MEDIFIT EDUCATION'S

BIOTIN FOR HAIR LOSS - A MEDICAL INSIGHT

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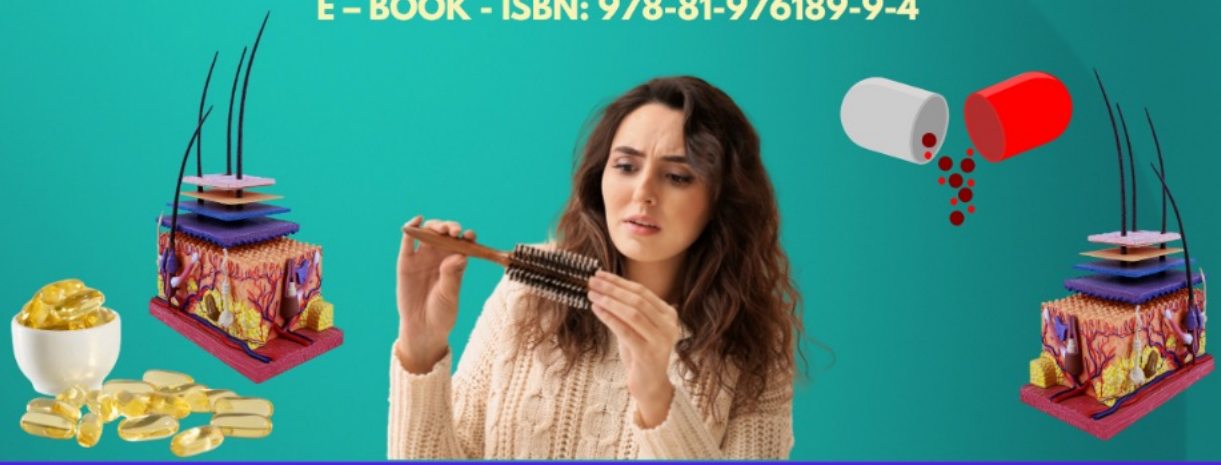

| HAIR LOSS BASIC INTRODUCTION | PATHOPHYSIOLOGY OF HAIR LOSS | CAUSES OF HAIR LOSS | PHARMACOLOGY OF BIOTIN | EVIDENCE-BASED RESEARCH ON BIOTIN AND HAIR LOSS | BIOTIN SUPPLEMENTATION | INTEGRATING BIOTIN INTO HAIR CARE REGIMENS |

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Biotin Supplementation - A powerful weapon for Hair loss

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INTRODUCTION TO HAIR LOSS

Hair grows everywhere on the human skin except on places like the palms of our hands and the soles of our feet, our eyelids and belly buttons, but many hairs are so fine they're virtually invisible.

Hair is made of a protein called keratin that is produced in hair follicles in the outer layer of skin. As follicles produce new hair cells, old cells are being pushed out through the surface of the skin at the rate of about 6 inches a year. The hair you can see is actually a string of dead keratin cells. The average adult head has about 100,000 to 150,000 hairs and loses up to 100 of them a day; finding a few stray hairs on your hairbrush is not necessarily cause for alarm.

At any time, about 90% of the hair on a person's scalp is growing. Each follicle has its own life cycle that can be influenced by age, disease, and a wide variety of other factors.

Hair loss (alopecia) can affect just your scalp or your entire body, and it can be temporary or permanent. It can be the result of heredity, hormonal changes, medical conditions or a normal part of aging. Anyone can lose hair on their head, but it's more common in men.

Baldness typically refers to excessive hair loss from your scalp. Hereditary hair loss with age is the most common cause of baldness. Some people prefer to let their hair loss run its course untreated and unhidden. Others may cover it up with hairstyles, makeup, hats or scarves. And still others choose one of the treatments available to prevent further hair loss or restore growth.

Before pursuing hair loss treatment, talk with your doctor about the cause of your hair loss and treatment options.

Hair loss can appear in many different ways, depending on what's causing it. It can come on suddenly or gradually and affect just your scalp or your whole body.

Signs and symptoms of hair loss may include:

- Gradual thinning on top of head.
- Circular or patchy bald spots.
- Sudden loosening of hair.
- Full-body hair loss.
- Patches of scaling that spread over the scalp.

TYPES OF HAIR LOSS

There are many types of hair loss, also called alopecia:

Involutional alopecia is a natural condition in which the hair gradually thins with age. More hair follicles go into the resting phase, and the remaining hairs become shorter and fewer in number.

Androgenic alopecia is a genetic condition that can affect both men and women. Men with this condition, called male pattern baldness, can begin having hair loss as early as their teens or early 20s. It's characterized by a receding hairline and gradual disappearance of hair from the crown and frontal scalp. Women with this condition, called female pattern baldness, don't have noticeable thinning until their 40s or later. Women experience a general thinning over the entire scalp, with the most extensive hair loss at the crown.

Alopecia areata often starts suddenly and causes patchy hair loss in children and young adults. This condition may result in complete baldness (alopecia totalis). But in about 90% of people with the condition, the hair returns within a few years.

Alopecia Universalis causes all body hair to fall out, including the eyebrows, eyelashes, and pubic hair.

Trichotillomania, seen most frequently in children, is a psychological disorder in which a person pulls out their own hair.

Telogen effluvium is temporary hair thinning over the scalp that occurs because of changes in the growth cycle of hair. A large number of hairs enter the resting phase at the same time, causing hair shedding and subsequent thinning. Learn more about what causes telogen effluvium.

Scarring alopecias result in permanent loss of hair. Inflammatory skin conditions (cellulitis, folliculitis, acne), and other skin disorders (such as some forms of lupus and lichen planus) often result in scars that destroy the ability of the hair to regenerate.

Traction alopecia. Hot combs and hair too tightly woven and pulled can also result in permanent hair loss.

Central centrifugal cicatricial alopecia. This is the most common type among Black women. This often manifests as a small bald patch in the center of the scalp that grows over time.

HAIR GROWTH CYCLE

The hair on your head grows from a root known as a follicle, which extends out from underneath the skin on your scalp. Each strand of hair has its own life cycle. Growth happens in four stages: anagen, catagen, telogen, and exogen. The hair cycle includes phases where hair is actively growing and phases of rest where no active growth is happening.

Factors like genetics, age, medical conditions, hair care habits, and stress can all affect hair growth. Here's what to know about each stage.

Stage 1: Anagen Phase

The first stage of hair growth is the anagen phase, a period of active growth. **During this time, the cells in the hair follicles work rapidly to continuously grow new hair strands.**

During the anagen phase, your hair follicles are pushing out hairs that will continue to grow until they're cut or until they reach the end of their lifespan and fall out. At any time, about 90 percent of the hairs on your head are in the anagen phase.

Anagen is the longest phase of the hair growth cycle, lasting anywhere from 2-8 years for hair on the scalp. This phase gets shorter with age, so hair doesn't tend to grow as much as a person gets older.

During a normal hair cycle, most strands on your head will be in the anagen stage at any given time.

Stage 2: Catagen Phase

The catagen phase is the second stage of hair growth. This is a transition phase when hair shifts from active growth to a non-growth period.

This phase is substantially shorter than the anagen phase—about two weeks. Hair growth slows throughout the catagen phase. The hair follicle shrinks, and the hair strand gets ready to detach from the follicle (though it still remains).

During this chapter, **hair follicles shrink and hair growth slows.** The hair also separates from the bottom of the hair follicle, yet remains in place during its final days of growing.

Only about 5 percent of the hairs on your head are in the catagen phase at any given time.

Stage 3: Telogen Phase

Telogen is the third stage of hair growth. This is the resting stage, where your strands remain mostly dormant.

During this phase, old hair is preparing to shed, and new hair is preparing to grow in its place. Telogen usually lasts 5-6 weeks for hair on the scalp.

While 10% or less of your hair follicles are in the telogen phase at a given time, any factors that disrupt hair growth (like a stressful event) can prompt more strands to enter this stage.

Stage 4: Exogen Phase

The final stage of hair growth is known as the exogen phase. **During this phase, your hair detaches from the hair follicle and falls out.** This allows new hair to grow in the follicle.

Exogen can last around 2-5 months. Shedding of as many as 100 strands daily during this phase is considered normal, especially if you maintain hair care habits like brushing and washing your hair.

CAUSES OF HAIR LOSS

People typically lose 50 to 100 hairs a day. This usually isn't noticeable because new hair is growing in at the same time. Hair loss occurs when new hair doesn't replace the hair that has fallen out.

Hair loss is typically related to one or more of the following factors:

Family history (heredity). The most common cause of hair loss is a hereditary condition that happens with aging. This condition is called androgenic alopecia, male-pattern baldness and female-pattern baldness. It usually occurs gradually and in predictable patterns — a receding hairline and bald spots in men and thinning hair along the crown of the scalp in women.

Hormonal changes and medical conditions. A variety of conditions can cause permanent or temporary hair loss, including hormonal changes due to pregnancy, childbirth, menopause and thyroid problems. Medical conditions include alopecia areata (al-o-PEE-she-uh ar-e-A-tuh), which is immune system related and causes patchy hair loss, scalp infections such as ringworm, and a hair-pulling disorder called trichotillomania (trik-o-til-o-MAY-nee-uh).

Medications and supplements. Hair loss can be a side effect of certain drugs, such as those used for cancer, arthritis, depression, heart problems, gout and high blood pressure.

Radiation therapy to the head. The hair may not grow back the same as it was before.

A very stressful event. Many people experience a general thinning of hair several months after a physical or emotional shock. This type of hair loss is temporary.

Hairstyles and treatments. Excessive hairstyling or hairstyles that pull your hair tight, such as pigtails or cornrows, can cause a type of hair loss called traction alopecia. Hot-oil hair treatments and permanents also can cause hair to fall out. If scarring occurs, hair loss could be permanent.

PSYCHOLOGICAL IMPACT

Being a disfigurement that can affect a person's sense of self and identity, hair loss is associated with a high prevalence of psychiatric comorbidities. The condition often triggers great psycho-emotional and psychosocial stress, particularly in relation to anxiety, depression, social phobia and personality disorders. Ironically, hair loss can cause these psychological disorders, but the disorders themselves can also trigger, or worsen, hair loss – leading to a vicious circle.

Common, life altering, psychosocial effects include embarrassment, humiliation, low self-esteem, altered self- and body-image, and less enjoyable social engagements. This, in turn, has been shown to result in reduced leisure and outdoor activities and decreased social engagements to avoid negative emotions, leading to self-isolation, anxiety and depression. Clinical symptoms, functional behaviour, and emotional stability in addition to anxiety and worry about hair loss all affect a person's quality of life. These serious psychosocial consequences can cause intense emotional suffering, as well as personal, social and work-related problems.

In medical terms, hair loss can cause antisocial personality disorder, posttraumatic stress disorder, generalized anxiety disorder, major depression, adjustment disorders, obsessive-compulsive disorder, panic disorder and social phobia. Sometimes, it can even lead to suicidal intent.

Diminished quality of life

The disease burden of hair loss has, at times, been compared to the suffering caused by chronic or life-threatening diseases that, at a first glance, are of significantly higher severity. This is not due to the hair loss itself, but rather caused by the reaction to losing one's hair.

There are several scientific studies that underline the profound implications of hair loss on a person's quality of life. For example, an Indian study from 2019 evaluated the quality of life in 200 men experiencing moderate hair loss and found that it was significantly reduced. Their results were age dependent, as younger individuals experienced a larger loss of quality of life. These findings are well in line with previous data.

The psychosocial impact of hair loss is greater for women than men

Hair loss is most common in men, in fact, it affects half of all men over the age of 50 even though it can debut at much younger ages. As a result, the efforts to reduce the stigma and psychosocial burden of hair loss in men has been going on for decades. As we have learned, there is plenty of room for improvement, but many men have come to cope with the idea of losing their hair much thanks to such activities.

However, hair loss also affects women to a large extent and about one in three women suffer from it at some point in their lives. Unlike with men, there has been no strong push to reduce the burden of hair loss experienced by women, who still need to hide their hair loss in order to preserve their femininity. Put simply, in our culture a bald man is socially acceptable, a bald woman is not.

As a natural consequence, there is scientific consensus stating that the distress caused by hair loss is larger for women compared to men. The important link between hair and identity is especially strong for women, and some studies have even reported that women have a psychologically harder time coping with hair loss than the loss of a breast through breast cancer.

Dealing with hair loss, especially something like androgenetic alopecia, isn't just a physical phenomenon. It often hits hard on the emotional side, too.

Ever find yourself feeling a bit down or shy because of your hair? That's pretty normal! Our hair is a big part of who we are, and losing it can influence how attractive we feel, knocking our confidence a bit. And it's not just about looking in the mirror—it can make us want to skip out on hanging out with friends or trying new things because we're worried about what others think.

Have you ever caught yourself spending a lot of time or money on hair care products, trying to fix it? You're not alone. Many people who suffer from hair loss find themselves in the same boat.

Acknowledging and understanding this impact and seeking proper support can be the first step toward managing hair loss and maintaining a healthy state of mind.

Let's dive into what research says about how hair loss can impact our mental well-being. It can be quite eye-opening to see how much our hair and our emotions are connected!

Body Dysmorphic Disorder (BDD)

If you're grappling with hair loss, you might be at risk of developing Body Dysmorphic Disorder. This is a condition where you might obsess over perceived flaws in your appearance, including hair loss. BDD can be deeply distressing and severely impact your daily life and functioning.

Anxiety and depression

Hair loss can act as a significant trigger for anxiety and depression. The emotional burden of losing hair can be as profound as experiencing chronic and severe life-threatening diseases, leading to feelings of hopelessness. In extreme cases, the distress caused by hair loss can escalate to suicidal thoughts. This highlights the need for psychological support and intervention for those severely affected by hair loss.

Impact on work and sexual performance

One of the less discussed but equally essential impacts of hair loss is on confidence, which can extend to your professional and intimate life. There's often a notable decrease in self-esteem, which can affect your performance at work and in sexual relationships.

Psychological impact on children

The emotional effect of hair loss isn't limited to adults. Children with alopecia areata, for instance, often exhibit more psychological problems than their peers. They may be more anxious, depressed, withdrawn, aggressive, or even delinquent. Girls, in particular, tend to be more affected than boys. In some studies, a significant number of children with alopecia areata met the criteria for anxiety disorders.

What to do if you're distressed: Hair loss and self-acceptance

Is hair loss getting you down? There are some positive steps you can take. Let's talk about boosting that confidence back up!

Always remember, you're not alone in this.

Seek supportive communities

Joining support groups where others with alopecia share their experiences can be incredibly beneficial. These groups provide a sense of community and understanding, helping to reduce feelings of isolation, embarrassment, and anxiety. They often feature healthcare professionals as guest speakers, offering valuable insights and advice.

Educate yourself

It is important to understand how hair loss can impact your mental health. Educating yourself about alopecia and its psychological impacts can help you come to terms with your situation. This could include exploring options like wigs if you desire a change.

Professional psychological support

In severe cases of alopecia, where the psychological impact is profound, seeking help from clinical psychology or psychiatric services is recommended. Professionals in these fields can assist in developing coping strategies to deal with the emotional and psychological consequences of hair loss.

Studies have shown that patients receiving psychological support during their hair loss treatment often have an improved prognosis. This support can be an integral part of the treatment process, addressing the physical and mental aspects of hair loss.

Remember, taking these steps is not just about dealing with hair loss—it's about taking care of your overall mental and emotional health.

MALE AND FEMALE PATTERN BALDNESS

F. Male and Female Pattern Baldness

Androgenic alopecia, or pattern baldness, is a hair loss condition that affects both men and women. While this can be a frustrating condition, it's essential to know that there are many available treatments that can help slow down or even reverse hair loss.

This article will review male- and female-pattern baldness signs, what causes it, and potential treatment options.

It's important to note that while the terms "male-pattern baldness" and "female-pattern baldness" are commonly used, hair loss can affect individuals of any sex or gender identity. Also, when research is cited, the sex and gender terms within that reference will be used.

Signs of Male- or Female-Pattern Baldness

Androgenetic alopecia is a type of hair loss commonly affecting females and males. However, it typically presents differently among the sexes. Female-pattern baldness is characterized by thinning hair on the crown (top) of the head, while male-pattern baldness typically involves a receding hairline and baldness on the crown.

Females: Hair Thinning at Crown

The pattern of hair loss in women is different from male-pattern baldness. This condition may cause hair thinning at the crown of the head, typically occurring in women in their 40s or 50s. Women may also experience hair thinning all over the scalp without their hairline receding.

This condition is caused by inheriting specific genes from one or both parents. Hormonal changes that happen during menopause may also trigger it. Androgenetic alopecia rarely results in total baldness in women.

Males: Receding Hairline and Thinning Crown

Male androgenetic alopecia (MAA) is the most common type of hair loss in men. It happens to between 30% and 50% of men by the time they're 50 years old. MAA follows a specific pattern and tends to affect the hair on the temples, the top of the head, and the middle of the front of the scalp.

In men, this condition is commonly referred to as male-pattern baldness, in which hair loss occurs in a distinct pattern that begins above the temples and causes a receding hairline to form the shape of the letter "M." Hair thinning at the crown may eventually lead to partial or complete baldness.

What Causes Pattern Baldness?

Androgenetic alopecia is a type of hair loss caused by a combination of genetic and environmental factors. Even though researchers are studying reasons for this condition, they still can't identify some causes.

However, it is known that androgenetic alopecia is linked to hormones called androgens, especially dihydrotestosterone (DHT). Androgens are important for normal male sexual development during the gestational period (in the womb) and puberty. However, they also help regulate other functions such as hair growth and sex drive. Too much DHT can cause hair loss.

It's important to note that a combination of factors can cause hair loss, and each person's experience is unique. Other genetic and environmental factors that may also contribute to male- and female-pattern baldness include the following:

Genetics

Male- and female-pattern baldness is often inherited from one or both parents.5 Although researchers believe that multiple genes may contribute to androgenetic alopecia, scientific studies have confirmed that variations in a single gene, known as AR, play a role.2

Hormonal Changes or Imbalances

Changes in hormone levels, such as those that occur during menopause, can contribute to hair loss. Polycystic ovary syndrome (PCOS) is a hormonal imbalance that causes cysts on the ovaries and symptoms, including hair loss.

Aging

As people age, hair follicles shrink, leading to thinner hair and eventual hair loss.

Medications

Certain medications, such as those used for cancer, arthritis, and depression, can cause hair loss. Hair loss typically reverses after discontinuing most medications.

Medical Conditions

Several medical conditions can cause hair loss, including:

- Alopecia areata
- Scalp infections
- Thyroid disorders
- Anemia (lack of healthy red blood cells)
- Syphilis (a sexually transmitted infection)
- Ringworm of the scalp (a contagious fungal disease)
- Bacterial infections of the scalp
- High fever or severe infection
- Childbirth
- Major surgery, major illness, sudden blood loss
- Severe emotional stress
- Crash diets, especially those that do not contain enough protein
- Drugs, including retinoids, birth control pills, beta-blockers, calcium channel blockers, certain antidepressants, and NSAIDs, including Advil or Motrin (ibuprofen)

Nutritional Deficiencies

Deficiencies in nutrients such as iron, vitamin D, and protein can cause hair loss.

