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### Design and Evaluation of Skin Firming Serum with Microencapsulated Ceramid

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#### ABSTRACT

Indeed, the pursuit of beauty transcends age. While aging is inevitable, the desire to maintain a vibrant and youthful appearance is a timeless aspiration for many. Embracing skincare routines, healthy habits, and self-care rituals can help individuals feel confident and radiant at any stage of life. Beauty is not solely defined by youthfulness but also by the grace and wisdom that come with age. It's about feeling comfortable in one's skin and embracing the journey of aging gracefully.

**Keywords:** Firming, antiaging, free radical scavenging, ceramides, microcapsule

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#### Introduction:

Skin aging refers to the process by which the skin undergoes changes over time due to both intrinsic and extrinsic factors. Intrinsic aging, also known as chronological aging, is influenced by genetic factors and naturally occurs as a person gets older. Extrinsic aging, on the flip side, is caused by external factors such as sun exposure, pollution, smoking, and unhealthy lifestyle choices. Scientifically, skin aging involves several physiological and biochemical changes, including:

- **Decreased Collagen and Elastin Production:**

Collagen and elastin are proteins that provide structural support and elasticity to the skin. With aging, the production of these proteins decreases, leading to sagging and wrinkling of the skin.

- **Loss of Moisture and Hydration:**

Aging skin tends to lose its ability to retain moisture, leading to dryness and an increased risk of irritation and inflammation.

- **Formation of Wrinkles and Fine Lines:**

As the skin loses its elasticity and firmness, wrinkles and fine lines become more prominent, especially in areas exposed to repetitive movements, such as around the eyes and mouth.

- **Decreased Skin Cell Turnover:**

The rate at which skin cells regenerate slows down with age, resulting in a dull complexion and uneven skin tone.

- **Increased Pigmentation:**

Aging can lead to the melanin overproduction, the pigment responsible for skin color, resulting in age spots, sunspots, and uneven pigmentation.

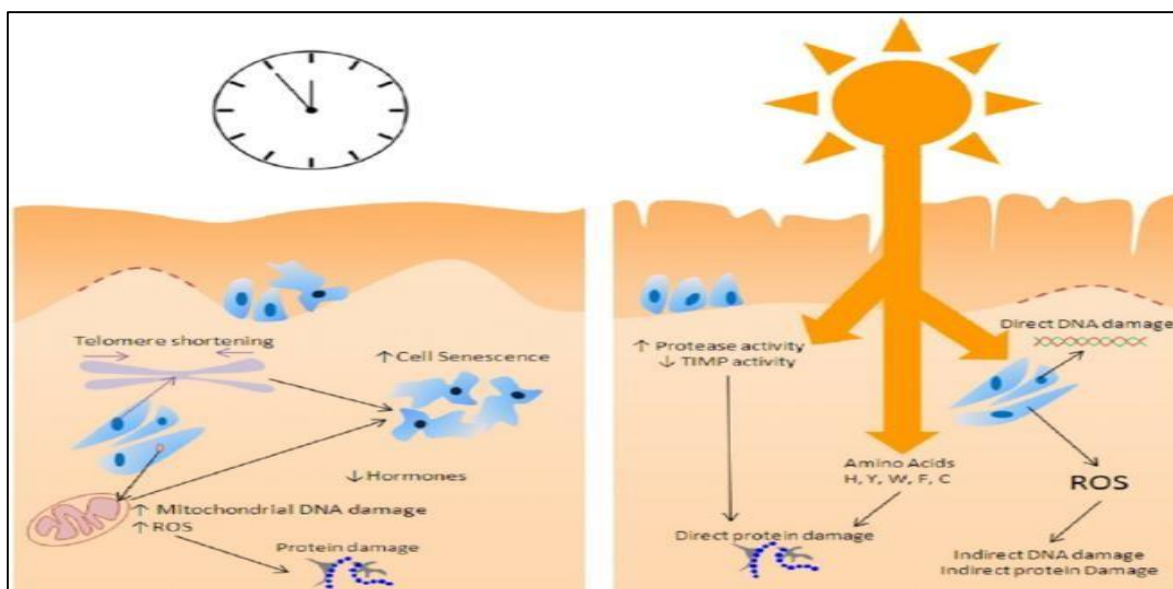
- **Reduced Skin Thickness:**

The epidermis (outer layer of the skin) becomes thinner with age, making the skin more susceptible to damage and slower to heal.

