JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Formulation and Evaluation Poly Herbal Hair Oil

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Abstract:

Mankind uses various products to enhance beauty and elegance to look young and charming cosmetics thus play a vital role in human life. Now a day's herbal cosmetic are widely used because of the belief that they have fewer side effects and better safety Hair is one of the primary parts of the body which acts as a protective appendage. The Objective of the present work is to develop a poly herbal hair oil for general purpose (daily use) using various herbs such as Amla, hibiscus pudina, Fenugreek, Henna, Curry leaves, Neem, Periwinkle, Banyan. The formulation oil was evaluated for its organoleptic properties, acid value, saponification value, refractive index, PH etc. All the parameters were found to be good and within the standards.

KEY WORDS:

Hair, oil, herbs, cosmetics, formulation, evaluation.

INTRODUCTION:

Hair is a protein filament that grows from follicles found in the dermis, or skin. Hair is one of the defining characteristics of mammals. The human body, apart from areas of globous skin, is covered in follicles which produce thick terminal and fine vellus hair. Most common interest in hair is focused on hair growth, hair types and hair care, but hair is also an important biomaterial primarily composed of protein, notably keratin. Attitudes towards hair, such as hairstyles and hair removal, vary widely across different cultures and historical periods, but it is often used to indicate a person's personal beliefs or social position, such as their age gender or region.

The word "hair" usually refers to two distinct structures:

1. The part beneath the skin, called the hair follicle, or, when pulled from the skin, the bulb. This organ is in the dermis and maintains stem cells, which not only re-grow the hair after it falls out but also are recruited to regrow skin after a wound.

2. The shaft, which is the hard filamentous part that extends above the skin surface. A cross section of the hair shaft may be divided roughly into three zones

Hair fibres have a structure consisting of several layers, starting from the outside

1. The cuticle, which consists of several layers of flat, thin cells laid out overlapping one another as roof

shingles,

2. The cortex, which contains the keratin bundles in cell structures that remain roughly rod- like.

3. The medulla, a disorganized and open area at the fibre's centre.

Hair loss, also known as alopecia or baldness, refers to a loss of hair from the head or body Baldness can refer to general hair loss or male pattern hair loss.

Hair loss and hypotrichosis have many causes including androgenetic alopecia, fungal infection, trauma (e.g., due to (trichotillomania). radiotherapy, chemotherapy, nutritional deficiencies (e.g., iron deficiency). and autoimmune diseases (e.g., alopecia areata) Hair loss severity occurs across a spectrum with extreme examples including alopecia totalise (total loss of hair on the head) and alopecia universalis (total loss of all hair on the head and body).

Causes:

Infection Dissecting cellulitis

Fungal infections (such as tinea capitis) Folliculitis

Secondary syphilis
Demodex folliculorum, a microscopic mite that feeds on the sebum produced by the sebaceous glands, denies hair essential nutrients and can cause thinning. Demodex folliculorum is not present on every scalp and is more likely to live in an excessively oily scalp environment.

Drugs:

Temporary or permanent hair loss can be caused by several medications, including those for blood pressure problems, diabetes, heart disease and cholesterol, any that affect the body's hormone balance can have a pronounced effect: these include the contraceptive pill, hormone replacement therapy, steroids and acne medications, Some treatments used to cure mycotic infections can cause massive hair loss

Medications (side effects from drugs, including chemotherapy, anabolic steroids, and birth control pills)

Trauma:

Traction alopecia is most found in people with ponytails or cornrows who pull on their hair with excessive force. In addition, rigorous brushing and heat styling. rough scalp massage can damage the cuticle, the hard outer casing of the hair. This causes individual strands to become weak and break off, reducing overall hair volume.

Pregnancy:

Hair loss often follows childbirth without causing baldness, In this situation, the hair is actually thicker during pregnancy due to increased circulating oestrogens. After the baby is born, the oestrogen levels fall back to normal pre-pregnancy levels, and the additional

hair foliage drops out. A similar situation occurs in women taking the fertility-stimulating drug clomiphene.

Management of hair loss:

Medications: Treatments for the various forms of hair loss have limited success. Three medications have evidence to support their use in male pattern hair loss: finasteride, dutasteride and minoxidil [2782] They typically work better to prevent further hair loss than to regrow lost hair. 1271

Minoxidil (Rogaine) is a nonprescription medication approved for male pattern baldness and alopecia areata. In a liquid or foam, it is rubbed into the scalp twice a day. Some people have an allergic reaction to the propylene glycol in the minoxidil solution and a minoxidil foam was developed without propylene glycol. Not

all users will regrow hair.

