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New Generation Natural Face Cream Formulation Development and *In Vitro* Evaluation

Yeni Nesil Doğal Yüz Kremi Formülasyonu Geliştirilmesi ve *İn Vitro* Değerlendirilmesi

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Öz

Amaç: Gelişen toplumlar yüz bölgesinde sivilce, leke, kırışıklık oluşumu ve cildin bozulan yapısı nedeni ile sürekli bakıma ihtiyaç duymaktadır. Sebum oluşumunun artması ve mikroorganizmalar nedeni ile akne ve izleri oluşumu gözlemlenmektedir. Ayrıca ciltte koyu lekeler, aşırı melanin nedeniyle gelişir. *Rosa damascena* Mill. ve, *Avena sativa* L (yulaf) içeren yüz krem formülü geliştirmeyi ve geliştirilen ürünün antimikrobiyal koruyucularının halk sağlığı için uygunluğunu test etmeyi amaçladık.

Kullanılaraktemler: Krem formülasyonları temel olarak üç bileşen (yüzey aktif madde, yağ fazı, su fazı) kullanılarak emülsifikasyon yöntemi ile hazırlanmıştır. Formülasyonların hidrofilik lipofilik denge (HLB) değereleri yağ fazı konsantrasyonundan hareketle hesaplandı. Formülasyyon içerisinde kullanılan bileşenleri güvenilirlikleri MoS değerleri PODsys /(SED*cons.%) üzerinden hesaplandı. Rotasyonal bir vizkozimetre ile krem formülasyonlarının viskoziteleri kaymaya karşı gösterdiği direnç üzerinden hesaplandı. 3 ay süresince farklı iklim koşullarında fizikokimyasal özellikleri test edildi. Dökme plaka yöntemi kullanılarak *Staphylococcus aureus*, aerobik mezofilik (bakteri, maya küfü), *Escherichia coli, Pseudomonas aeroginosa, Candida albicans* için toplam bakteri ve mantar analizleri CFU/g olarak raporlandı.

Bulgular: Krem formülasyonlarının organoleptik kontrolleri sonucunda dokuz formülasyonun homojen ve tek fazlı stabil kremler hazırlandı. Onuncu formülasyon emülgatör seçiminin yanlış yapılması nedeni ile kremlerde gözlemlenen faz ayrışması gözlemlendi. Sürülebilirlik ve reolojik özelliklerinden elde edilen sonuçlarına göre FC-F-7 formülasyonunda viskozite değerleri 1944.5 ± 342.3 cP ile 40953.0 ± 1787.0 cP arasında değişmiştir. Bu değerler göstermiştir ki setil alkol viskozite üzerine etkisi balmumu ve parafin mumu'na göre daha fazla artırmıştır.

Sonuç: Yağ esterleri krem formülasyonlarının reoloji, sürülebilirlik gibi fiziksel özellikleri üzerinde etkili olduğu bulunmuştur. Yüz bölgesi için geliştirilecek krem formülasyonlarında doğal bileşenler ile güvenilirliği ve stabilitesini kanıtlamış formülasyonların tasarımı ve geliştirilmesi gerçekleştirilmiştir.

Anahtar kelimeler: *Avena Sativa* L., Emülsiyon, Mikrobiyolojik analiz, *Rosa damascena* Mill., Yüz Kremi

Abstract

Aim: In developing societies, acne, blemish, wrinkle formation in the face area and the deteriorating structure of the skin require constant care. Acne and scars are observed due to increased sebum formation and microorganisms.

