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Dear Editor:

A recent *Journal of Athletic Training* editorial[1] summarized research conducted at the University of Connecticut Human Performance Laboratory.[2] E. Randy Eichner, MD, wrote that a helmet and shoulder pads "… had only a small effect on heat gain" and "… are not a substantial risk for [exertional heat stroke]." I disagree.

In this controlled, randomized investigation, 10 men (weight = 117 kg, body fat = 30.1%) exercised (10 minutes of repetitive box lifting (RBL) plus up to 60 minutes of continuous treadmill walking at a 5% grade) in a hot environment (33°C [92°F]) on 3 different days while wearing a full football uniform (FULL), a partial uniform with no helmet and shoulder pads (PART), or control clothing consisting of shorts, socks, and shoes (CON). The comparisons of PART versus FULL isolated the physiologic effects of wearing a helmet and shoulder pads as follows: (1) Seven participants completed the entire exercise protocol while wearing CON and 3 completed with PART, but only 1 completed with FULL. This demonstrated that 2 of 10 test participants could not complete the exercise protocol because of the helmet and shoulder pads. (2) Relevant to exercise-heat tolerance, the group average times to exhaustion during treadmill exercise were different ($P = .04$) for PART (43.1 minutes) versus FULL (36.2 minutes). (3) Relevant to hyperthermia and exertional heat stroke (EHS), the rate of rectal temperature rise during treadmill exercise was greater ($P < .001$) during FULL exercise (0.71°C/10 min) than during PART exercise (0.52°C/10 min). Thus, when participants wore a helmet and shoulder pads, we observed 2 clinically relevant factors: an earlier onset of volitional exhaustion and a faster rate of heat storage.

To provide controlled exercise stress, these trials ended with a maximum of 60 minutes of continuous, brisk treadmill walking. In my opinion, if the end of the trials had involved running (intermittent or continuous) for a duration greater than 80 minutes, the differences due to a helmet and shoulder pads would have been greater, because FULL represented uncompensable thermal stress (ie, the body could not compensate adequately). Our Figure 2 illustrates this risk to football players, in that rectal temperature rose on a steep slope during the FULL trial and never plateaued; in contrast, rectal temperature plateaued (ie, heat loss equaled heat production) during PART and CON exercise. I have redrawn the original Figure 2 by extending the plots for rectal temperature to the 80-minute point. The duration of football practices often exceeds 80 minutes.

Although research ethics would not allow this, if we had encouraged our volunteers to exercise beyond their self-selected point of volitional exhaustion, they clearly would have had a greater risk of EHS while wearing a helmet and shoulder pads because they *had already reached* the widely accepted rectal temperature threshold for EHS (39°C–40°C) at the end of FULL exercise. In virtually all cases of EHS in American football players to date, the player was not allowed (ie, by coach, workout, or peer pressure) to rest or cool down; if he had been, he would not have experienced dangerous hyperthermia. The risk of this situation is compounded by the loss of mental acuity and impaired decision making that EHS imparts: players don't perceive this threat to their health, as shown in our companion article.[3]

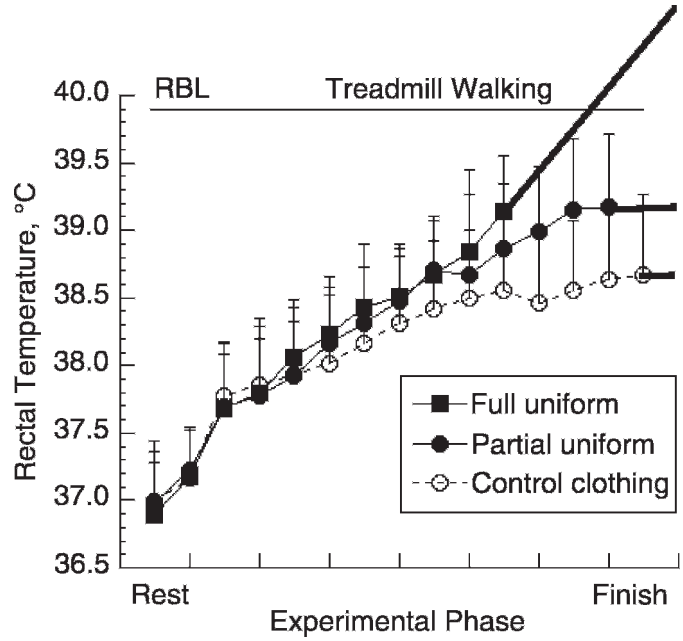

Figure 2 (redrawn). The rectal temperature (mean ± SD) plots for full uniform, partial uniform, and control clothing have been extended to the 80-minute point of exercise (solid line).

Helmets and shoulder pads are obviously necessary in a collision sport. However, the first 3 days of heat acclimatization are critical for the body to adapt to thermal stress. I hope that athletic trainers act to eliminate "… the traditional wearing of protective equipment during the initial 3 to 5 days of football summer workouts, when the highest incidence of exertional heat illness (eg, heat stroke and exertional heat exhaustion) occurs."[3(p126)]

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REFERENCES

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