

Unveiling the Hidden Causes: Epidemiology and Risk Factors Behind Hair Fall

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Abstract

Individuals of all ages and genders are frequently affected by hair loss, a problem with both physical and psychological impact. This article aims to provide a basis for understanding the epidemiology and risk factors associated with hair loss to promote effective prevention, early diagnosis, and treatment. Reasons for the global prevalence and distribution of hair loss (varying by age, sex, race, heredity, and environmental factors) have not been well established, but numerous forms of hair loss exist, including androgenetic alopecia, telogen effluvium, and alopecia areata, which are the more commonly diagnosed. There are many risk factors that lead to an excessive amount of hair loss; however, some of the most common include hereditary predisposition, hormone-related changes, nutritional deficiency, chronic illness, psychological stresses, medications, autoimmune diseases, and infections of the scalp. In addition to the aforementioned medical risk factors, several modifiable risk factors exist among individuals, such as dietary habits, smoking, lack of sleep, pollution, and chemical hair treatment use, which may increase the likelihood of developing hair loss. Women have additional contributing risk factors to hair loss that include pregnancy, menopause, and endocrine disorders (e.g. polycystic ovary syndrome), whereas the primary contributing risk factor to hair loss in men is their sensitivity to androgens. Other recent studies suggest that oxidative stress, inflammation, and the microenvironment of the hair follicle may contribute to the progression of the disease. By understanding these epidemiological patterns and modifiable risk factors, targeted prevention and personalized treatment options can be developed.

Keywords: Hair fall, Epidemiology, Risk factors, Androgenetic alopecia, Telogen effluvium, Alopecia areata, Genetic predisposition, Nutritional deficiency, Hormonal imbalance, Lifestyle factors

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Introduction

One of the most common skin complaints globally is hair loss (or alopecia). Hair loss results due to the disruption of hair growth and hair shedding rates; therefore, excessive amounts of hair loss may be seen, or this may also manifest in lower hair density. There are three different phases of the hair cycle: anagen (growth), catagen (transition), and telogen (rest). Each phase has its own duration of time, and disruption to these phases leads to abnormal rates of hair loss. While it is normal, for one individual to lose a certain number of hairs on a day-by-day basis, if someone is losing more than what would be considered normal, it may be a reflection of some type of genetic, hormonal, nutritional, or environmental influence. The major types of hair loss are androgenetic alopecia, telogen effluvium, and alopecia areata; these three types of hair loss differ based upon the type of factors leading to the hair loss as well as how the hair loss manifests clinically. Both men and women can be affected by the above types of hair loss and each type can affect an individual at various stages of their life. Besides affecting an individual's physical appearance, hair loss may have substantial psychological consequences such as a loss of self-esteem, increased anxiety, and increased concern regarding social implications due to the hair loss. As society has become more aware of the problem of hair loss, many researchers have investigated its epidemiology and risk factors in hopes of creating a better overall understanding of hair loss to better prevent, diagnose, and treat. Gaining an understanding of the multiple variables contributing to hair loss is also necessary for developing management strategies for improving an individual's quality of life. (Paus & Cotsarelis, 1999)

There are differences in the occurrence of hair loss (also known as hair fall, hair shedding) based on various factors including age, race, gender, ethnicity, and genetics. Androgenetic alopecia is the most common type of hair loss worldwide, associated primarily with inherited (genetic) factors as well as sensitivity to androgen hormones. The presentation of hair loss due to androgenetic alopecia differs markedly between men and women. In men, the hair loss typically presents as a gradual recession of the front hairline and thinning crown, and in women, diffuse thinning of the scalp can occur particularly after changes in hormones. There are other types of hair loss; for example, telogen effluvium is an involuntary shedding of the hair that occurs at the end of the normal cycle of hair growth and shedding, caused by multiple factors such as extreme stress, illness, surgery, childbirth, and nutritional deficiency. Alopecia areata is an autoimmune disorder that can cause sudden patchy hair loss, and may affect children and adults alike. Study findings have shown that the prevalence of hair loss increases with age due to changes in hormonal regulation and follicular activity. In addition, factors such as geographic location and lifestyle also contribute to the prevalence of hair loss, as modern populations are experiencing increased awareness of the effects of stress, pollution, and dietary changes on health and well-being and as a result, more cases of hair loss are being reported today than ever before. The epidemiological data collected on hair loss assists health care professionals in determining which populations are at high risk for developing hair loss and also assists researchers in developing targeted health care interventions for the prevention and treatment of hair loss. (Almohanna et al., 2019)