Understanding these scientific processes helps in developing strategies to prevent or minimize the effects of skin aging, such as using sunscreen, maintaining a healthy lifestyle, and utilizing skincare products containing ingredients that promote collagen production and skin hydration.

### **Mechanism of action of anti-ageing active**

Antiageing active ingredients stimulates fibroblasts to synthesize collagen fibres (stimulates the activity of fibroblasts and increases their number), improves skin elasticity (removes degenerated elastin fibers) and promotes angiogenesis. Some studies indicate that actives like retinol also enhances production of elastin fibres but at the same time also has its demerits as itchiness, erythema, and peachiness.



**Figure 1-** Potential mechanisms of skin ageing. Skin is subject to both an intrinsic ageing process (due to the passage of timeleft hand panel) and to an extrinsic ageing process (principally as a result of exposure to ultraviolet radiation [UVR]-right hand panel).

#### **Active ingredients used for anti ageing:**

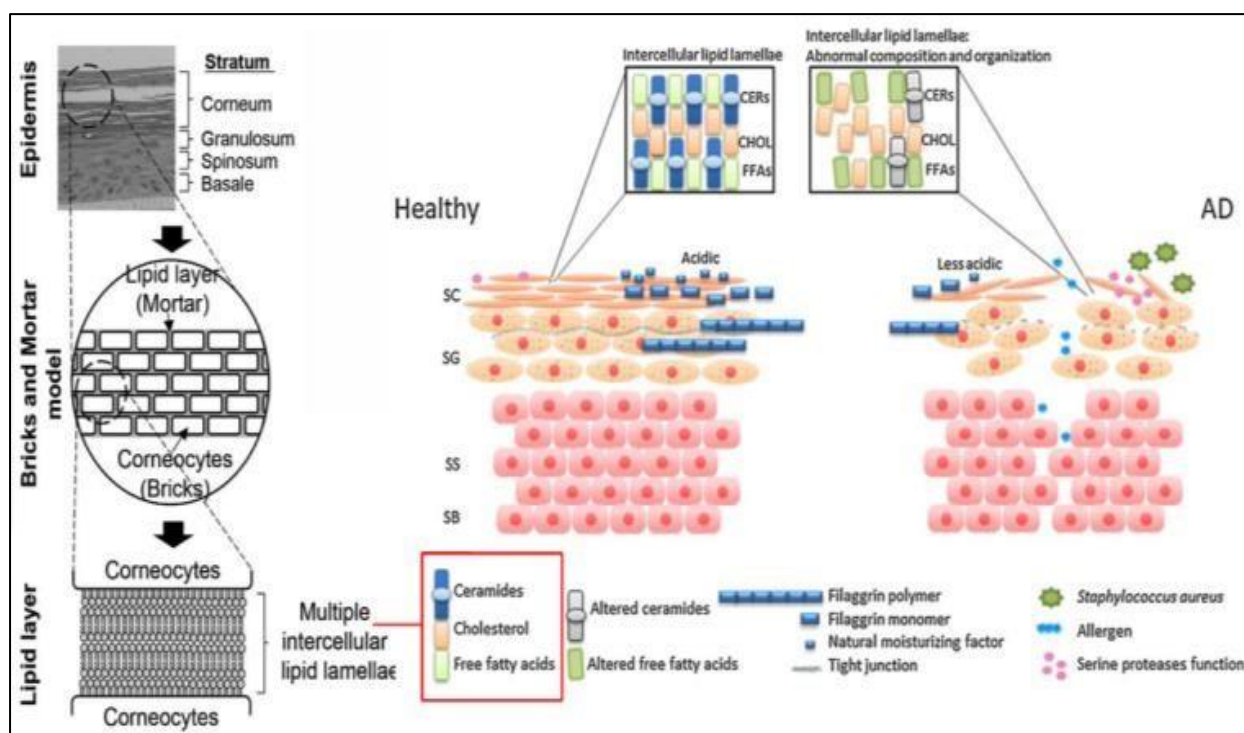
Based on their functions or impacts, anti-aging cosmetics can be categorized into three groups: moisturizing cosmetics, antioxidant cosmetics, and cosmetics with biological activity. The active ingredients in these cosmetics vary depending on their purpose. With ongoing research on bioactive components, the range of active ingredients in anti-aging cosmetics is expanding. This includes ingredients that scavenge free radicals, repair cells, moisturize the skin, and absorb UV radiation. Certainly! Here's a list of ten active ingredients commonly found in anti-aging skincare products, along with their effects:

