential for keratinocyte adhesion, follicular signaling, and overall scalp health. Calcium, in particular, plays a critical role in cellular communication and structural integrity; deficiency may impair follicular anchorage and lead to diffuse hair loss. Phosphorus, while vital for energy metabolism, typically remains stable unless systemic disease is present.

Beyond micronutrients, modern research highlights the role of vitamin D, vitamin B12, ferritin, and zinc in maintaining hair follicle function. Endocrine factors such as thyroid dysfunction and elevated cortisol levels due to chronic stress are also implicated.

Environmental exposures—including pollution, ultraviolet radiation, and chemical hair treatments—introduce oxidative stress, damaging both the hair shaft and follicular environment. Thus, biomedical science corroborates the Ayurvedic emphasis on diet, lifestyle, and stress as central determinants of hair health.

Epidemiological Trends

Epidemiological studies reveal that hair loss affects approximately 50% of men and 25% of women by the age of 50. In India, urbanization, dietary transitions, and occupational stress have contributed to a rising burden of Khalitya among younger adults. The psychosocial impact of hair loss is profound, often leading to diminished self-esteem, social withdrawal, and anxiety. These consequences underscore the need for preventive strategies that address both physical and psychological dimensions of the condition.

Rationale for Integrative Study

Despite the wealth of knowledge in both Ayurveda and modern biomedicine, few studies have attempted to correlate classical hetus with measurable biochemical parameters. This gap limits the ability to develop comprehensive management strategies that draw on the strengths of both systems. The present study seeks to bridge this divide by identifying predominant Ayurvedic hetus in individuals with Khalitya and correlating them with serum calcium and phosphorus levels. By doing so, it aims to validate classical concepts such as *Asthi Dhatu kshaya* through modern laboratory evidence, while also highlighting the relevance of dietary and lifestyle modifications in contemporary contexts.

OBJECTIVES

The specific objectives of this study are threefold.

1. To identify the most frequent classical hetus associated with Khalitya in a clinical cohort.
2. To measure serum calcium and phosphorus levels in participants and assess their correlation with hair loss.
3. To develop an integrative framework that synthesizes Ayurvedic and biomedical perspectives, thereby informing preventive and therapeutic strategies.

MATERIALS AND METHODS

Study Design and Setting

This research was designed as an observational, cross-sectional study conducted in a tertiary Ayurveda teaching

hospital with access to modern laboratory facilities. The study aimed to integrate classical Ayurvedic diagnostic frameworks with biomedical biochemical analysis, thereby creating a dual-lens approach to Khalitya. The setting provided a unique opportunity to recruit participants from diverse backgrounds, including students, service workers, and individuals from urban and semi-urban environments, reflecting the multifactorial nature of hair loss in contemporary society.

Participants and Eligibility Criteria

A total of 40 volunteers aged between 15 and 45 years were recruited. Inclusion criteria required visible signs of hair fall consistent with Ayurvedic diagnostic features of Khalitya, willingness to participate, and consent to provide venous blood samples.

Exclusion criteria were carefully defined to eliminate confounding factors: participants with systemic illnesses (renal, hepatic, or endocrine disorders), known hormonal imbalances, dermatological scalp infections, or those on medications known to affect calcium and phosphorus metabolism were excluded. This ensured that the observed biochemical variations were more likely to reflect dietary and lifestyle hetus rather than secondary systemic disease.

Ayurvedic Diagnostic Framework

Diagnosis of Khalitya was established using *Nidana Panchaka*, which includes.

- **Nidana (causes):** Identification of dietary incompatibilities, excessive intake of Lavana and Kshara, psychosocial stressors, and lifestyle practices.
- **Purvarupa (prodromal signs):** Early indicators such as increased hair fragility, scalp dryness, and mild itching.
- **Rupa (clinical features):** Observable hair fall, thinning, and receding hairline.
- **Samprapti (pathogenesis):** Vitiation of Pitta and Vata leading to Asthi Dhatu depletion.
- **Upashaya (palliative tests):** Relief observed with dietary correction and stress management.

  A structured questionnaire was developed to capture hetus systematically. The questionnaire included sections on dietary practices, psychosocial factors, lifestyle habits, and family history. Validation was performed by two senior Ayurveda faculty members, and pilot testing was conducted on five participants to ensure clarity and reliability.

Biochemical Analysis

Venous blood samples (3–5 mL) were collected under aseptic conditions using sterile vacutainers. Samples were centrifuged at 3000 rpm for 10 minutes to separate serum. Serum calcium and phosphorus levels were measured using standardized colorimetric methods in a certified laboratory. Internal quality controls were run daily to ensure accuracy. Reference ranges were based on WHO guidelines: calcium 8.5–10.5 mg/dL, phosphorus 2.5–4.5 mg/dL.

