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Original Research Article

Anti-ageing ability of a *Centella asiatica* callus exosomes-based face serum in healthy human volunteers with mild to moderate wrinkles and fine lines: a monocentric clinical trial

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ABSTRACT

Background: Plant exosomes are extracellular vesicles of lipid-protein complexes with potential to increase permeability, biocompatibility and sustained delivery of cosmetic actives. Since these exosomes are prepared through invitro techniques the resultant products are uniform in quality and efficacy. One such plant exosome, Centella asiatica callus extracellular vesicles, based serum was tested for anti-ageing efficacy and safety in healthy human volunteers.
Methods: The objective was to evaluate the anti-ageing potential and in-use tolerance of the face serum, at 0 day, 30 days, and 45 days in healthy women volunteers. Primary evaluations included wrinkle assessment using the Jin Ho Chung scale, Antera 3D imaging for wrinkles, fine lines and skin brightness, and MoistureMeterSC for skin hydration along with self-assessments by volunteers for efficacy. Secondary endpoints included dermatologist assessment by Draize scale and self-assessment questionnaires by volunteers for product tolerance.
Results: Twenty-six women with a mean age of 43.85±4.21 years and mild-to-moderate crow's feet wrinkles completed the evaluation. Compared with baseline, the serum significantly reduced wrinkle scores by 9.9% and 14.6% and fine-line scores by 15.8% and 27.0% on day 30 and 45, respectively ($p<0.05$). Skin luminescence increased by 1.0% and 1.6%, while ITA° increased by 6.9% and 11.1% on day 30 and 45, respectively ($p<0.05$). Skin hydration improved by 25.4% and 37.2% at the corresponding timepoints ($p<0.05$). No adverse events were reported.
Conclusions: In the current exploratory and monocentric study, exosome-based plant serum demonstrated promising anti-ageing capacity with no adverse events recorded under the tested conditions.

Keywords: Anti-ageing, Exosomes, Dermatologist, Claim substantiation, Tolerance, Formulation

INTRODUCTION

Today's population have become increasingly aware of the benefits of plant extracts in maintaining healthy skin, mind, and body. Bioactives from plants carry several skin and hair benefits including moisturization, nourishment, antioxidants, skin brightening, and anti-ageing potential.[1] However, rise in interest had led to excessive demand for such products in the market and conventional agriculture practices are dependent on the environment, expertise and genetic makeup of the raw materials. Such practices may not always yield phytoextracts of uniform quality thereby requiring adequate alternative technologies to maintain a constant supply of standardized bioactives.[2]

With the advent of biotechnology, plant stem cell extracts have started gaining precedence in the cosmetic industry-skin care and hair care segments. Such phytoextracts

developed from modern biotechnological practices can have several advantages over conventional extracts such as uniform phytochemical constituents, no dependency on environmental parameters (soil and water) and reproducible product performances. Further, these products can help protect the natural habitat and minimize illegal trade of plant-derived raw materials.[3,4]

For instance, plant exosomes which are extracellular vesicles comprised of lipid-protein complexes of sizes starting from 50 nm.[5] They are known to have stronger permeability and biocompatibility, similarity to cell membranes, physiochemical stability across pH and temperatures, and ability to enclose larger macromolecules (lipids, proteins and RNA) and ability to surpass immune system ensuring compatibility.[5,6] These molecules are applied as delivery systems for targeted, compatible and safe delivery of important bioactives or can also protect other actives from external factors. For instance, sustained delivery of resveratrol which faces challenges with respect to transdermal absorption in the stratum corneum or encapsulating actives like retinol and vitamin C to prevent enzymatic or environmental degradation in the formulation or prevent side effects of such promising actives.[7,8]

One such product, the Miracelle plant stem cell face serum, was formulated with *Centella asiatica* callus extracellular vesicles (1500 ppm) along with other potential cosmetic ingredients. The current study investigated anti-ageing efficacy and in-use tolerability of the face serum of the face serum in healthy women volunteers with mild-to-moderate signs of skin ageing for 45 days. The primary objective of the study was to assess the effect of the face serum using a combination of subjective assessment and objective instrumental evaluations.

