



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DEVELOPMENT AND EVALUATION OF MEDICATED SCALP SERUM

Dr. N. TAMILSELVAN^{1*}, HIND T P², JISNA³, JOJY T THOMAS⁴, MUFEEDA FARSHANA C⁵, NISHANA PARVIN M T⁶

¹Associate Professor & Head of the Department of Pharmaceutics, ²³⁴⁵⁶ B.Pharm Students, Nehru College of Pharmacy, Pampady, Thrissur.

ABSTRACT

Nowadays, cosmetics are in high demand in everyday life, and many people use them on a regular basis. Herbal cosmetics are popular because they have fewer negative effects and provide higher protection and safety. People who are experiencing hair loss are looking for ways to increase hair development and prevent hair loss. Scalp serums moisturise the skin behind the hair, making them a popular treatment for dry scalp. The formulation mainly contain concentrated ingredients such as nettle leaf, bhringraj, and amla. Urtica dioica (nettle leaf extract) can aid to preserve our scalp from damage while also stimulating new hair growth. Hair loss, split ends, dandruff, balding, and premature greying are all treated by Eclipta alba (Bhringraj). One of the most important medicinal plants, Phyllanthus Emblica Linn (Amla), offers necessary minerals and the highest level of vitamin C. It also promotes hair growth, pigmentation, and the prevention of greying. Vitamin E, Aloe vera, Biotin, Guar gum, D-panthenol, and essential oils of Rosemary, lavender, and clarysage were added to the aqueous extract of nettle leaf, bhringraj, and amla, to improve the effect in the scalp. The prepared medicated scalp serum was evaluated, and several characteristics such as physical appearance, viscosity, spreadability, and antimicrobial contamination were determined and documented. The colour of the prepared scalp serum was discovered to be brown. The formulation had a smooth and lubricating texture, and the pH was within the permissible range. The formulations were found to be stable when placed in the stability chamber and also found to have good antibacterial activity.

Key Words:

Medicated scalp serum, Urtica dioica, Eclipta alba, Phyllanthus emblica

INTRODUCTION

A sound head of hair is portrayed as hair that has gloss, is smooth, long and satiny, fun, with great volume and without any proof of thinning up top and dandruff ^[1]. To accomplish this, the hair care industry has furnished us with numerous items to improve, upgrade, fortify and to support our hairs [2]. Hair care items are wanted to give extra advantages, for example, improving the hair, making it simple to deal with or fixing harms. Moreover, there are exceptional items for the treatment of specific hair issues, for example, dandruff ^[3]. In human, hair has an aesthetic function impacting our appearance. Today, it has social, sexual and mental importance, Changes in the pattern of the hair, for example, going bald, hair abundance or variety change,

may adversely influence the confidence of the individuals ^[6]. Hair is a complex structure made by many components that act as a unit, with the biological purpose of protecting the scalp and enhancing physical attractiveness.

COSMETICS

Cosmetic science is a real science, and it is a multidisciplinary field since it incorporates essential information and a wide scope of data from various different scientific fields. It is involved with developing, formulating and producing cosmetic and personal care products ^[3].

The FD&C act characterizes Cosmetics as "Articles expected to be scoured, sprinkled, or splashed on, brought into, or generally applied to the human body for purging, enhancing, advancing engaging quality, or adjusting the appearance without influencing structure or function"^[9, 3].

Cosmeceuticals are publicized to contain bioactive ingredients that, despite the fact that are not drugs, but have visible and measurable short term and long term effects on the skin. The term seems like the mix of the expressions "cosmetics and pharmaceuticals". These are multifunctional items that can be bought as beauty care products and that are promoted to offer extra skin benefits over basic cosmetics ^[3]. Cosmeceuticals are a one of a kind and quickly developing field inside dermatology and healthy skin industry. The business was assessed to have created roughly \$8.2billion in deals in 2012 with an extended yearly development of 7.4% each year ^[10].

HERBAL COSMETICS

The products which are formulated using different 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 "Natural Cosmetics or Herbal Cosmetics"^[12]. The herbal cosmetic products are preparation containing phytochemical from different botanical sources, which influences the functions of skin and give nutrients necessary for healthy skin and hair ^[13]. There is additionally a typical beliefs that synthetic based beauty care products are harmful to the skin and an increased awareness among consumers for herbal product triggered the demand for natural products and natural extracts in cosmetic formulation ^[14].

