Anti-hairloss and Hair growth promoter

Hair growth cycle

Hair cycle of head hair shaft

Stage of the hair cycle
- Anagen: the growing phase
- Catagen: the intermediate phase
- Telogen: the shedding phase

Hair Loss
- Hair follicle gradually terminated
- Terminal hair changes to vellus hair

Vellus hair: Terminal hair = 6-8:1 Normal
Vellus hair: Terminal hair = 0.1-3.9:1 Bald

Causes of hair loss
- Reduction in hair follicle function due to male hormones
- Reduction in metabolic functions of hair follicles and hair bulbs
- Reduction in scalp physiological functions
- Local impairment of circulation due to tension in the scalp
Hair Loss

- Physical stress
- Emotional stress
- Diet considerations
- Hormonal causes
- Endocrinopathy
- Oral medications:
  - Blood thinning agents
  - Retinoids
  - Antihypertensive agents
  - Miscellaneous

Overall causes

- Androgen
- Genetic
- Age

Androgenic alopecia

Testosterone $\rightarrow$ 5α-Dihydrotestosterone

Regions of scalp potentially involved in pattern hair loss


Hair loss patterns in male


Male Pattern
(Hamilton/Norwood)

Diffuse
(Ludwig)

Frontal Accentuation
(Olsen)

Hair loss patterns in female


Graduation of hair loss in Ludwig pattern


Graduation of hair loss in frontal accentuation pattern


Savin patterns of hair loss


Big head? Bald head?

Hair care products

- Hair cleansing products
- Hair growth promoters
- Hair grooming cosmetics
- Hair waving and straightening products
- Hair coloring products

Basic ingredient and function

- Detergent: removes dirt, styling products, sebum and skin scale from hair and scalp
- Foaming agent: allows shampoo to foam
- Conditioner: soften and smoothen hair after sebum removal
- Thickener: thicken shampoo
- Opacifier: makes shampoo opaque

Basic ingredient and function

- Sequestering agent: prevent soap scum from forming on hair and scalp in hard water
- pH adjusters or neutralizer: minimize hair damage from base
- Fragrance: give acceptable smell
- Preservative: prevent microbial and fungal contaminations
- Specialty additive: treatment ingredient or marketing aid to impart other benefit to shampoo

Basic shampoo categories

- Normal hair shampoo
- Dry hair shampoo
- Damaged hair shampoo
- Oily hair shampoo
- Everyday shampoo
- Deep cleaning shampoo
- Baby shampoo
- Medicated shampoo
- Conditioning shampoo
- Hair dying shampoo
- Ethnic shampoo

Active ingredients: Hair loss

- Finasteride: 5α-reductase Type II inhibitor
- Minoxidil: vasodilator (long lasting anagen)
- Dutasteride or GI198745: 5α-reductase inhibitor
- Iamin or prezatide copper: 5α-reductase inhibitor
- Folligen or copper chloride: 5α-reductase inhibitor
- Zinc: hair growth, 5α-reductase Type I inhibitor
- Polysorbate 80: hair growing improvement

Active ingredients: Hair loss

- MK-386 or β-dimethyl-4-aza-5-cholestan-3-one: 5α-reductase inhibitor
- WO9704002: 5α-reductase inhibitor
- FCE28260: 5α-reductase inhibitor
- FCE26073 or Turosteride: 5α-reductase Type II inhibitor
- Ketoconazole: Androgenetic blocker
<table>
<thead>
<tr>
<th>Active ingredients : Hair loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Canrenone 2%</td>
</tr>
<tr>
<td>- Spironolactone 3%</td>
</tr>
<tr>
<td>- Dexamethasone</td>
</tr>
<tr>
<td>- Prednisone</td>
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<tr>
<td>- Cyclosporin A</td>
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<tr>
<td>- Cyproterone acetate</td>
</tr>
<tr>
<td>- Flutamide</td>
</tr>
<tr>
<td>- Drospirenone</td>
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<tr>
<td>- Bromocriptine</td>
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<table>
<thead>
<tr>
<th>Active ingredients : Hair loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Amino acids : hair growth and healthy, 5α-reductase inhibitor</td>
</tr>
<tr>
<td>- Biotin : hair nutrient and hair growth</td>
</tr>
<tr>
<td>- Folic acid : hair nutrient and hair growth</td>
</tr>
<tr>
<td>- Procyanidin B3 : hair thickener</td>
</tr>
<tr>
<td>- Azelaic acid : strong DHT inhibitor</td>
</tr>
<tr>
<td>- Ferritin</td>
</tr>
<tr>
<td>- B7, B12</td>
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</tbody>
</table>

