Targeting the real issues in men’s care: Reducing hair loss and irritation after shaving

KEYWORDS: Men’s care, soothing skin, androgenic alopecia, Opuntia ficus-indica, Ocimum basilicum.

Abstract

Two big issues for many men are hair loss and rashes after shaving. Discovering cosmetic actives that help in treating these problems are important for developing men’s grooming products. Here we show that an extract from the cactus Opuntia ficus-indica improves skin condition by reducing skin irritation after shaving. Furthermore, in vitro and in vivo studies show that hair loss caused by the hormone dihydrotestosterone can be reduced by scalp treatment with an extract from Ocimum basilicum.

INTRODUCTION

While some women’s and men’s skin care needs overlap, such as the necessity for moisturisation, there are some distinct issues that each gender has to face. For example, men are much less likely than women to develop cellulite due to a different cutaneous composition and connective tissue arrangement. On the other hand, men experience hair loss more often and to a greater degree and, for many men, a daily facial shaving routine leads to skin irritation. It is important to consider the specific physiology of male skin to target skin care for men. Here, we present two cosmetic actives that tackle these two issues that are prevalent in men.

Sensitive skin in men - exacerbated by shaving

More than 1 in 3 men feel that they have sensitive or very sensitive skin [1]. Sensitive skin tends to be more susceptible to some environmental factors. People with sensitive skin report exaggerated reactions such as redness, itching or rashes when their skin is in contact with certain cosmetics, plants, fabrics, or temperature.

At a molecular level, an irritating stimulus on keratinocytes leads to a signalling cascade that activates sensory neurons in the skin, which in turn produce the Calcitonin Gene-Related Peptide (CGRP). This signalling molecule activates mast cells, which release histamines, leading to itching and inflammation [2] (Figure 1A).

Daily shaving of facial hair can contribute to skin sensitization as it stresses the skin by continuously removing the top layers of the stratum corneum. The skin barrier is further disrupted by detergents in shaving foam that remove protective lipids in the skin leading to burning, irritation and redness of the skin. Therefore, it is important that shaving products and after shaving treatments contain cosmetic ingredients with a soothing effect.

A skin soothing active from a cactus

There are about 200-300 cactus species of the genus Opuntia 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 dried powdered cactus leaves are a rich source of minerals, pectins and flavonoids [3]. There are several scientific publications that report about an analgesic action and anti-inflammatory properties of Opuntia extract [4]. This makes Opuntia an ideal candidate for a cosmetic ingredient to soothe irritated skin. Here we conducted in vitro and in vivo experiments to investigate the ability of Opuntia ficus-indica extract to soothe irritated skin.

Male pattern hair loss

The typical person has between 100,000 and 150,000 hairs on their head. In order to maintain a normal volume, hair must be replaced at the same rate at which it is lost, which amounts to about 100 strands of hair over the course of a day. If this number is clearly exceeded over a longer period of time, the individual is experiencing hair loss. The technical term for hair loss is alopecia and it can occur for a variety of reasons such as infections, nutritional deficiencies, stress, trauma, drugs, or autoimmune phenomena. The most common type of hair loss in men however, which affects up to 70% of men in their life, is androgenic alopecia. It involves gradual hair thinning, which often takes place over the course of several decades. It can start at any age, is progressive and hereditary.
The cause of androgenic alopecia is male hormone-related but it is not primarily caused by excessive testosterone. Instead, the hair follicles become more sensitive to the hormone due to a genetic predisposition. An enzyme, 5α reductase, leads to the conversion of the male sex hormone testosterone to the active form dihydrotestosterone (DHT), which has two to three times greater affinity for androgenic receptors. DHT causes the hair follicles to produce thinner and smaller hairs up until the point that the hairs actually stop growing. Therefore, reducing the production of DHT by inhibiting 5α reductase could decrease hair loss. Importantly, there are three isoforms of 5α reductase (type I, II and III), with 5α reductase type II being the isoform detected in different parts of scalp hair follicles (5) (6). This makes 5α reductase II the main target for anti-hair loss products.

**Fighting hair loss with the king of herbs**
Basil is a common name for the culinary herb Ocimum basilicum. The word comes from the Greek word basileus, which means “King”. Indeed, basil is considered to be the “King of Herbs” and plays an important role in both Italian and Asian cuisine. Basil contains high concentrations of essential oils and potent antioxidants with anti-ageing, anti-cancer, anti-viral and anti-microbial properties. Thanks to these valuable components, basil is also used for its medicinal properties in Ayurveda, the traditional medicinal system of India. We conducted in vivo and in vivo studies to assess the ability of a hairy roots extract of Ocimum basilicum (Basil hairy roots extract, see experimental section) to inhibit 5α reductase type II activity and to reduce hair loss.