Advantages ^[8, 14]:

- Herbal cosmetic have better patient tolerance and acceptance.
- Accessibility of medicinal plants is not a problem.
- They produce less side effects compared with chemical based cosmetic product.
- Better safety and efficacy
- Easy to manufacture and cheap.
- Storage and handling of herbal products are simpler.

HAIR is an integrated framework with a peculiar chemical and physical behaviour ^[15]. It is a thin flexible keratin thread with extraordinary strength and elasticity. It is available on practically all surfaces of the human skin, expect for the palms, soles, vermilion zone of the lips, and certain genital parts ^[6]. The hair has mainly two distinctive structure:

- 1 The part underneath the skin, called hair follicle. This organ is situated in the dermis and keeps up with stem cells, which not just re-develop the hair after it drops out, yet in addition are enrolled to regrow skin after an injury.
- 2 The hair shaft, which is the hard filamentous part that reaches out over the skin surface ^[16].

The cross section of hair shaft has 3 significant parts:

1. Cuticle
2. Cortex
3. Medulla

SCALP

The scalp is an anatomical area framed by the human face at the front, and by the neck at the sides and back. The scalp is composed of soft tissue layers that cover the skull.

The scalp basically has 5 layers:

- The skin on the head from which the head hair grows. It contains multiple sebaceous glands and hair follicles.
- Connective tissue. A thick subcutaneous layer of fat and stringy tissue that lies beneath the skin, containing numerous nerves and vessels of the scalp.
- The Aponeurosis, also called Galea aponeurotica is the coming layer. It's the tough layer of thick stringy tissue which runs from the frontalis muscle anteriorly to the occipitalis posteriorly.
- The loose areolar connective tissue layer provides an easy plane of separation between upper three layers and pericranium. This layer is also called as "danger zone" because of the ease by which contagious agents can spread through it to emissary veins which also drain into the skull. The loose areolar tissue in this layer is made up of arbitrary collagen packets.
- The pericranium is the membrane that covers the exterior skin of the skull bones and provides nutrition to the bone and the capacity for repair. It's composed of irregular connective tissue ⁽¹⁷⁾.

HAIR AND SCALP CARE

Hair care and Scalp care may appear separate, but are actually intertwined because hair grows from beneath the skin. Scalp skin, just like any other skin on the body must be kept healthy to assure good hair product. Hair and scalp care is important for not only to enhance appearance, but also for our overall hygiene. A scalp treatment will involve some exfoliation to get relieve of all the dead skin, leaving a layer of fresh, healthy skin back. The sebaceous glands in the human skin produces sebum, which is composed primarily of fatty acids. Sebum acts to cover hair and skin, and can inhibit the growth of microorganisms on the skin. This oleaginous substance gives hair moistness and shine and serves as a defensive substance by preventing the hair from drying out or absorbing over extravagant quantities of external substances. Cleaning hair removes extra sweat and oil, as well as unwanted products from the hair and scalp. Various cosmetic products are used in hair and scalp care. Most of them are cleanser, conditioner, serums, moisturizers, gels etc.

SCALP SERUM

Serum is a concentrate of active constituents, which targets specific skin and hair care businesses, and the constituents are important, and made up of small molecules. Serums can also be said to be as thin consistence topical products that contain concentrated quantities of active constituents. The difference between hair and scalp serum is that one focuses on hair and other focus on scalp, but there are numerous serum formulations that can be applied on both hair and scalp ⁽²⁰⁾.

Types of serum available for hair and scalp care ⁽²¹⁾

- Oil based Serum
- Spray serum
- Water based Serum
- Silicone based serums
- Serums for other issues



Scalp serums are the serums that are meant to hydrate the skin beneath your hair, making them an progressively popular result for dry scalps. They're generally leave-in products made to instantaneously tame, hydrate and to nourish the hair. Medicated scalp serums are serums that contain active constituents elected to treat medical conditions like seborrheic dermatitis, dandruff, alopecia etc. The combination of cosmetic technology and medical remedy provides benefits of cosmetic products together with the efficacy of medical agents^(7, 14).

Ideal characteristics of Scalp serums^(3, 22)

- They must be gentle to scalp and hair, don't dry or damage it.
- Long lasting effect.
- Enhances smooth and luster of the hair and make it easy to comb.
- Well tolerated and non-allergic.
- Should be easy to use.
- Should have regional effect.
- Should be easy applied and readily washed off.

