Efficacy of 3% Euterpe Oleracea Extract Cream for Reduction of Periorbital Wrinkles

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***Abstract*— BACKGROUND: Periorbital wrinkles occur because of extrinsic and intrinsic aging. Aside from aging, genetics, smoking, drinking and even certain sleeping positions can contribute to wrinkle development. Free radical damage is proven to be one of the main reasons for aging and wrinkles. Several anti-aging and anti-wrinkle treatments are being studied these days but the efficacy of *Euterpe oleracea* has not been established yet. OBJECTIVE: To study the efficacy of topical 3% *Euterpe oleracea* extract cream in decreasing periorbital wrinkles. METHODS and MATERIALS: 20 subjects aged between 30 to 50 years were recruited for this clinical experimental study. Both male and female participated, and the study lasted for 12 weeks. Volunteers were instructed to apply 3% *Euterpe oleracea* extract cream twice daily to periorbital area during the 12-week period. Skin parameter measurements such as skin elasticity, hydration and wrinkle score assessment by dermatologists were taken at baseline, 4th, 8th, and 12th week respectively. RESULT: The mean of cutometer score (skin elasticity) increased from the start to week 12 and it was statistically significant. The mean corneometer score (skin hydration) also improved significantly from baseline to week 12. A rise in wrinkle evaluation score was also recorded from week 4 to week 12 with significance. There was no adverse effect in all subjects throughout the study with high patients' satisfactory score. CONCLUSION: The study demonstrated that Acai palm extract decreased periorbital wrinkles when it is applied topically with no adverse effects. It could be an alternative anti-wrinkle treatment.**

Keywords: Acai, Elasticity, Euterpe Oleracea, Hydration, Wrinkle

I. INTRODUCTION

People have always had tendencies to reduce the aging process of their skin. This is a phenomenon that is deeply rooted in the history of human civilization. It is widely known that Cleopatra, the queen of Egypt and a symbol of beauty, would often take two baths a day in donkey milk as it contains alpha-hydroxy acids for its role in the anti-aging process. There are many more topical treatments that were popularized throughout our history such as apple cider vinegar, honey and turmeric to more manmade treatments such as botulinum toxin, filler, thread lift and laser treatments.

The treatments mentioned above along with a plethora of others tackle similar aging issues like wrinkles, dark spots, dull skin and laxity. Wrinkles are skin folds or creases caused by a combination of factors. The first one is aging which can be classified into intrinsic and extrinsic aging. Intrinsic aging is a chronological process that is mainly influenced by genetical and hormonal factors whereas extrinsic aging is primarily caused by ultraviolet [UV] irradiation called Photoaging. UV lights degrade the collagen and elastin fibers by free radicals oxidation and expression of matrix metalloproteinases. As these layers are destroyed, the skin becomes weaker and wrinkles appear. Smoking also plays a role in the wrinkle formation by accelerating the aging process. Alcohol consumption promotes dehydration and dry skin is more prone to developing wrinkles. Other causes include repeated facial muscle expression, exposure to pollutants, toxins and diet.

The acai fruit, coming from a specific palm tree called *Euterpe oleracea*, may prove to be one of the most promising botanical extracts constituting powerful antioxidants. Largely cultivated in the Brazilian Amazon, acai tree extracts have a growing demand around the globe exactly for their anti-inflammatory, antinociceptive, wound healing and cholesterol lowering properties (Sadowska-Kręρa et al., 2014; Favacho et al., 2011; Oliveira de Souza et al., 2010; Kang & Kim, 2018).

In a recent study, acai berry water extract was shown to promote wound healing. It also increases type I collagen, VEGF, and fibronectin productions whilst MMP-1 and IL-1β expression are inhibited. MMP-1 or matrix metalloprotenase 1 is a collagenase. Inhibition of MMP-1 results in reduction of collagenase and accelerates wound healing. IL-1β is responsible for T cell activation which in turn promotes inflammatory cells like lymphocytes and monocytes. Inhibition of IL-1β can be attributed to anti-inflammatory effects in the wound healing process (Kang & Kim, 2018).

