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MOISTURIZING CAPACITY OF ALOE VERA GEL IN SKIN CREAMS MADE WITH SILICONE-BASED AND OLIVE OIL-BASED LATEX PREPARATIONS

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Summary

Aloe vera is known for its many pharmacological properties, particularly its hydrating capacity. To study this effect we designed two preparations based on silicone and olive oil and containing Aloe vera gel, and tested hydrating capacity in a random sample of healthy volunteers with different types of skin. The two formulations were applied on different parts of the body and hydration was measured with a CM 825 corneometer. In general, on can conclude that the participants preferred the silicone-latex formulation by its organoleptic properties, however, the olive oil-based cream had, in general, a better hydration in all types of skin.

Riassunto

L'aloe vera è conosciuta per le sue molteplici proprietà farmacologiche, in particolare per la sua capacità idratante.
Per studiarne questo effetto abbiamo preparato due emulsioni basate rispettivamente sull'uso di olio di oliva o di silicone, contenenti aloe vera.
Di queste emulsioni ne è stata controllata in modo casuale l'attività idratante in un gruppo di volontari sani appartenenti a diverse tipologie cutanee.
Le due formulazioni sono state applicate su diverse aree cutanee del corpo misurandone poi l'idratazione con l'uso del Corneometro CM825.
In generale si può concludere che tutti i volontari preferivano l' emulsione basata sull'uso dell'olio siliconico per le sue migliori caratteristiche organolettiche.
Mentre la crema basata sull'olio d'oliva ha fatto registrare maggiori incrementi dell'idratazione in tutti i tipi di pelle.

INTRODUCTION

To maintain the skin's natural moisture, oil-based emulsions for topical application on the stratum corneum should be balanced in aqueous and oil-based components. Normal levels of hydration depend not only on the water supplied by inner layers of the skin, but also on the mechanism of water retention, which slows the loss of water [1-2].

The factors that influence physiological hydration are cold, wind, rapid changes in temperature [3], skin alterations, season (prolonged exposure to sunlight and high temperatures in summer) [4], sebaceous secretions, excessive exposure to sunlight [5], diseases such as atopy and ichthyosis, pharmacological treatment and systemic diseases [6].

Because of differences in the number of sweat and sebaceous glands in different parts of the body surface, not all parts of the skin are covered by the same hydrolipid film. Natural hydration in areas with fewer sebaceous glands is lower as less water is retained; consequently these areas tend to become dry and scaly. The barrier function of the skin resides in the lipid matrix of the stratum corneum, and alterations in the proportion of lipids give rise to dry skin that is more sensitive to external agents.

Depending on the degree of sebaceous secretion, the skin is classified as [7]:

Normal: elastic, thin, pores not readily visible

Oily: open pores, shiny surface, blackheads. This type of skin is more resistant to external agents.

Dry: characterized by its low content in surface lipids, resulting in relatively less supple skin. Less resistant to external agents.

It is important to note that male and female skin differ in certain ways, and that the differences become more evident with age. Men's skin contains more collagen and is thicker through all layers, but thins significantly with age. Wrinkles are more pronounces in men's skin, but because of the lower collagen content in women's skin, the latter appears to age faster. The texture of men's skin is rougher, and because sebum production is greater than in women's skin, scaling appears later.

Lack of protection against poor weather conditions accentuates the physiological differences, which are increased further by shaving in men—thus men's skin requires greater rehydration than women's skin. This is an important cosmetic consideration, as an appropriate moisture content ensures that the skin remains soft and smooth.

The aims of cosmetic hydration are [8]:

- to maintain and increase surface moisture levels
- to maintain or recover homeostasis
- to delay aging
- to treat medical or cosmetic problems

These aims are met with different mechanisms of action and different substances including silicones [9], olive oil [10] and Aloe vera gel [11-12].

Aloe vera gel has been used for its curative properties for hundreds of years. Although its composition varies, the tannins, sterols, organic acids, enzymes, vitamins and minerals it contains have antiviral, antifungal and local anesthetic activities, antiinflammatory, and depigmentation activity, and analgesic, emollient, cell regeneration, astringent and partial solar filtering actions. Because of these properties, Aloe vera gel is used in dermatology and cosmetics to heal wounds and burns, and to prevent inflammation in seborrheic dermatitis thanks to its direct or indirect action on the immune system. It is also used as an alternative treatment for psoriasis. Because of its emollient, analgesic and astringent actions it is especially recommended for sensitive skins.

Because of its hydrating capacity, Aloe vera gel was tested in this study to determine how excipients influenced this action. We used two specially prepared types of latex, one based on olive oil and one based on silicone. In addition, we perfected a protocol for testing hydrating capacity.