Hair loss has many contributing factors; genetic factors are significant in the development of hair loss. Evidence suggests that individuals with a family history of balding can start to develop bald patches earlier and have a higher likelihood of developing bald patches later than those without a family history of hair loss. Other factors such as hormones are also related to hair loss as fluctuation in levels of hormones (androgens, thyroid hormones, and reproductive hormones) can play an important role in regulating the hair growth cycle. In women, the hormonal changes caused by pregnancy, menopause, and polycystic ovary syndrome increase the risk of excessive hair shedding due to hormonal imbalance. Other biological causes include nutritional deficiency caused by a lack of iron, zinc, vitamins, and protein, which can make hair follicles weak and impact their ability to grow hair normally. An unhealthy diet, or restrictive diet, has been shown to be an important risk factor in the development of hair loss. Chronic illnesses including diabetes,

autoimmune diseases, and chronic infection can negatively impact the function of hair follicles. Understanding the biological and nutritional risk factors for hair loss is important for establishing a correct diagnosis and for providing the proper treatment. Early identification of risk factors can allow the clinician to make recommendations for lifestyle changes and/or therapies to help slow the progression of hair loss. (Hunt & McHale, 2005)

Several factors related to the environment and lifestyle are becoming increasingly substantial contributors to hair loss within modern populations. Consistent exposure to air pollution, ultraviolet radiation (UV), and toxic chemicals can cause deficiencies in nutrients for hair follicles and damage the scalp environment, both of which negatively affect hair follicle health. Excessive use of hair dyes/colouring, straightening or smoothing products, heat styling tools, and harsh cosmetic treatments can weaken hair shafts and promote hair breakage. Additionally, some unhealthy lifestyle behaviours, including smoking, poor sleep hygiene, dehydration, and chronic psychological stress, may interrupt normal hair growth cycles. An example of this includes stress-related hair loss known as telogen effluvium, wherein a large number of hair follicles abruptly become dormant and fall out prematurely. Occupational stress and emotional disturbances also present considerable temporary hair loss triggers. Furthermore, a lack of exercise and eating behaviours that do not support good nutrition could result in inadequate amounts of nutrients necessary for normal hair growth. Addressing modifiable lifestyle and environmental risk factors can play an essential role in preventing excessive hair loss. Public knowledge about healthy lifestyle choices and hair care products/services is important to help decrease the increasing severity of hair loss. (Gupta et al., 2017)

Hair loss can be caused by many things, including genetics, biology, the environment and lifestyle. Many of these causes cannot be changed but the majority of risk factors for hair loss can be managed through preventative interventions and adopting a healthier way of life. A balanced diet and an effort to reduce stress, limit chemical treatments, and manage any medical conditions that may be affecting one's overall health can contribute to promoting health of the hair follicle to grow. Due to advancements made in dermatological research, the understanding of hair follicle biology has improved leading to better diagnostic and therapeutic methods. There are also a number of epidemiological studies that are continuing to find new risk factors for hair loss in many different types of groups. If an individual is able to identify the early signs of hair loss and pursue an appropriate course of treatment in a timely manner, the progression of serious hair disorders can be prevented. Because hair loss can have physical and psychological effects, the individual should seek out comprehensive care that includes medical evaluations and lifestyle changes. Increasing awareness of the causes of hair loss and how to prevent it will assist individuals with finding safe methods to protect themselves and improve the overall health of their hair and scalp. (Malkud, 2015)

The development of hair loss is significantly impacted by medical conditions and also by medications. Many systemic diseases such as thyroid disorders, anemia, autoimmune diseases and chronic infections can alter normal follicular function. Autoimmunity can also lead to the immune system to attack the hair follicle leading to conditions like alopecia areata. Certain medications, including chemotherapy agents, anticoagulants and other forms of hormone treatment can cause either temporary or permanent hair loss because of their effects on rapidly dividing follicular cells. In addition, multiple scalp infections and inflammatory conditions can also damage the follicles and lead to abnormal amounts of shedding. Hormonal fluctuations associated with both aging and reproductive stages can also impact the rate and density of hair growth. Given that hair loss may be a sign of an underlying medical issue, thorough clinical evaluation is critical. Identifying and treating associated medical conditions may allow restoration of normal hair growth; therefore, thorough understanding of all medical risk factors is crucial when diagnosing, distributing or managing disorders of hair loss. (Trüeb, 2009)

Hair Fall is a Common Global Health Concern

Globally, hair loss is a common concern for many people, as millions of people around the world suffer from hair loss and it is a major topic that is being intensely researched in dermatology. The presence of hair has multiple roles in terms of appearance, providing a level of protection for the body and helping with someone's psychological well being; therefore if a person loses too much hair their confidence and emotional wellness may be significantly impacted. Hair follows a regular cycle of growing, transitioning and resting; disruptions in this cyclical pattern can lead to the loss of hair and thinning of hair at a greater rate than would be expected in normal conditions. Many factors that contribute to the occurrence of hair loss include: genetics; hormones; diet; medical conditions; stress and environment. Though some shedding of hair is considered to be normal, an increased amount of shed hair requires the evaluation of the cause of the abnormal amount of hair shed. The increased occurrence of hair loss is occurring parallel to increasing modifications in lifestyle, diet and levels of pollution along with levels of psychological stress. Different types of hair loss (androgenetic alopecia, telogen effluvium, and alopecia areata) require different mechanisms of action and have different risk factors. Recognizing the early signs and symptoms and understanding the various contributing factors will assist with the prevention and treatment of hair loss. Knowledge and awareness of practices to improve hair health and to reduce the factors that increase the risk of losing hair may improve the health of one's hair and/or reduce the burden associated with hair loss. (Shrivastava, 2009)

