



## Development of *Damascus rosea* and Caffeine Based Hyperpigmentation Cream for the Treatment of Dark Circle

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### ABSTRACT:

Periorbital hyperpigmentation, commonly known as dark circles, is a frequent dermatological concern that affects facial appearance and may reduce an individual's self-confidence. The present study focuses on the development and evaluation of a herbal hyperpigmentation cream containing Damascus Rosea (*Rosa damascena*) extract and caffeine for the treatment of dark circles. Damascus Rosea possesses antioxidant, anti-inflammatory, and skin-soothing properties, while caffeine acts as a vasoconstrictor that helps reduce pigmentation and puffiness under the eyes. The cream was formulated using suitable excipients to obtain a stable and cosmetically acceptable topical preparation. The prepared formulations were evaluated for physicochemical parameters such as pH, homogeneity, viscosity, spreadability, washability, irritancy, and stability. Antimicrobial activity was also assessed against *Tinea versicolor*. The results indicated that the formulated cream exhibited good stability, acceptable physicochemical properties, and potential activity against hyperpigmentation-related conditions. Hence, the developed herbal formulation may serve as a safe and effective topical treatment for dark circles.

**Keywords:** Hyperpigmentation, Dark circles, *Rosa damascena*, Caffeine, Herbal cream, Periorbital hyperpigmentation, Topical formulation, Antioxidant activity.

### INTRODUCTION

#### 1. Hyperpigmentation:

Skin hyperpigmentation is a frequent dermatological disorder that typically causes the skin to get darker. Many internal and external variables, such as hormonal fluctuations, inflammation, injury, acne, eczema, certain medications, UV exposure, etc., can cause these variations in skin pigmentation (Pérez-Bernal et al., 2000). Melanocytes in different layers of skin create melanin, which is the skin pigment that controls skin coloring and pigmentation. Skin hyperpigmentation diseases are therefore caused by changes in melanocyte production or melanin dispersion (Rossi & Perez, 2011). Although hyperpigmentation is not a life-threatening condition, it can negatively impact patients' emotional and psychological well-being. There are several treatment options for hyperpigmentation. These agents are primarily used topically as creams, gels, or ointments. Topical therapies can cause skin dryness, irritation, peeling, and hypopigmentation. Prolonged treatment durations (months to years) might negatively impact patient compliance and satisfaction. Effective treatment for hyperpigmentation remains a problem, highlighting the need for alternative approaches. (1)

#### 2. Types of Hyperpigmentation:

##### Post-inflammatory Hyperpigmentation:

All skin types are susceptible to acquired hypermelanosis following skin inflammation or damage. Infections like dermatophytosis, allergic responses from mosquito bites, psoriasis, hypersensitivity reactions from drugs, irritating injuries, or cosmetic operations can all cause it. However, acne vulgaris, atopic dermatitis, and impetigo are relatively prevalent causes of it. In fact, dark-skinned individuals are more likely to get post-inflammatory hyperpigmentation (PIH) following acne. Melanocyte activity may increase, which might be triggered by reactive oxygen species and inflammatory mediators. Light to dark brown coloration in epidermal postinflammatory hyperpigmentation; however, dermal PIH tends to have grey to black coloration. (2)



**Figure 1:** skin affected by post inflammatory hyperpigmentation

### Age spot:

Skin aging is a carefully controlled biological process characterized visually by uneven pigmentation, wrinkles, and skin tags, and internally by decreased cell replacement efficiency, irregular hormone production, poor thermoregulation, delayed healing, and reduced sebum secretion. The course of skin aging is determined by a combination of intrinsic (physiological/genetic) and extrinsic (environmental/lifestyle) variables (Serre et al., 2018). Of the controllable extrinsic factors, UV radiation exposure has the most severe long-term effects, resulting in photoaging in conjunction with the natural aging process. The pattern and intensity of aging-induced pigmentation changes vary by skin phototype (Andreassi et al., 1999; Videira et al., 2013). Beginning with evidence suggesting the basic process of pigmentation includes interaction between the many cell types in the epidermal and dermal layers, including keratinocytes, fibroblasts, melanocytes, and endothelial cells (Yamaguchi & Hearing, 2009).(3)