- Retinoids (Retinol, Retinaldehyde, Retinoic Acid): Known for stimulating collagen production, reducing wrinkles, and improving skin texture and tone.
- Vitamin C (L-Ascorbic Acid): A powerful antioxidant that brightens the skin, fades hyperpigmentation, and protects against environmental damage.
- Hyaluronic Acid: A hydrating ingredient that retains moisture in the skin, plumping up fine lines and wrinkles.
- Peptides: Chains of amino acids that promote collagen and elastin production, improving skin firmness and elasticity.
- Niacinamide (Vitamin B3): Helps strengthen the skin barrier, reduces inflammation, and minimizes the appearance of pores and fine lines.
- Alpha Hydroxy Acids (AHAs): Including glycolic acid and lactic acid, AHAs exfoliate the skin, promoting cell turnover, and reducing the wrinkles appearance and hyperpigmentation.
- Beta Hydroxy Acid (BHA): Such as salicylic acid, BHA exfoliates the skin, unclogs pores, and reduces inflammation, making it beneficial for acne-prone and aging skin.
- Coenzyme Q10 (Ubiquinone): An antioxidant that neutralizes free radicals, reduces oxidative damage, and improves the appearance of fine lines and wrinkles.
- Resveratrol: Found in grapes and red wine, resveratrol is a potent antioxidant that protects against UV damage, reduces inflammation, and improves collagen production.
- Epidermal Growth Factor (EGF): Stimulates cell growth and regeneration, promoting wound recovery and reducing the wrinkles appereance and scars.

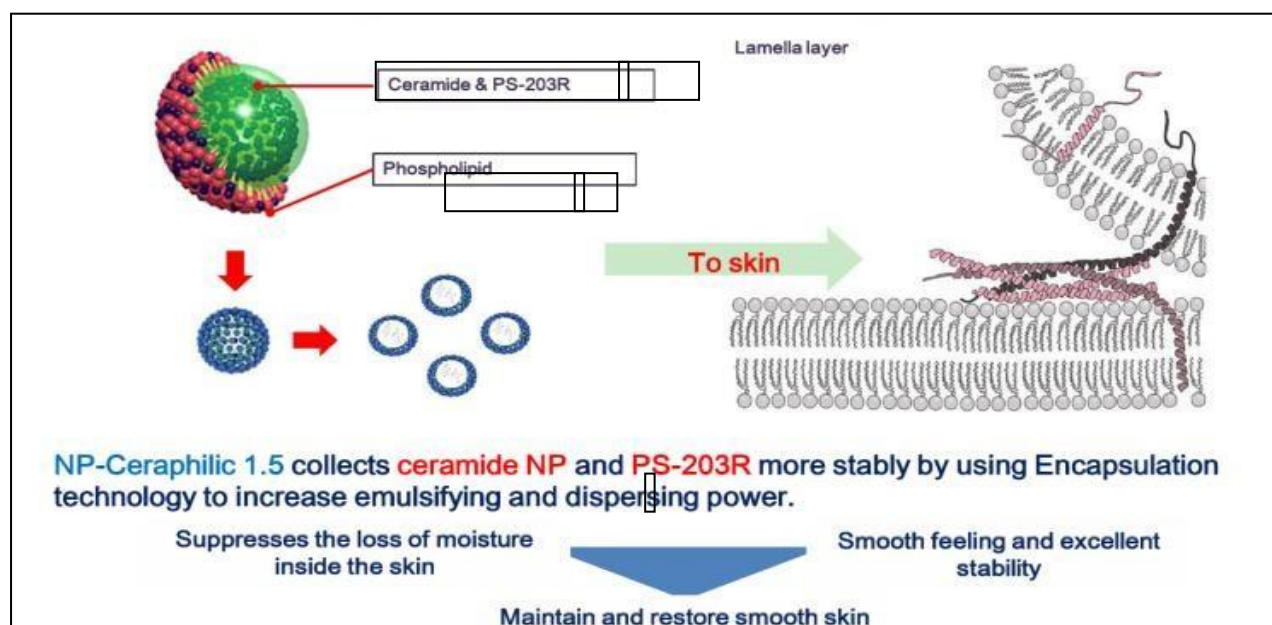
These active ingredients can be found in various anti-aging skincare products, including serums, moisturizers, and treatments, and they often work synergistically to provide comprehensive anti-aging benefits.

