

Skin irritability to sodium lauryl sulphate - as measured by skin water vapour loss - by sex and race

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Summary

The skin irritability of 38 volunteers (23 males, 15 females), of different ethnic groups, to sodium lauryl sulphate, 2% aqueous, was studied by measurement of skin water vapour loss (SVL). The mean SVL values of unirritated skin of females (2.9 g water/m²/h) was significantly lower than males (5.5 g water/m²/h) (P<0.001); the mean values between the different ethnic groups were not significantly different. The mean SVL values of irritated skin of males and females were not significantly different; the values for Chinese were significantly higher than Malays (p<0.05), but not significantly different between Chinese and Indians and between Malays and Indians. The irritation index (which is defined as the difference of SVL value between irritated and unirritated skin over SVL value of unirritated skin) was significantly lower in males (4.6 g water/m²/h) than females (12.4 g water/m²/h) (P<0.01). It was not significantly different between the various ethnic groups. It appears that the skin irritability (to SLS 2% aqueous) of males and females differ. Female skin appeared to be more irritable compared to male skin. The skin irritability of different ethnic groups appeared the same.

Irritant contact dermatitis is more common than allergic contact dermatitis, yet our knowledge of the former is limited. This is because, although there are accepted test procedures to study allergenicity of chemicals, test procedures for studying irritancy of chemicals is not established. One method of evaluating skin irritancy of cleansers is the soap chamber test, utilizing a visual scoring system.⁷ This method requires macroscopic assessment and is subject to interobserver bias. The measurements of skin water vapour loss (SVL) as a technique² to evaluate skin barrier function is increasingly used:^{3,5} although there is still some controversy about this method. The method has been

used to assess skin irritancy of various chemicals by several researchers.^{4,6}

The effects of irritant on the skin in different subjects differs. Susceptibility to irritants in different sexes and races has not been studied previously. Such differences may have important implications in formulating skin preparation for different groups of individuals and in identifying susceptible groups in their proness to occupational irritant dermatitis. The aim of this investigation is to compare skin irritability to the anionic surfactant, sodium lauryl sulphate, 2% aqueous, on normal skin of male and female volunteers of different races by *in vivo* measurement of SVL.

Materials and Methods

Thirty eight volunteers (23 males and 15 females) attending the sexually transmitted disease clinic of Middle Road Hospital were studied only volunteers without obvious skin disease were considered. Their age, sex, and race were noted.

The effect of sodium lauryl sulphate 2% aqueous (as measured by SVL) on the skin of the volunteers were studied as follows:

For exposure the large 2 mm aluminum Finn Chamber (Epitest, Helsinki, Finland) with its filter paper disc was used. The filter paper was saturated with sodium lauryl sulphate 2% (w/v) aqueous. 50 µl was deposited. The chamber was applied on the right scapular region of each patient. Vertically below (5 cm away), an empty chamber was applied to serve as control. The chambers were removed after 48 h and the SVL was measured.

Measurements of SVL was carried out 20 min after the chambers were removed and after the volunteer has rested in an air-conditioned room for another 10 min. The air-conditioned room was maintained at around 22°C and the relative humidity at 42% throughout the study period. SVL measurement was done as described by van der Valk et al⁴ Quantitative measurements of SVL were carried out using the ServoMed EPI Evaporimeter (ServoMed, Stockholm,

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Vallingby, Sweden), The SVL of the sites where sodium lauryl sulphate 2% aqueous (irritated skin) and the empty chambers (unirritated skin) were applied were measured for each volunteer.

Imitation index

The difference between the uninitated and irritated SVL values were calculated. This difference over SVL of unirritated skin is referred to as the irritation index. We consider the irritation index an expression of irritability of the skin as measured by SVL. The mean irritation indices for males and females and between the different races were compared.

The corresponding morphological skin changes were not evaluated.

Significance of differences between mean SVL values were determined by means of the Student unpaired t-test and P values below 0.05 are said to be significant.

