Review Article

Exploring the Link Between Selenium from Wheat and Hair Loss

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ABSTRACT

Hair loss is a wide issue with a multifaceted origin, including inheritable, hormonal, nutritive, and environmental factors. Selenium, a vital trace element set up in wheat, has surfaced as a crucial nutrient impacting hair health. This review investigates selenium's biochemical part, its presence in wheat, and how both insufficiency and excess may impact hair follicle health. Studies from mortal and beast models are bandied to punctuate selenium's remedial and toxicological applicability in dermatology. Hair loss is a prevalent dermatological concern that affects individuals across all age groups and genders, often leading to psychological distress and reduced quality of life. Its etiology is multifactorial, involving genetic predisposition, hormonal fluctuations, systemic illnesses, environmental factors, and nutritional imbalances. Among the essential micronutrients, selenium has emerged as a critical trace element due to its multifaceted biological functions. Selenium exerts significant influence on hair follicle biology through its incorporation into selenoproteins, which regulate oxidative stress, immune responses, and endocrine functions—factors integral to hair follicle homeostasis. Wheat, being a primary dietary source of selenium in many regions, especially in agrarian populations, contributes substantially to daily selenium intake. This review aims to systematically evaluate the connection between selenium derived from wheat and its potential impact on hair health. Emphasis is placed on selenium's biochemical mechanisms, its bioavailability from wheat, the effects of both deficiency and excess, and current evidence from animal models, clinical trials, and population-based studies. Furthermore, the review explores the regional variability of selenium in wheat crops, particularly in India, and the implications for public health strategies such as biofortification. By synthesizing current knowledge, this paper seeks to inform future research directions and support nutritional interventions targeting selenium status as a modifiable factor in the management and prevention of hair loss.

Keywords: Hair loss, treatment, hair health, Selenium.

INTRODUCTION

Hair loss affects millions of people encyclopedically, significantly impacting quality of life and cerebral well- being. While heritable and hormonal causes are well- honored, micronutrient scarcities have decreasingly been associated with hair diseases. Selenium is a pivotal micronutrient needed for the function of several enzymes and proteins involved in redox responses and vulnerable function. Wheat, a primary salutary chief for numerous, offers a natural source of selenium, particularly when cultivated in selenium-rich soils.

In recent times, there has been growing scientific interest in the part of micronutrients in maintaining hair follicle health and cycling. Among these, selenium — a trace element essential for mortal health has surfaced as a critical element due to its multifaceted natural places. Selenium is integral to the conflation and exertion of selenoproteins, which serve as antioxidants (e.g., glutathione peroxidases), controllers of redox balance, and modulators of vulnerable responses. Deficiency or excess of selenium can disrupt cellular homeostasis, vitiate keratinocyte function, and induce structural changes in hair follicles, potentially leading to verbose or patchy hair loss.

Wheat, a staple food in numerous corridors of the world, particularly in South Asia and Europe, is one of the major salutary sources of selenium. still, the selenium content in wheat varies significantly depending on soil selenium situations, agrarian practices, and processing styles. The bioavailability of selenium from wheat also depends on its chemical form, similar as selenomethionine, which is known for advanced immersion and objectification into body proteins.

This review aims to critically examine the interaction between selenium input — especially from wheat — and hair health. By exploring the biochemical mechanisms of selenium action, assessing the bioavailability of wheat-deduced selenium, and assaying clinical, epidemiological, and interventional studies, we seek to give a substantiation-grounded perspective on its implicit part in the forestallment and operation of hair loss. This integrative approach could pave the way for new nutritive strategies in dermatological and trichological care.

Hair Biology and Growth Cycle[6,7,8]

Human hair follows a cyclical pattern of growth anagen (growth), catagen (transition), telogen (resting), and exogen (slipping). A proper force of micronutrients ensures the effectiveness and duration of these phases.

Selenium influences cellular development and keratin product in hair follicles. Selenoproteins like glutathione peroxidase (GPx) help reduce oxidative stress, guarding growing follicles from unseasonable apoptosis.