There are genetic, biological and environmental factors all contributing to the way hair grows and how follicles function normally. Genetics is one of the single greatest causes of hair loss due to sensitivity to androgens in androgenetic alopecia, which results in follicles gradually becoming smaller due to this effect. Hormones themselves can also contribute to hair loss (especially during pregnancy, menopause, and when other endocrine problems arise), in combination with nutritional factors. Having deficiencies in nutrients such as iron, zinc, proteins, and vitamins results in weaker hairs and/or disruptions to the normal cycle of hair growth. Chronic illnesses/diseases, infections, autoimmune disorders, etc. can all negatively impact follicle activity and can be responsible for excessive shedding. Psychological stress has recently been identified as a very important trigger for temporary loss of hair (known as telogen effluvium) because stress causes hairs to prematurely enter the resting phase. Factors related to modern living such as poor sleep patterns, poor diet, pollution, and others increase the chances for hair to fall out. By identifying some of these risk factors it will allow us to create strategies to prevent hair loss and develop appropriate methods for treating any resulting condition. An overall understanding of these causes is needed to optimise patient outcomes and promote healthy hair. (Trüeb, 2009)

There is a lot of variation in how people experience baldness across various populations according to their age, sex, genetic and lifestyle differences, and environment. Most people experience some kind of baldness; however, both male and female baldness varies depending on the distribution and severity. The most common type of baldness is androgenetic alopecia (hereditary baldness); in men, it is typically characterized by recession of the frontal hairline and/or thinning of the crown (vertex) region of the scalp and in females, it is generally described as diffuse thinning over the entire scalp. Telogen effluvium is also frequently reported among people experiencing baldness; it occurs when many (hundreds to thousands) of hair follicles prematurely enter the "telogen" phase of the normal hair growth cycle in response to stress, illness, surgery, childbirth, or nutritional imbalances. Alopecia areata is an autoimmune disorder characterized by patchy baldness and can affect people of any gender and age. Increasing levels of baldness are related to the modernisation of our world including increased levels of stress, poor nutrition, decreased physical activity, and increased environmental pollution. Data from epidemiological studies can help researchers understand the distribution (the patterns) of baldness and which groups may be most at risk for developing baldness. The data collected from these epidemiological studies can then be used to develop, improve and implement strategies for preventing baldness, to increase awareness about the condition and to treat baldness in a timely manner. (Guo & Katta, 2017)

Factors in our environment and our lifestyle play an increasingly large role in the development and progression of hair loss. Long-term exposure to air pollution, ultraviolet light, and chemicals have been shown to affect the health of the scalp environment and contribute to weakening the structure of hair fiber. Overuse of cosmetic products (hair dyes, straightening treatments), heat-based styling devices, etc. can weaken the hair shaft and lead to an increased likelihood of breakage. Emotional/physical stress has also been identified as a major risk factor because prolonged periods of high levels of emotional or physical stress can disrupt the normal cycle of hair growth and result in more hair being shed. Individuals who experience chronic stress can experience temporary hair loss as a result of their hair follicles being impacted by changes in the follicular activity of their hair. In addition, food deprivation caused by dieting and/or unhealthy eating habits can cause a reduced amount of nutrient materials to be available to support hair growth. (Mysore & Shashikumar, 2016)

Hair loss is a multifaceted disease caused by various factors that are interconnected instead of being the result of one individual factor. The overall amount of hair shed by a person is determined by many risk factors, including genetic predisposition, hormonal imbalances, nutritional status, environmental factors, psychological stress, and many types of diseases. While there may not be a way to prevent some causes of hair loss completely, early identification of risk factors can improve management outcomes. Currently, advances in the field of dermatology have resulted in a greater understanding of the biological processes of the hair follicle, which has led to the creation of better ways to diagnose and treat cases of hair loss. By understanding the causes and preventative measures for hair loss, patients are more likely to seek a healthcare provider sooner than later after beginning to notice a significant amount of hair loss; therefore, this will likely help to minimize further damage. Continued research in the future will investigate new mechanisms that play a role in hair follicle regulation, inflammation, and genetic influence. It will continue to be important for hair-loss patients to take a combined approach to reduce the burden of hair loss by using both medical evaluations and lifestyle modifications to improve their overall quality of life. (Malkud, 2015)

