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Switching Focus: From Stretch Mark to Bikini

Smart Collagen Management with *Bulbine frutescens*

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abstract

The leaf sap from the South African medicinal plant ***Bulbine frutescens*** is an ideal starter material for a new natural collagen booster. It stimulates collagen synthesis without the inflammatory processes that would result in overdrive. In this way, it provides the skin with an extra portion of high-quality collagen and paves the way for exciting applications to fill wrinkles or lift sagging skin. Indeed, we show that an active ingredient based on Bulbine frutescens leaf juice (LIFTONIN®-XPERT) simultaneously acts as a biological filler for hollow skin and as a lifting agent for sagging skin.

Here we focus on its anti-stretch mark efficacy. Stretch marks are unsightly skin aberrations that have a significant impact on self-confidence and the willingness to show the skin in public, e.g. at the beach on holiday. There is a big market for anti-stretch mark products since 30 % of all women end up with stretch marks during puberty and 70 % face them following pregnancy. We show that this active ingredient visibly and measurably reduces stretch marks and hence renews self-esteem.

Bulbine frutescens leaf juice represents a promising regimen in situations where extra collagen is required – be it wrinkles, sagging skin, stretch marks or even tattoo aftercare.

Different Problems, but a Single Cause

Let us start with the fictive example of an average consumer, who we'll call Anne. She is 51 years old and would like to do something for her skin as it is beginning to lose elasticity and firmness. In the pharmacy, she is looking for something that helps to remodel or lift facial contours. However, she has a long shopping list:

She recently became a grandmother, and her daughter is struggling with the dreaded stretch marks after her pregnancy. Is there an effective remedy for these too? Her son has just had a tattoo done and lacks a suitable product to treat his skin, because the body lotion at home does not care for or soothe his skin well enough. Even her husband has asked her to buy something for him. As a craftsman he uses his hands for working so he's constantly suffering from stressed, unsightly skin around the nails.

These examples illustrate important customer needs, which all originate from the same cause: collagen, our skin's most important supportive substance, is not present in sufficient quantity, or is only of inferior quality. Here we propose an optimal solution for all the family, i.e. the plant sap from the South African medicinal plant *Bulbine frutescens*.

Collagen in the Dermis

Collagen comes from the Greek kolla (glue) and gennao (I make), implying that collagen is the glue that holds our body together. Collagens are amongst the most important structural proteins of the extracellular matrix and make up ~80 % of the dry weight of the skin [1, 2]. There are 28 different types of collagen but it is mainly type I and III collagens that play a role in the skin. These are synthesised by fibroblasts, with adults having a three time access of type I collagen over type III [3].

Collagens form a complex network of fibres and fibrillae, which together with elastin are responsible for the skin's firmness, elasticity and tensile strength. Collagen can notably withstand enormous tensile force: 1 gram of collagen even has a greater tensile strength than 1 gram of steel [4].

Collagen and Skin Ageing

In young skin, there is a balance between the creation and breakdown of collagen. There is a true equilibrium between collagenases, which breaks down collagen and the synthesis of new collagen by fibroblasts. In mature skin, the balance shifts towards a breakdown of collagen. There are two reasons for this:

Firstly, there is increased immune cell activity and inflammation, which is associated with elevated levels of collagenases. Secondly, the number of fibroblasts is reduced and they produce less collagen and this is of inferior quality (**Fig. 1**). In 80-year-olds, for example, the fibroblasts produce only around 1/3 of the collagen produced by 20-year-olds [5].