Ethical Considerations

Ethical clearance was obtained from the institutional ethics committee. Written informed consent was taken from all participants. Confidentiality was maintained by anonymizing data and restricting access to authorized personnel only. Participants were informed of their biochemical results and provided with dietary counseling where deficiencies were observed.

Data Management and Statistical Analysis

Data were captured on paper forms and transcribed into electronic spreadsheets. Double entry checks were performed to minimize transcription errors. Descriptive statistics were used to summarize demographic data, hetu frequencies, and biochemical parameters.

Frequencies were expressed as percentages, and biochemical values were reported as mean ± standard error. Chi-square tests were applied to assess associations between hetus and biochemical deficiencies, with $p < 0.05$ considered statistically significant.

RESULTS

Demographic Profile of Participants

A total of 40 participants were enrolled in the study, ranging in age from 15 to 45 years. The age distribution is presented in **Table 1**. The largest proportion of participants fell within the 26–30 year age group (27.5%), followed by the 31–35 year group (22.5%). Together, these two categories accounted for nearly half of the study population, highlighting the predominance of hair loss in young adults and early middle age. The lowest representation was observed in the 15–20 year group (2.5%), suggesting that although Khalitya can occur in adolescence, it is relatively uncommon at that stage.

Table 1: Age distribution of participants.

Age group	Percentage (%)
15–20	2.5
21–25	10
26–30	27.5
31–35	22.5
36–40	17.5
41–45	20

The demographic analysis indicates that Khalitya is not restricted to older age groups but is increasingly prevalent among individuals in their twenties and thirties. This finding supports the hypothesis that lifestyle and dietary factors, rather than aging alone, are major contributors to hair loss in contemporary populations.

Classification of Hetus

The study identified a wide range of classical Ayurvedic hetus contributing to Khalitya. These were categorized

into three grades based on frequency: Grade I (rare), Grade II (frequent), and Grade III (most frequent). The distribution is shown in **Table 2**.

Table 2: Classification of hetus.

Grade	Hetus
Grade I (Rare)	Shoka, Shrama, Heredity, Smoking
Grade II (Frequent)	Krodha, Unclean scalp, Excessive heating of hair
Grade III (Most frequent)	Viruddha Ahara, Lavana Rasa Atisevana, Kshara Atisevana

Narrative interpretation.

- **Grade III hetus** were the most prominent, with *Viruddha Ahara* reported in 85% of participants, *Lavana Rasa Atisevana* in 75%, and *Kshara Atisevana* in 62.5%. These findings underscore the central role of dietary incompatibilities and excessive salt/alkaline intake in the pathogenesis of Khalitya.
- **Grade II hetus** such as *Krodha* (anger), poor scalp hygiene, and excessive heating of hair were moderately frequent, reflecting lifestyle and psychosocial contributors.
- **Grade I hetus** including *Shoka* (grief), *Shrama* (exertion), heredity, and smoking were relatively rare in this cohort, though they remain important in individual cases.

  This classification highlights the predominance of modifiable dietary and lifestyle factors, aligning with both Ayurvedic theory and modern biomedical understanding.

Biochemical Parameters

Serum calcium and phosphorus levels were measured for all participants. The results are summarized in **Table 3**.

Table 3: Biochemical parameters of participants.

Parameter	Below normal (%)	Normal (%)	Mean ± SE
Serum calcium	55	45	9.06 ± 0.21 mg/dL
Serum phosphorus	0	100	3.59 ± 0.09 mg/dL

Narrative interpretation

- **Serum calcium:** More than half of the participants (55%) exhibited calcium levels below the normal reference range. This deficiency is clinically significant, as calcium plays a vital role in follicular signaling and keratinocyte adhesion. The mean calcium level was 9.06 ± 0.21 mg/dL, which is at the lower end of the normal range, further supporting the observation of widespread insufficiency.
- **Serum phosphorus:** All participants had phosphorus levels within the normal range, with a mean of 3.59 ± 0.09 mg/dL. This suggests that phosphorus metabolism remains intact in Khalitya, and that calcium deficiency is the more critical biochemical factor.