Results

Twenty three males (mean age 25.7 years, range 18-38 years) and 15 females (mean age 27.9 years, range 18-39 years) participated in the study. There were 10 Chinese males (mean age = 30.8 years, range 18-38 years), five Chinese females (mean age = 25.6 years, range 20-34 years); seven Malay males (mean age = 25.7 years, 19-37 years), five Malay females (mean age = 27.8 years, range 18-39 years); six Indian males (mean age = 26.5 years, range 18-35 years), five Indian females (mean age = 30.2 years, range 24-34 years).

Table 1 and Fig. 1 compare the SVL values of uninitated skin and irritated skin (where sodium lauryl sulphate 2% aqueous was applied) of male and female volunteers. The mean SVL values of unirritated skin of females was significantly ($p < 0.001$) lower than that of males. The mean SVL values of irritated skin of females

Table 1. Showing the mean SVL., values of uninitated and irritated (to SLS 2% aq.) skin of male and female volunteers

| | g water/m ² /h | | P values |
|---------------------------------------|---------------------------|----------------|----------|
| | male n=23 | female n=15 | |
| (a) unirritated skin | 5.5 (2.61) | 2.9 (1.62) | <.001 |
| (b) irritated skin (To SLS 2% aq.) | 26.7 (12.76) | 29.8 (17.3) | ns. |
| irritation index | 4.6 (3.0) | 12.4 (9.3) | <0.01 |
| [(b)-(a)]/(a) | | | |

SD = standard deviation, SLS-sodium lauryl sulphate

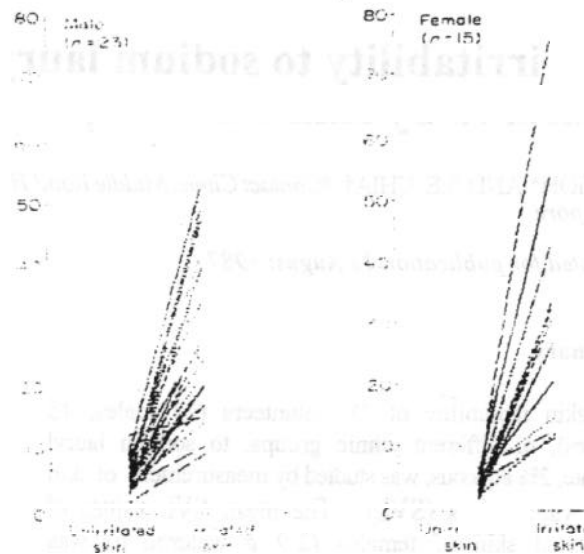


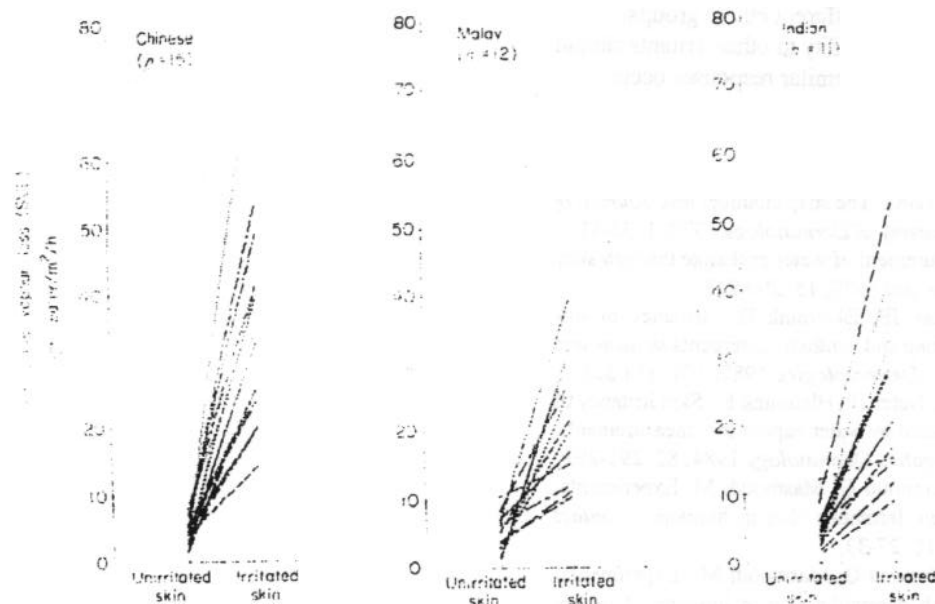
Table 2. Showing mean SVL values of unirritated and irritated (to SLS 2% aqueous) skin of volunteers of different ethnic groups

