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A Review of Preparation and Evaluation of Hair Tonic from Zizups jujuba.

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Abstract: *In the last few decades there has been exponential growth in the field of herbal medicine. It is getting popularized in developing and developed countries owing to its natural origin and lesser side effects. One such medicinal plant is Ziziphus Jujuba, a member of the family Rhamnaceae, commonly known Ber grows mostly in Europe, southern and easter Asia, And Australia, Especially the inland region of northern China. Jujuba has a long history of usage as a fruit and remedy. Ziziphus Jujuba Hair tonic posseses hair growth promoting activity. The Aim of this paper is to Review of Research on Ziziphus Jujuba Hair Tonic, Scientifically valid data in the form of a Mini Review*

Keywords: Ziziphus Jujuba, Hair Tonic, Hair length.

I. INTRODUCTION

A vital component of the body, hair is one of the body's protective appendages and is formed from the ectoderm of the skin. It is a significant component of the human [1]. Along with sweat glands, sebaceous glands, and nails, hair is an essential component and accessory structure of the integument. Alopecia is the medical word for hair loss. It could be either short-term or long-term [2]. Hair is a complex system that exhibits unusual physical and chemical characteristics. It is a complicated structure made up of multiple morphological elements that work Together.

Mammals' hair shafts are separated into three primary sections: the cortex, medulla, and cuticle [3]. The medulla is lacking from children's fine hair but present in coarser hair types such as grey, thick, and beared hair [4].

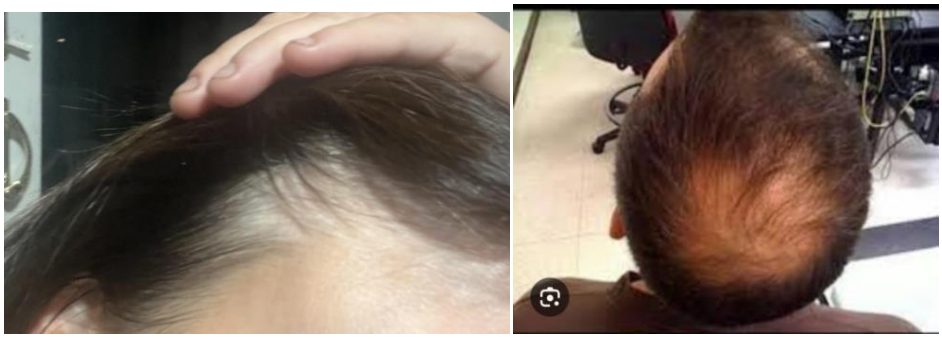

Fig.1 & 2: Hair Loss and hair scalp

The cuticle is made up of flap- Overlapping scales that resemble roof shingles and is resistant to chemicals. The epicuticle is covered in a layer that contains free lipids and 18-methyleicosanoic acid (18-MEA) [5]. Due to their high activity and very low or nonexistent adverse effects as compared to synthetic medications, herbal treatments have consistently garnered a lot of interest [6]. Reduced blood flow, illnesses of the scalp, and exposure of the hair to alkaline media are the causes of hair loss. One type of hair tonic that repairs and retexturizes hair is called a hair tonic. There are two different kinds: 1) Prodrugs, which address particular hair issues. For instance, dandruff and oily hair. 2) Products that are designed to maintain, repair, and enhance the state of the hair [7]. Even while dermatologists specialize in treating diseases of the scalp and hair, some cosmetic treatments are still difficult to achieve. While medical literature is rather rare and specialist literature is not easily accessible, hair cosmetics are freely available [8].The prickly plant Ziziphus Jujuba is a member of the rhamnaceae family, which is found throughout Europe and

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Southeast Asia. The leaves have hypoglycemic, antiulcer, antibacterial, anti- allergic, sweetening, sedative, and blood-purifying properties. The current study concentrated on the scientific investigation of the hair growth capacity of Common Jujuba (Ziziphus Jujuba) leafextract [1,9].

Historical Background of zizupus jujuba:

Fig.3: Zizupus jujuba fruit

The Chinese date, is the most significant species in the vast and diverse Rhamnaceae family. It has been used and cultivated since 7000 years ago, during the Neolithic era. Is currently one of the most widely grown fruit species, the most produced dried fruit, and the primary source of income for 20 million Chinese farmers [10]. It was brought into nearby nations like Japan and Korea. Jujube spread to at least 48 nations 2000 years ago. Iran, Israel, South Korea, the United States, Italy, Australia, and other nations [11]. Since ancient times, Ziziphus mauritiana, often
known as Ber, has been a valuable fruit in India; the Yajurveda (1958) even made reference to it. Pareek (2001) has cited all of the written materials from the 1000 BC–400 AD period. The
Deccan Plateau, which predates Gangetic culture, was one of the ancient agriculture regions. The plant has long had great therapeutic significance [12].