In addition, dark spots on the skin develop due to excess melanin. We aimed to develop a face cream formula containing *Rosa damascena* Mill. and *Avena Sativa* L (oat).
Method: Cream formulations were prepared using three components (surfactant, oil phase, water phase) by emulsification method. Hydrophilic lipophilic balance (HLB) values of the formulations were calculated based on oil phase concentration. Reliability of the components used in the formulation was calculated using MoS values PODsys / (SED*cons.%). It was calculated based on the resistance to shear with a rotational viscometer. Physicochemical properties were tested under different climate conditions for 3 months. Total bacteria and fungi analyses were reported as CFU/g for *Staphylococcus aureus*, aerobic mesophilic (bacteria, yeast mold), *Escherichia coli*, *Pseudomonas aeroginosa*, *Candida albicans* using pour plate method.
Results: The result of organoleptic control of cream formulations showed that nine formulations formed homogeneous and single phase stable creams. The tenth formulation showed phase separation observed in creams due to wrong emulsifier selection. According to the spreadability and fluidity properties, viscosity values in FC-F-7 formulation varied between 1944.5 ± 342.3 cP and 40953.0 ± 1787.0 cP. These results showed that cetyl alcohol increased viscosity compared to beeswax and paraffin wax. As a result of the search for a cream formulation with suitable physicochemical properties for face area, FC-F-7 formulation was developed.
Conclusion: It has been found that fatty esters have an effect on physical properties such as rheology and spreadability when developing cream formulations. In cream formulations to be developed for the face area, the design and development of formulations with natural ingredients that have proven their reliability and stability have been carried out.

Keywords: *Avena Sativa* L, Emulsions, Facial Cream, Microbiological analysis, *Rosa damascena* Mill.

1. Introduction

A balance between natural and synthetic chemical compounds is required. In order to be classified as green cosmetics, a product must contain ingredients that are derived from plants, as opposed to those that are laboratory-produced [1]. Post-inflammatory hyperpigmentation (PIH) is a prevalent dermatological condition with a multitude of potential aetiologies, including drug interactions, albinism, melasma, vitiligo, eczema, and acne vulgaris. Acne vulgaris is a common inflammatory skin condition caused by a blockage of the intercellular spaces in the epidermis and affects 85% of the population during their lifetime. Another problem is skin pigmentation, which determines the colour of the skin. Melanin is the primary pigment responsible for determining skin colour. Pheomelanin is associated with lighter skin tones, whereas eumelanin is linked to darker skin hues [1,2]. The dark brown pigment eumelanin protects the skin from sunburn by absorbing UV rays from the sun. A review of the literature reveals that individuals with higher levels of eumelanin are less susceptible to developing skin cancer [3].

Topical applications of creams are a reliable and efficacious method for addressing dermatological concerns and hyperpigmentation [4]. Facial creams are suitable for use by adolescents, adults and the elderly, depending on the needs of their skin. Medicinal and aromatic plants (MAPs) are a rich source of natural antioxidants and antimicrobial agents. This analysis must be complemented by an evaluation of the extracts' antioxidant and antibacterial potential. Approximately 3000 kg of rose oil and tons of rose water are consumed annually worldwide, with Bulgaria, Türkiye and Iran being the main producers [5]. Oats (*Avena sativa* L.) are used in medicine, especially for skin problems. Oat oils help the skin to stay moist and reduce inflammation [6].

Furthermore, studies have shown that oats can improve skin moisture by regulating the production of anchoring proteins. Rose extract components methanol and ethanol extracts of essential oil showed antioxidant activity in various systems and antimicrobial activity against S. aureus, *S. Typhimurium, B. cereus, C. albicans, P. aeruginosa, P. Fluorescens* [7].

In the contemporary era, cosmetics are employed for skin, hair, nail and oral care [8]. In addition to their cleansing and care functions, these products are also used as facial creams with the objective of rejuvenating, healing, repairing and moisturising the skin [9]. In this regard, there are natural ingredients that are and can be preferred in some face care creams [10,11]. Among these, rose [12], oat [13], rosemary [14], and pelargonium species [15], plants that increase antioxidant capacity containing resveratrol [16,17], beeswax, olive oil, lanolin, and sweet almond oil are available in the literature [18]. This study aimed to create a facial extract formula containing *Rosa damascena* Mill. and *Avena sativa* L (oat), and to test the effectiveness of the antimicrobial preservatives in the product for public health.