Surgery:

Hair transplantation is usually carried out under local anaesthetic. A surgeon will move healthy hair from the back and sides of the head to areas of thinning. The procedure can take between four and eight hours, and additional sessions can be carried out to make hair even thicker.

Hairline lowering can sometimes be used to lower a high hairline secondary to hair loss, although there may be a visible scar after further hair loss.

Herbal cosmetics:

Herbal cosmetics are in existence from when the men started to use the cosmetic products. So they are oldest products used by mankind. Some common cosmetics include creams, face packs, scrubs, hair oils, hair colours, shampoos, hair conditioners, lipsticks, blush-on or rouge as it is sometimes known, eyeliners, mascaras, foundations and eye shadow, perfumes and fragrance, soaps, etc. The formulation of all these cosmetic products includes addition of various natural additives like oils, waxes, natural colour, natural fragrances and parts of plants like leaves, flowers etc by specific formulation methods. 'Quality control for efficacy and safety of herbal cosmetic products is of paramount importance. So, quality control test must be carried out for herbal cosmetics. It is assumed to be safe for longer periods of time.

Herbal cosmetic also known as "natural cosmetics". With the beginning of the civilization, mankind had the magnetic dip towards impressing others with their looks. At the time, there were no fancy fairness creams or any cosmetic surgeries. The only thing they had was the knowledge of nature, compiled in the ayurveda. With the science of ayurveda, several herbs

and floras were used to make ayurvedic cosmetics that really worked. Ayurvedic cosmetics not only beautified the skin but acted as the shield against any kind of external affects for the body. Ayurvedic cosmetics also known as the herbal cosmetics have the same estimable assets in the modern era as well. There is a wide gamut of the herbal cosmetics that are manufactured and commonly used for daily purposes. Herbal cosmetics like herbal facewash, herbal conditioner, herbal soaps, herbal shampoo, and many more are highly acclaimed by the masses. The best thing of the herbal cosmetics is that it is purely made by the herbs and shrubs. The natural content in the herbs does not have any side effects on the human body, instead enrich the body with nutrients and other useful minerals. Herbal cosmetics are comprised of floras like ashwagandha, sandal (Chandan), saffron (kesar)and many more that is augmented with healthy nutrient sand all the other necessary components

Herbal Cosmetics, here in after referred as Products are formulated, using various permissible cosmetic ingredients to form the base in which one or more herbal ingredients are used to provide defined cosmetic benefits only, shall be called as "Herbal Cosmetics".

PLANT PROFILES

MURRAYA KOENIGII (CURRY LEAVES)

Scientific Classification:

Kingdom: Plantae Order: Sapindales

Family: Rutaceae Genus: Murraya

Species: M. koenigii

BOTANICAL NAME; MurrayaKoenigi

Uses:

Use of curry leaves make the hair shinier and manageable. Coconut oil and curry leaves usage make a good combination to darken the grey hair naturally. Curry leaves have substances which promotes the hair growth and combat the hair fall Curry leaves are high in beta carotenes which are also found in carrots and protein. Proteins are highly beneficial for hair since the hair strands are also made up of amino acids which are the building blocks of proteins.

PHYLLANTHUS EMBLICA (Amla)

Scientific Classification:

Kingdom: Plantae Order: Malpighiales

Family: Phyllanthaceae Genus:

Phyllanthus Species :P.emblica

BOTANICAL NAME: Phyllanthusemblica

Uses:

Popularly used in inks, shampoos and hair oils, the high tannin content of Indian gooseberry fruit serves as a mordant for fixing dyes in fabrics [37] Amla shampoos and hair oil are traditionally believed to nourish the hair and scalp and prevent premature grey hair.

HIBISCUS ROSA-SINENSIS (HIBISCUS)

Scientific Classification:

Kingdom: Plantae Order: Malvales

Family: Malvaccac

Sub Family: Malvoideae Genus:

Hibiscus Species: Rose sinensis

BOTANICAL NAME: Hibiscus rosa-sinensis

USES: It helps and prevents the premature greying of hair when used as hair oil or hair pack. Hibiscus is known to combat hair loss and hair fall in men and women.

Hibiscus is good for all skin types and does no harm. Hibiscus makes the hair

roost and strands stronger.