The wrinkles in the Crow's feet area were recorded using Jin Ho Chung scale and while Antera 3D imaging was used to evaluate wrinkles, fine lines, and skin brightness. Skin hydration was measured using MoistureMeterSC. Further, self-assessment by the volunteers was recorded towards the product's efficacy. The in-use tolerance towards the product by the dermatologist and the volunteers was monitored throughout the study duration.

METHODS

The product Miracelle plant stem cell face serum batch number C&I26437-BC was procured from AASK Cosmetics Private Limited. The Serum is composed of Centella asiatica exosomes along with peptides, additional herb complex, plant extracts, actives bakuchiol, EGF, vitamins (tocopherol) and adenosine. The serum was tested in healthy human volunteers through a monocentric, two-arm, double blinded, parallel group, active controlled study for its anti-ageing potential. However, the authors collectively decided to publish data for only their active blend and not the comparative benchmark product.

Ethical considerations

The study was approved by Independent Ethics Committee (Re-Registration number: ECR/245/Indt/MH/2015/RR-22) on 19th November, 2025. The entire trial was conducted in compliance with the approved protocol, Declaration of Helsinki, Good Clinical Practices, aligned with ICMR guidelines concerning clinical research in human volunteers. All the participants were explained the potential risks and benefits of the trials by the principal investigator, and only participants willing to sign the informed consent were included in the study.

Study place and duration

The trial took place in Andheri, Mumbai, Maharashtra from 11th December 2025 to 30th January, 2026.

Study inclusion criteria

The study population selected were women with mild to moderate wrinkles as assessed by crow's feet area and fine lines within the age group 35-55 years with a skin phototype of III-IV. Women with healthy skin on test area, willing to discontinue use of any other cosmetic products, avoid sun exposure and products same benefits, cooperative, compliant of study procedures, and ready to sign informed consent were included in the study. Pregnant or lactating women, hypersensitive to any components of the products, receiving any systemic medical treatment in the previous one month that can interfere with study goal, or participating in any other clinical trial for the past one month were excluded from the study.

Product application

The volunteers were instructed to wash their face and dab try with towel before the serum application. After drying, a thin layer (approximately 1 ml) of the face serum was applied twice a day (morning and evening). For the morning routine, the volunteers were also instructed to apply sunscreen post product application. The study duration was 45 days.

The data was recorded at 0 days or baseline for measuring the skin parameters before product application. Post product recordings were done on day 30 and day 45.

Study objectives

The primary objective of the study was to evaluate the anti-ageing potential of the test product, face serum, at 0 day, 30 days, and 45 days timepoints. The secondary objective was to determine in-use tolerability of the face serum under study conditions.

Primary endpoints

The anti-ageing potential of the face serum was assessed over a 45 days period using a combination of subjective and objective assessment parameters. The wrinkles in the Crow's feet area were measured using Jin Ho Chung Scale. The effect on face wrinkles, fine lines, skin luminescence (L*) and skin lightening (ITA) was estimated using Antera. The optical imaging uses a 3D camera that reconstructs the skin-surface illuminating the skin from different sides and angles. Through spatial and spectral analysis, the skin topography and chromophores can be studied. The potential of the face serum to modulate moisturization potential of the skin was monitored using MoistureMeterSC. MositureMeterSC measures hydration in the stratum corneum due to the electrical properties of the skin in terms of capacitance. Further subjective assessment by the volunteers was conducted to record their observations related to product efficacy. All the end points were mentioned in the protocol that was approved by IEC.

Secondary endpoints

The product was analysed for its in-use tolerance by the principal investigator using modified Draize Scale for scoring erythema and oedema. The scoring system used was 0-no reaction, 1-very slight reaction, 2-slight reaction, 3-moderate reaction and 4-severe reaction. The safety assessment questionnaire given to participants for in-use tolerance was composed of question related to prickling, tingling, itching, and burning sensation caused after use of the product till 45 days. The scale used was 0-none, 1-slight, 2-moderate, and 3-severe.

