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Murraya koenigii as a Natural Hair Growth and Grey hair: A Review

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Abstract:
Many academic fields have studied the morphology of human scalp hair, and they have found that human scalp hair is unique among mammals due to its intricacy. In addition to providing protection, hair helps control body temperature. Though it's frequently considered trash, hair has many benefits. Hair structure, which is made up of proteins and stratified cells, varies by ethnic group but has some common features. Greying, which usually starts after 10 cycles, is influenced by the anagen, catagen, and telogen stages of the hair growth cycle, affecting hair length and color. Globally, hair health is a major concern because many people are affected by conditions including premature greying and hair loss. Because they are safer than synthetic medicines, people are becoming more interested in natural remedies. Due to the possible health benefits of curry leaves (Murraya koenigii), especially in terms of encouraging hair development and delaying premature greying of the hair, these leaves have been utilized traditionally in many cultures. The article explores the diverse phytochemical composition of curry leaves, encompassing alkaloids, flavonoids, and essential oils that are responsible for their antibacterial, antioxidant, and anti-inflammatory characteristics. These characteristics are thought to protect against oxidative stress, a major cause of hair greying, and to improve scalp health and hair follicle stimulation. Curry leaves may be useful as a natural hair growth booster and hair greying delayer, according to the findings; nevertheless, more studies are required to determine their exact effectiveness and potential uses in dermatology.

Keywords: Hair growth, Hair Greying, Hair Growth cycle, Amla, Curry Leaves.

Introduction [1-5]:

Anthropologists, biologists, geneticists, forensic scientists, and cosmetic experts have all examined human scalp hair morphology during the past century from a variety of, and occasionally conflicting, angles.[1]
All mammals have hair, which sets them apart from other creatures. Its primary purposes in humans are to protect the skin from mechanical shocks and to promote homeothermy. In females especially, it is a unique and treasured feature.[3]
Although it has many known uses, human hair is regarded as a waste material in most parts of the world and when it accumulates in waste streams, it creates many environmental problems.[4]
Except for certain regions, such as the palm, the buccal surface of the lip, the sole, and parts of the external genitalia, the majority of the body surface in mammals is covered in hair.[3]
Furthermore, looking at how human hair is distributed across the various body surface areas, it is possible to observe that human hair growth is restricted, with virtually colorless, tiny hair on the majority of the body surface and thicker, longer hair that is heavily pigmented in other areas, like the eyebrows, eyelashes, and scalp. The shape of hair fibers varies throughout populations and across an individual's scalp due to their complex, multilayered structure.[2]
African, Asian, and European are the three traditional ethnic human subgroups based on which human hair is typically categorized. However, a recent study discovered that the measurement of three commonly available parameters—curl index, curve diameter, and wave count—allows for the classification of the numerous hair types found worldwide into eight basic coherent hair types.[5]
Nonetheless, the appearance, chemical composition, and molecular structure of all hair are similar, independent of the ethnic origin of the hair.[3]
Similar to other α-keratin materials like wool, nails, claws, and animal horns, hair fibres have a typical hierarchical structure. In reptiles and birds, keratin generally takes the form of β-sheets.[5]
Hair [6-8]

Proteins, lipids, water, trace elements, and colors are the components of human hair.[6]
Derived from the epidermis, hair is divided into two different parts:
The hair follicle
The shaft of hair [6]
The Follicle:
The area under the skin that contains the hair follicle, also known as the bulb or root when it is removed from the skin. The dermis is where this organ is situated. It preserves stem cells, which are called upon to regenerate skin following an injury in addition to proliferating hair following shedding.[7]

The Hair Shaft:
It's the portion that is rigid and filamentous and extends above the skin's surface.
It is composed of:
The major component of keratinized hair fibers, the cortex is composed of tightly spaced, elongated cells whose axes run parallel to the hairs.
The cuticle cells are made up of six to eight layers of flattened cells that are layered atop one another from the tip to the root.
Additionally, there is the medulla, which is made up of specialized cells with air gaps.[8]