Taxonomical classification:

Kingdom: Plantae
Division: Magnoliophyta Class: Rosales
Family: Rhamnaceae Genus: Ziziphus
Species: Jujuba [5]

Morphology

Ziziphus Tourn ex L. is the genus that includes jujubes. Ziziphus is a member of the Rhamnaceae family, which is named after the genus Rhamnus.The fruits of the Rhamnaceae are closely linked to those of the Vitaceae, another family that comprises important commercial species with berries as their fruit The word Ziziphus has Arabic roots, and the ancient Greeks called the jujube Ziziphon.different forms, ranging from tiny or medium-sized trees that may be erect, semi-erect, or spreading to shrubs [13]. Although trees exceeding 20 meters are uncommon, heights can range from 3– 4 to 10–16 meters or more. The bark is reddish or grayish brown with deep longitudinal furrows. The shrub is usually armed, but sometimes it is not or less frequently not developed into a spine, on petiolate leavesthat range in

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length from 1.1 to 5.8 mm. The flowers have a disk that is about 3 mm in diameter, dorsally tomentose sepals, and a two-celled ovary that is submerged in the disk. The fruit is greenish yellow or occasionally crimson, and the flesh is pleasant and acidic [8].

Phytochemical constituent –

Alkaloids

Every portion of the plant contains alkaloids. Alkaloids are found in the stem bark of Ziziphus species [14]. Z. mauritiana stems have yielded zizogenin, a sapogenin [15]. From the bark of Zajujuba, the cyclic peptide alkaloids mauritine-A, mucronine-D, amphibine-H, nummularine-A and -B, sativanine-A and sativanine-B, frangulanine, nummularine-B, and mucronine were extracted [16]. Z. jujuba stem bark was used to isolate the cyclic peptide alkaloids sativanine-C, sativanine-G, sativanine-E, sativanine-H, sativanine-F, sativanine-D, and sativanine-K [17]. Z. jujuba leaves were used to isolate the alkaloids coclaurine, isoboldine, norisoboldine, asimilobine, iusiphine, and iusirine [18]. It was discovered that Z. jujuba's cyclopeptide and peptide alkaloids had sedative properties [19]. Sanjoinenine, franguloine, amphibine-D, and four peptides are cyclic peptide alkaloids found in Z. jujuba var. spinosa seeds. Sanjoinine-B-D-F and-G2 are alkaloids [20].Chinese medicine uses the seeds as a sedative. The cyclopeptide alkaloids mauritines A and B-C-F-G, and H, frangufoline, amphibines D, E, B, and F, hysodricanin-A, scutianin-F, and aralionin-C were isolated from Z. mauritiana through chemical research [16]. From the root bark of Z. mauritiana, the cyclopeptide alkaloid mauritine J was extracted [21].

Initially Mauritine-A, Amphibine-H, Jubanine-A, JubanineB, Mucronine-D, and Nummularine-B are the six cyclopeptide alkaloids that have been identified from the stem bark of Z. jujuba [17]. Stated Sativanine- E. Frangufoline, an antibacterial peptide alkaloid from Ziziphus species, was documented [22]. Melonovine-A, Franganine, Frangulanine, Daechuine-S3, Daechuine-S6, Nummularine-A, and Nummularine-R are cyclopeptide alkaloids, according to Han and colleagues [20]. According to reports, Z. jujuba's stem bark contains four cyclopeptide alkaloids:

Scutianine-C, Scutianine-D, Jubanine- C, and Ziziphine-A [23]. Two findings on separated components from Z. jujuba root bark have been published in the literature. The active (sedative) cyclopeptide alkaloids Adouetine X and Frangulanine were separated and described [24].

Glycoside

The structure of spinosin (2"-O- beta- glucosylswertisin) that was taken from the seed of Z. jujuba var. spinosa [25]. Subsequently, they found three acylated flavone-C-glycosides (6'''-sinapoylspinosin, 6'''-feruloylspinosin, and 6'''- p-coumaroylspinosin), which exhibit sedative action in rats pharmacologically. Saponins Jujubosides A and B are among the saponins extracted from Z. jujuba seeds [26]. Protojujubosides A, B, and B1 [27]. as well as acetyljujuboside B [28]. and A1 B1 and C. Ziziphin, a saponin, was isolated from dried Z. jujuba leaves by Kurihara et al. [29]. A. Its structure is 3-O – a – L-rhamnopyranosyl (1-2) – a – arabinopyranosyl 20-O- (2,3).