**Figure 2:** Age spot

### 3.Periorbital Hyperpigmentation:

Periorbital hyperpigmentation is one of the most prevalent aesthetic and dermatological complaints made by people of either gender, albeit it is more common in women. It has been shown to be more noticeable in some ethnic groups and is often observed in several members of the same family. Although there are different definitions for this facial presentation, it is generally an ill-defined entity that manifests on an individual as bilateral round or semi-circular homogenous brown or dark brown pigmented macules in the periorbital region. Its clinical severity and presentation may vary, but it typically manifests bilaterally with one periorbital region more affected than the other. Either the upper or lower eyelid, or both, may be affected.(4)

**Table 1:** classification of periorbital hyperpigmentation according to Ranu et al. (2011).(8)

<b>Constitutional</b>	<ul style="list-style-type: none"><li>• Patients frequently have upper eyelid involvement along with a curving band of brownish to black skin pigmentation on lower eyelids that resembles the form of the orbital rim.</li></ul>
<b>Post-inflammatory</b>	Here, the upper, lower, or both eyelids have irregular patches of brownish or gray pigmentation with lichenification, while the surrounding regions have eczematous sores.
<b>Vascular</b>	<ul style="list-style-type: none"><li>• Patients often have thin, transparent skin, prominent capillaries, telangiectasia, and erythema that mostly affects the inner portion of the lower eyelids. Both obvious bluish veins and a blue darkening of the lower eyelid are possible.</li></ul>
<b>Shadow effect</b>	The primary cause of this kind is structural anatomical characteristics, such as a deep tear trough, eye bags, or overhanging tarsal muscle.
<b>Others</b>	<ul style="list-style-type: none"><li>• Such as internal illnesses (e.g., anemia, hormonal abnormalities, nutritional deficiencies), skin disease (e.g., acanthosis nigricans, cutis laxa, nevus Ota, nevus Hori, erythema dyschromicum perstans, fixed drug eruption), and medications (latanoprost and bimatoprost eye drops).</li></ul>

#### 4 .Damascus Rosea:

Damascus Rosea, or *Rosa damascena* Mill. is a member of the Rosaceae family. This wellliked aromatic and therapeutic plant is most recognised for its priceless essential oil (Kumar, Sharma, Kaundal, Sharma et al. 2016; Thakur et al. 2019; Mahajan and Pal 2020; Hamed, Ghasemi Pirbalouti, and Rajabzadeh 2022). The king of flowers, it goes by several names, including Gift of Angels, Oil Rosea, Pink Rosea, Kazanlik Rosea, and Isparta Rosea (Dirani and Ahmad 2016; Mileva et al. 2021). This is the primary species in Bulgaria and Turkey, although it is also grown for its essential oil and medicinal uses across the world. Several nations currently cultivate it, including Afghanistan, China, Crimea, France, Egypt, Germany, India, Iran, Italy, Japan, Libya, Morocco, North Korea, Pakistan, Syria, and Ukraine (Chauhan et al. 2012;)

**Figure 3:** Damascus Rosea

#### 5.Caffeine:

A member of the methylxanthine class of naturally occurring central nervous system stimulants, caffeine is largely acknowledged as the most extensively used psychoactive stimulant in the world. The most frequent source of this stimulant is coffee beans, although it may also be found naturally in certain teas and cacao beans, as well as added to energy drinks and soda. Although it has many other medicinal uses, caffeine is mostly used to reduce weariness and sleepiness. Caffeine has been authorized for the treatment of preterm apnea by the US Food and Drug Administration (FDA). Caffeine can be used off-label to alleviate migraines and post-dural puncture headaches, as well as to improve athletic performance, especially in endurance sports.(5)