It conditions the hair mildly and keeps them bouncier.

LAWSONIA INERMIS (HENNA)

Scientific Classification Kingdom:

Plantae Order: Myrtales

Family: Lythraceae Genus:

Lawsonia Species: Linermis

BOTANICAL NAME: Lawsoniainermis

Benefits of Henna for Hair:

Henna has natural properties that help it to correlate with proteins and this repairs and seals the cuticles which aid hair growth It also strengthens hair und prevents hair breakage along with adding shine and lustre to your mane

NEEM:

Scientific Classification:

Kingdom: Plantae Order:

Sapindales Family: Meliaceae

Genus: Azadirachta Species: A.

indica

BOTANICAL NAME: Azadirachtaindica

Uses:

Prevents premature graying Removes head

lice

Treats the itchy scalp

Reduces the redness/inflammation of the scalp Treats infections

in the scalp

BANYAN:

Scientific Classification:

Kingdom: Plantae Order: Rosales

Family: Moraceae Genus: Ficus

Sub genus: Urostigma Species: Aurea

Uses

Banyan prop roots are more very effective home treatment to prevent hair loss and to get good looking *Silky and shiny hair*.We will use banyan tree root or leaves in this treatment as main ingredients.

TRIGONELLA FOENUM-GRAECUM (FENUGREEK):

Scientific Classification:

Kingdom: Plantae Order: Fabales

Family: Fabaceae Genus:

Trigonella

Species: T.foeunm-graecum Uses:

1. It makes hair stronger
2. Hair becomes silkier and shinier
3. Helps in hair loos
4. Promotes hair growth
5. Treats dandruff and dry itchy scalp

PERIWINKLE (Catharanthus):

Scientific Classification:

Kingdom: Plantae Order: Gentianales

Family: Apocynaccae Genus:

Catharanthus

Species: Catharanthusroseua

Uses:

Periwinkle alkaloids have been used in the treatment of leukaemia, Hodgkin's disease, malignant lymphomas, neuroblastoma, Wilms tumour, Kaposi's sarcoma, mycosis fungoides, to improve cerebral blood flow, and treat high blood pressure.

MENTHAARVENSIS(PUDINA):

Scientific Classification:

Kingdom: Plantae Order:Lamiales

Family: Lamiaceae Genus: Mentha

Species: Maruensis

BOTANICAL NAME: Menthaarvensis

Uses: It is used as Hair conditioner and antidandruff age

Formulation Procedure of Poly herbal hair oil:

The poly herbal hair oils were formulated by using cloth method-Accurately all the dried and fresh herbs such as Neem, Amla, Curry leaves, Hibiscus, Banyan, Henna, Fenugreek, Periwinkle and Pudina were weighed, grinded in the mixer, tied in a muslin cloth and placed in a beaker containing 100 ml of coconut oil and 100 ml of castor oil according to the formulas (F1,F2,F3,F4) and the above content was boiled for 15 min and muslin cloth containing powdered herbs was removed and pressed to collect the oil and it was placed in amber coloured bottle.

Evaluation of poly herbal hair oil:

1 Organoleptic property:

Colour, odour was determined manually

2 P^H:

The pH of herbal hair oil was determined using pH meter

3 Primary Skin irritation test:

Three healthy female wistar albino rats, weighed 200-250gm were selected for study. Each rat was caged individually food and water given during the test period 24 hrs prior to the test. The hair from the back of each rat of 1 cm was shaved on the side of the spine to expose sufficiently large test areas, which could accommodate three test sites were cleaned with surgical spirit. 1 ml quantity of formulations F1, F2, F3 and F4 were applied over the respective test sites of one side of the spine. The test sites were observed for erythema and oedema for 48 hrs after application.

4 Sensitivity test:

The prepared herbal hair oil was applied on 1 cm skin of hand and exposed to sunlight for 4-5 min.

