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## Skin weathering and ashiness in black Africans

Ashiness describes a common physiological skin condition that may develop in people with dark skin complexion. Environmental influences, particularly cold and dry weather, seem obvious. This condition has seldom been studied so far. In the present study, skin ashiness was assessed in 37 black African women by means of colorimetric assessments and xerosis ratings. Colour changes were measured by the parameters  $a^*$  and the individual typology angle  $ITA^\circ$ . Xerosis was assessed by visual inspection, the ultraviolet light-enhanced visualization (ULEV) method, and the cyanoacrylate skin surface stripping (CSSS) method. The assessments were performed on ashy skin of the legs and on the normal looking forehead during the winter season. Ashy skin was lighter but not erythematous. The  $ITA^\circ$ -revealed colour changes were correlated with xerosis severity as assessed by dry dermoscopy and by the ULEV and CSSS methods. In conclusion, ashiness due to skin weathering does not appear to be related to mild inflammation. It corresponds to a peculiar type of xerosis with reduction in Fresnel reflection by the *stratum corneum*.

**Key words:** environment, ethnicity, skin complexion, skin dryness, *stratum corneum*, xerosis

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**E**thnicity plays an important role in the clinical presentation of diverse skin disorders [1, 2]. In particular, colour changes of lesional skin may be quite prominent in dark skin individuals. This may represent a psychologically distressing condition because of its persistent and visible nature. In particular, ashy hue may develop at the site of a variety of inflammatory skin disorders [2]. Among them, ashy dermatitis which is synonymous with erythema dyschromicum persans is a distinctive melanoderma of unknown etiology combining macular erythema and presence of melanophages in the dermis [3, 4]. Ashiness is a lay term describing another condition characterized by any xerotic process with loss of natural skin shine that prevails in individuals with dark skin complexion [5]. Ashen and ashing skin are other terms used for a similar condition in reference to restricted body sites including the elbows and knees.

This study was performed in black Africans who suffered from seasonal ashiness while under the geoclimatic environment of Belgium.

### Material and methods

The study was performed in winter in 37 women aged from 25 to 38 years. They were prototype VI Africans living in the Liège region for at least 2 years. They complained of seasonal ashiness predominating on the limbs. They were not allowed to use any cosmetic product on the skin for 10 days before the instrumental assessments.

The skin colour was measured on the forehead and on lesional skin of the legs using tristimulus reflectance colorimetry (Chroma Meter CR 200, Minolta, Osaka, Japan). The measurement procedure was performed in the  $L^* a^* b^*$  mode following the EEMCO recommendations [6]. The mean value of 5 measurements was recorded in each subject. The so-called individual typology angle ( $ITA^\circ$ ) [6, 7] was derived following  $ITA^\circ = \text{Arc Tangent} \left[ \frac{(L^* - 50)}{b^*} \right] \cdot 180\pi^{-1}$ . The values of  $a^*$  and  $ITA^\circ$  served to quantify erythema and the skin typology, respectively. The skin surface was observed and the severity of xerosis was assessed using the overall dry skin score (ODS) as defined by the EEMCO guidelines [8] and shown in Table I.

Table I. Overall dry skin (ODS) score according to the EEMCO guidelines [from ref. 8]

| Score | Description  |
|-------|--|
| 0     | Absent   |
| 1     | Faint scaling, faint roughness and dull appearance   |
| 2     | Small scales in combination with a few larger scales, slight roughness, whitish appearance                                       |
| 3     | Small and larger scales uniformly distributed, definite roughness, possibly slight redness and possibly a few superficial cracks |
| 4     | Dominated by large scales, advanced roughness, redness present, eczematous changes and cracks                                    |

Table II. Patterns and severity scores of xerosis as assessed by the ultraviolet light enhanced visualization (ULEV) method and by cyanoacrylate skin surface strippings

| Grade | Pattern of xerosis  |
|-------|---|
| 0     | Normal <i>stratum corneum</i>   |
| 1     | Hyperkeratosis of the primary and secondary lines and/or the appendageal orifices       |
| 2     | Hyperkeratosis covering less than 30% of the plateaus                                   |
| 3     | Hyperkeratosis covering more than 30% of the plateaus                                   |
| 4     | Diffuse confluent scales  |
| 5     | Thick, uneven scales covering the entire surface, obliterating the skin surface furrows |

Dry dermoscopy [9, 10] was used to enhance detailed visual perception of xerosis. In addition, the ultraviolet light-enhanced visualization (ULEV) method was used to increase the sensitivity of the observations. For that purpose, a CCD camera equipped with an internal ultraviolet light illumination (Visioscan® VC98, C + K electronic, Cologne, Germany) recorded scaliness as previously described [10, 11]. A cyanoacrylate skin surface stripping (CSSS) harvested as previously described [12-14] on the legs. The severity of xerosis was rated under the microscope according to a grading scale identical to that used for the ULEV method (*Table II*).

