

The Role of Hydrolyzed Jojoba Esters as a Unique Botanical Technology for Long-Acting Moisturization

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Introduction

Jojoba (*Simmondsia chinensis*) is a perennial shrub indigenous to arid regions of Arizona, California, and Northwestern Mexico.¹ Jojoba seed contains about 50% jojoba oil. Jojoba oil is not a triglyceride oil, as are all other known botanical oils. Rather, jojoba oil is approximately 99% liquid wax ester. The ester is composed of long-chain linear fatty alcohols, 20 to 24 carbons in length and long-chain linear fatty acids, 18 to 22 carbons in length. Nearly all of the acid and alcohol moieties are ω -9 monounsaturated.² Jojoba oil has been used in folk remedies for renal colic, sunburn, chaffed skin, hair loss, headache, wounds, and sore throats.³ Sulfurized jojoba oil has been studied as a treatment for acne, while the unmodified wax has been used to treat psoriasis.⁴

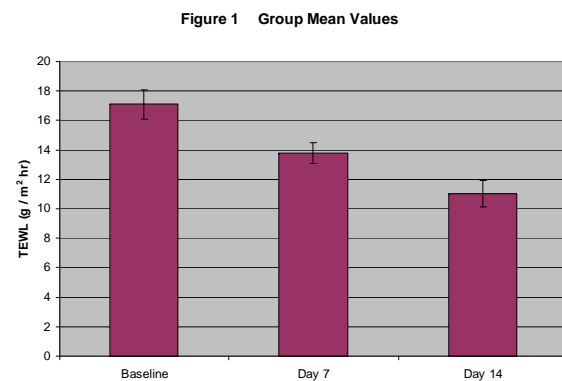
The current studies were undertaken to evaluate the role of hydrolyzed jojoba esters (HJE) and jojoba esters (JE) as unique technologies for development of long-acting barrier function activity. A combination of transepidermal water loss (TEWL) measurements, impedance measurements for skin moisturization, expert grading of dry skin, dermatologist grading of the signs and symptoms of hand dermatitis, as well as clinical photography were used to investigate the effects of HJE and JE. Additionally, the effect of HJE on two biomarkers involved in skin inflammation and barrier function (*i.e.* IL-6 and filaggrin) was investigated.

Clinical Design

Three small pilot studies were conducted at Floratech in Chandler, Arizona and one study was conducted at an independent laboratory to ascertain the effects of hydrolyzed jojoba esters and jojoba esters on skin moisturization and barrier function in normal skin and hand dermatitis. All subjects signed an informed consent form before being enrolled into each of the studies. There was a three-day wash-out period in which the subjects refrained from using any creams, lotions or gels on the skin test sites for each study. Cetaphil® (Galderma LLC) soap was given to the subjects to use during the wash-out period in studies #1 and #2 while Ivory Soap® (The Proctor & Gamble Company) was used in the wash-out period by the subjects in studies #3 and #4. Before evaluations were conducted at the testing facilities, the subjects equilibrated in an environment of 72±2° F and <50% RH. All TEWL measurements were taken with a Tewameter TM 300 (Courage + Khazaka, GmgH). All impedance measurements for skin moisturization were carried out using the Dermal Phase Meter (NOVA) 9003. All clinical photographs were taken with a Nikon® D70S digital SLR camera (Nikon Corporation) with standard, controlled lighting.

Study #1

The objective of this study was to evaluate the role of HJE and glycerin in an experimental alcohol hand sanitizer to mitigate the symptoms of irritant hand dermatitis in health care workers with a history of hand dermatitis. Fourteen health care workers with an average of thirteen years of hand dermatitis (dermatologist diagnosed) were enrolled in the study. A dermatologist evaluated their dorsal hands. Baseline TEWL measurements were taken, as well as clinical photographs. The subjects were then told to use the experimental hand sanitizer 8 times/day for 14 consecutive days, after which, they reported back to the testing lab for dermatologist scoring (Figure 2), photographs (Figure 3), and TEWL measurements (Figure 1).



*Error Bars = Standard Error Mean

The experimental hand sanitizer reduced TEWL at Day 7 by 19% and at Day 14 by 36% (p<0.01 and p<0.001, respectively).