Applications

- Nourishes and moisturizes hair and scalp
- They helps make hair strong, shining and lustrous
- Smoothens scalp and conditions the hair
- They neutralize free radical damage in hair
- Medicated serums have antimicrobial property and are used to treat split ends, dandruff, hair fall, scalp infections etc.
- They can be used as hair growth booster and prevent hair loss

The use of herbal constituents in serums and other cosmetic products are accelerating because of their beneficent effects like minimised side effects and increased compliance. Many herbs like amla, brahmi, henna, aloe vera, bhringraj, neem, tulsi etc are used in numerous hair formulations.

Problems associated with Hair and Scalp care

DANDRUFF AND SEBORRHOEIC DERMATITIS

Dandruff is one of the major and common problem of hair. It can influence in social and self- regard problems. Dandruff is a skin condition that substantially affects scalp. It produces flakes on scalp skin, followed by itching on skin.⁽²³⁾ Dandruff is a non-inflammatory and chronic condition which is characterized in ultimate common dermatological skin problem, related to the scalp that's prestigious by an extreme range of scalp tissue being affected⁽²⁴⁾. The main cause of dandruff is unclear, but it's believed to involve a number of inheritable and environmental factors. Oily scalp, poor-hygiene, use of dirty water, contact dermatitis, psoriasis, fungus and bacterial organisms in the scalp are the causative factors behind dandruff⁽²³⁾.

A more severe form of dandruff condition, which includes inflammation of the skin, is known as Seborrheic dermatitis. Seborrheic dermatitis, occasionally also related to as seborrhoea, is a long- term skin illness. The symptoms are red, scaled, greased, itchy, and inflamed skin. The cause of seborrhoea is unclear but believed to involve a number of inheritable and environmental factors. Danger factors includes poor immune function, Parkinson's condition, and alcoholic pancreatitis⁽²⁵⁾.

The main causative agent for dandruff and seborrhoea was constitute to be Malassezia species. Studies also shown that presence of bacterial species like Propionibacterium and Staphylococcus species are also responsible for dandruff. Dandruff was associated with increased appearance of Malassezia species and Staphylococcus species and a lower appearance of Propionibacterium species. The presence of dandruff was

set up to be associated with disequilibrium in the proportion of the major bacterial and fungal populations colonizing the scalp. It's also associated with changes in the proportion between fungal and bacterial populations ⁽²⁶⁾.

The treatment for dandruff and seborrhoea includes use of antifungal agents, essential oils and coal tar. The main ways of dandruff treatment are by using chemical based anti-dandruff formulation and herbal based formulations. Chemical formulations can yield side effects like itching, irritation, loss of hair, nausea, hair breakage and cancer. Herbal formulations are viable replacements for chemical medicines. The herbs like Stinging nettle, Bhringraj and Amla was plant to have further advantageous against dandruff and other scalp conditions.

Stinging Nettle (*Urtica dioica* L) is an herbaceous perennial flowering factory that's native to Europe, Northern America, and Asia. Stinging nettle is a magical herb that has numerous functions like injury recovery, anti-inflammatory and pain relief, soothing seasonal allergies, anti-aging, boosting hair growth and treating alopecia and dandruff. Nettle extracts also found to have pharmacological antioxidant, anti-microbial, anti-inflammatory, anti-ulcer and analgesic activities. *Urtica* species have been used to stimulate hair growth. The herbal medication increases the proliferation of human dermal papilla cells. The β -sitosterol in stinging nettle can trigger the configuration of new blood vessels (angiogenesis). Nettle provides a generous measure of essential vitamins and minerals that can help in hair health. Due to its abundant antioxidants, flavonoids, and vitamin C content, nettle leaf is a safe and natural result to reducing hair loss and to add luster to the hair. Nettle extract (leaves and roots) also has the capability to block dihydrotestosterone (DHT), a hormone, when overproduced can result hair loss. Nettle extract can also be an effective treatment for dandruff and seborrhoeic dermatitis ⁽²⁹⁾

