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Improving Skin Hardness and Thickness using a combination of Omega-3 Fatty Acid and Aloe Vera Oil: Pilot study

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Abstract

Background/Aims: Maintaining skin elasticity and hardness is one way of keeping younger skin. This study investigates the topical effects of Aloe Vera (AV) alone and accompanied with Omega-3 (O-3) on skin hardness and thickness.
Method: Healthy females were randomly selected and divided into two groups (15 in each group) for a double-blind controlled study. All volunteers, between 18-25 years of age, were not pregnant or suffering from any medical illness. Both groups were asked to put formulations having similar appearance on the skin of forearm for 30 days. A prepared skin formulation containing AV oil only was considered baseline. The other group was treated with AV oil and O-3 mixture. Skin elasticity and hardness were measured using Digital Durometer and Diagnostic Ultrasound System.
Results: Compared to baseline**,** skin elasticity & hardness significantly improved at the end of the study in both AV and the combination groups. There was a slight synergistic effect of combining O-3 and AV on both elasticity and hardness.
Conclusion: The study is the first of its kind exploring the possible use of AV and O-3 topically to reverse the signs of aging on skin thickness. At the end of trial period improvements in skin thickness were noticed.

Key words
Skin, Omega3, Aloe Vera, pilot study

1. Introduction

Loss of skin hardness and a considerable reduction in epidermal thickness are features of skin's aging process. This may give rise to paper-skin or "wrinkles" characteristic of old age. Many factors can adversely affect skin hardness and thickness such as free radicals [1]. The free radicals are produced by Reactive Oxygen Species (ROS). Many chemicals are termed as anti-oxidants for their ability to depress the occurrence of these ROS. Hence, the discovery or development of an agent that can delay appearance of wrinkles has been the quest of all pharmaceutical and cosmetic companies and manufacturers. Omega-3 and Omega-6 Fatty Acids are both essential fatty acids. Omega-3 (O-3) fatty acid is an antioxidant that benefit skin by regulating oil production, boosting hydration and delaying the skin's aging process [2]. On the other hand, Aloe Barbadensis which is commercially known as Aloe Vera (AV) oil, is another antioxidant containing essential vitamins and minerals for skin's wellness [3]. There are reports covering the various pharmacological and therapeutic advantages of this plant including usage by Alexander and Cleopatra since old times [4, 5]. Although, using exogenous antioxidants shows promises in anti-aging cosmetic products, the effect of AV oil and O-3 fatty acid on the skin is still a fairly unexplored territory.

The oxidative stress encountered in aging may be due to lipid peroxidation by ROS that eventually alters the redox set points [6]. Relationship of degenerative oxidative stress has been associated with aging time [7, 8]. Thus, the study aimed at exploring the possibility of reversing this effect by introducing anti-oxidant properties of Aloe Vera gel. This was done by evaluating the possible synergistic effect of O-3 fatty acid with AV oil on improving skin hardness and thickness in young Saudi females. Lastly, we planned to explore the efficacy of topical formulations containing O-3 fatty acid, in order to provide a basis for future cosmetic skin care formula.

2. Methods

A randomized double-blind controlled study was conducted on 30 healthy Saudi female college students aged 18 to 25 years. An ethical approval from the ethics committee at Princess Nourah bint Abdulrahman University (PNU) was received (CAMS 27-36/37). All methods were performed in accordance with the relevant guidelines and regulations. All participants were screened thoroughly for eligibility. With a volunteer being excluded from the study if she was using corticosteroids or was pregnant at the time of the study, had diabetes, cardiovascular diseases, skin disorders or cancer in addition to any other terminal illness.

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Each participant signed an informed consent. Participant's demographics data and some related information have been collected through a structured questionnaire. The study measurements were done in PNU. The formulation is oily mixture (5:1) of Aloe Vera oil pure and O-3 oil. The O-3 oil extracted from O-3 soft gelatin capsule (manufactured by: GNC (General Nutrition Centers, is a Pittsburgh, Pennsylvania-based American company selling health and nutrition related products, including vitamins, supplements, minerals, herbs, sports nutrition, diet, and energy products.) by using needle. Each capsule contains 1 mL of O-3 oil.

The subjects were randomly divided into two groups to use a prepared skin formulation containing either pure AV oil alone or combination of (AV+O-3) (5:1) for 30 consecutive days. Both groups contained randomly distributed 15 participants each. The two formulations were ensured to be homogeneous having similar appearance, odor and texture. The volunteers were instructed to apply two puffs of the formulation on the forearm daily.