Jujubogenin is di-O-acetyl-a-L-rhamnopyranosyl. A saponin was extracted from the leaves and stem of Z. jujuba byIkram et al. Jujubogenin was given the structure 3-O-((2-O-alpha- D- furopyranosyl – 3-O-beta-D-glucopyranosyl) – alpha-Larabinopyranosyl [30].

Flavonoids

Gong et al. extracted and reported sedative flavonoids from Z. jujuba fruit and seeds, including Swertish and spinosin. Gong et al. identified and reported the flavonoids puerarin, 6'feruloylspinosin, Apigenin-6-C-b-D-glucopyranoside, 6'-feruloylisospinosin, isospinosin, and isovitexin-2"-O-b-D-glucopyranoside. Quercetine 3-O0-robinobioside, Quercetine 3-Orutinoside, Quercetine 3-O- α -L-arabinosyl-(1→2)- α -L-rhamnoside, Quercetine 3-O-b- Dxylosyl- (1→2)- α -L-rhamnoside, Quercetine 3-O- β -D-glucoside, 3',5'-DiC- β -D-glucosylphloretin, and Quercetine 3-O-βD-

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rhamnoside-4'-O-a-. Gong et al. describe a few of the typical flavonoids. Found a novel flavonoid chemical called zivulgarin [31].

Terpenoids

The fruits of Z. jujuba have been found to contain triterpenoic acids, including colubrinic acid, alphitolic acid, 3-Ocis-p-coumaroylalphitolic acid, 3-O-transp-coumaroylalphitolic acid, and 3O- cis-p-coumaroylmaslinic acid. 3- Otrans-pcoumaroylmaslinic acid, zizyberenalic acid, betulinic acid, oleanolic acid, and betulonic acid [32]. Z. mauritiana roots have also been used to extract triterpenoic acids [33]. According to Shoei et al [17] , triterpenes include betulin, betulinic acid, ursolic acid, 2α-hydroxyursolic acid, and ceanothic acid. Some of them have antiHIV and anti- cancer qualities. Three triterpene esters were identified by Sang et al [34] : 2-Oprotocatechuoyl alphitolic acid, Caffeoyl alphitolic acid, and Ceanothic acid dimethyl ester.

Phenolic compound

Phenolic compounds from Z. jujuba fruit were recently described by Pawlowska et al [35] , but no biological action was mentioned. Every component of the plant contains a large amount of betulinic acid. It is a pentacyclic triterpenoid that occurs naturally and has shown selective cytotoxicity against several different types of tumors. It has been discovered to kill human melanoma cells only, sparing healthy cells. Furthermore, betulinic acid has been shown to have antibacterial and anti-inflammatory qualities [36,37]. It also prevents the growth of Escherichia coli and Staphylococcus aureus.

Pharmacological Activities –

Numerous pharmacological characteristics of Ziziphus jujuba are advantageous for hair. Follicles are shielded from harm caused by oxidative stress by antioxidant activity [38]. Anti-inflammatory properties lessen itching and irritation of the scalp. Antimicrobial properties guard against infections and dandruff. Saponins and flavonoids stimulate follicular activity and block 5-alpha-reductase to promote hair growth [39].

Medicinal Uses:

Ziziphus is a tiny tree or shrub. Medicine is made from the fruit. Using an in- vivo approach, the essential oils of Ziziphus jujuba demonstrated action that promoted hair development. Research conducted on BALB/c mice revealed that when compared among oils, 1% and 10% essential oils exhibit superior hair length, weight, thickness, and relative area of the hair follicle. Compared to 10% essential oil, 1% essential oil had superior activity [40]. Ziziphus is used as a sedative, to increase weight and muscle mass, and to avoid stress ulcers and liver problems [41].

Additionally, jujube is used to treat a variety of skin conditions, such as dry, itchy skin, purpura, sores, and ulcers;digestive issues, such as diarrhea and lack of appetite; and circulatory issues, such as anemia and high blood pressure.Additional applications include eye problems, asthma, fever, inflammation, hysteria, and exhaustion. Asthma and anxiety Diarrhea Weariness and fever

The fresh leaves of this plant are used by traditional healers to treat urinary tract infections along with cumin. The fruit is used externally and as an antidote for aconite toxicity and pregnancyrelated stomach pain. In wound care treatments and poultices [42].