E. oleracea, or the acai berry, has shown to have potential in preventing or retarding age-related diseases like cardiovascular diseases, cancer and aging skin. The fruit consists of such compounds as polyphenols and flavonoids that exert strong antioxidant actions. In the matter of choosing anti-aging products, those formulated from plants containing antioxidant, anti-inflammatory and free-radical-scavenging functions are preferred. The extract would be useful in reducing wrinkles because it has the properties of inhibiting the aging process. Evidence presents that acai berry water extract can increase type 1 collagen production and the dietary supplement can reduce oxidative stress. More importantly for this research, the extract has the quality of lowering MMP-1 expression.

The main reason of this study is to conduct that the antioxidant action of acai palm extract cream would be useful in treatment of wrinkles on face. Thus, the actual purpose is to study the efficacy and satisfaction of *E. oleracea* extract cream in wrinkles reduction.

II. MATERIALS & METHOD

2.1 Scope of Research

This study is to evaluate the efficacy and satisfaction of *E. oleracea* extract cream on periorbital wrinkles. A total of 20 subjects ranging from age 30 to 50 of both genders with mild to moderate periorbital wrinkles were selected according to the inclusion and exclusion criteria. The topical cream of 3% acai palm extract was instructed to be applied on both sides of the face around the eyes for 12 weeks. Cutometer and Corneometer were used to measure skin moisture and elasticity. The VISIA® complexion analysis system was also used to get report scores and wrinkle scores for all subjects and the grading scale is as follows.

-1 = worse
0 = no changes
1 = 1-25% fair improvement
2 = >25-50% moderate improvement
3 = >50-75% good improvement
4 = >75-100% excellent improvement

All parameters were tested at baseline, 4th, 8th, and 12th weeks. Adverse effects were observed, and satisfactory scores were recorded.

2.2 Manuel for Volunteers

Wash the face using mild soaps and pat the face with dry and clean tissues or towels. After washing the face, squeeze 1 finger-tip unit of topical 3% *Euterpe oleracea* extract cream through tube (1 finger-tip unit = 0.5 grams) and apply to left side around the periorbital region using index finger. Carefully place small dots over eyelid and under the eye, starting in the innermost corner and moving outward. Be sure to pat the product on the skin and NOT drag it or rub it. Go over the same steps to apply the cream in right periorbital area. Wait 2 minutes for the cream to fully absorb. Other routine facial skincare steps and sunscreen can be continued as usual. These steps are to be followed twice in the morning and at night, meaning the applied amount is 2 grams per day. Additionally, the volunteers were required to follow-up with the researcher in person on the 4th, 8th and 12th weeks.

III. RESULTS

3.1 Results of Cutometer Score for Skin Elasticity

Table 3.1 *Statistical analysis of cutometer score at crow's feet*

	Mean ± SD	p-value
Baseline	0.7103 ± 0.0845	< 0.001
Week 4	0.7481 ± 0.0922	
Week 8	0.8197 ± 0.0743	
Week 12	0.8630 ± 0.0898	

Note: P-value determine by Repeated measure ANOVA test

A (0.7103) B (0.7481) C (0.8197) D (0.8630)

Figure 3.1 *The comparison of mean cutometer scores at crow's feet*

Note: *The unjoining line denotes that the pairs are significantly different. A is Baseline, B is Week 4, C is Week 8 and D is Week 12.

The mean cutometer score at crow's feet were 0.7103 ± 0.0845, 0.7481 ± 0.0922, 0.8197 ± 0.0743, and 0.8630 ± 0.0898 at baseline, 4th, 8th and 12th weeks respectively. There was progressive increase with each visit and table 3.1 shows statistical significance ($p < 0.001$).

The mean cutometer score at crow's feet at baseline is not significantly different from that at week 4. However, the baseline score differs significantly from week 8 and week 12. Similarly, week 4 cutometer score is statistically significant from week 8 and week 12. Moreover, the two mean cutometer scores at week 8 and week 12 have been shown to be statistically different.

Table 3.2 Statistical analysis of cutometer score at undereye area on baseline, follow-up 4th, 8th, and 12th week

	Mean ± SD	p-value
Baseline	0.6920 ± 0.1006	<0.001
Week 4	0.7363 ± 0.7827	
Week 8	0.7936 ± 0.0840	
Week 12	0.8505 ± 0.1042	

Note: P-value determine by Repeated measure ANOVA

A (0.692) B (0.7363) C (0.7936) D (0.8505)

Figure 3.2 *The comparison of mean cutometer scores at undereye*

Note: *The unjoining line denotes that the pairs are significantly different. A is Baseline, B is Week 4, C is Week 8 and D is Week 12.

