

Formulation and evaluation of a face serum containing fenugreek extract

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ABSTRACT

Background: Wrinkles on the face and aging of the skin are an undesirable effect of photodamage and ultraviolet radiation. Serum has a quick absorption and ability to penetrate deep layers of the skin, as well as a non-oily finish and a deep formula with a very high amount of active ingredients.

Methods: In this study, we have formulated and evaluated a face serum containing combination of aqueous extract of fenugreek seed and lemon oil.

Results: Facial serum was tested for its pH, physical appearance, viscosity, microbial testing, cyclic temperature test, etc. The results of the stability study show that there was no change in visual acuity, homogeneity.

Conclusions: Serum containing Fenugreek extract have been able to cure bacterial infections and inflammations of facial skin, and other signs also moistens the skin without any side effects making skin soft, smooth and supple.

Keywords: Cosmetic, Anti-inflammatory, Anti-bacterial, Anti-oxidant, Face serum, Fenugreek extract

INTRODUCTION

A concentrated solution called serum is frequently used in cosmetology. In the field of professional cosmetology, the name originates from itself. In water or oil, the cosmetic serum is just as potent as any other cream. A concentrated liquid such as serum is a substance with 10 times as much organic material as cream. Thus, address the aesthetic issue as soon as possible.¹ The demand for cosmetic items has increased as a result of the rising expense of living worldwide. One of the most significant economic

resources is the Malaysian-based cosmetics business. Cosmetics have become increasingly valuable as individuals want to maintain their youth and beauty. A skin care product known as serum comprises a gel, light moisturizer, or lotion and has the power to deeply enter the skin to deliver active ingredients. A decent skin serum could provide your skin elasticity, a smooth texture, smaller-looking pores and more hydration. All skin care products, whether they are hydrating, anti-aging, anti-wrinkle, or serums, should contain antioxidants, compounds derived from cells and components that resemble skin. To maintain the healthiest possible skin, all

skin types require these substances.² In this study we have formulated and evaluated a face serum containing combination of aqueous extract of Fenugreek seed and lemon oil.



Figure 1: Lemon Oil and fenugreek seeds.

Fenugreek: From ancient times, fenugreek, also known as methi has been utilized as a remedy for a number of diseases. There are several elements found in fenugreek, includes Folic acid, Thiamin, Vitamin A, C and K, B6, Riboflavin, Niacin, iron, magnesium, potassium, zinc, selenium, calcium, copper and others. Fenugreek is a nutritious superfood that fights free radical damage, promotes natural skin radiance and provides excellent nutrients for your skin. It also helps to balance the pH levels of your skin. The natural anti-inflammatory, antimicrobial, and antioxidant properties of fenugreek are also very advantageous to the health of our skin.



Figure 2: Aqueous extract of Fenugreek and Fenugreek Serum (F3).

It can be used for many purposes such as for glowing skin, cleanser, as an anti-aging, for moisturizing skin, reducing blemishes, dark circles and acne.³ Lemon essential oil has been found to have a variety of uses for skin. A flexible element in the cosmetics business due to the advantages of lemon essential oil. Lemon oil is an efficient element in many cosmetic and beauty preparations, particularly wash-off items like soaps, cleansers and hair care products since it possesses antibacterial, antiviral, antifungal, and astringent characteristics. The use of lemon essential oil in skincare products can aid in the battle against free radicals that can cause skin to age prematurely. The high amount of antioxidants that lemon oil offers when used as an ingredient in cosmetic skincare formulation, along with its inherent astringent and antibacterial properties, make it a

very beneficial essential oil for very oily clogged skin types seeking for a brighter, more evident radiance to the skin tone. Lemon oil's antiseptic and antibacterial properties also make it highly useful for cleaning minor skin wounds, cuts, and abrasions as well as for treating various microbial skin issues.

METHODS

This in vitro study was conducted in practical laboratories of Kamla Nehru College of Pharmacy, Butibori, Nagpur during the period from August 2022 to March 2023.

Drug profile

Active: Fenugreek Seed Extract. Biological Name: *Trigonella foenum-graecum*. Classification: Kingdom-Plantae, Division-Magnoliophyta, Class-Magnoliopsida, Order-Fabales, Family-Fabaceae, Genus-Trigonella and Species- foenum-graecum

Biological source

Selection criteria of the sample: a fragrant member of the pea family (Fabaceae), fenugreek (*Trigonella foenum-graecum*), often spelt fenugreek, is utilized for its dried, flavorful seeds, which are used as a spice. Fenugreek is cultivated throughout central and southern Europe, western Asia, India, and northern Africa. It is a native of southern Europe and the Mediterranean region.¹

List of ingredients required for serum: Carbopol 940, Triethanol amine, Tween 80, Glycerin, Sodium Benzoate, Water, Lemon oil, Vitamin E, Fenugreek extract. These chemicals and ingredients were obtained from the practical laboratories of Kamla Nehru College of Pharmacy, Butibori, Nagpur, 441108.