2. Material and Methods

2.1. Material

The product contains the following ingredients: Phenoxyethanol, Ethylhexylglycerin (Ashland, Switzerland), Polysorbate 80 (Galenik, Türkiye), Rose pomace (local producer, Türkiye), Oat oil (new raw material, Türkiye), All other materials in the production process are of cosmetic quality.: The following equipment was used: rotational

viscometer PCE-RVI 10 (Hamburg, Germany), pH metre Milwaukee MW150 max (Szeged, Hungary), and heated magnetic stirrer (Isolab, Germany).

2.2. Method

The principal components are rose pomace and oat oil. The cream was made using the emulsification method [12]. Table 1 shows the ingredients. Ten different face creams were made by changing the ingredients. The creams were checked for colour, texture and other physical properties. The formulation was analysed using the pour plate method. The results showed the number of bacteria and fungi in the samples.

2.3. Study of the Formulation

Cream formulations are typical emulsion formulations which are defined as a heterogeneous mixture of two immiscible liquids in a dispersed surfactant. The oil phase components were weighed and melted between 70°C and 80°C until liquefied. The water phase mixture was heated to the same temperature and poured over the oil phase. The temperature was then raised to 40 ^{0}C, and vitamin E and preservatives were added and stirred for 5 minutes. Two distinct concentrations of olive oil, almond oil, and liquid paraffin were utilized, while three varying concentrations of paraffin wax, bees wax, and cetyl alcohol were employed. The efficacy of emulsifiers was evaluated through the utilization of varying quantities, as delineated by the HLB calculation. Ten formulations were developed and subsequently evaluated to ascertain the most efficacious one (Table 1).

Table 1. *Composition of ten different face cream formulations.*

Contents	FC-F-1	FC-F-2	FC-F-3	FC-F-4	FC-F-5	FC-F-6	FC-F-7	FC-F-8	FC-F-9	FC-F-10
Olea Europaea oil (g)	10.00	15.00	15.00	10.00	15.00	15.00	10.00	15.00	15.00	10.00
Almond Oil (g)	15.00	10.00	15.00	15.00	10.00	15.00	15.00	10.00	15.00	15.00
Vaseline (g)	15.00	15.00	10.00	15.00	15.00	10.00	15.00	15.00	10.00	15.00
Beeswax (g)	1.00	2.00	5.00	-	-	-	-	-	-	-
Paraffin wax (g)	-	-	-	1.00	2.00	5.00	0.00	0.00	0.00	0.00
Cetyl Alcohol (g)	-	-	-	-	-	-	1.00	2.00	5.00	1.00
Lanolin (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Span 80 (g)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	2.00
Rose pulp (g)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Oat Oil (g)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	6.00
Glycerin (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tween 80 (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tocopherol (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EDTA (g)	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.
Phenoxyethanol Ethylhexylglycerin (g)	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.
Distilled Water (g)	ad 100	ad 100	ad 100	ad 100	ad 100	ad 100	ad 100	ad 100	ad 100	ad 100

FC-F-1: Face Cream Formulation-1; FC-F-2 Face Cream Formulation-2, FC-F-3 Face Cream Formulation-3, FC-F-4: Face Cream Formulation-4, FC-F-5: Face Cream Formulation-5, FC-F-6: Face Cream Formulation-6, FC-F-7: Face Cream Formulation-7, FC-F-8: Face Cream Formulation-8, FC-F-9: Face Cream Formulation-9, FC-F-10: Face Cream Formulation-10, q.s.: quantum satis, ad: Complete to, EDTA: Ethylenediaminetetraacetic Acid, Span 80: Sorbitan Monooleate, Tween 80: Polysorbate 80

2.4. Study of the Physicochemical

For formulation physicochemical studies, pH and viscosity were measured, and samples were evaluated for homogeneity, phase separation, colour change, and spreadability (n=3).

