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# Opuntia Cactus Ingredient for Men's Care

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## Abstract

*An ingredient, based on an extract of the Opuntia ficus-indica cactus, was found to perform as a soothing active in a cell culture model with sensory neuron and keratinocyte cells. The soothing efficiency could be confirmed in clinical trials where skin irritation was induced either by UV or wet shaving. Many men experience daily reddened, irritated facial skin after shaving. The cactus ingredient, which also showed a long-lasting moisturizing effect, is therefore suitable for use in shaving foams and after-shave products*

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## Introduction

Recently, there has been a significant development in cosmetic products for men. The cosmetic market had to supply a new need. Men changed their grooming attitudes. Before, it was not appropriate for a man to care too much about his looks. Now, they want to look their best. But only products that are based on the unique anatomy and physiology of male skin, will be successful. Men's cosmetics should satisfy the specific needs of men's skin.

There are big differences between male and female skin. The obvious difference in facial skin is the beard that provides photo protection. The beard hairs have large follicular units that makes male skin thicker and thus more resistant to wrinkling. But men's skin produces more sweat and sebum and is therefore more likely to suffer from acne. Shaving can improve skin smoothness, but the shaving process is also a repeated stress for the skin. The razor removes the top layers of the stratum corneum. Lipids are removed by detergents contained in shaving foams leading to barrier disturbance. As a consequence, the skin can get irritated and inflammatory redness together with burning sensations develop. Ingrown hairs also lead to inflammatory skin irritations (pseudofolliculitis barbae). Shaving products to lubricate and those for after-shaving treatment should therefore contain actives with a skin soothing effect.

AquaCacteen, an ingredient based on an extract of the prickly pear cactus (*Opuntia ficus-indica*), was shown in a series of in vitro and in vivo studies to be a very efficient soothing factor. A study carried out on men clearly proved its efficacy to reduce skin irritation after wet shaving. As its name suggests, AquaCacteen also has excellent moisturizing properties. Thus,

beside soothing, it provides long-lasting moisture when applied in after-shave products.

## Mediators Involved in Skin Irritation

Itch and burning sensations and local skin inflammation are the consequence of a "crosstalk" between the stratum corneum, free sensory afferent nerve endings and mast cells (fig. 1). A stimulus such as a pruritogenic

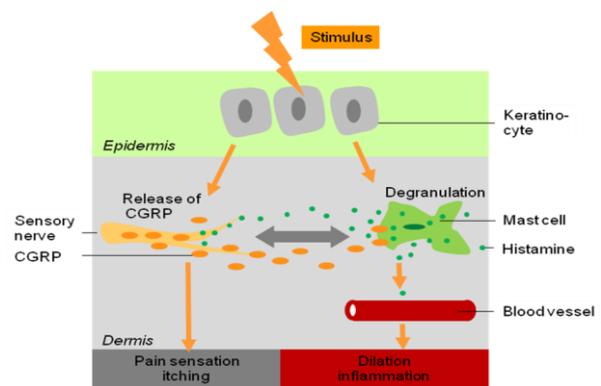


Figure 1: Sensory system of the skin

substance or inflammatory mediators or cytokines that are produced by keratinocytes after the skin has been irritated, acts on a subset of specialized nerve endings, called C-fibers, inducing an action potential, and on mast cells, inducing degranulation. The action potential induces nociceptive reflexes and pain and the release of neuropeptides, such as substance P and the calcitonin gene-related peptide (CGRP). These neuropeptides

induce dilation of the surrounding capillaries and local inflammation and also the degranulation of mast cells. Degranulation liberates histamine, which, in turn, initiates itch and local inflammation by stimulating the C-fiber nerve endings.

### The Cactus *Opuntia*

To the genus *Opuntia* (fig. 2) belong about 200 – 300 cactus species that grow all over the world in arid and semi-arid zones. Commercial cultivation is carried out in Italy, Spain, Mexico, Brazil, Chile, Argentina and California. Traditionally *Opuntia* cactus plants serve as sources for fruits and vegetables and for medicinal and cosmetic purposes. The term "nopales" is used for the flattened stem segments that are morphologically incorrectly described as cactus leaves.



Figure 2: Nopales of *Opuntia ficus-indica*

The dried powdered cactus leaves are used as a nutritional supplement. They are a rich source of minerals, pectins and flavonoids (1). The nopal extract was found in several studies to reduce the glucose plasma level which explains its positive contribution to overall health in diabetes mellitus type II. Saponins are assumed to be responsible for this anti-diabetic effect.