The mean and SD of the  $a^*$  and  $ITA^\circ$  values were calculated. Intra-individual comparisons were made for each colorimetric value between the forehead skin and lesional skin using the two-tailed paired Student *t* test. Correlations between the values of these parameters were searched for using regression model analysis with calculation of the coefficient of correlation *r*. Similar statistical assessments were performed to evaluate the relationships between, on the one hand,  $ITA^\circ$  values and, on the other hand, xerosis severity as assessed by dry dermoscopy, and the ULEV and CSSS methods. A *p* value lower than 0.05 was considered statistically significant.

## Results

Erythema as assessed by the  $a^*$  parameter was similar ( $p = 0.46$ ) on the forehead ( $8.3 \pm 1.3$ ) and on the legs ( $8.5 \pm 1.5$ ). By contrast, the  $ITA^\circ$  value of the forehead ( $-33 \pm 3$ ) was significantly lower ( $p < 0.01$ ) than on leg ashiness ( $-29.7 \pm 6.6$ ). A weak correlation was found between the  $a^*$  and  $ITA^\circ$  values on the forehead ( $r = 0.42$ ), but was absent on leg ashiness ( $r = -0.02$ ).

Xerosis of leg ashiness (*Fig. 1*) was recognized by dry dermoscopy grading ( $2.7 \pm 0.8$ ), ULEV assessment ( $3.3 \pm 0.9$ ) and CSSS xerosis grading ( $3.7 \pm 0.9$ ). Correlations were found between each of the 3 rating methods of xerosis and  $ITA^\circ$  values (*Table III*, *Figs. 2-4*).

## Discussion

Xerosis responsible for ashiness reduces the natural skin shine and presents as whitish areas in darker skinned indi-

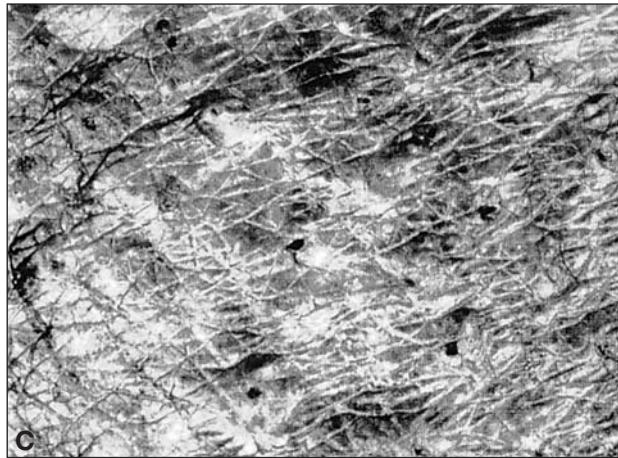
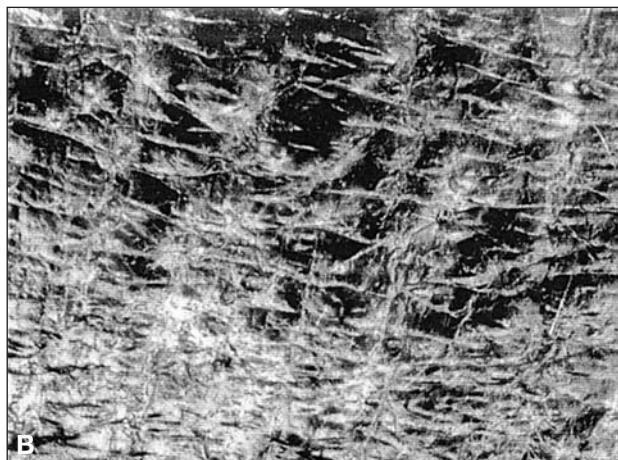
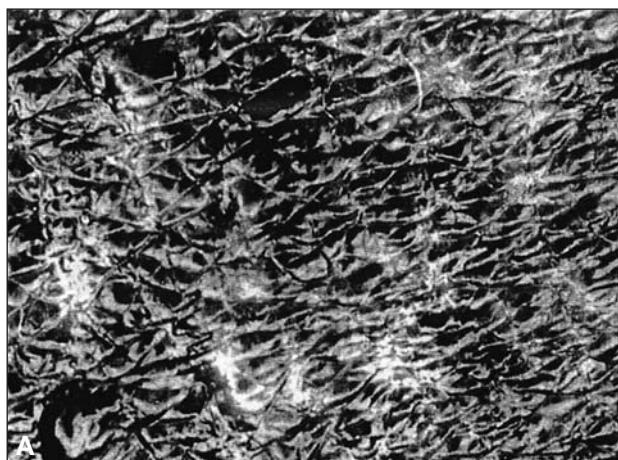