Statistical analysis

Statistical analysis was carried out for instrumental readings, using 30.0 version of statistical software SPSS. Continuous variables were summarized using descriptive statistics i.e., number of observations, mean, standard deviation or median with range of minimum and maximum). Difference between mean of observations at various time points was analyzed using Wilcoxon Sign Rank Test for Jin Ho Chung Scale and student's t-test for rest of the tests. A p value less than 0.05 was considered to be statistically significant.

RESULTS

Demographics

The demographics of the study population is mentioned in table 1.

Primary endpoints

Wrinkles in crow's feet area- Jin Ho Chung scale

At baseline on day 0, the mean Wrinkles in the crow's feet area were 3.85±0.46. At 30th day of the product application, a percent reduction of 7.0% was observed versus a 10.9% reduction at day 45 indicating the ability of face serum to reduce wrinkles in the crow's feet area. There was a significant reduction observed at both days 30 (p value 0.008) and 45 (p value 0.001) when compared to the baseline (Wilcoxon Sign Rank Test) (Figure 1).

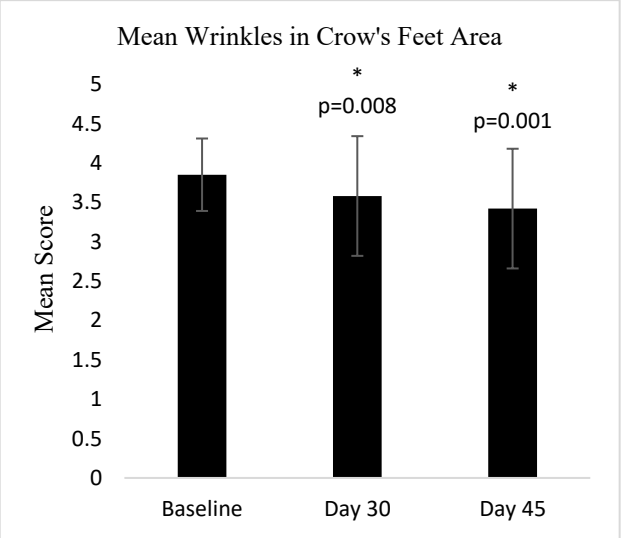


Figure 1: Changes in mean wrinkle in crow's feet area measured using Jin Ho Chung scale.
(* indicates p<0.05 as compared to the baseline, Wilcoxon Sign Rank Test).

Wrinkles, dine lines, skin luminescence (L*) and skin lightening (ITA) by 3D imaging

Effect of the face serum on skin wrinkles

At baseline on day 0, the mean wrinkle length was found to be 36.04±8.44 mm. At 30th day of the product application, a percent reduction of 29.9% was observed versus 45.4% reduction at day 45 indicating reduction in the length of the wrinkles due to the face serum. There was a significant reduction observed at both days 30 (p value 0.001) and 45 (p value 0.001) when compared to the baseline. At baseline on day 0, the mean wrinkle total area was recorded as 28.70±8.50 mm2. At 30th day of the product application, 27.2% reduction in total area of wrinkles was observed and at 45 days 41.3% reduction was measured. The observed difference was found to be statistically significant (p value 0.001). At baseline on day 0, the mean wrinkle total volume recorded was 1.20±0.49 mm^3. At 30th day of the product application, a 30.0% reduction in total wrinkle volume was observed and at 45 days 45.0 % reduction was measured. The observed difference was found to be statistically significant (p value 0.001). At baseline on day 0, the mean wrinkle score was found to be 38.00±6.34. At 30th day of the product application, a 9.9% reduction in total wrinkle volume was observed and after 45 days 14.6% reduction was measured. The observed difference was found to be statistically significant (p value 0.001) (Figure 2).

