

Do non-cholinergic efferent pathways have a functional relevance during the thermal and non-thermal stimulation of human eccrine sweat glands?

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Whilst the cholinergic modulation of thermally induced eccrine sweating has been extensively demonstrated, evidence concerning the neuropharmacological control of non-thermally mediated sweating is equivocal. However, a sparse distribution of noradrenergic nerve terminals surrounds the sweat gland, sweating can be induced by noradrenergic agonists, and it is also possible these glands receive dual innervation. Therefore, the long-held dogma is that non-thermally induced sudomotor responses are, at least in part, noradrenergically driven. Accordingly, this experiment was designed to test the hypothesis that sweating could not occur following a systemic cholinergic blockade. Sudomotor responses from nine healthy males were investigated when psychological (mental arithmetic), local pain and static exercise stimulations were applied under thermoneutral conditions (27.5-28°C), and also following passive heating (feet immersed 42-43°C, water-perfusion suit 33-48°C). Mean body temperature was then clamped (36.9±0.1°C), and atropine sulphate was administered (intravenous: 0.04 mg.kg⁻¹). Following complete sweat suppression, these stimuli were repeated. The isothermal clamp prevented the body temperature elevation that would normally accompany the cessation of sweating. Ventilated sweat capsules and skin conductance methods were used to measure sweat secretion from both glabrous and non-glabrous (hairy) skin surfaces. When thermoneutral, significant sweat secretion was evident only from glabrous skin following these non-thermal stimulations ($p < 0.05$; Figure). Passive heating induced sweating at all sites, and when these stimuli were superimposed upon this thermal load, significant sudomotor responses were evident from each site tested ($p < 0.05$). During the blockade, none of these stimuli elicited sweating, either as discharged or primary (skin conductance) sweat ($p < 0.05$). Therefore, these data demonstrate that sweating during these thermal, psychological and exercise stimulations was exclusively cholinergically mediated. Therefore, whilst eccrine sweat glands may indeed respond to catecholamines, the current results refute the proposition that functionally relevant noradrenergic, sudomotor pathways may exist.