According to statistical analysis of undereye cutometer score from table 3.2, mean cutometer scores were 0.6920 ± 0.1006 at baseline, 0.7363 ± 0.7827 at 4th week visit, 0.7936 ± 0.0840 at 8th week and 0.8505 ± 0.1042 at 12th week. The data indicate that mean cutometer scores was significantly increased at level of 0.05 ($p < 0.001$). Therefore, mean cutometer score at undereye area were significantly increased on 4th, 8th and 12th weeks compared to baseline.

As seen in multiple comparison analysis of cutometer score at undereye area, mean different changes were seen in different time points. The mean change in cutometer score at the undereye area is statistically different in each week.

3.2 Results of Corneometer Score for Skin Hydration

Table 3.3 *Statistical analysis of corneometer score at crow's feet at baseline, 4th, 8th, and 12th week*

	Mean ± SD	p-value
Baseline	64.20 ± 12.05	< 0.001
Week 4	73.84 ± 12.17	
Week 8	79.42 ± 9.32	

Week 12	84.72 ± 12.01	

Note: P-value determine by Repeated measure ANOVA test

A (64.20) B (73.84) C (79.42) D (84.72)

Figure 3.3 *The comparison of mean corneometer scores at crow's feet*

Note: *The unjoining line denotes that the pairs are significantly different. A is Baseline, B is Week 4, C is Week 8 and D is Week 12.

According to the statistical analysis of corneometer score at crow's feet from table 3.3, mean corneometer scores were 64.20 ± 12.05 at baseline, 73.84 ± 12.17 at 4th week visit, 79.42 ± 9.32 at 8th week and 84.72 ± 12.01 at 12th week. The mean corneometer scores were significant at the level of 0.05 ($p < 0.001$). Therefore, mean corneometer scores at crow's feet were significantly increased on 4th, 8th and 12th weeks compared to baseline. All the changes were statistically significant ($p < 0.05$) except from week 8 to week 12 ($p = 0.08$).

Table 3.4 *Statistical analysis of corneometer score at undereye area at baseline, 4th, 8th, and 12th week*

	Mean ± SD	**p-value**
Baseline	64.04 ± 13.11	< 0.001
Week 4	72.90 ± 10.77	
Week 8	78.06 ± 9.72	
Week 12	82.60 ± 11.44	

Note: P-value determine by Repeated measure ANOVA

A (64.04) B (72.9) C (78.06) D (82.6)

Figure 3.4 *The comparison of mean corneometer scores at undereye*

Note: *The unjoining line denotes that the pairs are significantly different. A is Baseline, B is Week 4, C is Week 8 and D is Week 12.

The mean corneometer scores at undereye area were 64.04 ± 13.11, 72.90 ± 10.77, 78.06 ± 9.72, and 82.60 ± 11.44 at baseline, 4th, 8th and 12th weeks which means there was progression with each visit. Table 3.4 shows this data is statistically significant at the level of 0.05 ($p < 0.001$). The multiple comparison analysis is shown below.

It is found that corneometer score at undereye area was statistically significant at the level of 0.05 ($p < 0.05$) for each follow-up. Therefore, undereye corneometer score at 12th week was higher than those at baseline, week 4 and week 8.

3.3 Results of Wrinkle Evaluation by Dermatologists

Photographs taken by VISIA Complexion Analysis System were evaluated by 3 different dermatologists with the following grading scale:

-1 = worse
0 = no changes
1 = 1-25% fair improvement
2 = >25-50% moderate improvement
3 = >50-75% good improvement
4 = >75-100% excellent improvement

Table 3.5 *Dermatologists' evaluation score of 3% Euterpe oleracea extract cream*

Grading scale	**3% *Euterpe oleracea* extract eye cream**		
	Week 4	**Week 8**	**Week 12**
4 = excellent improvement	0	0	0
3 = good improvement	0	3	4
2 = moderate improvement	5	7	12
1 = fair improvement	15	10	6
0 = no changes	0	0	0
-1 = worse	0	0	0

Table 3.6 *Statistical analysis of wrinkle evaluation score by dermatologists*

Week	**Mean ± SD**
Week 4	1.30 ± 0.57
Week 8	1.85 ± 0.49
Week 12	2.30 ± 0.66
p-value	**< 0.001**

Note: Data were analyzed by Friedman test.
$P < 0.05$ is significant.