**EXPERIMENTAL SECTION**

**Production of Opuntia ficus-indica extract**
Dried leaves of the species *Opuntia ficus-indica* served as source material. The material was taken up in a phosphate buffer solution, digested with a special enzyme mixture and filtered by cross flow filtration through a 10 kDa membrane.

**CGRP release in a neuron/keratinocyte coculture model**
Sensory neurons were cultivated in 96 well plates in coculture medium. After 2 days of coculture, supernatants were changed to coculture medium with or without 0.33% *Opuntia ficus-indica* extract. Normal human keratinocytes were seeded in each well. After 2 days of coculture, supernatants were collected and the amount of released CGRP (Figure 1A) was measured by ELISA. Treatment of the coculture with Lidocaine, a local anaesthetic that blocks the signal at the endings of sensory nerves, is used as positive control for CGRP release. CGRP release was decreased by 42% compared to the untreated but capsaicin stimulated control (Figure 1B). The presence of 0.33% *Opuntia ficus-indica* extract, neurons in coculture with keratinocytes were reduced the release of stress factors.

**RESULTS AND DISCUSSION**

**Opuntia ficus-indica extract reduces the release of stress factors**
To investigate a potential soothing activity of opuntia *ficus-indica* extract, neurons in coculture with keratinocytes were stimulated with capsaicin, an irritant present in chili peppers, and the amount of released CGRP (Figure 1A) was measured as a marker for irritation. Addition of capsaicin increased CGRP levels in the medium more than fourfold, indicating an upregulated stress signalling by the cultured neurons. Lidocaine, a local anaesthetic that blocks the signal at the endings of sensory nerves, is used as positive control for CGRP reduction. In the presence of 0.33% opuntia *ficus-indica* extract, CGRP release was decreased by 42% compared to the untreated but capsaicin stimulated control (Figure 1B). This suggests that opuntia *ficus-indica* extract has a soothing effect on neurons in the skin.

**Opuntia ficus-indica extract soothes skin after shaving**
To demonstrate an immediate soothing effect of opuntia *ficus-indica* extract, skin hydration of a panel of 21 volunteers (25 – 67 y, average 51.1 y), who suffered from mild to moderate hair loss (hair loss > 100 hair strands per day) applied the test fluid containing 1% basil hairy roots extract every day in the evening for two months. Volunteers collected their lost hair (mornings and evenings, only combed hairs in the brush) and placed them in prepared envelopes, which were collected and counted at the test institute. Hair collections were done on 3 consecutive days and the average of the total counts were taken: day 0 - 3 (baseline), on day 25 - 27 (1 month) and day 53 - 55 (2 months) respectively.
Basil hairy root extract inhibits 5α reductase II
Since 5α reductase is the enzyme which converts testosterone to dihydrotestosterone, the hormone responsible for hair miniaturization in androgenic alopecia (Figure 3A), the ability of basil hairy roots extract to inhibit the activity of 5α reductase II, the enzyme isoform present in scalp hair follicles, was investigated. In this in vitro study, cell extracts containing 5α reductase II from transfected human embryonic kidney cells were used. The inhibitory potency of basil hairy roots extract on 5α reductase II enzymatic activity was measured. As a positive control Finasteride, an approved 5α reductase inhibitor, in the treatment of men with androgenetic alopecia, was used. The results for treatment with basil hairy roots extract showed a clear concentration-dependent inhibition of 5α reductase II with an IC50 value of 2.62 mg/ml (Figure 3B). This indicates that basil hairy roots extract might be able to reduce hair loss in people with androgenic alopecia.

Basil hairy root extract reduces hair loss
In a clinical study conducted for two months on a mixed panel with mild to moderate hair loss, basil hairy roots extract displayed the capacity to significantly reduce hair loss. Volunteers applied a fluid containing 1% of the basil hairy roots extract every evening over a period of 2 months. Results showed that the numbers of daily lost hair dropped by 26% after the first month and 31% following the second month (Figure 4). This suggests that basil hairy roots extract significantly reduces hair loss and thus leads to denser hair.

Figure 1. (A) Schematic representation of the skin’s reaction to irritants. The neuropeptide CGRP is released from neurons, in order to signal to mast cells to produce histamine, which leads to an inflammation and irritation reaction. (B) Soothing effect of opuntia ficus-indica extract in a coculture model with sensory nerve cells and keratinocytes. The CGRP concentration in the culture supernatant was measured before and after stimulation with capsaicin. The analgesic lidocaine was used as a positive control.

Figure 2. Reduction of skin redness after wet shaving by treatment with opuntia ficus-indica extract.

REFERENCES