Fabric water absorption & wetness perception [Abstract]

FABRIC WATER ABSORPTION & WETNESS PERCEPTION

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Introduction

The ability to sense wetness is one of the most critical factors contributing to thermal (1, 2, 3) and sensorial discomfort during wear. Fabrics are characterised by different properties, including thickness, structure and fibre content and it is difficult to identify to what extent each variable contributes to fabrics moisture behaviour and the related wetness perception (WP). The amount of added water also plays a critical role in affecting WP outcomes. It is common to study fabrics moisture behaviour by adding the same absolute water content (4). However, for fabrics with different thickness and volume, the application of the same absolute amount of water results in a different water content to volume-ratio (relative water content), leading to confounding results. The aim of this study was twofold: 1) to examine the role of thickness and fibre type on fabrics absorption properties and WP as well as 2) to compare WP outcomes between two different wet states.

Experimental

Twenty-four fabric samples (of 100 cm^2), with different structure, thickness and fibre type were included in this experiment. Fabric absorption capacity was determined according to the 'water absorption capacity test' (4). Twelve Caucasian subjects (7 males/5 females) assessed WP of the fabrics, placed on their upper back by the investigator, using a magnitude estimation approach. To correct for volume-related differences in WP that could occur during the application of the same absolute water content, fabrics were wetted with the same relative water content (REL) of $0.4\mu l.mm^{-3}$. In a separated trial fabrics were tested at the same absolute water content (ABS) of $2400\mu l.mm^2$. Furthermore, to minimise the contribution of physical surface characteristics on the perception of wetness, fabrics were assessed under static contact with the skin.

Results

In REL, WP showed a positive relationship with fabric water content ($r^2 = 0.87$, $p<0.001$), mainly determined by fabric thickness which accounted for 98% ($r^2 = 0.98$) of the variability in water absorption capacity, despite differences in fibre content. The rank analysis indicated that in REL thinner fabrics (and thus having the lowest absolute amount of water) were ranked as driest, whereas in ABS thinner fabrics were ranked as wettest. This is likely due to the fact that thinner fabrics contained higher relative water amount to volume-ratio compared to the thicker fabrics in the ABS test. The ABS condition might suggest the use of thicker fabrics given that they result in dryer sensations (4) however, when profuse sweating occurs and saturation is reached, thicker materials would contain more water than the thinner ones, resulting in higher WP and thermal discomfort. This study demonstrated that thickness is the main factor affecting fabric water absorption and also the related WP. The diverse outcomes resulting from the application of two different water contents, i.e. REL and ABS, suggest that the methodology used when studying fabrics moisture behaviour and moisture perception should be carefully considered in relation to the application.

References

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