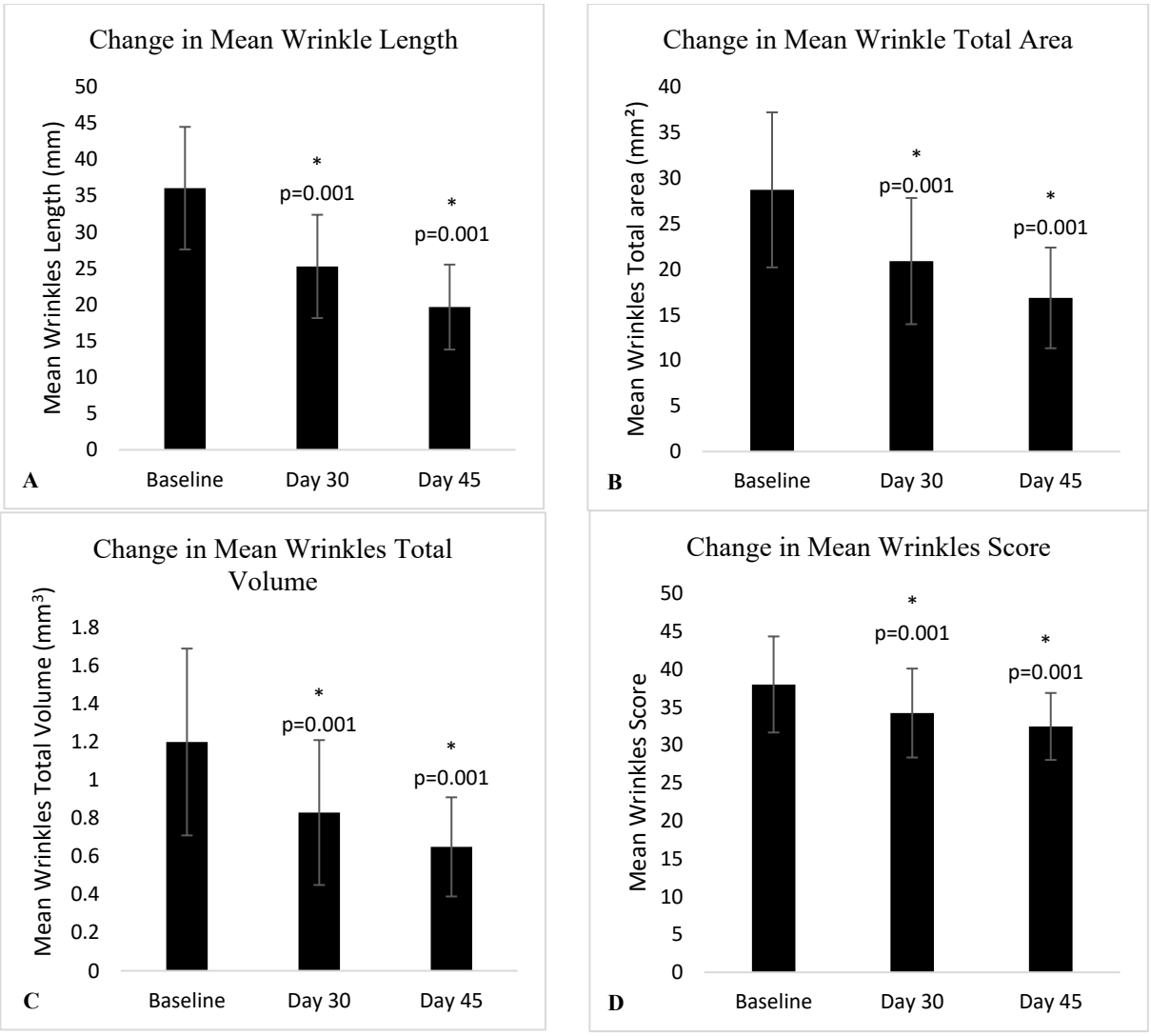


Figure 2: Changes in mean wrinkle parameters on day 30 and 45 following daily application of the test product (Face serum), measured using Antera: (A) change in mean wrinkle length (B) change in mean wrinkle total area (C) change in mean wrinkle total volume (mm^3) and (D) change in mean wrinkle score.