Hair tonic formulation

Extract from Ziziphus jujuba leaves (5%) The active component 90% coconut oil Base oil 0.5% of vitamin E Antioxidant Fragrance (q.s.) Preservative: q.s. (Stability) Method: Warm coconut oil (40– 45°C), whisk in Ziziphus jujuba extract, add vitamin E and preservative, let cool, and pour in to amber bottles [43]. Liquid concoctions called herbal hair tonics are intended to nourish hair, stop hair loss, and encourage growth. Bases like water, alcohol, glycerin, or oils are combined with Ziziphus jujuba leaf extract. Methods of extraction: Soxhlet extraction, maceration, and

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hydroalcoholic, methanolic, and aqueous extracts [44]. Additives include stabilizers, preservatives such sodium benzoate, and essential oils like lavender and rosemary for aroma and medicinal purposes [45]. Steps in the formulation process include shade- dried leaves, powder, extraction, filtration, base integration, and packing in amber bottles [44].

Evaluation Parameters

Safety, stability, and effectiveness are guaranteed by hair tonic evaluation (46). Organoleptic evaluation: consistency, odor, and appearance. Physicochemical parameters include density, foamability, viscosity using a Brookfield viscometer, and pH (5–7). Accelerated temperature and light exposure tests are examples of stability studies Microbiological assessment: Antimicrobial efficacy against infections of the scalp, such as Malassezia spp. Studies on hair growth: in vivo (rat vibrissae or clinical trials) and in vitro (follicle cultures). Skin irritation and allergy testing are examples of safety investigations.

Hair Anatomy and physiology

The hair,s microscopic and macroscopic structure The epidermis is the source of hair. Hair is made up of individual living hair follicles, cylindrical epithelial down growths into the dermis , and subcutaneous fat that enlarges at the base into the hair bulb surrounding the mesenchymal-derived dermal papilla. On the outside, hair is made up of thin, flexible tubes of dead, fully keratinized epithelial cells [47]. From a macrostructural perspective, the length, diameter, color, and cross-sectional shape of hair change between various ethnic groups and between individual people [48]. The hair shaft, which is visible on thesurface of the body, and the follicle in the skin are the two distinct structures that make up hair. The cortex, cuticlecells, and occasionally a medulla in the middle make up the hair shaft. The cortex, which is composed of roughly 50–60% macrofibrils and comprises the majority of the hair fiber composition and has a significant role in the physical and mechanical qualities of hair, is the

peripheral portion of the hair, whereas the medulla is the center port ion. Which are made up of microfibril rods embedded in a matrix [49]. The hair shaft cuticle, which is made up of flat overlapping cells , covers the hair from the root to the tip of the epidermis [50]. The cell membrane complex and several sublamellar structures, Including the epicuticle, A- Layer, exocuticle, endocuticle, and inner layer, make up each cuticle cell, which is typically 0.3–0.5 lm thick and has a visible length of roughly 50 lm [49]. The integrity and characteristics of the cuticle layer play a significant role I n keeping the hair clean and untangled, protecting the cortex from chemic al and physical damage, and greatly influencing its look [51].

The fundamental structure for hair growth is the follicle. The histology structures from the follicle's outermost aspect are:

1. Keratinocytes are found in the outer root sheath (ORS), which has been found to be a reservoir of multipotent stem cells, including melanocyte and keratinocyte stem cells. The ORS creates a noticeable protrusion between the sebaceous gland duct and the arrector pili muscle insertion [47, 52]. The glassy layer14, also referred to as the dermal sheet, is a basket-like configuration of two orthogonally arranged layers of collagen fibers that borders the ORS on the dermal side [53].
2. Henle's layer, Huxley's layer, and cuticle layer are the three layers that make up the inner root sheath (IRS). The hair shaft is anchored to the follicle by the IRS cuticle layer, which is next to the hair shaft's cuticle. Keratins and trichohyalin, which are produced by IRS cells, act as an intracellular cement that gives the IRS the strength to support and shape the growing hair shaft and direct its upward movement. The hair shaft and ORS are separated by the IRS [54].