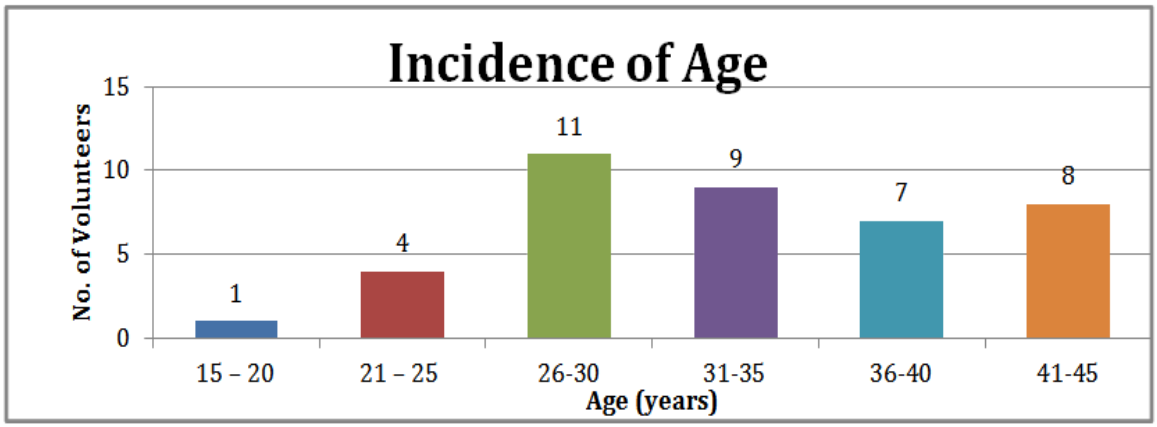
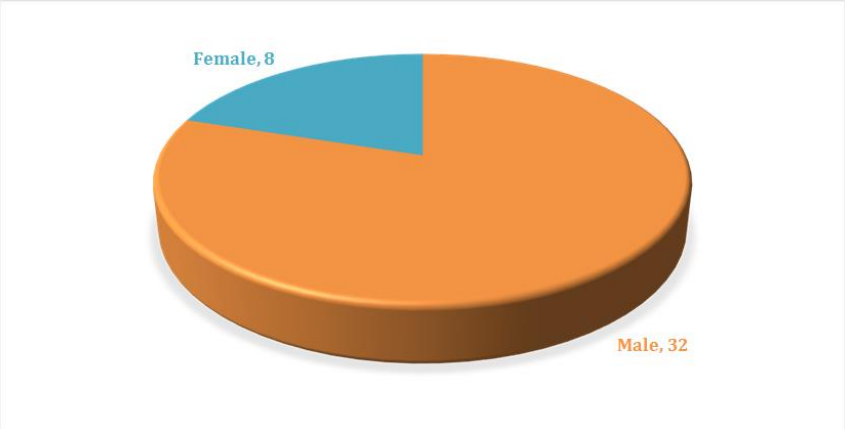


Figure 1: Age and Gender Distribution Graph age of the volunteers and its frequency.

Gender of the volunteers and its frequency



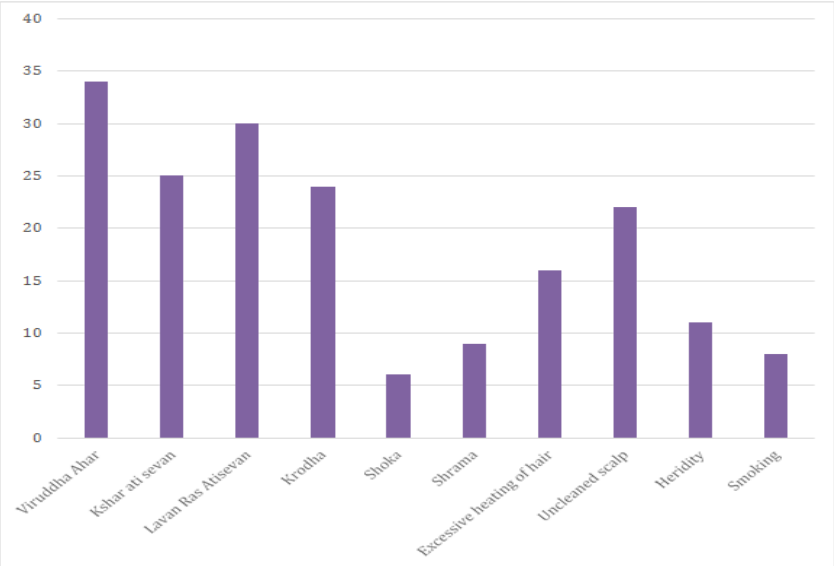


Figure 2: Hetus Frequency Chart – Hetu wise distribution of volunteers.

