

Formulation Of Herbal Cream From *Lavandula Angustifolia* Leaves Extract And *Aloe Vera* GelCollins O. Airemwen^{1,2*}, Rima Alhussen², Emmanuel M. Halilu², Johnbull A. Obarisiagbon³

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Abstract

Background and objective: Creams are semisolid formulations for external skin and mucous membrane application. The study aimed to formulate cream from the leaves extract of *Lavandula angustifolia* and *Aloe vera* gel.

Method: Three batches (L1, L2 and L3) of the herbal cream were formulated by mixing the aqueous and oily ingredients at 75°C with a homogenizer. The formulated creams' different parameters were evaluated, such as viscosity, spreadability, pH, appearance, homogeneity, irritancy, erythema, oedema, stability and antioxidant effect.

Results: The formulated creams possessed a significant antioxidant effect with IC₅₀ values of 2.30-6.12 mg/mL, saponification values of 20.9-28.4, acid values of 5.2-5.9, pH values of 5.5-6.2 and viscosity of 24,427-25,614 cps. The formulations also showed good washability, spreadability, consistency, texture, homogeneity, appearance, and stability, and there was no evidence of phase separation.

Conclusion: The formulated creams showed no erythema, inflammation, oedema and irritation during irritancy studies. The creams were stable at room temperature and safe for application to the skin.

Keywords: *Aloe vera*, cream, emulsion, *Lavandula angustifolia*

Introduction

Creams are semisolid, often medicated preparations intended for external skin and mucous membrane application. They are semisolid dosage forms containing one or more drug substances dissolved or dispersed in a suitable base. They are usually softer in consistency than ointment^[1]. Creams are of two types, aqueous and oily creams, which are oil in water (o/w) and water in oil (w/o) creams, respectively. Oil-in-water (o/w) creams are composed of small droplets of oil dispersed in a continuous phase (water). Emulsifying agents of natural origins, such as beeswax, wool alcohol and wool fat, are generally used in their preparation. Oil-in-water creams are more comfortable and cosmetically acceptable as they are less greasy and more easily washed off using water. Water-in-oil (w/o) creams are composed of small droplets of water dispersed in a continuous oily phase. They are more difficult to handle, though many drugs incorporated into creams are hydrophobic and will be released more steadily from a w/o cream than an o/w cream. They are more moisturizing as they provide an oily barrier which reduces water loss from the stratum corneum, the outermost layer of the skin, e.g. cold cream^[2].

Cosmetic creams consist of general-purpose creams such as baby, barrier, bleaching, cleansing, cold, hair, hand and vanishing creams. In contrast, medicated creams contain active pharmaceutical ingredients, e.g. cetrimide cream used as an antiseptic, zinc oxide cream used as an astringent and hydrocortisone cream used to treat rashes. Pharmaceutical and cosmetic creams are a prevalent form of external medications^[3]. The demand for herbal cosmetic creams is increasing because they are relatively safer than synthetic creams. Herbal cosmetic products enhance the skin's beauty, attractiveness and elegance^[4]. Previous studies have shown that lavender extract and aloe gel have a moisturizing and wound-healing effect on the skin^[5]. Herbal creams are prepared to reduce wrinkles, fight acne, control oil secretion, and treat various skin diseases. Herbal cosmetic formulations have been