The part of the follicle that actively generates hair is called the hair bulb. It contains a single capillary loop, nerve fibers, mucopolysaccharide-rich stroma, follicular dermal papilla, and dermal papilla cells. In addition to being a vital source of growth factors (keratinocyte growth factor, bone morphogenetic protein, hepatocyte growth factor, insulin-like growth factor, and stem cell factor) necessary for hair growth and melanogenesis, the follicular papilla is thought to

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be one of the most significant drivers that instruct the hair follicle to grow and form a particular size and pigmented hair shaft [55]. A lower part of undifferentiated cells and an upper region of differentiated cells make up the two sections of the hair bulb. The two areas at the critical level are divided by a line (Auber's line) that crosses the broadest portion of the papilla. The dermal papilla and the matrix, or germination core of the follicle, where all cells are mitotically active, are located beneath the Auber's line. Cells leave the matrix and travel to the top of the bulb, where they enlarge and undergo vertical elongation [56].

There are four components to the upper bulb:

i)The pre-elongation region, when the cells align themselves vertically and somewhat enlarge, is located in the broad section of the bulb above the critical level; ii) The cellular elongation region is located above this area, where the bulb's diameter is reduced and the cells noticeably lengthen;

iii) Different thin fibers or fibrils that can be stained with basic dyes are seen in the cortical prekeratinization zone directly above; and iv) The keratogenous zone is located further up, where the keratin of the hair stabilizes and the cells undergo hyaliagnosis. The keratogenous zone terminates at one-third of the way between the papilla tip and the skin's surface, depending on the length of the follicle. The infundibulum and the isthmus are the two anatomical components that make up the top hair follicle above the bulb. The sebaceous gland produces sebum, which fills the infundibulum, a funnel-shaped structure that runs from the skin's surface to the sebaceous duct. It acts as a reservoir and an interface for interactions with cell populations connected to hair follicles. The epithelium is continuous with the keratinized epidermis in the upper portion, known as the acroinfundibulum, and is covered by an intact, somewhat impermeable stratum corneum. This barrier is broken in the lower follicular infrainfundibulum as the differentiation pattern changes from epidermal to tricholemmal. There are very few differentiated corneocytes left, and the infundibulum's epidermal invasion must be regarded as extremely porous [57]. The isthmus, which runs from the sebaceous gland duct to the arrector pili muscle's exertion, completes the upper portion of the hair follicle [58].

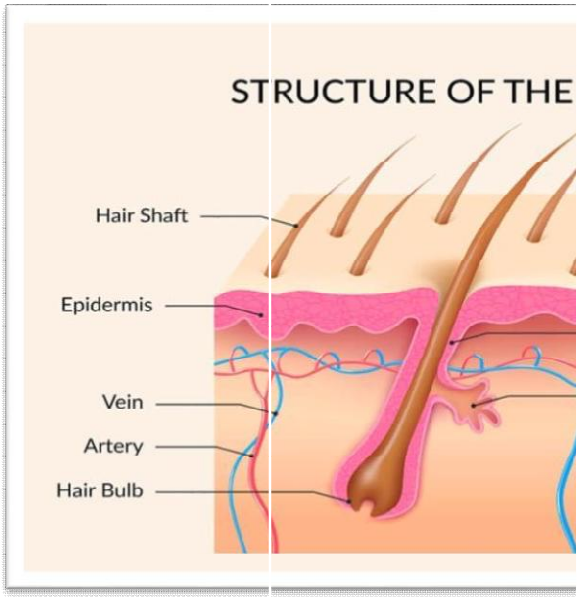

Fig.4 Structure of the hair

The scalp sheds 100 hairs per day, whereas hair grows about 0.3 mm every day, or 6 inches annually. 95% of hair is made up of keratin, a fibrous, helix-shaped protein that is a component of the skin and all phanera (hair, nails, etc.) [59].

Typically, hair is made up of two different structures:

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Follicle: The hair follicle is the area beneath the skin. It is shaped like a club. This organ is found in the dermis and contains stem cells that are used to restore skin following a wound as well as hair once it falls [60].

Hair shaft: The hair shaft is a structure that extends above the skin's surface and resembles a rigid filament. A three - layered cross section of the hair shaft.

Medulla: The medulla is the deepest and innermost layer. It is an open, disorganized space in the middle of the fiber. Only thick, big hair types have medulla [61,60].

Cortex: The largest and center portion of the hair shaft, it gives hair its color, strength, and texture. It is made up of keratin bundles in cell formations that resemble rods [61].

Cuticle: The thin, colorless outermost layer is called the cuticle. It is composed of multiple layers of thin, flat cells that overlap to preserve the hair's inner layers.