Hairstyling Practices

Certain hairstyles, such as pulling hair tightly into braids or ponytails, can cause hair loss over time.

Stress

Extreme stress, such as that caused by illness, surgery, or trauma, can lead to hair loss.

Other Causes

Other causes of baldness may include:

- Burns

- Excessive shampooing and blow-drying
- Nervous habits like continual hair pulling or scalp rubbing
- Hairstyles that put too much tension on the hair follicles

HAIR FOLLICLE ANATOMY

Anatomy of a follicle

A hair follicle is a tunnel-shaped structure in the epidermis (outer layer) of the skin. Hair starts growing at the bottom of a hair follicle. The root of the hair is made up of protein cells and is nourished by blood from nearby blood vessels.

As more cells are created, the hair grows out of the skin and reaches the surface. Sebaceous glands near the hair follicles produce oil, which nourishes the hair and skin.

The hair follicle is a skin appendage located deep in the dermis of the skin.

Its function is to produce hair and enclose the hair shaft. A hair follicle consists of two main layers, an inner (epithelial) root sheath and an outer (fibrous) root sheath. At the base of the hair follicle is the hair bulb, which houses the dermal papillae and hair matrix cells. The hair bulb and inner epithelial layer generates hair. More specifically, the hair matrix keratinocytes proliferate to form the growing hair shaft while the dermal papilla regulates the hair's growth and the inner root sheath provides a tube shaped channel for the hair. The outer fibrous layer surrounds the hair follicle. It is formed from dermal connective tissue, supplies blood to the epithelial sheath and holds undifferentiated hair stem cells. The cells of the hair follicle actively change during the growth cycle of a hair.

Each hair follicle is associated with a specialized smooth muscle, several sebaceous glands and free nerve endings. The arrector muscle of hair, or arrector pili muscle, acts to make the hair 'stand on end' when we have 'goose bumps' from feeling cold or scared. Sebaceous glands release an oily substance (sebum) into the hair follicle. Sebum keeps the hair soft and acts as a bactericide. Nerve endings associated with hair follicles provide sensory mechanoreceptor input relating to hair movement and deformation.

Hair has a number of important functions. For example, it provides a protective cushion layer for skin, protects against ultraviolet light, shields eyes, filters air, is involved in thermoregulation and sensation, and is associated with secondary sexual characteristics.

The life of a follicle

On average, your hair grows about half an inch each month. Your hair growth rate can be affected by your age, hair type, and your overall health.

Hair follicles aren't just responsible for how much your hair grows, they also influence what your hair looks like. The shape of your follicle determines how curly your hair is. Circular follicles produce straight hair while oval follicles produce curlier hair.

Hair follicles also play a part in determining the color of your hair. As with skin, your hair gets its pigment from the presence of melanin. There are two types of melanin: eumelanin and pheomelanin.

Your genes determine whether you have eumelanin or pheomelanin, as well as how much of each pigment you have.

An abundance of eumelanin makes hair black, a moderate amount of eumelanin makes hair brown, and very little eumelanin makes hair blonde. Pheomelanin, on the other hand, makes hair red.

This melanin is stored in hair follicle cells, which then determine the color of the hair. Your follicles can lose their ability to produce melanin as you age, which results in the growth of gray or white hair.

If hair is pulled out of the hair follicle, it can regrow. It's possible that a damaged follicle will stop producing hair. Certain conditions, such as alopecia, can cause follicles to stop producing hair altogether.

TEMPORARY VS. PERMANENT HAIR LOSS

Hair loss is a very common concern–and it's not even an exaggeration to say that many of us will deal with hair loss or hair thinning hair at some point in our lives. For some, hair loss is a "natural" phenomenon, almost something to be expected: they've seen older relatives deal with it, and they expect they'll have to deal with it too when the time comes. For others, hair loss comes as a major surprise: they'll start noticing hair loss during or after a period of stress, after pregnancy, or even during a change of seasons. There are multiple types of hair loss, and it's important to understand them–first, so you know what you're dealing with, and second, so you know how to correct it (if you choose to!)

Hair loss in general can be a very distressing experience. You can wake up with more hair on your pillows, or seeing them a lot more on your shower drain when you shower, or even noticing more strands on your hair brush when you comb your hair. However, not all hair loss is permanent. Sometimes, there are things that we can and can't control that can produce hair loss temporarily. Here are three things that can cause temporary hair loss:

Natural Cycle – The average human loses around 50 to 100 strands of hair per day. This is perfectly normal and is part of your hair's life cycle. Your hair undergoes through three phases of its life cycle: the telogen phase where there's not much shedding, the exogen phase where more shedding is observed, and the anagen phase where newer strands of hair grow in the place of the old ones. Studies show that the exogen phase happens to most people during the fall and winter time. However, there is cause for concern where casual brushing or combing of the hair causes MANY strands to fall off all the time. This might mean that there is an underlying cause for hair loss.

External Factors – Temporary hair loss can be caused by the many chemicals used in straightening, dyeing or curling your hair can cause more hairs to fall off. Styling products can cause hair loss as well, like in gels, mousses, hair sprays and styling waxes, especially when combined with heat styling tools like flat irons or curling irons. There is also this condition called traction alopecia, where tight hairstyles like ponytails and cornrows where a lot of pressure is being applied on the scalp, can cause the strands of hair to weaken and fall off. Once the chemical or hair styling technique causing the hair loss has been identified, you can pause on that for a bit and the hair will regrow. Permanent hair loss on the other hand will not slow down whether or not you change your hairstyle, but can be accelerated by further use of chemicals and aggressive styling techniques.

Identifiable Causes – There are many issues that can cause temporary hair loss. Stress or shock can be one of them. Pregnancy, menopause, and other changes in your body's hormone levels is also another. Once your body has adjusted or has passed these phases, usually the hair grows back. Permanent and rapid hair loss however can be caused by genetics where you might be at risk for developing baldness due to your family's history, or certain health conditions like lupus, thyroid disease or pattern baldness, also known as alopecia. Only your GP and your dermatologist can truly determine what may be causing your hair loss so always seek their guidance when you start noticing your hair to be thinning.

HAIR HEALTH AND NUTRITION

Some of the best foods for hair growth are foods with high nutritional value, like eggs, leafy greens, and fatty fish. Deficiencies in nutrients can affect hair health.

Best Foods for Hair Growth

Eggs for protein and biotin

Eggs are a great source of protein and biotin, two essential nutrients for hair growth.

Berries for antioxidants and collagen production

Berries are loaded with beneficial compounds and vitamins that may support hair growth. This includes vitamin C, which has strong antioxidant properties.

Spinach for vitamin A, vitamin C, iron, and folate·

Spinach is a healthy green vegetable loaded with beneficial nutrients like folate, iron, and vitamins A and C, which are important for hair growth.

Fatty fish for omega-3 fatty acids and protein

Fatty fish like salmon, herring, and mackerel have nutrients that may promote hair growth.

They are excellent sources of omega-3 fatty acids, which may support hair growth.

Sweet potatoes for beta-carotene

Sweet potatoes are a good source of beta-carotene. The body converts this compound into vitamin A, which is linked to hair health.

Nuts for vitamin E, vitamin B, zinc, and healthy fats

Nuts are tasty, convenient, and contain a variety of nutrients that are important for hair growth.

For example, an ounce (28 grams) of almonds provides 48% of your daily vitamin E needs.

Avocados for healthy fats and vitamin E

Avocados are delicious, nutritious, and a great source of healthy fats.

Seeds for vitamin E, zinc, and selenium

Seeds are rich in nutrients with relatively few calories. Many of these nutrients also support hair growth. These include vitamin E, zinc, and selenium.

Sweet peppers for vitamins C and A

Sweet peppers provide antioxidant-rich vitamin C, which may support hair growth.

One yellow pepper provides up to 456% of the daily vitamin C needs of females and 380% for males.

Oysters for zinc

Oysters are one of the best food sources of zinc. One medium oyster provides up to 96% of daily zinc needs for females and 75% for males.

Beans for protein, zinc, and more

Beans are a great plant-based source of protein, which is essential to hair growth.

Soybeans for spermidine

Studies have shown that compounds in soybeans may promote hair growth. One of these compounds is spermidine, which is abundant in soybeans.

Meat for protein and iron

Meat contains nutrients that may aid hair growth, including protein and iron.

What is the effect of nutritional deficiency on hair?

Your hair health and how fast it grows depends on many factors, including:

- age
- overall health
- genetics
- environmental exposure
- medications
- diet

Although you can’t change some of these factors, you likely have more control over your diet.

Vitamins and minerals from food play an important role in the hair follicle growth cycle and cellular turnover.

A diet lacking in needed nutrients can lead to hair loss, including deficiencies in:

- vitamins B12 and D
- biotin
- riboflavin
- iron

Eating a balanced diet rich in these vitamins and minerals may help promote hair growth, especially if your hair loss is due to poor nutrition.

While more research is needed to understand the connection between micronutrients and hair loss, ensuring you're getting enough of these 13 foods rich in nutrients that support hair growth is a good idea.

THERMOREGULATION AND SOCIAL ROLE

Introduction

Hair is often viewed through the lens of beauty, fashion, or age—but its functions are far deeper and more consequential than appearances suggest. From thermoregulation to shaping social identity, human hair, particularly scalp hair, holds significant biological and psychological value. Hair loss, therefore, isn't merely cosmetic; it's a multidimensional event with physiological, psychological, and evolutionary repercussions.

Thermoregulation: An Evolutionary Asset

Humans are among the few mammals that exhibit a largely hairless body while retaining dense scalp hair. This seemingly paradoxical trait is an evolutionary refinement linked to efficient heat regulation. As our ancestors adapted to open, sun-exposed environments, a shift to bipedalism brought increased exposure to direct solar radiation. In this context, body hair became a hindrance to evaporative cooling, while scalp hair evolved as a protective shield.

Studies using thermal manikins have shown that scalp hair—especially tightly curled textures—minimizes heat gain from solar radiation while balancing the need for sweat-based cooling. The structural properties of coiled hair appear to offer optimal protection from the sun while allowing heat dissipation from the body. This interplay illustrates the fine-tuned trade-offs that shaped human morphology.

While scalp hair serves as a solar insulator, it does slightly reduce evaporative cooling from the scalp. However, this is offset by reducing overall sweat loss, thereby conserving hydration—a critical advantage in arid conditions.

Hair Loss and Its Effect on Thermal Balance

In the context of thermoregulation, hair loss—particularly on the scalp—can reduce the body’s ability to shield the brain from direct solar heat. Although modern tools such as hats, air-conditioning, and indoor living mitigate this risk, the evolutionary implications remain intriguing. Individuals with androgenetic alopecia may experience a slightly higher susceptibility to solar heat stress in hotter climates.

Paradoxically, the human body’s lack of dense body hair has been linked to increased physical endurance. This supports the hypothesis that hair loss on the body facilitated long-distance running in hot environments by promoting greater sweat efficiency. Yet, the conservation of scalp hair illustrates its enduring functional importance.

Biological Mechanisms Behind Hair Loss

Hair follicles operate through a cyclical process involving four stages: anagen (growth), catagen (regression), telogen (rest), and exogen (shedding). Disruptions in this cycle due to hormonal shifts, genetic predispositions, chronic stress, or inflammatory responses can lead to various forms of hair loss.

Androgenetic alopecia—the most prevalent form—is influenced by sensitivity to dihydrotestosterone (DHT), which shortens the growth phase and miniaturizes follicles. While often framed as a cosmetic issue, it can potentially alter thermoregulatory capacity and psychological well-being.

In recent years, systemic inflammation and oxidative stress have been implicated in follicular degeneration. Chronic, low-grade inflammation in the scalp microenvironment can hinder nutrient delivery and compromise follicle function, contributing to progressive hair loss. This has fueled interest in integrative treatment strategies that incorporate nutrition, stress management, and sleep regulation alongside topical or procedural therapies.

Social Identity and Psychological Impacts

Hair also carries immense social symbolism. Across cultures, it denotes identity, gender expression, spiritual beliefs, and social hierarchy. Healthy hair is often equated with youth, vitality, and desirability. Therefore, its absence—especially when premature—can significantly affect confidence and interpersonal relationships.

Research shows that hair loss can result in increased self-consciousness, anxiety, and social withdrawal, particularly in cultures where physical appearance is strongly linked to professional or romantic success. For many women, hair is intertwined with femininity, empowerment, and cultural norms—heightening the psychological toll when it’s lost.

In professional settings, particularly in visually exposed roles such as media, sales, or public leadership, visible hair thinning may subtly influence perceptions of credibility, energy, or age. Although these associations are sociocultural constructs, their impacts are tangible.

Holistic Management and Forward Outlook

Effective management of hair loss necessitates a multidimensional approach. Topical minoxidil, oral finasteride, PRP therapy, low-level laser treatments, and hair transplantation are among the standard interventions. However, emerging strategies focus on correcting root causes such as hormonal imbalances, dietary gaps, gut health, and chronic inflammation. A well-rounded plan often includes anti-inflammatory nutrition, micronutrient optimization (e.g., iron, zinc, biotin), and stress modulation through practices like mindfulness or yoga.

Importantly, addressing hair loss should extend beyond treatment to include emotional and psychological support. Counseling, patient education, and realistic expectations play a crucial role in navigating this often distressing experience.

Conclusion

Hair loss straddles the line between biology and identity. It touches evolutionary adaptations for heat regulation and ripples into how individuals perceive themselves and are perceived by others. By viewing hair not merely as an aesthetic feature but as a marker of physiological and social significance, we can better understand its loss as a multidimensional phenomenon—one that deserves both scientific insight and empathetic care.

ANDROGENETIC ALOPECIA

Androgenetic alopecia is a common form of hair loss in both men and women. In men, it is also known as male pattern baldness, and in women, it is also known as female pattern hair loss.

In men, hair is lost in a well-defined pattern, beginning above both temples. Over time, the hairline moves back (recedes) to form a characteristic "M" shape. Hair also thins at the top of the head (vertex or crown), often progressing to partial or complete baldness.

The pattern of hair loss in women differs from male-pattern baldness. In women, the hair becomes thinner at the top of the head, and the middle part widens. The hairline does not typically recede. Androgenetic alopecia in women rarely leads to total baldness.

Androgenetic alopecia in men has been associated with several other medical conditions, including coronary heart disease and enlargement of the prostate. Additionally, prostate cancer, disorders of insulin resistance (such as diabetes and obesity), and high blood pressure (hypertension) have been related to androgenetic alopecia.

In women, this form of hair loss is associated with an increased risk of polycystic ovary syndrome (PCOS). PCOS is characterized by a hormonal imbalance that can lead to irregular menstruation, acne, excess hair elsewhere on the body (hirsutism), and weight gain.

Causes

A variety of genetic and environmental factors likely play a role in causing androgenetic alopecia. Although researchers are studying risk factors that may contribute to this condition, most of these factors remain unknown. Researchers have determined that this form of hair loss, particularly in men, is related to hormones called androgens, specifically an androgen called dihydrotestosterone (DHT). Androgens play a role in female pattern hair loss, but other factors that are not yet known are also involved.

Androgens are important for normal male sexual development before birth and during puberty. Androgens also have other important functions in both males and females, such as regulating hair growth and sex drive.

Hair growth begins under the skin in structures called follicles. Each strand of hair normally grows for 2 to 6 years, goes into a resting phase for several months, and then falls out. The cycle starts over when the follicle begins growing a new hair.

Androgens help control this cycle. However, too much stimulation of hair follicles by androgens may lead to a shorter growth period, resulting in shorter and thinner strands of hair. The growth of new hair to replace strands that are shed is also delayed. Together, these changes lead to hair thinning or loss.

Researchers suspect that variants (also called mutations) in several genes play a role in androgenetic alopecia. However, scientific studies have confirmed only that variations in one gene, the AR gene, are involved in this condition. The AR gene provides instructions for making a protein called an androgen receptor. Androgen receptors allow the body to respond appropriately to DHT and other androgens. Studies suggest that variations in the AR gene result in androgen receptors that are more easily stimulated by androgens than normal, leading to increased activity of the receptors in hair follicles. It remains unclear, however, how these genetic changes increase the risk of hair loss in men and women with androgenetic alopecia.

Researchers continue to investigate the connection between androgenetic alopecia and other medical conditions, such as coronary heart disease and prostate cancer in men and polycystic ovary syndrome in women. They believe that some of these disorders may be associated with elevated androgen levels, which may help explain why they tend to occur with androgen-related hair loss.

TELOGEN EFFLUVIUM

Telogen effluvium (TE) is a common form of hair loss characterized by diffuse shedding of hairs. It occurs when a significant number of hair follicles prematurely enter the telogen (resting) phase. Dermoscopy, or trichoscopy when referring to hair and scalp, is an invaluable tool in diagnosing TE, allowing for detailed visualization of the scalp and hair follicles.

Hair is an essential structure of mammalian skin. As it is associated with beauty and self-image, the loss of scalp hair can cause significant distress to patients. Medically significant and actionable causes of diffuse hair loss include androgenetic hair loss, diffuse-type alopecia areata (AA), anagen effluvium and telogen effluvium (TE).

TE was first described in 1961 by Albert Kligman who studied the response of the hair follicle under physiological stress. Unlike the hairs on our body (and mammalian fur), which are mostly in the telogen (rest) phase, our scalp hairs are mostly in the anagen (growth) phase (approximately 90%). Kligman suggested that following a stressful event, anagen hair follicles of the human scalp undergo an acceleration of their hair cycle and enter the telogen phase prematurely (through mechanisms unknown). This leads to shedding en masse about 2-3 months after the precipitating event, which prompts the patient to seek medical advice. Fortunately, this acute form of TE usually resolves spontaneously, with full regrowth of hair. However, the management of these patients before regrowth occurs can be challenging, and most interventions have not been shown to be very effective. In this review, we will discuss our current understanding of TE, summarise the treatments tried, and propose ways to advance our approach to TE.

Etiology and Pathophysiology

TE typically results from a disruption in the hair cycle due to various triggers such as severe illness, stress, hormonal changes, nutritional deficiencies, or medications. This disruption leads to an increased proportion of hairs in the telogen phase, causing noticeable hair shedding.

Dermoscopic Features of Telogen Effluvium

Hair Density

Reduced hair density is a hallmark of TE, more apparent through trichoscopic examination.

Hair Diameter Diversity

TE often shows a normal range of hair shaft diameter, contrasting with the variability seen in androgenetic alopecia.

Telogen Hairs

An increased number of telogen hairs, characterized by a white bulb at the end, are visible.