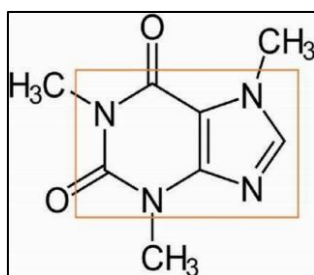


Figure 4: Structure of caffeine

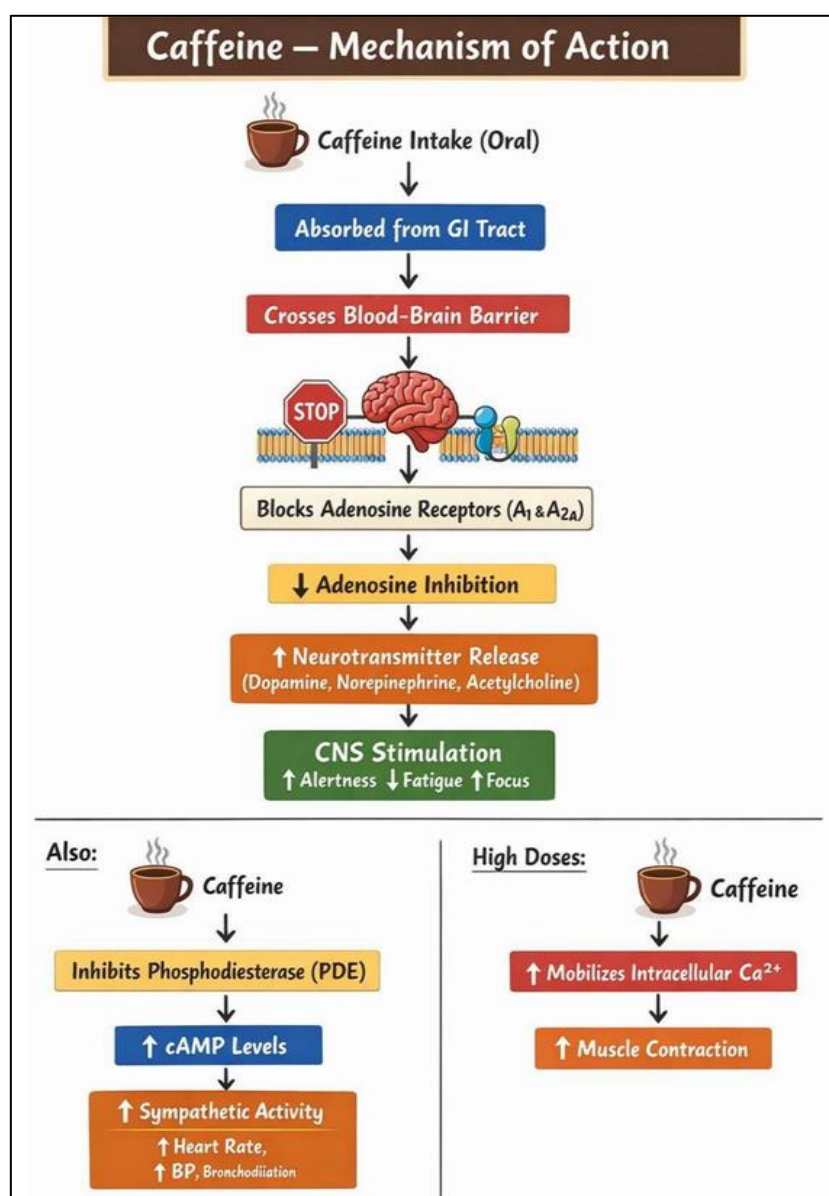


Figure 5: Mechanism of action (6)

**Cream:**

These days, there are several skincare products for practically every type of beauty issue, such as body washes, lotions, gels, exfoliants, moisturizers, toners, and sun protection. The primary goal is to support skin health from the inside out. Although many skincare products still regrettably have negative effects, the FDA's presence prevents the use of recognized harmful substances.



Creams and topical treatments have long been regarded as a crucial component of cosmetics. Since even cosmetic creams are based on pharmacy-developed procedures and unmedicated creams were widely utilized in ancient times to treat a range of skin disorders, creams may be regarded as pharmaceutical items. Simply combining two or more ingredients with water as the solvent produced creams. As technology advances, more recent Techniques are applied when creating creams. The public and society may employ these semisolid prepared elegantly. They demonstrate variety in their roles. Creams are easily applied to any area of the body. Cream is easy for people of all ages to use. Although it may be used just as effectively on non-aqueous items like ointments, liquid eye colors, and mascaras based on wax solvent. An emulsion is said to be lotion if its viscosity is low enough to allow it to flow when gravity alone is applied. Creams are water and oil emulsions. Cream formulation, assessment, and preparation will be done using increasingly sophisticated technology and techniques in the near future. Additionally, there is a growing need for creams made with botanical ingredients.(7)

