

## Drug that Causes Hair Loss and Promotes Hair Growth - A Review

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### ABSTRACT

Hair is a major esthetic display feature of the human body, especially in social and sexual interactions. Diagnosis of hair diseases occurred as early as ancient Egyptian times and is one of the oldest medical disciplines. Today, hair loss or thinning, and hypertrichosis or hirsutism are common complaints in clinical dermatology, but patients seeking advice for their hair problem are not necessarily completely bald or overall haired. The difficult task in diagnosing hair and hair disorders is to distinguish between a true disorder and a subjective complaint and to analyze the underlying pathogenesis. Patients consult for focal or diffuse effluvium, non-scarring or scarring alopecia, changes in hair structure or color and hair graying. Establishing the correct diagnosis is the key feature of successfully managing a hair patient.

**Keywords:** Hair, hair diseases, scarring alopecia, hair graying, hypertrichosis.

### INTRODUCTION

Hair is a protein filament that grows through the epidermis from follicles deep within the dermis. The fine, soft hair found on many nonhuman mammals is typically called fur; wool is the characteristically curly hair found on sheep and goats. Found exclusively in mammals, hair is one of the defining characteristics of the mammalian class [Al-Reza et al. 2009]. Hair is an epidermal appendage that lies within the dermis. Each hair emerges from a tubular invagination called a follicle. The follicle resembles a narrow pocket within the skin, as if a tiny finger had pushed the epidermis down into the Dermis and the underlying subcutaneous tissue. The lower extreme is penetrated by the Dermal Papilla an upward protrusion of connective tissue which produces microscopic cells of several kinds from which the hair is formed and developed by cellular elongation and keratinisation. Hair is closely associated with sweat gland and sebaceous gland activity [Al-Reza et al. 2010]. Each hair-producing follicle with its sebaceous gland is known as a pilo-sebaceous unit. The arrector pili muscle joins the wall of the follicle to the epidermis and is responsible for the erection of hairs and goose flesh during cold weather or emotional stresses [Ambasta et al. 2004]. The hair shaft is currently believed to be a dead structure composed of cells which die after leaving the dermal

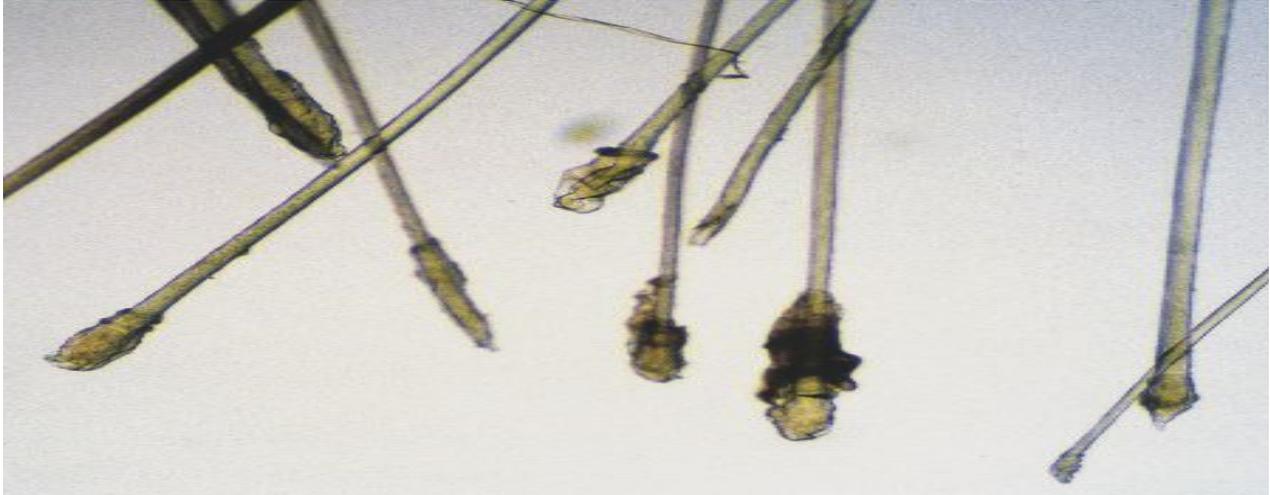
papilla. As all follicles are established before birth no new ones are created thereafter. All characteristics are genetically determined. Their hairshaft - a keratinised structure composed of an outer cuticle (tile-like protective layer of keratinised cells) the cortex where cells are held firmly together, and an inner medulla where the cells are larger more loosely connected and partially separated by air spaces [Arase et al. 1991]. The hair is approximately cylindrical.