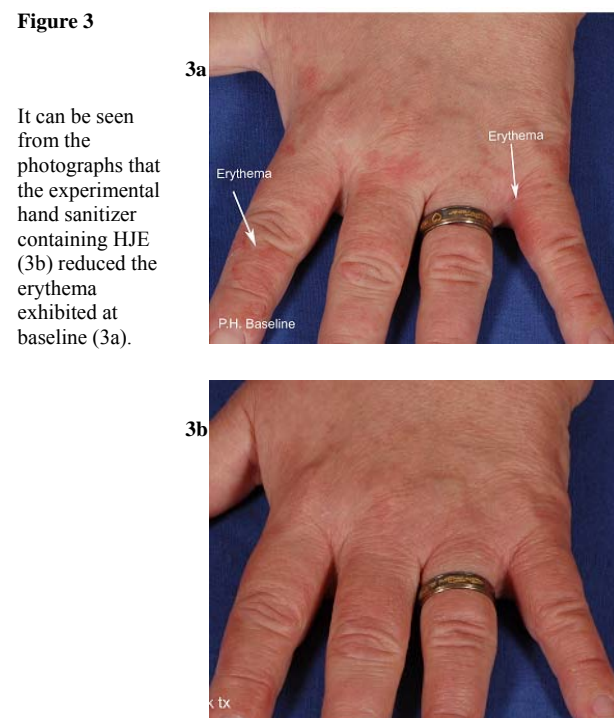
Figure 2 Dermatologist Assessment

Hand Surface (Dorsal) – Average Scores

	Baseline	14 Days Post-Treatment
Erythema	1.7	0.5*
Scaling	1.3	0.1*
Fissuring	0.1	0.0 (healed)
Xerosis	2.1	0.5*

* = data statistically significant (p<0.01) from baseline
 0 = no identifiable signs and symptoms
 + (0.5) = slightly more involvement
 1 = mild
 2 = moderate
 3 = moderately severe
 4 = very severe

Clinical Photographs of the Hands



It can be seen from the photographs that the experimental hand sanitizer containing HJE (3b) reduced the erythema exhibited at baseline (3a).

Study #2

The purpose of the next study was to evaluate whether an experimental hand sanitizer formulation containing hydrolyzed jojoba esters could affect biomarkers associated with inflammation and barrier function in individuals with moderate irritant hand dermatitis. Six subjects with moderate hand dermatitis (dermatologist diagnosed) had a 3 mm biopsy taken from a designated spot on the hand. The subjects were instructed to use the hand sanitizer product ten times per day for 14 days and return to the testing site for follow up biopsies. The biopsies at baseline and after 14 days of hand sanitizer use were fixed in paraformaldehyde, prepared for histopathology. The biomarkers that were evaluated were IL-6 and filaggrin. The results of the immunohistochemistry are seen in Figure 4. For both IL-6 and filaggrin, staining was reduced after 14 days of use from the experimental hand sanitizer that included hydrolyzed jojoba esters.

Figure 4

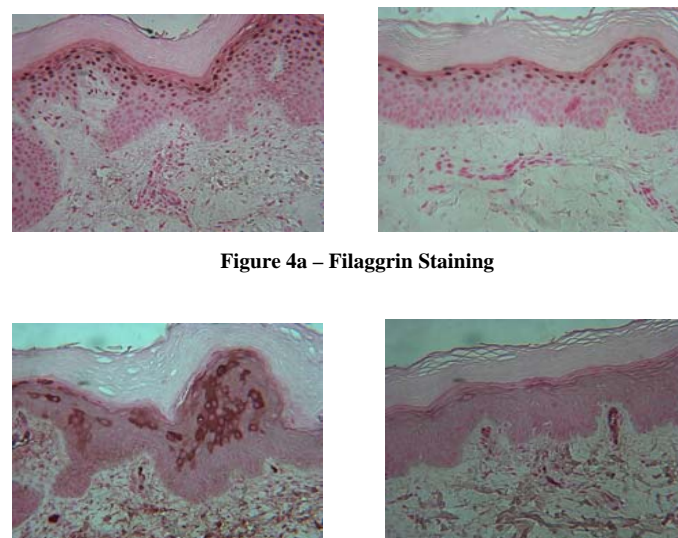


Figure 4a – Filaggrin Staining

Figure 4b– IL-6 Staining

Figure 4. Experimental formulation supplemented with hydrolyzed jojoba ester at baseline (left: pre-treatment) and at day 14 (right: post-treatment). 25x

Study #3

The objective of the third study was to compare the ability of a standard skin care lotion containing hydrolyzed jojoba esters and 2% glycerin to a leading market brand containing glycerin and petrolatum to improve dry, flaky skin after one application. Twelve healthy females had expert visual skin grading at baseline for dry skin and clinical photographs followed by one application of the two products, once to their lower, outer legs. Twenty-four hours later, the measurements were repeated. (Figure 5)

Clinical Photographs of Dry, Flaky Skin

Figure 5

(A) Baseline (mean visual scores = 2.1)
 (B) 24 hrs post currently marketed lotion with glycerin application (mean visual scores = 0.9)
 (C) 24 hrs post standard lotion with HJE and glycerin application (mean visual scores = 0.6)



The results clearly indicate that the experimental lotion containing 2% glycerin and the HJE reduced the appearance of dry skin greater than a leading market product containing glycerin and petrolatum (72% vs. 56% decrease in dryness, p<0.1).