Functional	Physicochemical	Subjective
Cleansing Creams	Medium to high oil content O/W or W/O	Oily
Cold Creams	Low slip point oil phase	Difficult to 'Rub in'
Massage Creams	Neutral pH	May be stiff and rich
Night Creams	May contain surfactant that improve penetration	Also popular as lotions
Moisturizing Creams	Low oil content	Easily spreadable and 'Rub in' quality
Foundation Creams	Usually O/W	Available as creams and lotions
Vanishing Creams	Low slip-point oil phase	

Figure 6: Table for characteristics of cream

#### Types of Cream:

They can be separated into two categories:

**Oil-in-water (O/W)** cream are characterized by the oil being distributed as droplets throughout the aqueous phase, whereas oil-in-water (O/W) creams are made up of tiny oil droplets distributed in a continuous phase.

**Water-in-oil (W/O)** creams are made up of tiny water droplets scattered across an oily layer. An emulsion is of the water-in-oil (W/O) type when the dispersed phase is water and the dispersion medium is oil.

#### Evaluation of Cream:

##### Irritancy;

Mark the region (1 cm<sup>2</sup>) that is irritable.washability) on the dorsal surface of the left hand. After applying the cream to that location, the time was recorded. After that, it is examined for irritation, erythema, and edema for a maximum of 24 hours and reported.

##### PH;

A digital PH viscosity meter was used to measure the PH after 0.5 g of cream had been dissolved in 50 ml of distilled water.

##### Viscosity:

Cream's viscosity was measured using a Brooke field viscometer set to 25 °C and spindle number 63 spinning at 2.5 RPM.

##### Phase Division;

The prepared cream was stored out of direct sunlight in a covered container between 25 and 100°C. After that, phase separation was examined for 24 hours for 30 D. Any alteration to the phase separation was noted and verified.



## Current Used in Management of Hyperpigmentation Drugs:

**Table 2:** list of drugs used in hyperpigmentation

S.NO	DRUG NAME	DRUG CLASS	REFERENCE
1.	Hydroquinone	Depigmenting agent	8
2.	Tretinoin	Topical retinoid	9
3.	Azelaic acid	Dicarboxylic acid	10
4.	Kojic acid	Tyrosinase inhibitor	9
5.	Tranexamic acid	Antifibrinolytic agent	11
6.	Vitamin c (ascorbic acid)	antioxidant	9
7.	Niacinamide	Vitamin B3 derivative	9
8.	caffeine	Vasconstrictor	9
9.	Kligmans formula	Combination therapy	12

## 6.Methodology

Collection of Material:

**Table 3:** list of drugs & source

S.NO	NAME OF THE CHEMICAL	SOURCE
1.	Caffeine	Toners Touch
2.	Damascus Roseaa	Gattefosse
3.	Stearic acid(gm)	Ennore India chemicals
4.	Cetyl alcohol(gm)	Tradeindia
5.	Coconut oil(ml)	IndiaMart
6.	Glycerol(ml)	IndiaMart
7.	Methyl paraben(gm)	Chemico glass and scientific company
8.	Triethanolamine(ml)	Qualigens
9.	Water	Chemico glass and scientific company

## List of Equipments:

**Table 4:** List of equipments used

S.NO	EQUIPMENTS	MODEL
1	Soxhlet apparatus	Glassco laboratory equipments Pvt.ltd
2	Digital balance	Satorius, Bangalore
3	UV\ Visible spectrophotometer	UV-1700 series, shimadzu
4	Digital pH meter	Systronics, Mumbai
5	Microscope	Olympus microscopes
6	Reflux condenser	Glasscolaboratory equipments Pvt.ltd

Methodology:

### Apparatus:

Damascus Rosea powder is extracted using solvent extraction in a soxhlet system. This specific soxhlet device consists of a glass extractor positioned between a bulb condenser at the top and a round-bottom flask at the bottom. Damascus powder is added to the thimble within the glass thimble holder.



Initially filled with an extracting solvent, the round-bottom distillation flask is heated by an electrothermal heating mantle to a maximum temperature of 100 C° and a maximum capacity of 1 liter. The solvent vapor condenses and builds up inside the extractor as it ascends to the condenser.