Figure 1. Ultraviolet light-enhanced visualization (ULEV) of skin ashiness.

a) grade 2, b) grade 3, c) grade 4.

viduals. Cross-polarized imaging combining image analysis and clinical pattern recognition has been suggested to quantify this skin condition [5]. Skin weathering, particularly during winter, results in some physiological and structural changes [11, 15-25]. Exposure to a cold environment alters the activity of desquamatory enzymes [11, 26]. This effect is amplified when the relative humidity of air is reduced with ensuing water depletion in the outer *stratum*

Table III. Coefficients of correlation  $r$  between the individual typology angle ( $ITA^\circ$ ) and xerosis ratings by dry dermoscopy, ultraviolet light enhanced visualization (ULEV) and by cyanoacrylate skin surface stripping (CSSS) examination

|                | ULEV | CSSS | ITA $^\circ$ |
|----------------|------|------|--------------|
| Dry dermoscopy | 0.65 | 0.68 | 0.73         |
| ULEV           |      | 0.83 | 0.76         |
| CSSS           |      |      | 0.83         |

corneum [19, 23]. The combination of cold and dry threat can be expressed by dew point variations [15, 20]. The resulting effect of such a process is the development of a peculiar type of xerosis [11, 21, 27] due to a defect in

corneodesmolysis and desquamation [28-30]. The altered specific enzymes are proteases, particularly serine and cathepsin-like enzymes.

The present study was performed combining colorimetric assessments and xerosis ratings by visual inspection, and by the ULEV and CSSS methods. It shows that skin ashiness is similarly objectivated by assessing the *stratum corneum* texture than by measuring skin colour. The whitish, dull and opaque appearance results from the overall increase in diffuse light scattering and a reduction in Fresnel reflection (optical phenomenon responsible for skin glare) at the skin surface. This optical phenomenon is responsible for the variations in skin glare.

Erythema was not evidenced by measurements of parameter  $a^*$  at the site of skin ashiness. This suggests the absence of clinically-relevant inflammation at the origin of this skin condition.

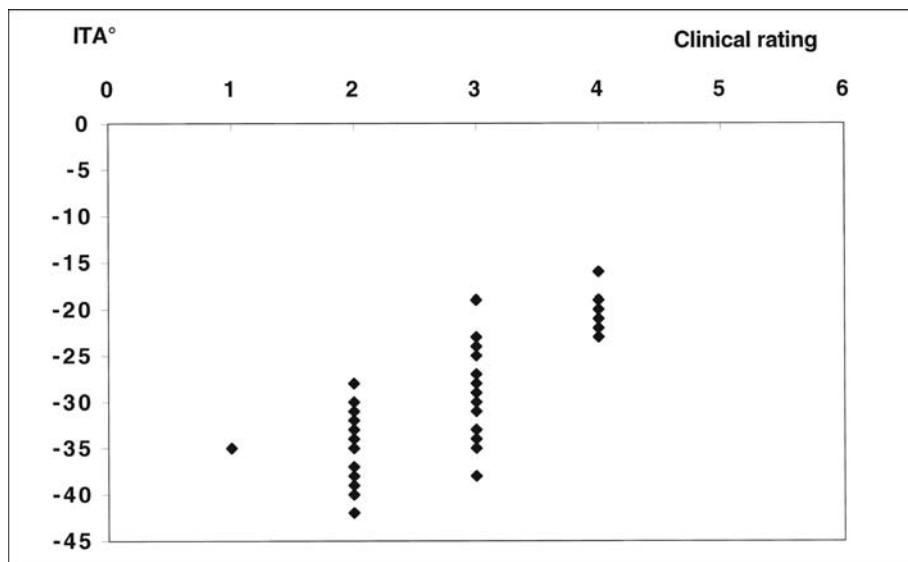


Figure 2. Correlation between  $ITA^\circ$  values and visual rating of skin ashiness of the legs.