A (1.30) B (1.85) C (2.30)

Figure 3.5 *The comparison of mean wrinkle evaluation scores by 3 dermatologists.*

Note: *The unjoining line denotes that the pairs are significantly different. A is Week 4, B is Week 8 and C is Week 12

Table 3.5 displays evaluation scores by three dermatologists. 15 of the participants showed fair improvement while there were 5 who showed moderate improvement in week 4. There was overall progress amongst the 20 participants as 10 of them showed fair, 7 showed moderate and 3 showed good improvements. There was more progress at the end of the study in week 12 where 6 participants showed fair, 12 showed moderate and 4 showed good improvements.

The mean wrinkle evaluation score issued by the three dermatologists progressively increased with every visit with the $p < 0.001$, meaning it was statistically significant as shown in table 3.6. The mean scores were 1.3, 1.85 and 2.3 at 4th, 8th and 12 weeks respectively.

The mean wrinkle evaluation scores of weeks 4 to 8 were statistically significant ($p = 0.018$) according to the multiple comparison analysis (figure 4.5). The mean score of week 4 was also statistically significant from that of week 12 ($p < 0.001$) apart from the mean change from week 8 to 12 ($p = 0.058$).

3.4 Patients' Satisfaction Score

Table 3.7 *Patients satisfaction score of 3% Euterpe oleracea extract eye cream on 12th week*

Satisfactory score	n
0 - no satisfaction	0
1 - little satisfaction	0
2 - average satisfaction	2
3 - more satisfaction	15
4 - most satisfaction	3

Above table 3.7 demonstrated patients' satisfaction score at 12th week. The data suggested that most of the volunteers rated more satisfaction while 4 rated most satisfaction and 2 average satisfaction.

3.5 Side Effect

All 20 participants were closely monitored during patch test and the course of research. However, no side effects were recorded for any of the participants in the duration of this research.

3.6 Standardized Photographs of Subjects

Figure 3.6 *Before and After comparison pictures of Left and Right periorbital area of Subject A*

Figure 3.7 *Before and After comparison pictures of Left and Right periorbital area of Subject B*

IV. Units

4.1 Discussion

Wrinkles can be caused by natural aging or due to external factors like UV exposure, smoking among many others. Oxidative stress produces ROS in excess of free radicals which can lead to increased MMP and collagen degradation. It also inhibits new collagen synthesis resulting in reduced skin elasticity and hydration, hence, wrinkles.

Due to their powerful antioxidant properties from anthocyanins and flavones such as orientin and isovitexin, *Euterpe oleracea* is known as superfood. Acai berries are also rich in other flavonoids and polyphenols.

This was the study of 3% *Euterpe oleracea* extract eye cream for reduction of periorbital wrinkles. Exactly 20 volunteers made up of both genders were recruited for the study duration of 3 months. All the subjects completed the study with monthly follow-ups. The mean age was 35.5 ± 5.35 years with minimum of 30 years and maximum of 50 years. They were all healthy with no underlying diseases. None of the subjects had photosensitivity, drug allergy, personal medication or treatment before the study. 11 of the participants had the combination skin type, 5 had dry skin and
4 had oily skin.

Cutometer was used to measure skin elasticity. Mean cutometer score at crow's feet increased significantly from baseline to consecutive follow-ups (table 4.2). Mean change in cutometer score at crow's feet progressively raised in each visit. Mean changes between the visits were all significant but for that from baseline to week 4. It indicates that elasticity at 12th week was higher than that at baseline. As for undereye elasticity, a progressive increase in mean cutometer score was observed in all follow-ups as well (table 4.3). Between follow-up phases, mean change in cutometer score was seen in all comparisons. Hence skin elasticity at undereye area was also greater in week 12 compared to baseline.