Skin hardness and thickness were measured (baseline, then at day 5, 18, and 31) using Digital Durometer (OO Model, Check. Line by Electromatic, NY, U.S.), and Diagnostic Ultrasound System (iU22 Model, Philips, WA, U.S.) respectively. A standard weight and a durometer foot (supplied by the manufacturer) were attached to the durometer and used in every measurement site. Skin hardness was conducted on the forearm. Subjects were sitting with the forearm supported by a pillow. All participants were evaluated between 10 AM to 2 PM every time to avoid any physiological diurnal changes in skin thickness and/or hardness. The laboratory temperature was maintained at 21-24 °C, with normal ventilation and free of noise environment.

Comparison of hardness and thickness within the same group and between the two groups was done by paired and independent Student's t-test respectively, using the SPSS software version 20 (SPSS Inc., Chicago, U.S.).

3. Results

Initially, both AV and the combination (AV+O-3) groups were comparable in age and skin hardness baseline as indicated in **(Table 1)**.

In each group, compared to the baseline, skin hardness significantly improved at the end of the study in both AV and the combination (AV+O-3) groups, (P-value=0.005, 0.001) respectively. The improvement in skin hardness was found to be time-dependent as shown in **(Figures 1 and 2)**.

At the end of the study, skin thickness was significantly increased compared to the baseline, in both AV and the combination (AV+O-3) groups, (P-value= 0.016, 0.0001) respectively. This improvement of skin thickness was in a time-dependent manner **(Figure 3)**. In addition, skin thickness was positively correlated to skin hardness in both AV and (AV+O-3) **(Figure 4)**, respectively, (r=0.8, r=0.73).

On the other hand, when skin hardness and thickness have been compared between the two groups AV Versus (AV+O-3) there was a slight synergistic effect of adding O-3 on both hardness (0.59±0.64) Versus (0.95±0.73), and thickness (0.01±0.012) Versus. (0.02±0.015) respectively, although this effect was insignificant. The author compared skin hardness between the 2 groups using t test and the results was insignificant although the mean hardness increased slightly in the AV+O3 group compared to AV group. Also, the author compared skin thickness between the 2 groups using t test and the results was insignificant although the mean thickness increased slightly in the AV+O3 group compared to AV group.

4. Discussion

Many age related changes in the body are assumed to be due to ROS which presents itself as a paradox that vital element for life i.e. oxygen could pose threats of such severity in the long term [7,9,10]. Age and anatomical region are important factors influencing skin hardness; therefore, this study was done on young females, measuring the same area of forearm during the study period.

Also, a useful proven quantitative measurement method of skin hardness was used which was expressed numerically using a Durometer. Two parameters, skin hardness and thickness were measured.

Our study is the first randomized double-blind controlled study screening female Saudi population skin's hardness and thickness, in addition to determining the possible effects of topical application of O-3 fatty acid. Omega-3 fatty acids (Ω-3 FA) have been verified to be the antioxidants and anti-inflammatory agents [11, 12]. In this study, we found that AV alone and the combination of (AV+O-3) significantly increase skin thickness, which affected hardness measurement (positive trend). Thus, such changes may result from the anti-aging effect of O-3, however the exact mechanisms are unknown. In the combination group (AV+O-3), the positive changes in both on skin thickness or hardness are related to both agents. In order to eliminate the influence of AV, future studies are recommended to investigate the effect of (O-3) vs. (AV).

Additionally, when we compared the two groups, AV Versus. (AV+O-3), the results show a non-significant trend of a potential synergistic effect of O-3 on AV. To demonstrate this effect, we recommend to enlarge the sample size and extend the study period. Further, increasing the concentration of O-3 might be beneficial to test the possibility of dose-response relationship. Lastly, the results verified that the formulation is cosmetically acceptable, stable and effective for skin thickness, which may contribute to reducing skin aging. Our results provide a basis for future cosmetic testing and the potential for the development of custom formula skin care.

Conclusion

The study is the first of its kind exploring the possible use of AV and O-3 topically to reverse the signs of aging on skin thickness. At the end of trial period improvements in skin thickness were noticed. There was also a slight synergistic relationship seen between AV oil and O-3._relationship seen between AV oil and O-3(effect of AV oil by addition of O-3).

Table 1: Features and baselines characteristics of AV group and the combination group.