Prevalence Varies with Age, Gender, and Ethnicity

Hair loss can be a complex condition that affects millions of people every year, and the incidence of this condition varies widely based on various factors such as age, gender, ethnicity, and genetic background. The most definitive factor is age. As we age, the activity of our hair follicles slows down, which results in an overall decrease in the amount of hair we have. Older adults tend to have lower amounts of hair because of changes that occur in the structure of hair follicles as well as hormones that regulate hair growth. In addition to age being a major factor for hair loss; gender also has its own unique impact on the development of hair loss. For example; men typically suffer from androgenetic alopecia (male pattern baldness); which is primarily attributed to genetic factors as well as the male hormone testosterone. On the other hand; women typically experience diffuse thinning (thinning hair all over the head), due to various reasons; including changes in hormones, nutritional deficiency, or underlying medical conditions (which may lead to hair loss). Furthermore; differences among different groups of people (e.g., Caucasian, Hispanic, African American, etc.) also play a role in how and where hair will be lost because of variations that exist in the structure of hair follicles; susceptibility to developing particular types of hair loss because of their genetics; and the environment in which persons live. Research shows that some ethnic groups have higher/lower rates of developing certain types of hair disorders based upon either inherited genetics or variations in lifestyles. Understanding these types of differences will help provide an effective way to recognize those that are at high risk for experiencing hair loss; improve clinician's ability to diagnose patients with disorders related to hair loss; and develop and implement effective prevention and treatment options for these same patients. (Hunt & McHale, 2005)

Hair loss occurs differently depending on the individual due to a combination of biological (genetic) and social (environmental) factors. Age-related changes in both the scalp and in the hair follicles lead to a natural increase in hair shedding and subsequently a slower rate at which new hair grows back in older adults. The baseline reduction in hair follicle activity, along with fluctuations in hormone levels over time often results in thinning hair. The prevalence and presentation of hair loss show significant gender differences. For example, male pattern hair loss is primarily associated with some form of genetic transmission to males combined with the negative impact that dihydrotestosterone has on specific hair follicles (i.e. the follicle is genetically predisposed to become miniaturized and eventually fall out), while the majority of females who lose their hair do so because of fluctuations in their hormone levels, pregnancy, menopause, stress or nutritional factors. In addition to gender differences, there are also differences between ethnic groups in terms of hair loss, which may be attributed to diversity in hair attributes, hair follicle density and genetic differences between ethnicities. Environmental influences (i.e. climate, exposure to pollution, and lifestyle behaviours) can also modify an individual's risk for hair loss development. Researchers will utilize the collective data from epidemiological studies which address these variations amongst different populations to start to understand why certain populations experience higher rates of hair loss than others. This type of information will enable practitioners to identify individuals who are more prone to hair loss prior to their developing it, thereby allowing practitioners to provide appropriate preventative measures and individualized approaches to management of vulnerable patients based on demographic characteristics. (Sinclair et al., 2015)

Heritage has an impact on how much hair falls out and how it presents itself. This happens because there are genetic differences among people, the way their hair is made, and how they're exposed to the outside world. Population groups can also have different densities of hair follicles, hair widths, growth patterns and the chances of experiencing different forms of hair loss. By looking at the genetics passed down through generations, an ethnic group may have a greater risk of developing a specific condition (such as androgenetic alopecia or alopecia areata), while the environments they live in (i.e. environmental factors, such as climate, pollution, or lifestyle) may affect how they experience hair loss.. In order to understand how different people experience hair loss, it is necessary to study the variations in ethnic groups regarding hair loss. As researchers learn more about these ethnic differences, they will be able to figure out how to identify people based on their ethnicity who will develop hair loss due to various conditions and develop more appropriate methods for preventing this condition from occurring. A better appreciation of these differences will only improve how effectively doctors can assess and treat patients of all ethnicities. (Almohanna et al., 2019)

There are three main factors (age, gender, and ethnicity) that can interact with lifestyle and environmental aspects that leads to the differences seen in hair fall between populations. Due to modern lifestyles (more stress, poorer dietary habits, insufficient sleep) and the growing environmental exposure to pollutants, the prevalence of hair loss is increasing. The normal hair growth cycle is interrupted when there is prolonged chronic stress and can lead to hair loss by causing excessive hair shedding via telogen effluvium and other conditions. Poor diets can lead to poor nutrition and insufficient levels of the essential nutrients needed to promote healthy follicle activity. Polluted environments have also been shown to impact the health of the scalp by increasing oxidative stress and decreasing hair strength. Furthermore, the aforementioned factors may affect people differently based on their genetics and/or living conditions, which adds to the complexity of the issue. To reduce the risk of hair loss, one can employ healthy preventative measures such as: eating a balanced diet, reducing the amount of unnecessary stress on the body, and avoiding damaging hair care practices. A clear understanding of the combined impacts of lifestyle and demographic factors is crucial for alleviating the impact of hair fall and enhancing healthy hair growth. (Gupta et al., 2017)