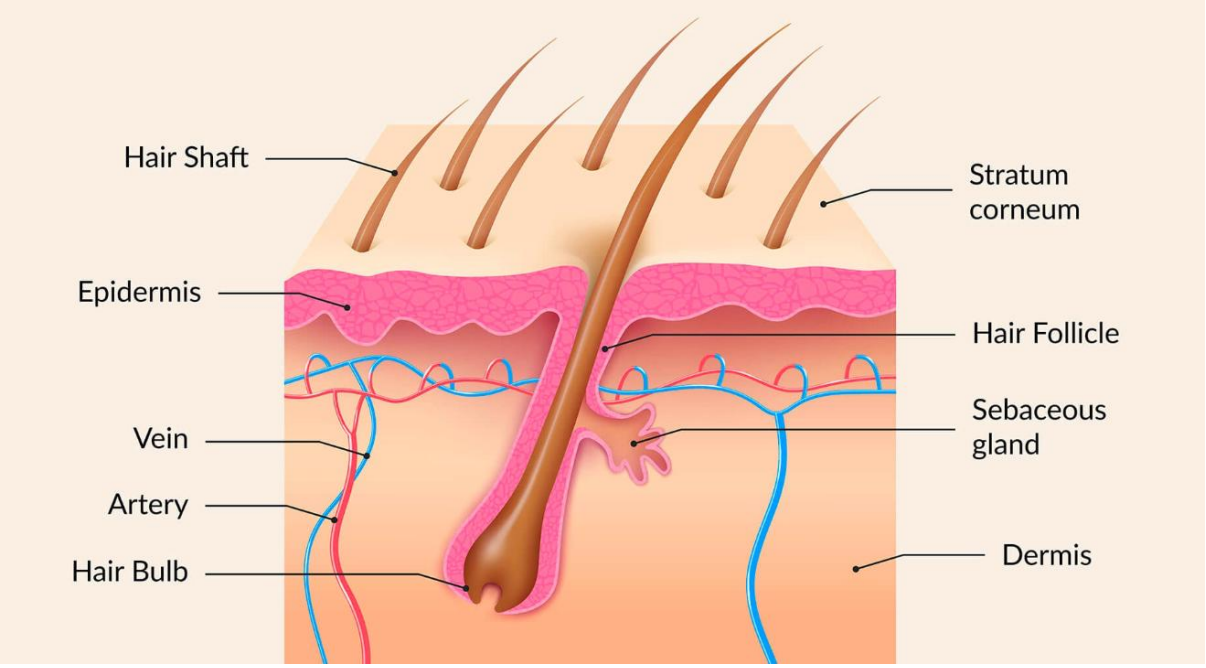

Figure 1: **Structure of hair**

Hair Growth Cycle [9-14]
Every mature follicle goes through a growth cycle, and hair formation is an ongoing, cyclical process.[9]
Three separate phases can be identified in the hair growth cycle:
Anagen or Growth phase;
Catagen or Transitional phase;
Telogen or Resting phase [10]
In addition to age and individual nutritional and hormonal health, the phase's duration varies according to the hair's location.[11]
Anagen or Growth phase:
Due to the rapid division of the hair root, the hair shaft is added to the hair follicles during the anagen phase of active growth. Approximately one centimeter of hair develops every 28 days during this phase.
There are six stages that it can go through (I–VI). Hair stem cells multiply during anagen I–V (pro anagen), enclosing the dermal papilla, growing down to the skin, and starting to proliferate the hair shaft and IRS, respectively. The shape of the hair shaft then starts to take shape as hair matrix melanocytes start to produce pigment; in anagen VI, the creation of the dermal papilla beside the hair bulb is completed, resulting in the appearance of the new hair shaft below the skin. In hair follicles, this stage can endure for many years.