Bhringraj (*Eclipta alba*), also known as false daisy, is a small branched perennial herbaceous plant that's wide in tropical and subtropical regions of the world. Bhringraj oil is well-known for maintaining dark hair and reversing baldness. It's often regarded as 'King of the hair'. *Eclipta alba* has anti-inflammatory, haemostatic, antipyretic, tonic, anticancer and hepato protective activity ⁽³⁰⁾. The remedial benefits of bhringraj are attributed to its alkaloid content including Ecliptine and Nicotine. It also contains flavonoids and isoflavonoids. The herb is also a good source of calcium, magnesium, iron, vitamin D and E. Bhringraj is considered as a wonder plant used to treat hair loss, split ends, dandruff, baldness, premature greying, etc. They can also convert hair follicles from telogen phase to anagen phase ⁽⁵⁾. The extract of Bhringraj leaves penetrates deep into the scalp skin and moisturizes the scalp deeply and therefore helps to help scalp itching and dandruff. The β -sitosterol and wedelolactone are the phytochemicals responsible for hair growth activity ⁽³¹⁾.

Amla (*Emblica officinalis*), also known as Indian gooseberry, is a medium sized deciduous plant. The flower of the plant is yellow greenish in colour. The fruit is globular pale yellow with six perpendicular furrows ⁽³²⁾. It's an ample source of Vitamin C. Amla fruit extracts are used in tonics to enhance hair growth and enhance pigmentation. They're used to reduce baldness and hair loss. This is due to the tannin contents as tannic acid, ellagic acid, gallic acid, iron and antioxidant material that freezes free radical damage to hair follicles, caused by dandruff ⁽²³⁾. Amla extracts also helps in strengthen the scalp and hair, reduce premature color loss from hair, or greying, stimulate hair growth, reduce hair loss, prevent or treat dandruff and dry scalp, parasitic hair and scalp infections, like lice infections and fungal and bacterial hair and scalp infections.

METHODOLOGY

FORMULATION OF SCALP SERUM

The herbal medicated scalp serum is prepared as per general method of serum formulation. In this formulation, aqueous extract of *Urtica dioica*, *Eclipta alba*, *Phyllanthus emblica* were specifically weighed and poured to a beaker. Aloe vera gel and biotin were mixed thoroughly. Required amount of guar gum and D-panthenol were taken in a china dish and mixed well to get a paste. About 3 drops of essential oils such as Rosemary oil, Clary sage oil, lavender oil and vitamin E capsule were added and mixed together. The mixture of china dish were added to extract with constant stirring. The serum is made up to 50 ml with distilled water. Methyl paraben is added as a preservative. Then the prepared serum was kept in an amber colored dropper bottle^[33].

Ingredients	F1(50ml)	F2(50ml)	F3(50ml)	F4(50ml)
Stinging Nettle	10ml	4ml	4ml	8ml
Bhringraj	4ml	10ml	4ml	8ml
Amla	4ml	4ml	10ml	8ml
Aloe vera	5ml	5ml	5ml	5ml
D-Panthenol	0.5ml	0.5ml	1ml	1ml
Biotin	5mg	5mg	5mg	5mg
Vitamin E	0.8ml	0.8ml	0.8ml	0.8ml
Guar gum	0.2g	0.1g	0.2g	0.1g
Rosemary oil	0.15ml	0.15ml	0.15ml	0.15ml
Lavender oil	0.15ml	0.15ml	0.15ml	0.15ml
Clarysage essential oil	0.15ml	0.15ml	0.15ml	0.15ml
Methyl paraben	0.042g	0.042g	0.042g	0.042g
Water	q.s	q.s	q.s	q.s

COMPOSITION OF SCALP SERUM



EVALUATION OF SCALP SERUM^[23,33,34]

- **Physical Examination**

The organoleptic characters like colour, odour and consistency are studied.

- **pH Test**

The pH meter was calibrated using buffer solutions. Then, the electrode was dipped in the scalp serum and left until the pH normalized after a few minutes.

- **Homogeneity**

Scalp serum is tested for homogeneity by visual examination in a petridish. Presence/absence of particles or flocculates are noted.

- **Skin Irritation Test**

It is carried out by applying the serum on skin and tested for any redness or itching after 2 hours.

- **Sensitivity Test**

It is carried out by applying the serum on the skin and is exposed to sunlight and tested for any rashes or itching after 10 minutes.

- **Viscosity**

The viscosity measurement was performed with spindle number 64 on a Brookfield viscometer (RVDV-II+PRO). In the beaker, 50 ml of serum was placed, and the viscosity was measured at 50 rpm

- **Spreadability**

Few ml of the formulation was sandwiched between two slides. A weight of 100g was placed on the upper slide so that formulation between the 2 slides get pressured uniformly to form a thin layer. The weight was removed. The time taken by the upper slide to slip off lower slide was noted. The lesser the time taken for separation, the better the spreadability.