The hair can be divided into three parts length-wise-

1. The bulb, a swelling at the base which originates from the dermis
2. The root, which is the hair lying beneath the skin surface
3. The shaft, which is the hair above the skin surface.

In cross-section, there are also three parts-

1. The medulla, an area in the core which contains loose cells and airspaces
2. The cortex, which contains densely, packed keratin
3. The cuticle, which is a single layer of cells arranged like roof shingles [Bandaranayake et al. 2004].



**Fig. 1: The epilated and embedded hair roots under magnification**

### Hair Cycle

Normal hair follicles undergo periods of growth (Anagen) followed by regression (Catagen), resting (Telogen), regeneration ('new' Anagen) with hair shedding. No hair therefore grows continuously. This hair cycle, which dictates the ultimate hair length attainable by an individual, is explained under the following headings:-

### Anagen

The period of follicle regeneration (folliculo-genesis) with active hair growth. (scalp hairs grow for 2-7 years). Hair in the anagen phase may grow faster during the early years. Average growth rate is 1-2 cm per month.

### Catagen

The preliminary stage of the retrogressive catagen phase. During this changes may occasionally be seen above the skin surface with the naked eye: e.g. loss of

pigment and the narrowing of the hairshaft accompanied by a narrowing and eventual loss of the medulla. During this short period of change (approximately 2 weeks) the follicle rests the dermal papilla stops production of new cells, the dendrites and melanocytes contract and melanin production ceases. The follicle and epithelial sheath contract and the hairshaft is ejected.

### Telogen

The resting phase of the follicle which lasts for approximately four months. The follicle remains quiescent in its shortened state and awakens to regenerate with the onset of the new Anagen phase.

### Exogen

The process of hair shedding. Whereas hairs may be shed at any stage of the cycle, the majority of shedding occurs during the 'new' Anagen phase [Bhaumik et al. 2002, Cash 2001].



**Fig. 2a: Anagen hair; b. Telogen hair; c. Catagen hair; d. Anagen dysplastic hair; e. (#) Dystrophic and (\*) broken hair**

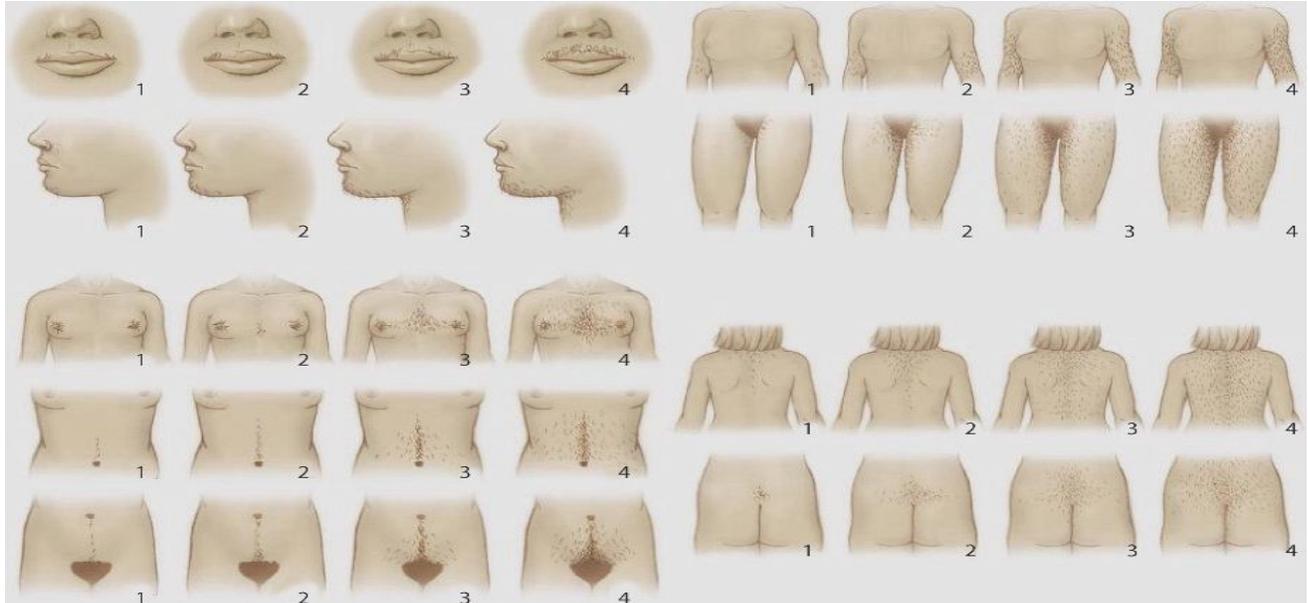
**Hair Density, Numbers of Hairs, Rate of growth**