To cut a long story short, the skin loses about 2 % of its collagen every year [6], which has major implications. First of all, the gradual loss of the collagen-based filling substance

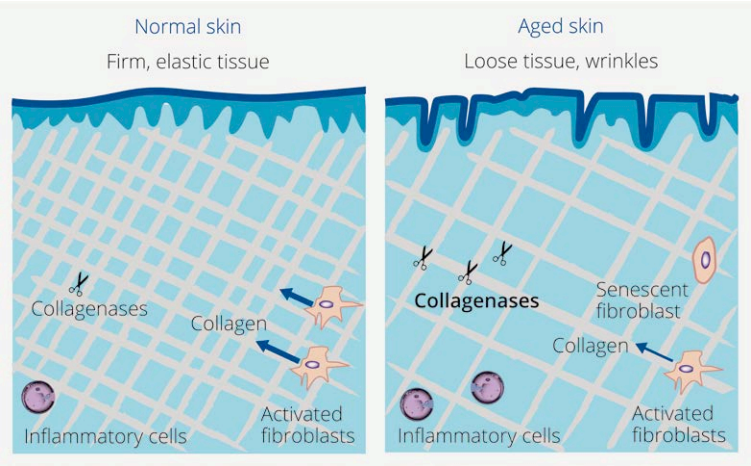

Fig. 1 Young skin is firm and elastic (left). Aged skin suffers from a lack of collagen since breakdown by collagenases is faster than synthesis by fibroblasts. The result is loose, wrinkly skin prone to gravity (sagging skin) and shearing forces (stretch marks)

leads to a reduction in the thickness and density of the dermis. This eventually drives the formation of wrinkles, since a lack of volume in the dermis can only be compensated for with surface invaginations. Moreover, the gradual loss of collagen leads to a reduction of the skin's firmness and renders it more prone to the negative effects of gravity and shearing forces. This eventually drives the formation of sagging skin or stretch marks.

Boosting Collagen in the Right Way

In order to maintain a youthful skin structure, it is essential to counteract the continuous dwindling of collagen in ageing skin. However, applying collagen to the skin cannot replace a deficit in the dermis, as collagen is much too large to penetrate the skin. The same applies to other proteins (for example, elastins or silk proteins that are used in cosmetics to improve the skin's elasticity). The activation of fibroblasts, in contrast, has already been recognised as a promising starting point [7]. Conventional collagen boosters usually activate fibroblasts to produce collagen by stimulating a particular receptor on their surface, i.e. the Transforming Growth Factor (TGF)-ß receptor.

TGF-ß, however, is also part of the skin's alarm system and an oversupply of TGF-ß may stimulate fibroblasts to produce too much collagen of an excessively inferior quality, as is the case in wound healing. During wound healing, activated immune cells work together with TGF-ß to provoke the greatest possible activation of fibroblasts in order to seal the wound as fast as possible [8]. Collagen is produced in large quantities, albeit of inferior quality. This should be avoided as it leads to the formation of inelastic tissue and the deposition of fibres that are arranged in parallel and only possess tensile strength in one direction (scar tissue) [9].

As an alternative, we propose smart collagen management, which means controlled, constant and moderate boosting. We recommend collagen synthesis without inflammatory processes that would result in overdrive. This is important in order for the newly synthesized collagen to be fully integrated into the existing dermis network. This smart regulation of collagen synthesis can be achieved by using the leaf juice of *Bulbine frutescens*.

Bulbine frutescens – South African Medicinal Plant

Bulbine frutescens is a succulent plant that is native to the dry valleys of South Africa. It is also used as a decorative shrub in our gardens (**Fig. 2**). It is known as "burn jelly plant", which refers to its long history in indigenous medicine for the healing of skin injuries, burns, sunburn and insect bites due to the soothing, anti-inflammatory effect of the gel-like leaf sap [10].

In more recent studies Bulbine has been used for scar aftercare: it helped to avoid uncontrolled proliferation of scar tissue [11], which is likely achieved by supporting collagen production [12, 13] while suppressing inflammatory responses. We suggest two major bioactive compounds: Acetylated polymannose which makes up around 5 % of the Bulbine leaf juice and boosts collagen synthesis [14, 15], while kniphofone, which is unique to the genera *Bulbine* and *Kniphofia,* suppresses inflammatory responses by blocking leukotriene synthesis [16].

