

# The Influence of Diet, Lifestyle, and Environmental Factors on Premature Hair Greying: An Evidence-Based Approach

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## Abstract

Premature hair greying, characterized by the loss of melanin pigment in hair follicles before the age of 35, is a complex phenomenon influenced by a multitude of factors. This review comprehensively examines the impact of dietary, lifestyle, and environmental factors on premature hair greying. Dietary factors play a crucial role. Adequate intake of protein-rich foods, particularly those containing tyrosine and cysteine, is essential for melanin synthesis. A balanced diet rich in fruits, vegetables, and whole grains provides essential vitamins and minerals, including vitamin B12, vitamin D, vitamin C, copper, zinc, and iron, which support antioxidant defense systems and melanin production. Lifestyle factors significantly contribute to premature greying. Smoking and excessive alcohol consumption increase oxidative stress and damage hair follicles. Chronic stress disrupts hormonal balance and elevates oxidative stress, accelerating hair greying. Insufficient sleep further exacerbates oxidative stress and weakens the immune system. Environmental factors also exert a considerable influence. Exposure to ultraviolet radiation from sunlight can damage melanocytes and accelerate hair greying. Air and water pollution, containing heavy metals and particulate matter, can induce oxidative stress and contribute to premature hair greying. Chemical exposure from hair dyes and other hair treatments can damage hair follicles and trigger allergic reactions. The underlying mechanisms of hair greying involve oxidative stress, inflammation, and hormonal imbalances. Reactive oxygen species (ROS) generated by various internal and external factors damage melanocytes and deplete melanin production. Chronic inflammation disrupts hair follicle function and accelerates greying. Hormonal imbalances, particularly those involving thyroid hormones and androgens, can significantly influence melanin production. Future research should focus on large-scale clinical trials to investigate the efficacy of dietary interventions and lifestyle modifications in preventing or delaying premature hair greying. Mechanistic studies are crucial to elucidate the underlying molecular mechanisms of hair greying and identify potential biomarkers for early detection. Personalized approaches, considering individual genetic and lifestyle factors, are essential for developing effective interventions. In conclusion, this review highlights the significant impact of diet, lifestyle, and environmental factors on premature hair greying. By adopting a healthy lifestyle, including a balanced diet, regular exercise, stress management techniques, and adequate sleep, individual may be able to mitigate the risk of premature hair greying and maintain healthy hair pigmentation.

**Keywords:** premature hair greying; melanin, oxidative stress; inflammation, diet; lifestyle; environment, smoking; alcohol; stress; sleep; sun exposure; pollution; hair dyes; antioxidants; vitamins; minerals; hormones

## 1. Introduction

Hair whitening or premature greying occurs when hair cell unable to produce pigments melanocytes cells are synthesis melanin or pheomelanin [1]. Biosynthesis of melanin or pheomelanin decreases as the ageing process but premature greying of hair is not a natural process it may sign of inadequate nutrition, inborn errors, lifestyle, environmental. Premature greying of hair, also recognized as canities, can have adverse effects on appearance, confidence, self-esteem, and social acceptance of the affected individual [2,3].

### Causes for Premature Greying of Hair

Premature greying of hair is not having only one reason it may cause so many different possibilities. Scientific research reveals some main causes of premature greying hair turning grey at an unexpected age. This is one of the main causes of premature greying. The AR gene is located on the X chromosome, which means that, for males, it was inherited from their mother. Genetics factor effect person baldness and hair whitening [2,3]. Premature canities may happen alone as an autosomal dominant condition or in association with various autoimmune or premature ageing syndromes. Down syndrome (trisomy 21) ageing process is so fast then normal human, including hairs greying of hair and loss of melanocytes function. Premature greying needs to be distinguished from several genetic hypomelanotic hair disorders [4].

The nutrients are basic constituents of collagen, enzyme, a hormone that is responsible for healthy and colorful hair according to RDA, all nutrients should be taken adequate amounts for healthy hair foods enriched with Vitamin C, B12, E, Zinc and copper, Vitamin C & B12 and E long term deficiency these nutrients make the hair turn grey [5-12].