The average human scalp measures approximately 120 sq. inches (770 sq.cm). The hair covering varies numerically according to hair colour and ethnicity [Ebling 1987].

**Rate of growth**

Normal Caucasian hair growth rate is 1-2 cm per month. Researchers have shown that this rate of

growth may reduce beyond the length of approx. 27cm. Afro-Caribbean hair growth rate is approximately half that of Caucasian, and due to the fragility of their multi-helical structure, rarely attain great length. Asian hair-shafts grow rapidly exceeding the average for Caucasians and may attain great length [Erenmemisoglu et al. 1995, Fujie et al. 1993].



**Fig. 3: Modified Ferriman-Gallwey score (mF6): Nine body regions are evaluated for their degree of hair growth from 0–4. A total score >8 is a sign for hirsutism.**

**Causes of Hair Loss**

Hair loss is a dermatological disorder that has been recognised for more than 2000 years. It is common throughout the world and has been estimated to effect nearly 2% of the world's population [Hattori et al. 1983, Jahoda et al. 1992].

- Apart from metabolic and hereditary causes alopecia has been observed as a major side effect of anticancer, immunosuppressant and many others drug treatments.
- Low thyroid function (hypothyroidism) can cause a thick oily scalp, with coarse sparse hair, or actual baldness. Over active thyroid function (hyperthyroidism) results in sparse fine hairs.
- Damage of pituitary gland that stimulates the thyroid gland, sex glands and adrenal cortex also result in hair loss.
- Excess formation of male hormones due to any of the disorders can be a cause of hair fall.
- Heredity may also play an important role. Sushruta stated that romkoop (hair follicles) never increase, they remains constant, since birth [Jain et al. 2006].
- Most popular theory of alopecia areata states it as an autoimmune disease where the immune system of the body attacks the hair follicles.
- Inadequate calories and insufficient protein intake will affect your hair, if you are on a crash diet to loose your extra weight. Hair loss can occur [Kim et al. 2002].
- In anorexia nervosa, a psychosomatic problem associated with refusal to eat an adequate amount of food may also affect hair.
- Severe psychic stress results in sudden loss of hair. Biological stress is a more common cause of sudden hair loss. Any number of surgical operations, haemorrhage or shock associated with an accident can cause it.

