

Moisturizers Prevent Irritant Dermatitis

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The purpose of this study was to investigate the ability of eight different moisturizers to prevent irritant dermatitis. Twelve healthy female students washed the outer aspect of their upper arms with a liquid detergent for one minute twice a day for one week. Seven skin creams and one skin oil were applied to 3×7 cm areas of the left upper arm just after each washing, while the right upper arm was left untreated.

Transepidermal water loss (TEWL) (mean) increased from 7.1 to 9.3 g/m²/h ($p < 0.001$) and laser-Doppler flowmetry (LDF) value (mean) decreased from 11.8 to 10.8 arbitrary units (N.S.) in the left upper arm, but there was no statistical difference between the eight moisturizers. During the second week of the study, the test subjects did not continue washing their arms. Eight areas (3×7 cm) of the right upper arm were treated with the moisturizers twice a day. The mean TEWL value decreased from 20.3 to 8.6 ($p < 0.0011$) over 7 days, but there were no significant differences between the individual moisturizers. The laser-Doppler values showed the same trend as the TEWL values. In conclusion, regular use of emollients prevented irritant dermatitis from a detergent. *Key words: transepidermal water loss; laser-Doppler flowmetry.*

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Moisturizers and emollients are said to be able to prevent and to heal irritant dermatitis. Very little is known as to which

types of lotions, creams and ointments are the most effective in retaining the optimal conditions in the keratin layer. In the study by Blanken et al. (1), none of four afterwork emollient creams enhanced regeneration of irritated skin. An emulsion based on mineral greases was found to reduce water vapour loss from skin exposed to a detergent significantly, whereas creams containing 15% and 38% linoleic acid had less or no effect (2). The aim of the present study was to investigate the effect of eight moisturizers in preventing and treating experimental irritant dermatitis. Measurements of skin blood flow and transepidermal water loss (TEWL) were used to evaluate the skin barrier function. Some of the results were presented at the Ninth International Symposium on Contact Dermatitis in Stockholm, in May 1990 (3).

Table I. *The eight moisturizers used in the study*

Moisturizer no.	Type	Water content (%)
1	O/W cream	70
2	O/W cream	70
3	O/W cream	65
4	double emulsion	50
5	skin oil	–
6	double emulsion	67
7	double emulsion	48
8	double emulsion	61

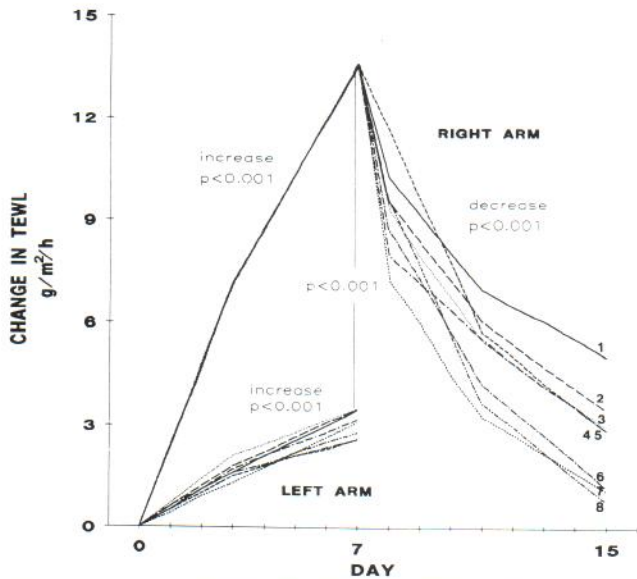


Fig. 1. Changes in transepidermal water loss (TEWL). During the first week, both upper arms were washed twice a day with a detergent, and the moisturizers were applied b.i.d. to the left arm while the right arm was left untreated. During the second week the moisturizers were applied b.i.d. to the right upper arm, without any washing. The numbers (1-8) denote the moisturizers, whose composition is presented in Table I. In *D15*, no statistical differences were found between the moisturizers.

MATERIALS AND METHODS

Twelve voluntary healthy Caucasian female students (aged 21-26 years) participated in the first part of this study, which was done in spring.

The subjects washed the outer aspects of their upper arms with a liquid dishwashing detergent ("Fairy", Procter & Gamble Ltd, England) for one min twice a day for one week. They moistened their hands and the upper arm skin with water, applied 0.3 ml of the detergent to both palms and washed the areas to be treated by moving their hands once per second. If the lather became too sticky they added some drops of water to their hands. They were otherwise allowed to bathe as usual, but were told not to use soap or other detergents on the upper arms.

