

Motorcycle protective clothing: impact on cognitive performance and mood when worn in hot conditions

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Abstract

Thermal discomfort is a disincentive to motorcyclists wearing protective clothing in hot conditions. Previous work has established that products currently available to Australian riders potentially impose an uncompensable heat stress upon riders in average Australian summer conditions. This study was designed to examine the potential for the physiological and cognitive concomitants of heat strain to compromise rider safety.

The results demonstrated increased reaction times, perceived workload and mood disturbance associated with increasing heart rate, body core and skin temperatures. These results confirm the importance of establishing the performance thresholds required of motorcycle protective clothing suitable for use in hot conditions.

Background

Motorcycle protective clothing is primarily designed to reduce the risk of injury in contact with the road surface. However, as in many other occupations (e.g. firefighting, military), there is often a compromise between protection and thermal comfort because the materials used are often highly insulating, reducing the body's thermoregulatory system and potentially inducing heat strain (Caldwell, Patterson, & Taylor, 2006; Faerevik & Reinertsen, 2003). Over twenty years ago, thermal discomfort due to protective clothing in hot conditions was first identified as a potential safety risk for motorcyclists, but little work has been done to explore this issue (de Rome, Taylor, Croft, et al., 2015b; EEVC, 1993). The aim of this study was to examine the physiological and cognitive impacts of wearing motorcycle protective clothing in hot conditions.

Method

Eight volunteers completed 90 minute tests under controlled climate conditions (35°C, relative humidity 45%), representing average summer conditions in urban areas in Australia. Participants wore full motorcycle gear including the jackets and trousers previously found to have the lowest thermal permeability of ten tested suits (de Rome, Taylor, Troynikov, et al., 2015a). Sun and wind speed were simulated using overhead, infra-red lamps and fan (velocity 30km.h⁻¹), respectively. Heart rate, body core and skin temperature were continuously monitored. Computer-based cognitive tests of reaction-time, workload -Raw Task Load Index (RTLX(Byers, Bittner, & Hill, 1989)) and mood -Visual Analogue Mood Scale (VAMS(Bond & Lader, 1974)) were conducted at baseline, 30-min intervals and post-trial. Results are presented descriptively.

Results and Conclusions

Over the 90-min trial, heart rate increased by 81% (60 beats.min⁻¹), while body core and skin temperatures rose by 1.7°C and 3.2°C, respectively. Perceptions of workload demand increased by 68% and negative mood scores almost tripled (147%). Reaction time and the number of errors decreased in the first hour by 5% and 37%, but increased in the last 30 min (9%, 25%).

These results demonstrate the potential for heat strain to increase fatigue perception and to negatively affect reaction time and mood. The findings suggest motorcycle protective clothing that impairs thermoregulation may also compromise a rider's capacity to manage the riding task safely under hot conditions.

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