Hair loss is the result of an intricate balance between environmental, biological and genetic influences. Some examples of this are age, race and gender which influence the degree of hair loss that an individual might experience. While some of the factors relating to the cause of hair loss can not be changed - genetics and age being two prime examples - many of the other influences can be mitigated through the early detection and implementation of a healthy lifestyle. Through the use of epidemiological studies which provide valuable data on populations experiencing hair loss, people are becoming more aware of their own risk for hair loss and when to seek early treatment. Knowledge of the causes and risk factors of hair loss should help increase awareness and give people the motivation to seek medical advice in a timely manner, and implement protective techniques for their hair. A holistic approach involving proper nutrition, proper stress management and a medical assessment will be critical in maintaining hair health. Future research will continue to contribute to an increased understanding and managing of hair loss disorders in the global population. (Malkud, 2015)

Hair loss severity differs based on genders. Hair loss in men is attributed to genetic influences and the effects of dihydrotestosterone on their hair follicles, making their hair follicles progressively smaller, less dense, and ultimately leading to baldness. In women, hair loss may be more complicated because there are many factors—hormonal imbalance, pregnancy, menopause, high levels of stress, thyroid disorders, and poor nutrition—that contribute to hair loss. Women typically lose their hair in a more diffuse manner rather than having a specific type of baldness and thus may be affected by the psychological and emotional issues associated with hair loss differently than men. Another risk factor for women experiencing hair loss is the hormonal changes experienced through reproduction; therefore, by having a good understanding of hair loss causes, healthcare providers can more accurately diagnose patients and provide individualized treatment plans based on gender differences that can improve treatment outcomes and decrease how much hair loss reduces the quality of life for affected individuals. (Paus & Cotsarelis, 1999)

Genetics is a major risk factor

Hair fall is thought to be one of the most significant risk factors affecting the incidence of hair loss, and most importantly, genetic factors are the most significant factor in determining susceptibility to many forms of hair loss. Hereditary factors are related to the anatomy, life cycle and ability of hair follicles to respond properly; therefore, some individuals are at greater risk of developing hair thinning or excessive hair fall. The most commonly observed genetically determined hair loss condition is androgenetic alopecia, which can occur in males as well as females. This occurs when hair follicles that are genetically predisposed become sensitive to the effects of androgens (such as dihydrotestosterone), resulting in the gradual miniaturisation of the follicles as well as reduced ability to produce hair. A family history of hair loss significantly increases the chance of having a family member with the same type of hair loss. In addition to a family history of hair loss, genetic variation can influence the age of the onset, severity of hair loss and rate of progression of hair loss from genetic predisposition. While there are several environmental and lifestyle-related causes of hair loss, inherited predisposition continues to be the major factor influencing the risk of developing hair loss. By understanding the genetic causes of hair loss, researchers can learn about the mechanisms of action involved in hair loss-related diseases as well as develop ways to treat hair loss with targeted therapies. Early identification of individuals with a hereditary predisposition to hair loss allows them to take preventive measures and obtain timely medical attention in order to mitigate the rate of progression. (Paus & Cotsarelis, 1999)

There are many different genes involved in hair fall due to genetic reasons because they control follicle development, growth of the hair, and each person's response to hormones. The combination of all of the factors involved in androgenetic alopecia will change how sensitive the hair follicle is to androgens versus how much hair is being lost. Those who have a strong family history of baldness will typically have an earlier onset and more significant levels of hair loss. The inheritance of baldness and hair loss through genetics is not always a straightforward pattern because

multiple genes, sometimes from both sides of the family (father's side and mother's side), can be responsible. Research has shown that different variations of the gene that encodes for androgen receptors and other genes that relate to the hair follicle are associated with a greater risk of hair loss. Genetic factors will affect the duration of the growth phase of the hair as well as the gradual change of the thicker/longer terminal hairs into shorter/finer hair. Genetic factors can also play a role in the development of autoimmune conditions that cause hair loss (eg, alopecia areata). An understanding of the inherited mechanisms behind baldness and other types of hair loss can help improve the diagnosis and prediction of the disease's progression and provide treatment on an individualized basis. (Ellis et al., 2001)

Assessing the risk of losing hair is still based on the family history of that loss as people are more likely to lose their hair if they have close relatives who have lost their hair. Genetic predisposition will help determine not only if any individual experiences hair loss, but also how old he or she will be when he or she experiences hair loss, and to what extent he or she will exhibit that hair loss. Generally, pattern hair loss in men is associated with genetics, while the degree of loss can vary from person to person. Genetic predisposition may also play a role in pattern hair loss in females, however, environmental, hormonal, and nutritional factors may also affect hair loss in females as well. The interaction between genetics and the environment will ultimately determine the level of hair loss experienced by each individual. Genetic predisposition makes hair follicles more susceptible to external factors such as stress, changes in hormonal levels, and aging; therefore, early indicators of hair loss include: an increased number of lost hairs (shedding) and a decrease in hair density. Early genetic awareness may lead to earlier intervention and the development of protective hair care practices before follicles have been significantly damaged. (Norwood, 1975)