used to manage skin infections for a long time, and their effects are also well-accepted, especially in rural areas [2]. *Lavandula angustifolia* plant, commonly called the "English Lavender", is an essential member of the Lamiaceae family and can be found across the Mediterranean regions in countries such as Cyprus, Italy, France, and Spain. Lavender extract has a soothing, calming, and healing effect on the skin. It is beneficial for skin diseases such as minor burns, wounds, insect bites, stings, acne and sunburn [5]. *Lavandula angustifolia* is a well-known fragrant and medicinal plant used traditionally to treat various gastrointestinal, rheumatic and neurological diseases [6]. Previous studies have shown that *Lavandula angustifolia* leaves possess antinociceptive, immunomodulatory, antioxidant, antibacterial [7], antifungal [8], anti-parasitic [9], wound healing and anti-inflammatory activities [10]. It is also used in aromatherapy massage (lavender inhalation) [11] and bathing [12]. *Aloe vera* L., sometimes called the "miracle" plant, belongs to the Liliaceae family and is mainly cultivated in tropical regions. From 2000 years ago, Greek intellectuals referred to the *Aloe* plant as the 'universal panacea', and Egyptians named *the Aloe* "the plant of immortality." The leaves of *Aloe vera* consist of a thick epidermis and a cuticle, known as a 'healing plant'. Once the epidermis is removed, a transparent, clear mucilaginous gel is formed [13].

Aloe gel (AG) is the popular name of the parenchymatous leaf gel, which exhibits a wide variety of pharmacological effects. *Aloe* gel has been used to formulate cosmetic products such as skin moisturizers, soaps, shampoos, face and hand creams, sun protection products and skin lighteners [14]. AG may also be found in a wide variety of shaving creams, bath products, make-up and aroma products for babies [15]. Previous studies have shown that *Aloe* gel possesses antiviral, antibacterial, laxative, radiation protection, antioxidant, anti-inflammation, anti-cancer, anti-diabetic, anti-allergic, and immunostimulatory activities [16,17]. Ankush and Bharat [2] have previously formulated herbal cosmetic cream using *Daucus carota* and *Ocimum sanctum*, while Rajvanshi *et al.* [18] formulated herbal cream of *Cyperus rotundus* and *Cucumis sativus* for external application to the skin. *Lavandula angustifolia* leaves, and *Aloe vera* gel are widely used in therapy for skin irritation and diseases, and they have not been formulated into standardized creams; hence, this study aimed to formulate herbal creams using these natural plants and evaluate the formulations for antioxidant effect, viscosity, stability, spreadability, pH, homogeneity, erythema and irritancy.

Materials and Methods

Materials

Lavandula angustifolia leaves, *Aloe vera* gel, pH meter (Mettler Toledo, Switzerland), Viscometer (Brookfield, USA), 2,2-diphenyl-1-picrylhydrazyl (DPPH) (Merck, Germany), UV spectrophotometer (Shimadzu, Japan).

Collection of plant material

The Aloe vera plant and the *Lavandula angustifolia* leaves were obtained from the botanical garden of Cyprus International University, Lefkosa, Cyprus (Latitude: 35.2107° N; Longitude: 33.4271° E) in April 2022. The plants were authenticated by a Pharmacognosist (Dr Mshelia Halilu). The specimen was prepared and deposited at the Herbarium of the Faculty of Pharmacy, Cyprus International University, Cyprus, with voucher B296 for reference purposes. The *Lavandula angustifolia* leaves were air-dried for 14 days and then size reduced with a wooden mortar and pestle. The powder obtained was stored in a plastic container for future use. Also, healthy mature and fresh *Aloe vera* leaves were collected and washed with distilled water. After drying the leaves adequately, the outer part of the leaves was longitudinally dissected using a sterile knife to obtain the *Aloe vera* gel consisting of colourless parenchymatous tissue. The extracted gel was then filtered using muslin cloth to remove unwanted fibres and other impurities [19].

Organoleptic examination of *Lavandula angustifolia* dried leaves

The organoleptic examination of *Lavandula angustifolia* powdered leaves was performed using the specific sensory organs to identify the colour, texture, odour and taste. The organoleptic characters of the sample were examined according to the method previously described by Khayat *et al.* [5].

Extraction of Lavandula angustifolia

The dried sample (30 g) was macerated using 200 mL of ethanol in a flask. The sample was allowed to soak for 12 hours and then filtered. The obtained residue was washed with fresh solvent three more times to ensure proper extraction. The liquid extract was concentrated using the rotary evaporator.