MATERIAL

Aloe vera gel 10:1, supplied by Zeus Química, Barcelona, Spain
Dow Corning 245, supplied by Dow Corning Corporation.
Abil EM 90, a nonionic W/O silicone emulgent used to incorporate plant extracts and hydrating agents, supplied by Th. Goldschmidt
Pharmaceutical grade olive oil, used in cosmetic hydrating preparations because of its compatibility with skin. Olive oil is considered compatible with natural skin oils. Its occlusive action is highly effective in cosmetic hydration. Supplied by Fluka Chemika.

- Olivem 700, nonionic O/W emulgent that produces stable creams without the use of other emulgents. Its stabilizing capacity in emulsions is due to the formation of liquid crystals. Supplied by Quimibios, S. L.
- n-Decane, supplied by Panreac S.A.
- Distilled water up to 100%
- Hydration was measured with Sebumeter 810 and Corneometer 825 pH meters (Clinipro S.L, Cologne, Germany) [13].

METHODS

Formulations

1. Silicone latex [14-15]
Aloe vera gel 5%
DC-245 23%
Abil EM 90 5%
n-Decane 0.3%
Distilled water up to 100%
Components in the oily phase were combined, and separately Aloe vera gel was dissolved in distilled water. The aqueous phase was added slowly to the oily phase with constant shaking. The result was a white, non-oily cream with pH 5.87.
2. Olive oil latex [16]
Aloe vera gel 5%
Olive oil 23%
Olivem 700 5%
n-Decane 0.3%
Distilled water up to 100%
The aqueous phase was prepared by dissolving Aloe vera gel in distilled water. The oily phase was prepared by heating olive oil to 85 °C, then adding Olivem until it was melted. When the mixture had cooled, n-decane was added with shaking, and the aqueous phase was slowly added. The result was a yellowish cream with pH 6.09.

Hydration

Hydration was measured with Sebumeter 810 and Corneometer 825 pH meters. The sebumeter was used to directly measure sebaceous secretion on the skin, and the corneometer was used to directly measure hydration. Of the participants in the hydration assays, 64% were women and 36% were men.
Two types of assay were nsed depending on the time the participants were able to volunteer.
Long assay: Cream was applied for 5 days a week during 2 weeks, and from the third week hydration was measured every day on bare skin until it returned to the initial value.
Short assay: In the short assay cream was applied for 5 days and hydration was measured daily from the second week after application had ended until hydration returned to its initial value.
Hydration was measured on the face, where per-

cutaneous absorption is 5-fold to 10-fold as great as on other body surfaces. All measurements were made on the cheek and chin to compare values with the concentration of sebaceous glands in each area. Hydration was also measured on the inside surface of the forearm.

On the first day of the assay the participant's type of skin was determined as closely as possible by measuring skin oil levels before the cream was applied on the forehead, cheek, chin and forearm. The normal level of hydration was then measured in each area.

All data were recorded on a specially designed form. Information was noted on skin oil level and hydration, and we also noted the participant's age and whether he or she had any allergies or skin problems, or was receiving dermatological treatment. The form also contained a questionnaire that each participant completed on the first day of the study, with items pertaining to organoleptic characteristics of the two preparations. This information was useful in determining participants' perceptions of the products during use—an important consideration when two or more preparations are compared in pharmaceutical development studies.

RESULTS and DISCUSSION

They type of skin of each volunteer was determined. The results were classified according to type of skin, site of application, sex and type of preparation.

Type of skin

In most participants with oily forehead skin, hydration increased during treatment with both the olive oil-based and silicone-based latex preparations, and was slightly greater in the former group (Fig. 1).

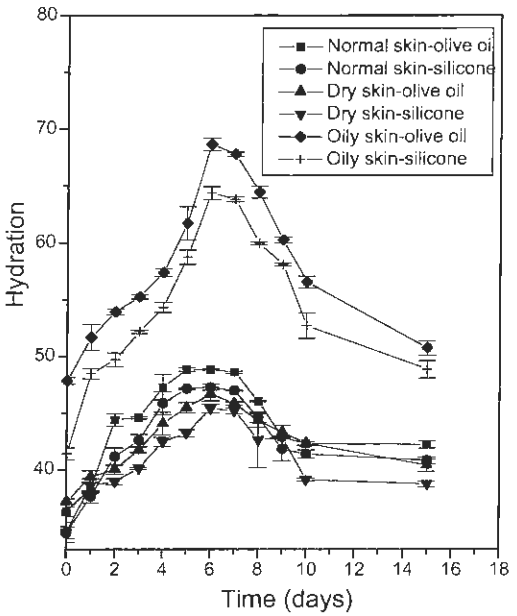

Fig. 1 Hydration with time in the three types of skin with the two formulations

In participants with normal or dry skin on the forehead, hydration increased during treatment, with slightly lower values in comparison to participants with oily skin. The results were slightly better with the olive oil-based latex preparation.