	AV Group (n= 15) Mean ± SD	AV+O-3 Group (n= 15) Mean ± SD	P-Value
Age	21.6±1.80	21.0±1.50	0.32
Skin hardness Baseline (HU)	0.53±0.84	0.50 ± 0.51	0.88
Skin Thickness Baseline(mm)	0.08±0.01	0.09±0.01	0.03

AV=Aloe Vera; O-3= mega-3; n= number of participants.

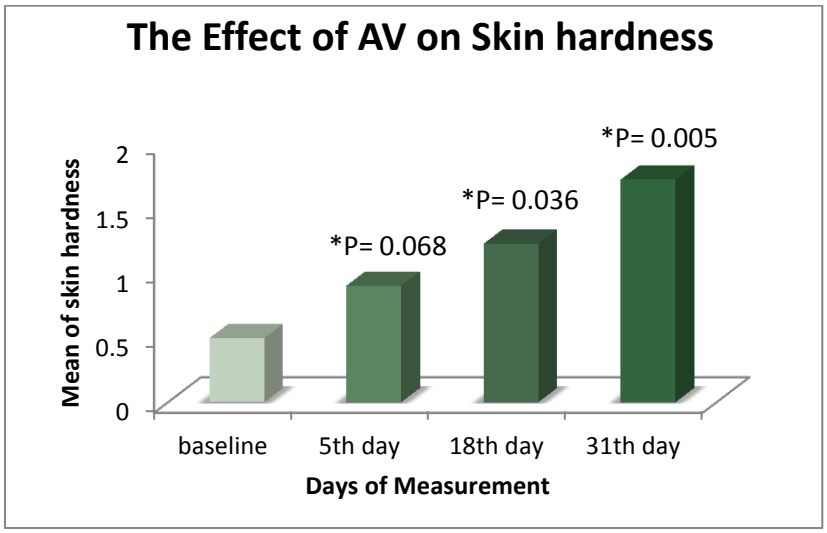

Figure 1: The effect of AV on skin hardness after 5, 18 and 31 days respectively.

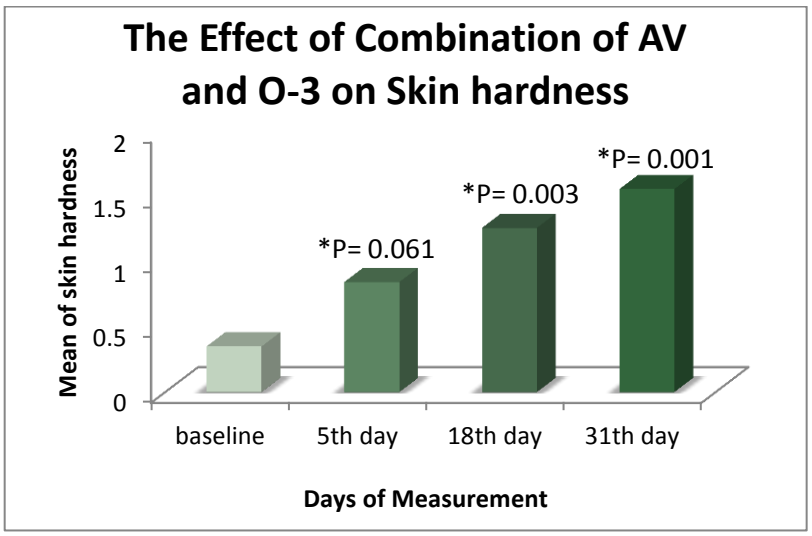

Figure 2: The effect of combination of AV and O-3 on skin hardness after 5 ,18 and 31 days respectively.

