



DESIGN AND EVALUATION OF HERBAL HAIR OIL FORMULATIONS BY USING ETHANOLIC EXTRACT OF *Ziziphus jujuba* Mill. LEAVES

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ABSTRACT

Herbal hair oils have always attracted considerable attention, when compared to synthetic drugs. Synthetic drugs may have side effects like local irritation, itching and burning sensation. They may cause dermatological reactions and systemic side effects like headache, dizziness, etc. So there is a need for development of herbal hair oil for potent hair growth and to prevent hair fall with no side effects. In the present study herbal hair oil was prepared by using n-hexane extract of *Trigonella foenum-graceum* seed oil and the ethanolic extract of *Ziziphus jujuba* Mill. leaves. The three (HF₁, HF₂ & HF₃) different hair oils are formulated by changing the concentration of ethanolic extract of *Ziziphus jujuba* leaves. The prepared formulations were evaluated by using standard methods like physical and biological evaluation. All the parameters showed that they are within the limits. The hair growth studies finally prove that formulation HF₃ (5%) have excellent hair growth activity by taking less time to initiate the hair growth (8 days) and time taken for complete hair growth within 26 days. When compared to the standard, it holds the promise of potent alternative for Minoxidil (5% ethanolic solution).

KEY WORDS: Herbal hair oil, *Ziziphus jujuba* Mill. leaves, *Trigonella foenum-graceum* seed and Minoxidil.



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INTRODUCTION

The appearance of hair plays an important role in people's overall physical appearance and self-perception. With today's increasing life-expectations, the desire to look youthful plays a bigger role than ever. The hair care industry has become aware of this and is delivering active products directed towards meeting this consumer demand. There are plenty of hair tonics available in the market these days for hair care. However, the commercially available products are expensive and may pose certain kinds of side effects. Therefore, natural products should be used to treat hair fall. Herbal hair oils have always attracted considerable attention, when compared to synthetic drugs. Synthetic drugs may have side effects like local irritation, itching and burning sensation. They may cause dermatological reactions and systemic side effects like headache, dizziness, etc.^{1, 2} Hair is the one of the most important part of our body that improves the overall appearance of a person. Formulations that are used to maintain good and healthy hair are known as Hair care products. These formulations are used to clean and modify the texture of hair, to change the color of the hair, to give life to the stressed hair, to provide nourishment to the hair

and to give healthy appearance to the hair. Herbal hair oils are formulated with herbal extracts in an oil base. Hair oils are the hair care formulations applied for treatment of hair disorders such as baldness, aggression of hair, discoloring of hair, hair falling, and dryness of hair etc. The nature of oil is non sticky and addition of perfumes enhances the fragrance and overall improves its popularity. Proper application of hair oil gives luster to hair, softening the hair, gives flows to hair and more important gives cooling effect to the brain. The most recognized hair care preparation is herbal hair oils, they moisturize the scalp and also helpful in dry scalp and dry hairs. Herbal hair oil maintains normal functions of sebaceous glands they supply normal essential elements for hair to naturally grow.^{3,4} So there is a need for development of herbal hair oil for potent hair growth and to prevent hair fall with no side effects. Hence, an attempt is being made to formulate a herbal hair oil from, *Trigonella foenumgraecum* (seeds) and alcohol extract of *Ziziphus jujuba* Mill.(leaf) and also to evaluate its hair growth stimulating activity. Table. No: 1 shows the Current Marketed Herbal hair Care Products and Table. No: 2. shows some important plants used for preparation of herbal hair oil.

Table.No 1
Current Marketed Herbal Hair Care Products⁵

Products	Brand Name	Manufacturer
Anti dandruff shampoo	Himalaya antidandruff shampoo	The Himalaya drug company, Banglore
Hair Oil	Radiconeem&amala hair oil	Radico.pvt.ltd
Hair gel	Aroma sikakai&tulsi hair gel	Aroma Treasures
Hair conditioner	Vedicoaloevare hair conditioner	Vedico Bio Labs
hair colours	Crown henna hair colors	Crown herbals.pvt.ltd
hair oil	Prakritisksam gold hair oil	Prakriti Herbals, Bangalore
Shampoo	Agarwal honey aloe vera shampoo	Agarwal Herbal Products