Smoking through the body detoxifies with nicotine and other toxic substances that affected hair follicle, deficiency of oxygen, secretion of androgen. Hair follicles necessitate oxygen, nutrients and minerals to produce healthy hair many research studies proved that Smoking is a major risk factor that is recognized to be related to premature greying of hair. Smoking outcomes in the generation of a tremendous amount of reactive oxygen species starting to increased oxidative stress culminating into injury to melanin producing cells, melanocytes. Continued exposure to ultraviolet rays is considered to inaugurate similar processes in hair follicles resulting in premature greying of hair [4-7].

### Lifestyle:

A balanced lifestyle is not only fit for a professional career but also well for physical and mental. Lifestyle effects on the biochemical activity like hormonal balance and metabolism that directly associated with health. Biochemical activity concerns the circadian rhythm, a cycle lasting approximately 24 hours. It coordinates sleep patterns, immune responses, hormone production, and tissue repair, and is frequently kept fine-tuned by doses of daylight [7,12-16].

A disorganized circadian rhythm can commence to sleep deprivation and has been linked to an increased risk of developing certain diseases, including mental disorder, confusion, hormonal imbalance, cancer, type 2 diabetes and cardiovascular disease. Biologists correlated that the rhythms are managed by a set of genes whose activity can be monitored via their production of messenger RNA molecules. It is necessary to have an active lifestyle which suggests an exercise session of 30 minutes every day and diet, sleep, rest need to take proper time [5,7,17-25].

Nutrients provide all basic components that need in biochemical metabolism, biosynthesis of hormone, enzyme, collagen formation any person is probably

not on a healthy diet, the chances of premature greying are high. Junk food or processed food expedites premature ageing as oxidative stress boosts. This again appears in loss of hair color so try to include green leafy vegetable, dark colored fruits and dry fruits [8-10,26,27].

### Bad food habits

#### Overconsumption of Sugar

**A.** Sugar Glucose is the main source of energy that use in the metabolism. dietary sources main are fruits, vegetable, milk and dairy products, etc in the form of simple or complex carbohydrate. when human take direct sugar in the form of cane sugar, jam, jelly, sweets. long term taking too much sugar added foods are associated with many adverse health effects. An overabundance of sweetened foods and beverages can lead to blood sugar problems and an amplified risk of heart disease, weight gain, among other dangerous conditions. Sugar-rich foods have the potential to invent hair turn grey prematurely because of their ageing effects. For healthy hair growth, Vitamin E is considered essential and sugar inhibits the absorption of this vitamin [8,9,28].

**B.** Salt in Asian diet table salt are overused then RDA 2300 mg per day that is the cause of initiation of chronic disease like hypertension, renal disease, etc long term it disturbs cell transport system, hormonal balance, impact on the hair follicle and melanocytes that adverse impact on hair colour and health.

**C.** Aerated drinks are one of the main problems of premature hair greying. Aerated drinks have soda which is filled with high amounts of sugar, artificial sweeteners and colour which adversely effect on hair follicle health.

**D.** According to the US FDA has approved the usage of MSG in foods, within prescribed limits, it is assumed to impact the biochemical metabolism which conclusively results in greying of hair [30].

### Chemical hair dyes and hair products

Chemical hair dyes and hair products, even shampoos, have an adverse effect to premature hair greying. Many of these products contain harmful ingredients that decrease melanin. Hydrogen peroxide, which is in common hair dyes, is one such dangerous chemical. Excessive use of products that beach hair will also eventually cause it to turn white [10,26].

### Prevention and reversing premature white hair

If genetics or ageing is the cause, nothing can prevent or reverse the process. However, treating greying hair could allow colour pigmentation to return if the loss is due to a medical condition. When diet and vitamin deficiencies are the cause of prematurely white hair, correcting these may reverse the problem or stop it from worsening [7-9,30].