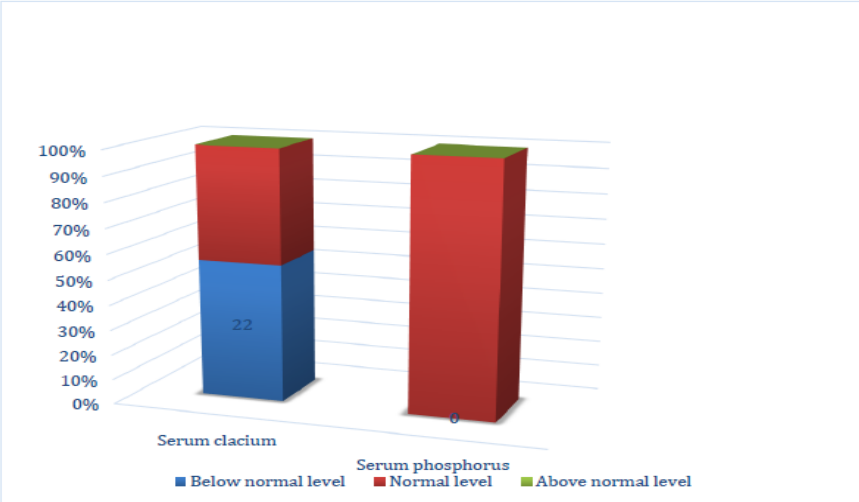


Figure 3: Serum Calcium and Phosphorus Levels – Distribution of volunteers according to laboratory parameters.

SUMMARY OF RESULTS

The results demonstrate that Khalitya is most prevalent among young adults aged 26–35 years, with dietary hetus such as Viruddha Ahara, Lavana Rasa Atisevana, and Kshara Atisevana being the most frequent contributors. Biochemical analysis revealed a high prevalence of

calcium deficiency, while phosphorus levels remained stable. These findings support the Ayurvedic concept of *Asthi Dhatu kshaya* and highlight the importance of dietary regulation and nutritional monitoring in the prevention and management of hair loss.

DISCUSSION

Integrating Classical Hetus with Modern Biomedical Risk Factors

The findings of this study reveal striking parallels between Ayurvedic etiological factors (*hetus*) and modern biomedical risk determinants of hair loss. Ayurveda emphasizes the role of *Viruddha Ahara* (incompatible food combinations), *Lavana Rasa Atisevana* (excessive salt intake), and *Kshara Atisevana* (excessive alkaline food consumption) as primary contributors to Khalitya. These dietary hetus were the most frequently reported in our cohort, with prevalence rates of 85%, 75%, and 62.5% respectively. Modern nutrition science corroborates these observations, demonstrating that poor dietary practices, high sodium intake, and consumption of processed foods contribute to systemic inflammation, oxidative stress, and micronutrient deficiencies. Such disturbances impair follicular health and accelerate hair loss.

The psychosocial hetus identified in Ayurveda—*Krodha* (anger), *Shoka* (grief), and *Shrama* (exertion)—also align with biomedical evidence. Chronic stress elevates cortisol levels, disrupts endocrine rhythms, and induces telogen effluvium, a condition characterized by diffuse hair shedding. Anger and grief, though less frequently reported in this study, remain clinically relevant as they contribute to psychological distress and hormonal imbalance. Thus, the Ayurvedic recognition of manasika hetus (mental factors) finds resonance in modern psychoneuroendocrinology.

Calcium Deficiency and Asthi Dhatu Kshaya

One of the most significant findings of this study was the high prevalence of calcium deficiency, observed in 55% of participants. Ayurveda associates hair health with *Asthi Dhatu*, and depletion of this dhatu (*Asthi Dhatu kshaya*) manifests as hair fragility and loss. Modern science provides a mechanistic explanation: calcium is essential for keratinocyte adhesion, follicular signaling, and structural integrity of hair shafts.

Deficiency impairs follicular anchorage, leading to diffuse shedding. The observed calcium insufficiency thus validates the Ayurvedic concept of Asthi Dhatu involvement in Khalitya.

Interestingly, serum phosphorus levels remained normal in all participants. This selective deficiency suggests that calcium metabolism, rather than phosphorus, plays a more critical role in hair physiology. It also highlights the need to investigate related factors such as vitamin D status, which regulates calcium absorption and utilization. Future studies should therefore expand biochemical profiling to include vitamin D, ferritin, zinc, and thyroid hormones.

Occupational and Environmental Contributors

The demographic analysis revealed that a substantial proportion of participants were workers, drivers, and farmers—occupations associated with exposure to heat, dust, and pollutants. Ayurveda recognizes excessive heat and poor scalp hygiene as hetus, while modern science identifies environmental pollutants and ultraviolet radiation as sources of oxidative stress. Occupational exposures thus represent a convergence point between classical and biomedical perspectives, underscoring the importance of preventive counseling tailored to specific work environments.

