Humans' moisture perception of textiles materials under static contact with the skin [Abstract]

THE FASEB JOURNAL
The Official Journal of the Federation of American Societies for Experimental Biology

Humans' moisture perception of textiles materials under static contact with the skin

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Abstract

Despite the absence of receptors for the sensation of humidity and moisture on the skin, humans possess the ability to sense wetness, which is critical for behavioural thermoregulatory responses. It has been proposed that the perception of wetness is based on a multimodal integration of thermal and mechanical inputs occurring at the skin, when it is wet (Filingeri & Havenith, 2015). However, little is known on the neurophysiological basis of moisture perception when the skin is in contact with clothing. The current study aimed to investigate mechanisms underlying the human ability to perceive changes in fabrics moisture when clothing statically interacts with the skin. Twenty-four fabrics (of 100 cm^2), with different weight, volume, thickness and fibre type were included in the experiment. Twelve subjects (7 males and 5 females) assessed wetness perception of fabrics, placed on their upper back, by using a magnitude estimation approach. Before each trial fabrics were wetted with the same relative (to volume) water amount (of 0.4µl.mm^{-3}), to simulate water content when moderate sweating occurs. The relationship between fabric weight and wetness perception, as well as the drop in skin temperature in response to the application of various wet fabrics, were observed to study the contribution of the mechanical and thermal component in perceiving different levels of moisture. A strong negative relationship was found between wetness perception and thermal comfort (r^2=0.98, $p<0.001$), confirming the role of wetness perception in modulating behavioural thermoregulatory responses. Results also indicated that the perception of wetness showed a strong positive relationship with the total water content (r^2=0.87, $p<0.001$) and therefore with the absolute wet weight of the fabrics (r^2=0.86, $p<0.001$), which is sensed as load on the skin by the cutaneous mechanoreceptors. When fabrics were corrected for weight differences ($W_{corr;}$ same weights, different water contents) various levels of wetness were still perceived ($p<0.05$). In this case the cooling property of the fabrics, given by their specific water content and sensed as changes in skin temperature by the cutaneous thermoreceptors, seems to contribute to the perception of wetness. The latter was confirmed by the strong relationship between drop in skin temperature and water content (r^2=0.74, $p<0.001$) as well as drop in skin temperature and wetness perception (r^2=0.69, $p<0.001$). The W_{corr} fabrics (heavier) were perceived significantly wetter ($p<0.05$) than the corresponding no-weight corrected (noW_{corr}) fabrics, although the water content was the same. The latter is likely due to the higher contact between skin and fabric as well as to an illusory sensation, which suggests higher water content in heavier fabrics. We concluded that, under static contact with the skin, the central integration of thermal (cooling provided) and mechanical (load on the skin) inputs from fabrics significantly contributes to the human ability to perceive various levels of wetness.

Footnotes

This abstract is from the Experimental Biology 2016 Meeting. There is no full text article associated with this abstract published in The FASEB Journal.

Print ISSN: 0892-6638
Online ISSN: 1530-6860
DOI: 10.1096/fj.1530-6860