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Authors: Daniel Gagnon

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We know that horses sweat and men perspire. But do ladies merely glow?

Author details: Daniel Gagnon, daniel.gagnon.3@umontreal.ca
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For some time, the euphemism "horses sweat, men perspire, but ladies merely glow" was scientifically supported. Initial studies examining gender differences in sweat production generally observed that women sweat less than men during heat exposure (i.e., they merely glow). However, the influence of body morphology upon these observations was quickly acknowledged (Wyndham *et al.*, 1965). Whether gender differences in sweating are explained by variations in body morphology or physiological differences in temperature regulation has received considerable attention (Gagnon & Kenny, 2012). In this issue of *Experimental Physiology*, Notley *et al.* (2017) provide the most definitive evidence to date that gender differences in thermoeffector responses are primarily explained by morphology, not physiology.

The thermoeffectors of sweating and cutaneous vasodilation are stimulated by afferent input from peripheral and central thermoreceptors. During exercise, these responses are activated in proportion to the heat load imposed upon the body. Therefore, one might expect sweating and cutaneous vasodilation to be similar between men and women who display the same change in body temperature while exercising at a similar heat load. Despite employing this approach, Notley *et al*. (2017) nonetheless observed differences in sweating and cutaneous vasodilation between men and women. To determine if physiology or morphology contributed to these differences, Notley *et al*. (2017) employed two approaches. First, they examined the variation in thermoeffector responses that could be attributed to relevant factors. Using hierarchical multiple linear regression, three models were evaluated. The first included fitness, body adiposity and change in mean body temperature which were controlled factors within the experimental design. Physical characteristics were then added to the second model. Finally, the third model included the addition of gender. If physiology underlies gender differences in thermoeffector responses, we would expect the third model to account for most of the variation in these responses. However, the third model uniquely explained ≤5% of the variation in sweating and cutaneous vasodilation. Second, Notley *et al*. (2017)

compared thermoeffector responses between sub-groups of men and women matched for physical characteristics. If physiology underlies gender differences in thermoeffector responses, we would expect sweating and cutaneous vasodilation to remain different between men and women matched for physical characteristics. In contrast, sweating and cutaneous vasodilation were similar when comparing these sub-groups. Therefore, when morphologically typical men and women are compared, women merely glow not because they are women but because they are smaller. In contrast, when men and women of similar physique are compared, both perspire.

The confounding influence of body morphology on gender differences in thermoeffector responses has been considered before (Havenith *et al.*, 1998). However, Notley *et al*. (2017) approached this question in a way not done previously. Relatively large samples of men and women were recruited. Importantly, men and women spanned a wide and overlapping range of specific surface areas; the ratio of body surface area to body mass. Furthermore, stringent inclusion criteria ensured that factors which may influence thermoeffector responses, such as fitness and body adiposity, were well controlled. Finally, the experimental protocol was designed to have men and women achieve similar changes in mean body temperature, thus ensuring similar thermoafferent stimulation. These approaches allow for a more definitive conclusion that gender differences in thermoeffector responses are primarily explained by variations in body morphology.

If body morphology primarily explains gender differences in thermoeffector responses, should women be considered different than men when it comes to body temperature regulation during heat exposure? To answer this question, it should be considered that Notley et *al.* (2017) examined thermoeffector responses during exercise performed at light and moderate intensities. As such, their findings can only be applied to conditions when men and women must contend with low to moderate heat loads. This is important, because gender differences in sweating appear dependent upon the heat load that is imposed upon the body. At low to moderate heat loads, gender differences in thermoeffector responses are primarily explained by variations in body morphology. However, as the heat load increases beyond an (as of yet) unidentified threshold, gender differences in sweating that are seemingly unrelated to variations in body morphology become apparent (Gagnon & Kenny, 2012). Furthermore, the post-junctional responsiveness of sweat glands to cholinergic agonists is often lower in women (Gagnon *et al.*, 2013), suggesting gender differences in sweat gland function. Nonetheless, the study by Notley *et al*. (2017) reminds us that, under most circumstances, women typically sweat less than men because, as a population, they are physically smaller. Their findings highlight the importance of accounting for variations in body morphology before concluding that gender does or does not influence these responses. It seems that women do not merely glow after all.

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