2.5. Study of the Rheology

Viscosity was quantified with a rotational viscometer, whereby the torque necessary to rotate the shafts within the face cream was calculated and documented on the instrument display. Viscosity was measured using shaft 2 at 6 rpm for 120 seconds. Share ratio was calculated according to equations outlined in our previous studies, considering shaft dimensions, speed and gap between shaft and vessel (equations 1-2) [19]. The clearance between the rotating and stationary components was set at 1.25 mm, resulting in a clearance ratio of 1.2. The share rate was determined using formulations 1-2. A one-way ANOVA test was used to ascertain the significance of the discrepancy between the formula values.

$$y = 2 \times \frac{2 \times \pi \times Ni}{60} \times \frac{{R_0}^2}{{R_0}^2 - Ri^2} \qquad (1)$$

In the equation above, the variable "y" represents the shear rate in units of s^{-1}, the variable "Ni" denotes the rotational speed in revolutions per minute (RPM), and the variables "R0" and "Ri" are the radius of the container and shaft in millimetres (mm), respectively. The apparent viscosity values are plotted as a function of the shear rate and fitted to Equation 2 in accordance with the Ostwald-de Waele relationship.

$$\eta = K.\gamma^{n-1} \qquad (2)$$

The viscosity coefficient is represented by K, and the flow behavior index is represented by n=3.

2.6. Margin of Safety (MOS)

Margin of Safety (MOS) calculation of the face cream formulation for adults was calculated using the values specified in table 4 of the cosmetic products safety assessment guideline (Annex-3) for face cream, and the daily use was found to be 1.54 g/day. The reliability of the ingredients used in the face cream formulation was calculated using formula 3 and formula 4. It was assumed that 100% of the product would be absorbed, which is the worst case for all raw materials. MoS value in dermo-cosmetic products is expected to exceed 100 for adults. These criteria were taken into consideration in the formulation of the face cream.

$$SED=SSA\ (cm^2) \times 10^{-3}mg/\mu g \times F(day^{-1}) \times DAa\ (\mu g/cm^2)/\ 60 \quad (3)$$

$$MoS = POD_{sys}\ /(SED*cons.\%) \geq 100 \text{ (for adults)} \quad (4)$$

2.7. Study of the Stability

Stability studies were conducted for a period of six months to assess the appearance, colour, pH, viscosity changes, and microbiological growth in accordance with International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) and Turkish Medicines and Medical Devices Agency (TITCK directives. The studies were carried out at three temperature levels: in the refrigerator, at room temperature, and 45°C [20].

2.8. Microbiological Evaluation

2.8.1. Preparation of Samples

In this study, the formulation developed for microbiological analyses was disinfected using 70% ethanol. To prepare the sample, 1 g of ethanol was mixed with 9 ml of sterile phosphate-buffered saline (PBS) containing 0.1% polysorbate 80. This mixture was then thawed in a water bath for 10 to 15 minutes. The sample was further diluted with PBS containing 0.1% polysorbate 80, resulting in serial dilutions of 10^{-1}, 10^{-2}, and 10^{-3}. Using the pour plate method, 1 ml from each diluted tube was transferred to a 90 mm petri dish, and the dilutions were repeated twice. Subsequently, 15 to 17 ml of agar medium, cooled to 45°C in a water bath, was poured into the petri dishes and allowed to solidify. The total number of aerobic mesophilic microorganisms was determined using tryptic soy agar (TSA, Merck Germany) at 30 to 35°C for 3 to 5 days. For the enumeration of total yeast and mold count, Sabouraud dextrose agar (SDA) medium was employed, and the medium was incubated at 20-25°C for 5-7 days [21]. In the event of growth, the calculation formula was utilized to enumerate the colonies that could be discerned with the naked eye (5). The formula is as follows:

$$CFU/ml = (\text{Total number of colonies obtained x dilution}) / (\text{Sample volume}) \quad (5)$$

2.8.2. Study of Aerobic Mesophilic Microorganisms

One ml of each sample was placed in a sterile petri dish and then mixed with 20 mL of Tryptone Glucose Extract Agar (TGEA) to quantify aerobic mesophilic bacteria. The plates were incubated at 32.5 ± 2.5°C for 3 to 5 days. Following this incubation period, the number of colony-forming units (CFU) per gram of sample was calculated [22].