Preventive Strategies: Nidana Parivarjana and Modern Nutrition

Ayurveda emphasizes *nidana parivarjana*—the avoidance of causative factors—as the cornerstone of disease prevention. In the context of Khalitya, this entails strict avoidance of incompatible food combinations, moderation of salt and alkaline intake, and regulation of psychosocial stress. Modern nutrition echoes these recommendations, advocating balanced diets rich in protein, vitamins, and minerals. Calcium supplementation, vitamin D optimization, and adequate hydration are particularly important.

Lifestyle modifications also play a crucial role. Scalp hygiene should be maintained through gentle cleansing and avoidance of harsh chemical products. Excessive heating of hair through blow-drying or hot water should be minimized. Stress management techniques such as yoga, pranayama, and mindfulness can mitigate psychosocial hetus and restore endocrine balance. Together, these strategies embody an integrative approach that combines classical wisdom with modern evidence.

Limitations of the Study

While the findings are compelling, several limitations must be acknowledged. The sample size was modest (n = 40), limiting generalizability. The biochemical analysis was restricted to calcium and phosphorus, excluding other important parameters such as vitamin D, ferritin, and zinc. The cross-sectional design precludes causal inference, and reliance on self-reported questionnaires introduces potential recall bias. Despite these limitations, the study provides valuable preliminary evidence supporting the integration of Ayurvedic and biomedical perspectives in understanding Khalitya.

Future Directions

Future research should adopt larger, multicentric cohorts to validate these findings. Expanded biochemical panels including vitamin D, ferritin, zinc, and thyroid hormones will provide a more comprehensive understanding of nutrient involvement. Longitudinal studies can assess causality and track the impact of preventive interventions

over time. Randomized controlled trials comparing Ayurvedic interventions (nidana parivarjana, herbal formulations) with modern nutritional supplementation would further strengthen the evidence base. Additionally, exploration of scalp microbiome dynamics and oxidative stress markers could offer novel insights into the pathogenesis of hair loss.

CONCLUSION

Khalitya, or hair loss, emerges as a multifactorial disorder that is deeply rooted in both classical Ayurvedic theory and modern biomedical science. The present study demonstrates that dietary incompatibilities (*Viruddha Ahara*), excessive intake of salt (*Lavana Rasa Atisevana*), and alkaline substances (*Kshara Atisevana*) are the most frequent etiological factors contributing to the condition. These findings resonate strongly with contemporary biomedical evidence, which highlights poor nutrition, high sodium consumption, and systemic inflammation as key drivers of follicular dysfunction. The convergence of these perspectives underscores the enduring relevance of Ayurvedic constructs in modern clinical contexts.

Biochemical analysis revealed that calcium deficiency was present in more than half of the participants, while phosphorus levels remained within normal limits. This selective deficiency validates the Ayurvedic concept of *Asthi Dhatu kshaya*, wherein depletion of bone tissue manifests externally as hair fragility and loss. Modern physiology explains this through the role of calcium in keratinocyte adhesion, follicular signaling, and structural integrity. The absence of phosphorus deficiency suggests that calcium metabolism, rather than phosphorus, is the critical biochemical factor in Khalitya.

The integrative model developed in this study emphasizes prevention as the cornerstone of management. *Nidana parivarjana*—the avoidance of causative factors—remains central in Ayurveda and finds direct parallels in modern preventive medicine. Dietary regulation, stress management, and scalp hygiene are essential strategies that can be implemented at both individual and community levels. Nutritional counseling, calcium supplementation, and vitamin D optimization complement classical recommendations, creating a holistic framework for prevention and treatment.

The psychosocial dimensions of Khalitya must also be acknowledged. Hair loss has profound effects on self-esteem, social confidence, and psychological well-being.

Ayurveda recognizes *Krodha* (anger), *Shoka* (grief), and *Shrama* (exertion) as contributing hetus, while modern science links these factors to cortisol surges and endocrine disruption. Addressing these dimensions through stress management techniques such as yoga, pranayama, and mindfulness is therefore integral to comprehensive care.

In conclusion, Khalitya is not merely a cosmetic concern but a systemic disorder that reflects deeper imbalances in diet, lifestyle, and metabolism. By bridging Ayurvedic wisdom with modern biomedical evidence, this study provides a robust framework for understanding and managing hair loss. The findings highlight the importance of dietary regulation, calcium monitoring, and stress management, while also pointing to the need for expanded biochemical profiling and larger cohort studies. Ultimately, an integrative approach that respects both classical constructs and modern diagnostics offers the most promising pathway for effective prevention and holistic management of Khalitya.

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