Measurement of skin hydration was done by using Corneometer. Mean corneometer scores at crow's feet were higher in 4th week, 8th week and 12th week than in baseline. For comparison, mean changes from week 0 to week 4, week 0 to week 8, week 0 to week 12, week 4 to 8 and week 4 to 12 were shown to be statistically significant. However, the mean change from week 8 to 12 was not statistically significant. The results indicate improvement in skin hydration in crow's feet at week 12 when compared to baseline. For undereye, mean corneometer score went up in all visits. After comparison was done between the follow-ups, the mean change was statistically significant in all comparison groups. Hydration of the undereye also increased in week 12 compared to baseline.

Photographs taken by VISIA complexion analysis system were evaluated by 3 dermatologists and the scores were analyzed by Friedman test. The mean of evaluation score increased in each visit (table 4.7). The mean changes from week 4 to 8 and week 4 to 12 were statistically significant whereas that from week 8 to 12 was not. At week 12, wrinkle score was higher than that at week 0. Therefore, overall improvement is seen in all skin parameters after 12 weeks of using 3% *Euterpe oleracea* extract cream.

Additionally, volunteers were asked to rate their satisfaction from 0 to 4 after the study, with 0 being NO satisfaction and 4 being MOST satisfaction. From 20, 2 (10%) gave score 2 ratings, 15 (75%) gave score 3 ratings, 3 (15%) gave the study score 4. The data suggested that 3% acai palm extract cream has high patients' satisfactory score. Regarding adverse effects, itchiness, erythema, or any serious side effects were not observed with any participants during the patch test. Moreover, there were no occurrences of any side effects over 12 weeks of this study. Thus, 3% *Euterpe oleracea* extract cream is safe for topical application.

In this study, both skin hydration and elasticity were improved after regular use of 3% acai palm extract eye cream for 3 months. This might be due to the anti-collagenase action of acai palm extract. The proposed effect is associated with an increase in expression of type I collagen, VEGF, and fibronectin as well as downregulation of the expression of MMP-1 (Kang & Kim, 2018). Previous studies showed that it can scavenge superoxide and hydroxyl radicals. Amazingly, acai palm was found to have the highest antioxidant capacity than any other fruits or vegetables (Peixoto et al., 2016). The extract not only exhibited an inhibition of new ROS formation, but also increased some antioxidant enzymes like SOD, catalase, and glutathione when healthy women consumed acai pulp for 4 weeks (Peixoto et al., 2016).

The anti-inflammatory property of acai extract is largely related to its ability to downregulate the expression of pro-inflammatory transcription factor, NF-KB (de Souza et al., 2012). It is well understood that NF-KB is involved in the pathogenesis of aging by releasing several proinflammatory cytokines and increasing oxidative stress. By downregulation of NF-KB, the acai extract can inhibit the process of inflammation implicated in the formation of wrinkles. Owing to these informations, 3% acai berry extract cream showed its anti-wrinkle effects in line with the hypothesis.

V. Recommendations

This research may be used as a database for further research about skin rejuvenation and smoothness.

This study may be used as an alternative antiaging treatment for wrinkle reduction and the collected data may be used in comparison with other topical antiaging treatments. The collected data may also assist the usage of acai palm extract for skin diseases and other cosmetic purposes.

VI. Conclusion

After 12 weeks of use of 3% Euterpe oleracea extract eye cream, the results demonstrated the gradual increase in the means of cutometer and cornrometer scores in each visit. This implies that the acai palm extract improves skin elasticity and hydration. More importantly, it did not give rise to any kind of adverse effects and the treatment satisfactory score received from the volunteers is also high. Lastly, the topical 3% Euterpe oleracea extract cream as a treatment for periorbital wrinkles is considered a safe and promising anti-wrinkle intervention.

VII. Limitations

It is important to note that while the participants were strongly recommended to avoid outdoors, sun exposure and to get enough sleep while the study is going on, the researcher cannot control the lifestyles of the participants.

While there were improvements in skin elasticity and hydration, better improvements compared to baseline numbers could potentially be observed had the study been longer. Moreover, this study was done using a concentration of 3% of Euterpe oleracea extract in the cream and the researcher believes the effects of a cream with moderately higher acai palm concentration against wrinkles should be studied upon.

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