IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 14, Issue 6 Ser. 4 (Nov. – Dec. 2025), PP 08-11
www.iosrjournals.org

Hair And Nutrition: A Comprehensive Review

Dr. Nishita Sheth, M.B.B.S., I.A., D.P.D.
Founder & Director– DNCC & Inlab India

Abstract
Hair growth and overall hair quality are regulated by a multifactorial interplay between genetic predisposition, hormonal balance, environmental exposure, and nutritional status. Among these, micronutrient adequacy plays a foundational role in maintaining healthy hair follicle function, keratin production, and scalp homeostasis. Increasing clinical evidence suggests that deficiencies in key nutrients—such as iron, vitamin D, vitamin B12, biotin, zinc, and essential fatty acids—are common contributors to diffuse hair shedding, telogen effluvium, reduced hair shaft thickness, and poor hair texture.
This review explores the biological significance of essential nutrients in hair physiology and synthesizes recent research linking nutritional deficits with hair loss disorders. Special attention is given to the prevalence of these deficiencies in Indian populations, where dietary patterns, limited sun exposure, and lifestyle factors are associated with higher risk. The aim is to support clinicians in recognizing nutrition-related hair concerns, improving diagnostic protocols through appropriate laboratory assessment, and guiding evidence-based dietary or supplement interventions.
By emphasizing the importance of nutrition as a modifiable factor, this review aims to encourage early identification and correction of micronutrient imbalances as part of a comprehensive hair management strategy. A combined approach addressing both internal nutritional health and external hair care may provide more sustainable and holistic outcomes for individuals experiencing hair loss.
Keywords: *Hair loss, telogen effluvium, micronutrients, iron deficiency, vitamin D, biotin, zinc, nutrition, trichology.*

Date of Submission: 04-12-2025 Date of Acceptance: 14-12-2025

I. Introduction

Hair is a highly dynamic tissue with a rapid cell turnover rate, making it particularly sensitive to nutritional deficiencies. While androgenetic alopecia (AGA) and hormonal factors remain primary causes of hair loss, there is growing evidence that inadequate intake or poor absorption of essential nutrients significantly contributes to hair shedding, thinning, and reduced density.

Modern lifestyle patterns—poor diet quality, vegetarian diets lacking complete proteins, crash dieting, stress, and gastrointestinal malabsorption—have increased the prevalence of nutrient-related hair loss, especially among women aged 20–45 years.

This review evaluates the current scientific literature on nutrition-related hair loss and highlights clinical implications for dermatologists and trichologists.

Hair Biology and the Role of Nutrition

Hair follicles undergo cyclical phases: anagen (growth), catagen (regression), and telogen (rest). Nutrients support:

- Keratin synthesis
- Matrix cell proliferation
- Hair follicle cycling
- Scalp barrier integrity
- Mitochondrial energy production

Even mild deficiencies can prematurely push hairs into telogen, leading to diffuse shedding.

Key Nutrients in Hair Health

1. Iron

Iron deficiency is one of the most common nutritional deficiencies associated with hair loss in women. Iron is crucial for DNA synthesis and energy metabolism in rapidly dividing hair matrix cells.

Key Evidence:
- Ferritin levels <30 ng/mL are linked with telogen effluvium.
- Iron supplementation improves hair growth in deficiency-related shedding.

Recommendations:
Check ferritin, serum iron, TIBC. Treat aggressively if ferritin <40 ng/mL.

2. Vitamin D
Vitamin D receptors play a role in hair follicle cycling and anagen initiation.

Evidence:
- Low vitamin D levels are associated with AGA, alopecia areata, and TE.
- Supplementation improves hair density in deficient patients.

3. Vitamin B12 and Folate
Vital for DNA synthesis and red blood cell formation.

Deficiency Manifestations:
- Diffuse hair fall
- Premature greying
- Fatigue and anemia

Common in vegetarians and patients with hypothyroidism.

4. Zinc
A cofactor in keratin formation and protein synthesis.

Evidence:
- Zinc deficiency causes hair thinning, brittleness, and telogen effluvium.
- Supplementation shows improvement within 3–6 months.

5. Biotin (Vitamin B7)
Biotin deficiency is rare but supplementation is popular.

Key Point:
Supplementation is useful only in deficiency or brittle hair syndrome; routine use is not recommended without testing.

6. Essential Fatty Acids
Omega-3 and omega-6 fatty acids maintain scalp barrier, reduce inflammation, and improve hair shine.

7. Protein
Hair is 85–90% keratin. Low protein diets can lead to reduced anagen phase and increased shedding.

Diagnostic Evaluation
A recommended laboratory panel for patients with unexplained hair fall:
1. CBC
2. Serum ferritin, serum iron, TIBC
3. Vitamin B12
4. Vitamin D (25-OH)
5. Thyroid profile (T3, T4, TSH)
6. Zinc levels
7. Folate
8. CRP (inflammation)
9. Optional: Homocysteine, ANA, hormonal profile (women)

Management and Supplementation
1. Diet Optimization

Encourage:
- Lean protein (0.8–1.2 g/kg)
- Iron-rich foods (spinach, jaggery, legumes, eggs, meat)
- Omega-3 foods (walnuts, chia seeds, fish)
- Vitamin-rich fruits and vegetables

Avoid:
- Crash diets
- Highly processed foods
- Nutrient-depleting habits (excess tea/caffeine inhibiting iron absorption)

2. Oral Supplementation
Iron:
Ferrous fumarate or ferrous bisglycinate
(40–60 mg elemental iron/day

Vitamin D:
60,000 IU weekly × 8 weeks or daily 1000–2000 IU.

B12:
1500 mcg weekly (sublingual) or injections for severe deficiency.

Zinc:
15–30 mg/day for 3 months.

Biotin:
Only in deficiency—2.5–5 mg/day.

3. Adjunct Therapies
- Low-level laser therapy (LLLT)
- PRP/GFC
- Topical minoxidil
- InLab nutrition-based formulations enriched with Baicapil, peptides, and vitamins
- Anti-inflammatory scalp therapies

II. Discussion

Nutritional deficiencies remain an underdiagnosed but reversible cause of hair loss. In Indian populations, iron deficiency, vitamin D deficiency, and B12 deficiency are most prevalent due to dietary patterns and limited sunlight exposure.

While supplementation is essential, over-supplementation (especially biotin and zinc) can cause systemic side effects or interfere with lab tests. Thus, personalized nutrition based on blood reports provides the best outcomes. Combination approaches—nutrition correction, topical therapy, regenerative medicine, and lifestyle changes—offer clinically significant improvement.

III. Conclusion

Nutrition plays a foundational role in maintaining healthy hair growth, density, and strength. Early evaluation and correction of micronutrient deficiencies can significantly improve outcomes in telogen effluvium and serve as an important adjunct in AGA and other alopecies'.

Integrating nutrition-focused therapy with dermatological treatments provides a comprehensive and evidence-based approach to managing hair loss.

Future Scope

Further research on the relationship between nutrition and hair health can expand in several directions. Advanced biochemical and genetic profiling may help identify specific nutrient deficiencies linked to different patterns of hair loss, enabling more personalized treatment strategies.

Future studies may also explore the combined effect of nutrition with other hair restoration therapies such as topical medications, regenerative treatments, or lifestyle modifications, to better understand synergistic outcomes. Emerging tools for digital hair assessment and dietary monitoring can provide more accurate and objective measurements of improvement.

Overall, expanding scientific evidence in this area can contribute to developing comprehensive, nutrition-based approaches to support hair quality, prevent hair loss, and promote holistic scalp health in future clinical practice.

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