Others studies with *Opuntia* stem extract showed a general anti-hyperlipidemic effect that most probably comes from the especially high pectin content. There are several scientific publications that report an analgesic action and anti-inflammatory properties of nopal extract (2).

### Materials and Methods

Preparation of the cosmetic cactus ingredient AquaCacteen: Leaves of the species *Opuntia ficus-indica* that had been carefully dried at relatively low temperatures served as the source material. It was taken up in a phosphate buffer solution and digested with a special enzyme mixture. The final product was obtained after passing through different filter devices, followed by cross-flow filtration through a 10 kDa membrane.

Coculture model with sensory neurons and keratinocytes: Rat sensory neurons were cultivated in 96 wells plate in a coculture medium. After 10 days, normal human keratinocytes were seeded in each well. After 2 days of coculture, supernatants were changed by coculture medium alone or with the test compound and cells were incubated for 30 minutes. At the end of this incubation, the cells were stimulated for 20 minutes with  $10^{-6}$  M capsaicin. Then the supernatants were recovered and frozen to analyze CGRP by ELISA. Lidocaine at  $10^{-6}$  M was used as a positive control.

Study on protection against UV irradiation: Emulsions with different concentrations of AquaCacteen were tested in a study over 17 days on 20 women aged from 18 to 60. The test products were applied twice daily for 14 days on the inner side of the forearms. After 14 days, the test areas were irradiated with 1 MED. Skin firmness was determined with the Cutometer SEM 475 (Courage & Khazaka GmbH, Cologne) at the beginning of the study, at day 14 and day 17.

Study on reduction of skin irritation after shaving: The trial was carried out on the volar forearm of 20 men aged from 35 to 65. Skin irritation was induced by shaving with a commercial razor (Quattro Titanium coated blades, Wilkinson Sword GmbH, Solingen, Germany). After using a shaving foam, the test areas were shaved ten times under slight pressure. Immediately after shaving, the areas were treated with the placebo cream or a cream containing 2% AquaCacteen (approximately 2 mg/cm<sup>2</sup>). One area remained untreated and served as a control. In all areas, skin redness was determined (Chromameter CR 300, Minolta, Japan) before and 30 minutes, 1, 2, and 4 hours after treatment.

### Results and Discussion

The *Opuntia* cactus preparation AquaCacteen was first studied in vitro in a cell culture test system with sensory nerve cells and keratinocytes. This coculture model represents best the in vivo situation of sensitive skin. Capsaicin, the pungent active in chili pepper, is a strong skin irritant and was therefore used in this test system as a stimulus to induce an action potential. Stimulation of the C-fiber nerve endings is recorded by measuring the concentration of the released neuropeptide calcitonin gene-related peptide (CGRP). Reduced CGRP liberation in presence of capsaicin indicates a soothing activity. Lidocaine, a local anesthetic that blocks the signal at the

endings of sensory nerves, was used as a positive control.

Stimulation of the coculture with capsaicin resulted in a prominent release of the neuropeptide CGRP (fig. 3). The positive control lidocaine reduced CGRP release by 61 % and a solution of 0.3 % AquaCacteen by 42 %.

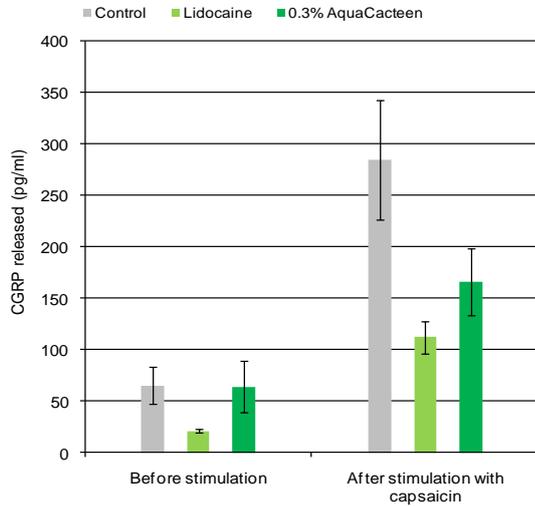


Figure 3: Soothing effect of AquaCacteen in a coculture model with sensory nerve cells and keratinocytes. The concentration of the neuropeptide CGRP in the culture supernatant was measured before and after stimulation with capsaicin. The analgesic lidocaine was used as a positive control.