**Ceraphilic** is a microencapsulated ceramide which is a skin texture improving agent. It prevents water loss on skin and improves skin texture to be smooth with encapsulated ceramide. Also, this product can help to protect and repair skin barrier is a skin texture improving agent. It prevents water loss on skin and improves skin texture to be smooth with encapsulated ceramide. Also this product can help to protect and repair skin barrier

Ceraphilic has a structure of ceramide and it disperses and emulsifies better than ceramides to compensate for the shortcomings of ceramides and to maximize the efficacy of ceramides. Also, the phospholipid ingredient itself has the effects of soothing and moisturizing the skin, making it smooth. Whereas lipid component that fills the stratum corneum and protects the skin from the outside, maintains the lamellar structure of the stratum corneum and suppresses the evaporation of moisture inside



**Figure 2-** Impact of ceramide on different layer of skin.



**Figure 3-** Ceramide as encapsule on skin layer with its lamellar structure.

**b) Methodology/Experimental section/Materials and Methods:**

**Formulation:**

Sr.No	Ingredient	INCI	Quantity (%) (Placebo)	Quantity (%) (loaded)
1	Di Water	Aqua	Up to 100	Up to 100
2	Xanthan Gum	Xanthan Gum	0.50	0.50
3	Carbopol 995	Carbomer	0.75	0.75
4	Di EDTA	Ethylene diamine tetra-acetic acid	0.10	0.10
5	Triethanol amine	Triethanol amine	0.35	0.35
6	Brij L 23	Laureth 23	1.00	1.00
7	CCTG	Capric Caprylic Tri Glyceride	3.00	3.00
8	Glycerin	Glycerol	2.00	2.00
9	Propylene glycol	Propane-1,2-diol	1.00	1.00
10	Simulsol 165	PEG-100 Stearate (and) Glyceryl Stearate	1.00	1.00
11	Span 120	Sorbitan Isostearate	1.00	1.00

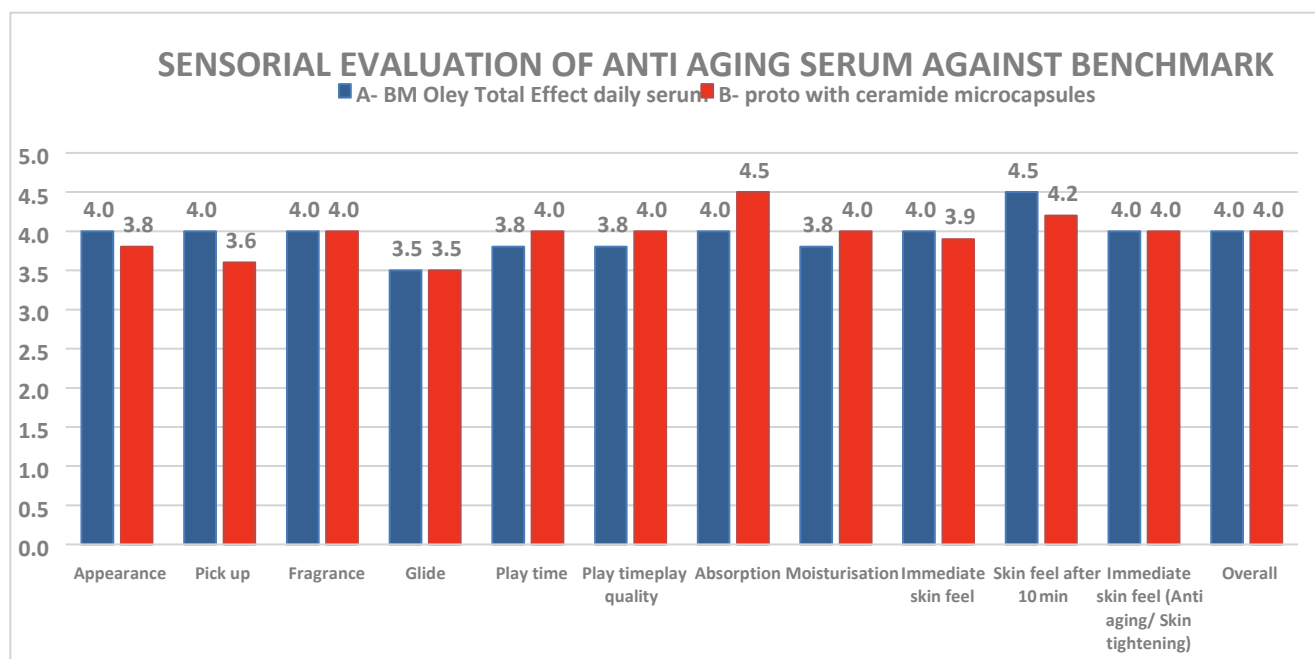
12	Element 14 PDMS 350	Dimethicone	2.00	2.00
13	Dryflo PC	Aluminum Starch Octenylsuccinate	2.00	2.00
14	Euxyl PE 9010	Phenoxyethanol (and) Ethylhexylglycerin	0.50	0.50
15	Ceraphilic	Phytosteryl/OctyldodecylLauroyl Glutamate and Ceramide	0.0	3.00
	Total		100%	100%

