# CHANGE IN LOCAL EVAPORATION RATES IN RESPONSE TO TEMPERATUTE INCREASES TO 33, 36 AND 39°C FROM 28°C

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A new device to measure local evaporation rates more precisely has been developed by the author (Kakitsuba and Katsuura, 1992), by improving the gradient method first proposed by Lamke (1977). Using this device, temperature and relative humidity at three different points within a boundary layer on the skin can be measured to predict a real distribution of absolute humidity on the skin. In the present study, four young male subjects were exposed to 33, 36 and 39°C for 40 min, following a 20-min control exposure at 28°C. Subjects were clothed only in swimming trunks, and sat on a reclining chair throughout exposure. Local evaporation rates, skin temperatures, heat flow rates at forehead, chest, upper arm, thigh and calf were continuously measured. Oesophageal temperature, ECG and metabolic rate were also continuously measured. In addition, thermal and comfort sensation votes were recorded at 5-min intervals. Evaporation rates ($m_{sk}$) at all sites gradually increased, but did not reach a plateau at 33°C. However, $m_{sk}$ increased promptly during the first half of exposure, and reached a plateau at 36 and 39°C. Knowing that $m_{sk}$ remains unchanged, or slightly decreases, when the skin is fully wetted with sweat, the critical $m_{sk}$ value (the maximum evaporative capacity for a given thermal condition) can be identified. Local evaporative heat transfer coefficients (*he*) at three sites were then calculated:

| *Sites* | *he* (W/m$^2$/mmHg) |
|---|---|
| Forehead | 6.8 |
| Front thigh | 6.2 |
| Chest | 5.7 |

Lamke, L.O. *et al*., 1977. Insensible perspiration from the skin under the standardized environmental conditions, Linkoping Univ. Med. Dissertation

Kakitsuba, N. and Katuura, T., 1992. Development of a new device to measure local heat exchange by evaporation and convection. Aviat. Space Med. 63,538-542}

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