In participants with normal skin on the cheek and chin, neither preparation led to significant changes in hydration during treatment (Fig. 2).

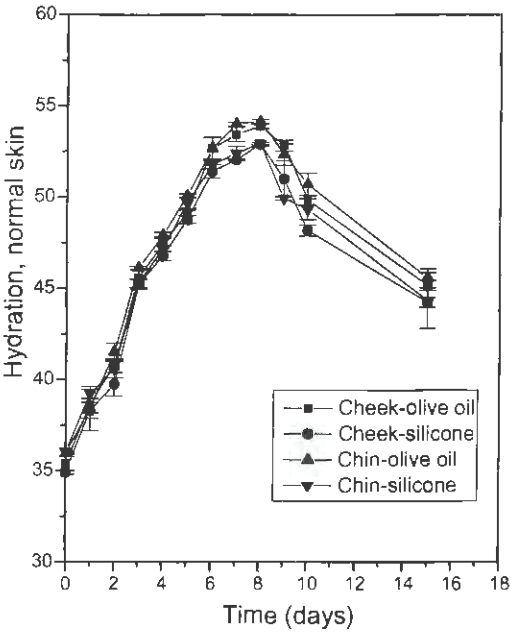

Fig. 2 Influence of site of application on hydration obtained with the two formulations

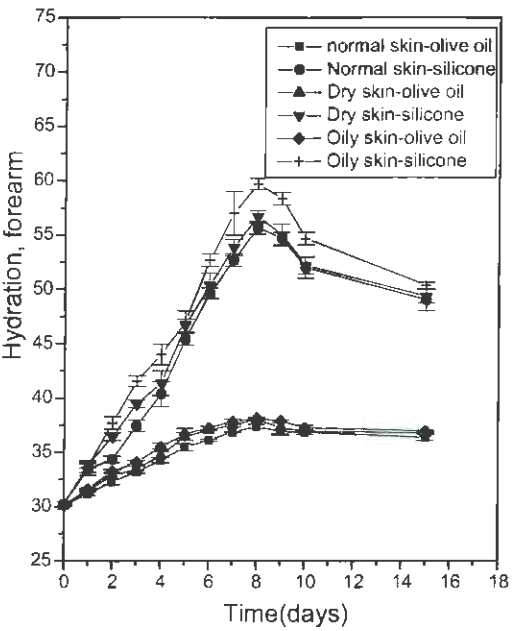

Fig. 3 Influence of type of formulation on hydration in forearm skin of participants with different types of skin

In participants with oily or normal skin, hydration in cheek and chin areas began to show substantial increases a few days after treatment started. Neither preparation performed significantly better than the other.

In contrast to facial areas, the results of treatment on forearm skin were similar regardless of the participant's type of skin. This area shows smaller variations in hydration between individuals, and the results were therefore more reproducible, as reported earlier by Torres et al. [17]. Figure 3 shows that hydration increased throughout the treatment period, then decreased when applications stopped, eventually returning to baseline values. The olive oil-latex preparation led to similar but smaller increases in hydration than the silicone-latex preparation.

Despite the differences in the findings for different body areas, these results showed that in general, the hydrating effect of Aloe vera gel in dry skin was evident as both short-term and long-term improvements. The benefits were still measurable as long as 4 to 7 days after treatment had ended. The findings for individuals with normal skin were similar.

In persons with oily skin, Aloe vera gel showed a short-term hydrating effect but was less effective during the rest of the treatment period. Hydration returned to baseline values after treatment had ended, so that long-term improvements in hydration were harder to obtain.

Site of application

Hydration was greatest on the chin, possibly because the concentration of sebaceous glands is

highest in this area. Lowest hydration scores were seen in the forearm, possibly because in most volunteers this area was classified as dry skin. Of the different body surface areas we tested, this area may be the least well protected against external agents [18].

Sex

In women, the increases in hydration were large and occurred rapidly, whereas increases in men were moderate. At the end of treatment hydration values remained increased for longer in women than in men (Fig. 4). The changes in hydration showed clearly different behaviors in men and women, owing mainly to the physiological characteristics of the skin in each sex.