2.8.3. Study of Yeast and Mold

For the enumeration of yeast and mould, one mL of each sample was taken and transferred onto Sabouraud Dextrose Agar (SDA). Subsequently, the plates were incubated at a temperature of 22.5 ± 2.5°C for a period of 5 to 7 days. Following the incubation period, the number of colony-forming units (CFU) per gram of the sample was calculated. [21]

2.8.4. Study of *Escherichia coli*

One ml of each sample was plated on MacConkey Agar (MCA) (Merck, Germany). The plates were incubated for 18 to 72 hours at 30-35℃. If there was growth, brick-red colonies surrounded by precipitated bile indicated the presence of *Escherichia coli* [22]

2.8.5. Study of *Staphylococcus aureus*

One ml of each sample was plated on Baird Parker Agar (Merck, Germany). The plates were incubated for 18 to 72 hours at 30 to 35°C. If growth occurs, black, shiny colonies surrounded by clear zones will be seen [22].

2.8.6. Study of *Pseudomonas aeruginosa*

One ml of each sample was taken and transferred to Cetrimide Agar (Merck, Germany). The plates were then incubated at a temperature between 30°C and 35°C for a period of 18 to 72 hours. If growth occurs during incubation, the plates will display colonies that range in color from yellow to green [22].

2.8.7. Study of *Candida albicans*

One ml of each sample was plated onto Sabouraud Dextrose Agar (SDA) medium. The plates were then incubated at 25 °C for 5 to 7 days. If growth occurs during incubation, white to beige colonies will be visible on the plates. If growth is observed, the number of colonies is calculated using Formula 5 [22].

Table 2. pH, appearance, HLB and rheological results of the developed products (n=3).

Formulation code	Appearance	pH	Oil Phase HLB	Sorbitan monooleate %	Viscosity (cP)	Shear Rate (1/sec)	Shear Stress (D/cm2)
FC-F-1	Homogeneous Cream	5.971 ± 0.21	6.88	6.37	5892.3 ± 602.5	6	353.54 ± 0.92
FC-F-2	Homogeneous Cream	5.935 ± 0.33	7.12	6.34	6053.4 ± 522.8	6	363.20 ± 0.73
FC-F-3	Homogeneous Cream	5.917 ± 0.18	7.11	6.49	12308.6 ± 621.4	6	738.52 ± 1.02
FC-F-4	Homogeneous Cream	6.137 ± 0.23	6.88	6.37	6221.3±342.1	6	373.26 ± 0.64
FC-F-5	Homogeneous Cream	6.112 ± 0.31	7.12	6.34	8435.3±333.5	6	506.12 ± 0.76
FC-F-6	Homogeneous Cream	6.049 ± 0.28	7.11	6.49	12203.6±356.2	6	732.18 ± 0.82
FC-F-7	Homogeneous Cream	5.902 ± 0.22	6.88	6.37	7174.0±242.5	6	430.44 ± 0.96
FC-F-8	Homogeneous Cream	5.957 ± 0.17	7.12	1.96	10104.4 ± 322.7	6	726.24 ± 0.56
FC-F-9	Homogeneous Cream	5.942 ± 0.15	7.12	6.49	16430.0 ± 473.2	6	1105.00 ± 1.2
FC-F-10	Heterogeneous Cream	-	6.88	2.03	-	-	-

Face cream formulation (FC-F), Hydrophilic-lipophilic balance (HLB)

3. Results

The physicochemical, stability and microbiological limits of face cream formulations were tested, and it was concluded that they met the required standards. Following this, the formulations were characterized and assessed for safety, and it was determined that the FC-F-7 formulation was the most suitable of the eight tested, exhibiting the best appearance, flow properties, and stability.