### c) Results and Discussion

#### Parameters used for evaluating serum formulation:

Pre-use parameters	Appearance
	Pickup
	Fragrance
In-use parameters	Strokes to absorb product in skin
	Glide
	Play time
	Play quality
	Absorption
Post-use parameters	Immediate post feel
	Post feel after 5 min
	Fragrance post use

### Sensorial Evaluation



The resultant product is comparable with benchmarks and thus the product is selected for external consumer study and claim substantiation

**Stability studies: Stability conducted as per ICH guidelines:**

Parameter Condition & Duration	pH @ 27°C	Viscosity (Cps) @spindle no.5, 10 rpm	Moisture Content(%)	Appereance	Fragrance
<b>Initial</b>	5.3	14300	80.96	Pale White	Characteristic
<b>1 Month</b>					
<b>RT</b>	5.38	14320	83.2	No Change	No Change
<b>Ref</b>	4.91	14300	83.5	No Change	No Change
<b>45°C/75°RH</b>	5.32	13800	83.07	No Change	No Change
<b>50°C (Dry Heat)</b>	5.13	11420	84.12	No Change	No Change
<b>2 Month</b>					
<b>RT</b>	5.34	14210	83.6	No Change	No Change
<b>Ref</b>	4.98	14020	83.3	No Change	No Change
<b>45°C/75°RH</b>	5.23	13780	82.9	No Change	No Change
<b>3 Month</b>					

<b>RT</b>	5.04	13200	83.37	No Change	No Change
<b>Ref</b>	5.14	12800	83.54	No Change	No Change
<b>45°C/75°RH</b>	5.19	11320	82.2	No Change	No Change

## IN VITRO INSTRUMENT EVALUATION OF ACTIVES

### Brief Overview:

Serum with Ceramide microcapsule is tested in in-vitro instrument evaluation by the supplier of active against placebo. which will cover the impact of active ingredient through Cutometer® Dual MPA 580 (Courage Khazaka) instrument for studying skin antiageing properties of product.

The cutometer® is the mostly used instrument worldwide to determine the elastic properties of skin. Cutometer® Dual MPA 580 (Courage Khazaka) instrument for studying skin antiaging properties of product with Cutometer® measuring principal is based on the suction method, negative pressure deforms the skin mechanically. Cutometer created the pressure and draws the skin into the aperture of the probe and in defined time, releases it again

Skin penetration depth is measured inside the probe using the Cutometer principle, which consists of an optical device with a light source and two opposing prisms. These prisms route light from the emitter to the receiver, and the intensity of the transmitted light varies according to how deeply the skin is dragged into the probe. This change corresponds to the skin's hardness (resistance to suction) and elasticity (ability to return to its former shape), both of which are shown in real time as curves representing penetration depth over time. These curves can be used to calculate a variety of factors relating to the skin's elastic and viscoelastic behavior, as well as aging indicators.