The follicle enters the catagen phase after the anagen phase due to an unidentified signal.[12]
Catagen or transitional phase:

When anagen comes to a close, the matrix cells' mitotic activity decreases, and the follicle moves into the tightly controlled involutionary phase known as catagen. Regardless of the region or kind of follicle, catagen lasts roughly two weeks in humans.
Beginning with the start of the catagen phase, melanocytes' ability to produce pigment stops, hair shaft synthesis is finished, and the differentiation and proliferation of hair matrix keratinocytes dramatically decline. The follicle experiences regression caused by apoptosis, which causes it to shrink to roughly one-sixth of its original diameter. During catagen, a unique structure called club hair forms. Once fully developed, the club hair follicle enters the telogen phase.[13]

Telogen or resting phase:
Between the end of follicular regression and the beginning of the subsequent anagen phase, the period known as the telogen stage is described. Two to three months make up the telogen stage. Ten to fifteen percent of the hair is at the telogen stage. The hair shaft changes into club hair at the telogen stage when it eventually sheds. This stage of follicle development continues until the hair germ, which responds to signals from the dermal papilla that initiate anagen, begins to exhibit increased transcriptional activity and proliferative activity in late telogen, thereby commencing anagen.[14]

Timeline:[14]
Scalp:
Each person experiences these phases for a different duration, and the timing of these stages is influenced by variations in follicle shapes and hair color.

Anagen phase	2–8 years (occasionally much longer)
Catagen phase	2–3 weeks
Telogen phase	around 3 months

Eyebrows:

Anagen phase	4–7 months
Catagen phase	3–4 weeks
Telogen phase	about 9 months

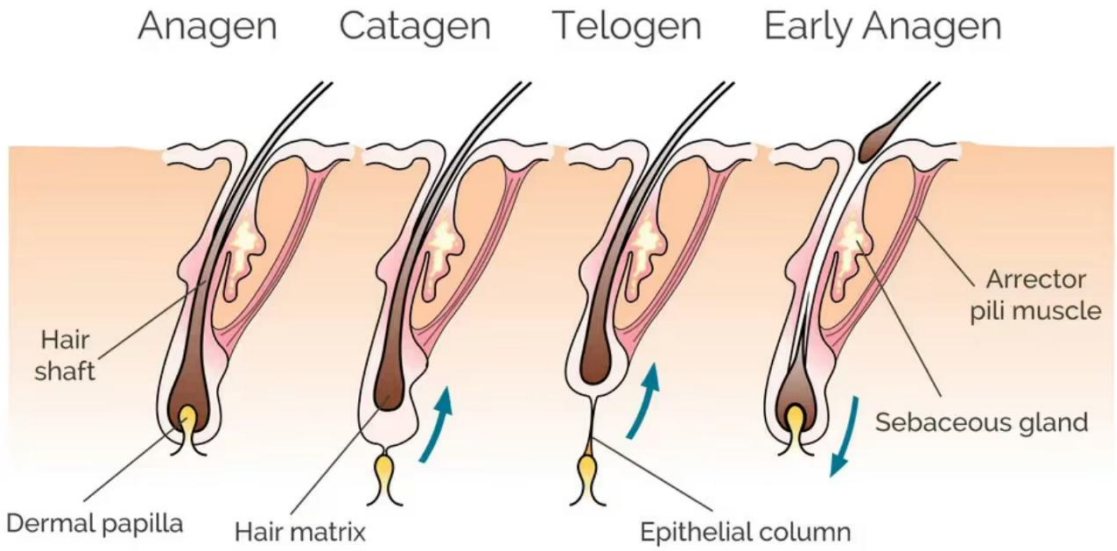

Figure 2: **Hair growth cycle**

Hair Greying [15-19]
One of the earliest and simplest ways to notice aging in a person is by looking at their hair. Researchers, physicians, and businesses have become increasingly interested in how genetic, emotional, oxidative, hormonal, metabolic, and nutritional factors affect the greying of hair. The average human scalp hair cycle lasts for about 3.5 years, and Caucasians typically start to get grey hair around 35–40 years old.[15] This means that greying generally happens about 10 hair cycles before it becomes visible. In the early stages of hair development, each new cycle is associated with the complete regeneration and rebuilding of the pigment-producing unit in the hair follicle. However, after around ten hair cycles, there's a noticeable decrease in the production of pigment in each subsequent cycle, resulting in an increased number of hair strands with less pigment (grey hairs).[16]