- There are number of mechanical stresses on the scalp and hair that can cause hair loss [Liang et al. 1997].
  - Post partum alopecia - About two to five months after having a baby, women may suddenly start loosing hair. The hair loss may continue for several months, but eventually there is a complete restoration of normal hair. The cause is not clear.
  - Severe fever or any illness associated with prolonged fever may result in a subsequent loss of hair [Oliver 1970].
  - Diseases, particularly those associated with weight loss, which usually means mal nutrition as well, may also cause alopecia. This includes cancer of lymphoma group [Paus 1998].
  - Tuberculosis and syphilis may rarely cause alopecia.
  - Some patients have autoimmune diseases such as systemic lupus erythematosus. Alopecia is a useful diagnostic pointer for that and is seen in more than 50% of patients.
  - Tinea capitis, which is a fungal infection of the scalp, may cause a localized loss of a patch of hair that resembles alopecia areata, but that spot usually has scales and other changes by which doctor can identify it [Paus et al. 1991].
  - Certain beauty practices can lead you to hair loss. Hair styles that cause pulling on the hair providing constant traction cause traction alopecia, when the hair is pulled back from the frontal hairline, as in a ponytail, top knot etc. You can see the stretched hair contributing to a receding hairline. Alopecia may occur in those who straighten their hair with a hot comb and use hot petrolatum with iron e.g., crimping or hot water bath etc. This causes thermal damage to the hair follicle and may eventually lead to irreversible destruction of hair follies [Price 1999].
  - Certain techniques can damage the hair shaft, but it won't affect the hair growth. You can regard the hair shaft as a piece of dead wood. It can become dry and cracked or broken if not properly cared for, or if subjected to harsh chemicals e.g., hair bleaching and colouring [Rathi et al. 1998].
  - Many medicines may cause hair loss. The most common are those, which are used for chemotherapy, in the treatment of cancer, particularly doxorubicin and cyclophosphamide. If such drugs are prescribed, physicians warn the patients in advance [Roh et al. 2002].
  - Medicines used to treat arthritis (Penicillamine, Indomethacin, Naprosyn and Methotrexate), parkinson's disease (levodopa); any other medication which has an androgenic (male) hormone action, such as - anabolic steroids, often used by athletes and bodybuilders or danocrine used for treating endometriosis in women causes hair loss.
  - Oral contraceptives may sometimes causes loss of hair.( Progestins & Estrogens) [Souleles et al. 1998].
  - High blood pressure beta-blocker medications that have been noted to occasionally cause hair loss include: Atenolol (Tenormin), Metoprolol (Lopressor), Nadolol (Corgard), Propranolol (Inderal), and Timolol (Blocadren).
  - Prescription NSAIDs that may also cause hair loss include: Celecoxib (Celebrex), Diclofenac (Voveren), Etodolac (Lodine), Fenoprofen (Nalfon), Indomethacin (Indocin), Ketoprofen (Orudis, Oruvail), Oxaprozin (Daypro), Nabumetone (Relafen), and Sulindac (Clinoril) [Stenn et al. 1998].
- These medicaments do not always have this side effect as many patients use these without hair loss, still one should keep this in mind that thinning or fall of hair could occurs.

#### Method for preventing hair loss

- a. Fruit and vegetables should be taken in abundance to facilitate the supply of essential vitamins and minerals.
- b. Endocrine abnormalities like hyperthyroidism, disorders that result in an excess formation of male hormones, an autoimmune disease like SLE etc., should be properly managed by treatment.
- c. Don't go for a crash diet to lose your weight as it causes damage to your health and will affect your hairs also. Return to proper nutrition that provides you sufficient protein and required calories, to recover normal hair growth.
- d. Avoid tension, stress, worries, anger, etc., as far as possible.
- e. Avoid inflicting mechanical tension to the hair by pulling, crimping etc. Certain beauty practices like trimming, using strong hair colour etc., impart sufficient damage to the hair.

- f. Avoid such hairstyles, which pull back hairs from frontal hairline.
- g. Don't use hot combs or hot water bath for hairs.
- h. Take care of hair shafts also by proper oiling etc., to avoid dryness or cracking of it.
- i. Don't use harsh chemicals (certain shampoos) over scalp.
- j. If dandruff is there take proper treatment. A high fat intake including whole milk, butter, cream, cheese chocolates etc., often worsens the dandruff condition; better avoid it [Stough et al. 2001].

Medication for your hair fall has to be taken in the earlier stages because if all the hair has fallen out and the follicles have closed, nothing much can be done.

#### Hair loss treatment Available

Specialists often biopsy hair to determine the integrity of a given hair follicle. This evaluation is used to establish the underlying cause of the hair thinning / balding, and to decide what treatment options are available.