Fig. 2 Organic cultivation of the medicinal plant *Bulbine frutescens* in South Africa. Its leaf juice forms the basis for a smart collagen-boosting active ingredient

Active Ingredient

Bulbine frutescens is grown sustainably on an organic farm in South Africa and pure sap is obtained by means of gentle cold pressing of the leaves. Upon filtration and refinement this then gives rise to LIFTONIN®-XPERT (INCI: Bulbine Frutescens Leaf Juice, Sodium Benzoate, Potassium Sorbate, Citric Acid). The active ingredient is an intelligent collagen booster that is intended to make Anne's wrinkles disappear, re-define her facial contours and provide new elasticity and firmness. Some of this data has already been published elsewhere [17] so this particular article will primarily focus on the reduction of stretch marks.

Bulbine Acts as a Collagen Filler and Lifting Agent

In the initial study, we aimed to show the active ingredient's efficacy at reducing signs of dermal ageing in the face. 21 females with healthy Caucasian skin, aged from 45 to 65 years were included in a double-blind, placebo-controlled, randomised and half-sided study. An emulsion containing 3 % active ingredient was applied to one half of the face and neck and placebo was applied to the other for 84 days, twice daily. The main parameters we looked at related to dermis structure (via ultra-sonography), firmness and elasticity (by cutometry), sagging skin (by Vectra XT) as well as wrinkles (via Primos readout or on the professional opinion of a dermatologist using a photograding wrinkle score [18]).

The application of the active ingredient imparted substantial benefits. Most notably, it

- improved the dermal structure and doubled collagen density in the subepidermal area [17];
- significantly increased firmness and elasticity in both the eye and neck area (not shown);
- simultaneously imparted a strong filling and lifting effect: hollow skin was replenished, sagging skin was lifted, and the overall skin topography was levelled out (**Fig. 3** and not shown);
- visibly reduced the number and severity of wrinkles (**Fig. 3** and [17]).

Taken together, the study confirmed that the most noticeable signs of ageing were measurably and visibly reduced with a high degree of efficacy in contrast with the placebo. In order to better illustrate the extent of this improvement and its practical importance, we conducted an age estimation on before and after images (**Fig. 3**). Group 1 (n=32) was asked for the D0 and group 2 (n=35) for the D84 image. The swarm intelligence of group 1 estimated a correct age of 52.5 years for the D0 image. Group 2 estimated an age of 45 years for the D84 image. The difference reflects a noticeable rejuvenation of 7.5 years within 84 days.

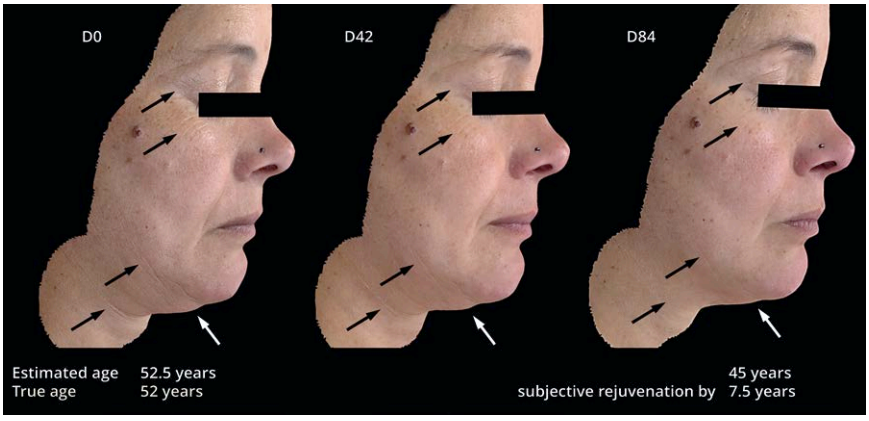

Fig. 3 Reduction of wrinkles (black arrows), lifting of sagging skin (white arrow) and improvement of skin texture. What can be seen by the non-trained eye on one representative panellist, was also confirmed on the whole panel using instrumental measurements and objective evaluation by a professional dermatologist [17] (not shown)

Bye-bye Stretch Mark – Hello Bikini

Stretch marks appear in situations of prolonged extension of the skin: The matrix of the dermis is torn apart and loses its density. The subsequent lack of collagen and other matrix proteins manifest itself as concave, usually drawn-out reddened stretch marks. Causes can be pregnancy, fast weight gain or muscle building. Prevalence is high: 30 % of all women gain stretch marks during puberty and 70 % will be faced with stretch marks following pregnancy [19]. Stretch marks are an

unsightly skin aberration having a significant impact on self-confidence and self-esteem.