Scalp Features

The scalp usually appears normal without significant erythema, scaling, or scarring.

Symptoms and Signs

Patients with TE often report hairs of varying lengths in the shower, on the pillow or around the house. There will be a noticeable reduction in hair density, with complaints about a more visible scalp, or a thinner ponytail. Patients with chronic TE will also experience daily hair loss, but may not report accompanied changes in hair density.

ALOPECIA AREATA

What is alopecia areata?

Alopecia areata is an autoimmune condition affecting hair follicles causing hair loss. It typically presents with discrete bald patches on the scalp but can cause hair loss from all hair-bearing areas on the body.

Alopecia is a Latin term meaning hair loss, and areata refers to the patchy nature of the hair loss. The term alopecia areata is considered an umbrella term, which encompasses a number of variants including alopecia areata totalis or universalis, ophiasis, ophiasis inversus, and diffuse alopecia areata.

What causes alopecia areata?

- A normal hair follicle cycles through multiple phases:
- Anagen is the active growth phase lasting one to eight years
- Catagen is a short involution phase lasting several weeks
- Telogen is the resting phase lasting several months
- Exogen is the shedding of the hair.

The exact mechanism responsible for hair loss in alopecia areata remains unclear. It is hypothesised that loss of immune privilege in anagen hair follicles plays a key role in the pathogenesis, and genetic susceptibility is also thought to contribute.

Immune privilege hypothesis

- Normal anagen hair follicles are thought to exhibit immune privilege, rendering them exempt from immune surveillance and protected against autoimmune attack.
- Protective immune privilege may be lost in alopecia areata, allowing hair follicle autoantigens to be presented to autoreactive CD8+ T cells.
- Subsequent autoimmune attack of the anagen follicle causes premature transition of the follicle into the telogen phase with ultimate loss of the hair.

This hypothesis is supported by the observation of a dense perifollicular infiltrate of T cells on histopathological examination of anagen follicles in alopecia areata; an area that is normally sparse of immune cells.

Genetic factors

- Alopecia areata has a strong hereditary component.
- At least 16 genetic risk loci have been detected.
- Include numerous human leukocyte antigen (HLA) class I and II alleles, and several alleles of genes involved in immune pathways, hair pigmentation, and response to oxidative stress.
- Mode of inheritance appears to be complex, with environmental influences also at play.

CICATRICIAL ALOPECIA

What is central centrifugal cicatricial alopecia?

Central Centrifugal Cicatricial Alopecia (CCCA) is a form of scarring alopecia on the scalp that results in permanent hair loss. It is the most common form of scarring hair loss seen in black women. However, it may be seen in men and among persons of all races and hair colour (though rarely). Middle-aged women are most commonly affected.

What is the cause of central centrifugal cicatricial alopecia?

The exact cause of CCCA is unknown and is likely multifactorial. A genetic component has been suggested, with a link to mutations of the gene PADI3, which encodes peptidyl arginine deiminase, type III (PADI3), an enzyme that modifies proteins that are essential to formation of the hair-shaft. Hair care practices, such as the use of the hot comb, relaxers, tight extensions and weaves, have been implicated for decades, but studies have not shown a consistent link. Other proposed causative factors include fungal infections, bacterial infections, autoimmune disease, and genetics. One study has shown an association with medical conditions such as type 2 diabetes mellitus.

What are the clinical features of central centrifugal cicatricial alopecia?

Hair loss typically begins at the vertex or mid-scalp and extends outward in a centrifugal manner. There is loss of the follicular openings on examination of the scalp. Thus, the scalp may appear shiny. While some persons do not have symptoms, tenderness, itch and burning are common. Hair breakage may also be an early sign of CCCA. Hair loss is slowly progressive. A photographic scale has been developed to rate the severity of the central hair loss.

How is the diagnosis of central centrifugal cicatricial alopecia made?

Early diagnosis of CCCA is important because medical intervention can prevent further progression that often results in extensive, permanent hair loss. Diagnosis is based on clinical features, scalp biopsy and exclusion of other hair loss disorders.

Scalp biopsy should be taken from an active edge of a patch of alopecia rather than the centre of a scarred area. Histopathology reveals a lymphocytic inflammatory infiltrate (inflammatory cells) around the infundibulum (base of the hair follicle), and fibrosis (scarring). Premature desquamation (peeling) of the inner root sheath is a common feature.

Treatment of central centrifugal cicatricial alopecia

The goal of therapy is to halt progression of disease and prevent further hair loss. In areas where the hair follicle has been replaced with fibrosis, regrowth is not possible. As the exact cause is not known, targeted therapy for CCCA is not available.

Treatment options for CCCA include anti-inflammatory agents such as:

- Potent topical steroids (eg clobetasol) or intralesional steroids
- Calcineurin inhibitors: tacrolimus ointment, pimecrolimus cream
- Tetracyclines (eg doxycycline 100 mg twice daily, taken for several weeks to months)
- Hydroxychloroquine
- Ciclosporin

Hair transplantation can be considered in individuals with well-controlled CCCA for at least one year. However, graft survival is low.

Discontinuation of traumatic hair care practices is an essential aspect of treatment of CCCA.

Women with CCCA are encouraged to consider natural hairstyles.

Relaxers should be performed by a professional, no more frequently than every 6-8 weeks. The scalp should not burn as a result of relaxer application.

- Minimise heat application (hooded dryers, blow dryers, hot combs and flat irons)
- Avoid tight braids and weaves/extensions
- Avoid hair style practices associated with discomfort, scalp irritation or scale
- It is important for providers to know that frequency of shampooing the hair varies among Black women. Many shampoo every 1–2 weeks. This is the norm and prevents excessive dryness.

Minoxidil solution may help stimulate growth in viable follicles. Seborrhoeic dermatitis should be treated with appropriate medicated shampoos and topical anti-inflammatory agents as needed.

Hair transplantation can be considered in individuals with well-controlled CCCA that has been stable for at least one year. However, graft survival is low.

Adjuvant, low-dose, oral metformin has been associated with symptomatic improvement in a small case series, warranting further study.

NUTRITIONAL DEFICIENCIES

Patients presenting with hair loss should be screened by medical history, dietary history and physical exam for risk factors for nutrient deficiency. If warranted, laboratory studies may be performed. In patients with no risk factors, further laboratory evaluation searching for nutritional deficiencies is not warranted. For patients with nutritional deficiencies, it is clear that those deficiencies should be corrected. Further research is required to determine whether any benefit exists for nutrient supplementation in the absence of documented deficiency. At this time, patients must be informed that such research is lacking and that in fact some supplements carry the risk of worsening hair loss or the risk of toxicity.

Nutritional deficiency may impact both hair structure and hair growth. Effects on hair growth include acute telogen effluvium (TE), a well-known effect of sudden weight loss or decreased protein intake, as well as the diffuse alopecia seen in niacin deficiency. Studies have also reported potential associations between nutritional deficiency and chronic TE, androgenetic alopecia (AGA), female pattern hair loss (FPHL), and alopecia areata (AA).

Effects of nutrient deficiency and supplement use on hair loss.

Iron

Chronic diffuse telogen hair loss with iron deficiency anemia.

In the absence of anemia, studies are not clear whether there is a significant link between ID and hair loss.

Zinc

Statistically lower serum zinc concentrations in a study of 312 patients with AA, MPHL, FPHL, or TE compared to 30 healthy controls

Niacin (Vitamin B3)

Diffuse hair loss with pellagra due to severe deficiency.

No known studies regarding serum niacin levels in patients with hair loss.

Fatty acids

Loss of scalp and eyebrow hair

Selenium

In animal studies, rats deficient in selenium display sparse hair growth, while knockout mice lacking specific selenoproteins exhibit progressive hair loss after birth, ultimately leading to almost total alopecia.

One case report of selenium deficiency in a young child reported clinical manifestations of dry skin and sparse, light-colored hair, improving after supplementation.

Vitamin D

Serum vitamin D2 levels in a study of eight females with either TE or FPHL were shown to be significantly lower than in 40 age-matched female controls, with decreased levels correlating to increased disease severity.

Vitamin A

Deficiency has no known link to hair loss.

Vitamin E

Deficiency has no known link to hair loss.

Folic Acid

No significant difference in serum folate levels in a study of 91 patients with diffuse hair loss and 74 healthy controls.

Biotin

Deficiency can result in alopecia, eczematous skin rash, conjunctivitis, and candidiasis.

Amino Acids and Proteins

Protein malnutrition can result in hair loss.

Genetic predispositions

Hair loss is a pervasive issue that can significantly impact an individual's self-esteem and overall quality of life. While genetic hair loss, age, lifestyle choices, and environmental conditions contribute to hair loss, genetics play a fundamental role in determining whether and to what extent hair loss occurs. In this article, we will explore genetic hair loss, focusing on hereditary factors, the influence of genetics on pattern baldness, available genetic testing options, and more. In men, Male Pattern Baldness (MPB) often begins with a distinctive 'M'-shaped hairline recession, typically starting in their 20s or 30s. Astonishingly, around 80 percent of men experience MPB by age 80. For women, hair loss, mainly Female Pattern Hair Loss (FPB), tends to manifest after menopause, typically following the Ludwig pattern, marked by a gradual thinning along the hair part. Surprisingly, nearly half of women will experience FPB by age 80. Androgenetic alopecia, encompassing MPB and FPB, is the most prevalent cause of hair loss.

Hereditary Factors Contributing to Hair Loss

Alopecia, or hair loss, is a complex disorder impacted by genetic, hormonal, and environmental factors. But the hereditary components at the root of genetic hair loss demand closer examination:

Genetic Predisposition: The fundamental cause of hereditary hair loss is genetic predisposition. You have a higher chance of developing hair loss if your parents or grandparents struggle with it. This inclination can be acquired from your maternal or paternal heritage; it is not specific to one side of the family. Researchers have identified specific genes linked to this tendency, while it is probable that numerous genes are at play.

Androgenetic alopecia: Pattern baldness is a genetic condition that causes hair loss in both genders. Androgenetic alopecia is the medical word for this ailment. A recognizable pattern of hair loss or thinning distinguishes it. In men, it frequently starts with a thinning hairline and progresses to a crown bald patch formation. Instead of prominent bald spots, it usually causes a widespread thinning of the hair in women. The presence of androgens, a class of hormones that includes testosterone and dihydrotestosterone (DHT), and a complex interaction of hereditary variables drive the origin of this illness. Genetic differences influence the response of the hair follicles to these hormones in androgen receptors and enzymes involved in hormone metabolism, which eventually causes shrinkage and hair loss.

Key Highlights

Genetic Predisposition: Since genetic hair loss can be inherited from both sides of your family, your family history greatly influences your risk of hair loss.

Androgenetic Alopecia: Androgenetic alopecia, also known as pattern baldness, is a hereditary hair loss controlled by hormonal and genetic variables.

Genetic Influence: By increasing the sensitivity of hair follicles to hormones like DHT, genetic factors, including androgen receptors and specific genes, contribute to the onset of pattern baldness.

Genetic Testing: Through medical genetic testing, direct-to-consumer DNA testing, and genetic counseling, individuals can determine their hereditary risk of hair loss.

Female Hair Loss: Similar genetic causes can contribute to hereditary hair loss in women. Women can identify suitable treatment alternatives by speaking with experts.

Hormonal imbalances

What Hormones Are Responsible for Hair Growth?

In a healthy individual, hair grows at a rate of around ½ inch each month, or the equivalent of 6 inches per year.

While the speed at which your hair grows is dependent on a variety of factors, hormones play a huge role.

The hormones involved in hair growth include:

- Androgens
- Estradiol
- Progesterone
- Prolactin
- Thyroid gland hormones
- Melatonin
- Corticotropin-releasing hormone (CRH)
- Adrenocorticotropic hormone (ACTH)
- Thyrotropin-releasing hormone (TRH)
- Cortisol
- Galanin (GAL)

"Can hormone imbalance cause hair loss?"

Definitely.

In fact, an imbalance of hormones is the most common cause of hair loss in both men and women.

And in both sexes, the incidence of hair loss increases with age.

If you are concerned about current or future hair loss, Nutrition Response Testing at HealthierU can identify any hormonal imbalance you may have and determine the exact lifestyle and dietary changes you need to make to restore your hair growth.

What Hormones Cause Hair Loss in Females?

Hormonal imbalance hair loss in females is the result of unbalanced levels of:

- Estrogen
- Progesterone
- Testosterone

Hair loss with hormone imbalance is partly genetic, so a woman's risk of hair loss is higher if other female family members have also experienced hair loss.

What Hormones Cause Hair Loss in Males?

If you are a man, the stats for maintaining a full head of hair can look grim.

Approximately 35 million men in the United States will suffer some type of hair loss during their lifetime.

And roughly 25 percent of men with hereditary male pattern baldness (androgenetic alopecia) begin losing their hair before their 21st birthday.

By the time they reach 35, around 66 percent of all men will have some degree of hair loss.

While genetics play a major role in hair loss, hormones are also a huge piece of the hair loss puzzle.

Hormonal Imbalance Hair Loss: 4 Common Causes

Hormonal imbalance hair loss can occur for a wide variety of reasons.Sometimes it is triggered by hormonal changes, such as pregnancy or menopause.In other cases, factors such as stress or irregular thyroid levels may be affecting your hairline.Let's take a look at the 4 most common causes of hair loss with hormone imbalance.

1: Irregular Thyroid Levels

Located in the front of your neck, your thyroid gland releases 2 hormones:

- Triiodothyronine (T3)
- Thyroxine (T4)

2: Pregnancy

During pregnancy, the body ups its levels of progesterone and estradiol (a form of estrogen) - both of which are amazing for your hair.

3: Menopause

During menopause, a woman's estrogen and progesterone levels drop dramatically.

4: Stress

There are 3 types of hair loss associated with elevated levels of stress:

Alopecia areata - In alopecia areata, the body's immune system attacks the hair follicles — resulting in substantial loss of hair.

Telogen effluvium - Here, excessive stress pushes many of the hair follicles into a phase of "resting," which results in the gradual loss of hair.

Trichotillomania - This disorder results in an irresistible urge to pull out the hair of your scalp, eyebrows, or other areas of the body. It may be a way of dealing with negative emotions, such as stress, tension, boredom, or loneliness.

Ultimately, testosterone and thyroid levels are to blame for hormonal imbalance hair loss in men.

Nutritional deficiencies, including biotin deficiency

Micronutrient deficiencies

Hair is made up of two main structures — the hair shaft, which is what you see, and the hair follicle, which is hidden underneath the skin. Hair grows from the hair follicle.

Hair typically grows at a rate of 0.35 mm per day. The scalp sheds about 100 hairs per day, which can increase with hair care practices like washing and brushing.

Hair follicles are highly active and sensitive. In fact, hair follicle cells are among the most rapidly dividing cells in your body, so it's no surprise that nutrient deficiencies can negatively affect hair growth.

Vitamin D. Vitamin D is essential for creating the cells that develop into hair follicles. It also supports healthy bones and your immune system. If you have hair loss and low vitamin D levels, your doctor may recommend vitamin D supplements.

Iron. Iron is responsible for carrying oxygen to your hair follicles so your hair can grow. Iron supplements may be recommended if you have hair loss as well as iron deficiency that is confirmed by laboratory tests. Too much iron can be toxic, so supplements should be taken exactly as prescribed by your doctor.

Vitamin C. Vitamin C is necessary to absorb iron from your diet. If you have both hair loss and iron deficiency, vitamin C supplements can help.

Other nutrients that may affect hair loss

In addition to the vitamins and minerals listed above, research has found that deficiencies in the following nutrients are associated with hair loss (6Trusted Source, 16Trusted Source, 17Trusted Source, 18Trusted Source):

- copper
- biotin
- vitamin B12
- folate
- riboflavin

Keep in mind that a number of factors may cause hair loss, including one or more nutrient deficiencies.

If you think that you may be experiencing hair loss due to a nutrient deficiency, talk with a healthcare professional. They may suggest you get a blood test to assess your micronutrient levels and rule out deficiencies.

There is conflicting scientific evidence supporting the benefit of vitamin A, vitamin E, zinc, selenium, vitamin B2 (riboflavin), vitamin B3 (folate), vitamin B7 (biotin), and vitamin B12 for hair loss. Your doctor can make recommendations tailored to your needs based on laboratory test results.

Vitamin and Mineral deficiencies and hair loss

You may experience hair loss if you are deficient in any of the vitamins and minerals that are essential for healthy hair. As discussed, your doctor can test for some vitamin and mineral deficiencies using blood tests, and can make recommendations based on these findings. Addressing any deficiencies through diet and supplementation may prevent hair loss and support hair growth.

However, shortfalls in these micronutrients are rarely the only cause of hair loss. If your hair loss is caused by another underlying medical condition, or a particular stressor, then diet and supplementation may not provide a noticeable benefit.

Stress and Hair Loss

Why does stress cause hair loss?

Yes, stress and hair loss can be related.

Though we tend to think of stress as a psychological issue, it can affect your body. If you've ever experienced a period of significant stress you'll know it can cause a long list of symptoms, including problems sleeping, headaches, and heartburn.

Stress symptoms are linked to the body's "fight, flight or freeze" response. This is a survival response to stressful or potentially dangerous situations. Our body releases stress hormones such as cortisol which help us through this particular situation.

But if the stress is ongoing (also known as "chronic"), we might have an excess of stress hormones circulating through our body. This can have a negative effect on your body - and it can also cause hair loss.

Stress pushes a large number of hair follicles into the resting phase where they stop growing. Then within a few months these hairs might suddenly fall out. You may notice this when brushing or washing your hair.

Stress-related hair loss types

Three types of hair loss can be associated with high stress levels:

Telogen effluvium. In telogen effluvium (TEL-o-jun uh-FLOO-vee-um), significant stress pushes large numbers of hair follicles into a resting phase. Within a few months, affected hairs might fall out suddenly when simply combing or washing your hair.

Trichotillomania. Trichotillomania (trik-o-til-o-MAY-nee-uh) is an irresistible urge to pull out hair from your scalp, eyebrows or other areas of your body. Hair pulling can be a way of dealing with negative or uncomfortable feelings, such as stress, tension, loneliness, boredom or frustration.

Alopecia areata. A variety of factors are thought to cause alopecia areata (al-o-PEE-she-uh ar-e-A-tuh), possibly including severe stress. With alopecia areata, the body's immune system attacks the hair follicles — causing hair loss.

Stress and hair loss don't have to be permanent. And if you get your stress under control, your hair might grow back.

If you notice sudden or patchy hair loss or more than usual hair loss when combing or washing your hair, talk to your doctor. Sudden hair loss can signal an underlying medical condition that requires treatment. If needed, your doctor might also suggest treatment options for your hair loss.

Does stress-related hair loss grow back?

For most people, stress-related hair loss will be temporary, and it's simply a case of "waiting it out". This is particularly the case with telogen effluvium, which normally resolves within six to nine months.