5 Grittiness: Gritty particles are absent.

List of Materials (TABLE NO:1)

S.NO	NAME OF PLANT HERBS	PLANT PART
1	MurrayaKoengii(curry leaves)	Leaves
2	Phyallanthusemblica(Amla)	Fruits
3	Hibiscus rosa-sinenses(hibiscus)	Flowers, leaves
4	Lawsoniainermis (henna)	Leaves
5	Azadirachtaindica(neem)	leaves
6	Banyan	Roots
7	Frigonellafoenum-graecnum(frenugreek)	Seeds
8	Menthaarvensis(pudina)	Leaves
9	Periwinkle	leaves
10	Coconut oil	Base or vehicle
11	Castor oil	Base or vehicle

List of Instruments: (TABLE NO:2)

S.NO	EQUIPMENTS	COMPANY NAME
1	Electronic balance	CITIZEN CTG-302
2	Digital p^{H}meter	Edison Instruments
3	Hot plate	Edison Instruments
4	Refractometer	Edison Instruments

Formulation of Poly herbal hair oil:(Table:3)

The various ingredients used in the formulation of poly herbal oils:

S.NO	Plant name	F1	F2	F3	F4
1	MurrayaKoengii(curry leaves)	10gm	11gm	10gm	11gm
2	Phyallanthusemblica(Amla)	8 gm	9 gm	8 gm	9 gm
3	Hibiscus rosa-sinenses(hibiscus)	9 gm	10 gm	9 gm	10 gm
4	Lawsoniainermis (henna)	7 gm	8 gm	7 gm	8 gm
5	Azadirachtaindica(neem)	5 gm	6 gm	5 gm	6 gm
6	Banyan	2 gm	2 gm	2 gm	2 gm
7	Frigonellafoenum-graecnum(frenugreek)	3 gm	2 gm	3 gm	2 gm
8	Menthaarvensis(pudina)	3 gm	1 gm	3 gm	1 gm
9	Periwinkle	3 gm	1 gm	3 gm	1 gm
10	Coconut oil	100ml	100ml	-	-
11	Castor oil	-	-	100ml	100ml

Role of Herbs In Herbal Hair Oil:(Table No:4)

S.NO	Ingredients	Importance
1	MurrayaKoengii(curry leaves)	Prevents air fall and greying if hair
2	Phyallanthusemblica(Amla)	Promotes hair growth, hair conditioning
3	Hibiscus rosa-sinenses(hibiscus)	Nourishes and thickening of hair
4	Lawsoniainermis (henna)	Hair colourant, hair growth
5	Azadirachtaindica(neem)	Antibacterial
6		Strengthens hair, prevents hair loss

7	Frigonellafoenum-graecnum(frenugreek)	Moisturises hair, replenishes hair growth
8	Menthaarvensis(pudina)	Flavouring agent
9	Periwinkle	Nervine tonic
10	Coconut oil	Base or vehicle
11	Castor oil	Base or vehicle

Density Specific gravity:

Takes specific gravity bottle, rinsed it with distilled water, dry it in oven for 15 minutes, cool, closed it with cap and weigh it (a). Now fill the same specific gravity bottle with the sample, closed it with cap again weigh it (b). Now determine the weight (c) of sample per millilitre by subtracting the weight (b-a)

CALCULATION:

$$\text{Density of the Solution (p)} = \frac{\text{Mass(c)}}{\text{Volume (Capacity in ml of the bottle)}}$$

Viscosity:

The viscosity was determined using Ostwald's viscometer. Ostwald

Viscometer:

(i)Take clean and dry U-tube Ostwald viscometer bearing two bulbs (one large and one small)

(ii) Fill water in a large bulb and suck it in to the smaller bulb to the mark. Record the time taken by water to leave the bulb up to the given mark. Use a stopwatch to record the time.

(iii) Repeat the same step using the sample solution. Calculate the densities of water and the sample solution using the method given above.

OBSERVATIONS:

Room temperature C. Density of water (p)

=gm\ C

Density of Solution (p2) "gm\C Time of flow for

water (t)..... Minutes

Time of flow for solution (t)= Minutes Viscosity of water (n) =

Viscosity of solution (n_2)

General viscosity calculation (TABLE NO: 5)

S.no	liquid	Time of flow 1 2 3	Mean time(sec/min)	Density	Viscosity
1	Water				

2	Solution				

Refractive index:

It was determined using refractometer.

PROCEDURE:

The temperature of the refractometer and sample must be controlled to within ± 0.1°C. Refer to product specification for sample temperature.

1. Place the oil onto the prism surface. If viscous, spread evenly on the prism face with a wooden applicator. The prisms are then closed slowly, allowing the excess to squeeze out. If the liquid is free flowing or volatile, it may be introduced by means of a pipette or dropper through one of the channels alongside the prism.