#### A. Eating more antioxidants

Eating a diet with quantities of antioxidant-rich foods, including vegetables and fruits, may help to prevent hair from graying. A person's diet sounds a part in preventing white hair. A diet rich in antioxidants can reduce oxidative stress. A antioxidant rich foods include, herbs, fresh fruits and vegetables like Indian gooseberry also named amla, this is a herbal supplement recognized for reversing premature greying by promoting pigmentation. Brahmi is commonly used for cognitive improvements and better memory but scientific research revealed that it is also useful in strengthens hair roots, controls dandruff, makes hair thicker, prevents hair loss, premature greying. One of the numerous beneficial herbs for greying hair if your hair turning colour due to stress. This brain and nervine tonic are used in Ayurveda as a

tranquillizer. Massage your hair and scalp with Brahmi oil to keep Pitta at bay or use the powder in a cooling hair mask. Its effectiveness is considered to be because the gooseberry is rich in antioxidants and anti-ageing characteristics [7-11].

Black tea Polyphenols are a variety of antioxidant found in several foods and beverages, including black tea. Groups of polyphenols, including catechins, theaflavins and thearubigins, are the chief sources of antioxidants in black tea and may improve overall health. Saw palmetto is a species of palm used to construct a supplement that's packed with health benefits. The research concluded that saw palmetto accretion testosterone levels, promote prostate health, decrease inflammation, inhibit hair loss, and improve urinary tract function Investigators have observed that saw palmetto helps slowdown 5-alpha reductase [18-22].

This enzyme convert's testosterone into a dominant androgen hormone called dihydrotestosterone (DHT) by slowing down 5-alpha reductase, saw palmetto could diminish the effects of DHT as men get older. Sesame customarily used as oil for head massage, sesame or til is a unique way to overcome grey hair naturally. The seeds can be consumed after dry roasting them. White sesame seeds have more significant iron content than the black variety, which contain more calcium. Traditional use of sesame seeds is quintessential to Indian cuisine. Sesame seeds distinguished for their nutritional value and health advantages are not only used in snacks but are used to vegetable preparations also. Especially in south India Andhra cuisine, the use of sesame while cooking veggies is prevalent. North Indian Sesame seeds make a delicious additive to smoothies or they can be blended with jaggery (syrup) to make tasty and nourishing laddoos [18-25].

**Onion**

Onion is acknowledged to be one of the best solutions for hair greying alopecia areata or baldness. Onion is basic constituents of Indian salads besides salads nowadays onion oil use for hair greying, hair fall, fungal infection, dandruff due to its contents higher amount of sulphur and antioxidants enriched the research concludes that it reduces hair loss by increasing blood circulation in the scalp and the hair. The sulphur in the oil helps in the production of essential collagen that promotes hair growth [29,30].

**Nettle Root –**

Nettles roots are extremely rich in nutrients like vitamin A, B, C, D and K, a high amount of iron, magnesium, phosphorus, sodium, sulfur, and iodine, potassium, calcium, silica, a plentiful number of proteins and omega 3 these nutrients required for collagen formation and follicle health. it is well proved DHT–dihydrotestosterone is a metabolite of the main male hormone: testosterone. High levels of DHT have been linked to both male and female baldness[27-30].

Scientific research reveals that nettle extract (roots and leaves) has a potential to inhibit 5-alpha-reductase—the enzyme that transforms testosterone to DHT and therefore blocks its production. DHT accomplishes its role by binding to the receptor sites which can be found throughout the body but mainly on the prostate and in the scalp. Nettle extracts antagonist with DHT and binds to receptors so DHT does not continue aggravating the prostate or inhibiting the hair growth [27-32].

**Horsetail**

Horsetail extract stimulates hair growth because of its antioxidant and anti-inflammatory properties. Horsetail enriched with selenium, cysteine and silica which are some of the reasons why this plant serves as a great ingredient for hair health and hair growth.

**Barley Grass**

Barley Grass Juice powder has been proved to stimulate the immune system, relieve constipation, alkalinize the body, increase energy, aid digestion, and improve the health of skin, hair and nails. Research Studies confirmed that wheatgrass juice has an efficacious ability to fight neoplasms without the usual toxicity of drugs. Barley grass juice is potent detoxifier protects the hepatic and the blood and neutralizes toxic substances like mercury, cadmium, nicotine, strontium and polyvinyl chloride. Barley Grass is distinguished having sufficient amount in Catalase that is effective to naturally reverse grey hair [31].