- **Stability Studies**

It is to determine the physical and chemical stability of the product in which it is subjected to elevated temperatures. The prepared formulations are stored in stability chamber for 3 months at 30°C and 65% RH. The samples are withdrawn weekly and physical parameters are analyzed.

- **Determination of Microbial activity**

It is carried out by using well plate method. In this method drug potency is based on the measurement of diameter of zone of inhibition surrounding the well. At first the solid nutrient media was prepared and is inoculated with microbes (Staphylococcus aureus) later wells are made and the extracts are added in it. Inhibition procedure by test compound is compare with that procedure by known concentration of reference standard.

DISCUSSIONS AND CONCLUSION

In the personal hygiene and health care system, using natural cosmetics has modified via way of means of numerous folds. Therefore, the natural cosmeceutical individual care or personal health care industry, that is surely concentrating and paying greater care at the manufacturing of herbal based cosmetics. It may be inferred that organized natural scalp serum has a useful impact at the mechanism of hair growth and antidandruff activity. Study concluded that herbal scalp serum can be efficiently formulated by the usage of distinct herbal components which includes nettle leaf extract, bringaraj extract, amla extract, Aloe vera, vitamin E capsule, biotin, guar gum, D-panthenol, and essential oils of clary sage, rosemary, lavender. The formulated medicated scalp serum turned into examined and distinct standards have been determined. Stability parameters like physical appearance, consistency, pH, viscosity, irritation, spreadability turned into no considerable variation during the study duration. The prepared formulation was in the desirable pH range. The formulations does not produced any redness or itching during the testing period. The formulations was found to have good anti-bacterial activity. The scalp serum is predicted to promote hair growth and appropriate anti dandruff activity. Hence, from the present study we concluded that the formulated medicated scalp serum shows minimum side effects and has good antibacterial activity and can be used against dandruff, hair loss and other scalp infections.

BIBLIOGRAPHY

1. Sinclair RD. Healthy hair: What is it? J Investig Dermatol Symp Proc 2007;12:2-5
2. Madnani N, Khan K. Hair cosmetics. Indian J Dermatol Venereol Leprol 2013;79:654-67
3. Gabriella Baki, Kenneth S. Alexander ; “Introduction to Cosmetic formulation and Technology” ; First edition; 2015
4. B.M. Mithal, R.N Saha. “A Handbook of Cosmetics” Pg No. 105-109
5. Semwal B.C et.al. , Alopecia : Switch to Herbal medicine. Journal of Pharmaceutical Research And Opinion 1: 4 (2011) 101 – 104.
6. Dr. Aijaz A Sheikh, Dr.Subhash V Deshmane, Dr. kailash R Biyani, Dr.Md.Rageeb Md. Usman ; “A Textbook of Cosmetic Science” Pg No. 35-38
7. Alessandrini A, Piraccini BM. Essential of Hair Care Cosmetics. *Cosmetics*. 2016; 3(4):34. <https://doi.org/10.3390/cosmetics3040034>
8. Kokate C K., “Book of Pharmacognosy” 45th Edition Published by Nirali Prakashan.
9. FD&C ACT Section 201(i)
10. Brandt FS, Cazzaniga A, Hann M (2011) Cosmeceuticals : Current trends and market analysis. *Semin Cutan Med Surg* 30: 141-143.
11. Sharma P(2011) Cosmeceuticals: Regulatory scenario in US, Europe & India. *Int J Pharm Technol* 3: 1512-1535.
12. Glaser DA, Anti-ageing products and cosmeceuticals. *Facial Plast Surg, Clin N Am*, 12(4), 363-372, 2004.
13. Larsson, S.C.; Bergkvist, L.; Näslund, I.; Rutegård, J.; Wolk, A. Vitamin A, retinol, and carotenoids and the risk of gastric cancer: a prospective cohort study. *Am. J. Clin. Nutr.*, 85(2); 497–503, 2007.
14. Kumar M, Sumith & Swarnkar, Vandana & Sharma, Suhani & Baldi, Ashish. (2012). Herbal Cosmetics: Used for Skin and Hair. *Inventi Rapid Cosmeceuticals*. 2012. 1-7.
15. Gavazzoni Dias MF. Hair cosmetics: an overview. *Int J Trichology*. 2015;7(1):2-15. doi:10.4103/0974-7753.153450