It's important to note that individual hair strands don't actually "turn grey." Instead, the production of melanin is reduced or stopped, leading to the growth of new hair strands with less or no pigment in the hair follicle.[17] Research has found that a decrease in melanin in the bulb and the number of bulb melanocytes is linked to the absence of melanin in the hair strand. When hair turns grey, it may regrow more quickly in people who aren't experiencing hair loss. Unlike the skin, where pigment production is continuous, the stages of the hair growth cycle are closely connected to melanin production in the hair. While the hair is not actively pigmented during the catagen phase and is absent during the telogen phase, it is actively pigmented during the anagen phase. Thus, a single hair cannot be white on the root side, and coloured on the terminal side.[18]

Causes:[19]

Literature Review [20-50]:

Murraya koenigii:

Figure 3: Curry Leaves

Murraya koenigii belongs to the Rutaceae family, which includes more than 150 genera and 1600 species. It is also known as curry leaf or kari patta in Indian dialects. In South India and Sri Lanka, curry leaf has been used for centuries to add flavor to curries, chutneys, vegetables, and drinks.[20] Curry leaf is grown throughout India and was introduced to Malaysia, Burma, and Singapore by traders from South India. During the British colonial period in India, it was named curry leaf, inspired by the Tamil word "kari," which means seasoned sauce. India is renowned for its vast collection of medicinal herbs, and curry leaf is one of them. Due to its rich bioactive components, it is considered to be a significant medicinal plant. The vegetation is associated with tonic and stomachic effects.[21]

Synonyms:[22]
Hindi: Curry Leaves
Bengali: Barsunga
Gujarati: Limdo or meetholimdo
Kannada: Karibue
Marathi: Kadhilimbu
Telugu: Karivepku

Biological Source:
The genus Murray honors Swedish physician and botanist Johann Andreas Murray, who passed away in 1791. The species is named in honor of the botanist Johann König.[23]

Taxonomical Status:[24]

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliospida
Subclass	Rosidae
Order	Sapindales
Family	Rutaceae
Genus	Murraya J. Koenig ex L.
Species	*Murraya koenigii L.* Spreng

Geographical Source:
The Murraya koenigii plant originates from the eastern and southern regions of India, Pakistan, Sri Lanka, China, and Hainan. It is widely grown across Southeast Asia, as well as in certain regions of the United States and Australia. In India, it can be found all over the country, reaching elevations of 1500–1655 meters above sea level.[25] The plant also grows in humid forests of Guangdong, Shainan, S Yunnan (Xishuangbanna), Bhutan, Laos, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam, which are located between 500 and 1600 meters above sea level. Curry leaves were introduced to Malaysia, South Africa, and Reunion Island by immigrants from South India. Out of the fourteen species of the genus Murraya that are found worldwide, Murraya paniculata and Murraya koenigii (Spreng) are the only two known species found in India. It can be grown in full sun or light shade.[26]

Chemical Constitute:
Curry leaves have a distinct aroma attributed to terpene hydrocarbons such as b-caryophyllene, b-phellandrene, b-gurjunene, and b-elemene. Other terpene components that contribute to the flavour include citral, linalyl acetate, menthone, menthol, and carvomenthone. Additionally, curry leaves are rich in minerals, fiber, vitamins A and C, calcium, carotene, and nicotinic acid. The leaves also contain mahanimbine and koenigine, two carbazole alkaloids that exhibit high levels of antioxidant activity.[27]