### Active Details:

Ceraphilic:

Ceraphilic is a nano-emulsified product of ceramide and phospholipid and is improved dispersibility and emulsification. which maximizes the efficacy of ceramide to tightly fill the lipid protective film of the skin lamella layer and blocks water evaporation. It also helps to repair skin damage arising from a variety of external causes.

### Sample details:

1. 2 samples of skin serum were given to the principal lab for evaluation



2. These contained finalised trials based on internal sensorial evaluation. The sample was tested in comparative evaluation against the formulation base without active.

### **Study objective:**

To evaluate skin viscoelastic properties of product with reduction in skin wrinkle, the cutometer is used to check the efficacy of product containing active.

### **Instrument working principal**

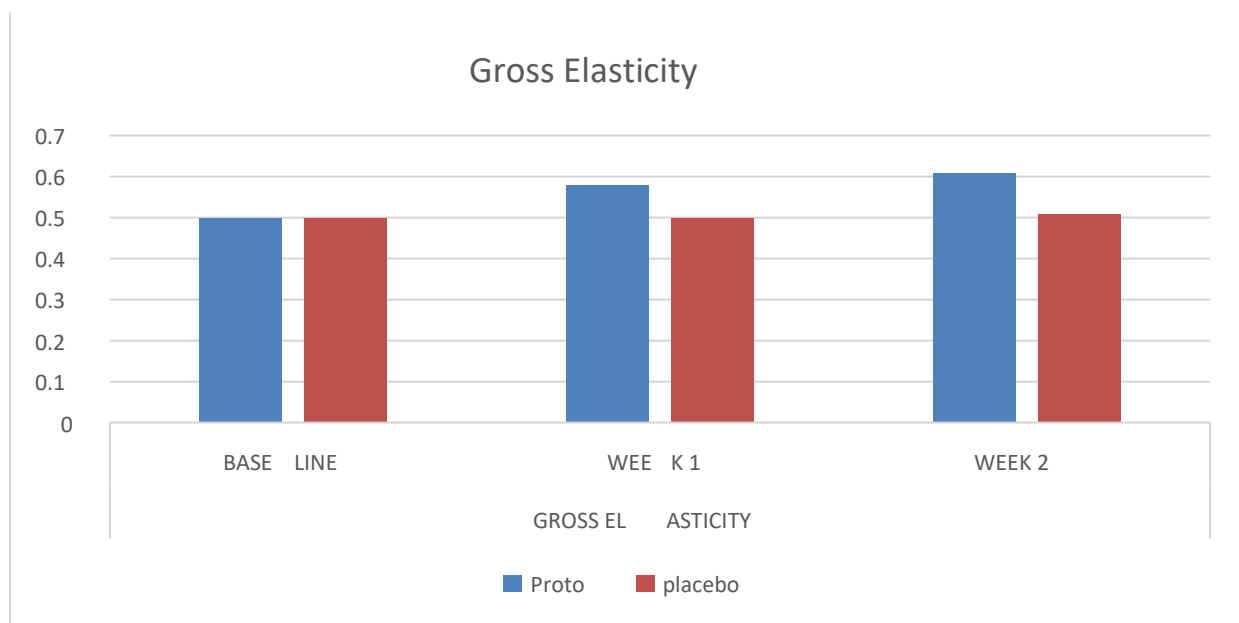
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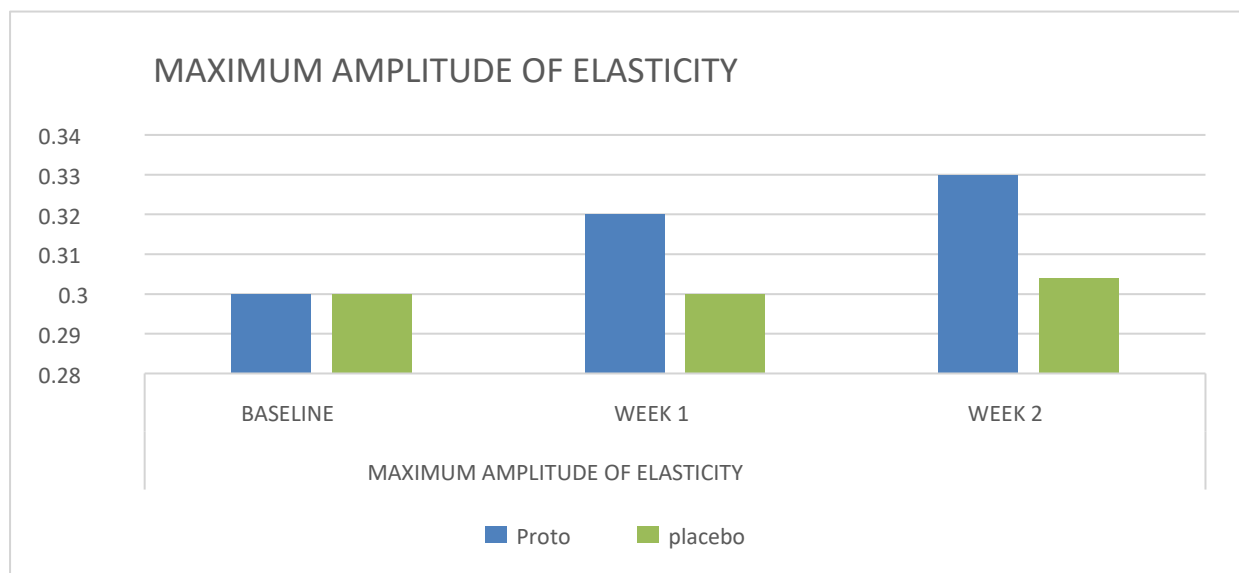