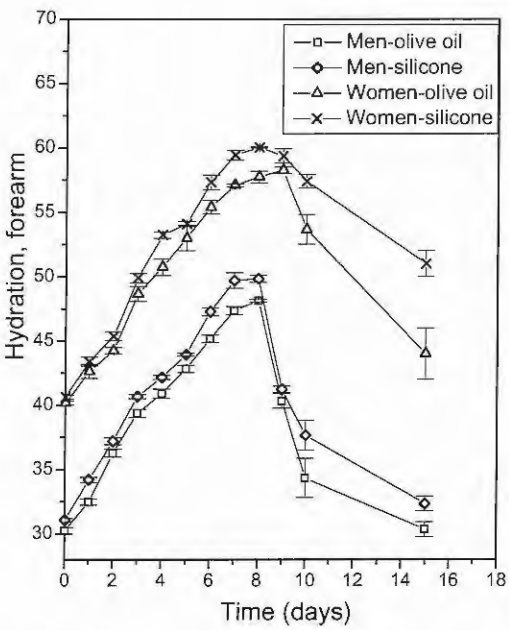

Fig. 4 Influence of sex on hydration with each formulation on forearm skin in men and women with dry skin

Type of preparation

According to information provided by the participants in the questionnaire, the silicone latex-based preparation had a more pleasant skin feel than the olive oil latex-based preparation.

The silicone latex preparation was more appropriate for oily skin, whereas the olive oil silicone preparation yielded better results for dry skin. Both preparations were equally satisfactory for normal skin.

During application the silicone latex preparation was judged moderately or much more pleasant, and generally led to no concerns over contact between the skin and clothing. The olive oil-based latex preparation was pleasant to the touch and did lead to concerns over contact with clothing. Most volunteers preferred the silicone latex-based formulation (Fig 5).

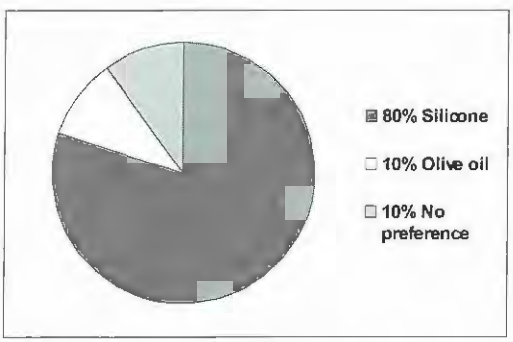

Fig. 5 Results of the sensory analysis

CONCLUSIONS

Type of assay. The findings we obtained with the short (7 days) and long versions (15 days) of the assay did not differ significantly. However, we conclude that the long version provides better information on the influence of external factors on hydration.

Type of skin. Despite the variability in our findings, both creams had short-term and long-term hydrating effects (evident throughout the treatment period) in dry and normal skin, and these effects lasted for 4 to 7 days after treatment ended. In oily skin the hydrating effect of both creams was more evident in the short term.
Site of application. Hydration increased most in the chin, possibly because this area contains the greatest number of sebaceous glands. In contrast, hydration showed the smallest changes in the forearm. It is worth noting that the skin in this area is considered ideal for measuring hydration because variations are smallest.
Sex. The increases in hydration were greater and occurred sooner in women, and were more moderate in men. After treatment had ended, the increases in hydration were maintained for longer in women. These findings are consistent with the physiological differences in skin between men and women because of the action of sex hormones.
Type of preparation. The silicone-latex formulation was more compatible with oily skin than the cream prepared with olive oil. In general, the participants preferred the former on the basis of its organoleptic properties. However, the olive oil-based cream had, in general, a better hydration capacity in all types of skin and in all body surface areas tested.

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Table I.

Data collection card used to record hydration and sensory analysis data for each volunteer

FORMULATION
Volunteer's name:
Age:
Observations:

SKIN OIL / HYDRATION
Forehead
Chin
Cheek
Arm

Forehead
Chin
Cheek
Arm

Time

SENSORY ANALYSIS
Questionnaire:

*Sensation on rubbing the product between fingertips:

FIRMNESS: (0-10) (force needed to squeeze the product between thumb and forefinger)
STICKINESS (0-10) (force needed to separate fingers)
COHESION (0-10) (formation of threads on separating fingers slowly)

*Pleasantness of the product:
1. Unpleasant (1-5)
2. Pleasant (1-5)

*Ease of use:
- After applying the product do you feel like washing your hands?
1. No 2. A little 3. Some 4. A lot 5. Must wash my hands

- After applying the product, do you feel like washing the place you applied it to?
1. No 2. A little 3. Some 4. A lot 5. Must wash the place

- Concerns with dressing: After you have applied the product, would you be worried about putting on a long-sleeved blouse or shirt?
1. No 2. Slightly 3. A little 4. A lot 5. Very much

*Preference: If both products had the same cosmetic effect, which would you prefer to use? Why?

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