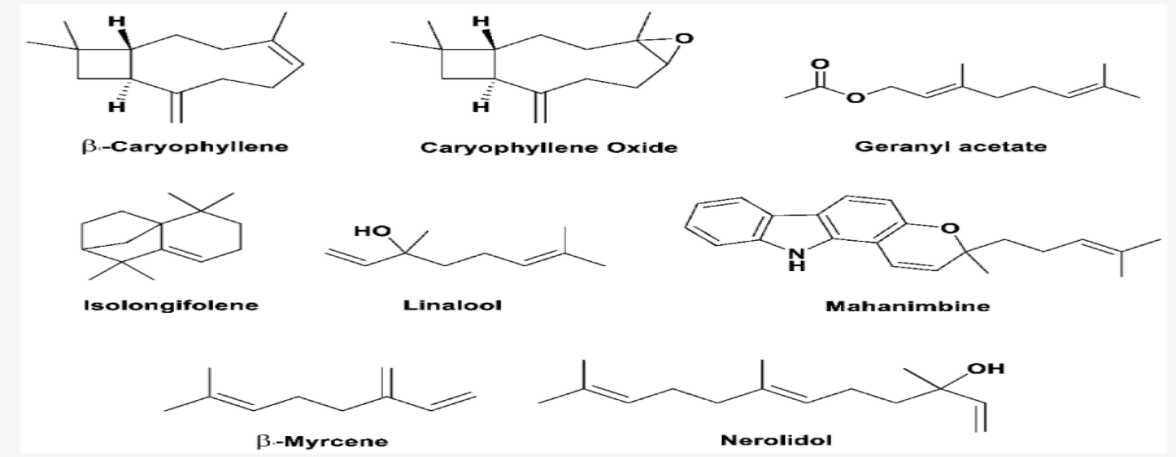

Figure 4: Chemical constitution of curry leaves

Uses:

Antimicrobial Activity:

Research has shown that curry leaf essential oil has antibacterial properties against Corynebacterium pyogenes, Bacillus subtilis, Proteus vulgaris, Staphylococcus aureus, and Pasteurella multocida. It was found during this investigation that pure oil was more effective against these microorganisms.[28]

Antiprotozoal Activity:

Curry leaf ethanolic extracts have demonstrated strong antiprotozoal activity against Entamoeba histolytica, antihypertensive properties in cats and dogs, and antispasmodic properties in the ileum of guinea pigs.[28]

Antidiabetic Activity:

The chemical Mahanimbine, which is the active ingredient in curry leaves, works by either raising insulin secretion or improving glucose utilization.[29]

Hypolipidemic Activity:

For ninety days, albino rats given curry leaves exhibited reduced levels of low-density lipoprotein and total serum cholesterol, increased levels of high-density lipoproteins, increased activity of lecithin cholesterol acyl transferase, and decreased release of lipoproteins into the bloodstream.[28]

Antihypertensive Activity:

In individuals with high blood pressure, supplementing with curry leaves (Murraya koenigii) chutney has shown encouraging antihypertensive effects.[30]

Antilipid Peroxidative Activity:[30]

Antioxidant Activity:

Mahanimbine and koenigine, the carbazole alkaloids recently discovered in curry leaves, have shown increased antioxidant activity. The aryl hydroxyl group of curry leaf alkaloids also demonstrated a higher antioxidant potential.[29]

Anti-inflammatory Activity:

Curry ethanolic extract has demonstrated both anti-inflammatory and antihistaminic properties. It significantly reduces inflammation when used to treat yeast-induced hyperpyrexia.[28]

Immunomodulatory Activity:

The extract from curry leaves has shown effective immunomodulation in experimental animals through antioxidant and immunosuppressive processes. This could be particularly important in managing ethanolic liver injury, which is characterized by immunological activation or autoimmune processes.[28]

Anthelmintic Activity:

Ethanolic and aqueous extracts of curry leaves were utilized to demonstrate the anthelmintic efficacy against Pheretima posthuma. The anthelmintic action of both extracts is evident at a concentration of 100 mg/mL.[30]

Wound Healing Activity:

Curry leaves possess potent wound-healing properties, helping to reduce the surface area of the wound and accelerate the healing process.[28]

Anticancer Activity:
During testing on human cell lines like the MCF-7 breast cancer cell line, the HeLa cervical cancer cell line, and the murine leukemia cell line, researchers discovered that the chemicals mahanine, mahanimbicine, and mahanimbine, found in curry leaves, exhibited potential anticancer effects.[30]

Hepatoprotective and Antiulcer Activity:
The compound carbazole found in the aqueous extract of curry leaves has been shown to have hepatoprotective properties. Additionally, the bark powder of the curry tree, extracted with acetone, has demonstrated significant ability to protect liver cells from ulcers. This extract also exhibits notable antiulcer effects, reducing stomach volume and fewer ulcerative lesions.[30]