Table.No 2
Some Important Plants Used In Preparation Of Herbal Hair Oil⁶

S.No	Common Name & Biological Source	Distribution	Part used	Uses
1.	<i>Phyllanthusemblica</i> , (Amla) Euphorbiaceae	Throughout India	Fruit	Hair growth
2.	<i>Arnica Montana</i> , Asteraceae (Arnica)	Cultivate sparingly in India	Flowers	Hair tonic and stimulates Hair follicles
3.	<i>Ficusracemosa</i> , (Bargad) Moraceae	Throughout India	Root	Massage and to reduce hair fall
4.	<i>Eclipta alba</i> , (Bhangra/Bringraj) Asteraceae	Himalaya region	Whole plant	Hair nourishment
5.	<i>Betulapendula</i> , (Birch) Betulaceae	North west India	Leaves	As antidandruff
6.	<i>Bacopamonneri</i> , (Brahmi) Scrophulariaceae	Throughout India	Entire herb	Hair growth, Good for Sleep
7.	<i>Arctiumlappa</i> , (Burdock root) Asteraceae	Temperate region of India	Roots	Promots hair growth
8.	<i>Centellaasiatica</i> , (Gotu kola) Umbelliferae	Wet areas of India	Plant	Hair care, Darkening of hair, Hair oil
9.	<i>Lawsoniainermis</i> , (Henna) Lytheraceae	Throughout India	Leaves	For hair dye
10.	<i>Nardotachysjatamansi</i> , (Jatamansi) Valerianaceae	Alpine India	Rhizome	As hair tonic and hair growth
11.	<i>Barssica spp.</i> (Mustard) Brassicaceae	Throughout India	Seed	As hair oil and hair nourishment
12.	<i>Acacia concinna</i> , (Shikakai) Mimosaceae	Tropical forest of India	Pods	Dandruff control

MATERIALS AND METHODS

Collection and authentication of the plant

The fresh leaves of *Ziziphus jujuba* Mill. And seeds of *Trigonella foenumgraecum* were purchased from the local market and authenticated by Smt . V.J.SAILAJA RANI (M.Sc. B.Ed) Dept. of Botany by comparing with standard specimens available in , PSC & KVSC government college, Nandyal, Kurnool district, Andhra Pradesh. The various parts of the plant drugs are crushed in mixer and passed through the sieve number 80. The various powder drugs were subjected to pharmacognostics studies for conformation.

Preparation of Herbal Hair Oil

In the present study the three (HF₁, HF₂ & HF₃) different hair oils are formulated by changing the concentration of ethanolic extract of *Ziziphus jujuba* Mill. leaves by using the refined castor oil as the base.⁷

HF₁

In this preparation 100ml of castor oil is taken in to a clean beaker and 1gm of Stearic acid is added & dissolved by heating using the heating mantle. Now add ethanol to the plant extract of 1gm and dissolve the plant extract by continuous stirring up to the complete dissolving of the plant extract (ethanolic leaf extract of

Ziziphus jujuba) & now both the solvent and oil were mixed together along with the fenugreek oil, colouring agents & flavouring agents. Finally check the pH which is not more than 5.⁸

HF₂

In this preparation 100ml of castor oil is taken in to a clean beaker and 3gm of Stearic acid is added & dissolved by heating using the heating mantle. Now add ethanol to the plant extract of 1gm and dissolve the plant extract by continuous stirring up to the complete dissolving of the plant extract (ethanolic leaf extract of *Ziziphus jujuba*) & now both the solvent and oil were mixed together along with the fenugreek oil, colouring agents & flavouring agents. Finally check the pH which is not more than 5.⁸

HF₃

In this preparation 100ml of castor oil is taken in to a clean beaker and 1gm of Stearic acid is added & dissolved by heating using the heating mantle. Now add ethanol to the plant extract of 3gm and dissolve the plant extract by continuous stirring up to the complete dissolving of the plant extract (ethanolic leaf extract of *Ziziphus jujuba*) & now both the solvent and oil were mixed together along with the fenugreek oil, colouring agents & flavouring agents. Finally check the pH which is not more than 5.⁸

Table. No 3
Formulation Of The Herbal Hair Oil

S.NO	CONTENTS	HF ₁	IF ₂	HF ₃
1	Ethanolic extractof <i>Ziziphus jujuba</i> Mill. eaves	1%	3%	5%
2	<i>Trigonellafoenum-graecum</i> seed oil	1%	1%	1%
3	Stearic acid	1%	1%	1%
4	Alcohol	10%	10%	10%
5	Colouring agent	0.05%	0.05%	0.05%
6	Flavouring agent	0.05%	0.05%	0.05%
7	Refined Castor oil	100ML	100ML	100ML

EVALUATION

General characterization

The general; characters like color and odour were evaluated manually.