Formulation of herbal cream

The cream was formulated according to the method previously described by Navindgikar *et al.* [20]. The oily phase, which includes olive oil and beeswax, was heated in a borosilicate glass beaker to a temperature of 75°C. At the same time, borax was dissolved in distilled water to form the aqueous phase and heated to the same temperature as the oily phase. The aqueous phase was added to the heated oily phase in three portions. Then, the appropriate amount of *Lavandula angustifolia* extract and *Aloe vera* gel was added and stirred continuously using a homogenizer in one direction until a smooth cream was formed. Three different batches (L1, L2 and L3) of the cream were prepared to obtain the optimized formulation. The formula used to prepare the creams is shown in Table 1.

Table 1: Formula of herbal cream

S/No.	Ingredients	Formulations		
		L1	L2	L3
1.	<i>Aloe vera</i> gel (mL)	1.0	1.5	2.0
2.	Lavender extract (mL)	1.5	2.5	3.0
3.	Beeswax (g)	1.5	1.5	1.5
4.	Olive oil (mL)	5.0	5.0	5.0
5.	Borax (g)	1.5	1.5	1.5
6.	Distilled water (mL)	14.5	13.0	12.0

Evaluation of herbal cream*Physical evaluation*

The cream (2 g) was applied on the dorsal surface of the hand and spread gently. The colour, odour and texture of the cream were recorded.

Irritancy

An area of 1 square centimetre was marked on the left-hand dorsal surface, the cream (2 g) was applied to the marked area, and the time was recorded. The marked skin area was checked at regular intervals up to 24 h for irritation, erythema, and oedema, and the results were documented.

Washability

The ease of removal of the cream from the marked area of the skin was examined by washing the applied part with tap water, and the results were documented.

pH determination

The cream (0.5g) was dissolved in 50 mL of distilled water. A digital pH meter (Mettler Toledo, Switzerland) was calibrated using a standard buffer solution for the readings.

Acid value

The cream (5 g) was dissolved in a 50 mL mixture of equal volumes of alcohol and ether; the flask was connected to a reflux condenser and slowly heated until the sample was dissolved completely. Phenolphthalein (1 mL) was then added and titrated with 0.1N NaOH until a faintly pink colour appeared after shaking for 30 s, and the acid value was determined using Equation 1.

$$\text{Acid value} = \frac{n \times 5.61}{w} \quad - \quad - \quad - \text{equ 1}$$

Where n = the number of mL of NaOH required, w = the weight of the cream

Saponification value

The cream (2 g) was refluxed with 25 mL of 0.5 N alcoholic potassium hydroxide for 30 min. 1 mL of phenolphthalein was added and titrated immediately with 0.5 N HCl. The saponification value was determined using Equation 2.

$$\text{Saponification value} = \frac{(b-a) \times 28.05}{w} \quad - \quad - \quad - \text{equ 2}$$

Where a = the volume in mL of titrant, b = the volume in mL of titrate and w = the weight of the substance in g.

Spreadability

The study used two identical sets of glass slides with conventional dimensions. The cream mixture was then placed on a slide with the proper dimensions, and a second slide was retained on top of the formulation. A specified load or a certain weight was applied on the upper slide to squeeze the cream between the two slides evenly to create a thin layer. Once the pressure was interrupted, the excess formulation sticking to the slides was scraped off. The weight attached to the top slide enabled it to fall off easily. The time it took for the top slide to slip off was recorded.

Finally, the spreadability value was calculated using Equation 3:

$$\text{Spreadability} = \frac{m \times l}{t} \quad - \quad - \quad - \text{equ 3}$$

Where;

m= standard weight tied to or placed over the upper slide, l= length of a glass slide and t= time taken(s).

Greasiness

In order to determine whether or not the cream was greasy, it was spread onto the skin in large amounts, and the results were noted.

Viscosity

The viscosity of the formulation was determined using Brookfield Viscometer (USA) at 100 rpm, using spindle no 7.