Treatment for stress-related hair loss

In instances where there is no regrowth, or hair doesn't grow back fully, a few different treatments are available. The type of treatment that's best for you depends on the type of hair loss you're experiencing.

Treatment for telogen effluvium

Thinning caused by telogen effluvium may be treated with a medication called minoxidil (Regaine) – this is a topical treatment applied directly to the scalp.

Men can order a hair loss bundle, from our site which contains minoxidil, shampoo and vitamins which can help hair health and hair loss. You can find out more about hair loss vitamins in our article.

Treatment for alopecia areata

For alopecia areata, there are a range of treatments available. Some of these treatments might be prescribed by your GP but most are only prescribed by dermatologists including:

- Steroid creams, lotions, tablets or injections
- Dithranol
- Immunotherapy

Treatment for trichotillomania

Because trichotillomania is often related to anxiety or OCD (obsessive compulsive behaviour), the most effective treatment is thought to be psychological therapy, for example CBT (cognitive behavioural therapy).

Tips for managing stress

If you think stress might be causing your hair loss, you might be advised on some things you can do to destress. This might include things like:

- Identify what situations are causing you stress – might it be a stressful work situation that's triggered your stress? A relationship? A loved one being ill?
- Tring to take control of the situation – prioritise your workload, speak to someone about getting some support, etc.
- Getting active and exercising more
- Connecting with friends, family and colleagues
- Cut down on alcohol, smoking and caffeine
- Try and eat a healthy balanced diet

Autoimmune Disorders

Hair loss (alopecia) can be devastating for many people, and that's understandable. Hair loss can affect quality of life and the way people feel about themselves. And it can happen for a lot of reasons. Common causes of hair loss include aging, stress, and genetics. This is seen in conditions like androgenetic alopecia (AGA), which is a hereditary pattern hair loss in men and women due to hormone changes.

Less commonly, autoimmune conditions cause hair loss. If you have hair loss, you may be wondering if you have an autoimmune condition. If you have hair loss and an autoimmune condition, you might be wondering how the two are related. Let's take a closer look at when to get help for your hair loss — and what to expect when you do.

When evaluating hair loss in patients with autoimmune disorders, several potential factors come into play:

- Vitamin and mineral Deficiencies (like deficiencies in vitamins like D, iron, and biotin)
- Nutritional Factors, stress, and environmental exposure (poor nutrition, high stress levels, and exposure to pollution)
- Hair Treatments (coloring, bleaching, or heat styling)
- Hormonal Changes (hormonal fluctuations, such as those occurring after pregnancy, menopause or due to conditions like PCOS)

What autoimmune diseases can cause hair loss?

Active autoimmune disease and Inflammation (uncontrolled autoimmune diseases like rheumatoid arthritis, thyroid disorders, lupus, dermatomyositis, scleroderma, and inflammatory bowel diseases can lead to hair loss due to excessive inflammation).

Autoimmune diseases affecting hair-covered areas (conditions like psoriasis of the scalp or lupus can cause hair loss due to localized inflammation).

Can Medications used to treat autoimmune diseases cause hair loss?

Yes, unfortunately, certain medications used to treat autoimmune diseases, such as methotrexate, leflunomide, mycophenolate mofetil, and adalimumab, can contribute to hair loss as a side effect. If methotrexate or leflunomide are used, it is recommended to be paired with folic acid supplementation, as both of these medications can cause folate deficiency in the body. If folic acid supplementation is not helpful, then discuss changing the therapy with your physician.

How to treat hair loss in autoimmune diseases?

First, it is important to undergo thorough evaluations and also consult a dermatologist. While many products are advertised on the market for hair loss, only some of these are scientifically supported.

Conventional Treatments include:

- Topical Minoxidil (Rogaine)
- Ketoconazole Shampoo
- Vitamins and Supplements (blends like Nutrafol containing vitamins A, D, C, E, biotin, zinc, selenium, and iodine)
- Led Light Therapy and Low-Level Laser Therapy
- Platelet-Rich Plasma (PRP) Therapy

It depends. There are many different autoimmune conditions, and most of them can't be diagnosed with a single test. Some are tougher to diagnose than others. Diagnosis frequently involves:

Physical exam: A healthcare professional will determine where the hair loss is located. They'll look for other signs, like blisters, scales, thickening of the skin, discoloration, and scarring.

Blood tests: Tests such as a complete blood count, electrolytes, and hormone levels are often ordered. Special blood tests that look for antibodies associated with specific autoimmune conditions can also help narrow down the diagnosis.

Biopsies: Small amounts of the affected areas can be surgically removed to look at under the microscope. This allows the healthcare professional to check for inflammation and to see which specific hair structures are being affected.

Different types of healthcare professionals may diagnose and treat autoimmune conditions. Oftentimes, the specialist in charge depends on which part of the body is affected. For example:

- Dermatologists treat skin, hair, and nail problems, including autoimmune hair loss.
- Rheumatologists treat autoimmune disorders, such as rheumatoid arthritis and lupus.
- Endocrinologists treat hormone disorders, including autoimmune hypothyroidism.

In many cases, a healthcare team will come together to help people with autoimmune disease.

Medications and Hair Loss

How do drugs cause hair loss?

When the body experiences trauma, sudden, substantial shedding can occur. Triggers can include an acute illness, stress, a severe nutritional deficiency, rapid weight loss — or a drug that proves toxic to hair follicles.

Medications that affect hormone or stress levels in the body can be the culprit for a condition known as drug-induced telogen effluvium, which leads to increased shedding, usually on top of the scalp, a few months after exposure.

Chemotherapy drugs that target rapidly dividing cells, including hair follicles, are commonly associated with hair loss, Saunders says.

If you suspect a prescription drug may be linked to hair loss, consult your doctor immediately: It may be a sign of other health problems. Ask for a referral to a dermatologist. "Dermatologists are extremely important in helping to diagnose hair loss and its causes, suggest potential treatments and know expected outcomes.

10 Types of Meds That Can Harm Your Hair

1. Anticoagulants

- Heparin
- Warfarin (Coumadin, Panwarfin, Sofarin)

2. Antidepressants, mood stabilizers, bipolar disorder medications

- Citalopram (Celexa)
- Divalproex sodium (Depakote)
- Fluoxetine (Prozac)
- Lithium
- Paroxetine (Paxil)
- Sertraline (Zoloft)
- Valproic acid

3. Antimicrobial tuberculosis drugs

- Isoniazid

4. Arthritis, inflammation drugs

- Etanercept (Enbrel)
- Leflunomide (Arava)
- Methotrexate (Rheumatrex, Trexall)

5. Blood pressure meds

- ACE inhibitors
- Beta-blockers

6. Chemotherapy drugs

- Checkpoint inhibitors: avelumab (Bavencio), ipilimumab (Yervoy), nivolumab (Opdivo), pembrolizumab (Keytruda)
- Cyclophosphamide (Cytoxan)
- Daunorubicin (Cerubidine)
- Docetaxel (Taxotere)
- Doxorubicin (Adriamycin)
- Epirubicin (Ellence)
- Erlotinib (Tarceva)
- Etoposide (VePesid)
- Gefitinib (Iressa)
- Ifosfamide (Ifex)
- Irinotecan (Camptosar)
- Nilotinib (Tasigna)
- Paclitaxel (Taxol)
- Topotecan (Hycamtin)
- Vinorelbine (Navelbine)

7. Cholesterol-lowering meds

- Atorvastatin (Lipitor)
- Gemfibrozil (Lopid)

8. Epilepsy and anti-seizure meds

- Carbamazepine (Tegretol)
- Divalproex sodium (Depakote)
- Lamotrigine (Lamictal)
- Trimethadione (Tridione)
- Valproic acid

9. Hormonal medications

- Anastrozole (Arimidex)
- Exemestane (Aromasin)
- Letrozole (Femara)
- Tamoxifen (Soltamox)

10. Severe acne and psoriasis

- Acitretin (Soriatane)
- Isotretinoin (Accutane, Absorica)

Each hair on your head has its own individual life cycle: A strand grows two to eight years. Then, in two or three weeks, it stops growing and rests for three to four months before detaching from the follicle. Your head of hair is a mixture of 85 to 90 percent actively growing hair and hair that's resting and waiting to shed.

How to diagnose hair loss from medications

Determining whether a medication is behind hair loss requires "medical detective work. When a patient reports excess shedding (more than 200 hairs per day), changes in medical history and medications over the previous three to four months should be carefully reviewed.

Although no tests can confirm that a medication caused hair loss, a scalp biopsy can help rule out other potential causes.

Even when a new prescription is a primary suspect, "medication associations with hair shedding and thinning are difficult to identify and confirm. a dermatologist specializing in hair loss at Mayo Clinic in Rochester, Minnesota. Sometimes hair loss can be triggered by a combination of drugs. Or patients may be prescribed a number of medications simultaneously, further confusing the diagnosis. Since it may take weeks or even months after the trigger event for hair loss to begin, it's often hard to know the exact cause.

Sudden hair loss can be traumatic, but it may be reversible.

Treatment options for hair loss

In some instances, hair loss can be reversed by changing the medication dosage, prescribing the brand-name drug (or an alternative drug), or adding B vitamins or folic acid. Still, even after the source is identified, it could take six months for the hair to begin growing back.

Discontinuing or substituting offending medication: If possible, switching to an alternative drug that doesn't cause hair loss can help. This should only be done under the guidance of the prescribing physician to ensure the underlying condition remains treated.

Topical treatments: A widely used over-the-counter topical medication, minoxidil, can stimulate hair growth and increase its density when applied directly to the scalp.

Oral treatments: Typically used for male-pattern baldness, finasteride can be prescribed to reduce follicle miniaturization in specific types of hair loss.

Injections: Hair growth can be promoted through injectable forms of minoxidil or platelet-rich plasma (PRP), which uses concentrated platelets from a patient's blood to enhance hair follicle function and stimulate growth.

Nutritional support: A diet rich in essential vitamins and minerals is crucial for healthy hair. Supplements such as biotin, zinc and iron can help if there is a deficiency. Consult with a nutritionist or dietitian to create a personalized diet plan.

Healthy lifestyle habits: Eating a balanced diet, getting adequate sleep, exercising regularly and decreasing stress are important for preventing, minimizing or reversing medication-induced hair loss.

Hairstyling Practices

Can Certain Hair Styling Cause Hair Loss

Traction alopecia is a type of hair loss that occurs when there is prolonged or repeated tension applied to the hair follicles. This tension can be the result of various hairstyling practices or habits that pull on the hair, causing it to become damaged and eventually leading to hair loss. Traction alopecia is a common cause of hair loss, particularly in people with tight hairstyles or those who use certain hair accessories regularly.

Common causes and contributing factors of traction alopecia include:

Tight Hairstyles

Wearing hairstyles that place constant stress on the hair follicles, such as tight braids, cornrows, dreadlocks, or tight ponytails, can lead to traction alopecia.

Hair Extensions

The application of hair extensions, especially if they are heavy or tightly attached, can pull on natural hair and cause damage over time.

Excessive Use of Hair Accessories

Regularly using hairpins, clips, or rubber bands that are too tight can contribute to traction alopecia.

Chemical Treatments

Frequent use of chemicals, like relaxers or perms, combined with tight hairstyles, can weaken the hair shaft and make it more prone to breakage and hair loss.

Tight Headgear

Constantly wearing helmets, hats, or headgear that fit tightly can put pressure on the hair and scalp.

The symptoms of traction alopecia can include hair thinning or hair loss, especially along the hairline, temples, and the areas where tension is applied. In the early stages, it may be reversible if the underlying cause is identified and the damaging hairstyle or practice is discontinued. However, if the tension continues over an extended period, it can lead to permanent hair loss.

Preventing traction alopecia involves adopting gentle hairstyling practices, avoiding hairstyles that pull on the hair, and giving your hair regular breaks from tight styles. If you suspect you have traction alopecia or are concerned about

hair loss, it’s essential to consult with a dermatologist or healthcare professional for an accurate diagnosis and personalized treatment recommendations.

Age-Related Hair Changes

As you age, it’s normal for your body to go through many different changes. Changes in your hair are a part of that process. Hair naturally changes color and texture over time. Sometimes that means having thinner hair or less hair as you get older.

Just like many other parts of your body, your hair changes as you age. For instance, most of us expect our hair to go grey or white hair as we get older. But what if you notice some hair loss? Should you be worried? In fact, hair loss in older adults is a normal part of the aging process and isn't usually cause for concern. Your hair's texture and thickness will also change over time and these changes are considered typical.

Both men and women experience thinner hair with age, and there are several different types of hair loss that can affect people. If you choose to treat the condition, the treatment will depend on the cause of your thinning hair.

Normal Hair Loss in Older Adults

As a person ages, there are several normal, aging-related changes to hair growth patterns that can result in thinner locks. In fact, nearly every older adult has some hair loss or change in thickness. These are some of the things you may notice as part of normal aging:

Fewer individual hairs - An individual hair has a typical lifespan of up to seven years. When that hair falls out at the end of its normal lifespan, it's usually replaced by a new hair in the same follicle. However, as you age, some of your hair follicles will stop producing new hairs, resulting in fewer hairs on your head.

Finer strands of hair - Individual strands of hair also become finer with age. While someone may have course hair in their 20s, they are likely to have fine hair in their 60s or 70s. This can make your hair feel thinner overall.

Slower hair growth - The growth rate of hair decreases with age. This happens because the follicles simply do not allow for hair to grow as quickly. You may find that you need haircuts less often.

Why Do You Lose Hair as You Age?

Here are a few different reasons why you may experience hair loss as you get older.

Hereditary traits. Hereditary traits are traits passed along from parents to children. Does one of your parents have thinner hair or a history of hair loss? You likely will too.

Endocrine disorders. Hormones are chemicals produced by glands in your endocrine system and released into your bloodstream. An imbalance occurs when there is too much or too little of a hormone. Hair loss may accompany several endocrine disorders.

Thyroid disorders. When hormone production is disrupted by your thyroid it affects other processes in your body. This includes the development of hair at the root. Hair falls out and may not be replaced by new growth. This can result in thinning across your scalp and other areas such as your eyebrows.

Reduced hormonal support. Both male and female hormones affect hair growth. Male hormones are known as androgens, a category that includes testosterone. Androgens stimulate hair growth on the face and body and create fuller, thicker hair on the head.

Nutritional deficiencies. Consuming a diet lacking the right nutrients can lead to hair loss.

Menopause. Menopause is the time in a woman's life where her monthly menstrual cycle stops. When this happens, it lowers the production of estrogen and progesterone. These hormones help hair grow faster and stay on the head for longer periods of time. When there’s less of the hormone, there is less hair.

How to Manage Hair Loss for Older Adults

Since aging hair generally does not grow at as rapid a pace as it once did, it's important to protect the hair in order to slow down additional thinning. There are some changes you can make that could slow down the loss and some treatments that can help restore some of your hair's thickness.

As you get older, you can support your hair growth in several ways.

Washing less frequently. Washing your hair too frequently can cause it to become dry and brittle. Don’t shampoo too much. Keep your scalp clean by washing it at least twice per week.

Use conditioner and volumizer. Using a conditioner after you shampoo your hair can help add moisture to replenish hair’s sheen and natural oils that may have been stripped away. You can add volumizers to strengthen each strand of hair, plumping it up and adding more volume overall.

Choose the right product. Do you color your hair? It’s best to see a professional stylist who can help choose the safest dye for your hair type. They can also provide tips on the best shampoos, conditioners, and other hair products.

Try to avoid daily heat styling tools like blow dryers, curling wands, and flat irons. Using these tools occasionally is usually fine. However, if you use them every day it can be extremely damaging to your hair. If you do use heat-styling tools, apply a heat protectant to your hair before you use them. This can add moisture and give your hair a protective coating.

Eat a protein-rich diet. As you age, it's common to start eating less. Sometimes, this may lead you to become nutritionally deficient. Because hair follicles are made mostly of protein, it's important to include protein into your diet.

Foods like red meat, spinach and green leafy vegetables, eggs, berries, and avocados are all great options. It can also be helpful to take a daily multivitamin to make up for the nutrients you may not be getting in the foods you eat.

Check your medications. Some medications can interfere with hair growth or loss. Your doctor can advise you on how to help counteract the negative effects.

Environmental Factors

Physiochemical properties of hair are impacted by many stressors ranging from physical, chemical, mechanical to environmental. A combination of several environmental factors such as sun exposure and air pollution can impact overall hair and scalp health. Damage induced by these aggressors impacts hair properties such as protein content, melanin oxidation, surface quality and structural components. Hair and scalp care go hand in hand and prolonged exposure to pollution can cause scalp sensitivity. In this article, we will discuss the impact of environmental factors on hair and some of the treatment strategies that can help protect hair against these harmful effects.

Hair Structure

Hair is composed of heavily melanized keratin fibers. Hair keratins are classified as hard keratins, consisting of 65-96% proteins, 1-9% lipids, 3% melanin and other minor compounds. These proteins are the building blocks that contribute to the strength, flexibility, and overall health of hair. Hair is broadly structured in three layers: the cuticle, cortex, and the medulla. The cuticle forms the outermost coat of the hair shaft, acts as a protective wall shielding the inner layers and contributes to the feel and appearance of hair. The cuticle is subjected to many day-to-day insults such as washing, brushing, the use of thermal tools, UV radiation and pollution. Thus, the hair structure is gradually damaged. Next, we will review the impact of UV exposure and air pollution on hair properties.

How air and water affect hair

Large cities are plagued by pollution from cars, factories, burning fossil fuels, and a host of other sources. The dark, poisonous and hair-damaging smog hangs like a dark cloud overhead.

Studies have shown that airborne pollution causes oxidative stress, in other words, the body’s inability to detoxify free radicals with antioxidants. This leads to increased hair shedding.

Eventually, the air particles, dust, and soot make their way into the water cycle through rainfall. Pollutants in surface and groundwater combined with other minerals, like those in hard water, cause dryness, breakage and thinning of hair follicles.

Pollution has also been linked to oily, itchy scalp, and dandruff, which are fairly common symptoms for the average person. Whilst there could be a much simpler explanation, it’s important, especially if one lives in a large industrial city, to keep in mind that pollution may be the root cause. This irritation, if left unnoticed or improperly treated, may even lead to permanent hair loss.

Reducing effects air/water pollution has on hair:

- Wear a hat or covering your hair when outdoors
- Wear a swim cap in chlorine pools
- Avoid using oily hair products as they can cause air particles to stick to hair
- Soften water with a purifier or naturally with vinegar or lemon juice
- Avoid contact with rainwater/acid rain

How hot and cold environments affect hair

Living in a humid or dry environment can make hair loss more severe by drying out hair and making it more brittle. At the extreme end, scalp sunburn can in some cases do irreversible damage to hair follicles, causing permanent hair loss. As we highlighted in our article on the effect of UV rays on hair, ultraviolet rays can damage proteins in hair.