Genetic influences on hair loss impact hair follicles and the normal cycle of hair growth. Normally, hair follicles will cyclically undergo three growth phases (growth, transition, and resting), but disruption of this cycle may occur through genetic defects/inherited sensitivities to the follicular biology of the hair follicles causing a shortening of the growing phase of the hair and decreasing the diameter of the hair follicles. A classic example of this phenomenon is seen with androgenetic alopecia, where genetic predisposition to hormonal sensitivity produces hair loss progressively over time. Genes can likewise impact how hair follicles respond to other environmental factors (e.g., stresses) and various nutrient deficiencies and aging. Although genes cannot change, having information about the genetic component of hair loss aids healthcare providers in identifying those who are at a greater risk for experiencing hair loss. Recent advances in the area of genetics have improved the understanding of the molecular pathways that are involved in regulating hair follicle biology. These improvements will aid in developing better diagnostic and future therapeutic methods. In addition to managing other controllable risk factors (for example, through nutrition and stress management), managing these additional controllable factors may help to lessen the effects of genetic susceptibility on hair loss progression. (Kaufman, 2002)

The link between genetics and hair loss is very complicated because inherited components co-exist with hormones, lifestyle, and the environment. A person with a genetic risk factor for hair loss could suffer from complete hair loss or no loss at all based on their health and the conditions surrounding them. For example, the genetic pathways activating hair loss include androgen amounts and may play a large part in activating these pathways, leading to miniaturization of hair follicles. Nutrition, stress levels, and the condition of the scalp may also affect how genetic pre-dispositions to hair loss present themselves. Genetics alone does not cause the outcome; rather genetics are a main contributor to one's risk of experiencing hair loss. Understanding these interactions is essential in order to provide a comprehensive approach to our prevention and treatment of hair loss. Individuals who are genetically susceptible to hair loss can help themselves by following healthy eating habits, reducing stress levels, avoiding damaging hair care practices, and obtaining an early evaluation. Research continues to identify genetic markers that will enhance our understanding of hair disorders and ultimately lead to the development of more personalized approaches to treatment. These

advances should help in determining risk and treatment based on a person's genetic markers. (Yip et al., 2009)

Hormonal imbalance contributes significantly

Hormonal imbalances are thought to be significant risk factors for hair loss because hormones regulate the growth cycle of hair. Hair follicles are sensitive to hormonal fluctuations. When hormones are out-of-balance, this can disrupt the functioning of hair follicles; how long each follicle grows hair (growth duration) as well as how frequently it sheds hair (shedding pattern) can all be affected by hormonal levels. Hormones such as androgens, thyroid hormones, estrogens, and others all play a part in developing and maintaining healthy hair. If an individual has a hormonal disturbance, the normal balance between hair that is being grown and hair that is being shed becomes disrupted resulting in excessive hair loss. One well known example is androgenetic alopecia, where increased sensitivity to male androgen hormones contributes to a gradual miniaturization of the hair follicles. Hormonal changes due to effects of pregnancy, menopause, and aging in women can also lead to temporary or progressive thinning of the hair. Certain endocrine disorders like thyroid disorders and polycystic ovary syndrome may lead to disturbances of the levels of hormones in one's body which then contributes negatively towards a person's ability to grow healthy hair. To effectively identify the cause of hair loss and to create an effective treatment plan for hair restoration, it is necessary to understand the relationship between hormones and the hair follicle. If a hormonal abnormality can be detected early enough, then further loss of hair may be prevented and better outcomes with hair restoration will result. (Price, 2003)

Hair loss caused by hormonal imbalances in women is common at various times through a woman's life, including pregnancy, childbirth, menopause and any reproductive conditions. These hormone fluctuations can have a direct impact on the growth of hair from hormonal changes during these events. For example, the hormones that increase hair growth are higher during pregnancy than after birth, resulting in what is known as postpartum telogen effluvium or the excessive shedding of hair after giving birth. Menopause is also characterized by lower female hormone levels and therefore can create thinning of hair on the scalp. Additionally, conditions such as polycystic ovary syndrome (PCOS), are linked to increased male hormone (androgen) activity and create excess shedding of hair or pattern baldness. Further, a change in hormone levels can cause changes in the body and therefore also can create and cause stress and nutritional deficiencies. Recognizing the signs and symptoms of hormonal imbalance is key for a practitioner when providing an accurate diagnosis and determining proper treatment options. Addressing the underlying hormonal imbalance will improve the health of the hair follicle and reduce the excessive shedding of hair for those affected by this condition. (Blume-Peytavi et al., 2011)