Dye test

The scarlet red dye was mixed with the cream. A drop of the cream was placed on a microscopic slide and covered with a cover slip, then examined under a microscope.

Homogeneity

The formulations were tested for homogeneity by visual appearance and by touch.

Appearance

The appearance of the cream was examined by visual inspection of its colour, pearlescence and smoothness.

After feel

The emollience, slipperiness and residue left after applying a fixed amount of cream was checked.

Evaluation of antioxidant activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH)

The antioxidant activity of the *Lavandula angustifolia* leaves extract, and the cream was investigated according to the previous method described by Airemwen and Obarisiagbon^[19]. The leave extract and the diluted cream (1 g) each were used to prepare a 10 mg/mL stock solution. Serial dilutions were done to obtain 5, 2.5, 1.25 and 0.25 mg/mL solutions. The DPPH (0.8 mM) was prepared in methanol, then added to the samples' test tubes and incubated for 30 min in the dark. The absorbance of each sample was measured at 470 nm using a UV spectrophotometer (Shimadzu, Japan). The percentage inhibition was calculated using Equation 4.

$$\text{Percentage inhibition} = \frac{\text{Absorbance of control} - \text{Absorbance of sample}}{\text{absorbance of control}} \quad - \quad - \quad \text{equ 4}$$

Accelerated stability testing

Accelerated stability testing was done for two (2) most stable formulations (L2 and L3) at room and elevated temperature (40°C) and observed on the 0, 5th, 10th, 15th and 20th day^[21].

Results

Organoleptic examination

The organoleptic evaluation of *Lavandula angustifolia* leaves revealed a fine, smooth, dark green powder with a fragrant odour and bitter taste (Table 2).

Table 2: Organoleptic evaluation of *Lavandula angustifolia* leaves

S/No.	Parameter	Results
1.	Size	Fine powder
2.	Colour	Dark green
3.	Texture	Smooth
4.	Odour	Fragrant odour
5.	Taste	Bitter taste

pH of the cream

Batches L1, L2 and L3 of the formulated creams had pH values of 5.8, 6.2 and 5.5, respectively (Table 3). All the formulations had pH values within the acceptable range (4.7-6.5) for healthy skin.

Table 3: pH values of the creams

Formulation	pH
L1	5.8
L2	6.2
L3	5.5

Viscosity

Viscosity is the resistance of a liquid to flow. It is a result of interaction between the different molecules in a fluid. The viscosity of the formulated creams was in the range of 24,427 – 25,614 cps, which indicates that the cream is easily spreadable by small amounts of shear (Table 4).

Table 4: Viscosity values of the creams

Formulation	Viscosity (cps)
L1	24,427±0.01
L2	24,837±0.02
L3	25,614±0.01

Dye test

From the dye test, the dispersed globules appear red and the background colourless, confirming that the cream is an o/w type. The reverse condition occurs in a w/o cream, i.e. the dispersed globules appear colourless on the red background.

Spreadability

The ability of the cream to spread was evaluated by the time it took for two slides to separate from the cream present between them under a specific load. The less time the two slides take to separate, the greater the spreadability of the cream. All the formulated creams had spreadability values of <10 s, which indicates good spreadability [18].

Acid value and Saponification value

The acid value is the mg of potassium hydroxide required to neutralize the free carboxyl groups in 1g of the cream, and it is usually expressed as mg/KOH per g. The acid value is determined in the cold and measures the free fatty acid content. The saponification value is the number of mg of potassium hydroxide required to react completely with all the reactive groups in the mg of the cream. It is also expressed as mg/KOH per g. Saponification is determined hot under reflux in an alcohol solution of potassium hydroxide (KOH). The triglycerides are broken down into glycerin and free fatty acids, neutralized with potassium hydroxide. The acid values for the three batches (L1, L2 and L3) of creams formulated range from 5.2-5.9, while the saponification values ranged from 20.9 – 28.4 (Table 5).