20 post-pregnant woman aged from 18 to 35 years and with stretch marks on the belly, hip or thigh, were included in another double-blind, placebo-controlled, randomised and half-sided study with 0 % and 3 % active ingredient for 84 days, twice daily. Primary endpoints were stretch mark dimensions (by Primos), overall appearance (by Vectra XT or the professional opinion of a dermatologist using the "Individual Clinical Stretch Marks Score") as well as subjective self-esteem and self-confidence (by questionnaire).

Bulbine Reduces the Appearance of Stretch Marks

Uneven skin and a large number of stretch marks were observed at the beginning of the study. After 42 days the thigh in general had a smoother appearance and visible stretch marks were reduced (**Fig. 4**). The topology of a stretch mark is of major concern as changing light incidence may lead to increased visibility of the stretch marks by producing shadows. In this context, it is reassuring to know that the volume of stretch marks more than halved when Bulbine was applied. Furthermore, length, width, depth, area as well as longitudinal and lateral roughness were substantially reduced too. All parameters showed significant improvement over the placebo, which failed to observe any significant changes in any one of the parameters after 84 days (**Fig. 5**, and not shown).

The instrumental data on stretch mark appearance was confirmed in a visual and haptic manner by a professional dermatologist. Indeed, the application of Bulbine significantly improved the stretch mark scoring over baseline and placebo, whereas no significant effect was observed for the placebo (**Fig. 6**).

Finally and most importantly test subjects reported that they felt more self-confident and more attractive. By way of example, the women were more light hearted about the prospect of showing their skin, e.g. wearing a bikini on holiday (**Fig. 7**). Moreover, there was a clear preference for the formulation with Bulbine as 90 % of the subjects would warmly recommend the formulation with 3 % Bulbine.

Conclusion

Smart skin collagen management is essential, because uncontrolled activation of collagen synthesis can lead to the induction of inflammatory processes and the development of inferior quality collagen. The unique combination of valuable substances hav-

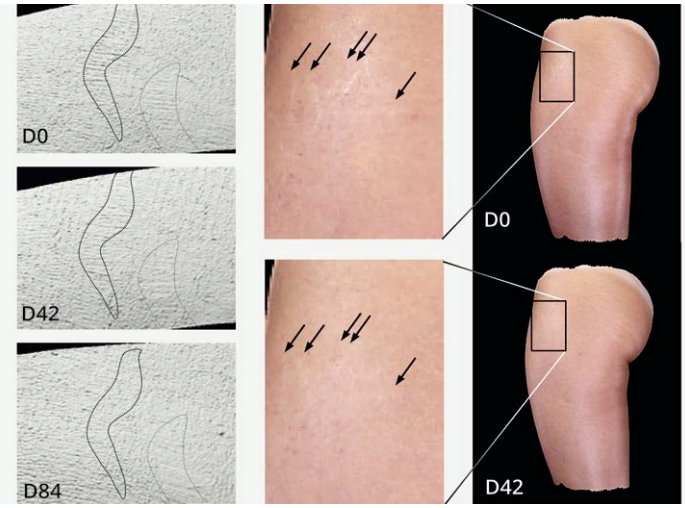

Fig. 4 Representative Vectra XT images showing a visible harmonisation of stretch mark colour and skin tone - the stretch marks almost disappeared (right). Primos analysis revealed a reduction of roughness indicated by the parallel ruffles within the stretch mark (left; the boundaries of 2 stretch marks are depicted)