The left upper arm was divided into eight areas (7×3 cm), and one out of eight moisturizers (0.2 ml of each) was applied to each area after each washing. Six subjects applied moisturizer No. 1 to the most proximal and No. 8 to the most distal test area; the order was reversed for the other six subjects. The moisturizers tested are shown in Table I.

TEWL was measured with an Evaporimeter EP1 (ServoMed, Stockholm, Sweden) (4,5), and the blood flow with laser-Doppler flowmetry (LDF) equipment (Periflux PF1, Perimed KB, Stockholm, Sweden) (5) at a room temperature of $23 \pm 2^\circ\text{C}$, and a relative humidity of $21 \pm 9\%$. The measurements were taken on days 0, 3 and 7, at least 4 h after the last application of moisturizers.

During the second week of the study, the subjects no longer washed their upper arms. They applied the same eight moisturizers twice a day to eight areas on the right upper arm. TEWL and blood flow were measured on days 7, 8, 11 and 15.

The measurements were also made on a control skin site on the upper back.

On day 7, when the eight moisturizers were applied to the right upper arm for the first time, any immediate contact reactions were followed up by measuring the LDF values before application and 20 min after it.

Six months later, in order to compare the healing rate of incipient irritant dermatitis with and without any treatment, 6 of the test sub-

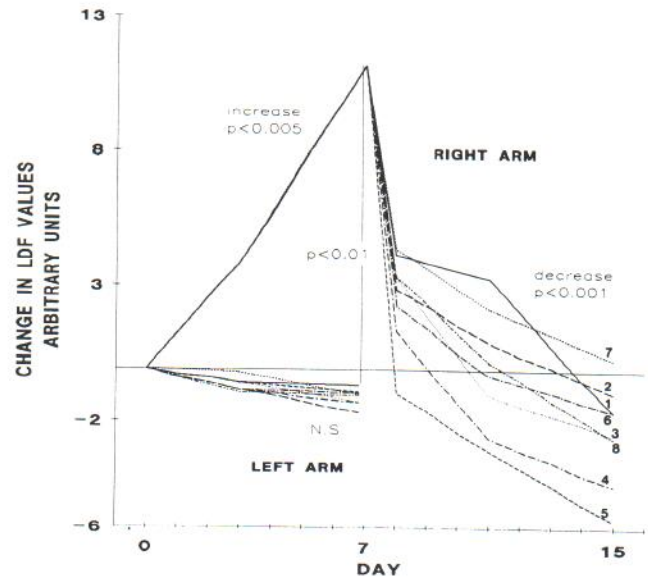


Fig. 2. Changes in laser-Doppler flowmetry (LDF) values. During the first week both upper arms were washed twice a day, and the moisturizers were applied b.i.d. to the left upper arm while the right upper arm was left untreated. During the second week, the moisturizers were applied b.i.d. to the right upper arm, without any washing. The numbers (1-8) denote moisturizers, whose composition is presented in Table I. In *D15*, no statistical differences were found between the moisturizers.

jects washed the outer aspect of one of their upper arms for one week as described earlier, but they did not use any emollients. During the second week they no longer continued washing their arms. The washed area was divided into two areas 4×7 cm in size. Emollient no. 2 was applied to one of the areas twice a day, and the other area was left untreated. TEWL and blood flow measurements were made on days 0, 7, 8 and 15.

An analysis of variance was used to test the significance of the increasing and decreasing values of TEWL and blood flow measured during the study. Differences between the two arms and between the eight moisturizers were tested with the paired *t*-test.

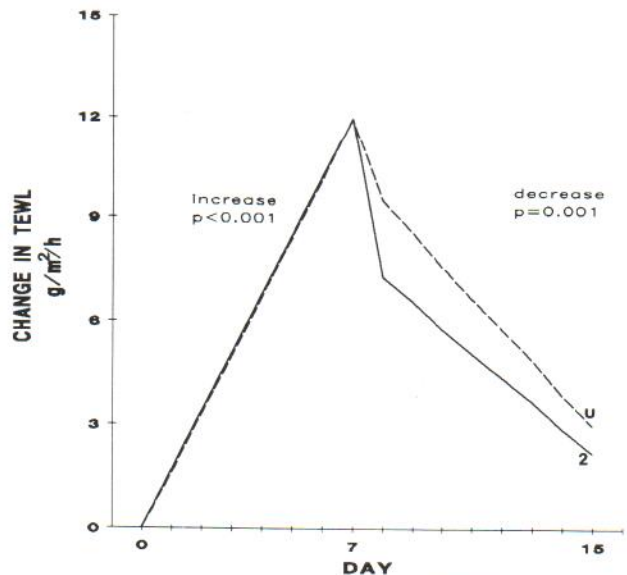


Fig. 3. Changes in transepidermal water loss (TEWL) from the upper arm skin washed twice a day for one week. During the second week, half the washed area was treated b.i.d. with a moisturizer (cream no. 2, Table I) and the other half left untreated (U).