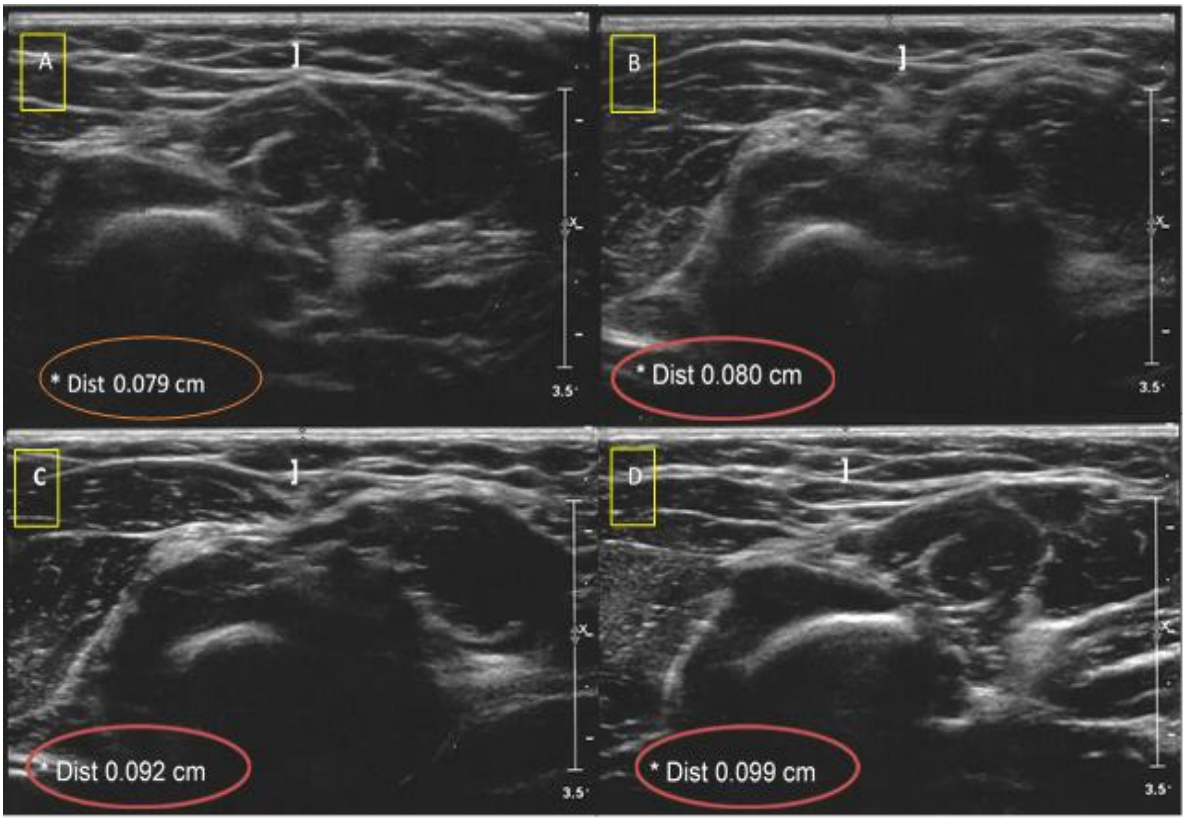

Figure 3: The figure shows ultrasound results for one participant in the AV group during the study period. (A: baseline, B: day 5, C: day 18, D: day 31). * Thickness of dermis layer.

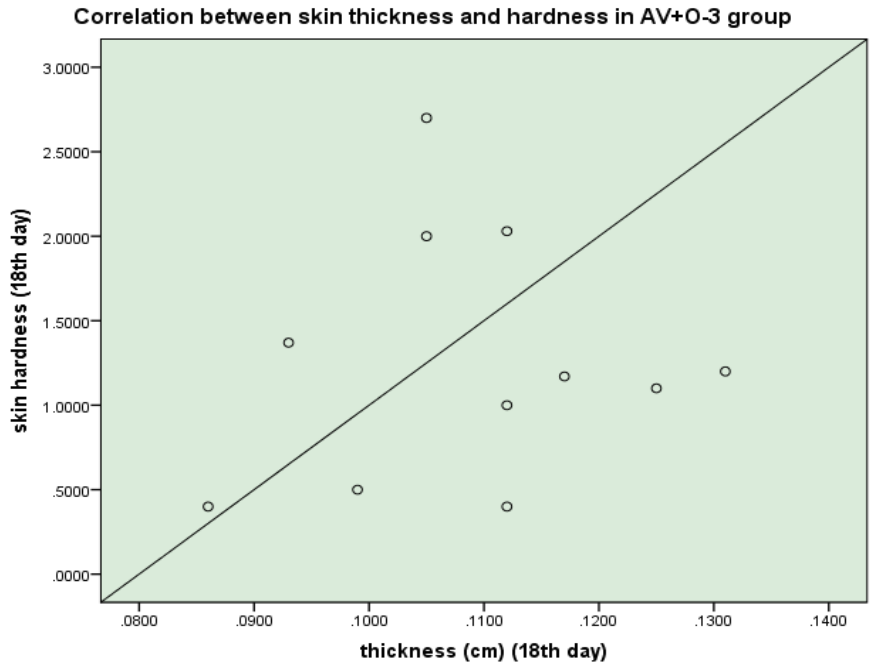

Figure 4: Scatter plot represents a positive correlation between skin thickness and hardness in AV+O-3 group.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

There are no conflicts of interest including personal or financial bias.

Acknowledgments

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