**Red wine**

Red wine in hair loss and greying is number one on the list of benefits of red wine. A phytochemical called resveratrol present in red wine helps prevent hair fall and aids in hair growth. The antioxidants found in red wine not only increase blood circulation in your scalp but also helps destroy pesky dandruff and therefore cures itchy scalp fulfilment of nutritional deficiencies [20].

**Key Nutritional Deficiencies Linked to Premature Greying**

Proper nutrition is vital for hair health, and deficiencies in key vitamins and minerals are strongly associated with premature greying. The following table outlines essential nutrients, their functions, and dietary sources:

**B. To Correct Nutrients Deficiencies**

Hair greying major reason is nutrients deficiencies that effect on hair follicle health and melanin biosynthesis if nutrient replenishes again by dietary supplements or these nutrients enriched foods counter can also correct deficiencies.

**Correcting Nutrient Deficiencies: Scientific Evidence**

Supplementation of key nutrients can reverse or slow down premature greying if deficiencies are the underlying cause. The following table highlights key nutrients and their supplementation effects:

Nutrient	Effect on Hair Health	Recommended Dosage	Reference
<b>Biotin (Vitamin H)</b>	Promotes collagen production and prevents hair loss	300 mcg daily	11,12,13
<b>Pantothenic Acid (Vitamin B5)</b>	Strengthens follicles, prevents greying	5–10 mg daily	14
<b>Folic Acid</b>	Supports keratin and melanin synthesis	400 mcg daily	15
<b>Copper</b>	Essential for melanin production	1.2 mg daily	16
<b>Selenium</b>	Enhances follicle stimulation and antioxidant activity	55 mcg daily	17

**Beta Carotene**

Beta-carotene is a proactive form of vitamin A when it converts into vitamin gives antioxidants property its neutralize free radicals, A red and orange pigment obtained mostly in reddish veggies and fruits. The human body

converts beta carotene and retinol or vitamin A that is a key nutrient for good overall health including hair growth. the need vitamin A for our good eye health, healthy skin, mucus membranes, immune system, and vision besides the hair growth. Vitamin C is antioxidant defends the cells of the human body from oxidation vitamin B-6 and B-12 are two of the Complex-B vitamins that support healthy skin and hair. B-6 may help restore hair to its original colour following an illness or deficiency [20].

**Inositol**

Inositol is a phytochemical synthesizes naturally in cantaloupe, citrus fruit, and many fibre rich foods (such as beans, brown rice, corn, sesame seeds, and wheat bran). Inositol is used to treat a wide range of medical conditions, including metabolic and mood disorders. Inositol is frequently referred to as vitamin B8, but it is not a vitamin. It's a type of carbohydrate that works secondary messenger to signaling several hormones that are correlated with mood and cognition. biologist studies many potential roles of inositol like a powerful antioxidant in the brain, circulatory system, and other body tissues like hair, skin, nail it protect collagen structure [20].

**Biotin**

Vitamin H, known as Biotin, is an important constituent part of collagen. Biotin deficiencies are often associated with premature grey hair. Biotin deficiencies can cause hair loss as well as thin, brittle and splitting hairs. Although Biotin deficiencies are rare, low levels of biotin in the body might result in hair loss and greying of hair. Some of the functions of Biotin in the body is the production of amino acids and cellular growth. Studies have shown supplementing with Biotin (300 mcg) can help to reverse grey hair to its natural colour[11-14].

**Niacin**

Greying hair, like hair loss, has multiple causal factors but the underlying reason hair turns grey is diminishing melanocyte function explained in table

.1. Melanocytes are the cells that produce melanin in hair, and a surprisingly small amount of active melanocytes are required to keep one’s natural hair colour. To sustain pigment production, numerous nutrients, elements, and reactions are required and high-quality natural supplements can provide invaluable vitamins, minerals, and other components to support and maintain colour[24].