3.1. Result of the Physicochemical Tests

Face cream formulas were analyzed for taste, texture, pH, and stability, and the best formula was found (Table 2)

3.2. Results of the HLB Calculation

The emulsifier quantity for cream formulations was calculated using the HLB values of the emulsifiers. To assess the efficacy of the HLB calculation in emulsion formation, the concentrations of the emulsifiers utilized in the optimal formulation, FC-F-7, were altered, and the formation of the emulsion was evaluated. The findings revealed that the use of inaccurate emulsifier ratios in FC-F-10 resulted in the absence of a cream formation and phase separation. However, the selection of emulsifiers for the remaining nine formulations was deemed appropriate, and no phase separation was observed (Fig. 1).

3.3 Results of Rheological Studies

Rheological studies were carried out at room temperature (24 ± 0.5^{0}C) by controlling the

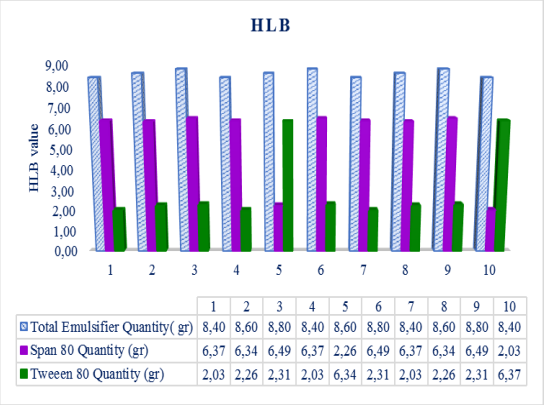

Figure 1. HLB comparison for face cream formulations

temperature with a heating jacket system. During the determination of the rheological properties of the FC-F-7 optimum face cream formulation, although the shear rate increased, the shear stress and viscosity did not increase similarly and exhibited pseudo-plastic flow, which is a type of flow thinned by shear. According to the results, shear rate was between 0.10 s^{-1} and 19.32 s^{-1}, shear stress was between 39.57 ± 0.04 and 375.64 ± 8.13 (D/cm^2) and viscosity values were between 1944.5 ± 342.3 and 40953.0 ± 1787.0 cP. It has been shown that the viscosity results have changed significantly as a result of increasing the fatty ester ratio from 1g to 5g. Among the formulations, FC-F-1, FC-F-4 and FC-F-7 formulations used at 1g oil esters have been found to have more suitable spreadability for the

face. The FC-F-7 formulation, which is the most suitable for the face cream formulation, compared to the FC-F-1 and FC-F-4 formulations containing beeswax and paraffin wax at the same concentration (Table 2, Fig. 2, Fig. 3). Formulation FC-F-10 was excluded from rheological studies because phase separation was observed (Table 2).

3.4 Microorganism Evaluation Results

The tested face cream formulation did not demonstrate any growth. The product exhibited no growth on the 14th and 28th days following the application of the preservative.

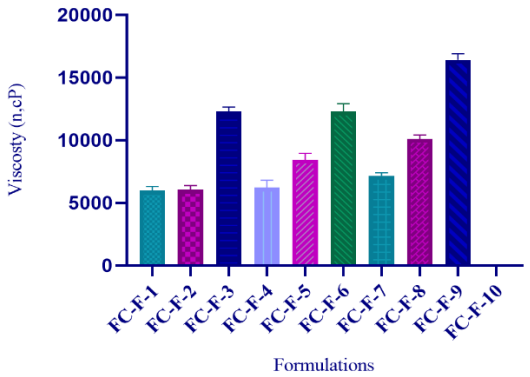

Figure 2. *Viscosity, shear stress, shear rate results of face cream formulations* (n=3)