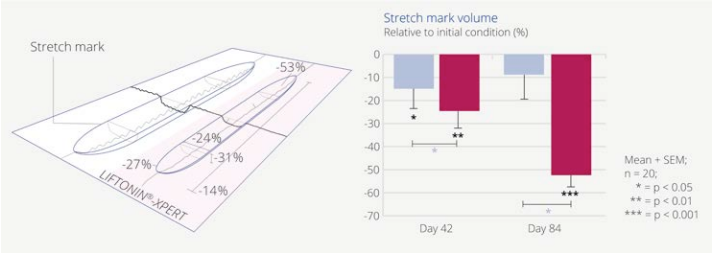

Fig. 5 Bulbine halves the scale of the stretch marks. The schema on the left illustrates and summarises the parameters analysed. In brief, Bulbine reduced the stretch mark volume by 53 % after 84 days as compared to the initial condition (right). Statistical values in violet relate to the comparison with the placebo, whereas black values relate to the comparison with the initial condition. Wilcoxon signed rank test

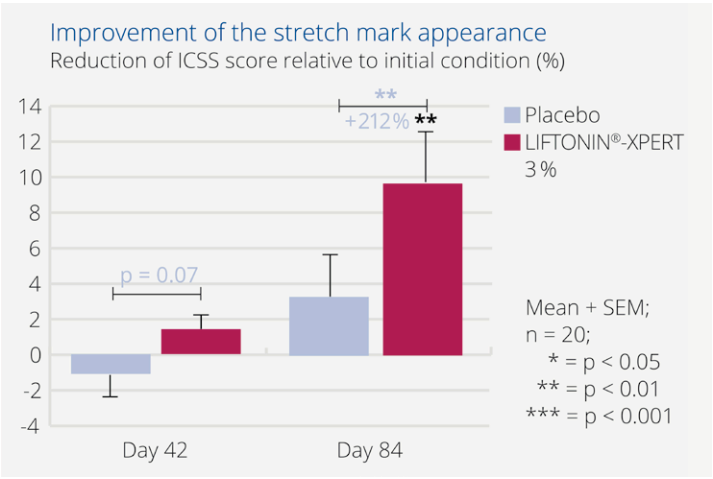

Fig. 6 Substantial reduction of the Individual Clinical Stretch Marks Score (ICSS) and thus reduced visibility of the stretch mark. For statistical details, please see **Fig. 5**

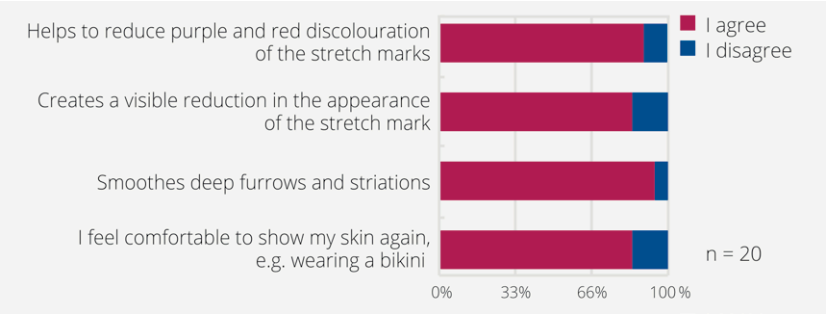

Fig. 7 Bulbine increases self-esteem and self-confidence. In a subjective assessment, on average 90 % of the study participants agreed that the visible appearance of their stretch marks improved. 85 % of the women surveyed felt comfortable to show their skin again

ing both a stimulating effect on the fibroblasts, as well as an attenuating effect on inflammatory responses, makes *Bulbine frutescens* leaf juice a smart manager of the dermis structure. In this way the formation of wrinkles can be delayed for a long time, and aged skin can be restored to a more youthful condition. *Bulbine frutescens* leaf juice helps in any situations where the long-term quality of the collagen is important: in the anti-ageing area as well as with the aftercare for tattoos or stretch marks.

It is worth noting that *Bulbine frutescens* leaf juice demonstrated excellent efficacy in the visible and measurable reduction of stretch marks both in terms of the baseline condition and the placebo. Objective assessment by a dermatologist confirmed a visible reduction in the appearance of stretch marks and the subjective assessment revealed that women gained fresh confidence.

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