Cold and damp climates can also have a negative effect on hair, not only through the immediate drying effects they have, but also the fact that people living in cold climates often wear hats. The friction between hats and hair may cause breakage.

The comforts of modern living that people enjoy like heating and air conditioning also contribute to dry and brittle hair. Air conditioning in particular sucks the moisture out of the air, but obviously going without the air conditioning can make life unbearable, so hair care is important.

Reducing effects cold/hot environments have on hair:

- Wear a head scarf, hat, or other head covering
- Use sunscreen for hair
- Reduce friction in cold climates with a light scarf under hats
- Employ full climate control with humidifier when using air conditioning

How toxic heavy metals and other chemicals affect hair

Heavy metals can be ingested, inhaled or absorbed through the skin. Lead, cadmium, mercury, iron, aluminum and copper are the most common causes of heavy metal poisoning that lead to hair loss. Working and living conditions, such as chemical factories, industrial zones, and disaster areas can be contaminated, causing damage to health. These metals affect hormone levels, deprive the hair of nutrients, and can damage hair follicles.

Chemicals, like pesticides, chemotherapy drugs, formaldehyde, and benzene may also cause hair loss.

Reducing effects toxic metals and chemicals have on hair:

- Change workplace or living conditions
- Chelation therapy (in cases of toxic metal poisoning)
- Detoxification therapy

Some general tips for reducing effects of environmental factors:

- Use natural, high-quality cosmetic products and treatments
- Moisturise, shampoo, and condition
- Eat a balanced and nutritious diet high in antioxidants

Conclusion

Pollution and sun exposure are a global concern and the emphasis is beyond just skin. These stressors can cause hair damage and induce scalp sensitivity. Novel ingredients and new products that focus on providing full protection continue to advance. Key for hair and scalp health are protective hair and scalp care solutions that can help create an eco-barrier on the hair surface to prevent the adhesion and penetration of pollutants and radiation, restore hair from the inside-out and provide scalp bio balance.

Role of Biotin

If you find yourself browsing the hair care aisle or searching the internet for hair treatments, one thing that might pop up is biotin. This B vitamin has a reputation for helping your locks stay healthy, and it's frequently recommended by dermatologists to help with hair loss.

But can biotin actually help your hair grow, too?

We find biotin to be very helpful for hair disorders,It also makes nails thicker, and oral biotin is exceedingly safe.

Biotin contains essential proteins that help with the development of your skin, nails and hair, but this doesn't mean it's a miracle product for your locks. Let's brush up on what biotin can — and can't — do for your hair.

Does biotin help increase hair growth?

Biotin is an essential vitamin that helps with the production of keratin (a protein that's in charge of forming nails, skin and hair). Some research has shown that a lack of biotin in your system can lead to hair loss.

In which case, you may be wondering if increasing your intake of biotin will lead to better hair growth. And any googling you may have done on the topic has likely brought up such claims. But first, it's first important to know that there's a difference between something that helps promote hair growth and something that helps prevent hair loss.

For now, there isn't enough research to definitively state that biotin can help grow hair.

But biotin has been shown to help with preventing balding and hair loss.

In fact, biotin is primarily used for alopecia — a condition that causes hair loss in all sexes. "Biotin helps maintain hair growth and helps with inflammation. "The hair follicle, the skin and the nails all benefit."

Women with self-perceived thinning hair experienced improvement in their hair's overall thickness and growth after taking a multivitamin that contained biotin. But as the multivitamin contained other ingredients, it's hard to attribute it completely to biotin.

The good news is that taking biotin in reasonable amounts won't do any harm.

How much biotin should you take?

If you want to make sure you're getting enough biotin, the daily recommended biotin intake is 30 micrograms (mcg) for adults, according to the National Institute of Health. If you're pregnant, you need about 35 mcg a day.

If you're experiencing alopecia, your doctor may recommend certain biotin supplements or a higher biotin-rich diet as a way to combat hair loss. They may recommend upping your dosage to 3 milligrams (or 3,000 mcg) a day.

What types of biotin are there?

There are a couple different ways to reap the benefits of biotin. Believe it or not, you may be already getting a decent dose without knowing it.

Here are some ways you can get biotin:

Biotin-rich foods

First, you may consider working some biotin-rich foods into your diet. This is the best way to get biotin into your system naturally. And you may already have some items in your pantry or fridge that fit the bill.

Biotin is present in many foods, including:

- Beef liver (30.8 mcg).
- Eggs (10 mcg).
- Salmon (5 mcg).
- Pork chop (3.8 mcg).
- Sweet potatoes (2.4 mcg).
- Almonds (1.5 mcg).
- Broccoli (0.4 mcg).

Mega-B vitamins

If you have certain dietary restrictions or need an extra biotin boost, certain supplements may be used as alternatives.

For supplementation, many dermatologists favor a mega-B vitamin combination that includes:

- 3 milligrams (mg) of biotin.
- 30 mg of zinc.
- 200 mg of vitamin C.

- < 1 mg of folic acid.

"Occasionally, the mega B-vitamin combination gives some patients minor gastric trouble, but switching them to biotin alone relieves it.

And if you can't find the mega B-vitamin combination, you can buy biotin, zinc and vitamin C separately.

Biotin shampoo

If your goal is for biotin to help your hair grow, you may consider adding a biotin shampoo into your wash routine.

It's true that many shampoo brands utilize biotin in their formulas as a way to combat hair loss. However, similar to the research around biotin supplements, the data to support hair growth from biotin-infused shampoo is limited. But there's no harm really in giving this kind of shampoo a try if you want your hair to feel fuller — but don't expect a magical regrowth of hair.

Possible side effects of biotin

Working more biotin into your system (whether through supplements or diet) is generally safe. But it's important not to overdo it. In some rare cases, too much biotin from supplements can cause stomach issues, trouble sleeping and skin rashes.

Another concern surrounding biotin is that it may interfere with certain common lab tests done by your doctors. Best way to avoid this? Don't take too much. Stick to the recommended amount and be sure to talk to your doctor before upping your dosage. And if you're taking large amounts of biotin, be sure your healthcare provider knows before you do any lab tests.

While there's still a lot of research needed on the effects of biotin on hair growth, as well as preventing hair loss, it has been shown to work for some. But it's best to first make sure you're eating a well-balanced diet of biotin-rich foods before considering too many supplements.

Biotin Metabolism

Biotin is a cofactor in two reactions involving amino acids: the carboxylation of 3-methylcrotonyl-CoA in the pathway of leucine catabolism and the carboxylation of propionyl-CoA to form methylmalonyl-CoA. Biotin also is a cofactor for the pyruvate carboxylase reaction in the gluconeogenic pathway and for acetyl-CoA carboxylase in the pathway of fatty acid synthesis. Hence, dietary deficiencies of biotin or congenital anomalies of biotin metabolism lead to the accumulation of several organic acids.

Biotin is covalently bound to these enzymes via an amide linkage with ϵ -NH2 groups of lysine residues. A specific enzyme, holocarboxylase synthetase, mediates this attachment. Another enzyme, biotinidase, cleaves biotinyl residues from enzymes, thereby facilitating the recycling of free biotin. Inherited defects of both biotinidase and holocarboxylase synthetase have been described. Prompt clinical recognition of these syndromes is essential because treatment with pharmacological doses of biotin dramatically improves outcome.

Holocarboxylase synthetase deficiency prevents biotinylation of holocarboxylase and results in metabolic acidosis, marked tachypnea, hypotonia, vomiting and seizures

Most patients become symptomatic early in life. The blood pH is typically quite low, often less than 7, and the blood lactate is high. Many infants also have hyperammonemia. Quantitation of urinary organic acids typically shows a marked ketoaciduria with excretion of lactate, 3-methylcrotonylglycine, tiglylglycine, 3-hydroxypropionate, methylcitrate and 3-hydroxyisovalerate, inter alia. If the disorder is not treated promptly, patients can develop a skin rash, alopecia and varying degrees of psychomotor retardation. Direct assay of holocarboxylase synthetase in fibroblasts is possible. Antenatal diagnosis is feasible, either by determination of enzyme activity or by quantitation of organic acids in the amniotic fluid.

Biotinidase deficiency prevents recycling of biotin and often causes developmental retardation, hypotonia, seizures, cerebellar signs, alopecia, dermatitis and conjunctivitis

Hearing loss is common. Quantitation of the urinary organic acids shows increased excretion of lactate, 3-hydroxyisovalerate, methylcitrate and 3-hydroxypropionate; however, these are not invariant findings, and the measurement of biotinidase activity in fibroblasts or peripheral blood cells may be necessary. Biotinidase activity in the serum of affected children usually is <10% that of control values. Antenatal diagnosis is possible.

Pathological lesions in the brain include cystic changes and demyelination. The cerebellum is especially vulnerable. A few patients have manifested changes suggesting meningoencephalitis. Virtually all patients respond favorably to oral

biotin at a dose of 10 to 40 mg daily. Many of the clinical findings are reversible, even including some of the neurological abnormalities, although the hearing loss tends to persist.

Biotin - Absorption and Distribution

The water-soluble vitamin biotin is required for normal cellular functions, growth, and development. The vitamin (a carboxyl carrier) acts as a cofactor for 5 carboxylases; 4 are located in the mitochondria and 1 in the cytoplasm. These carboxylases play a critical role in the intermediate metabolism of gluconeogenesis, fatty acid synthesis, and amino acid catabolism. Recent studies have suggested an additional role for biotin in the regulation of gene expression, with both stimulation (as in the case of the insulin receptor, glucokinase, and human thiamin transporter-2) and suppression (as in the case of hepatic phosphoenolpyruvate carboxykinase) being reported. In addition, a role for biotin in normal immune functions and cell proliferation has been cited. Thus, it is not surprising that deficiency of this essential micronutrient leads to a variety of clinical abnormalities. These include growth retardation, neurological disorders, and dermatological abnormalities. The incidence of biotin-deficiency and suboptimal levels have been reported with increased frequency in recent years and occurs in patients on long-term parenteral nutrition, in patients with inborn errors of biotin metabolism, and in those on long-term therapy with anticonvulsant agents. Suboptimal levels of biotin have been reported in a substantial number of alcoholics, in women during pregnancy, in patients with inflammatory bowel disease, and in patients with seboric dermatitis and Leiner's diseas.

In nature, the biotin molecule (Fig. 1A; pKa = 4.5) exists in the form of 8 stereoisomers, but only the D-biotin isomer is biologically active. Microorganisms (like certain bacteria and yeast) and plant cells, but not mammalian cells, can synthesize biotin endogenously. Biotin is widely distributed in foodstuffs, with organ meat (like liver and kidney), egg yolks, some vegetables, and cow milk representing good sources for the vitamin.

Digestion and absorption of biotin

General characteristics of the human intestinal biotin uptake process.

Humans and other mammals cannot synthesize biotin and thus must obtain the vitamin from exogenous sources via intestinal absorption. The human intestine is exposed to 2 sources of biotin: a dietary source, and a bacterial source, which is normal microflora of the large intestine. Bioavailability of dietary biotin differs from one food source to another and ranges from 5% to close to 100%. Dietary biotin exists in protein-bound and free forms. Protein-bound forms of biotin are digested to free biotin prior to absorption in the small intestine. Digestion is first performed by the action of gastrointestinal proteases and peptidases, leading to the generation of biocytin (biotinyl-L-lysine) and biotin-short peptides. The enzyme biotinidase then liberates free biotin from biocytin and biotin-short

peptides. The latter step is essential for efficient absorption and optimal bioavailability of dietary protein-bound biotin. Mutations in biotinidase, which occur in the autosomal recessive disorder of biotinidase deficiency, lead to impairment in the bioavailability of dietary protein-bound biotin.

Uptake of free biotin by human small intestinal epithelial cells occurs via an efficient Na+-dependent, carrier-mediated mechanism that saturates at the micromolar range. The carboxyl group of the valeric acid moiety of the biotin molecule must be free for its proper recognition by the involved mechanism. Because transport across the highly polarized human intestinal epithelial cells represents movement of biotin across 2 structurally and functionally different membrane domains, i.e., the brush border membrane (BBM) and the basolateral membrane (BLM) domains, understanding the mechanisms involved in each transport step is important. This was addressed using purified BBM vesicles and BLM vesicles isolated by established procedures from the small intestine of human organ donors. Biotin uptake by human intestinal BBM vesicles occurred via a carrier-mediated system that is Na+ gradient-dependent and is capable of moving the substrate against a concentration gradient. Higher biotin transport was found in the proximal compared with the distal small intestine. The biotin transport event across the human intestinal BBM was sensitive to the inhibitory effect of the anticonvulsant drugs carbamazepine and primidone. Studies with human intestinal BLM vesicles showed that biotin transport across the BLM was via a carrier-mediated mechanism, but the system was Na+-independent and electrogenic in nature.

An important characteristic of the human intestinal biotin uptake process is that it is also utilized by 2 other structurally and functionally unrelated nutrients, namely pantothenic acid and lipoate. Pantothenic acid is a water-soluble vitamin that plays a role in the synthesis of coenzyme A and acryl carrier proteins. Lipoate is a potent intracellular and extracellular antioxidant and also plays a role in redox cycling of other antioxidants (e. g., vitamins C and E) and in regulating the glutathione cellular level. It is for the above reason that the involved transport system is referred to as the sodium-dependent multi-vitamin transport system (SMVT); in humans it is referred to as hSMVT.

Regarding the bacterial source of biotin, the normal microflora of the large intestine synthesize and release into the intestinal lumen a substantial amount of free biotin. The relative contribution of this source of biotin toward total human biotin nutrition, however, is not well defined. In vivo studies have shown that the human large intestine is capable of absorbing installed biotin. The mechanism involved in the large intestinal biotin absorption process was investigated using cultured human colonic epithelial NCM460 cells, with results showing the existence of an efficient Na+ -dependent, carrier-mediated process. This process was again shared with pantothenic acid and lipoate. However, the abundantly available (and negatively charged) short-chain fatty acids acetate

and butyrate, which are also produced by the normal microflora of the large intestine, did not interfere with the colonic biotin uptake process.

Regulation of the intestinal biotin absorption process

Transcriptional activity of the hSMVT gene.

The 5'-regulatory region of the hSMVT gene has been recently cloned and characterized. Two distinct and functional promoters were identified, and both were TATA-less, CAAT-less, contained highly GC-rich sites, and had multiple putative regulatory cis-elements. Functionality was assessed by fusing the promoters to the Firefly luciferase reporter gene, followed by transfection into human intestinal epithelial Caco-2 cells. hSMVT P1 was much more active than P2 in these cells. The minimal region required for basal activity of hSMVT P1 was encoded by a sequence, whereas that of P2 was encoded by a sequence between (relative to the translation initiation codon). Mutation of specific cis-regulatory elements in the minimal region [Kruppel-like factor 4 (KLF-4) and activator protein-2] led to a decrease in promoter activity. The trans-acting factors KLF-4 and activator protein-2 were indeed found to interact with these identified cis-regulatory elements, as shown by studies using oligonucleotide competition and antibody super-shift assays. Activity of the hSMVT promoter (using an integrated hSMVT promoter-luciferase construct) was confirmed in vivo in transgenic mice to establish the physiological relevance of the in vitro promoter studies described above. Studies with the transgenic mice also showed that the pattern of expression of the hSMVT promoter in different mice tissues was similar to the pattern of expression of the endogenous mouse SMVT message.

Clinical Uses of Biotin

Likely Effective for...

Treating and preventing biotin deficiency. Symptoms of deficiency include thinning of the hair (often with loss of hair color), and red scaly rash around the eyes, nose, and mouth. Other symptoms include depression, listlessness, hallucinations, and tingling in the arms and legs. There is some evidence that cigarette smoking may cause mild biotin deficiency.

Possibly Ineffective for...

Skin rash in infants (seborrheic dermatitis)

Insufficient Evidence to Rate Effectiveness for...

Hair loss

There is some preliminary evidence that hair loss can be reduced when biotin is taken by mouth in combination with zinc while a cream containing the chemical compound clobetasol propionate (Olux, Temovate) is applied to the skin.

Diabetes

Biotin alone doesn't seem to affect blood sugar levels in people with type 2 diabetes. However, there is some evidence that a combination of biotin and chromium might lower blood sugar in people with diabetes, whose diabetes is poorly controlled by prescription medicines.

Other early evidence shows that the same combination reduces ratios of total cholesterol levels to “good” high-density lipoprotein (HDL) cholesterol, “bad” low-density lipoprotein (LDL) cholesterol to HDL cholesterol, and non-HDL to HDL cholesterol in people with type 2 diabetes.

Diabetic nerve pain

There is some evidence that biotin can reduce nerve pain in people with diabetes.

Brittle fingernails and toenails

Biotin might increase the thickness of fingernails and toenails in people with brittle nails.

Other conditions

More evidence is needed to rate biotin for these uses.

Multiple sclerosis (MS)

Taking high-dose biotin by mouth does not reduce disability in people with MS. It also doesn't seem to affect the risk for relapse.

Rough, scaly skin on the scalp and face (seborrheic dermatitis)

Taking biotin does not seem to help improve rash in infants.

There is interest in using biotin for a number of other purposes, but there isn't enough reliable information to say whether it might be helpful.

Hair and Nail Health

Biotin is a B vitamin (B7, to be specific) that's important for many body functions.

Biotin helps metabolize food — turning food into energy. And many people swear that biotin has improved their hair, skin and nail health, too.

B vitamins, including biotin are water-soluble. That means that your body doesn't hang on to more of it than you need. But that doesn't mean you can't overdo it on biotin.

biotin does much more for your body than those supplements claim. And enhancing your hair and nails isn't necessarily at the top of the list. What's more, you probably don't need to shell out for those bottles of biotin to reap the benefits.

Biotin and hair and nail health

Perhaps biotin's biggest claim to fame is that it's gotten quite a reputation in the beauty industry in promoting healthy skin, hair and nails.

That's because biotin deficiency (not having enough biotin) can lead to issues like:

- Brittle nails
- Hair loss
- Red, scaly rash

Biotin deficiency is rare "So, if you have thinning hair or brittle nails, it's probably not due to a biotin deficiency. There's usually another health condition causing these problems, such as iron deficiency or a thyroid issue."

No studies have proven that biotin supplements will change the appearance of your hair, skin or nails, "But some people will tell you that taking a biotin supplement helps them boost hair and nail growth."

Benefits of biotin

Biotin is an essential vitamin, which means you can't live without it.

Biotin plays an important role in giving you fuel to go about your day. That's because one of its top benefits is that it helps convert carbohydrates, fats and proteins into energy.

"Biotin is a co-factor for enzymes that help to break down fatty acids, glucose and amino acids," Delpra explains. "We need certain enzymes to break down the

foods we eat so we can metabolize them. And those enzymes don't work properly without biotin."

Biotin is also involved in maintaining healthy nervous system function. And it helps with gene functions.

How much biotin do you need?