2. Set the scale at the approximate value expected.

3. Bring the borderline, which is probably coloured, near the crosshairs and compensate the colour by adjusting the position of the dial located below the eyepiece. The borderline should be faintly blue on one side and faintly red at the other. Observe the crosshairs, sharply focusing eyepiece if necessary, and bring the dividing line upon their intersection by means of the coarse or fine controls.

4. Read the refractive index, estimating to the fourth place. Record the refractive index and the prism temperature at the time of reading.

Acid value:

Preparation of 0.1 molar solution: Weighed 0.56 g KOH pellets and dissolved in 100ml. of distilled water and stirred continuously. The prepared 0.1 molar KOH solution was filled in the burette.

Preparation of sample: Measured 10 ml oil and dissolved in 25 ml of ethanol and 25 ml of ether mixture and shacked. Added 1 ml of phenolphthalein solution and titrated with 0.1 molar KOH solution.

Acid value 5.61n/w
Where, n Number of ml of 0.1M кон W= Weight of oil

Saponification value:

2g of oil was accurately weighed and transferred into a 250ml iodine flask. 25ml of 0.5M Alcoholic potassium hydroxide was added and boiled under reflux on a water bath for 30mins. Phenolphthalein was added as indicator and titrated against 0.5M HCI ('a' ml). Similarly blank was performed ('b' ml) without the sample. Saponification Value: 28.05(b-a)/w

Where, we weight in grams of the solution.

Iodine value:

1. Pipette out 10 ml of fat sample dissolved in chloroform to an iodination flask labelled as Test.

2. Add 20ml of iodine monochloride reagent into the flask. Mix the contents in the flask thoroughly.

3. Then the flask is allowed to stand for a half an hour incubation in dark

4. Set up a blank in another iodination flask by adding 10 ml chloroform to the flask.

5. Add to the blank, 20 ml of iodine monochloride Reagents and mixture the contents in the flask thoroughly.

6. Incubate the blank in dark for 30 min meanwhile, take out the Test form incubation after 30 min and add 10 ml of KI iodide solution into the flask.

7. Riase the stopper and the sides of the flask using 50 ml distilled water.

8. Titrate the Test against std sodium thiosulphate solution until a pale straw colour is observed and about I ml starch indicator into the contents in the flask, a purple colour is observed.

9. Continue the titration until the colour of the solution in the flask turns colourless

10. The disappearance of the blue colour is recorded as the end point of the titration.

11. Similarly, the procedure is repeated for the flask labelled blank.

12. Record the end point values of the blank calculation.Volume of sodium thiosulphate used (Blank-Test) ml iodine No. of fat equal wt. of iodine.

Hair growth test:

The rats were divided into six groups of three rats each. A 4cm²area of dorsal portion of all the rats were shaved and wiped with surgical spirit. Hair remover was also applied over the shaved area to assure the removal of trace of hairs from denuded area. Group 1 was kept as control, where there was no drug treatment Group 2 was treated as standard, where 2% of nuzen gold hair oil was applied over the shaved area, once a day. The animals of remaining groups were given application of 2% poly herbal hair oil of formulations- F1, F2, F3 and F4 respectively .

Images Of Formulations:

F[1] Formulation (Fig No.35)

F[2] Formulation (Fig No.36)

F^3 Formulation (Fig No.37)

F^4 Formulation (Fig No.38)

Evaluation of Formulation for Different Parameters:(Table No:7)

s.no	parameters	F1	F2	F3	F4

1	Colour	Dark green	Dark green	Greenish black	Greenish black
2	Odour	Characteristic	characteristic	characteristic	characteristic
3	pH	6.7	6.8	6.5	6.6
4	Primary skin irritation test	No irritation	No irritation	No irritation	No irritation
5	Sensitivity test	No reaction	No reaction	No reaction	No reaction
6	Grittiness	No grittiness	No grittiness	No grittiness	No grittiness
7	Density/specific gravity	0.9731	0.9733	1.1271	1.1282
8	Viscosity	0.9123 poise	0.9128 poise	0.9231poise	0.9245 poise
9	Refractive index	1.522	1.5.2	1.623	1.610
10	Acid value	2.4	2.2	2.8	2.5
11	saponification	270	278	272	276

Evaluation of Hair Growth Activity Test (Table no:8)

S. No	**Formulations**	**No. Of Rats**	**Time Taken to Initiate Hair Growth (In Days)**	**Time Taken for Complete Hair Growth (In Days)**
1	CONTROL(GROUP5.1)	3	12	30
2	F^1	3	8	27
3	F^2	3	6	24
4	F^3	3	9	28
5	F^4	3	9	28
6	MARKETED HAIR OIL (GROUP 2)	3	7	26