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<thead>
<tr>
<th>Active ingredients : Hair loss</th>
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</thead>
<tbody>
<tr>
<td>- Phytoestrogens</td>
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<tr>
<td>- Isoflavone</td>
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<tr>
<td>- Daizein</td>
</tr>
<tr>
<td>- Genistein</td>
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<tr>
<td>- Glycitein</td>
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<tr>
<td>- Lignans</td>
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<tr>
<td>- Enterodiol</td>
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<tr>
<td>- Enterlactone</td>
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<tr>
<td>- Bisnapthaquinone</td>
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<tr>
<td>- Capsaicin</td>
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<tr>
<td>- (-)-epoglaaocatechin-3-gallate</td>
</tr>
<tr>
<td>- Soymethide-4</td>
</tr>
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<table>
<thead>
<tr>
<th>5α-reductase inhibitor</th>
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</thead>
<tbody>
<tr>
<td>Hair regrowth promoter</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>5α-reductase inhibitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Essential fatty acid</td>
</tr>
<tr>
<td>- γ-linolenic acid, α-linolenic acid, palmitoleic acid, oleic acid, myristoleic acid</td>
</tr>
<tr>
<td>- palmitic acid, stearic acid, oleic acid, linoleic acid</td>
</tr>
<tr>
<td>- Evening primrose oil</td>
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<tr>
<td>- Emu oil</td>
</tr>
<tr>
<td>- β-sitosterol</td>
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<thead>
<tr>
<th>Saw palmetto : Serenoa repens</th>
</tr>
</thead>
<tbody>
<tr>
<td>- DHT formation inhibitor</td>
</tr>
<tr>
<td>- 5α-reductase inhibitor</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pygeum : Pygeum africanum</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Androgenic blocker</td>
</tr>
<tr>
<td>- 5α-reductase inhibitor</td>
</tr>
</tbody>
</table>
Holy basil: *Ocimum sanctum*

- Chillies
  - Capsaicin

Fenugreek: *Trigonella foenum*

- Multivitamin B
- Hair root strengthen
- DHT formation inhibitor

False daisy: *Eclipta alba*

- Hair growth promoter

**False daisy: *Eclipta alba***

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Follicle count</th>
<th>Skin thickness, μm</th>
<th>Anagen induction, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% minoxidil</td>
<td>69 ± 3.9</td>
<td>160.2 ± 10</td>
<td>87.5</td>
</tr>
<tr>
<td>2% minoxidil</td>
<td>73 ± 8.2</td>
<td>251.25 ± 6.6</td>
<td>87.5</td>
</tr>
<tr>
<td>1.6 mg E.alba</td>
<td>39 ± 8.4</td>
<td>417.4 ± 35.9</td>
<td>50</td>
</tr>
<tr>
<td>3.2 mg E.alba</td>
<td>66 ± 7.3</td>
<td>480.4 ± 41.2</td>
<td>87.5</td>
</tr>
</tbody>
</table>

False daisy: *Eclipta alba* (J. Ethnopharmacol. 2009. doi:10.1016/j.jep.2009.05.023)

**Fennel: *Foeniculum vulgare***

- Antiinflammatory
- Androgenic blocker
- 5α-reductase inhibitor
Nettle: *Urtica dioica*
- Androgenic blocker
- DHT blocker
- 5α-reductase inhibitor
- Blood circulator

Bayberry: *Myrica rubra*
- 5α-reductase inhibitor
- Hair growth stimulant
- Anti hair loss

Arborvitae: *Thuja*
- 5α-reductase Type II inhibitor
- Sebum reduction

Arborvitae: *Thuja*

<table>
<thead>
<tr>
<th>Compounds</th>
<th>5α-reductase Type II inhibitor, IC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linoleic acid</td>
<td>31.55 μg/ml (112.50 μM)</td>
</tr>
<tr>
<td>γ-Linolenic acid</td>
<td>5.55 μg/ml (19.93 μM)</td>
</tr>
<tr>
<td><em>T. occidentalis</em></td>
<td>2.6 μg/ml</td>
</tr>
<tr>
<td>Finasteride</td>
<td>0.34 μM</td>
</tr>
</tbody>
</table>


Gourds
- 5α-reductase inhibitor
- Anti hair loss

Avocado: *Persea americana*
- 5α-reductase Type I inhibitor
- Sebum secretion reduction
- Antidandruff
- Antitching
Hop: *Humulus lupulus*
- 5α-reductase inhibitor
- Hair growth stimulant
- Scalp tonics