### **Skin wrinkle impact with and without active ingredient.**

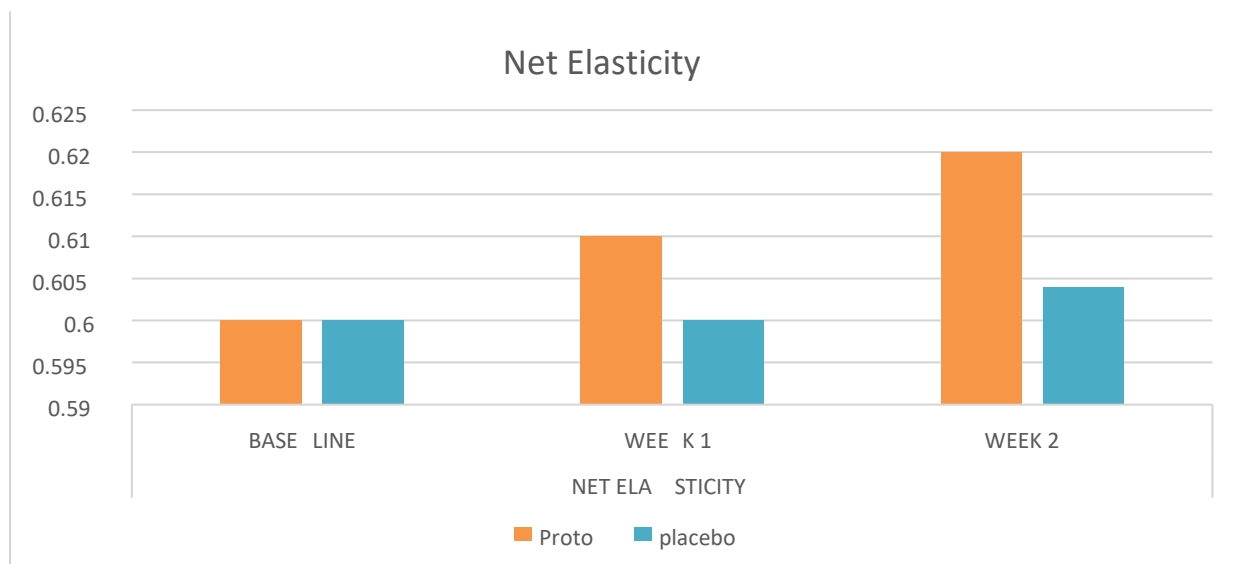
- a. Gross elasticity which is parameter is the gross elasticity/viscoelasticity, which is the skin's resistance to the mechanical suction force versus its ability to recover ( $R2 = Ua/Uf$ )