**Pantothenic acid**

Pantothenic acid essential in the development of hair colour. Sustaining proper levels of pantothenic acid can strengthen your hair follicles and their cells. This vitamin contributes to the nourishment of hair follicles, helping them to function properly and promote the growth of your hair. Adding pantothenic acid to the diet in the form of a supplement may reverse greying and/or prevent healthy hair from turning grey[14].

**Folic Acid**

Deficiency of Folic Acid is connected with symptoms like slower growing hair as well as hair turning grey. This is mainly because Folic Acid metabolizes and builds new proteins (including Keratin and Melanin). Copper deficiency is a preeminent cause of grey hair according to key studies. Copper is an essential ingredient in the production of Melanin, making it an essential ingredient in any Gray Hair Supplement. Zinc is very essential micronutrients and cofactor for a biochemical reaction. Zinc deficiencies are suspect of causing premature grey hair in at least one study, according to an October 2014 issue of *Observation*. Accurate supplementation is 10 Mg of Zinc. Selenium is a chemical element works as super anti oxidant that biosynthesis seleno proteins[25-30].

**Herbal and Natural Remedies for Premature Greying**

Natural remedies have gained attention for their effectiveness in preventing and managing premature greying. Below is a summary of scientifically supported herbal treatments:

Herb/Natural Ingredient	Benefits	Usage	Reference
Indian Gooseberry (Amla)	Rich in antioxidants; supports melanin production	Hair oil, oral supplements	18-20
Black Tea	Contains polyphenols that reduce oxidative stress	Topical application	20
Sesame Seeds	Rich in calcium and iron, supports melanocyte health	Consumed roasted or as oil	21
Onion Extract	Enhances blood circulation and collagen production	Applied topically as oil	22
Nettle Root	Inhibits DHT, supports follicle health	Oral supplements or topical application	23

**Table 2: Herbal and Natural Remedies for Premature Greying**

Table :2. explained natural remedies have gained attention for their effectiveness in preventing and managing premature greying. Below is a summary of scientifically supported herbal treatments.

These proteins support the stimulation of the hair follicles to hair growth. Another benefit that selenium can have on hair, is its ability to overcome build-up and dandruff on the scalp. This

frees the hair follicles, allowing the hair to grow in more easily. Cysteine is a semi-essential amino acid that plays a significant role in healthy hairs. it is a basic constituent of collagen, keratin that builds up hairs, nails cells. cysteine is a sulphur-containing amino acid that s present is important for healthy, shiny hairs and nails health and without the adequate amount of protein, hair appears to be dry, brittle and it may even result in hair loss[25].

This trace mineral has been confirmed to assist with strengthening blood vessels which result in enhanced circulation. As mentioned in a previous

post, blood circulation is extremely important in regard to hair growth because with improved circulation comes improved oxygen output which supports stimulate hair growth on the scalp. Oxygen is crucial for our bodies to thrive, and our hair and scalp are no exception. Silica has also been shown to keep hair, skin and nails strong through its importance for the skin’s connective tissues [1-4].

Henna is the best treatment for grey hair because of its colouring and conditioning properties. Soak henna in an iron pot overnight and make a deep conditioning hair mask by combining eggs, curd and other herbs for grey hair. The ridge gourd is known for restoring hair pigment and stimulating the roots of the hair. Regular massaging of ridge gourd oil can prevent hair from turning white[26].

## Conclusion

Graying of hair is an ageing process that is natural but inadequate diet, lifestyle, genetic disorder it occurs more usual ageing process if premature greening is due to nutritional deficiency, inborn metabolism then vitamin mega dosage therapy, dietary supplementation can help to prevent and delay premature greying. White hair due to old age cannot turn black again naturally, while white hair appearing due to bleaching, stress, food, pollution, vitamin deficiency and other physical influence can turn to black again if properly taken care of nutrients. Present time mushrooming of a dietary supplement company and hair oil claim to prevent and reverse of trying but due lack of scientific research and clinical trials not only doubtful but also it may contaminants of heavy metals may be hazardous to health so need proper biochemical ingredients and heavy metal check.

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