Burdock: *Arctium lappa*
- Scalp tonics
- Antidandruff
- Antiitching
- Anti hair loss
- Hair sheening

Pumpkin
- 5α-reductase inhibitor

Grape seeds
- proanthocyanidins
- \textit{in vitro} hair follicle proliferation promotion
- \textit{in vivo} Telogen converts to Anagen

Willow
- Antiinflammatory
- 5α-reductase inhibitor
- Hair loss treatment

Black cohosh: *Cimicifuga racemosa*
- 5α-reductase inhibitor
Soy bean  Flax seed

- 5α-reductase inhibitor
- Grey hair treatment

Ginkgo : Ginkgo biloba

- Hair regrowth promoter
- Astringent
- Epidermis growth stimulant
- Antiinflammatory
- Radical scavenger

Tea : Camellia sinensis

- Antioxidant
- Androgenic blocker
- 5α-reductase inhibitor
- Similar activity with saw palmetto

Sophora : Sophora flavescens

- 5α-reductase Type II inhibitor
- Anagen elongation activity

Licorice : Glycyrrhiza glabra

- DHT formation inhibitor
- Hair loss treatment

Breadfruit: Artocarpus incisus

5α-reductase Type II inhibitor
- Chlorophorin IC_{50} 37 μM
- Artocarpin IC_{50} 85 μM
Melanin biosynthesis inhibition

**Henna : Lawsonia inermis Linn.**

- Hair growth accelerator
  - Leaf extracts have mild antiinflammatory and antiallergic action and analgesic effect
- Impart dark red shades: Lawsone

**Aloe : Aloe vera L.**

- Traditionally for hair loss
- Improve hair growth following alopecia

**Rhinacanthus nasutus Kurz.**

- Hair loss treatment
- Grey hair treatment

**Butterfly pea : Clitoria ternatea**

- Antiinflammatory
- Antioxidant
- Hair growth promoter
- Grey hair recover

**Citrus hystrix DC.**

- Wound healing
- Antidandruff
- Soft & smooth hair

**Citrus grandis**

- Skin & scalp tonic
- Exfoliation refresh
**Sapindus rarak A. DC.**
- Wound healing

**Acacia concinna DC.**
- Cleansing
- Shining
- Antidandruff

**Sesame : Sesamum indicum Linn.**
- Skin & scalp soother
- Antioxidant
- Natural moisturizer

**Centella asiatica (L.) Urb.**
- Antioxidant
- Wound healing
- Blood circulation
- Scalp conditioning
- Energy stimulant
- Detergent
- Anti hair loss

**Coconut : Cocos nucifera Linn.**
- Saturated fatty acid
- Lauric acid
- Myristic acid

**Cymbopogon citratus Stapf**
- Oily and grease hair treatment
- Antidandruff
- Antiseptic
**Garlic: *Allium sativum* L.**
- Dandruff control
- Antiseptic
- Tonic
- Antioxidant
- Antiinflammatory
- Antibacterial
- Antifungal

**Ginger: *Zingiber officinale* Roscoe**
- Antiinflammatory
- Blood circulation stimulant
- Muscle relaxation
- Hair loss treatment

**Ginseng: *Panax ginseng***
- Skin & scalp soften
- Antiinflammatory
- Blood circulation
- Cell regeneration

**Rice: *Oryza sativa***
- Skin & scalp conditioning
- Moisturizer
- Emollient
- Antioxidant

**Almond: *Prunus amygdalus***
- Skin conditioning
- Moisturizer
- Sun protect

**Sage: *Salvia officinalis* L.**
- Hair conditioning
- Maintain the sheen of dark curly hair
- Strengthen and stimulate hair growth
- Antidandruff
- Anti hair loss
- Greasy hair treatment
Rosemary : *Rosmarinus officinalis* Linn.
- Stimulate hair growth
- Antioxidant
- Greasy hair conditioner
- Gives body and sheen to hair
- Daily antidandruff treatment

Thyme : *Thymus vulgaris* L.
- Inhibit dandruff
- A scalp rub to prevent hair falling out
- Promote natural hair health

**Swertia japonica** Makino
- abdominal pain
- skin infection
- blood circulation
- hair growth stimulant

**English Walnut** *Juglans regia* L.
- Eczema
- Acne
- Hair loss
- Scalp itching
- Scalp peeling
- Dandruff
- Emollient
- Skin disorder treatment: crack, abrasion, frostbite, chaps
- Sun burn treatment
- Nappy rashes