(* indicates $p<0.05$ as compared to the baseline, Student's T-Test)

Effect of the face serum on fine lines

The effect of the face serum was measured for 45 days on the length, area, volume, and score of fine lines. At baseline on day 0, the mean wrinkle length was found to be 86.38±14.49 mm. At 30-day post product application the fine lines reduced significantly by 17.7% (p value 0.001) and after 45 days it reduced by 30.8% (p value 0.001). At day 0, the mean fine lines total area was recorded to be 73.37±10.15 mm^2 and which was reduced by 16.0% and 22.1% at 30th day and 45th day respectively. The difference measured was found to be statistically significant (p value 0.001). Similar trend was observed for mean fine lines total volume. At baseline the value was observed to be 1.41±0.28 mm^3. At the end of 30th day a 22.7% reduction (p value 0.001) in the fine line volume was observed and at 45 days a 31.9% reduction (p value 0.001) was observed indicating the potential of the face serum to reduce fine lines. Further the mean fine lines scores indicated that the mean score of 35.00±4.95 at day 0 was significantly reduced by 15.8% and 27.0% at days 30 and 45 respectively (p value 0.001) (Figure 3).

Effect of the face serum on skin luminescence (L) and skin lightening (ITA°)*

The effect of the test product was assessed over a period of 45-days on skin luminescence (L*). The mean L* was recorded as 58.21±2.84 on day 0. The increase in L* from baseline was recorded on day 30 and day 45 and it was found to be 1.0% (p value 0.013) and 1.6% (p-value 0.001) post product application. Further, a statistically significant increase in skin lightening by 6.9 and 11.1% was observed with from baseline (19.06 ± 6.80 ITA o) at day 30 (p value 0.014) and day 45 (p value 0.001) respectively (Figure 4).