Here, the powdered damascus and the solvent come into touch. Mass transfer occurs when the condensate descends through the powder. However, when the collected solvent rises only as a result of the hydrostatic pressure head, a significant portion of mass transfer of the extraction from the powder to solvent takes place.(13)

Preparation of Damascus Rosea extract:

#### Collection and Preparation of Plant Extracts:

Rosea flowers were collected early morning from gattefose.

#### Extraction with Ethanol:

Alcohol was used to remove the petals from the Rosea. The extract was dried at 60°C under decreased pressure in a rotating vacuum evaporator. Chloroform, ethyl acetate, and butanol were then used to fractionate the dried extract. At 60°C and low pressure, all solvent fractions were dried.

#### Extraction with Hexane:

Hexane was used to remove the petals from the Rosea. To create the concrete, the hexane was evaporated at 40°C under low pressure.

#### Extraction with Water:

The water extract was dried at 60°C under low pressure after petals were boiled with water for 30 minutes.(14)

#### Cream Formulation:

The result is a semi-solid combination called an oil in water (O/W) emulsion. After heating cetyl alcohol, stearic acid, and coconut oil to 75°C, the oil phase dissolves the oil. The part is A. The water-soluble components, including methylparaben, triethanolamine, DAMASCUS ROSEAA extract, and caffeine, are dissolved in the aqueous phase by heating it to 75°C. It's a piece.

B. The emulsifier was heated, then the aqueous phase was progressively added to the oil phase while being continuously agitated until it cooled. The table shows the cream's formula.(14)

**Table 5:** cream formulation

S.NO	INGREDIENTS	FORMULATIONS		
		F1	F2	F3
1.	Caffeine	1.5	1	0.5
2.	Damascus Roseaa	0.5	1	1.5
3.	Stearic acid(gm)	4	4	4
4.	Cetyl alcohol(gm)	0.4	0.4	0.4
5.	Coconut oil(ml)	1	1	1
6.	Glycerol(ml)	1	1	1
7.	Methyl paraben(gm)	0.2	0.2	0.2
8.	Triethanolamine(ml)	1	1	1
9.	Water	QS	QS	QS

#### Evaluation:

#### PH of the cream:

The pH metre was calibrated using a buffer solution. A digital pH meter was used to measure the pH following the weighing and dissolution of 0.5 g of the cream in 50.0 ml of distilled water.



#### **Dye test:**

The methylene blue is combined with the produced cream. Put a drop of the cream on a tiny slide using a cover slip, then examine it under a microscope. The background is colorless when the globules appear as methylene blue. It's known as O/W-type cream. "W/o type cream" describes a scenario in which the scattered globules appear colorless but the background is blue.

#### **Appearance:**

The color should not have changed after the formulation was stored for 40 days. The color, roughness, and pearlescence of the cream were used to grade its appearance.

#### **Homogeneity:**

Cream consistency is produced by all prepared formulas. Both touch and look may confirm it. In order to ascertain the cream's homogeneity.

#### **After feel:**

When applying the cream to the skin, its smoothness and emollient qualities are crucial. The smoothness and emollient qualities of the skin are assessed after the cream is applied.

#### **Type of smear:**

The cream was applied to the watch glass in order to conduct the examination. The properties of the film or smear that formed on the glass after the application were assessed.(15)

#### **Washability test:**

The area where the cream is administered will be washed with tap water to gauge how easy it is to remove.

#### **Irritancy test:**

On the dorsal surface of the left hand, a 1 cm<sup>2</sup> region was marked. The application duration was meticulously recorded for accurate assessment, and the cream was applied gently to ensure uniform coverage. After intervals of up to 24 hours, any signs of erythema, edema, or irritating effects were carefully observed and recorded. On the dorsal surface of the left hand, mark the area. This test helps determine whether skin sensitivity or irritation may result from the cream formulation.

#### **Viscosity:**

A viscometer was used to measure the cream's viscosity. The viscometer was used to measure the viscosity. The viscosity of the test sample was measured in compliance with the viscometer's normal operating protocols after the prepared sample was placed into the adapter. The torque measurement that was closest to 100% was noted when the spindle was turned at different rates of 0.5, 1, 5, 10, and 20 rpm.(16)

#### **Antifungal activity of cream by agar well diffusion:**

##### **Agar Well Diffusion Method:**

##### **a. Potato Dextrose Agar Medium:**

The potato dextrose agar medium was prepared by dissolving 20 gm of potato infusion, 2 gm of dextrose and 1.5 gm of agar in 100ml of distilled water. The dissolved medium was autoclaved at 15 lbs pressure at 121°C for 15 minutes. The autoclaved medium was mixed well and poured onto 100mm petri plates (25-30 ml/plate) while still molten.