Hair growth activity test-images of Wistar albino rats on application of F^2 formulation:

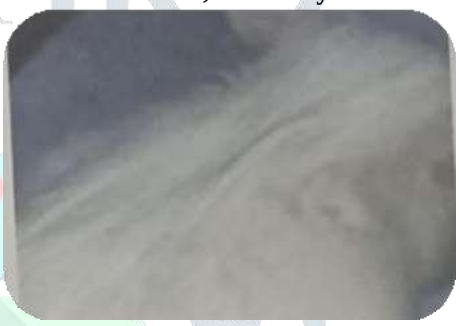
Female Wistar albino rat- fig.no:39

female Wistar albino rat-F2, on 1st day fig .no 40

female wistar albino rat- F2, applying oil

female wistar albino rat-F2,on 6th day

female wistar albino rat-F2,on 14th day



female wistar albino rat-F2,on 24th day

Conclusion

All the parameters showed that they are within the limits and since all the ingredients added have many advantages, this oil will help in maintaining good growth of hair, turning grey hair to black and results in lustrous looking hair. Among all four formulations, F formulation as given the best results having dark green colour, characteristic odour, P" of 6.8, no primary skin irritation, no grittiness, no reaction on sensitivity test, specific gravity of 0.9733, viscosity of 0.9128 poise, refractive index of 1.502, acid value of 2.2, Saponification value of 278, time taken to initiate hair growth (in days) was of 6 days and time taken for complete hair growth was 24 days.

REFERENCES

1. Jump up^ Sherrow, Victoria (2006). Encyclopaedia of Hair: A Cultural History. 88 Post Road West, Westport, CT: Greenwood Press. p. iv. ISBN 0-313-33145-6.

2. Jump up^ Krause, K; Foitzik, K (2006). "Biology of the Hair Follicle: The Basics". Seminars in Cutaneous Medicine 10. doi: 10.1016/j.sder, 2006.01.002. and Surgery25: 2-

3. Jump up^ Feughelman, Max (1997). Mechanical Properties and Structure of Alpha-keratin Fibres: Wool, Human Hair and Related Fibres. UNSW Press. ISBN 978-0-86840-359-5.

4. Jump up to: Hair Structure and Hair Life Cycle. follicle.com

5. Jump up^ "Topic 2". Texascollaborative.org. Retrieved 2015-02-18.

6. Jump up^ Ley, Brian (1999). "Diameter of a Human Hair". Archived from the original on 2010-06-28. Retrieved 2010-06-28.

7. Jump up Councilman, W. T. (1913). "Ch. 1". Disease and Its Causes. United States: New York Henry Holt and Company London Williams and Norgate the University Press, Cambridge, USA.

8. Jump up Frenkel, R.K. and Woodley, D.T., ed. (March 15, 2001). The Biology of the Skin. CRC Press. p. 80. ISBN 9781850700067.

9. Jump up^ Pawlina, Wojciech; Ross, Michael W.; Kaye, Gordon L (2003). Histology: a text and atlas: with cell and molecular biology. Hagerstown, Maryland: Lippincott Williams & Wilkins. ISBN 0-683-30242-6.

10. Jump up^ Ma DR; Yang EN; Lee ST (2004). "A review: the location, molecular characterisation and multipotency of hair follicle epidermal stem cells". Ann. Acad. Med. Singap. 33 (6): 784-8. PMID 15608839.

11. Jump up^ Cotsarelis G (2006). "Epithelial stem cells: a folliculocentric view". J. Invest. Dermatol. 126 (7): 1459-68.doi: 10.1038/sj.jid.5700376. PMID 16778814.

12. Jump up^ Lin, K. K.; Andersen, B. (2008). "Have Hair Follicle Stem Cells Shed Their Tranquil Image?". Cell 582.doi: 10.1016/j.stem.2008.11.005. PMID 19041772

13. Jump up^ "Histologic Diagnosis of Inflammatory Skin Diseases". Derm101.com. chapter= ignored (help)

14. Jump up to: Paus R; Cotsarelis G (August 1999). "The biology of hair follicles". N. Engl. J. Med. 341 (7): 491-7. doi:10.1056/NEJM199908123410706. PMID 10441606.