Physical Evaluation

The physical evaluation parameters to be determined are specific gravity, pH, refractive index, viscosity, acid value, iodine value, and saponification value .⁹

Specific Gravity

Density bottle was used in determining the specific gravity of the oil. A clean and dry stoppered bottle of 25 mL capacity was weighed (W1) and then filled with the oil stoppered and reweighed to give (W2). The oil was substituted with distilled water after washing and drying the bottle and weighed to give (W3).¹⁰

$$\text{specific gravity}(\rho_1) = \frac{W_3 - W_1}{W_2 - W_1} \rho_2$$

Where W1 = weight of dry empty density bottle; W2 = weight of density bottle + oil; W3 = weight of density bottle + distilled water and ρ_2 is the density of water.

pH

In a dry clean 25 mL beaker, 2 g of the sample was placed followed by 13 mL of hot distilled water and the mixture was stirred slowly. The mixture was then cooled in a cold-water bath to 25°C. The pH electrode was standardized with buffer solutions (pH 4 and 7) and the electrode immersed into the sample where an average pH of three recordings per sample were recorded.¹¹

Refractive Index

Abbe's refractometer was used in the determination of refractive index. In this case, a few drops of the sample were transferred into the glass slide of the refractometer. Water at 30°C was circulated round the glass slide to keep its temperature uniform. Through the eyepiece of the refractometer, the dark portion viewed

was adjusted to be in line with the intersection of the cross. At no parallax error, the pointer on the scale pointed to the refractive index. The refractometer was calibrated using distilled water where the refractive index of water at that temperature was obtained. The

procedure was repeated by using the formulations and their refractive indices were obtained at 30°C. The mean value for each region was noted and recorded as the refractive index.¹¹

$$\text{Refractive index} = \frac{c}{v}$$

where c is the speed of light in vacuum and v is the phase velocity of light in the medium

Viscosity

The viscosity of herbal hair oil formulations is determined by using Brookfield viscometer with spindle no.64 rotated at 25 rpm at 25°C which was connected to a thermostatically controlled circulating water bath.¹²

Acid Value

The acid value is determined by directly titrating the oil or fat in an alcoholic medium against standard potassium hydroxide or sodium hydroxide solution by using Phenolphthalein as an indicator until pale pink color is obtained.¹³

$$\text{Acid value} = \frac{56.1 \times V \times N}{W}$$

Where V = volume of standard potassium hydroxide or sodium hydroxide solution used;
N = normality of potassium hydroxide or sodium hydroxide and W = mass of sample.

Iodine Value

An accurately weighed amount of substance is taken in iodine flask to it 10 ml of carbon tetrachloride and 20 ml of iodine chloride. Insert the stopper and allow to stand

in dark for 30 min. Add 15ml of potassium iodide to the flask and rinse the stopper and sides of the flask with the 100ml of water and titrate with 0.1M sodium thiosulphate using starch as indicator.¹³

$$\text{Iodine value} = \frac{12.69 \times N \times (V_2 - V_1)}{W}$$

Where, N = normality of thiosulphate solution, V1 = volume of thiosulphate solution used in test, V2 = volume of thiosulphate solution used in blank and W = weight of sample

Saponification Value

Boil weighed amount of substance with a measured volume of std alc.KOH and little pumice powder and boil under reflux condenser on a water bath for 30 min with excess of alcoholic KOH solution is back titrated with

0.5M HCl using phenolphthalein solution indicator. End point disappearance of pink color. Blank titration is also performed to detect saponification value which is a measure of both free and combined acids. Fats and oils lies between 180-200.¹⁴

$$\text{Saponification value} = \frac{56.1 \times N \times (V_2 - V_1)}{W}$$

Where, N = normality of HCl, V1= volume of HCl used in the test, (mL), V2 = volume of HCl used in the blank, (mL) and W = weight of sample, (g)

Biological Evaluation

Primary Skin Irritation Test

Four healthy female Wister albino rats, weighed 200-250gm were selected for study. Each rat was caged individually food and water given during the test period 24hrs prior to the test. The hair from the back of each rat of 1 cm² 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. 1ml quantity of formulations HF₁, HF₂ & HF₃ was applied over the respective test sites on one side of the spine. The test sites were observed for erythematic and edema for 48hrs after application.¹⁵ The results were shown in Table.No:6.

access to drinking water for two days. The rats were divided into 5 group's of 6 rats each 6cm² area of the dorsal portion of all the rats shaved to remove all hair. The group I was kept as control, where there was no drug treatment. Group II was treated as standard, where 1ml of 5% Minoxidil ethanolic solution was applied over the shaved area.¹⁵ Remaining groups were given application of 1ml of formulation HF₁, HF₂ & HF₃ respectively. This treatment was continued for 30 days.¹⁶

