

## **Sportswear Ph.D. research abstract**

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Determination of rugby union shirt prototype functional performance is currently reliant on generic Standard fabric test methods or unstructured human participant trials that, often, do not take into account the demands of the game. Current research, sponsored by Canterbury of New Zealand, describes the development and implementation of reproducible rugby shirt specific textile test methods to determine the effects of contemporary garment construction. Four rugby shirt functions were chosen for investigation: rugby ball-shirt friction interaction, garment strength, thermoregulatory response to exercise when clothed and on-field garment serviceability.

Using a sled-type tribometer, the rugby ball-shirt friction interaction was investigated in a range of contemporary shirt designs during simulated light human interference. It was found that the addition of polymer grip textures did not necessarily enhance traction unless raised geometric textures, adhered to the fabric surface, promoted frictional interlocking with ball pimples.

A fully-manufactured shirt, as opposed to Standard bulk stock fabric, tensile strength protocol was developed to benchmark a range of contemporary shirt constructions using the strip method. Tensile strength was affected by fabric construction and anisotropy whereby micromesh fabrics, particularly orientated in the course direction, were weakest. In some cases, seam specimens were much weaker than fabric specimens in the same shirt.

The thermoregulatory response to rugby attire was investigated using a novel rugby backs-specific intermittent treadmill protocol designed to replicate the physiological and locomotive demands of competitive professional match-play. The thermal and moisture management properties of baselayer, padding and shirt technologies highlighted significant thermoregulatory effects of garment choice. The thermal functionality of baselayers was superior to that of a 100% cotton t-shirt and did not impose a further thermophysical load when worn beneath a team-shirt. Shoulder padding increased skin temperature, sweat rate and rate of change of core temperature, even when worn singly.

The need for a structured rugby-shirt specific wearer trial was highlighted from observation of current procedures employed by manufacturers in the rugby shirt industry. Three distinct elements of the wearer trial process were investigated: wear-service conditions replicating the physiological intensity of game-specific demands of rugby, structured garment assessment techniques including failure criteria, and unbiased player questioning through self-administered questionnaires.

The range of rugby shirt performance predictors and potential design weaknesses observed in the current research has highlighted the need for a more systematic research-led approach to prototype rugby shirt testing. It is hoped manufacturers will adopt the textile test methods described to better understand rugby apparel functionality, necessary for the potential improvement of match-day performance through superior garment design.