Most people get adequate biotin through a healthy diet. Recommended daily intakes for biotin are as follows:

- Under 6 months: 5 micrograms (mcg)
- 7 to 12 months: 6 mcg
- 1 to 3 years: 8 mcg
- 4 to 8 years: 12 mcg
- 9 to 13 years: 20 mcg
- 14 to 18 years: 25 mcg
- 19 and older: 30 mcg
- Pregnant: 30 mcg
- Lactating: 35 mcg

That's much (much) less than the biotin content you'll find in some common supplements.

Adult daily multivitamins and prenatal vitamins typically contain 100% of your recommended daily value for biotin. Other supplements, like "super B" vitamin formulations or vitamins that promote hair and nail growth can contain a lot more. We're talking in the neighborhood of 10,000% of your daily value.

Biotin Safety

Healthcare professionals consider biotin to be very safe. Even very high doses of up to 300 mg daily, to treat MS, have not led to adverse side effects. The recommended daily dosage for adults is much lower: 30 mcg.

Biotin is a water-soluble vitamin, and any amount that the body does not absorb is excreted in urine.

However, there have been some reports of high doses of biotin causing strange results on thyroid tests. Anyone who has a thyroid condition may benefit from checking with a doctor before trying a biotin supplement.

What happens if you take too much biotin?

Too much biotin is anything more than the recommended dosage. This recommended amount includes what you naturally get from foods.

There are cases that show negative effects on the health of some individuals who are taking large amounts of biotin supplements and getting too much biotin. The majority of people get enough biotin through a normal diet. You shouldn’t need to take biotin supplements unless directed by a doctor.

High amounts of biotin can create false positives in laboratory tests for thyroid disease.

Takeaway

Your body makes enough biotin on its own through your dietary intake each day. Therefore, you shouldn’t take biotin supplements unless directed by your doctor. There are some rare health conditions that can cause some people to need biotin supplements on a regular basis. This can be determined by a doctor.

Supplements are not monitored Food and Drug Administration for purity or safety, so it’s important to buy from a manufacturer that you trust.

There’s not enough research yet to determine all the side effects of taking too much biotin. However, there are case studies showing that some of the possible effects can be severe. If you feel like you need to take biotin supplements, you should always consult a doctor first.

Summary

Biotin is a B vitamin that plays a crucial role in the metabolism of carbs, fats, and proteins. It supports health in many ways.

Biotin deficiencies are relatively rare, but they can cause skin, hair, and nail problems. Pregnant or breastfeeding women may require more of this vitamin.

Anyone who has a deficiency can increase their biotin intake by consuming foods rich in the vitamin or taking biotin supplements.

Why is it important?

Biotin is important in helping the body to process glucose and to metabolize proteins, fats, and carbohydrates. It also helps to transfer carbon dioxide.

According to the European Food Safety Authority, biotin contributes to:

- Metabolism of nutrients
- Energy-producing metabolism
- Maintaining hair, skin and mucous membranes
- Nervous system function
- Psychological function

Biotin contributes to healthy nails, skin and hair, so it features in many cosmetic and health products for the skin and hair. However, it cannot be absorbed through hair or skin.

Drug Interactions

Biotin is a vitamin B supplement. It occurs naturally in food such as liver, legumes, tomatoes, soybeans, and carrots.

B vitamin is a member of the water-soluble vitamin family, and contributes to several naturally occurring reactions in the body between various enzymes or carboxylases.

While biotin deficiency is extremely rare, it may cause dermatitis, brittle fingernails, diabetes, hair loss (alopecia), and perosis. Biotin is necessary for healthy skin, nails, and hair.

Biotin is available under the following different brand names: coenzyme R, vitamin H, Nail-ex, and Appearex.

What Other Drugs Interact with Biotin?

If your doctor has directed you to use this medication, your doctor or pharmacist may already be aware of any possible drug interactions and may be monitoring you for them. Do not start, stop, or change the dosage of any medicine before checking with your doctor, health care provider or pharmacist first.

The following 8 drugs have moderate interactions:

- azithromycin
- ciprofloxacin
- clarithromycin
- erythromycin base
- erythromycin ethylsuccinate
- erythromycin lactobionate
- erythromycin stearate
- roxithromycin

Biotin has mild interactions with at least 77 different drugs.

This document does not contain all possible interactions. Therefore, before using this product, tell your doctor or pharmacist of all the products you use. Keep a list of all your medications with you, and share the list with your doctor and pharmacist. Check with your physician if you have health questions or concerns.

What Are Warnings and Precautions for Biotin?

This drug is generally safe and doses of 10 mg per day have been taken with no adverse effects.

This medication contains biotin. Do not take coenzyme R, vitamin H, Nail-ex or Appearex if you are allergic to biotin or any ingredients contained in this drug.

Keep out of reach of children. In case of overdose, get medical help or contact a Poison Control Center immediately.

Contraindications

There are no contraindications associated with the use of biotin.

Effects of Drug Abuse

There are no effects of drug abuse associated with the use of biotin.

Short-Term Effects

There are no short-term effects associated with the use of biotin.

Long-Term Effects

There are no long-term effects associated with the use of biotin.

Cautions

Hypersensitive individuals use with caution. Avoid consuming too much raw egg white as it contains protein which binds biotin.

Pregnancy and Lactation

There are no studies for use when pregnant or lactating. Consult your physician.

Reviewing scientific studies on biotin supplementation for hair loss treatment

Why does hair fall out?

If you're dealing with hair loss, you're likely wondering not only what you can do about it, but also why it's happening in the first place. Hair loss has multiple causes, many of which are systemic. "If your hair is falling out at the roots, often something is going wrong in your body or in your life situation."

Certain medical conditions are linked to hair loss. Among them are endocrine disorders, which include problems with your pituitary, parathyroid or adrenal glands, or your ovaries or testes. "For example, premenopausal women who bleed excessively may be losing iron, and anemia causes hair loss."

Anything that disrupts your gastrointestinal (GI) tract can also affect hair growth, she adds.

But one of the most common causes may surprise you: nutrition. "When we look at what our patients eat, we find they are often low in protein and essential vitamins." "Also, you need some carbohydrates to make hormones, and your brain needs fat."

It's important to understand what's causing your hair loss, but this can take some detective work. says dermatologists start with a thorough physical exam. They consider not just your diet, but your exercise habits and family history as well. Then, they review your medications (because some can cause hair loss) and blood work.

Does biotin help increase hair growth?

Biotin is an essential vitamin that helps with the production of keratin (a protein that's in charge of forming nails, skin and hair). Some research, including a 2016 study, has shown that a lack of biotin in your system can lead to hair loss.

In which case, you may be wondering if increasing your intake of biotin will lead to better hair growth. And any googling you may have done on the topic has likely brought up such claims. But first, it's first important to know that there's a difference between something that helps promote hair growth and something that helps prevent hair loss.

For now, there isn't enough research to definitively state that biotin can help grow hair.

But biotin has been shown to help with preventing balding and hair loss.

In fact, biotin is primarily used for alopecia — a condition that causes hair loss in all sexes. "Biotin helps maintain hair growth and helps with inflammation." "The hair follicle, the skin and the nails all benefit."

In a small 2012 study, women with self-perceived thinning hair experienced improvement in their hair's overall thickness and growth after taking a multivitamin that contained biotin. But as the multivitamin contained other ingredients, it's hard to attribute it completely to biotin. The good news is that taking biotin in reasonable amounts won't do any harm.

Rethinking biotin therapy for hair, nail, and skin disorders

Biotin (vitamin B7 or H) is an essential cofactor for mammalian carboxylase enzymes that are involved in important metabolic pathways in humans. It is acquired from food sources, including egg yolks, milk, nuts, grains, supplementation, and synthesis by intestinal bacteria. The importance of biotin was first observed when rats without biotin in their diets developed neuromuscular dysfunction, alopecia, and dermatitis. Biotin deficiency is quite uncommon in humans, and results in similar findings to that seen in rats. For the inherited holocarboxylase synthetase and biotinidase deficiencies, biotin supplementation can be life saving. Biotin supplementation at high doses (300 mg/day) resulted in sustained reversal of multiple sclerosis–related disabilities. While there are no established daily allowances for biotin, the Food and Nutrition Board of the Institute of Medicine recommends 30 mg/day for adults. Biotin supplementation is likely unnecessary for most individuals, since estimated biotin intake is 35-70 µg/day with a Western diet.

A Review of the Use of Biotin for Hair Loss

Background

Biotin has gained commercial popularity for its claimed benefits on healthy hair and nail growth. Despite its reputation, there is limited research to support the utility of biotin in healthy individuals.

Objective

To systematically review the literature on biotin efficacy in hair and nail growth.

Methods

We conducted a search of all case reports and randomized clinical trials (RCTs) using the following terms: (biotin and hair); (biotin and supplementation and hair); (biotin supplementation); (biotin and alopecia); (biotin and nails); (biotin and dermatology), and (biotin recommendations).

Results

We found 18 reported cases of biotin use for hair and nail changes. In all cases, patients receiving biotin supplementation had an underlying pathology for poor hair or nail growth. All cases showed evidence of clinical improvement after receiving biotin.

Conclusions

Though its use as a hair and nail growth supplement is prevalent, research demonstrating the efficacy of biotin is limited. In cases of acquired and inherited causes of biotin deficiency as well as pathologies, such as brittle nail syndrome or uncombable hair, biotin supplementation may be of benefit. However, we propose these cases are uncommon and that there is lack of sufficient evidence for supplementation in healthy individuals.

Analyzing the efficacy and limitations of biotin in hair loss management

Biotin has gained commercial popularity for its claimed benefits on healthy hair and nail growth. Despite its reputation, there is limited research to support the utility of biotin in healthy individuals.

To systematically review the literature on biotin efficacy in hair and nail growth.

Introduction

Biotin (also known as vitamin B7 or vitamin H) is a water-soluble vitamin that serves as an essential cofactor for carboxylase enzymes in multiple metabolic pathways. Due to its relatively low cost and abundance of availability in cosmetic products, biotin has become the new trend for consumers wishing to have longer, healthier hair and nails. Current recommendations for biotin by the Institute of Medicine state that the daily adequate intake (AI) for adults is 30 µg/day. Most healthy individuals meet these requirements through a well-balanced diet, though many still take up to 500–1,000 µg of biotin supplementation daily. Although no major toxicities of excess biotin have been reported, data on the actual benefit of biotin's effect on hair and nail growth is limited. Moreover, outside the setting of pregnancy, malnutrition, medication effects, and biotinidase deficiency in children, reports of low biotin levels have rarely been cited. Therefore, we propose that true biotin deficiency is uncommon and that there is lack of sufficient evidence for supplementation for hair and nail growth in individuals who do not present with low levels of biotin.

Materials and Methods

We conducted search of all case reports and randomized clinical trials (RCTs) published using the following terms: (biotin and hair); (biotin and supplementation and hair); (biotin supplementation); (biotin and alopecia); (biotin and nails); (biotin and dermatology), and (biotin recommendations). We identified additional sources through references contained in the original articles. We limited our search to studies discussing human subjects only. Through this search, we found 18 reported cases of biotin use for hair and nail changes of the reported cases in the literature, all patients receiving biotin supplementation had some underlying pathology for either poor hair or nail growth. Moreover, all cases showed evidence of clinical improvement after receiving biotin. Time to improvement as well as dosage administered varied for each case. Ten of the 18 cases were reports of patients with inherited enzyme deficiency in either biotinidase or holocarboxylase synthetase. Of these 10, 8 cases reported alopecia that subsequently resolved after varying months of biotin supplementation. Additionally, there were 3 reported cases of uncombable hair syndrome that all showed improvement in hair quality after a few months of treatment. Fujimoto et al. reported a case of biotin deficiency secondary to diet in an infant who was consuming a special amino acid formula. This patient had

low serum and urine levels of biotin as well as perioral dermatitis and alopecia. Hair regrowth in this patient occurred after 2 months of biotin supplementation. Only 1 study conducted by Castro-Gago et al. showed decreased levels of both biotin and biotinidase secondary to medication usage (valproic acid) that improved after 3 months of supplementation with biotin. Finally, 3 cases of brittle nail syndrome treated with biotin were found in the literature and each case showed improvement of nail strength as well as growth on either 2,500 or 3,000 µg of biotin/day.

Discussion

Biotin is a required cofactor for carboxylase enzymes that become activated once they are joined together by holocarboxylase synthase. These enzyme complexes play an important role in multiple metabolic processes including gluconeogenesis, fatty acid synthesis, and amino acid catabolism. Biotin's function in protein synthesis and more specifically, in keratin production, explains its contribution to healthy nail and hair growth. Biotin is readily found in many foods and is also produced by normal gut flora. Foods found to have high amounts of biotin include nuts, legumes, whole grains, unpolished rice, and egg yolk. Recommended daily allowances of biotin have not been established due to a lack of sufficient evidence. However, AI levels have been recommended by the Food and Nutrition Board of the Institute of Medicine. It has been estimated that in Western populations, typical dietary intake of biotin is between 35 and 70 µg/day. Though several animal models demonstrating the effects of induced biotin deficiency can be found in the literature, there are currently no studies that show biotin deficiencies in healthy human individuals with balanced diets.

Biotin deficiency can be either acquired or congenital. Though an acquired biotin deficiency is possible, it is still rare. A commonly documented cause of acquired biotin deficiency is secondary to increased raw egg consumption. The protein avidin, found in raw egg whites, can be denatured through cooking, but when uncooked, this protein binds to biotin tightly preventing it from being used as an essential cofactor. Patients taking anticonvulsant medications, such as valproic acid, can also become deficient, and therefore, are prophylactically administered biotin. Additional causes of acquired biotin deficiency include states of alcoholism or pregnancy, other medications, such as isotretinoin, impaired intestinal absorption, or prolonged use of antibiotics interrupting normal gut flora. Congenital or genetic biotin deficiency is due to an autosomal recessive trait leading to a lack of either holocarboxylase synthase or biotinidase. When it occurs within the first 6 weeks of life, this deficiency is defined as the neonatal type. In this type of biotin deficiency, the enzyme holocarboxylase synthetase is absent and patients typically have severe, life-threatening conditions. Beyond 3 months of life, the infantile form predominates and is defined by a biotinidase deficiency which is involved in the absorption of free biotin following carboxylase degradation. Whether acquired or congenital, typical symptoms of biotin deficiency include alopecia, eczematous skin rashes, seborrheic dermatitis,

conjunctivitis, and multiple neurological symptoms, such as depression, lethargy, hypotonia, and seizures. While the neurological symptoms occur at more severe levels of biotin deficiency, the dermatological manifestations often appear first and are therefore an important indicator. The normal biotin plasma concentration ranges from 400 to 1,200 ng/L. Deficiency is technically considered to be a level of less than 200 ng/L. However, plasma biotin levels can fluctuate daily and thus are not considered to be a sensitive marker. A more validated measure of biotin deficiency is an increased urinary excretion of the metabolite, 3-hydroxyisovaleric acid (normal level: 195 µmol/24 h).

Conclusion

Given the widespread popularity of biotin as a hair supplement, one would presume that this claim must be grounded in strong evidence; however, there is a large discrepancy between the public's perception of its efficacy and the scientific literature. The utility of biotin as a hair supplement is not supported by high-quality studies.

Limited Scientific Evidence

The Scientific Evidence Supporting Biotin for Hair Growth

Many people believe that biotin plays a role in promoting hair growth because it is involved in the production of keratin, the protein that makes up our hair, skin, and nails. Supporters argue that increasing your biotin intake can strengthen your hair, prevent breakage, and enhance hair growth. However, what does scientific research say about these claims?

Numerous studies have examined the relationship between biotin and hair health. While some have shown positive outcomes, the overall evidence remains inconclusive. A review analyzed the effects of biotin on hair growth. They found limited scientific data to support its use as a standalone treatment for hair loss.

Researchers suggest that those with biotin deficiencies are more likely to benefit from supplementation, but for those with adequate biotin levels, the impact on hair growth may be minimal.

Biotin's role in hair growth is not a one-size-fits-all solution. While studies hint at its potential benefits, true biotin deficiency is rare in well-nourished populations. So, before reaching for biotin supplements, consider your diet and consult a healthcare professional to ensure it's the right path to your hair goals.

A Review of the Scientific Literature

In the mid-1980s, routine biotin supplementation for hair improvement was supported by both the pediatric and dermatologic communities. In fact, an article published in The Journal of the American Academy of Dermatology stated "It is a general recommendation that any child with unexplained hair loss, rash or candidiasis receive a trial of biotin therapy". However, to date, there have been no clinical trials conducted to evaluate the efficacy of biotin supplementation for any type of alopecia, and currently, its use to improve hair quantity or quality is not routinely recommended. The initial literature investigating the efficacy of biotin for hair dates back to a study in 1965 in which 46 women were treated with an unknown dose of biotin and observed for "effects on hair roots". The authors concluded that biotin supplementation produced no change in the "state of the hair roots" in any of the 46 women. In the 1980s, animal studies investigating the efficacy of biotin supplementation on hair quality and quantity were published; in one notable study, 119 dogs with poor coat quality consisting of symptoms including dull coat, brittle hair, and loss of hair due to unknown factors were treated with 5 mg biotin/10 kg body weight/day for 3 to 5 weeks. The study produced notable results; 60% of treated dogs demonstrated complete resolution of all hair and coat symptoms, 31% showed at least partial improvement in hair quality and/or quantity, and only 9% showed no change. These results initially suggested that biotin supplementation may help to treat alopecia or at least improve hair quality in

humans as well, however this has yet to be substantiated.In addition, recent research investigating the potential benefits of biotin supplementation at the molecular level has failed to demonstrate any improvement on hair growth or development. Biotin supplementation appears to have no effect on the proliferation and expression of differentiation specific keratins K1 and K10 in cultures of outer root sheath cells and biotin concentrations likewise do not effect the expression of keratin K16, involucrin, and filaggrin as well. However, not all is grim for biotin's ability to improve hair quality and quantity, and supplementation may be beneficial for certain patients. It is well known that chronic anticonvulsant therapy with valproic acid can result in a diffuse, nonscarring alopecia. Valproic acid is a well-established treatment for a wide variety of neurological and psychiatric disorders including various types of seizures and mood disorders. The pathophysiology underlying the alopecia is thought to be related to an acquired biotin deficiency (both relative and absolute) and this has been corroborated in both animal and human studies. In a Shapirorecently published animal study, alopecia from valproic acid was reversed with biotin supplementation. In this study, rats were randomly divided into 4 groups: control, valproic acid (600mg/kd/day) without biotin, valproic acid with biotin supplemented at 6mg/kg/day and valproic acid with biotin supplemented at 0.6mg/kg/day. Alopecia was seen in 40% of the valproic acid group without biotin supplementation, but only 13.3% in either of the biotin supplemented groups. Serum biotin levels in the valproic acid only group were significantly lower than levels seen in the control group, indicating that valproic acid decreases biotin levels, and there were significant decreases in the levels of serum and liver tissue biotinidase in all of the study groups compared with the control group. Another recently published study investigated serum concentrations of biotin and biotinidase activity in 20 children treated with valproic acid and compared them to age and sex matched controls. Hair loss was observed in 3 patients treated with valproic acid and the alopecia disappeared in all 3 patients after oral administration of biotin for 3 months at 10 mg/day. Surprisingly, the authors found no significant differences in the serum levels of biotin and biotinidase activity between patients taking valproic acid and the control group. Though apparently conflicting with previous animal studies, serum biotin level measurements in human subjects are notoriously unreliable, and that measurement of urinary excretion of biotin and its metabolites are a better predictor of deficiency or excess. In another study, the mean biotinidase activity was assessed in 32 pediatric patients treated with valproic acid and found to be decreased in the first three months of valproic acid use, with a gradual return to baseline after 6 months. Similarly, in a different study involving 75 pediatricpatients treated with valproic acid, biotinidase activity was found to be significantly reduced as compared with controls (P less than 0.001). A strong inverse correlation was observed between biotinidase enzyme activity and serum valproic acid levels with the activity of the enzyme.In subjects treated with valproic acid, 18% demonstrated alopecia, which was once again improved with biotin supplementation at a dose of 10 mg/day. The findings above suggest that

valproic acid may cause alopecia through an acquired deficiency in biotin secondary to a reduction in biotinidase activity, which may account for the utility of biotin therapy in reversing this type of medication-induced alopecia.Biotin supplementation has also been shown to improve hair quality in patients with uncombable hair syndrome. Uncombable hair syndrome, a rare autosomal dominant condition with incomplete penetrance, is characterized by dry, frizzy, unruly straw-colored or silvery blond hair that is extremely difficult to manage. Although difficult to quantify, there have been several reports demonstrating the efficacy of biotin supplementation on improving hair quality and growth rate in these subset of patients.In one notable study, oral biotin supplementation at 0.9mg/day (given as 0.3 mg three times a day), produced significant improvement in hair strength, combability and growth rate after 4 months. Apart from the aforementioned conditions including: 1) medication-induced alopecia (namely valproic acid) and 2) uncombable hair syndrome, there is no scientific evidence validating biotin’s clinical efficacy in the improvement of hair quality or quantity. Given the above, its use is not routinely recommended.