The cycle of hair growth :

Every type of hair goes through a recurring cycle of development and rest. The length of each cycle is determined by an individual's age and the area where hair grows. The follicle's cyclic phases are called telogen (a resting phase), catagen (a regression phase), and anagen (a growth phase)

1. Anagen phase: The hair's growth or active phase is known as the anagen phase. For two to six years, scalp hair follicles will be in the anagen phase. This hair grows half an inch every month [59].

2. Catagen phase: The cessation of vigorous hair growth is indicated by this regression phase. At any given time, about 3% of all hairs are in this stage. It lasts for two to three weeks.

3. Telogen phase: Lasting two to three months, this is the third stage and resting phase. The hair follicles are at rest and not actively growing during the telogen phase. At any given time, 10– 15% of all hairs are in this stage [61].

Fig.5 Hair growth cycle

Hair issue:

Typical hair issues include: Hair Loss:

Hair loss is a miserable condition for a men and women. Each and every strand of hair is Genetically designed to a cycle that includes growth, stabilization, aging and shedding. Hair loss can occur due To many reasons like genetics, hormonal changes, nutritional deficiencies, stress, or certain medical Conditions. By identifying the root cause of hair

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loss, it can be treated. It involve consulting with a Dermatologist to determine the cause and provide appropriate treatment [62].

Dry Hair:

One of the causes of dry hair is shampooing. An excessive amount of hair washing can result in a loss of moisture in the scalp and hair shafts, making the hair appear brittle and dull.

Environmental factors like excessive sun exposure, severe weather, and harsh hair care products can also cause it. Dryness can be lessened by using hydrating and nourishing elements in hair care routines, such as moisturizing shampoos and conditioners, deep conditioning treatments, serums or oils, and reducing heat styling [63].

Dandruff:

Fifty percent of people worldwide suffer from dandruff. The flaking of dead skin cells is typically the condition's defining feature [64]. It is brought on by dry skin, excessive oil production, and an overabundance of yeast-like fungi called Malassezia restricta and Globosa malassezia, formerly known as Pityrosporum, which infect the scalp and skin [65]. It can range in severity from mild scaling to severe scaling, which is more common in children and young men but less common in older people. Anti-dandruff shampoo and a healthy scalp might help manage it.

There are two types of it: oily dandruff and dry dandruff.

1. Dry dandruff: Also referred to as pityriasis simplex capillitii, dry dandruff is a common scalp ailment brought on by the shedding of tiny, dry skin flakes. Dry dandruff is noticeable when the scalp is very dry because it causes the skin cells to flake off.
2. Oily dandruff: Also referred to as seborrheic dermatitis, this scalp ailment is brought on by an excess of sebum, an oily substance. Oily flakes and profuse skin cell shedding are the outcomes of this. Oily dandruff can be prevented with regular cleaning and a healthy diet [64].

Split Ends:

Damage to the cuticle, the outside layer of hair, results in split ends, a frequent hair issue caused by fraying or splitting of hair strands. Chemical treatments, excessive heat style, and a lack of moisture can all contribute to this. Regular hair trimming, the use of heat protectants, a widetooth comb for gentle drying, deep conditioning, and a balanced diet can all help prevent it [66].

Frizz:

Frizzy hair occur when the hair cuticle lift and allow moisture to enter which result in a rough and Unmanageable texture. Factors such as humidity, heat styling, lack of moisture, damaged hair cuticles and Using of harsh hair products responsible for frizz. It can be managed by

adopting a proper hair care routine.Use of hydrating shampoos and conditioners are responsible for maintaining moisture levels in the hair. Application of Leave-in conditioners, serums , or oils provide an extra layer of hydration and smooth the hair Cuticle. Using of anti frizz product and avoiding excessive heat can reduce frizziness [67].

Oily scalp:

This condition is brought on by an overabundance of sebum, a natural oil. Sebaceous glands, which can generate excessive amounts of oil, are the source of sebum. Hormonal fluctuations, heredity, the use of harsh hair treatments, regular hair washing (which can increase oil production), and some medical problems including seborrheic dermatitis are other reasons of oily scalps. Using lightweight, oil-free hair products and adhering to a regular hair care regimen will help control this [66].

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Hair thinning:

The term "thinning hair" describes a reduction in the diameter or density of hair strands, which results in a drop in hair volume. It cause owing to many variables such heredity, hormonal changes, ageing, nutritional deficiencies, certain medical disorders, or excessive styling and usage of harsh hair products. Hair thinning results in a decrease in hair volume and an increase in scalp visibility. To stop hair loss and boost hair volume, it's critical to identify the primary reason of hair thinning. Using volumizing hair products and avoiding heat and chemical treatment are two ways to treat it.