The soothing, anti-inflammatory activity of AquaCacteen could also be demonstrated in a clinical trial. Emulsions with 0.5 and 2 % AquaCacteen were tested in a study with 20 female subjects. A pretreatment period of 2 weeks showed that the product with 2 % AquaCacteen clearly improved the firmness of the skin (fig. 4). The test areas on the inner

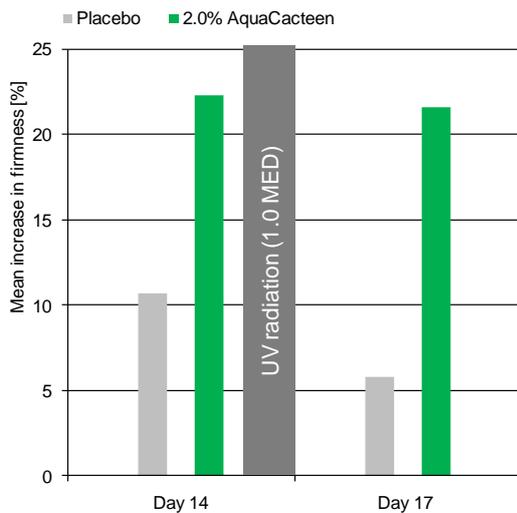


Figure 4: Increase in firmness and UV protection. The inner side of the forearm was pretreated for 2 weeks. The test areas were then irradiated with 1 MED of UV light and 3 days later skin firmness was analyzed again.

side of the forearm were then irradiated with 1 MED. Three days later skin firmness was found to be

reduced in the zone with the placebo emulsion whereas firmness in the zones treated with the AquaCacteen emulsions remained the same or even improved further.

Finally AquaCacteen was tested for soothing efficacy in a shaving study on men. For better reproducibility, the shaving procedure was done on the volar forearm. Repeated shaving with a razor blade, applying slight pressure, induced a distinct, clearly measurable redness (fig. 5). 30 minutes after shaving, redness in the

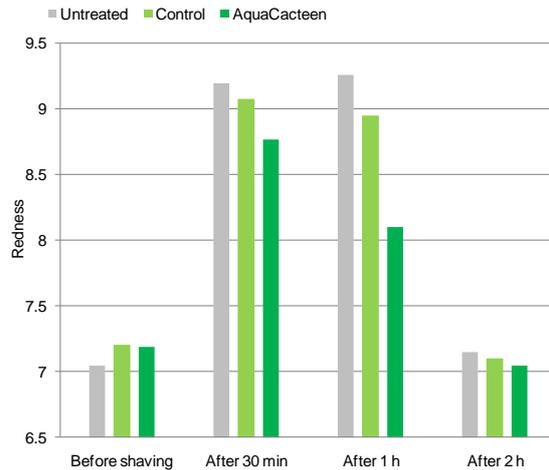


Figure 5: Reduction of skin redness after wet shaving.

AquaCacteen treated zone was only slightly less than that treated with the placebo. But 1 hour after shaving, the redness was significantly reduced in the zone treated with AquaCacteen. Redness returned to base values two hours after treatment.

## Conclusion

Members of the cactaceae family are biologically adapted to resist strong sunlight, extreme drought and big differences in day / night temperatures. The commercially available *Opuntia* cactus was used as the source material to exploit this extraordinary protective activity. The final product AquaCacteen was shown in an earlier publication (3) to increase skin hydration. A coculture skin model, comprising keratinocyte and sensory nerve cells, was used to demonstrate the soothing, anti-inflammatory effect of the *Opuntia* cactus ingredient. This in vitro result was confirmed in a clinical trial where UV light was used to irritate the skin. Men are regularly confronted with irritated skin resulting from daily shaving. Shaving products with a soothing effect therefore meet a clear need. The shaving study presented here demonstrated the efficacy of AquaCacteen for this special application. Because in reality most men still use only shaving products for facial skin care, AquaCacteen that provides soothing and additionally long lasting moisturization, is an ideal ingredient for men's care.

## References

(1) Stintzing F. C. and Carle R. (2005) Cactus stems (*Opuntia* spp.): A review on their chemistry, technology, and uses. *Mol. Nutr. Food Res.* 49: 175 – 194

(2) Park E.-H., Kahng J.-H., Paek E.-A. (1998) Studies on the pharmacological actions of cactus: Identification of its anti-inflammatory effect. *Arch. Pharm. Res.* 21: 30 – 34

(3) Schmid D., Suter F., Züllli F. (2005) Soothing Factor from *Opuntia* Cactus for Sensitive Skin. *SöFW Journal* 131 (11): 14 – 18