16. Krause, K; Foitzik, K (2006). "Biology of the Hair Follicle: The Basics". *Seminars in Cutaneous Medicine and Surgery*. 25 (1): 2–10. doi:10.1016/j.sder.2006.01.002. PMID 16616298
17. Desai SC, Sand JP, Sharon JD, Branham G, Nussenbaum B. Scalp reconstruction: an algorithmic approach and systematic review. *JAMA Facial Plast Surg*. 2015 Jan-Feb;17(1):56-66.
18. <https://www.academyofbeautyprofessionals.com/benefits-of-scalp-treatments/>
19. <https://growknoxville.com/why-healthy-hair-is-important-to-your-overall-well-being/>
20. <https://www.lorealparisusa.com/beauty-magazine/hair-care/all-hair-types/scalp-serum>
21. <https://www.stylecraze.com/articles/best-hair-serums-available-in-india/>
22. Gautam D Mehetre, Jaya P Ambhore, Rameshwar S Cheke, Sachin D Shinde; "Concise Course in Cosmetic Science" Pg no.210-213
23. Saxena Pal, Rashmi & Saraswat, Nikita & Wal, Ankita & Wal, Pranay & Pal, Yogendra. (2020). Preparation & Assessment of Poly-Herbal Anti-Dandruff Formulation. *The Open Dermatology Journal*. 14. 22-27. 10.2174/18743722202014010022.
24. Chandrani D, Lubaina SZ, Soosamma M. A review of the antifungal effect of plant extract vs. Chemical substances against *Malassezia* spp. *Int J Pharma Bio Sci* 2012; 3(3): 773-80.
25. Ijaz N, Fitzgerald D (June 2017). "Seborrhoeic dermatitis". *British Journal of Hospital Medicine*. 78 (6): C88–C91
26. Clavaud, C., Jourdain, R., Bar-Hen, A., Tichit, M., Bouchier, C., Pouradier, F., El Rawadi, C., Guillot, J., Ménard-Szczebara, F., Breton, L., Latgé, J. P., & Mouyna, I. (2013). Correction: Dandruff Is Associated with Disequilibrium in the Proportion of the Major Bacterial and Fungal Populations Colonizing the Scalp. *PLoS ONE*, 8(10), 10.1371/annotation/bcff4a59-10b7-442a-8181-12fa69209e57.
27. Myagmar K, Lkhagvasuren E, Semchin M. Hair Growth Promoting Effect of *Urtica dioica* L. *CAJMS* 2018;4:187-193.
28. Pekmezci E, Dundar C, Turkoglu M. Proprietary Herbal Extract Downregulates the Gene Expression of IL-1 α in HaCaT Cells: Possible Implications Against Nonscarring Alopecia. *Med Arch*. 2018;72(2):136-140.
29. Nahata A, Dixit VK. Ameliorative effects of stinging nettle (*Urtica dioica*) on testosterone-induced prostatic hyperplasia in rats. *Andrologia*. 2012;44 Suppl 1:396-409
30. Goutam Mukhopadhyay, Shymodip Kundu, Argha Sarkar, Pintu Sarkar, Riyanka Sengupta, Chandan Kumar. A review on physicochemical & pharmacological activity of *Eclipta alba*. *Pharma Innovation* 2018;7(9):78-83
31. <https://www.womenbuddha.com/bhringraj-benefits-for-hair-and-skin/>
32. Raja, Alagar & V, Shailaja & Banji, David & Knv, Rao & Duraipandi, Selvakumar. (2014). Evaluation of standardisation parameters, pharmacognostic study, preliminary phytochemical screening and in vitro antidiabetic activity of *Emblca officinalis* fruits as per WHO guidelines. *J Pharmacognosy and Phytochemistry*. 3. 21-28.
33. Ruchi Tiwari, et al. : "Development and Evaluation of Herbal Hair Serum: A traditional way to improve hair quality", vol. 15, 2021, 52-58
34. Budiasih, Sri & Masyitah, I. & Khan, Jiyauddin & Kaleemullah, Mohammed & Samer, A. & Asmani, Fadli & Yusuf, Eddy. (2018). Formulation and Characterization of Cosmetic Serum Containing Argan Oil as Moisturizing Agent. 297-304.