##### **Procedure:**

Petri plates containing 20ml potato dextrose agar medium was seeded with 72 hr culture of fungal strain (*TINEA VERSICOLOR*) with different concentrations of sample F1, F2 and F3 will be added. The plates were then incubated at 28°C for 72 hours. The



anti-fungal activity was assayed by measuring the diameter of the inhibition zone formed around the wells. Caffeine was used as a positive control. The values were calculated using Graph Pad Prism 6.0 software (USA).

## 7.RESULTS AND DISCUSSION

### PH of the CREAM:

The cream's pH has been found to be between 6.71 and 6.84, which is a good range for skin pH.

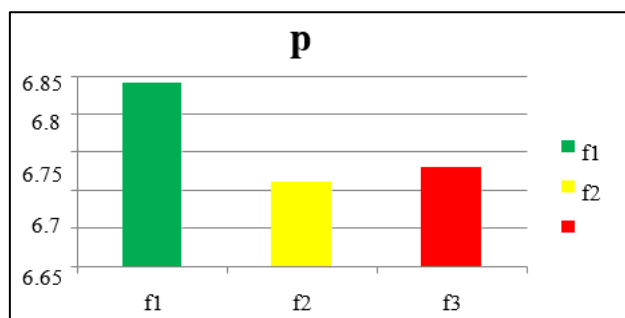
Every cream formulation that has been created has a pH that is closer to that of skin.

**Table 6:** pH of the cream

Parameter	Formulations								
	F1			F2			F3		
	1	2	3	1	2	3	1	2	3
Average pH Value	6.93	6.85	6.74	6.81	6.62	6.71	6.83	6.72	6.64
	6.84			6.71			6.73		

The pH of the formulations F2 was satisfied compared to the F1 & F3.

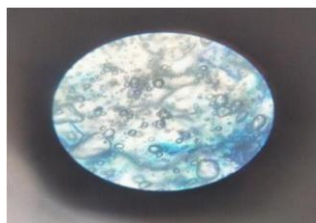
### Graphical Representation:



**Figure 7:** graph for pH of cream

### Dye Test:

The o/w type emulsion cream composition was confirmed by Methylene blue dye. Formulation F2, however, exhibits greater stability in o/w type emulsion.



**Figure 8:** Dye test

### 6.3 Homogeneity:

Every produced composition yields a uniform cream. Homogeneity was verified through touch and appearance.



**Table 7:** Homogeneity of cream

Parameters	Formulations		
	F1	F2	F3
Homogeneity	Good	Good	Good

Appearance:

Long-term storage of the formulation revealed no change in the cream's color.

**Table 8:** Appearance of cream

Parameters	Formulations		
	F1	F2	F3
Appearance	No change	No change	No change

The appearance of the above three formulation has no change under different conditions.

After Feel:

Following the application of a predetermined quantity of cream, emolliency, slipperiness, and residual amount were determined.

**Table 9:** After feel of cream

Parameters	Formulations		
	F1	F2	F3
After feel	Emollient	Emollient	Emollient

Type of Smear:

The type of smear that developed on the skin after cream application was non-greasy.

**Table 10:** Type of smear of cream

Parameters	Formulations		
	F1	F2	F3
Type of smear	Non greasy	Non greasy	Non greasy

The above three formulations F1,F2 &F3 are non-greasy.

**Washability Test:**

Washing with tap water made it simple to remove the cream that had been applied.

**Table 11:** Washability test of cream

Parameters	Formulations		
	F1	F2	F3
Removal	Good	Good	Good

Irritancy Test:

The formulation shows no redness, edema, inflammation and irritation during irritancy studies.

These formulations are safe to use.

**Table 12:** Irritancy test of cream

Parameters	Formulations		
	F1	F2	F3
Irritancy	Nil	Nil	Nil

None of the formulations exhibit redness, edema, inflammation, or irritation.

