**Title:** Infographic. Impact of the Nordic hamstring and hip extension exercises on hamstring architecture and morphology: implications for injury prevention

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Understanding the adaptations to common hamstring exercises likely provides better evidence upon which to base injury prevention and rehabilitation protocols than the popular surface electromyography and functional magnetic resonance imaging studies of activation patterns.(1)

Approximately 80% of hamstring strain injuries involve lesions within the biceps femoris long head (BFLH),(2, 3) and Nordic hamstring exercises (NHE) are effective at reducing these injuries.(4, 5) However, it has been argued that the NHEs may be suboptimal for injury prevention because it involves preferential activation of the semitendinosus and biceps femoris short head muscles.(1) It has also been proposed that exercise at longer muscle lengths than those observed in the NHE may be more effective at increasing BFLH fascicle length,6 an apparent risk factor for hamstring injury.(7)

We recently showed that the long hamstrings, including the BFLH, are relatively more evenly activated during a hip extension exercise than in the NHE1 and this suggests the possibility that the latter may be more effective at increasing BFLH muscle size. This may be important in rehabilitation given the observation of persistent BFLH atrophy after strain injury.(8)

This investigation was designed to compare the effects of the NHE and the 450 hip extension exercise on BFLH fascicle lengths, muscle volumes and eccentric knee flexor strength after ten weeks of resistance training.

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# IMPACT OF THE NORDIC HAMSTRING AND HIP EXTENSION EXERCISES ON HAMSTRING ARCHITECTURE AND MORPHOLOGY: IMPLICATIONS FOR INJURY PREVENTION

Reference: Matthew Bourne et al. BJSM 2016 @MBourne5 @das_shield @BJSM_BMJ

## BACKGROUND

**1** Short biceps femoris long head (BFLH) fascicles and low levels of eccentric knee flexor strength, increase the risk of hamstring strain injury in elite Australian soccer players.

## METHODS

**2** Thirty recreationally active male athletes were randomly allocated into 1 of 3 groups for a 10 week program:

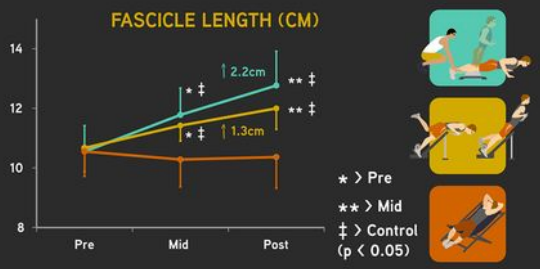
**a** Hip extension (HE) training (n=10)

**b** Nordic hamstring exercise (NHE) training (n=10)

**c** No specific hamstring strength training, continued regular activity (control, CON) (n=10)

## TAKE HOME MESSAGES

**3** Hip extension and Nordic hamstring exercise training both promote the elongation of biceps femoris long head (BFLH) fascicles, and increase eccentric knee flexor strength. These adaptations would be expected to lead to a large and clinically meaningful reduction in an athlete's risk of hamstring injury.




**4** Hip extension appears to promote more hypertrophy in the biceps femoris long head and semimembranosus (SM) than the Nordic hamstring exercise, which preferentially develops the semitendinosus (ST) and the short head of biceps femoris (BFSH). These observations may have implications for targeting specific muscles in injury prevention and rehabilitation programmes.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