Selenium Biochemistry and Functions[10,12,15]

Selenium is essential for mortal health and is incorporated into selenoproteins similar as GPx, thioredoxin reductase, and iodothyronine deiodinases. These proteins play places in antioxidant defense, thyroid hormone metabolism, and vulnerable modulation. Selenium's natural goods depend on its chemical form and cure; organic forms like selenomethionine, set up in wheat, are largely bioavailable and less poisonous.

1.Glutathione Peroxidases (GPx)

- cover cells from oxidative damage by reducing hydrogen peroxide and lipid hydroperoxides.

- Act as a major antioxidant enzyme family in the body.

2. Thioredoxin Reductases

- Maintain redox balance inside cells.
- Involved in DNA conflation and form, and cellular signaling.

3. Iodothyronine Deiodinases (DIOs)

- Regulate thyroid hormone metabolism by converting thyroxine(T4) into the more active triiodothyronine (T3).
-Essential for growth, metabolism, and development.

4. Selenoprotein P

- Acts as a selenium transport protein in the tube.
- Also has antioxidant parcels, especially in the brain and testis 15.

5. Selenoprotein W, M, and K

- Involved in muscle function, brain exertion, and vulnerable responses.

Selenium in Wheat attention and Bioavailability[8,9]

Wheat shops absorb selenium from the soil, and its attention depends heavily on the soil selenium situations, climate, and husbandry ways. Biofortification styles, similar as selenium fertilization, have proven effective in adding selenium content.

Milling and baking processes reduce selenium attention, but wheat remains a crucial salutary contributor, particularly in regions where it's a staple food.

Part of Selenium in Hair Health[11,13]

Selenium supports hair health through antioxidant action, reducing the oxidative damage that contributes to hair follicle retrogression. Also, it's involved in thyroid hormone activation, and thyroid dysfunction is a known contributor to hair loss. Selenium also modulates vulnerable responses that may impact autoimmune-affiliated hair conditions like alopecia areata. Selenium plays a vital role in maintaining healthy hair through several interconnected biological mechanisms. As a key component of selenoproteins like glutathione peroxidases and thioredoxin reductases, it provides antioxidant protection to hair follicle cells, reducing oxidative stress that can cause follicular damage and hair loss. Selenium also supports proper thyroid hormone metabolism, essential for regulating hair growth cycles. It promotes cell proliferation and apoptosis balance within hair follicles and contributes to DNA synthesis and repair. Additionally, selenium modulates immune responses and reduces inflammation, which may help prevent autoimmune-related hair loss. It works synergistically with nutrients like zinc and vitamins A, C, and E. However, both selenium deficiency and excess can impair hair follicle health, highlighting the importance of optimal levels.

Substantiation from Animal Studies[17,18]

Beast studies show that selenium insufficiency leads to meager fur, delayed hair growth, and structural hair anomalies. Mice with selenium- confined diets parade increased oxidative damage and poor dermal papilla function.

Again, selenium supplementation improves fleece texture and viscosity. still, high-cure selenium is poisonous and induces alopecia, demonstrating the need for balance.

Clinical and Epidemiological Studies[14,15]

Studies in selenium-deficient regions report increased frequence of hair loss. A check in pastoral China indicated a correlation between low serum selenium and verbose alopecia.

Clinical case reports show hair regrowth in cases with alopecia areata following selenium and zinc supplementation. still, inordinate selenium input from supplements has also led to hair slipping, pressing a U-shaped cure- response relationship.

Indian Context Selenium Status and Hair Loss[21,25]

In early 2025, a significant outbreak of unexplained hair loss was reported in the Buldhana quarter of Maharashtra. Following expansive disquisition, elevated selenium situations were detected in wheat flour distributed through original public distribution systems. Affected individualities displayed symptoms of selenosis, similar as hair thinning, brittle nails, and fatigue. This stressed the need for routine monitoring of micronutrient content in staple foods.

The wheat was sourced from areas with naturally selenium-rich soils, and indecorous milling ways failed to reduce the selenium attention. This real- world event emphasizes the narrow remedial window of selenium and the pitfalls of indigenous soil variability in India.