#### Counseling of Patient

An explanation of alopecia areata, including discussion of the nature and course of the disease and the available treatments, is essential. Some patients are profoundly upset by their alopecia and may require psychological support. Contact with other sufferers and patient support groups may help patients adjust to their disability. The decision to treat alopecia areata actively should not be taken lightly. Treatment can be uncomfortable for the patient, time consuming and potentially toxic. It may also alter the patient's attitude to their hair loss. Some patients find it difficult to cope with relapse following or during initially successful treatment and they should be forewarned of this possibility. These considerations are particularly important in children where the social disruption and focusing of the child's attention on their hair loss, which may result from active treatment, have to be weighed carefully against the potential benefits. On the other hand, some patients are appreciative that something has been tried, even if it does not work.

#### Traditional / Herbs used as medicines for hair growth include

- i. Aromatherapy and include scalp blood circulation- Ginkgo biloba( ginkgoaceae), thyme vulganis (lamiaceae), cedrus atlantica( Pinaceae)
- ii. Few herbal preparation and method of application for the treatment of alopecia as- Phyllanthus embelica( Euphorbeaceae), Rosmarinus officinalis ( labiatae) Allium cepa (liliaceae) glycyrrhiza glabra( leguminosae)
- iii. *Bacopa monniera* include alkaloids, saponins and sterols [Kulshreshtha et al.1973].
- iv. Spore of Lygodime jubonicum- inhibit testosterone 5- $\alpha$ -reductase activity. It contain oleic acid, linolic acid and palmitic acid
- v. Eclipta alba extract with potential for hair growth activity.
- vi. Semecarpus anacardium, Trigonella Foenumgracum. Trigonella conniculata, Zizyphus jujube essential oil, Hibiscus rosa sinensis [Adhirajan et al.,2003].
- vii. *Tridax procumbens* L. (Compositae) is a weed found throughout India. The plant is known to local people as "Ghamara" and is dispensed for "Bhringraj" by some of the practitioners of Ayurveda .
- viii. *Cuscuta reflexa* Roxb.(Convolvulaceae) is a leafless, twinning, parasitic dodder with slender long yellow stems distributed in tropical and temperate region and common throughout India.

#### Synthetic drugs used as medicines for hair growth include

- Minoxidil- used for hair regrowth and to inhibit any additional loss of hair
- Tretinoin- decreases dermal layers on scalp to further the penetration of applied products containing minoxidil
- Hair Transplantation
- Topical or Injectable Steroid Treatments
- Finasteride (Propecia)
- Radiation Therapy (PUVA) [Takahashi et al. 1998]

**Role of Nutritional Supplement for Prevention of Hair Loss: [Uno et al. 1993]**

Supplement	Application
Essential Fatty Acids (EFAs)	Improves Hair Texture
Raw Thymus Glandular	Improves Functioning Capacity of Hair Glands
B-complex Vitamins	Extremely Important Nutrients for the Overall Health and Growth of Hair
Biotin	Deficiencies of Biotin Have Been Linked to Hair Loss
Inositol	Critical for Proper Hair Growth
Methylsulfonyl-methane (MSM)	Assists With Production of Keratin, a Protein Component of Hair
Vitamin C with Bioflavonoids	Provides Antioxidant Action in Hair Follicles/Increases Scalp Circulation
Vitamin E	Also Increases Scalp Circulation, d-alpha tocopherol Improves Health and Growth of Hair
Zinc	Stimulates Hair Growth via Immune System
Coenzymes Q10, A	Increases Tissue Oxygenation in Scalp
Dimethylglycine (DMG)	Circulation Properties
Kelp	Dense Mineral Which Assists in Hair Growth
Copper	Used in conjunction with Zinc, Chelated Copper Aids in Hair Growth
Grape Seed Extract	Antioxidant Properties Protect Follicles from Free Radical Damage
L-Cysteine, L-methionine, Glutathione	Amino Acids which Prevent Hair Fallout/Promotes Blood Supply to Scalp
Silica	Aids in the Health and Growth of Hair
L-Lysine	Inhibits 5-alpha-reductase Conversion of Testosterone into Dihydrotestosterone
L-Arginine	Enhances Nitric Oxide to Promote and Maintain Health and Growth of Hair
Saw Palmetto	Block 5-alpha-reductase, Provides a Reduction in DHT Uptake by Follicles, Blocks Binding of DHT to Specific Androgen Receptors
Green Tea Extract	Adversely Affect type I 5-alpha-reductase

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