RESULTS

During the first week the mean TEWL value for the left arm, which was washed and treated, increased from 7.1 to 9.3 g/m²/h ($p < 0.001$). There was no statistical difference between the eight moisturizers. On the right upper arm the mean TEWL value increased from 7.1 to 20.3 g/m²/h ($p < 0.001$), and some test subjects had visible dermatitis. The difference between the two arms was significant in the paired *t*-test ($p < 0.001$) (Fig. 1).

During the first week, the mean LDF value on the left side decreased from 11.8 to 10.8 arbitrary units (N.S.). There was no statistical difference between the eight moisturizers. At the same time the right side showed an increase from 12.7 to 24 arbitrary units ($p < 0.0005$). The difference between the two sides was significant ($p < 0.01$) (Fig. 2).

During the second week the mean TEWL value for the right arm decreased from 20.3 to 8.6 ($p < 0.001$) and the mean LDF value from 24 to 10.6 ($p < 0.001$). There were no differences between the moisturizers.

An increase ($p < 0.05$) in the LDF value occurred with only one cream (no. 4) on day 7, 20 min after the first applications of the moisturizers to the right upper arm. That particular cream contained sorbic acid as the preservative. It also produced an immediate contact reaction in some subjects when tested on unwashed upper back skin, but the change was not significant for the whole group.

In the second experiment, done 6 months later, the mean TEWL value increased from 4 to 16 g/m²/h ($p < 0.001$) during the one-week washing period. During the second week it decreased to 6.2 g/m²/h in the test area where the emollient was used and to 7 g/m²/h on the untreated skin (Fig. 3). The difference between the two sites was significant in the paired *t*-test. The rise in the mean LDF value was statistically insignificant.

DISCUSSION

The present results showed that different types of emollients prevented the development of experimental irritant dermatitis equally well. The rate of healing was slower for untreated skin than for skin treated with an emollient. The difference between the treated and untreated areas, though statistically significant, was not very marked. This finding is in accord with the results of Blanken et al. (1) who did not find any marked improvement in the regeneration rate of irritated skin following the application of four emollients after work.

TEWL and LDF measurements are frequently used to

evaluate the skin barrier. TEWL values reflect the condition of the keratin layer. The thinner the layer is and the looser the individual horny cells are, the greater the TEWL is. LDF has been used to measure the increase in blood flow caused by irritant substances applied to the skin. The weaker the barrier is, the higher the LDF values are. In this study TEWL appeared to be a slightly more sensitive indicator of nascent irritant dermatitis than LDF.

We chose the method of washing the skin by hand only in order to simulate the use of detergents in daily life. The outer aspect of the upper arm is well suited to this type of experiment because very few occupations present the need to wash this particular area daily with soap or some other skin cleanser. Moreover, the upper arm is fairly sensitive to the drying effect of sodium lauryl sulphate (6). The interindividual variations in the rapidity and degree of drying of the skin were fairly great. There also appeared to be some seasonal variation in the drying rate. The TEWL increased faster in spring than in the autumn. This difference obviously reflects alterations in the thickness of stratum corneum.

In conclusion, regular use of emollients prevents the development of irritant dermatitis due to using detergents. Emollients can also be used to treat mild and nascent irritant dermatitis. The composition of such creams and ointments seems to have little, if any, effect on the rapidity of the healing process.

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REFERENCES

1. Blanken R, van der Valk PGM, Nater JP, Dijkstra H. After-work emollient creams: Effects on irritant skin reactions. *Derm Beruf Umwelt* 1987; 35: 95-98.
2. Blanken R, van Vilsteren MJT, Tupker RA, Coenraads PJ. Effect of mineral oil and linoleic-acid-containing emulsions on the skin vapour loss of sodium-lauryl-sulphate-induced irritant skin reactions. *Contact Dermatitis* 1989; 20: 93-97.
3. Hannuksela A, Kinnunen T. Prevention of primary irritant contact dermatitis by using moisturizers. *Contact Dermatitis* 1990; 23: 296-297.
4. Nilsson GE. Measurement of water exchange through skin. *Med Biol Eng Comput* 1977; 15: 209-218.
5. Blanken R, van der Valk PGM, Nater JP. Laser-Doppler flowmetry in the investigation of irritant compounds on human skin. *Derm Beruf Umwelt* 1986; 34: 5-9.
6. Cua AB, Wilhelm K-P, Maibach HI. Cutaneous sodium lauryl sulphate irritation potential: age and regional variability. *Br J Dermatol* 1990; 123: 607-613.