Amla

Figure 5: Amla

Mother Nature has bestowed upon us incredible medicinal plants that can help people live healthy, disease-free lives. One of the most significant therapeutic plants in the Indian traditional medicine system, Ayurveda, is Phyllanthus emblica Linn, also known as Emblica officinalis Gaertn., or Indian gooseberry, commonly referred to as amla. It is often used as a tonic to help the body regain its lost vitality and energy. Phyllanthus emblica is an extremely nutrient-dense plant that provides a significant nutritional supply of minerals, amino acids, and vitamin C. The fruits of E. officinalis are commonly used in rasayana, either by themselves or in conjunction with other traditional herbs, to treat a variety of viral and non-infectious disorders, even though all sections of the plant have medicinal uses.[31]
Amla is known as "Divya" and "Amrut" or Amrit Phala in Sanskrit, which translates as "nectar fruit" or "fruit of heaven." In Sanskrit, amlaki means either "the sustainer" or "the fruit where the goddess of prosperity resides".[32]

Synonyms:[33]
Sanskrit: Dhatriphala, Amla, Amalaki, Amalakan, Sriphalam, Vayastha
Hindi: Amla
English: Emblica myrobalan
Italian: Mirabolano emblico
German: Amla
French: Phyllanthe emblica
Nepalese: Amba
Chinese: A Mole
Malaysian: Popok Melaka
Portuguese: Mirabolano emblico

Biological Source:
Phyllanthus emblica L., also known as Indian gooseberry, is a medium-sized deciduous tree in the Euphorbiaceae family.[34]

Taxonomical Status:[35]

Kingdom	Plantae
Order	Malpighiales
Family	Euphorbiaceae, Phyllanthaceae
Genus	Phyllanthus
Species	P. emblica
Binomial name	Phyllanthus emblica
Botanical name	Emblica officinalis Gaertn.

Geographical Source:
The plant is native to India but also grows in Southeast Asia, China, Malaysia, Pakistan, Uzbekistan, Sri Lanka, and other tropical and subtropical countries.[36]
Chemical Constituents:

The plant amla has been extensively studied. Reports indicate that it contains phenols, alkaloids, and tannins. The fruits have a bitter flavor, possibly due to a high density of ellagitannins, including emblicanin A (37%), emblicanin B (33%), punigluconin (12%), and pedunculagin (14%). They also contain high levels of ascorbic acid (vitamin C). Amla also contains punicafolin, phyllanemblinin A, and other polyphenols such as flavonoids, kaempferol, ellagic acid, and gallic acid.[37]

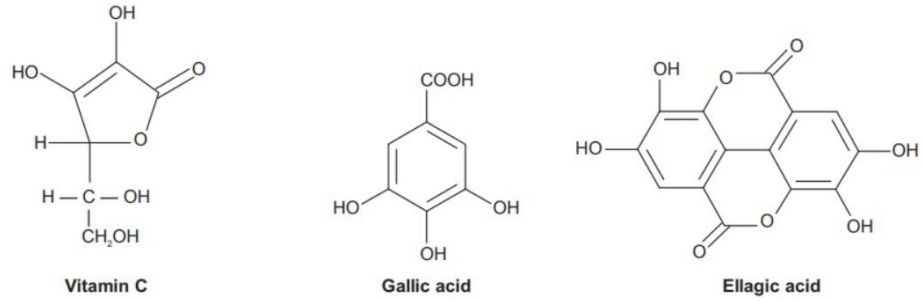

Figure 6: Chemical constitution of amla

Uses:
Anti-oxidant Activity:
Aside from being used as seasonings and flavorings, herbs and spices are believed to contain antioxidants naturally. Amla fruit extract demonstrates a chemical composition with oxidation-inhibiting properties. Each phenol component shows positive antioxidant effects and contains high levels of flavonoids and tannins.[38]

Hepatoprotective Activity:
Hepatoprotection using amla fruits has been documented in Ayurvedic medicine. Amla extract has been shown to have hepatoprotective effects due to its ability to stabilize membranes, function as an antioxidant, and inhibit CYP 2E1. Amla fruit supports the liver's activities by purifying blood and nutritional fluid, and fortifies the liver while aiding in the body's detoxification.[39]

Nephroprotective effect:
The study evaluated the protective impact of a 600 mg/kg dried fruit extract of E. officinalis on cisplatin-induced nephrotoxicity in rats.[40]