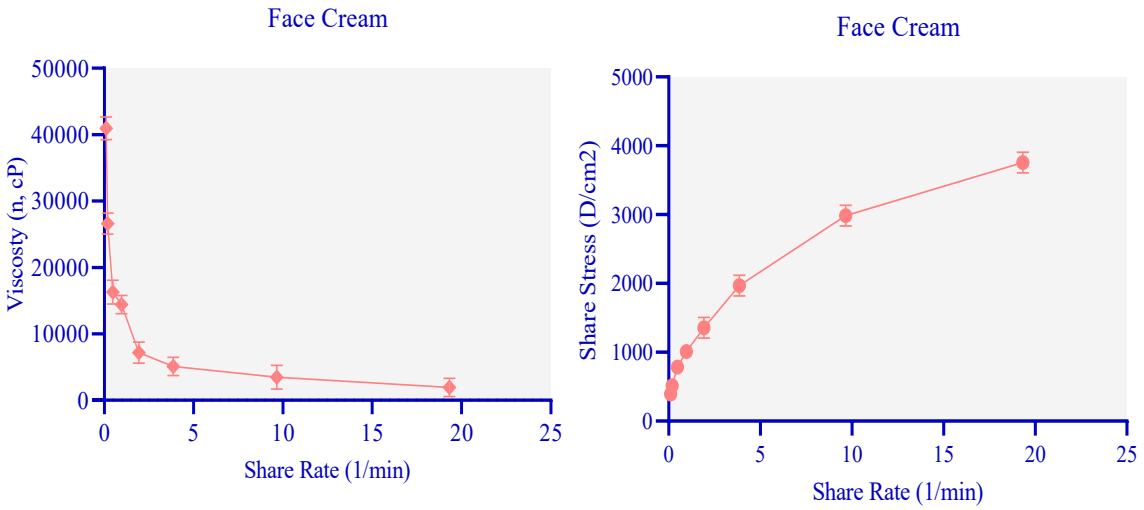

Figure 3. Plot of viscosity and shear stress of optimum formulation FC-F-7 against shear rate (n=3)

Table 3. *Microbiological test results of the cosmetic sample*

Microorganisms	**Results**
Aerobic mesophilic microorganisms	≤1 x 10^2 cfu/ g
Yeast and mould	≤10^2 cfu/g
E. coli	No growth
P. aeruginosa	No growth
S. aureus	No growth
C. albicans	No growth

3.5 Safety Range Results

The safety assessment results for FC-F-7 are in the Table 4. The MoS value should be 100 or above for the concentration ratios of the components. Olive oil, almond oil and rose pulp are safe for topical applications regardless of the usage concentration. Calculations confirm that the concentrations of all components in FC-F-7 formulations are suitable for adult use.

3.6 Stability Results

Stability studies were carried out in the refrigerator, room and oven (45 ^{0}C) for 6 months in accordance with ICH directives and TİTCK cosmetic regulation.

Appearance, color, viscosity changes and microbiological growth were controlled (Table 5). Rose pulp, oat oil containing face cream preserved its physicochemical properties in all environments.

Table 4*. MoS values of the components of FC-F-7 Formulation*

Ingredients	POD_{sys}	MoS
Lanolin	2000	3898>100
Vaseline	1000	130>100
Beeswax	250	162>101
Paraffin Wax	1000	650>100
Cetyl Alcohol	1822	1183>100
Glycerin	1000	649>100
Sorbitan monooleat	1000	306>100
Polysorbate 80	500	422>100
Tocopherol	125	487>100
EDTA	250	487>100
Phenoxyethanol/Ethylhexyglycerol	800	1559>100

Appearance, color, viscosity changes and microbiological growth were controlled (Table 5). Rose pulp, oat oil containing face cream preserved its physicochemical properties in all environments. After organoleptic controls, it was observed that specific appearance and color remained the same from day 0 to month 6. Cream formulation preserved its rheological properties for 6 months in different

climatic conditions. The pH value was between 5.0 and 6.5, which is normal for the face. It did not cause any irritation. Preservative efficacy test (45^0C) was carried out in the oven for microbiological growth control and no growth was observed.

