

# The Effects Of Acute Stretching On Muscle Pennation Angle, Fascicle Length And Thickness

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## Introduction

Static stretching is a common prior to exercise however research has indicated that it may illicit a blunting response and thus a decrease in performance. The speculation to a decrease in performance is commonly explained by a reduction in force output and muscle activity. There is little research addressing whether acute changes in fascicle properties could contribute to this deficit as a result of the muscle being lengthened during stretching.

## Purpose

To determine if acute static stretching alters pennation angle, fascicle length and thickness of the Vastus Lateralis.

## Results

There was no significant difference for fascicle length measurements ( $P=0.25$ ) however there was significant difference between pre and post for pennation angle ( $P=0.01$ ) and thickness ( $0.04$ ). Values for fascicle length (mean  $\pm$  SD) were pre  $10.6 \pm 2.0$  vs post  $10.8.3 \pm 1.9$  cm. Values for pennation angle (mean  $\pm$  SD) were pre  $11.6 \pm 3.7$  vs post  $13.5 \pm 4.2$  degrees. Values for thickness (mean  $\pm$  SD) were pre  $2.1 \pm 0.5$  vs post  $2.3 \pm 0.5$  cm.

This Research was Funded by the Office of Undergraduate Research at Furman University

## Methods

Thirty participants ( $68.1 \pm 3.8$  cm,  $73.7 \pm 16.9$  kg, Age  $23.5 \pm 9.8$  years) had Three panoramic ultrasound images of the vastus lateralis were taken prior to and after static stretching. The transducer was positioned in the center of the muscle belly just inferior to the largest circumference of the muscle, it was then moved superior until the full length of a fascicle was captured. Static stretching was performed via a standing quad stretch where the participant reached back and grabbed their foot and pulled posteriorly and superiorly until a slight discomfort caused by the stretching muscle was felt. This was repeated for 5 sets of 60 seconds with 30 sec rest in-between for 5 total minutes of stretching. Images were analyzed for pennation angle, fascicle length, and thickness. Values were then averaged across all three images (pre and post) and compared using paired t-tests.

## Conclusion

The results indicated that the fascicle pennation angle and muscle thickness increases as a result of stretching. This increase in muscle size and pennation angle maybe contributed to the increase in compliance of the tendon allowing for the strain to be reduced from the muscle allowing for it to relax and be less elongated. The increase in pennation angle then might alter the mechanical properties of the muscle creating a less advantageous angle for force production. This could be another potential reason why there is a reported force deficit following stretching.

## Practical Applications

The force detriment associated with stretching has been contributed to neuromuscular properties but as a result of this study mechanical properties may be altered as well. In agreement with the literature it is advised that stretching not be the sole component of a pre-exercise routine.

## Data