15. Jump up^ K. S. Stenn & R. Paus (1 January 2001). "Controls of Hair Follicle Cycling". Physiological Reviews 81 (1): 449-494.PMID 11152763. (comprehensive topic review, successor to landmark review of 1954 by HB Chase)

16. Jump up^ Hwang, J.; Mehrani, T.; Millar, S. E.; Morasso, M. 1. (2008). "Dlx3 is a crucial regulator of hair follicle differentiation and cycling". Development 135 (18): 3149-3159. doi: 10.1242/dev.022202. PMC 2707782. PMID 18684741.

17. Jump up^ Park, G. T.; Morasso, M. I. (2002). "Bone morphogenetic protein-2 (BMP-2) transactivates Dlx3 through Smadl and Smad4: Alternative mode for Dlx3 induction in mouse keratinocytes". Nucleic Acids Research 30 (2): 515-522.doi: 10.1093/nar/30.2.515. PMC 99823. PMID 11788714.

18. Jump up^ Brannon, Maryland, Heather. "Anagen Phase". The New York Times. Retrieved 2007-11-14.

19. Jump up^ Brannon, Maryland, Heather. "Categen Phase". The New York Times. Retrieved 2007-11-14.

20. Jump up^ Brannon, Maryland, Heather. "Telogen Phase". The New York Times. Retrieved 2007-11-14.

21. Jump up^ "Hair loss, balding, hair shedding. DermNet NZ" Archived from the original on 14 November 2007. Retrieved 2007-12-07

22. "Hair loss". NHS Choices. Retrieved 22 September2013

23. Jump up^ "Infectious hair disease - syphilis". Keratin.com. Retrieved 2011-11-17.

24. Jump up^ "Anagen Effluvium". Retrieved 2010-06-29.

25. Jump up^ Alopecia Areata, by Maria G. Essig, MS, ELS, Yahoo! Health

26. Jump up^ "Congenital triangular alopecia". Retrieved 2010-06-29.

27. Jump up to: Banka, N; Bunagan, MJ; Shapiro, J (January 2013). "Pattern hair loss in men: diagnosis and medical treatment". Dermatologic clinics 31 (1): 129-40.doi: 10.1016/j.det.2012.08.003. PMID 23159182.

28. Jump up to:bcdef Rogers, Nicole E.; Avram, Marc R. (Oct 2008). "Medical treatments for male and female pattern hair loss" Journal of the American Academy of Dermatology 59 (4):
568. doi: 10.1016/j.jaad.2008.07.001.ISSN 1097-6787. PMID 18793935.

29. Jump up^ Joly P (October 2006). "The use of methotrexate alone or in combination with low doses of oral corticosteroids in the treatment of alopecia totalis or universalis". J Am Acad
6. doi: 10.1016/j.jaad.2005.09.010.PMID 17010743. Dermatol. 55 (4): 632.

30. Jump up^ Shapiro, J (Dec 2013). "Current treatment of alopecia areata.". The journal of investigative dermatology. Symposium proceedings / the Society for Investigative Dermatology, Inc. [and] European Society for Dermatological Research 16 (1): $42-4. doi: 10.1038/jidsymp.2013.14.PMID 24326551.

31. Jump up^ 'Hair Transplants', WebMD: http://www.webmd.com/skin-problems-and- treatments/hair-loss/hair-transplants

32. Henry, Trimen (1893). A handbook to the flora of Ceylon. London: Dulau & Co. p. 219. Retrieved 1 August 2015.

33. Siddiqui (1942). pp. 278-27

34. Sidhu et al. (2004), pp. 69-75

35. "Phyllanthus emblica information from NPGS/GRIN", US Department of Agriculture. Retrieved 2008-03-06.

36. Lim, T.K. (2012). "Phyllanthus emblica". Edible Medicinal and Non-Medicinal Plants. Springer Netherlands. pp. 258-296.

37. "Caldecott T. Amalaki

38. Dharmananda S. Emblic Myrobalans: Amla, Institute of Traditional Medicine

39. Pole, Sebastian (2006). Ayurvedic Medicine: The Principles of Traditional Practice, Singing Dragon. pp. 126-127. ISBN 978-1-84819-113-6.

40. Tarwadi K. Agte V (Aug 2007). "Antioxidant and micronutrient potential of common fruits available in the Indian subcontinent". Int J Food Sci Nutr 58 (5): 341-9. doi:10.1080/09637480701243905. PMID 17558726.