Qualitative Hair Growth Study

The three parameters evaluated are hair growth initiation time, hair growth completion time and mean hair length.^{8, 17}

Application of Test Formulations

Female Wister albino rats, 200-250gm, were used for hair growth studies. They were placed in cages and kept in (23°C±10, 60% ±10 RH) standard environmental conditions, fed with standard diet and allowed free

RESULTS AND DISCUSSION

In the present study herbal hair oil was prepared by using n-hexane extract of *Trigonella foenum-graceum*

seed oil and the ethanolic extract of *Ziziphus jujuba* Mill. leaves. The three (HF₁, HF₂ & HF₃) different hair oils are formulated by changing the concentration of ethanolic extract of *Ziziphus jujuba* Mill. leaves. The general

characterization of the oils proved that the formulations do not show any objectionable color and odour and reported in Table.No:4.

Table.No 4
General Characterization Of The Oils

General characters	HF ₁	HF ₂	HF ₃
Colour	Green	Green	Darkish Drown
Odour	Nil	Nil	Characteristic

By physical evaluation, parameters like specific gravity, pH, refractive index, viscosity, acid value, iodine value, and saponification value, were

determined and it was found that the all the parameters evaluated were within the limits and the results were shown in the Table.No:5.

Table.No 5
Physical Evaluation Parameters

S.NO	PARAMETRES	HF ₁	HF ₂	HF ₃
1	Saponification Value	259.46±0.021	241.4±0.046	224.4±0.053
2	Acid Value	5.4±0.01	5.6±0.01	5.8±0.02
3	Iodine Value	79±0.4	87±0.6	94±0.2
4	Specific Gravity	0.994±0.005	0.9313±0.025	0.9328±0.016
5	Refractive Index	1.604±0.002	1.572±0.012	1.534±0.013
6	Viscosity(cps)	0.931±0.004	0.942±0.002	0.957±0.005
7	pH	6.8±0.1	6.6±0.2	6.4±0.1

*average of 3 determinations (n=3), p < 0 .05 are significant

In the biological evaluation, primary skin irritation test was conducted to evaluate the irritation by the prepared formulations on the intact skin of rats. All the prepared formulations do not show any erythematic

reaction on the skin.¹⁷ This indicates that the prepared formulations were non-irritant to the skin of the rats and the results were summarized in Table.No:6.

Table.No 6
Primary Skin Irritation Test

S.No	Group	Skin Irritation
1	Control(castor oil)	NO
2	Standard(5% Minoxidil oil)	NO
3	HF ₁	NO
4	HF ₂	NO
5	HF ₃	NO

The qualitative hair growth analysis was conducted on three parameters like Hair growth initiation time, hair growth completion time and mean hair length.¹⁸ All the prepared formulations were compared with the Control (castor oil) and Standard (5% Minoxidil oil). It has been

observed that the herbal formulation HF₃ shows fast hair growth and also increases the length of the hair.¹⁹ Table.No:7 shows the results of Hair growth initiation time and completion time. Table.No:8 show the results of mean hair length (mm).

Table.No 7
Hair Growth Initiation Time And Completion Time.

S.No	Group	Initiation Time (Days)	Completion Time (Days)
1	Control(castor oil)	10	30
2	Standard(5% Minoxidil oil)	12	28
3	HF ₁	12	30
4	HF ₂	10	28
5	HF ₃	8	26

Table.No 8
Mean Hair Length (mm)

S.No	Group	Mean Hair Length(mm)
1	Control(castor oil)	6.7±0.12
2	Standard(5% Minoxidil oil)	8.5±0.22
3	HF ₁	6.5±0.32
4	HF ₂	7.2±0.14
5	HF ₃	9.6±0.15

*average of 3 determinations (n=3), p < 0.05 are significant

CONCLUSION

Herbal hair oil is one of the most recognized hair treatments. Herbal hair oil not only moisturizes scalp, but also reverses dry scalp and dry hair conditions. It provides numerous essential nutrients required to maintain normal functions of sebaceous glands and promotes natural hair growth. Hence the herbal hair oil was formulated and evaluated. 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, increases hair

length and results in lustrous looking hair. The hair growth studies finally prove that HF₃ (5% ethanolic extract of *Ziziphus jujuba* Mill. leaves) have excellent hair growth promoting activity by taking less time to initiate the hair growth(8 days) and time taken for complete hair growth (within 26 days). When compared to the standard it holds the promise of potent herbal alternative to minoxidil (5% ethanolic solution).

CONFLICT OF INTEREST

Conflict of interest declared none.

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