Method of extraction

The extraction of fenugreek seeds was done using the maceration method. To expand the surface area and make it easier to extract the active ingredients, fenugreek seeds were first washed, dried, and crushed. The solvent was distilled water. In a clean container, fenugreek seeds were crushed and water was added at a ratio of 1:10 (1 part seeds to 10 parts water). To ensure that the seeds are evenly dispersed throughout the water, the mixture is swirled. 72 hours are given for the mixture to stand at room temperature. At this period, the fenugreek seeds' active ingredients diffuse into the water and produce a fenugreek extract. To stop the active ingredients in the extract from degrading, it was kept in a sterile, airtight container out of the way of direct sunlight.⁵

Formulation of serum base

Procedure: Carbopol was dispersed in water and allowed to hydrate by keeping overnight. Triethanol amine was

added at last for desired consistency after adding remaining ingredients given in the table one by one.

Table 1: Formulation of serum base (100 ml).

Ingredients	F1	F2	F3
Water	QS	QS	QS
Carbopol 940	0.1 g	0.2 g	0.3 g
Triethanol amine	0.3 ml	0.3 ml	0.3 ml
Glycerin	7 ml	7 ml	7 ml
Tween 80	2 ml	2 ml	2 ml
Lemon oil	0.3 ml	0.3 ml	0.3 ml
Vitamin E	1 ml	1 ml	1 ml
Sodium Benzoate	0.1 g	0.1 g	0.1 g

Table 2: Incorporation of fenugreek extract in serum base (100 ml).

Ingredients	F1	F2	F3
Water	QS	QS	QS
Carbopol 940	0.1 g	0.2 g	0.3 g
Triethanol amine	0.1 ml	0.2 ml	0.3 ml
Glycerin	7 ml	7 ml	7 ml
Tween 80	2 ml	2 ml	2 ml
Lemon oil	0.3 ml	0.3 ml	0.3 ml
Vitamin E	1 ml	1 ml	1 ml
Sodium Benzoate	0.1 g	0.1 g	0.1 g
Fenugreek Extract	5 ml	5 ml	5 ml

Evaluation of the extract

Preliminary phytochemical screening; alkaloids: In order to determine whether alkaloids are present in the extract, 2ml of the extract and 2ml of Wagner's reagent are combined. There is evidence of a brownish precipitation development. As a result, it suggests the presence of alkaloids.^{6,7} Cardiac Glycoside: To check for glycosides, 2ml of the extract is diluted in 2ml of chloroform, and then a layer of strong sulphuric acid is carefully added. Cardiac glycosides are present where the steroid ring and deep reddish brown colour meet.^{6,7} Flavonoids: 2ml of the extract was mixed with 2ml of 10% lead acetate to determine whether the extract contains flavonoids. The occurrence of

flavonoids is indicated by the yellowish green colour.^{6,7} Saponins: 2 ml of extract and 2 ml of Benedict's reagent are dissolved for this. Saponins are shown by the colour blue and black in the precipitate.^{6,7} Tanins: 2 ml of the extract is reacted with 0.1% ferric chloride to determine the presence of tannins. The amount of tannins is indicated by the brownish-green coating.^{6,7} Terpenoids (Salkowski test): Concentrated sulphuric acid is cautiously added to produce a layer after 2 ml of extract has been gently diluted in 2ml of chloroform to check for the presence of terpenoids. The colour is reddish brown, which denotes the existence of terpenoids.^{6,7} Anthraquinone: 1 ml of fenugreek seed extract is cooked with 10% HCL for a short period of time in a pot of boiling water to determine the

existence of anthraquinones. It is then filtered and given time to cool. The filtrate is mixed with an equal amount of CHCL₃, several drops of 10% ammonia, and heated. Anthraquinones are observed to have a rose-pin colour, considered to be a sign of their existence.^{6,7} Reducing Sugar: Purified water was added to the extract, which was then shaken. After boiling Fehling's solutions A and B with the filtrate for a short period of time, an orange-red precipitate shows the presence of reduced sugars.^{6,7} Glycoside: Extract is hydrolyzed with HCL solution and neutralized with NAOH solution to detect this. Some few drops of Fehling's solutions A and B are added; the occurrence of glycosides is indicated by the colour red.^{6,7}