Hair breakage:

For many people, hair breakage is a regular issue. Excessive heat style, chemical treatments (such coloring, bleaching, or perming), environmental variables (such as pollutants or severe weather), nutrient deficiencies, and insufficient moisture are some of the causes of hair breakage; dry, brittle hair is more likely to break. Hair breakage can be avoided with a good hair care regimen, light brushing, heat protectants, and little usage of chemical treatments [68].

Scalp irritation:

The sensation of discomfort, itching, or sensitivity on the scalp accompanied by redness or inflammation is known as scalp irritation. Scalp irritation is mostly caused by dry skin, allergies, and dangerous hair products. Regular hair washing, avoiding chemical treatments, and maintaining good hygiene and hair care practices are all part of managing scalp irritation [68].

Color-damaged hair:

This type of damage is brought on by procedures like bleaching, dyeing, or using hair style products that include chemicals. When coloring hair, the cuticle—the outermost layer of hair— acts as a barrier that lets dye into the cortex. Regular coloring weakens the cuticle, which causes hair damage. To avoid damaging hair, less hazardous hair color should be used [67].

Ziziphus jujuba's Hair Growth Process

Genetic, hormonal, and environmental variables all influence the intricate biological process of hair growth. Numerous bioactive components found in Ziziphus jujuba, including saponins, flavonoids, triterpenoids, and alkaloids, work together to stimulate hair follicles and improve scalp health. Numerous routes are involved in the mechanism, including proliferative, antiinflammatory, and antioxidant actions.

1) Dermal Papilla Cell (DPC) Stimulation

Hair follicle creation, growth, and cycling are controlled by dermal papilla cells (DPCs), which are found at the base of hair follicles. Z. jujuba's ethanolic extract promotes the growth of these cells, prolonging the hair cycle's anagen (growth) phase and delaying its catagen (resting) phase.

Mechanism

Z. jujuba's saponins and triterpenoids boost the expression of IGF-1 (Insulin- like Growth Factor- 1) And VEGF (Vascular Endothelial Growth Factor). By increasing microvascularization, these growth factors improve the nutrition supply to hair follicles. Stronger and thicker hair strands result from the increased cell division [69].

2) Activity of Antioxidants

Because oxidative stress damages follicular cells, it is a major factor in early hair loss. Apoptosis results from the follicular membrane being destroyed by reactive oxygen species (ROS). Z. jujuba's polyphenols and flavonoids neutralize free radicals and shield follicular DNA from harm Mechanism In scalp tissues, flavonoids raise the activity of the enzymes Catalase (CAT) and Superoxide Dismutase (SOD). By lowering ROS, follicle vitality is maintained and androgen- induced baldness is avoided. Tannins and vitamin C promote the production of collagen, which improves root anchoring and scalp suppleness [70].

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3) Reduction of Inflammation

Dandruff, hair loss, and scalp discomfort are caused by inflammation of hair follicles. Because Z. jujuba extract contains triterpenoid saponins, it has anti inflammatory qualities.

MechanismReduces the production of prostaglandins and leukotrienes by inhibiting the Cyclooxygenase (COX-2) and Lipoxygenase (LOX) pathways. Prevents follicular shrinkage by reducing inflammatory cytokines such TNF-α, IL1β, and IL-6. Has a calming effect on the scalp, reducing redness and itching [57].

4) Antifungal and Antimicrobial Properties

One of the main causes of hair loss is bacterial and fungal infections of the scalp. The broad- spectrum antibacterial action of Ziziphus jujuba maintains the health of the scalp.

Mechanism

Pseudomonas aeruginosa and Staphylococcus aureus, the microorganisms that cause folliculitis, are inhibited by ethanolic extract. Additionally, it inhibits the dandruff-causing fungus, Malassezia furfur. As natural surfactants, saponins gently remove dirt and oil from the scalp without harming the follicles [56].

5) Control of Sebum Production

Overproduction of sebum obstructs follicles, resulting in dandruff and hair loss. Sebum Levels are restored by Z. jujuba's tannins and alkaloids.

Mechanism

Because of their astringent qualities, tannins tighten scalp pores and lessen excessive oil secretion. Sebum levels that are in balance keep you hydrated and stop microorganisms from growing [73].