Hypolipidemic:
The Amla fruit contains compounds that can lower glucose, making it hypolipidemic, lipid deficient, and immune modifying. These effects are similar to those of other plants. The fruit can help regulate lipids such as triacylglycerides and cholesterol in the blood.[41]

Metabolic syndrome:
Studies show that Amla extract produced with ethyl acetate extraction can help with fructose-induced metabolic syndrome, as it contains a high proportion of polyphenols.[42]

Cardioprotective Activity:
Additionally, Amla fruit may have cardioprotective properties, promoting circulation, blood flow, and supporting heart health.[43]

Anti Diabetes Effect:
Because of its high vitamin C content, this herb helps manage diabetes. When taken daily for two months, a tablespoon of its juice combined with a cup of bitter gourd juice would activate the pancreas and allow it to generate insulin, which lowers blood sugar in diabetics. When taking this medication, rigorous adherence to dietary guidelines is required. Additionally, it will stop diabetic eye complications.[44]

Immunostimulant:
Ascorbic acid, which enhances immune cell and antibody activity, is most abundant in amla.[45]

Antimicrobial:
Numerous studies have shown that Amla fruit, leaf, and bark possess antimicrobial properties, including antibacterial, antifungal, and antiviral activity. Amla extract (E. officinalis) dissolved in organic solvents like CHCl3 and CH3 OH is effective against a limited number of Gram-positive and Gram-negative bacteria.[46]

Amla is rich in Vitamin C and helps in controlling blood pressure. Amla can be consumed as churna (powder), in the form of Triphala tablets, or decoction. Triphala, which combines Amla with two other herbs, is an excellent remedy for high blood pressure.[47]

Osteoporosis:
Amla (E. officinalis) fruit is very useful for strengthening weak bones, such as osteoporosis. It may take several years for symptoms to appear, making diagnosis difficult. E. officinalis extract is used to stimulate the growth of osteoclasts.[48]

Gastroprotective:
Amla (E. officinalis) extract not only has anticarcinogenic properties but also contains phytochemical components that are beneficial for preventing gastrointestinal infections. It is used in the treatment of diarrhea and has demonstrated spasmolytic activities.[49]

Dermoprotective:
In addition to other medicinal plants, E. officinalis extract has been widely used in skincare and dermatological treatments for over 20 years. Amla extract protects the skin from oxidative stress due to its antioxidant properties, while E. officinalis helps defend the skin against free radicals that can cause damage. Amla (E. officinalis) is particularly effective for anti-aging and is commonly used in the production of skincare cosmetics.[49]

Anti-inflammatory, Antipyretic and Analgesic activity:
Extracts from leaves and fruits have strong anti-inflammatory, antipyretic, and analgesic effects, possibly due to the presence of tannins, alkaloids, phenolic compounds, amino acids, and carbohydrates.[50]

Nourishes the brain and mental functioning:
Amla-Berry is beneficial for the brain as it nurtures the mind and enhances coordination among dhi (acquisition), dhriti (retention), and smriti (recall). It helps to sharpen the intellect and mental functioning, supports the nervous system, and strengthens the senses.[50]

Conclusion:

The complex relevance of hair has been highlighted by the involvement of different disciplines in the study of human scalp hair morphology, including anthropology, biology, genetics, forensic research, and cosmetic science. Hair has several benefits and functions, including protecting the skin and helping to regulate body temperature, even though it is seen as trash in many places. Human hair differs in content and structure between people and bodily parts, yet it has commonalities such as a multilayered, intricate structure and a common chemical and molecular makeup among various ethnic groups. The significance and distinctive qualities of human hair are covered in this paragraph. The statement underscores the significance of hair, a characteristic unique to mammals, in safeguarding skin and controlling body temperature. The essay examines the diversity in hair morphology among various individuals and populations, as well as the intricacy of hair structure. Though research proposes a more sophisticated classification based on characteristics like curl and wave, hair is normally divided into ethnic categories. The chemical and molecular makeup of all hair is similar, notwithstanding these variations. The growth phases of hair, the greying phenomena, and the meaning of hair in many circumstances are also discussed in the paragraph.

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