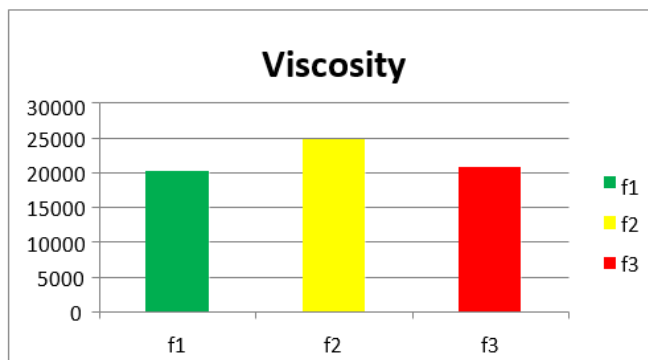
**6.9 Viscosity Test:**

The formulation's viscosity was measured at 25°C and 100 rpm using a viscometer.

**Table 13:** Viscosity test of cream

Parameters	Formulations		
	F1	F2	F3
Viscosity	20185	24679	20754

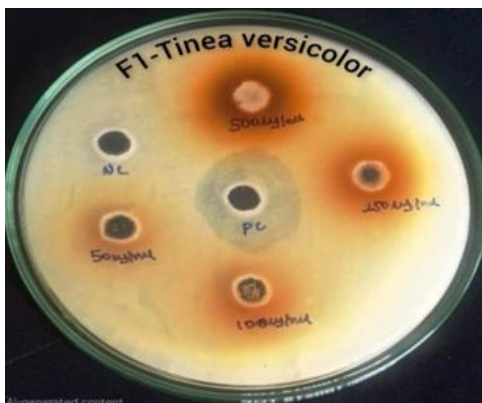
**Graphical Representation:**



**Figure 9:** graph for viscosity

**In vitro studies:**

Agar well diffusion method



**Figure 10:** effect of sample f1 against tinea versicolor

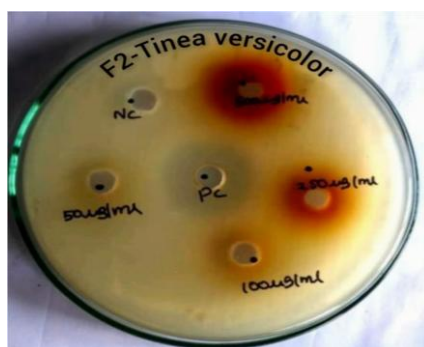


Figure 11 : effect of sample f2 against tinea versicolor

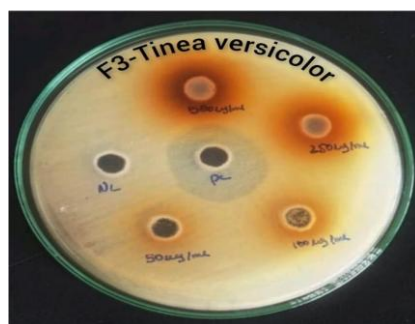


Figure 12: effect of sample f3 against tinea versicolor

Table 14: Mean ± SD of zone of inhibition obtained by sample F1 F2 F3 against Tinea versicolor.

S. N O	Name of the test organism	Name of the test sample	Zone of inhibition (mm) Mean ± SD				
			500 µg/ml	250 µg/ml	100µg/ml	50 µg/ml	PC
1.	Tinea versicolor	F1	23±2.12	17.65±0.91	14.5±0.70	12.75±0.3	21.5±2.12
2.	Tinea versicolor	F2	20.25±1.06	19.1 ±1.27	12.15±0.2	0	21±1.41
3.	Tinea versicolor	F3	20.75±0.35	18.15±1.20	12.5±0.70	10.75±0.35	21.5±0.70