India has different selenium situations in soil, with northern and eastern regions showing insufficiency. Studies show that wheat grown in selenium-poor soil leads to lower salutary input among populations counting on wheat-grounded diets. Dermatologists in countries like Bihar and Uttar Pradesh have reported increasednon-scarring alopecia in populations with low selenium status. Interventions with fortified wheat are under consideration.

Selenium toxin and Hair Loss[13,18]

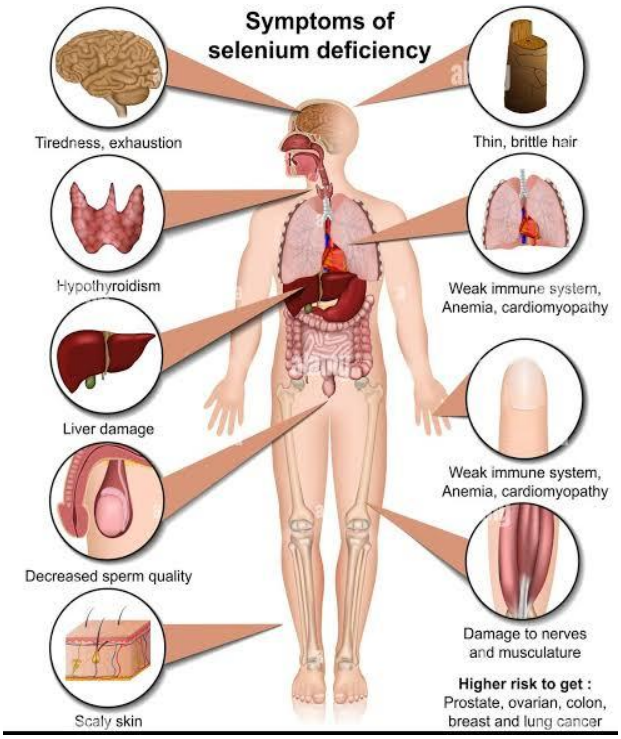
While selenium is salutary at physiological situations, habitual input above 400 µg/ day can beget selenosis, marked by hair loss, nail fineness, skin rash, and fatigue. Overconsumption via supplements or drinking water impurity has led to proved cases of acute selenium poisoning. thus, selenium supplementation must be approached cautiously.

Stage	Description
Sources	Industrial runoff and natural selenium deposits
Contamination	Contamination of water and soil
Uptake	Uptake by wheat
Consumption	Consumption of contaminated wheat

Fortified Wheat A Nutritive Strategy[21,23]
Agronomic biofortification — perfecting wheat crops with selenium — is an effective system to enhance selenium input safely. Trials in China, India, and Finland show bettered tube selenium and affiliated health benefits. A 2021 trial in Madhya Pradesh observed dropped hair fall complaints after six months of consuming selenium-amended wheat flour.

Case Study[22,24]

A 34- time-old womanish presented with verbose hair slipping for over a time. Blood tests revealed low serum selenium and frame hypothyroidism. Her diet comported largely of unfortified wheat products from a selenium-deficient region. After a 3- month authority of selenium supplementation and preface of selenium- amended wheat, her hair viscosity bettered, and serum selenium regularized. This case illustrates the direct link between salutary selenium and hair health.



DISCUSSION[7]

The case of Buldhana acts as a real- world evidence of the delicate balance needed in selenium consumption. Public health programs must incorporate geospatial nutrient mapping to guide husbandry and bastion programs. In addition, educating growers, millers, and consumers about the signs of selenosis and safe supplementation practices is pivotal to avoid similar incidents. Further, interdisciplinary collaboration between agriculturists, dermatologists, and toxicologists can insure that unborn nutritive interventions are both effective and safe.

Hair health is told by multiple interdependent factors, including selenium status. Its natural places in redox balance, hormone metabolism, and vulnerable modulation position selenium as a critical factor in precluding hair loss.

still, the narrow periphery between insufficiency and toxin clearances careful salutary planning. individualized approaches considering original soil content, inheritable predilection, and salutary habits are essential.

CONCLUSION

Selenium from wheat contributes significantly to overall selenium input and, by extension, hair health. Public health strategies like biofortification can help address scarcities at a population position. nonetheless, mindfulness of implicit toxin and the need for balance must guide salutary recommendations and supplement use.

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