Preventing Hair Loss

Does biotin help prevent hair loss?

Although the evidence to support biotin alone for hair growth is weak and limited, the evidence is slightly stronger for preventing hair loss.

Still, biotin supplements are only likely to prevent hair loss and promote hair growth in people with a biotin deficiency.

In one study, a biotin deficiency was found in 38% of women complaining of hair loss. Of these participants, 11% had a history of deficiency risk factors, such as inflammatory bowel disease (IBD) or the use of certain medications like antibiotics.

While this study didn't assess the effects of biotin supplements or biotin-added hair products on preventing hair loss, it demonstrates the link between hair loss and inadequate biotin levels.

Other causes of hair loss include:

- androgenetic alopecia, also known as female pattern baldness
- rapid weight loss
- other nutritional deficiencies like iron, zinc, or protein
- certain hormonal diseases like thyroid disorder

Due to the multiple factors involved in hair loss and thinning, supplementing with biotin without determining the cause can prevent or delay the appropriate treatment in instances where a biotin deficiency isn't at fault.

Even in cases where a biotin deficiency is present, biotin supplements may not necessarily prevent hair loss.

For example, researchers in one study prescribed a biotin supplement to 22 patients with low biotin levels for hair loss following gastric sleeve surgery.

After 3 months, 5 of the patients reported a significant decline in hair loss, 14 reported a small effect, and 3 reported no effect, demonstrating that other factors may also be at play when it comes to hair loss and its prevention.

Why does hair fall out?

If you're dealing with hair loss, you're likely wondering not only what you can do about it, but also why it's happening in the first place. Hair loss has multiple causes, many of which are systemic. "If your hair is falling out at the roots, often something is going wrong in your body or in your life situation".

Certain medical conditions are linked to hair loss. Among them are endocrine disorders, which include problems with your pituitary, parathyroid or adrenal glands, or your ovaries or testes. "For example, premenopausal women who bleed excessively may be losing iron, and anemia causes hair loss".

Anything that disrupts your gastrointestinal (GI) tract can also affect hair growth.

But one of the most common causes may surprise you: nutrition. "When we look at what our patients eat, we find they are often low in protein and essential vitamins". Also, you need some carbohydrates to make hormones, and your brain needs fat.

It's important to understand what's causing your hair loss, but this can take some detective work. Dermatologists start with a thorough physical exam. They consider not just your diet, but your exercise habits and family history as well. Then, they review your medications (because some can cause hair loss) and bloodwork.

Conclusions

Though its use as a hair and nail growth supplement is prevalent, research demonstrating the efficacy of biotin is limited. In cases of acquired and inherited causes of biotin deficiency as well as pathologies, such as brittle nail syndrome or uncombable hair, biotin supplementation may be of benefit. However, we propose these cases are uncommon and that there is lack of sufficient evidence for supplementation in healthy individuals.

Excess Biotin

Health Risks from Excessive Biotin

The FNB was unable to establish ULs for biotin because there is no evidence in humans that biotin is toxic at high intakes. Several studies have found no adverse effects of 10–50 mg/day biotin, and up to 200 mg/day oral biotin or 20 mg/day intravenously in patients with biotinidase deficiency do not produce symptoms of toxicity.

High biotin intakes, and potentially even intakes greater than the AI, may pose another type of health risk. Supplementing with biotin beyond recommended intakes can cause clinically significant falsely high or falsely low laboratory test results, depending on the test. These incorrect results may lead to inappropriate patient management or misdiagnosis of a medical condition. The following section has more details on these interactions.

Biotin overdose: What are the biotin side effects?

It has become a trend to take large doses of the vitamin with the intention of achieving results faster. Unfortunately, there are biotin side effects, and so, can actually create health problems. Hence, it is important to know everything about the biotin side effects before taking supplements:

1. Weakens immunity

Too much biotin can lower vitamin C level, which needs to be up, as the nutrient acts as a powerful antioxidant. It protects cells from damage and enhances the body’s natural defenses. If the level goes down, it can weaken your immunity, which can make you fall ill frequently. A study published in the American Journal of Physiology suggests that immunity can be hampered by too much biotin.

2. Elevates blood sugar

One of the biotin side effects is that it can lead to high blood sugar levels, which can prove to be dangerous for people with diabetes. A study, published in the Frontiers in Nutrition, says that it influences lipid levels as well as blood glucose levels.

3. Affects neurological system

Too much biotin can lower vitamin B6 levels in the body. This can then impact the neurological system, which can prove to be very dangerous for the body. It may lead to dizziness, mainly due to interactions with other vitamins.

4. Leads to rashes

If you feel that all biotin can do is make your skin glow, you must understand all the biotin side effects. Instead of making your skin flawless, an overdose of biotin can lead to skin rashes. There may be skin irritation and even acne in some people.

5. Impacts the liver

One of the biotin side effects is that it can negatively impact your liver. Too much biotin can lead to problems with insulin release. This, in turn, can interfere with the functioning of your liver, and that will effect other processes in the body.

6. Leads to digestion and kidney problems

You can end up with digestion problems that can lead to gut-related problems. If you are wondering if biotin is safe for your kidneys, then you should know that too much biotin leads to excessive urine production. This means that your kidneys will be burdened.

High Doses Of Biotin And Safety

Biotin is a water-soluble vitamin and excess amounts are eliminated through the urine. While vitamins that are "water-soluble" generally are difficult to "overdose", they aren't without potential side effects. For example, "mega doses" of Vitamin C, another water-soluble vitamin, has been known to increase the risk of kidney stones and cramping.

Nevertheless, biotin doesn't not have documented cases of overdose and appears very well tolerated. While the daily recommended intake of biotin is only 30 micrograms, it is used in much higher quantities as a supplement. Studies have used doses ranging from 2,500 micrograms (2.5 milligrams) all the way to to 10,000 micrograms (10 milligrams) will no adverse effects.

In fact, toxicity studies with biotin have shown that:

- Ingestion of doses of biotin over 300 times the recommended intake does not produce signs of toxicity.
- Other studies have reported that there were likewise no signs of toxicity of overdose in those receiving doses, both orally and intravenously, over 600 times the recommended daily intake.

While there have been some anecdotal reports that biotin can alter the release of insulin and cause high blood sugar levels, but this doesn't appear to be the case. Evidence actually supports the opposite, that biotin can lower total blood glucose levels.

What most likely is taking place in anecdotal reports of side effects is that biotin is interfering with lab results. Although biotin appears very safe to take as a supplement, it is well known that it can affect a variety of laboratory blood tests, as discussed in the next section.

Different forms of biotin supplements

What are biotin supplements?

Biotin, also known as Vitamin B7, is an important vitamin that is essential for the metabolism of fats, carbohydrates, and amino acids. "Substances containing this water-soluble vitamin are called biotin supplements, and they are often sold as tablets or in other forms. It is often noticed as having beneficial effects on nails, skin, and hair," explains dietician Veena V. A study published in the Journal of Nutrition states that biotin supplementation is effective during pregnancy as well as lactation. It helps in better embryonic growth.

What are the other ingredients that biotin supplements contain?

Biotin supplements are made out of more than just biotin, including substances like fillers, binders, and preservatives. These help in the stabilization and production process of biotin. "Some of the common additional ingredients are cellulose, magnesium stearate, or silica, which help with tablet formation and prevent clumping," explains Veena. Some supplements also have other nutrients such as zinc, vitamin C, or selenium. These support the benefits of biotin for hair, skin, and nails. Some biotin supplements are available in liquid or gummy forms. These biotin supplements may contain sweeteners, flavourings, and colourings. It's important to check the ingredient list, especially if one has allergies or sensitivities.

What are the different types of biotin supplements?

Biotin supplements are produced in different formats that cater to different users, according to their needs and preferences.

1. Tablets and capsules

These are the most common forms of supplements which contain biotins in a powdered form. They can be consumed like any other tablet according to the prescribed dosage.

2. Softgels

These are similar to capsules but differ in textures. Softgels contain biotin dissolved in oil, which helps to enhance absorption for some people. They are also considered to be easier and less messy to swallow.

3. Gummies

Biotin supplements have recently developed into gummies that are quite chewable and have become popular due to their pleasant taste. They are often used for those who prefer not to take pills.

4. Powders

Biotin in the form of powders provides people with the flexibility to consume the same by either mixing it with their drinks or food. It especially helps people who have difficulty swallowing pills or chewing them.

5. Multivitamins

Some multivitamins also include biotin amongst other vitamins and minerals, providing a broader range of nutrients in one supplement.

Biotin for Hair loss - A Medical insight

Uses & Effectiveness

Biotin may support hair growth in people whose hair thinning or loss occurs due to a biotin deficiency. Other vitamin deficiencies may also affect the health of your hair.

Whenever I shop at a big box retailer, I like to browse their dietary supplement offerings to stay aware of any new products.

Increasingly, I've noticed more products that offer targeted health solutions, especially around hair growth and thickness.

Most of the products contain multiple ingredients. Biotin, a water-soluble B vitamin, is almost always one of them.

Similarly, many shampoos and conditioners that promise thicker, fuller hair often contain this B vitamin.

The reoccurring theme here is that biotin, whether taken as a supplement or lathered in your hair, supposedly benefits hair growth.

This article explains the link between biotin and hair health and whether the vitamin is effective and safe for hair growth or preventing hair loss.

Does biotin help prevent hair loss?

Although the evidence to support biotin alone for hair growth is weak and limited, the evidence is slightly stronger for preventing hair loss.

Still, biotin supplements are only likely to prevent hair loss and promote hair growth in people with a biotin deficiency.

In one study, a biotin deficiency was found in 38% of women complaining of hair loss. Of these participants, 11% had a history of deficiency risk factors, such as inflammatory bowel disease (IBD) or the use of certain medications like antibiotics.

While this study didn't assess the effects of biotin supplements or biotin-added hair products on preventing hair loss, it demonstrates the link between hair loss and inadequate biotin levels.

Other causes of hair loss include :

- androgenetic alopecia, also known as female pattern baldness
- rapid weight loss
- other nutritional deficiencies like iron, zinc, or protein
- certain hormonal diseases like thyroid disorder

Due to the multiple factors involved in hair loss and thinning, supplementing with biotin without determining the cause can prevent or delay the appropriate treatment in instances where a biotin deficiency isn't at fault.

Even in cases where a biotin deficiency is present, biotin supplements may not necessarily prevent hair loss.

For example, researchers in one study prescribed a biotin supplement to 22 patients with low biotin levels for hair loss following gastric sleeve surgery.

After 3 months, 5 of the patients reported a significant decline in hair loss, 14 reported a small effect, and 3 reported no effect, demonstrating that other factors may also be at play when it comes to hair loss and its prevention.

Daily needs and biotin-rich foods

Normally, the Food and Nutrition Board at the National Academies of the Sciences, Engineering, and Medicine sets a recommended dietary allowance (RDA) for each nutrient.

When there isn't enough data to set an RDA for a nutrient, which is the case with biotin, the board instead sets an adequate intake (AI). This is the nutrient level assumed to be adequate for most people.

The AI for biotin is 30 mcg for adults and 35 mcg for women who breastfeed.

You can easily meet these recommendations by enjoying a balanced diet. In fact, it's estimated that people living in the United States get about 35–70 mcg per day of biotin.

Recommended dosage and administration

Description

Biotin supplements are used to prevent or treat biotin deficiency.

Vitamins are compounds that you must have for growth and health. They are needed in only small amounts and are usually available in the foods that you eat. Biotin is necessary for formation of fatty acids and glucose, which are used as fuels by the body. It is also important for the metabolism of amino acids and carbohydrates.

A lack of biotin is rare. However, if it occurs it may lead to skin rash, loss of hair, high blood levels of cholesterol, and heart problems.

Some conditions may increase your need for biotin. These include:

- Genetic disorder of biotin deficiency
- Seborrheic dermatitis in infants
- Surgical removal of the stomach

Increased need for biotin should be determined by your health care professional.

Claims that biotin supplements are effective in the treatment of acne, eczema (a type of skin disorder), or hair loss have not been proven.

Biotin supplements are available without a prescription.

Importance Of Diet

For good health, it is important that you eat a balanced and varied diet. Follow carefully any diet program your health care professional may recommend. For your specific vitamin and/or mineral needs, ask your health care professional for a list of appropriate foods. If you think that you are not getting enough vitamins and/or minerals in your diet, you may choose to take a dietary supplement.

Biotin is found in various foods, including liver, cauliflower, salmon, carrots, bananas, soy flour, cereals, and yeast. Biotin content of food is reduced by cooking and preserving.

Vitamins alone will not take the place of a good diet and will not provide energy. Your body needs other substances found in food, such as protein, minerals, carbohydrates, and fat. Vitamins themselves cannot work without the presence of other foods.

The daily amount of biotin needed is defined in several different ways.

Because lack of biotin is rare, there is no RDA or RNI for it. Normal daily recommended intakes for biotin are generally defined as follows:

Infants and children

- Birth to 3 years of age: 10 to 20 micrograms (mcg).
- 4 to 6 years of age: 25 mcg.
- 7 to 10 years of age: 30 mcg.

Adolescents and adults—

- 30 to 100 mcg.

This product is available in the following dosage forms:

- Capsule, Liquid Filled
- Tablet, Chewable
- Tablet
- Capsule
- Tablet, Disintegrating

Proper Use

Dosing

The dose of this medicine will be different for different patients. Follow your doctor's orders or the directions on the label. The following information includes only the average doses of this medicine. If your dose is different, do not change it unless your doctor tells you to do so.

The amount of medicine that you take depends on the strength of the medicine. Also, the number of doses you take each day, the time allowed between doses, and the length of time you take the medicine depend on the medical problem for which you are using the medicine.

For oral dosage form (capsules or tablets):

To prevent deficiency, the amount taken by mouth is based on normal daily recommended intakes:

- Adults and teenagers—30 to 100 micrograms (mcg) per day.
- Children 7 to 10 years of age—30 mcg per day.
- Children 4 to 6 years of age—25 mcg per day.
- Children birth to 3 years of age—10 to 20 mcg per day.

To treat deficiency:

Adults, teenagers, and children—Treatment dose is determined by prescriber for each individual based on severity of deficiency.

Missed Dose

If you miss a dose of this medicine, take it as soon as possible. However, if it is almost time for your next dose, skip the missed dose and go back to your regular dosing schedule. Do not double doses.

If you miss taking biotin supplements for one or more days there is no cause for concern, since it takes some time for your body to become seriously low in biotin. However, if your health care professional has recommended that you take biotin, try to remember to take it as directed every day.

Drug Interactions

Although certain medicines should not be used together at all, in other cases two different medicines may be used together even if an interaction might occur. In these cases, your doctor may want to change the dose, or other precautions may be necessary. Tell your healthcare professional if you are taking any other prescription or nonprescription (over-the-counter [OTC]) medicine.

Other Interactions

Certain medicines should not be used at or around the time of eating food or eating certain types of food since interactions may occur. Using alcohol or tobacco with certain medicines may also cause interactions to occur. Discuss with your healthcare professional the use of your medicine with food, alcohol, or tobacco.

Biotin for Hair loss - A Medical insight

Potential risks and Adverse effects

Whether you're looking to improve your skin or get thicker hair and nails, biotin is a popular fix. But, like any supplement, biotin can also have a dark side. Below, experts explain the unexpected side effects of taking biotin so you can be aware of whether the ingredient is working against your body instead of for you.

Before putting anything new in your body, it's helpful to know what it is. Biotin is another name for vitamin B7, and is a crucial ingredient to keep your hair, skin, and nails healthy. You usually get your biotin naturally through eating foods like nuts, eggs, and whole grains. But you can also opt to get an extra dose of the vitamin in supplement form (studies suggest doses of up to 100 micro-grams).

The vitamin can also come with some unwanted side effects — so, when in doubt, consult with a physician before beginning your regimen. To help you understand if your supplement is causing you trouble, experts share six unexpected side effects of biotin.

Positive side effects

Biotin provides an important source for creating energy as well as maintaining the function of your body as a whole. Like all vitamins, your body needs biotin to stay healthy. There are several systems that biotin helps keep healthy. Some of these include your liver, nervous system, hair, eyes, and more.

Biotin may be effective in treating certain medical conditions. Some of these conditions include:

- hypoglycemia
- hyperlipidemia
- glucose control in obese patients with diabetes (when combined with chromium picolinate)

Some people believe that taking biotin supplements will improve your hair and nails. However, there is currently little medical evidence that this is true. More research is needed into this possible benefit of biotin.

Negative side effects

While it's available as a supplement, biotin is something you should only take if advised by your doctor. Most people get enough biotin through their regular diet.