Evaluation of face serum

In-vitro Study; Colour and Appearance: Visual observations was made of the formulation's colour and appearance. Homogeneity: The formulation was created using the evenly distributed extract. This was supported by both tactile and visual cues.⁸ pH determination: Apparatus used was pH meter, typically with glass electrode, Principle: Serum formulations are designed for topically applied use. Thus, their pH should be comparable to skin. The pH of the skin serum must be between 5 and 9 because the skin has an acidic pH range. Chemical inertness, or the fact that a skin serum shouldn't be either excessively acidic or too alkaline, is crucial to ensuring that it has the requisite shelf life. The typical pH of skin should be between 4 and 5.5 based on the aforementioned statement, Procedure: The serum formulation was taken in a beaker and pH was determined using a pH meter after calibrating the equipment with the standard buffer solution. The glass rod was dipped in the serum samples and their pH were noted.⁴ Viscosity determination, Apparatus: Brook Field Viscometer, Principle: The most crucial factor in a cosmetic product's assessment is viscosity. Many characteristics, including spreadability and pourability of the substance from the container, are governed by viscosity. As a variety of factors, including changes in temperature, modifications to the production process, and the quality of the raw materials, can impact viscosity. Thus, it is crucial to determine the product's viscosity, Procedure: Spindle No. 4 of a brook field viscometer was used to measure the viscosity of the serum, and all of the working parameters were then established. The final value will be the mean of the next five readings, which were obtained at various rpm. At 6 rpm and 3 rpm, the viscosity was measured in cps.⁴ Cyclical temperature study: These evaluations are not conducted at a constant temperature or humidity level. In this experiment, the temperature was cycled daily, for instance, low-high-low-high, to simulate regular temperature fluctuations.¹ Microbial examination of the serum: The formulated serum was inoculated into agar medium plates, and control was created by leaving out the cream. The plates were put in the incubator and kept at 37°C for 24 hours. Plates were removed from the incubation time and checked for microbial growth by comparing them to the control.⁹ Antimicrobial assay: The agar-well diffusion method was used to conduct a test that

evaluates the bacterial efficacy of prepared serum. The commercial Kojic acid serum served as a standard and positive control. The bacterial isolates of dormant *Staphylococcus aureus* were acquired from the Kamla Nehru College of Pharmacy in Butibori. Four wells on a plate of agar were pierced using a gel borer. The agar bed had the bacterial strain evenly dispersed across it. Three wells above the agar bed were loaded with serum samples using a micropipette, and one well was filled with commercial Kojic acid serum. The different values of the inhibition zone have been recorded and assessed after 24 hours of incubation at 37°C.^{10,11}

RESULTS

Results of current investigation are as depicted in tables and figures below.

Table 3: Preliminary phytochemical screening.

Phytochemicals	Inference
Alkaloids	++
Cardiac Glycosides	++
Flavonoids	++
Saponins	++
Tanins	++
Terpenoids	++
Anthraquinone	--
Reducing Sugar	++
Glycosides	++

++ Shows the presence of the phytochemical, -- Shows the absence of the phytochemical

Table 4: Physical evaluation of face serum.

Colour	Cloudy white
Odour	Citrus
Texture	Silky water
Homogeneity	Good

Table 5: pH determination of the Serum incorporated with the extract.

Formulations	pH
F1	4.9
F2	4.7
F3	5.1

Microbial examination of the serum

The absence of a zone of inhibition after being inoculated on agar proved that the formulation was devoid of microorganisms.

Antimicrobial assay

From the results it was found that all formulations have satisfactory inhibition of microbial growth. It was

observed that among all the samples the inhibition rate of third sample F3 was greater.

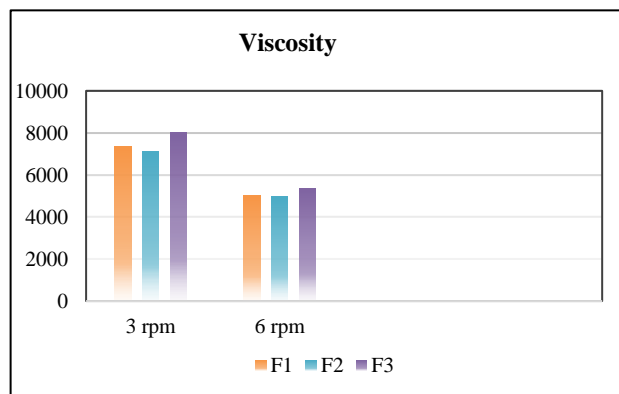


Figure 3: Viscosity determination of the Serum incorporated with the extract.

Table 6: Cyclical temperature study.