Study #4

A clinical study, conducted by an independent contract laboratory, was performed with 12 healthy subjects. The subjects selected were gender/race unspecific with noticeable dry skin on their lower legs. The subjects were in good health and had not used any skin treatments in the previous 7 days before the clinical study. Experienced technicians performed instrumental readings at baseline, 1, 7 and 24 hours after one application of the ultra moisturizing cream (UMC) with and without HJE and JE. The relative degree of skin hydration was assessed using the Dermal Phase Meter (NOVA) 9003. Measurements were made by applying an alternating voltage to the skin with a closely spaced pair of electrodes and measuring impedance. Changes in water content change the impedance of the capacitive circuit. Readings were taken in duplicate at each test site. The graph in Figure 6 illustrates the results.

Figure 6. 24 Hour Moisturization UMC w/ HJE/JE showed a 220%, 137%, 125%, and 34% increase from baseline at 1, 4, 7, and 24 hours respectively (p<0.05) compared to a 103%, 55%, 34%, and 25% increase (p<0.05) with UMC w/o HJE/JE.

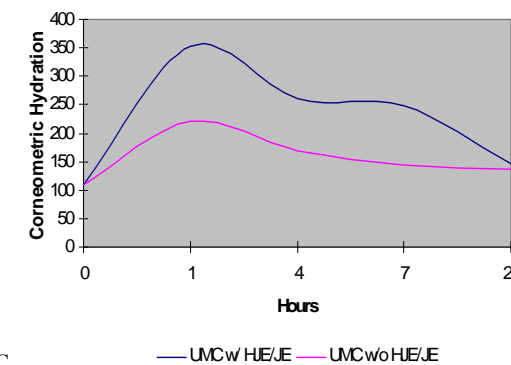


Figure 7 Consumer Perception of Moisturization

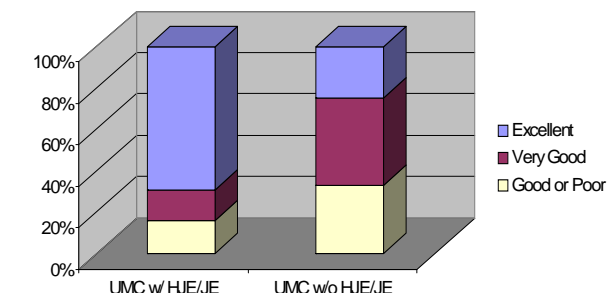


Figure 7. When participants were asked to rate each of the formulations, the formulation w/ HJE/JE was favored with 69% of participants considering the product excellent as compared with only 25% for the formulation w/o HJE/JE.

Conclusions:

- Hydrolyzed jojoba esters and jojoba esters potentiate the effect of glycerin in increasing skin moisturization
- Hydrolyzed jojoba esters may potentiate the effect of glycerin in reducing dry, flaky skin
- Hydrolyzed jojoba esters incorporated into a hand sanitizer containing glycerin can statistically reduce TEWL, erythema, and scaling over 7-14 days of use
- Preliminary immunohistochemistry data suggests that hydrolyzed jojoba esters may have an inhibitory effect on the expression of IL-6 and filaggrin in dermatitic skin

References:
 1. United States. Department of Agriculture. Natural Resources Conservation Service. Edited by John T. Kartesz PLANTS Profile. <http://plants.usda.gov/java/profile?symbol=SICH>. (Accessed 30 January 2009).
 2. Wisniak J. The chemistry and technology of jojoba oil. Champagne, IL: American Oil Chemists' Society Press; 1987. p. 42-45.
 3. Yaron A. Metabolism and physiological effects of jojoba oil. In Wisniak J, editor. The chemistry and technology of jojoba oil. Champagne, IL: American Oil Chemists' Society Press; 1987. p. 251-65.
 4. Mosovich B. Treatment of acne and psoriasis. In Wisniak J, Zabicky J, editors. Proceedings of the Sixth International Conference on Jojoba and its Uses. Beer Sheva, Israel: University of the Negev; 1985. p. 393-7.