

# Correlation Study Between Flexibility and Isokinetic Strength's Peak Torque and Angle of Peak Torque, of the Hamstring Muscles in Athletes.

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## BACKGROUND

Muscle strength and flexibility are two key components in strengthening or rehabilitation program [1]. Prevention regimens also include, as both are associated with injury in athletes [2]. In sports where sprinting and stretching activities are required, hamstring muscle injuries and re-injuries are prevalent and common [3]. Due to their high injury incidence and recurrence rates, hamstring injuries are regarded as a major problem in the sports medical community and their cause, rehabilitation and prevention strategy is the focus of much research [2].

Although some studies have reported lower injury and re-injury rates after certain preventive or rehabilitation regimens, these are few and far between within the literature [4]. Intervention have included improving muscle strength, either of the hamstring's alone or along with core strengthening, the development of detailed return-to-play examination protocols [5]. However, flexibility has conflicting outcomes in prevention of injury [6]. While some are of the opinion that that stretching can have a preventive effect on hamstring injuries [7], other researchers have not found such an effect [8, 9]. Moreover, recent research proposes that static stretching during warm-up seems to have adverse effects on performance [10]. Stretching protocols have the potential to improve performance if a greater range of motion (ROM) is achieved, especially in certain sports like sprinting where increasing range is beneficial to performance [11]. This would suggest that despite some short-term undesirable effects, stretching could prove beneficial in the long-term.

## OBJECTIVES

The aim of this study was to investigate if any correlation exists between hamstring flexibility and strength, in terms of their peak torque and the angle of peak torque.

## METHODS

27 (15 males, 12 females) high-level and elite track and field athletes were examined in two flexibility tests, the Active Range of Motion (AROM) and the Active Straight Leg Raising (ASLR) and their strength was measured isokinetic, concentric and eccentric contractions at 60 and 180o/sec. Peak torque and angle of peak torque were collected. The Shapiro-Wilk test was used to assess normality of the distribution, and the Pearson's r parametric or Spearman's rho non-parametric tests were used, to investigate if relationships exist between flexibility and strength variables. Level of significance was set at  $\alpha=.05$ .

## RESULTS

In all (males and females) a moderate to strong positive correlation ( $r=0.49$ ) was obvious in all flexibility-peak torque ( $p.05$ ) tests and moderate to strong negative relationship in two flexibility-angle of peak torque tests (AROM-AEcc60, ASLR-AEcc60) ( $r<.472$ ,  $p<.05$ ). In males' subgroup, no significant correlation was present in any of the tests. On the contrary, in females' subgroup, strong, significant correlation ( $r>.673$ ,  $p<.05$ ) was found when all peak torque values were compared with the flexibility tests, and strong negative relationship in the AROM-AEcc60 and the ASLR-AEcc60 tests ( $r<-.68$ ,  $p<.05$ ).

Total (n=27)			
		CC (r)	Sig. (p)
AROM	Con180	.583	.001*
	Ecc180	.510	.007*
	Con60	.508	.007*
	Ecc60	.487	.010*
ASLR	Con180	.581	.001*
	Ecc180	.540	.004*
	Con60	.541	.004*
	Ecc60	.492	.009*

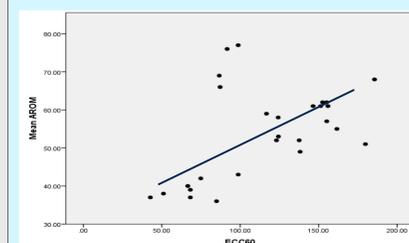


Table 1 showing the correlation coefficient and the statistical significance for the Active Range of Movement (AROM) test and The Active Straight Leg Raise (ASLR) against peak torque. \* denotes a statistically significant result.

Figure 1 shows a scatter plot of AROM and Eccentric Hamstring strength at 60 deg/s. Plot also shows the line of best fit, indicating that strength of the hamstring at slow Ecc speeds has a positive correlation with AROM. This relationship was seen in All correlations measured

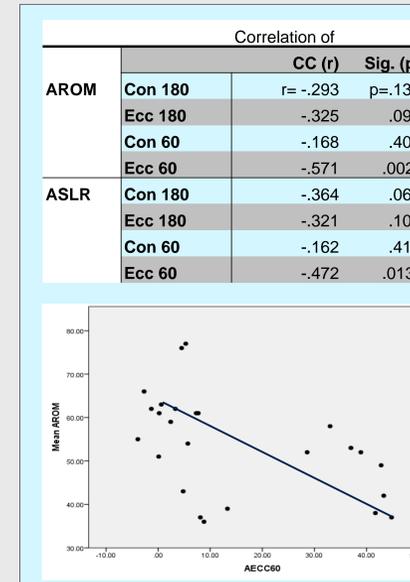


Table 2 showing the correlation coefficient and the statistical significance for the Active Range of Movement (AROM) test and Active Straight Leg Raise (ASLR) against the angle of peak torque \* denotes a statistically significant result.

Figure 2 shows a scatter plot of AROM and angle of peak torque with eccentric Hamstring at 60 deg/s. Plot also shows the line of best fit, indicating that there is a strong relationship and that as the angle of peak torque increases the AROM Decreases.

## CONCLUSION

Results revealed a potential relationship between hamstring strength and flexibility. Athletes and especially female athletes with greater flexibility had also higher peak torque values. In slow angular speeds, eccentric contractions this peak torque was obvious at lower knee angles, than when the knee was closer to full extension.

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