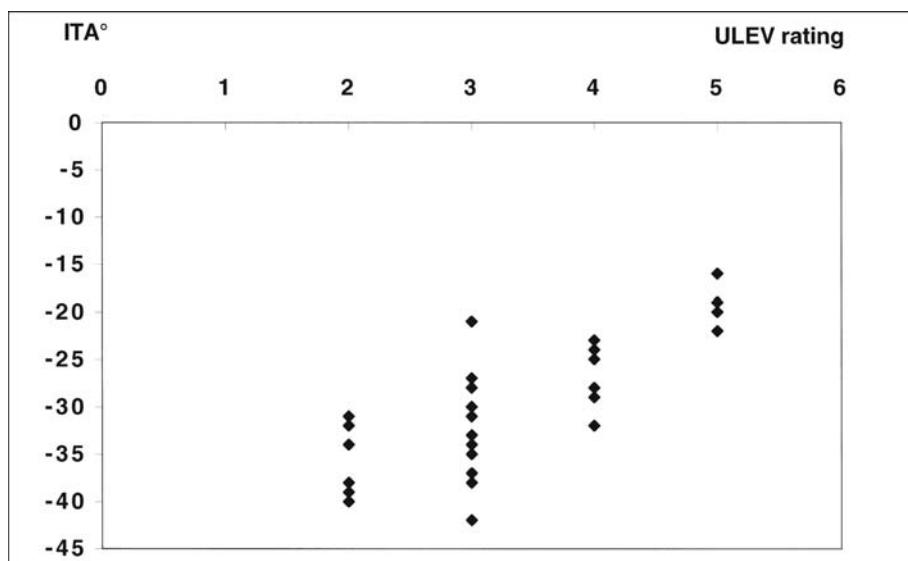


Figure 3. Correlation between  $ITA^\circ$  values and xerosis rating by the ultraviolet light enhanced visualization (ULEV) of skin ashiness of the legs.

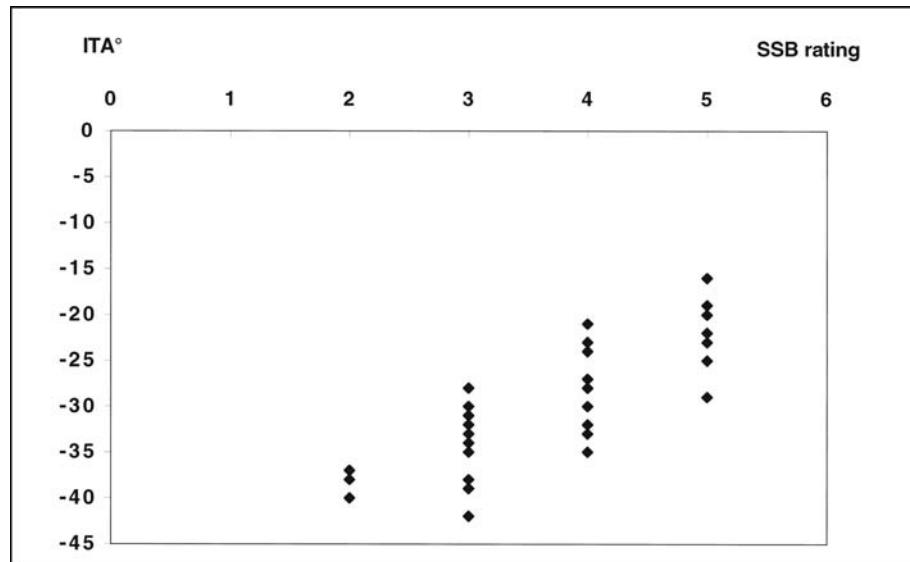


Figure 4. Correlation between  $ITA^{\circ}$  values and xerosis rating on cyanoacrylate skin surface strippings (CSSS) harvested from skin ashiness of the legs.

In conclusion, ashiness as a consequence of skin weathering does not appear to be related to inflammation. Xerosis with a reduction of Fresnel reflexion seems to be the major cause of this common skin condition in individuals with a dark skin complexion. ■

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