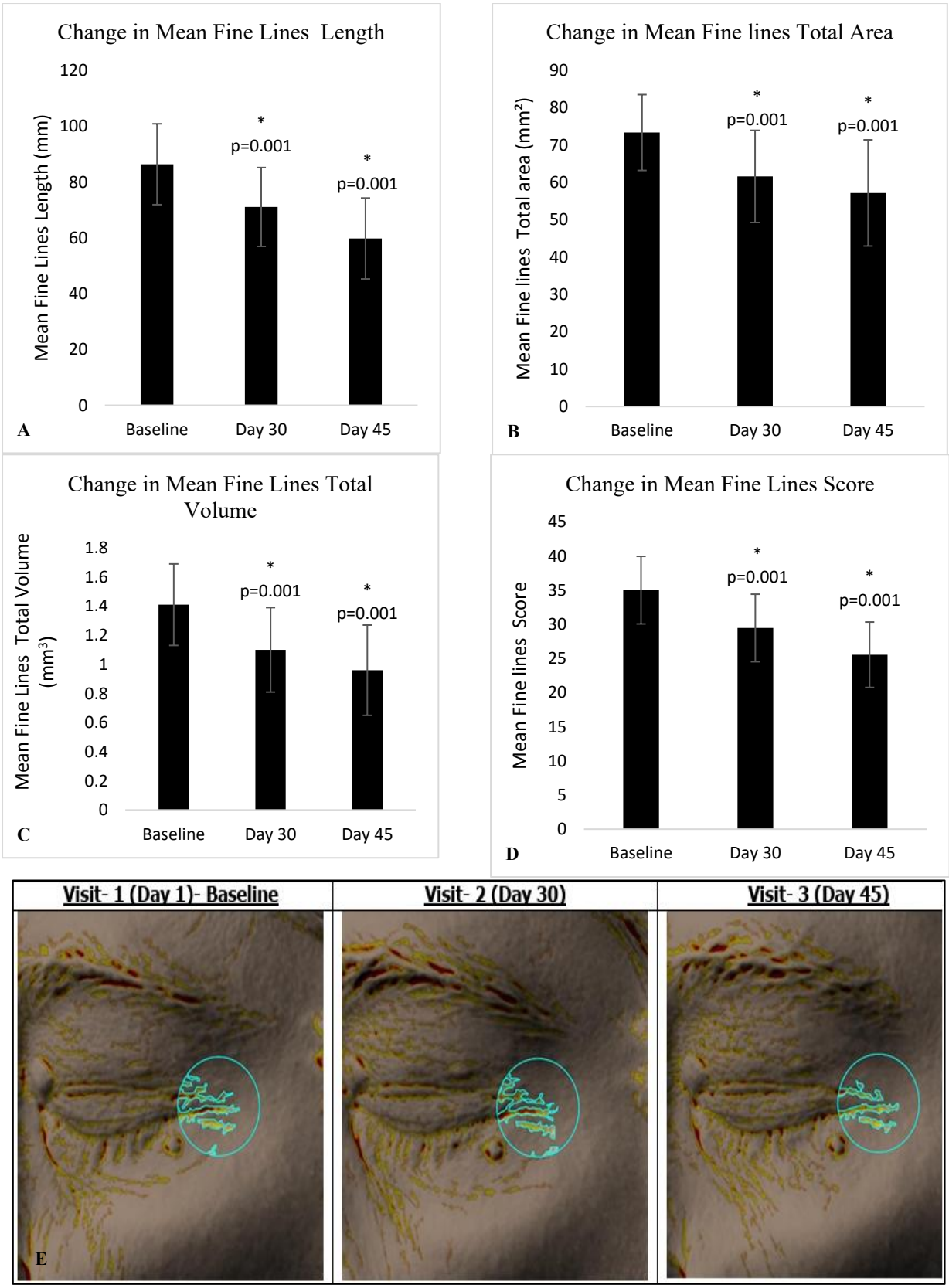


Figure 3: Changes in mean fine-line parameters on day 30 and 45 following daily application of the face serum, measured using Antera: (A) mean fine-line length (mm) (B) mean fine-line total area (mm²) (C) mean fine-line total volume (mm³) (D) change in mean fine lines score and (E) Representative image of reduction of wrinkles and fine lines.

(* indicates $p<0.05$ as compared to the baseline, Student's T-Test)

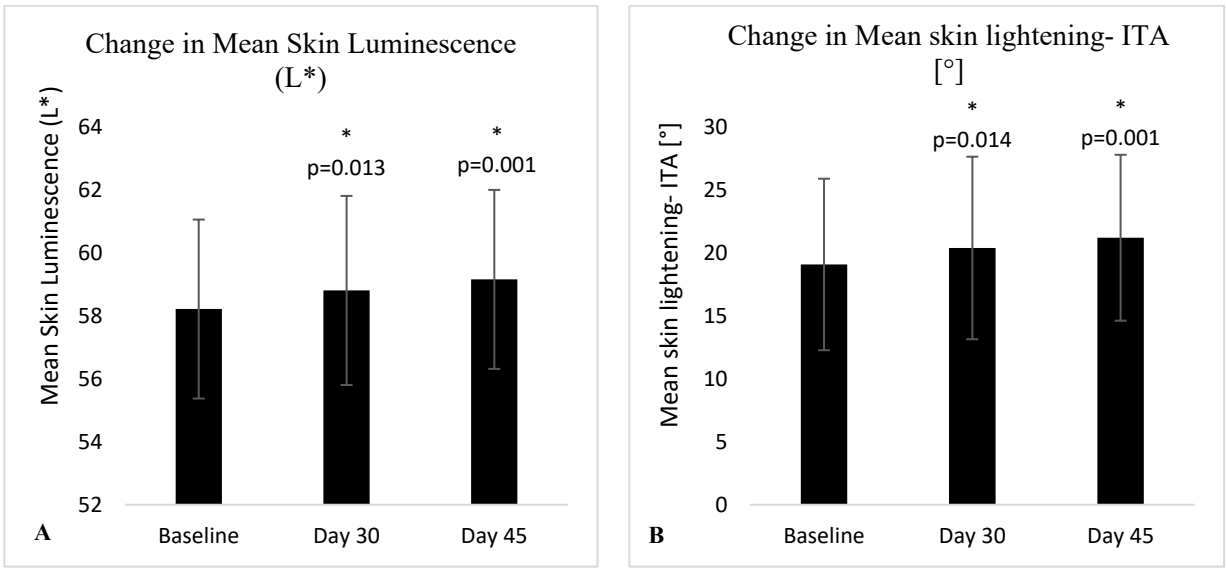


Figure 4: Changes in (A) mean skin luminescence (L*) and (B) mean skin lightening- ITA (o) on day 30 and 45 following daily application of the face serum, measured using Antera.