Parameters	F1	F2	F3
Freeze Temperature	Stable	Unstable	Stable
Room Temperature	Stable	Stable	Stable
High Temperature	Unstable	Stable	Stable

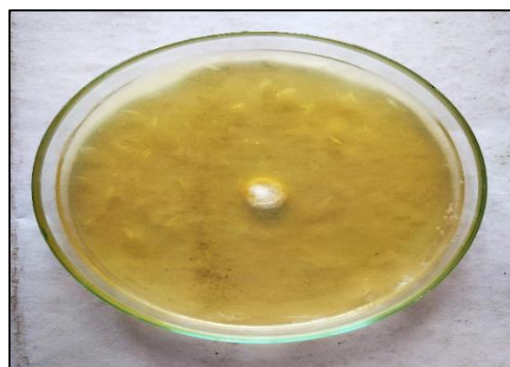


Figure 4: Serum showing no microbial growth in the agar media.

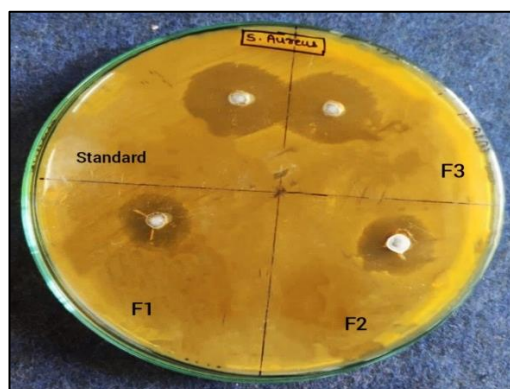


Figure 5: Zone of inhibition of standard and the serum.

Table 7: Formulations zone of inhibition.

Formulations	Zone of inhibition (mm)
Standard	25
F1	17
F2	19
F3	22

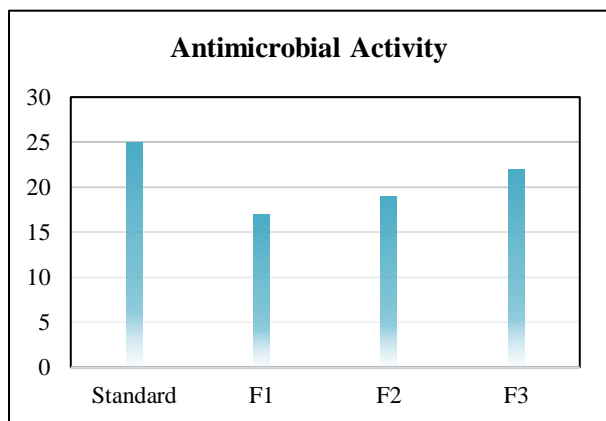


Figure 6: Graphical representation of antimicrobial activity of the serum formulations.

DISCUSSION

In formulation and evaluation of a serum containing Bee Venom and Aloe Vera Gel by Ojha et al evaluate that face serum pH 6.2 as the skin having acidic pH.² In stability study the formulation was undertaken stability study for Physical and Chemical change no considerable variation were observed. In formulation and evaluation of face serum Rajdev et al in evaluate the pH of formulation and it was found to be 6.4 having acidic pH.¹ Viscosity is a critical parameter for tropical formulation, as with low viscosity have faster clearance than viscous solutions, so viscosity of face serum found to be 13759 Pascal second and spreadability of liquid formulation to spread over the skin and play important role in administration of standard dose of medicament formulation credibility of face serum was found to be 5 to 6 cm. So in this formulation and evaluation we did the evaluation parameters pH, viscosity, spreadability very important for serum and it is closely to all these result for example pH found to be 4 to 4.7 standard values in between the 4 to 6.7. Spreadability upto 5 to 6 cm. which provide feeling very soothing and gives emollient and moisturizing action. Alghamdi et al in her review article fenugreek a multipurpose crop: potentialities and improvements represent that study about analysis of genetic divergence in fenugreek, genetic variability and correlation studies on yield and yield components of fenugreek, path coefficient analysis etc. done properly and according to all these parameter fenugreek serum also able to give anti-aging activity and anti-inflammatory activity and so on.³ Sasidharan et al Formulation and evaluation of fairness serum using polyherbal extracts represent preliminary phytochemical screening of fenugreek and in our study

also the same parameters are complies and since it shows excellence in serum activity.⁸ Haouala et al in 2008 in The anti-bacterial and anti-fungal role of fenugreek is recently being shown in study and because of this activity it also used in serum so that it provide emollient and soothing property.⁹⁻¹²

Limitations

Limitation of current study was this study was not performed in human being.

CONCLUSION

The aim of the study was to formulate different herbals into a serum form for specially, moisturizing, anti-bacterial and anti-inflammatory activity on facial skin. At present because of availability of wide range of cosmetic products in the market, consumers are giving special attention towards the selection of cosmetics to develop a well standard formula of the new product, viz. herbal anti-bacterial serum was formulated by incorporating active extract of Fenugreek seeds for good anti-bacterial effect. Thus, conclusion can be made that the serum containing Fenugreek extract have been able to cure bacterial infections and inflammations of facial skin, and other signs also moistens the skin without any side effects in making skin soft, smooth and supple.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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