The influence of an androgen on hair loss due to hormones is primarily through dihydrotestosterone (DHT). People with a genetic predisposition to androgenic hormone influences are susceptible to DHT at higher concentrations in their hair follicles resulting in hair follicle miniaturization. This process leads to hair becoming progressively thinner in diameter and hair producing fewer strands in the scalp over time. Hair loss due to Androgenic influence in males is largely a result of androgen action, while females may also experience thinning of the hair as a result of changes in hormones or increased sensitivity to androgens. In addition to the androgens, thyroid hormones also play an important role in regulating hair metabolism and follicular function. Both hyperthyroid and hypothyroid conditions can disrupt the normal hair cycle, leading to increased shedding. Hormonal fluctuations may have an impact on the quality and strength of the hair that is produced after the shedding has occurred. This is why it is essential to assess the hormonal status of anyone experiencing unexplained hair loss; identifying the hormone(s) causing the hair loss allows for the development of targeted treatments and ultimately for the restoration of normal hair follicle activity through effective medical therapy and changes in lifestyle. (Sawaya & Price, 1997)

Hormones and hair loss relate to a distance-finder problem in which hormones and hair follicle biology are in sync through the way the endocrine system sends information to hair follicles

via hormone receptors determining how hair will grow. Disruptions in hormone signals can make the follicle act differently and it will have a different hair growth cycle than if the hormones were providing appropriate signals to the hair follicles. Follicles may also start to shed hair before their time or go into a resting phase earlier than they would have if there were no hormonal disorders; these are some ways chronic hormonal imbalance can lead to more than normal shedding. Hormones can also contribute to loss of hair through cortisol (a hormone produced in response to stress) affecting follicle function. Certain metabolic disorders which affect hormones also can indirectly lead to issues with scalp and hair health. Because hormones affect people differently, people can have similar hair disorders, but experience the disorder differently. A complete evaluation for hair loss should include an assessment of hormonal disorders as well as genetic, nutritional, and environmental influences. Understanding how hormones work helps one decide what treatments may be appropriate, and what would be the most effective long-term management of hair loss. (Kanti et al., 2018)

Hormonal imbalances are commonly associated with numerous other risk factors. Therefore, hair loss due to hormonal imbalances is considered an occurrence that includes multiple causes. Genetic predisposition can contribute to an increased sensitivity of the follicles to hormonal changes. Both poor nutrition and stress can further weaken follicular function. In many instances, the resulting hair loss is gradual, making detection difficult unless a thorough evaluation is performed. Individuals with a thyroid disorder, hormonal disorder of reproduction, or metabolic condition have a higher risk of developing thinning hair. Lifestyle-related factors such as poor sleep, ongoing chronic stress or an unhealthy diet may potentially cause disruption to hormone regulation and cause further disturbances to the hair cycle. Hormonal imbalance can improve hair growth patterns through identification and appropriate medical treatment. Lifestyle changes may assist in creating a balanced hormonal environment, which in turn, may enhance overall follicle health. Since hormones influence a number of other body systems, treating the underlying problem of the hormone imbalance is frequently more effective than just treating the symptoms of hair loss. Comprehensive approaches to management are essential in order to achieve better outcomes in conditions of hair loss associated with hormone imbalances. (Messenger & Sinclair, 2006)

Hormonal imbalance is one of the most significant contributors to hair loss by changing follicular development and affecting the natural hair growth cycle. Various types of hair loss occur due to varying levels of androgens, thyroid hormones, reproductive hormones, and stress hormones. Changes in these and many other hormone levels will lead to changes in hair loss patterns and some of these changes will occur as part of aging and/or at different life stages while others will result from previous health conditions that require intervention. Identifying the cause of hormonal changes can lead to early detection and allow for the selection of the most appropriate medical treatment options. Continued research is being conducted to identify the connection between hormonal regulation and hair follicle physiology in order to provide new therapeutic options. By performing hormonal evaluations, following healthy lifestyle practices, and using targeted interventions, it is possible to reduce hair loss and improve hair growth. Identifying risk factors for hormonal changes is therefore critical for effectively preventing and managing hair loss disorders. (Sinclair et al., 2015)

Nutritional deficiencies increase hair loss risk

Nutritional deficiencies pose a risk to hair loss as the hair follicles depend on the continuous supply of necessary nutrients to grow and maintain the hair. Hair is made of keratin (a type of protein) that requires adequate nutrition for proper formation. When there is a deficiency in essential nutrients, they will disturb the normal hair growth cycle and can cause increased shedding, thinning, or decrease in hair quality. Key nutrients including iron, zinc, protein, various vitamins & minerals are essential in developing and activating hair follicles. If the body lacks these essential nutrients, hair follicles can prematurely enter the resting (telogen) or inactive (anagen) phase leading to conditions of telogen effluvium. Therefore, restrictive diets; low eating habits; and someone who may have a nutrient absorption disorder puts them at a higher risk for experiencing hair loss related to nutritional

deficiencies. Nutritional deficiencies do not necessarily exhibit symptoms immediately, but if left untreated for an extended period of time, an imbalance will adversely affect the health of the scalp and the ability of the hair to regenerate. As such, identifying and correcting nutritional issues is essential in managing hair loss. A diet containing an adequate amount of nutrients will also promote hair follicle function & decrease the likelihood of excessive hair shedding. (Rushton, 2002)