SD – Standard Deviation, \*Significance -  $p < 0.05$

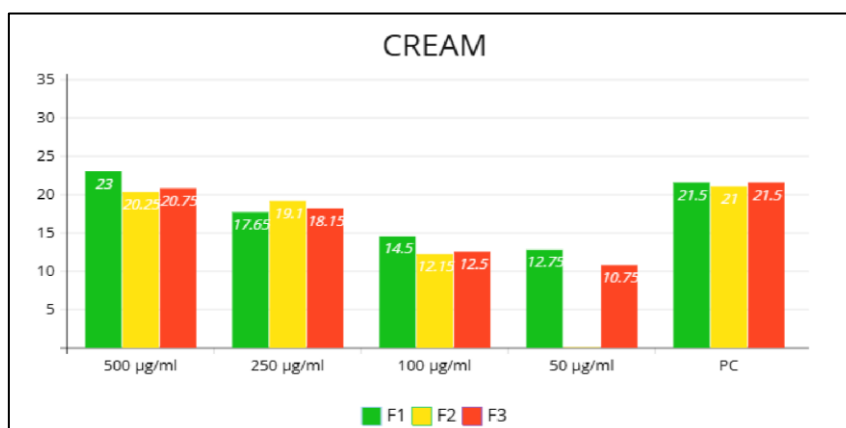


Figure 13: graphical representation of zone of inhibition of tinea versicolor



## SUMMARY

Hyperpigmentation is a common dermatological condition characterized by the darkening of certain areas of the skin due to excessive melanin production. It can occur due to several internal and external factors such as hormonal changes, inflammation, UV radiation exposure, medications, nutritional deficiencies, and certain diseases. Common types of hyperpigmentation include post-inflammatory hyperpigmentation, melasma, freckles, age spots, and periorbital hyperpigmentation (dark circles).

Periorbital hyperpigmentation is one of the most frequent cosmetic concerns affecting individuals of different age groups and genders. It appears as dark pigmentation around the eyes and may be caused by genetic factors, vascular changes, dermal melanocytosis, tear trough deformity, environmental exposure, or lifestyle factors. Although it is not life-threatening, it can negatively affect a person's appearance, confidence, and psychological well-being.

Several treatment options are available for hyperpigmentation, including topical agents such as hydroquinone, tretinoin, kojic acid, azelaic acid, niacinamide, vitamin C, and tranexamic acid. However, these treatments may cause side effects like irritation, dryness, peeling, and long treatment duration, which can reduce patient compliance. Therefore, the use of herbal and natural ingredients is gaining attention due to their safety, effectiveness, and fewer adverse effects.

Damascus Rosea (*Rosa damascena*) is a medicinal plant widely used in cosmetics, pharmaceuticals, and traditional medicine. It contains several bioactive compounds such as flavonoids, terpenes, phenolic compounds, and essential oils that possess antioxidant, anti-inflammatory, antibacterial, and skin-soothing properties. These properties help protect the skin from oxidative stress and may contribute to improving skin pigmentation disorders.

Caffeine, a naturally occurring methylxanthine compound, is widely used in cosmetic formulations due to its vasoconstrictive, antioxidant, and anti-inflammatory properties. It can improve blood circulation around the eyes and help reduce the appearance of dark circles and puffiness. Creams are one of the most commonly used topical dosage forms for dermatological treatments. They are emulsions of oil and water that allow easy application, better absorption and improved patient compliance. Cream formulations can be categorized as oil-in-water (O/W) or water-in-oil (W/O) emulsions and are widely used for cosmetic and therapeutic purposes.

The present study focuses on the development of a cream formulation containing Damascus Rosea extract and caffeine for the management of hyperpigmentation, particularly periorbital hyperpigmentation. The formulation is evaluated based on parameters such as pH, viscosity, spreadability, washability, phase separation, and skin irritation to ensure its stability, safety, and effectiveness.

## CONCLUSION

Hyperpigmentation, particularly periorbital hyperpigmentation, is a common dermatological and cosmetic concern that affects many individuals worldwide. Conventional treatments are often associated with side effects and long treatment durations, which highlights the need for safer and more effective alternatives.

Natural ingredients such as Damascus Rosea and caffeine offer promising benefits due to their antioxidant, anti-inflammatory, and skin-protective properties. Damascus Rosea provides soothing and rejuvenating effects on the skin, while caffeine improves microcirculation and reduces pigmentation around the eyes.

The development of a topical cream formulation (F2) containing these natural ingredients provides a convenient and effective approach for managing hyperpigmentation. Herbal-based cosmetic formulations are increasingly preferred due to their safety, minimal side effects, and compatibility with skin physiology.

Therefore, a Damascus Rosea and caffeine-based cream may serve as a beneficial and innovative formulation (F2) for the treatment and management of dark circles and other hyperpigmentation disorders, while also promoting healthier and more radiant skin.

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