6) Modulation of Hormones

One of the main causes of androgenic alopecia (hair loss) is dihydrotestosterone (DHT), a derivative of testosterone. Extracts from Ziziphus jujuba have demonstrated a slight inhibitory effect on the enzyme 5-α reductase, which transforms testosterone into DHT.

Mechanism

Triterpenes and flavonoids inhibit the activity of 5-α reductase. Lower DHT levels sustain healthy growth by preventing hair follicles from becoming smaller. This mechanism functions similarly to finasteride, yet it has no negative side effects [74, 75].

7) Improvement of Keratin and Collagen Synthesis

The primary structural protein of hair is keratin. By providing necessary amino acids and promoting fibroblast activity, Ziziphus jujuba improves keratin synthesis.

Mechanism

The extract's polysaccharides and vitamin C encourage the production of collagen, which fortifies the follicular basis. Hair that is thicker, shinier, and more resilient to breakage results from improved keratinization [70, 72].

8) Synopsis of the Mechanism

Effect of Pathway Active Constituents DPC stimulation Triterpenoids and saponins extends the anagen phase Polyphenols and Antioxidant Flavonoids shields follicles from oxidative harm Anti- inflammatory Triterpenes avoids inflammation of the scalp Saponins with antimicrobial

properties gets rid of scalp infections Regulation of Sebum Tannins regulates hormones and balances scalp oil Flavonoids lowers the level of DHT Support from collagen and keratin

Polysaccharides and Vitamin C fortifies the roots of hair.

Herbal tonic for hair

Hair tonics are formulas made to nourish and moisturize the scalp and hair follicles as well as address other hair issues. It is an essential component in hair care. There are countless advantages of utilizing hair tonic. Hair tonics boost the long-term health of hair by nourishing the roots and scalp, which promotes the growth of new hair and increases the volume of existing hair. Although hair tonics address many issues with hair, the main advantage is increased hair

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growth. It is a liquid formulation that encourages the growth of thick hair and prevents blading. It adds volume, texture, luster, and less frizz to hair and is lightweight and
simple to use [76]. Hair tonics should be sprayed on the scalp or the aflicted area on a regular basis, then gently massaged with the fingertips. It is rapidly absorbed and increases blood flow to the scalp and hair follicles. For at least four months, it is advised to take it twice a day (morning and night) in order to witness noticeable hair growth. It facilitates the scalp's quick absorption of nourishing substances and the efficient elimination of pollutants and accumulated debris. A study of 35 volunteers with mild to severe hair loss showed that using a hair tonic reduced Hair loss by 57.9% in just 28 days 9.[77]

Advantages of Herbal Hair Tonic

1. Little adverse effects, natural, and environmentally beneficial [78].
2. Hair roots are strengthened and the scalp is nourished. Prevents dandruff and lessens hair loss.
3. An affordable substitute for synthetic formulations. Antioxidant, antibacterial, and antiinflammatory properties that are multifunctional [67].
4. They don't trigger allergic reactions or have any negative side effects.
5. They mix seamlessly with the hair and skin.
6. Plant extract lessens the bulk characteristics of cosmetics and provides the appropriate pharmacological activities.
7. Abundant and easily obtainable in a variety of forms.
8. Easy to make and expensive

Disadvantage of Herbal hair Tonic

1. When taken in dosage forms, herbal medicines function more slowly than allopathic ones
2. Long-term treatment is required.
3. The production procedure is difficult and takes a long time.
4. Odor and flavor can be difficult to cover up at time.
5. The use of any specific technique or ingredient in herbal cosmetics is not specified by any pharmacopeia.

Ideal properties of Herbal hair Tonic

1. Protect your hair's cuticle.
2. Get rid of dirt without getting rid of natural oil.
3. Restore lost protein, water, and minerals.
4. Maintain porosity balance and prevent moisture loss.
5. A smooth, abraded cuticle scale

II. DISCUSSION AND CONCLUSIONS

Ziziphus jujuba is a widely traditionally used and potent medicinal plant amongst all the thousands of medicinal plants. The pharmacological activities reported in the present review confirm that the Ziziphus Jujuba Hair tonic therapeutic value is much more. Antioxidant effects of Jujube are known for reversing the effects of aging by promoting cell health and helping to improve elasting in your skin. Skincare products also use jujube extract to improve dry skin and relieve pain caused by sunburns. Some advocates also claim that jujube helps reduce acne, scar tissue and stretch marks though more research is needed on these fronts.The Presence of phytochemicals constituents and pharmacological activities proved that the plant has a leading capacity for Manufacturing of Hair tonics and new good efficacy drugs in future.

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