Hair loss can be caused by several deficiencies, however iron, zinc and protein are the most frequently implicated nutrients. Iron is a necessary nutrient for maintaining an oxygen-balance as well as cellular metabolism, both of which are critical for the rapid division and growth rate of hair follicles. Low levels of iron could disrupt the normal functioning of hair follicles and ultimately weaken their ability to grow hair. Zinc is another nutrient that plays a significant role in hair loss; it is required for protein synthesis, regulating the immune system and repairing tissue. Low levels of zinc could lead to abnormal structures of the hair follicle and slow down the normal process of growth. Insufficient protein intake can also result in hair loss because without adequate amounts of protein, keratin (the primary component of hair) cannot be produced. Other vitamins such as vitamins D, A and B complex are also important to maintain healthy hair follicles; deficiencies or imbalances of these vitamins can affect the growth of hair. An accurate nutritional assessment enables physicians to identify any deficiencies present and develop an individualized plan to assist in restoring the hair follicles to their optimal state. (Almohanna et al., 2019)

There are many Poor dietary habits, along with insufficient nutrient intake have increasingly been linked to hair falling out due to a change in how we live today.. The reason for this is because if we experience rapid weight loss, our body will use the resources we have to function and be able to process vital body functions and forget about hair. Therefore, individuals with eating disorders or some types of chronic illnesses that can affect the body's ability to absorb nutrients have a higher chance of suffering from hair loss. Antioxidants and micronutrient deficiencies raise the level of oxidative stress which can negatively affect the activity of the hair follicle site Since hair will grow as long as the body continues to be supplied with the nutrients it needs, over time, with an inadequate diet, hair will begin to decrease in the amount of strength and density as well. To help support the normal functioning of the follicle and to minimize hair loss due to lack of good nutrition; one must eat a balanced diet that consists of protein, vitamins, minerals and good fats. (Guo & Katta, 2017) Various kinds of hair loss, including telogen effluvium and diffuse thinning, may occur due to nutrient deficiencies. Nutritional stress triggers a significant number of follicles to transition from the growth stage to the resting stage in telogen effluvium, leading to a marked increase in shedding after several months. This condition usually happens after malnourishment, episodes of illness, or major dietary modifications. (Mysore & Shashikumar, 2016) Hair loss can be affected by multiple factors including nutritional deficiencies, which will typically vary based on age, gender, health, and genetic predisposition. Women are often more susceptible to some nutrient deficiencies because of menstruation, being pregnant, and/or restricted diets. Older adults may also be more susceptible due to a decrease in their ability to absorb nutrients from the food that they eat and by making changes to their diet. (Almohanna et al., 2019)

Nutritional deficiencies are a large and modifiable cause of hair loss. Nutrition is necessary for proper structure, strength, and growth cycles of hair follicles. If there are deficiencies of iron, zinc, protein, and vitamins, this will have an effect on follicular function; therefore, increasing the chances of losing a larger than normal amount of hair. Nutritional causes are easier to improve upon than some genetic disorders that cause hair loss. If nutrient deficiencies are detected early, then effective interventions are possible and may allow the hair follicles an opportunity to return to their normal growth cycles. A proper diet rich in nutrient-dense foods and a proper medical evaluation can assist in preventing hair loss due to nutrition-related causes. Additional research continues to be conducted to determine the relationship of certain nutrients and follicular biology to provide the most effective treatment options. By better understanding how nutrition affects hair health, it is apparent that

lifestyle modification should be included in a comprehensive hair loss management plan. (Ablon, 2018)

Conclusion

Hair loss (or "alopecia") is a common skin disorder that can occur as a result of many factors, such as genetics and hormones, and typically affects men and women of all ages. Each person may experience hair loss in different ways, depending on their age; sex; ethnicity; and whether they are genetically predisposed to have hair loss. The most common type of hair loss is called Androgenetic Alopecia (AGA), which is caused predominantly by genetics (but can also be influenced by hormones), and is seen much more often in men than in women. Hormone levels (androgens; thyroid hormones; reproductive hormones) also significantly affect the function of hair follicles. Inadequate intake of important nutrients (essential proteins; vitamins; minerals) can also cause hair follicles to function improperly, which can lead to a disruption of the normal hair growth cycle and increased shedding. Other factors that contribute to the progression of hair loss include exposure to the environment, psychological stress, unhealthy eating habits, and certain medical conditions. Identifying and addressing the "hidden" causes and risk factors for hair loss is important for early detection of hair loss disorders, as well as for effective prevention and treatment of hair fall. A comprehensive strategy that incorporates a healthy diet; stress reduction; healthy lifestyle choices; and timely medical evaluation should be pursued in order to minimize experiencing hair loss and maximize achieving healthy hair. In the future, continued investigation of human follicular biology and other risk factors associated with hair loss will be beneficial toward developing better treatment options for hair loss that are tailored specifically for each individual. Overall, being aware of the early signs of hair loss and acting quickly to counter hair loss will be effective in reducing the negative impact of hair loss on both self-esteem and overall mental health.

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