(* indicates $p<0.05$ as compared to the baseline, Student's T-Test)

Effect of the face serum on skin hydration

Daily application of the face serum twice significantly improved the skin moisturization potential of the skin as measured by MoisturemeterSC. At day 0, the mean skin hydration recorded was 21.17±5.13. At day 30 the hydration increased by 25.4% and at day 45 the increase recorded was 37.2% ($p<0.01$) and the difference was found to be statistically significant at both the time points (p value 0.001) (Figure 5).

Self-assessment for product efficacy by the volunteers

The volunteers were instructed to fill the questionnaire related to product efficacy on days 30 and 45 on a scale of strongly agree to strongly disagree. The questionnaires were made with a view to understand perception of the volunteers towards the effects of the test product. On day 30 around 100% volunteers showed overall likeability towards the products efficacy versus 92.3% on day 45. The overall assessment of efficacy parameters filled by the volunteers in mentioned in the Table 2.

Secondary endpoints

As per the clinical assessment by a trained dermatologist, neither of the 26 volunteers exhibited any erythema, oedema, or skin intolerances during the entire course of the study. Further self-assessment by volunteers also revealed that throughout the duration of 45 days, the test product did not induce prickling, tingling, itching or burning sensation post product application on days 30 and 45. Therefore, no adverse events were reported under the test conditions till 45 days.

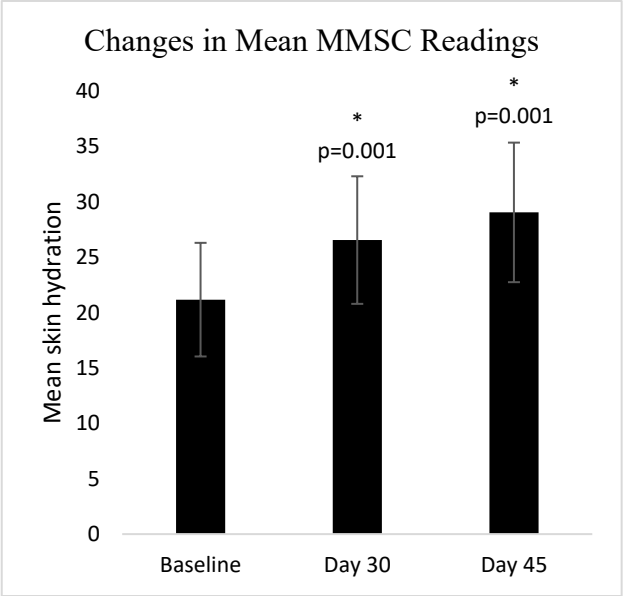


Figure 5: Changes in mean skin hydration on day 30 and 45 following daily application of the face serum, measured using MMSC

(* indicates $p<0.05$ as compared to the baseline, Student's T-Test)

Table 1: Demographics of the volunteers that participated in the study.

Parameters	Data
Number	26
Mean Age (in years)	43.85±4.21
Range (in years)	36.00–52.00

Table 2: Self-assessment score by the volunteers for product efficacy.

Questions	% of participants reporting top 2 scores for various parameters-D30	% of participants reporting top 2 scores for various parameters-D45
Did the product reduce wrinkles and fine lines?	84.6	92.6
Did the skin appear well moisturized and hydrated?	100	100
Did your skin look younger?	80.7	84.6
Did the product make your skin look bright and glowing?	100	96.1
Overall, did you like the product?	100	92.3

