The role of decreasing contact temperatures in the perception of wetness on the skin

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Introduction

Previous studies have indicated that the perception of wetness on the skin results from the integration of the somatosensory sub-modalities of touch and temperature [1]. However, how these inputs interact to evoke this synthetic perception is still unclear [2].

Methods

In this study, the role played by peripheral cold afferents and thermal sensations in evoking the perception of wetness was examined when six different cold-dry stimuli (-2, -5, -7, -10, -15, -20°C less than the individual's skin temperature) were applied in a balanced order on the bare and dry forearm of 9 female participants (27.3 ± 8.8 years) resting in an environmental chamber (20°C; 50% relative humidity). Participants were informed only about the body region subjected to the stimulation. No information was provided on the type and magnitude of the stimulation, to limit any expectation effects. Skin temperature, skin conductance, thermal sensation and wetness perception were recorded before, during and after the application of each cold stimulus (30 s) and during the following re-warming phase. Data were analysed using a repeated measures ANOVA, Friedman test and multiple regressions.

Results and Discussion

Each cold-dry stimulus produced significantly different decreases in the skin temperature ($p<0.05$), varying in a range between -0.8°C ± 0.8 to -12.3°C ± 2.7, corresponding to a cooling rate of 0.02 to 0.41°C/s. Stimuli produced statistically significant differences ($p<0.05$) in thermal sensation, with colder stimuli producing colder thermal sensations. Data related to wetness perception showed that overall, in 19 out of 54 scores (35.2%), a cold-dry stimulus was perceived as wet. For this reason, we proceeded with the analysis of individual data which showed the existence of two sub-groups within the whole sample tested in this experiment. 5 out of 9 participants (responders) perceived skin wetness as result of cold stimuli producing a cooling rate ranging from 0.14 to 0.41°C/s, whereas 4 out of 9 participants (non-responders) did not perceive skin wetness at all. Regression analyses were performed between the variation in skin temperature from baseline, thermal sensation and wetness perception values recorded from the responders sub-group. All the relationships were found to be statistically significant ($p<0.01$), showing the skin cooling and the evoked thermal sensations to drive the perception of wetness in this sub-group.

Conclusions

These findings showed that skin cooling and thermal sensations can contribute significantly in the perception of skin wetness but other somatosensory sub-modalities, particularly touch and vision, are potentially essential to characterize this multi-sensory experience.

References

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