Table 5: Results of the acid and saponification value of the creams

Formulation	Acid value	Saponification value
L1	5.2±0.01	20.9±0.01
L2	5.9±0.01	25.2±0.01
L3	5.7±0.01	28.4±0.02

Irritancy test

The formulations L1, L2 and L3 showed no erythema, oedema, inflammation or irritation during the observation period, which shows that the formulations are safe and harmless to the skin (Table 6). This result is similar to the results obtained by Sahu *et al.* [21].

Table 6: Results of erythema, oedema and irritant effect

Formulation	Erythema	Edema	Irritant
L1	Nil	Nil	Nil
L2	Nil	Nil	Nil
L3	Nil	Nil	Nil

Homogeneity, appearance, after feel and washability

All the formulations produced a homogenous distribution of the extracts in the cream, which was confirmed by visual appearance and touch. The creams were emollient and had good washability.

DPPH scavenging activity of Lavandula angustifolia leaves extract and cream

The quantitative antioxidant assay results were expressed as IC_{50} and percentage inhibition (Table 7 and Figure 1). The result revealed that the cream had a better antioxidant activity than the extract at all concentrations. However, the ascorbic acid showed higher activity than the cream and leaves extract. Based on the percentage inhibition, the antioxidant effects demonstrated by all the samples were concentration-dependent. From the graph of the percentage inhibition against concentration, the IC_{50} of the extract, cream and ascorbic acid were 2.30 mg/mL, 3.82 mg/mL and 6.12mg/mL, respectively (Table 7).

Table 7: Percentage inhibition of cream, extract and ascorbic acid against DPPH

Conc. (mg/mL)	Extract (%)	Cream (%)	Ascorbic acid (%)
10	18.64	28.58	36.74
5	32.25	43.32	60.42
2.5	52.85	62.56	76.36
1.25	67.78	78.21	89.43
0.625	80.14	90.54	95.49

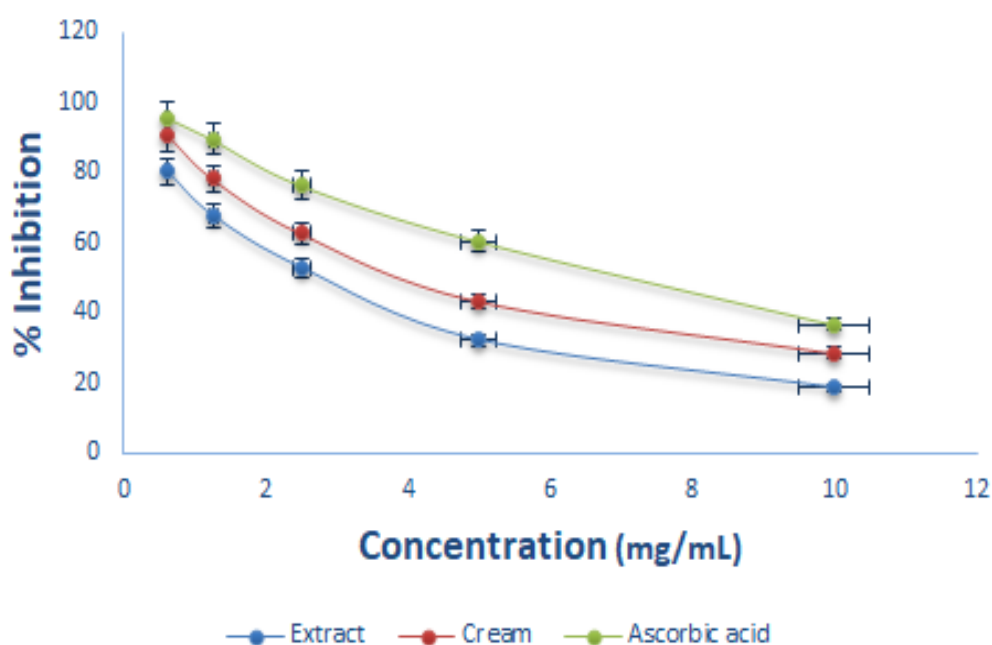


Figure 1: Percentage inhibition of cream, extract and ascorbic acid on DPPH

Accelerated stability test

The accelerated stability test results showed that the formulations L2 and L3 were stable, as there was no phase separation and no significant change in colour and pH values during the test period (Table 8).