**Black walnut** : *Juglan nigra*

**Honey**
- Hair growth promoter
- Skin & scalp conditioning

**Propolis**
- Antifungal
- Antibacterial
- Similar activity with aloe
<table>
<thead>
<tr>
<th>Plants</th>
<th>Parts</th>
<th>α-reductase inhibitory activity, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpinia galanga</td>
<td>Leaves</td>
<td>0</td>
</tr>
<tr>
<td>Tamarindus indica</td>
<td>Leaves</td>
<td>0</td>
</tr>
<tr>
<td>Albizia myriophylla</td>
<td>Leaves</td>
<td>5</td>
</tr>
<tr>
<td>Acacia concinna</td>
<td>Fruits</td>
<td>21</td>
</tr>
<tr>
<td>Psidium littoricum</td>
<td>Leaves</td>
<td>23</td>
</tr>
<tr>
<td>Leucaena leucocephala</td>
<td>Leaves</td>
<td>25</td>
</tr>
<tr>
<td>Citrus hystrix</td>
<td>Fruit peels</td>
<td>25</td>
</tr>
<tr>
<td>Citronia ternatea</td>
<td>Flowers</td>
<td>29</td>
</tr>
<tr>
<td>Eucalyptus sp.</td>
<td>Leaves</td>
<td>47</td>
</tr>
<tr>
<td>Passiflora foetida</td>
<td>Fruits</td>
<td>47</td>
</tr>
<tr>
<td>Piper betle</td>
<td>Leaves</td>
<td>51</td>
</tr>
<tr>
<td>Mitragyna hirsuta</td>
<td>Leaves</td>
<td>53</td>
</tr>
<tr>
<td>Alpinia galanga</td>
<td>Leaves</td>
<td>29</td>
</tr>
<tr>
<td>Artocarpus altilis</td>
<td>Leaves</td>
<td>76</td>
</tr>
<tr>
<td>Ixora macrophylla</td>
<td>Leaves</td>
<td>79</td>
</tr>
<tr>
<td>Citrus hystrix</td>
<td>Fruit peels</td>
<td>25</td>
</tr>
</tbody>
</table>


Hair loss treatment example products

- Kigelia africana
- Salvia sclarea
- Gingko biloba
- Cinnamomum zeylanicum
- Panax ginseng

Hair loss treatment example products

- Niacin
- Biotin
- Plant Phytosterols
- Saw Palmetto Berry
- Macademia Nut oil
- Borage Oil
- Evening Primrose oil
- Pygeum africana
- Green tea extract

Hair loss treatment example products

- Linolenic acid
- Linoleic Acid
- Oleic Acid
- Azaleic acid
- Vitamin B6
- Zinc
- Saw Palmetto Extract
- β-Sitosterol
- Procyanidin Oligomers

Minoxidil 5% w/v for men

Minoxidil 2% for women
Hair loss treatment example products

- Hops extract
- Rosemary extract
- Swertia extract
- Si compounds
- Panthenol

Hair loss treatment example products

- Saw palmetto
- Zinc
- Nettles
- Pumpkin seed extract

Hair loss treatment example products

- Soy bean
- Panax ginseng
- Castanea sativa
- Arinca montana
- Hedera helix
- Geranium maculatum
- Inositol, Panthenol
- Cystine, Cysteine, Methionine
- Biotin

Hair loss treatment example products

- Swertia extract

Hair loss treatment example products

- Biotin
- Zinc PCA
- Panax ginseng, Ginkgo biloba, Swertia japonica, Palmaria palmata, Soy bean germ, Glycyrrhiza glabra extracts
- Simmondsia chinensis Oil
- Benzyl Nicotinate, Inositol, L-Cystine, Cysteine, Choline, Niacin, Methionine
Hair growth promoters evaluations

**Animals**
- Mice
  - hair length
  - hair growth area
- Rabbits
  - hair length and weight
- Hamsters
  - sebaceous glands size (*in vivo*)
  - 5α-reductase inhibition (*in vitro*)
  - DHT receptor inhibition (*in vitro*)
- Monkeys
  - hair growth at head

**Hair growth promoters evaluations : Mice**

30 days application of *Asiasari radix* extract 1% solution in 40% EtOH


**Biometrological Test**

**Hair Loss / Hair Growth**

**Principle**
- Anti-hair loss efficacy
- Anti-hair regrowth products
- Videomicroscope visualizations

**Protocol design**
- Long term studies: M0-M1-M2
- Up to M0-M3-M6 studies
- Female and male volunteers
- No age criteria

**Videotrichogram**

Illustrations:
- the telogenous hairs

Selected references


Thank you for your attention