| | g water/m ² /h | | |
|---------------------------------------|---------------------------|---------------|----------------|
| | Chinese n=15 | Malay n=12 | Indian n=11 |
| (a) unirritated skin | 4.0 (1.9) | 4.9 (2.9) | 4.7 (3.2) |
| (b) irritated skin (to SLS 2% aq.) | 35.3 (16.1) | 21.7 (9.3) | 24.7 (13.8) |
| irritation index | 10.0 (8.3) | 6.7 (7.9) | 4.6 (3.3) |
| [(b)-(a)]/a | | | |

SD=standard deviation, SLS=sodium lauryl sulphate. There was no significant difference of the mean irritation index between the different races.

and males were not significantly different. The mean irritation index (to SLS 2% aqueous) was significantly lower in males (4.6 g water/m²/h) than females (12.4 g water/m²/h) ($P < 0.01$).

Table 2 and Fig. 2 compare the SVL values of unirritated skin and irritated skin (to SLS 2% aqueous) of three ethnic groups *viz.* Chinese, Malay and Indian. There was no significant difference in the mean SVL values of unirritated skin among the different races. The mean SVL values of irritated skin of Chinese was significantly higher than that of Malay volunteers ($P < 0.05$). The difference was not significantly different between Chinese and Indians nor between Malays and Indians. The mean irritation indices among the three races were not significantly different.



Discussion

SVL appears to be a useful method of assessing the damaging effects of irritants on the skin. It was also found to be useful for differentiating allergic and irritant patch-test reactions^{9,10} Several studies have indicated good correlation between the SVL and perceptible morphologic changes of irritated skin.^{4,6,8,9} We did not correlate perceptible morphologic changes in our study because from our experience, morphological changes or irritated skin in Malays and Indians are difficult to assess due to their pigmentation. The Chinese are of fair skin. Therefore, any attempt to correlate perceptible morphological changes between the different races will be inaccurate. We introduce the term irritation index as an expression of the irritability of the skin (to SLS 2% aqueous) as measured by SVL. We feel that this is a useful expression of skin irritability to an irritant. As the unirritated SVL values differ in different individuals, the percentage increase in SVL values of irritated skin over unirritated skin (the irritation index) is a more accurate assessment of skin irritability.

A recent review article on contact dermatitis reported the finding in a study that human subjects may be divided into hypo- and hyper-reactors to skin irritants. In the normal population, the incidence of subjects with sensitive skin has been estimated to be 14%. It was noted that the main feature of these individuals seems to be a thin permeable stratum corneum barrier which makes them more

susceptible to most chemical irritants.¹¹ Our study was carried out to establish if such differences in skin irritability to irritant between female and male and between three different ethnic groups exist. This has important implications as differences in skin irritability in different groups may affect results of dermatotoxicological studies. It may also be an important factor in identifying susceptible groups who are prone to develop occupational irritant dermatitis.

Our study indicated that the mean SVL of unirritated skin in female was significantly lower than male volunteers. The basal metabolic rate of females is lower than males and could have accounted for the difference. There was no significant difference between the mean SVL values of irritated skin (to SLS 2% aqueous) of male and female volunteers. The irritation index was significantly lower in males than females. It appears that the female skin is more easily irritated (to SLS 2% aqueous as measured by SVL).

There was also no significant difference in the mean SVL values of unirritated and irritated skin among different races. Similarly, the mean irritation indices (to SLS 2% aqueous) among the different races were not significantly different.

Our findings appear to suggest that there is a difference in the skin irritability (to SLS 2% aqueous) between male and female volunteers. This difference should be considered when conducting dermatotoxicological studies. It should also be considered when evaluating patch-test reactions. There is no significant difference in skin

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irritability among people of different ethnic groups.

Similar studies on skin irritability to other irritants should be undertaken to ascertain if similar responses occur.

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