Talk to your doctor about other medications you're taking as well as any medical conditions you have before taking biotin. Vitamins and supplements can have a negative effect on some medications and medical conditions.

There are currently no known adverse side effects of biotin when taken as prescribed by a doctor or through normal dietary intake.

There are some cases where certain dietary or other habits have caused a deficiency of biotin. Studies have found that women who smoke can increase the metabolism of biotin in their bodies and cause a deficiency.

Another case showed that eating raw eggs — particularly the whites of the eggs — on a regular basis can also create a biotin deficiency. In this instance, the deficiency brought about a condition called biotin-responsive limb weakness. This condition mimics quadriplegia.

The regular consumption of raw egg whites was used in another research study that showed this caused a biotin deficiency as well.

Common symptoms of a biotin deficiency include:

- hair loss or thinning
- high cholesterol
- rash on the skin
- heart problems

6 Unexpected Side Effects To Know Before You Take Biotin Supplements

Acne

Though you may be taking the vitamin to improve your skin, you might actually notice more pimples after starting the supplement.

Your body absorbs biotin through your gastrointestinal system the same way that it absorbs another vitamin that helps deter acne called vitamin B5. But if you take too much biotin, your system is overloaded and isn’t able to take in as much B5. Less of that acne-fighting vitamin, which can lead to cystic acne along your chin and jawline.

"Although this is not considered 'dangerous,' it is a side effect that can impact your life — cystic acne can be painful." It can also impact your self-esteem or negate the point of taking biotin in the first place. So if this sounds all too familiar, she recommends lowering your dosage or quitting the supplement altogether.

Skin Rash

Skin side effects don’t stop at acne. an allergy and immunology specialist. "There have been instances of severe skin rashes from biotin, where blood vessels can become inflamed because the immune system perceives the biotin as something foreign."

Sometimes skin rashes develop because of an allergic reaction to the vitamin, but other times it can happen due to a biotin overdose. She recommends working with your doctor to find the right amount for you and starting with

smaller doses so your body can get used to the vitamin before you use it more regularly.

Allergic Reaction

It is possible to have an allergic reaction to your biotin supplement. Symptoms include nausea, a rash, or swelling of the throat and face. While often manageable, allergic reactions can become dangerous if not addressed by a medical professional. To avoid this, check with your doctor before starting the supplement to make sure you're using it safely.

Skewed Lab Results

Depending on your dosage, high levels of biotin may cause false-positives or false-negatives for different lab tests, like thyroid hormone tests. And if your lab results are incorrect, it could contribute to a misdiagnosis. Tell your doctor about every medication and supplement you're taking when you get blood drawn.

Your doctor may even recommend that you stop taking the vitamin for a while before having any lab tests done to make sure your results are accurate. Check in with your doctor if you have upcoming tests to see when they recommend you stop your daily dose.

Upset Stomach

Taking biotin may also wreak havoc on your digestive system: biotin side effects can include stomach troubles like nausea, cramping, and diarrhea, according to Elliott. If you're having tummy issues whenever you take the supplement, it may be best to ditch your dose to keep your digestive system healthy.

Interactions With Medications

Biotin can cause interactions with medications like anticonvulsants. It could lower their effectiveness or cause new side effects to pop up, like more stomach problems. "Any interaction with a medication can potentially be dangerous to a patient, which is why it is very important to discuss all of your medications and supplements with your doctor."

Though many people take biotin with no issue, it's still important to talk to your doctor if you're experiencing anything out of the ordinary. That way they can provide you with safer alternatives if need be.

Pregnancy & Lactation

An unborn baby is completely dependent on their mother for nutrients and vitamins, which is why pregnant women are advised to follow a healthy diet. Expectant mothers should ensure that their food chart includes all the essential nutrients and vitamins that are required to sustain a pregnancy. One such essential vitamin is biotin. It is a water-soluble B-complex vitamin which plays a major role in the conversion of food to energy. Biotin is required to form the enzymes that help in breaking down proteins, carbohydrates, and fats. This is why doctors advise pregnant women to take essential supplements like biotin and folic acid tablets during pregnancy.

Can You Take Biotin During Pregnancy?

Biotin, also known as vitamin H or B-7, plays a crucial role in maintaining healthy skin, hair, and nails, as well as supporting the body's metabolism. While biotin is commonly taken, many pregnant women wonder, 'Is biotin safe during pregnancy?' Yes, the intake of prescribed biotin is safe during pregnancy. Supplemental biotin can help cure the deficiency of biotin, but too much of it might increase the chances of a miscarriage. Studies conducted on animals show that biotin is teratogenic and may result in a miscarriage. Therefore, you must consult your doctor before you start taking any supplemental biotin.

Biotin Deficiency During Pregnancy

Many expectant women suffer from a biotin deficiency because their body breaks down biotin more rapidly during pregnancy. According to studies, 33% – 50% of expectant women are mildly deficient in biotin, and this occurs mostly during late pregnancy. it was found that low levels of serum biotin in pregnancy have been associated with preterm labour or babies born small for their gestational age (SGA).

Biotin deficiency can be caused due to several health issues, including:

- Increased risk of seborrheic dermatitis
- Poor nail and hair health
- Peripheral neuropathy
- Diabetes
- Reduced appetite
- Fatigue
- Insomnia
- Depression

What Is the Recommended Dosage for Pregnant Women?

Expectant women should have an intake of at least 25-30 mcg of biotin per day. The symptoms of toxicity do not occur at this dosage. Biotin supplements of this dosage might help an expectant woman prevent the issues caused due to biotin deficiency.

Can Biotin Cause Birth Defects?

In some cases, a deficiency of biotin in pregnant women may also lead to birth defects. In a study conducted on animals, it was proven that the deficiency of biotin might result in birth defects in animals, particularly issues like cleft palate, skeletal deformities, cleft lip, etc. It is possible for these effects to show up in humans as well.

What Are the Food Sources of Biotin?

Some biotin-rich food sources are as follows:

1. Dairy Products and Eggs

Egg yolk is said to be rich in biotin. Dairy products like milk, cheese, etc., also have good amounts of biotin. These food sources can be easily incorporated into your regular diet.

2. Nuts and Grains

Nuts and whole grain products like pecans, walnuts, peanuts and almonds are considered to be rich in this vitamin.

3. Fish and Meat

Sardines, organ meats, and salmon are considered to be rich in the concentration of biotin.

4. Legumes

Black-eyed peas, soybeans, and other legumes are also rich sources of biotin.

5. Fruits and Veggies

Many fresh fruits and vegetables are excellent sources of this vitamin. Avocadoes, cauliflower, raspberries, mushrooms, Swiss chard, carrots, cucumbers, onions etc., have a good concentration of biotin.

Biotin & Breast-feeding

With a newborn in the house, you need all the energy you can get, and biotin will help you. Biotin, or vitamin H, is used to digest carbohydrates, fats and proteins, converting food into energy. It's also needed for healthy skin, hair and eyes as well as proper liver and nervous system functioning. It's rare to be deficient in biotin, but pregnancy makes you more susceptible. You need more of this nutrient when breast-feeding to keep you and your baby healthy.

Signs of a Deficiency

Biotin is a water-soluble vitamin. You don't store it, but rather excrete it through your urine. Without adequate amounts of this vitamin, you develop signs of a deficiency. There is no accurate test to detect a deficiency, but your doctor should recognize it by your symptoms, which include thinning hair and a scaly rash on your face. Biotin is also required for a healthy nervous system, and without enough you may develop depression, exhaustion, hallucinations and tingling in your arms and legs.

Recommendations and Sources

Adults and pregnant women need 30 micrograms of biotin daily. The recommended dietary allowance for breast-feeding women is 35 micrograms. Biotin is found in brewer's yeast, egg yolks, nuts, beans, black-eyed peas, whole grains, cauliflower, bananas and mushrooms. Food processing can kill biotin, so opt for the least processed version of these foods. Try to eat enough healthy foods to meet your biotin requirements, but if you're concerned you may be deficient, speak to your physician about taking a supplement.

Biotin in Your Breast Milk

When breast-feeding, you not only excrete biotin in your urine, but you pass it to your baby through your breast milk, which is why the recommended dosage is higher for breast-feeding moms. "Nutrition During Lactation," your breast milk contains variable amounts of biotin. The more you nurse your baby, the more biotin is in your milk. The quantity of biotin is also directly linked to the biotin in your blood, but the quantity in your milk is hundreds of times greater than the content in your blood.

Cradle Cap and Biotin

Biotin may be useful in treating cradle cap in infants. Although harmless, cradle cap causes flaky, dry skin on your baby's scalp. You might also notice thick yellow or brown scaly patches that flake on her head or around her ears, eyebrows, eyelids and armpits. This condition should clear up on its own by 12 months of age, but you can take a biotin supplement to move the process along. breast-feeding moms take a biotin supplement to treat cradle cap or care for

their baby's brittle finger and toenails. Check with your doctor first before adding supplements to your diet.

Incorporating biotin-rich Diet

Many factors, including your diet, determine the quality of your hair. You must provide it with nutrients just like your body for healthy hair. One such nutrient that is a promoter of hair growth is Biotin, which many dermatologists recommend for hair growth.

Biotin-Rich Foods

In addition to supplements and hair care products, numerous foods are naturally rich in biotin.

By incorporating these biotin-rich foods into your diet, you can support hair growth from the inside out.

Examples of biotin-rich foods include eggs, nuts, seeds, salmon, avocados, and sweet potatoes.

Consuming these foods regularly can provide your body with a natural source of biotin and help maintain optimal hair health.

Here are some detailed biotin-rich foods that you can consume for better hair growth:

1. Meat

Biotin can be found in certain lean meats such as liver, pork chops, and cooked hamburger meat. Despite not being a popular food, the liver offers the highest level of biotin.

- Biotin content of cooked beef liver (75 g): 31 mcg
- Biotin content of Cooked chicken liver (75 g): 138 mcg

2. Yeast

Although nutritional yeast and brewer's yeast both contain biotin, the amount provided by each can differ. Brewers' yeast or active dry yeast is used to make beer and leaven bread. On the other hand, nutritional yeast is a yeast that's inactive and is usually used to make dairy-free cheese.

- Biotin content of active dry yeast (7 g): 0.25 mcg
- Biotin content of nutritional yeast (16 g): 21 mcg

3. Legumes

Most legumes are a great source of biotin, with the two richest sources being peanuts and soybeans. Peas, beans, and lentils are high in protein, fibre, and numerous micronutrients also have high biotin contents.

- Biotin content of roasted peanuts (28 g): 5 mcg
- Biotin content of roasted peanuts (100 g): 19.3 mcg

4. Eggs

Eggs contain numerous vitamins and minerals, protein, iron, and phosphorus, with the yolk being especially rich in biotin. It's best to thoroughly cook them, as egg whites contain an antinutrient called avidin, which will interfere with the absorption of biotin if eaten raw.

- Biotin content of cooked eggs (50 g): 10 mcg

5. Mushrooms

Mushrooms are nutrient-rich fungi abundant in biotin and offer several health benefits. They are protected by parasites and predators thanks to their high concentration of biotin.

- Biotin content of fresh button mushrooms (70 g): 5.6 mcg

6. Spinach

Spinach is also a good source of biotin. In addition to that, spinach is also an excellent source of vitamin A, vitamin C, calcium, iron, and folic acid.

- Biotin content of cooked spinach (64 g): 5 mcg

7. Seafood

In terms of seafood, salmon and tuna have the highest biotin content. Both contain omega-3 fatty acids, which are advantageous to people who wish to grow their hair faster and thicker. It may help prevent hair loss by supplying healthy fats to the hair.

- Biotin content of cooked salmon (85 g): 5 mcg
- Biotin content of cooked tuna (85 g): 0.6 mcg

8. Sunflower seeds

Sunflower seeds contain biotin along with other micronutrients like calcium, potassium, magnesium, and vitamin E. You can easily add them to your daily diet, consume them as a snack or add them as a salad topping.

- Biotin content of roasted sunflower seeds (20 g): 2.6 mcg

9. Sweet potatoes

As a vegetable source of biotin, sweet potatoes are one of the best ones. Moreover, they're full of vitamins, minerals, fibre, and antioxidants, making them an all-around healthy food option.

- Biotin content of sweet potatoes (125 g): 2.4 mcg

10. Avocados

Having avocados is a great way to get biotin. Due to the high vitamin E content, it may be an excellent choice for people who wish to protect their skin health.

- Biotin content of avocados (28 g): 1.8 mcg

11. Nuts

Protein, fibre, and unsaturated fat can all be found in nuts. Several nuts, including almonds, pecans, hazelnuts, and cashews, contain biotin that the body needs every day and are easy to carry as snacks.

- Biotin content of roasted almonds (30 g): 1.5 mcg

12. Whole wheat bread

Biotin content in a slice of whole wheat bread ranges from one to six micrograms. When it comes to white bread, it has a downside that it contains very little biotin, so it is not recommended.

- Biotin content of whole wheat bread (1 slice): 1 mcg

13. Dairy

Small amounts of biotin can be found in dairy products such as milk, yoghurt, and cheese.

- Biotin content of cheddar cheese (28 g): 0.4 mcg
- Biotin content of milk (128 g): 0.3 mcg
- Biotin content of plain yoghurt (128 g): 0.2 mcg

14. Broccoli

Biotin can be found in broccoli and many nutrients like fibre, calcium, vitamin A, and vitamin C. One half-cup of raw broccoli contains 0.4 micrograms of biotin.

- Biotin content of broccoli (45 g): 0.4 mcg

15. Bananas

The banana is a popular fruit that has a small presence of biotin. Moreover, they also contain fibre and carbohydrates and micronutrients like B vitamins, copper, and potassium, so they have many more advantages.

- Biotin content of bananas (105 g): 0.2 mcg

Selecting biotin-infused hair care products

Biotin-Infused Hair Care Products

Hair care products such as shampoos, conditioners, and hair masks are often formulated with biotin as a key ingredient.

These products are designed to be applied externally, directly to your hair and scalp.

Through regular use, biotin-infused hair care products can strengthen your hair strands, improve overall hair health, and provide the necessary nourishment to combat hair loss.

Incorporating these products into your hair care routine can be a beneficial and convenient choice.

How Biotin Shampoos Work

Shampoos infused with biotin are believed to improve scalp circulation, increase hair density, and strength hair follicles. Using biotin shampoos can help hair feel more nourished and thicker. If you have thin hair, biotin can aid in making it thicker and fuller.

Biotin-Rich Products from Pantene

Take a look at these biotin shampoos and conditioners from Pantene to keep your hair looking and feeling healthy, even if it’s been color-treated or had highlights added.

Illuminating Color Care Shampoo With Biotin

Pantene’s Illuminating Color Care Shampoo With Biotin has a fragrance you’ll love and is sulfate free so you can trust the ingredients, which include pro vitamin and antioxidants, to pamper your hair. Paired with Illuminating Color Care Conditioner With Biotin, you can rely on this hair care system to lock in smoothness, shine, and keep your color looking crisp.

Developing personalized hair care routines

Getting into a hair care routine is just like embarking on a skin care one. Once you've found one that works for you, you'll rarely stray.

But the process of finding that routine can seem a little daunting, especially when there's numerous options for people with the same hair type.

Here's a breakdown of everything you need to know to find the hair care ritual that's right for you.

Your individual routine ultimately depends on a few factors

From the feel of your hair to the styles you prefer, these elements will all alter the routine you end up choosing.

Your natural hair texture or type

Hair types tend to be fine, thick, or coarse and fall into one of four categories:

- straight
- wavy
- curly
- kinky

Each has its upsides and downsides. For example, straight hair usually looks and feels greasy quicker than curly hair due to oil speedily making its way down the hair shaft.

Whether your hair has been bleached, dyed, or otherwise chemically processed

If your hair has come in contact with dye, bleach, or chemicals, you may have to think extra hard about your routine.

People with dyed hair are advised not to wash it every day to prevent premature color fading and dryness.

And bleached hair may require some extra nourishment in the form of conditioner or hair masks.

How you want to wear your hair on a daily basis

It's another thing you'll have to consider, especially if you're a fan of using damaging heat tools.

It's normal to find at least one aspect of your hair problematic, whether it's frizz, a flaky scalp, or dry, damaged strands.

Knowing what the problem is, is half the task. The rest involves finding the best solution.

Every routine shares a few basic components

Although your hair type and concerns will alter your hair care routine in some ways, there are a few basic steps that every person can benefit from.

Cleanse

Cleansing is a balance between removing things like dead skin and product residue without stripping the hair of its natural oils.

Without a good wash, sebum will build up, leaving unwanted oiliness.

So will dead skin if not removed. The skin renews itself around every 28 days, and this may be noticeable if the hair is not clean.

And, if you're an avid swimmer, you don't want to leave chlorine on your locks. The longer it sits, the more time it has to strip hair of its natural elements and cause damage.

Condition

Conditioners have myriad benefits. The main one is moisturizing, but others include detangling, shininess, and frizz reduction.

The main ingredient of a conditioner is called a cationic surfactant.

When hair is wet, this sticks to it, coating the strands to replenish the moisture that shampoo may have removed.

Moisturize and seal

To add further hydration to the hair, you may want to embark on a two-step process known as moisturize and seal.

This can be particularly useful for kinky or coily hair that tends to be dry.

The aim is to seal in moisture, not to lock in dryness, using a hydrating product and sealing oil.

Detangle

Detangling is essential for stopping breakage and for making your life a whole lot easier.

But you need to use the right tool, such as a wide-tooth comb, to avoid pulling hair out by mistake.

Depending on your hair type, you may need to detangle every day or much less often.

Style and protect

Thanks to a number of tools and tricks like volumizers and gels, you can style your hair practically any way you want.

But if you're a fan of heated tools, you'll need to protect those strands with a heat protection spray.

Spot-treat

Spot-treating hair simply means picking out a particular area that's bothering you and doing something to remedy it.

For example, you're fed up with how frizzy your hair is, so you try a protein treatment.

Or you've noticed that your scalp is feeling extra dry, so you apply a super nourishing product designed for that area.

Cleansing and conditioning

Clarifying shampoo. A deep-working shampoo, clarifying formulas work to remove buildup from the hair. Restrict use to around once a month, as they can remove natural oils.

"Daily" shampoo. Used for regular washing, this shampoo may not need to be applied daily as the name suggests, but whenever your hair feels like it needs a good cleanse.

"Daily" or rinse-out conditioner. The conditioner that you use the most is likely to be one that rinses out after a couple of minutes. It's best applied to the middle and ends, as root application can result in a greasy-looking scalp.

Leave-in conditioner. With this kind of conditioner, you apply it in the same way but don't rinse it out. This allows for an increased level of nourishment.

Deep conditioner. For even more hydration, try a deep conditioner. Great for hair that's prone to dryness, these conditioners are.

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Explores the scientific basis of different hair loss types, aiding in diagnosis and treatment.

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Highlights the role, metabolism, and clinical uses of biotin in hair and nail health.

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