DISCUSSION

Skin ageing is governed by internal and external stimuli that can modulate the structure of the dermis and epidermis. Physiologically aged skin shows lower numbers of mast cell and fibroblasts, secretes senescence associated secretory proteins (SASP), inadequate release of growth factors, degraded extracellular matrix, increased MMPs, telomere shortening, oxidative stress and altered microbiome.[9] Thereby, formulating with having a deeper understanding about the ingredients and its effect on skin has become key to address concerns related to ageing. The current product under study was designed with *C. asiatica* based exosomes, with peptides, plant extracts, 10 herbs complex and bioactives like bakuchiol, epidermal growth factors (EGF), tocopherol, and adenosine. The product was tested in 26 healthy women volunteers with mild-to-moderately aged skin. The product showed statistically significant anti-ageing, skin brightening, and skin hydrating effects ($p<0.05$) upon daily application till 45 days and was well-tolerated during the study duration. Mechanistically, the ability of the product to manage signs and symptoms of aged skin can be attributed to the presence of carefully selected cosmetic delivery systems and ingredients. For instance, exosomes can activate specific immune cascade, have low immunogenicity, low toxicity, and can mimic skin's natural structure thereby can overcome biological barriers.[10,11] In case of retinal, they can deliver it to the deeper layers of the skin, and encapsulation can lower skin irritation.[11,12] Exosomes (animal, fungi or plant) are also being studied to counteract the anti-ageing related process such as oxidative stress, inflammation and senescence caused extrinsic ageing (UV, lifestyle, pollution and oxidative stress). The mechanisms associated with stem-cell derived exosomes are skin rejuvenation, ability to reduce expression of matrix metalloproteinases, relieve oxidative stress, promote extracellular matrix (ECM) such as collagen and elastin levels and modulate intra- and inter-cellular communications.[13] Further, plant extracts also carry anti-ageing and skin resilience potential by virtue of its radical scavenging activity, cell rejuvenation, photoprotection, ECM restoration and moisturization capacities.[14] For example, incorporation of C. asiatica can mitigate inflammation and promote skin hydration thereby strengthening skin barrier.[11,15]

The most commonly employed skin-care product for aged skin is retinol which is used for photodamaged and photoaged skin. Nevertheless, several reports indicate its in-use tolerability issues causing occasional erythema, dryness, flaking, oedema, itching, tingling and burning sensation.[11] Bakuchiol, a functional analog of retinol, is often considered as a natural anti-ageing ingredient in the cosmetic industry. The current product under study was formulated with bakuchiol. It is well-documented for its pre-clinical and clinical anti-ageing benefits such as stimulation of ECM contents (fibronectin, collagen), accelerate epidermal regeneration, and wound healing. Reports also suggest that bakuchiol has shown comparable potency to retinol to improve signs of photoageing and is also well tolerated than retinol.[16] Similar to bakuchiol, EGF (epidermal growth factor) is also a regenerative skin treatment option because of its ability to treat hyper-pigmentation, dryness, laxity heal wounds and induce ECM contents.[17]

Evidence suggests that oxidative stress from mitochondrial metabolism could be a primary cause of skin cell senescence caused due to generation of reactive oxygen species (ROS), low-grade inflammation, and secretion of SASPs. Strategies to target mitochondrial oxidation include incorporation of nicotinamide adenine dinucleotide (NAD+) precursors and has shown promising results in clinical and preclinical studies.[18] Tocopherol is also known to manage oxidative stress by modulating redox status, inflammation and restoring mitochondrial function that have led they incorporation in treatment of photoaging related cancers.[19]

Our results indicate that the plant stem cell-based face serum is loaded with the correct set of ingredients to counteract signs of ageing. From the result it is evidenced that the face serum can reduce wrinkles, fine lines, improve skin luminescence, skin topology, increase moisture and is dermatologically safe to use without any adverse effects when tested for 45 days.

Limitations

Although the product showed promising anti-ageing and moisturizing benefits, the study has several limitations. The small sample size and absence of male volunteers may limit the generalizability of the findings. Further, the study

duration was limited to 45 days, and the long-term effects of the product on skin health and appearance warrants further investigation. The lack of a vehicle control group is another major limitation. A placebo-controlled and randomized clinical trial should consider the design of well-studied trial along with limitation observed in the current study.

CONCLUSION

The plant stem cell-based serum demonstrated anti-ageing, skin brightening, and skin moisturizing potential in healthy women volunteers with a mean age of 43.85±4.21 years and mild-to-moderate crow's feet wrinkles. Majority of the volunteers reported that the serum made their skin look bright, glowing, younger, moisturized, hydrated with reduced fine lines and wrinkles. As per the dermatological evaluations, the product did not exhibit any adverse effects and basis the self-assessment done by volunteers the product was found to be well-tolerated.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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