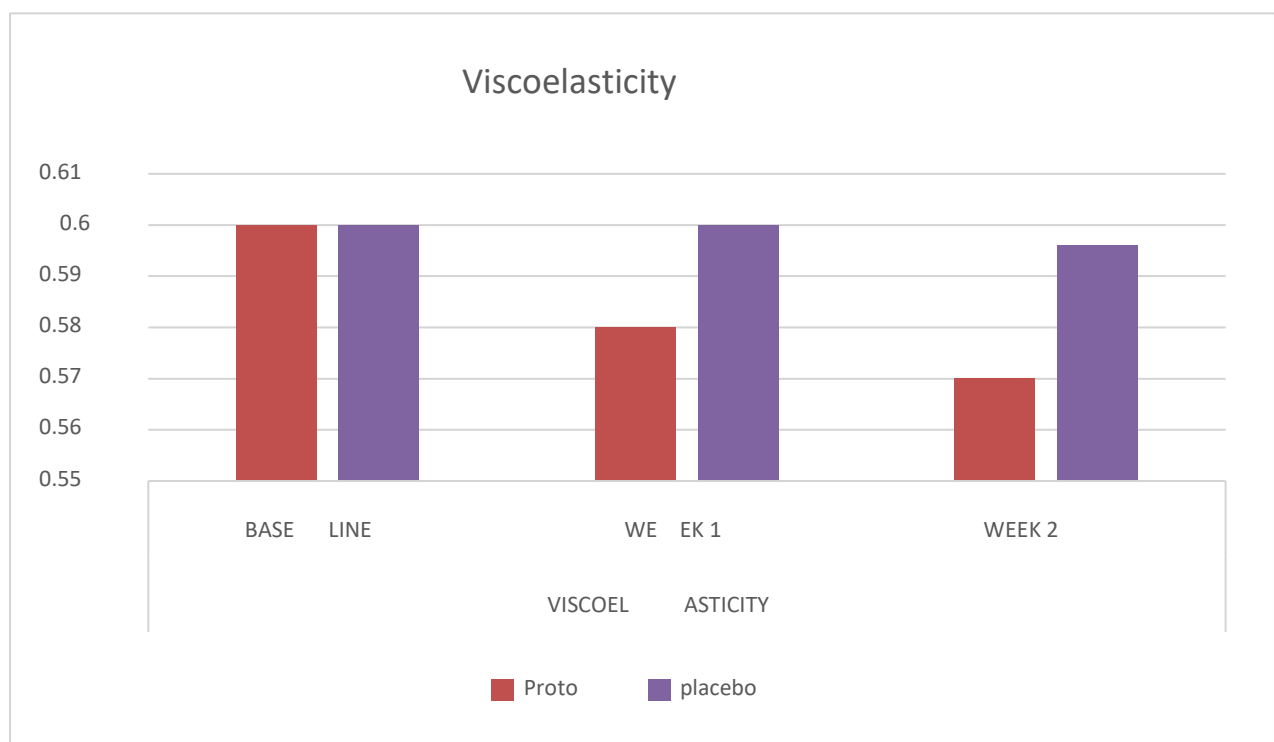
- b. Maximum amplitude of elasticity is of last and first curves compared to give "tiring effects" of skin



- c. Net elasticity ( $R5 = Ur/Ue$ ), meaning the higher the value the more elastic the skin.



- d. Tiring effects of the skin after repeated sucking, the smaller the value the smaller the effect of ageing or grooved or lines.



#### d) Observations:

Significant improvement in gross elasticity, maximum amplitude, and Net elasticity was noted at all the time points.

Viscoelasticity is assessed by reduced final distention at each evaluation time point, with an average reduction after 14 days of twice-daily use. The decreases are considered statistically

significant at all time points. A decrease in the viscoelasticity parameter is indicative of improved skin firmness, thickness, and tightness.

#### **e) Conclusion:**

The results of the study described herein suggest that ceraphilic is a safe and effective molecule for skin antiageing and reducing signs of aging. These findings could potentially be applied in various other formulations of skin care products that help reduce the skin wrinkled appearance by providing the firming impact. With the increasing demand for the natural cosmetic requirement by the consumers, ceraphilic offers a effective technology driven cosmetic formulations to prevent deteriorative changes during skin aging and keep the skin glowing and healthy.

The study was conducted only for 2 weeks. On further continuation of study the visible changes in skin firming and wrinkle reduction can be observed based on the initial positive impact against placebo.

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