Table 8: Results of accelerated stability test

Days	Temperature	Formulation	pH	Appearance	Spreadability	Type of smear
0	RT	L2	6.1	NCC	**	NG
		L3	5.8	NCC	**	NG

	40°C	L2	6.0	NCC	**	NG
		L3	5.5	NCC	**	NG
5	RT	L2	5.9	NCC	**	NG
		L3	6.2	NCC	**	NG
	40°C	L2	5.3	NCC	**	NG
		L3	5.9	NCC	*	NG
10	RT	L2	6.4	NCC	**	NG
		L3	5.7	NCC	*	NG
	40°C	L2	5.8	NCC	**	NG
		L3	6.4	NCC	**	NG
15	RT	L2	6.1	NCC	**	NG
		L3	5.8	NCC	**	NG
	40°C	L2	5.6	NCC	*	NG
		L3	6.4	NCC	**	NG
20	RT	L2	6.2	NCC	**	NG
		L3	5.8	NCC	**	NG
	40°C	L2	5.7	NCC	**	NG
		L3	6.2	NCC	*	NG

NCC: No colour change, **: Good, *: Satisfactory, NG: Non greasy

Discussion

The formulated creams were emollient, smooth, soft, slippery, non-greasy and had good washability as they were easily removed with tap water after application. The formulations were safe and did not cause erythema, inflammation, skin irritation or allergic reaction. The pH of the cream was found to be in the range of 5.5 – 6.2, which lies within the value of healthy skin pH. Previous studies have shown that acidic pH values of 1-4 can cause acne, oily skin, erythema and inflammation, while alkaline pH values of 8-12 can cause skin dryness, sensitivity, sun damage and wrinkles [2]. All the formulations (L1, L2 and L3) showed good viscosity values for creams. The rheological behaviour of the cream confirmed that it had dilatant flow or shear-thickening (an increase in viscosity with increasing rate of shear in a steady shear flow) characteristics. All the formulations showed no thixotropic (shear-thinning) characteristics.

The result of this study conforms to a previous study by Ankush and Bharat [2], who formulated herbal cosmetic cream using *Ocimum sanctum* and *Daucus carota* with viscosity values ranging from 27019-27023 cps. This dye test confirms that all the formulations were o/w emulsion creams. The acid and saponification values of all the formulated creams were within acceptable values and similar to the results of a previous study by Ankush and Bharat [2]. The higher antioxidant activity demonstrated by the cream may be due to the synergistic effect of *Lavandula angustifolia* leaf extract and aloe gel in the cream, as previous studies have shown that both plants possess significant antioxidant effects [14]. The formulated creams had a good DPPH scavenging activity and antioxidant effect. They were compared with ascorbic acid (vitamin C) as a standard natural antioxidant. From the study results, the extract and cream were able to scavenge DPPH in a concentration-dependent manner, and ascorbic acid, being the reference antioxidant, had a better scavenging activity than the extract and cream. The findings from the accelerated stability test show that there was no colour change when the cream was kept for a long time as the colour remained green. These observations were similar to the findings obtained by Sahu *et al.* [21]. This shows that the creams can be safely stored at room temperature.

Conclusion

The study successfully formulated Herbal cream using *Lavandula angustifolia* leaves and *Aloe vera* gel. The formulated creams possessed a significant antioxidant effect and showed no erythema,

inflammation, oedema or irritation. The creams were stable at room temperature and safe for application to the skin.

Conflict of Interest

The authors declared no conflict of interest.

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