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Editorial

Do tattoos impair sweating?

Tattoos are increasingly common in industrialised countries.[1] Forty percent of young adults in the United States[2] and approximately 1 in 4 young adults in Australia have at least one tattoo.[3] Tattoos are also frequently evident among elite athletes. In 2017, an important paper by Luetkemeier et al.[4] reported that tattoos potentially impair local sweating, which seems to suggest an elevated heat stress risk. The postulated mechanism is that the tattooing process (repeated needle insertion and deposition of ink into the dermal layer) has the potential to interfere with sweat gland function.[4] The consequent restriction to sweat output could be especially problematic for tattooed athletes training and competing in the heat, and even more so for spinal-cord injured athletes that already have areas of denervated skin and a compromised thermoregulatory capacity.[5] From a research perspective, the potential effect of tattoos on heat loss capacity could have implications for study methodology and participant inclusion. A recent article published in the *Journal of Science and Medicine in Sport*, reports an important advancement in this area. In contrast to previous findings, Rogers et al.[6] report in a group of 22 individuals that localised sweat rates during exercise in a temperate (25 °C) environment do not appear to be affected by the presence of tattoos.

The contrasting results between Rogers et al.[6] and previous studies in this area are possibly related to the different methodologies employed. The present study used absorbent sweat patches during intermittent cycling exercise in temperate conditions, whereas others[4] artificially invoked sweating by delivering pilocarpine transdermally via iontophoresis. During exercise, sweating is primarily induced by the release of acetylcholine from efferent sympathetic nerve fibre endings in response to changes in core temperature (with some modulation by skin temperature and non-thermal factors).[7] Sweat stimulation by iontophoresis, in contrast, occurs by inducing a local electrical gradient on the skin which facilitates the transit of an acetylcholine agonist (in this case pilocarpine) across the dermis.[8] As this method is essentially enhanced topical drug application, drug delivery is more limited compared to direct innervation of sympathetic nerves — as evidenced by the lower sweat rates in the Luetkemeier et al.[4] compared to Rogers et al.[6] Previous studies have suggested that iontophoresis is less effective at delivering drugs transdermally when applied to areas with thicker skin tissues[8] and therefore with the present context of scarred skin from the tattooing process, it is possible that drug delivery via the iontophoresis method may be hampered on tattooed skin rather than an impairment of sweat gland function secondary to the tattooing process. However, this notion must still be experimentally assessed.

The work of both Luetkemeier et al.[4] and Rogers et al.[6] have taken important steps to investigate the potential implications of tattoos on sweating. Rogers et al.[6] expanded on earlier work by including a larger sample size and examining the influence of tattoo site density upon sweat rate but did not observe an effect. The heat production of their exercising participants remains unknown, but this was not likely a significant issue when measuring bilateral localised sweat rates. Future studies should examine whether heavily-tattooed individuals have a meaningful difference in whole-body thermal strain at a given heat production relative to non-tattooed individuals matched for body size. Whether, and to what extent, the presence of tattoos on the skin alter the upper environmental limit for the physiological compensation of core temperature – a key determinant of heat stress risk – also remains unresolved. Both studies reported that tattoo age did not influence the sweating response. However, in light of the long-term nature (and usual permanency) of tattoos, participants in both studies only had tattoos for a relatively brief period of time (mean of 2.4[4] and 3.1[6] years). Future research should determine the effect of truly long-term tattoos.

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Samuel Chalmers
Amy E. Harwood
Thermal Ergonomics Laboratory, Faculty of Health Sciences, University of Sydney, NSW, Australia

Nathan B. Morris
Department of Nutrition, Exercise and Sports, University of Copenhagen, Denmark

Ollie Jay [a,b,*]
[a] *Thermal Ergonomics Laboratory, Faculty of Health Sciences, University of Sydney, NSW, Australia*

[b] *Charles Perkins Centre, University of Sydney, NSW, Australia*

[*] Corresponding author at: Thermal Ergonomics Laboratory, Exercise and Sports Science, Faculty of Health Sciences, University of Sydney, NSW, 2141, Australia.
E-mail address: ollie.jay@sydney.edu.au (O. Jay)

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