Table 5. *Stability results in different conditions and periods*

Stability conditions	Control Period Month	Appearance	Color	pH	Viscosity (n/cP)	Growth at 45°C
Room	0^{rd}	Homogeneous Cream	Specific	5.902 ± 0.22	7174.0 ± 242.5	None
	3^{rd}	Homogeneous Cream	Specific	5.910 ± 0.17	7044.0 ± 312.3	None
	6^{rd}	Homogeneous Cream	Specific	5,911 ± 0.25	7014.0 ± 345.1	None
Incubator (45°C)	0^{rd}	Homogeneous Cream	Specific	5.902 ± 0.22	7174.0 ± 242.5	None
	3^{rd}	Homogeneous Cream	Specific	5.911 ± 0.25	6997.0 ± 413.2	None
	6^{rd}	Homogeneous Cream	Specific	5.915 ± 0.28	6934.0 ± 376.1	None
Refrigerator	0^{rd}	Homogeneous Cream	Specific	5.902 ± 0.22	7174.0 ± 242.5	None
	3^{rd}	Homogeneous Cream	Specific	5.905 ± 0.24	7124.0 ± 303.7	None
	6^{rd}	Homogeneous Cream	Specific	5.906 ± 0.21	7101.0 ± 206.7	None

4. DISCUSSION

Plants have been used as medicine since the beginning of human civilization. This study looked at rose pulp from the Isparta region as a possible ingredient for face cream. Natural ingredients were used to make the products. Olive oil, almond oil, beeswax, and lanolin are often used in cosmetics to protect the skin and improve appearance. Ten formulations with different oil concentrations were tested. Kahn et al. show that ight times, speeds, and temperatures are important for preparing creams with the emulsification method. If the optimum values are not achieved, coalescence, flocculation, and phase separation may occur [23].

Cream formulations are simple emulsions, therefore, the amount and ratio of emulsifiers used are important. Kurt et al. observed phase separation using the terz HLB technique in a diaper rash cream developed for infants[18]. In addition to the 9 formulations developed, the emulsifier amounts were changed in the 10th formulation, and it was shown that emulsifier selection and concentrations were necessary for cream formation. Phase separation was observed, and no cream was formed. The rheological studies of the formulations revealed that the oil esters used at a concentration of 1g exhibited the most suitable viscosity characteristics. Szumała and Ganguly observed that the viscosities of the formulations in which the cetyl alcohol ratio was 6.88% in accordance with the emulsion ratio in the formulation they developed with cetyl alcohol and beeswax were superior and resulted in the formation of rheologically stable formulations [24,25]. The viscosity value of the FC-F-7 formulation developed using cetyl alcohol was found to be high. These results are consistent with the findings of previous studies on the viscosity of similar formulations

[26]. Rheological studies of FC-F-7 formulation found that it has pseudoplastic flow, which is a thinning flow character depending on the applied flow rate.

Stability study results of face cream formulations showed that FC-F-7 formulation preserved its properties in three different climate conditions with the use of excipients at the right concentrations. As a result, suitable formulations were prepared for face cream developed with rose pulp in terms of spreadability, homogeneity, and flow properties.

A review of the literature on facial creams reveals that natural ingredients are frequently employed for anti-ageing, skin smoothing and microbial activity. In previous studies, oat and rose plants were used separately. About oats, Diadora et al. noted the moisturising effects of oats in a single study [6]. There is a substantial body of literature on cosmetic and antimicrobial studies on rose. Denkova et al. conducted studies on these effects of rose [7]. In our study, oat and rose plants were used together in cosmetic products and contributed to the literature.

The production of cosmetic products is susceptible to contamination, and the presence of *Staphylococcus, Pseudomonas, Aspergillus and Penicillium* species is to be avoided [27]. Following the addition of preservatives to the developed product, no growth was observed on days 14 and 28. It was thus established that the product in question complies with the stipulated microbiological limit values.

5. Conclusion

The research findings indicated that the cream preparations were stable, homogeneous, safe, and healthy. It is possible to develop suitable creams for the face using herbal resources. The developed formula contains antioxidants that maintain the skin's moisture levels, prevent irritation and protect against dehydration. The utilisation of herbal sources in the formulation of cosmetic products allows for the creation of natural products formation and phase separation.

Ethics Committee Approval: This study has been performed with cell culture. Ethical approval is not required.

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Conflict of Interest: There is no conflict of interest

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