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# Upper Extremity Performance Changes in Division III Collegiate Swimmers Over a Competitive Season

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# Upper Extremity Performance Changes in Division III Collegiate Swimmers Over a Competitive Season

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## INTRODUCTION & PURPOSE

The sport of swimming has increased in popularity in recent years. Each year more and more athletes achieve record breaking swims. Swimmers strive to see improvements in their times throughout the course of a competitive season. Shoulder injuries and imbalances are also very common with swimmers. After studying some literature it was concluded that FMS, strength and ROM measures should be taken in order to determine overall strength, and flexibility of an athlete's shoulder. These measures were taken to see if there was any correlation between them, and swim performances. There have been many studies about shoulder injuries in swimmers, and why they occur. However, this study sought to investigate how strength and flexibility of a healthy swimmer's shoulder correlated to their individual swim performance.

The purpose of this experiment was to examine the relationship between changes in shoulder strength, ROM, and stability during a season with end of season performances. Supine shoulder ROM of the left and right arm (external and internal), shoulder prone strength of the left and right arm (external, internal, scaption and extension), and upper quarter Y balance test where measured. Also a pain severity questionnaire was given out every week. The hypothesis was that improvements in shoulder strength would predict performance outcomes.

## METHODS

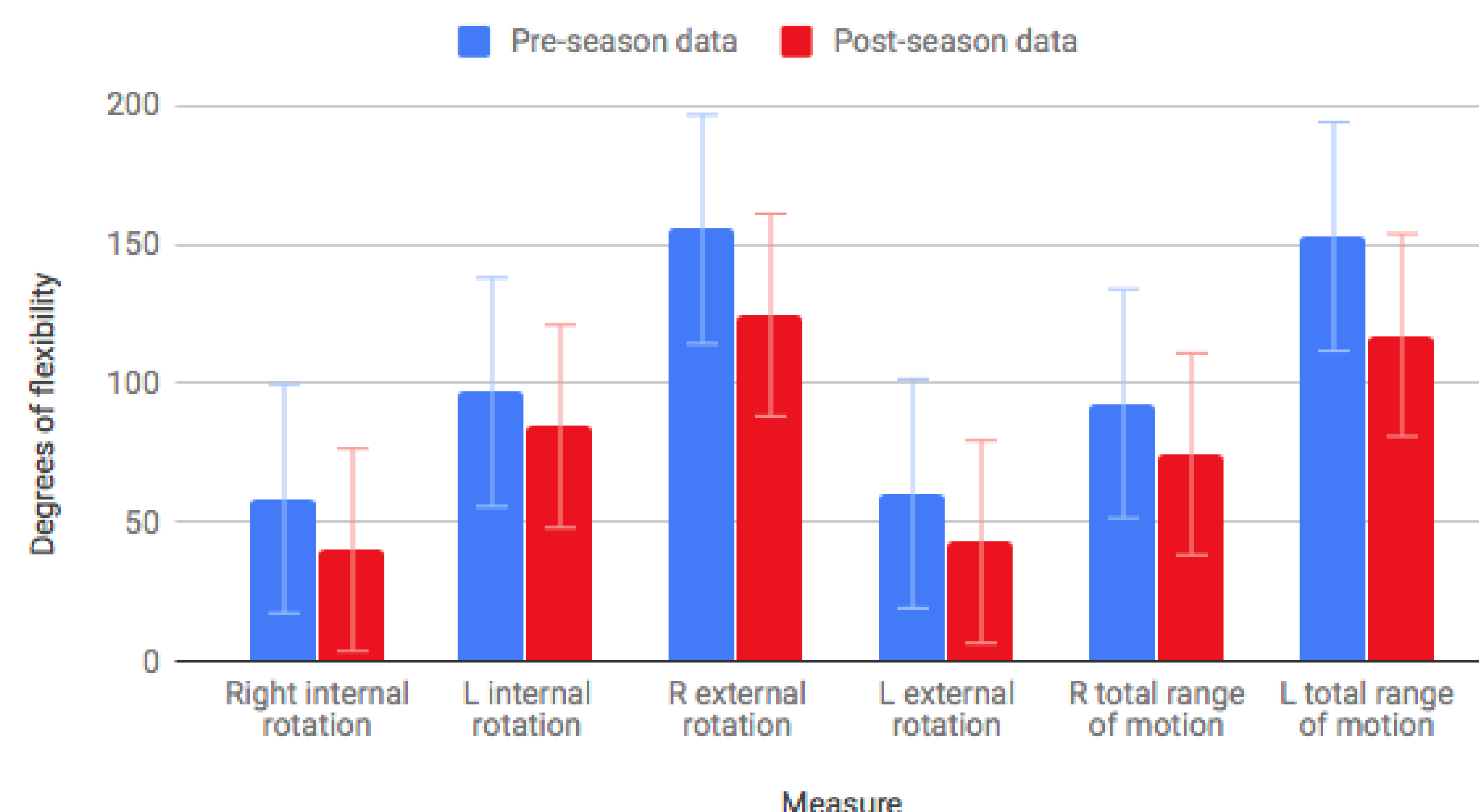
- This study used a cross-sectional design to assess relationships between strength, and ROM in the shoulder joint of NCAA DIII swimmers at Ohio Wesleyan University.
- All of the athletes were tested in the preseason to determine their strength and ROM values without the in-season training having an effect on those numbers.
- The testing was completed on three different days in order to break up the group of athletes to allow the testing methods to be done in an efficient manner.
- The ROM of the shoulder joint was tested by calculating supine shoulder ROM of the left and right arm (external and internal) using a digital inclinometer.
- Shoulder strength was tested with athletes in a prone position on an examination table, using a hand-held dynamometer. Athletes performed a maximal isometric contraction in both arms for external rotation, internal rotation, scaption and extension.
- The FMS Upper quarter Y-Balance test was completed to determine stability of the shoulder joint and measured.
- The FMS shoulder mobility test was completed to determine dynamic shoulder mobility of each individual.
- Pilot testing data demonstrated high intra-rater reliability for the following tests: ROM ICC=0.989 (95% CI=.996-.997  $p<0.0001$ ), Strength ICC=0.864 (96% CI=.647-.953  $P<0.0001$ )

## SUBJECTS

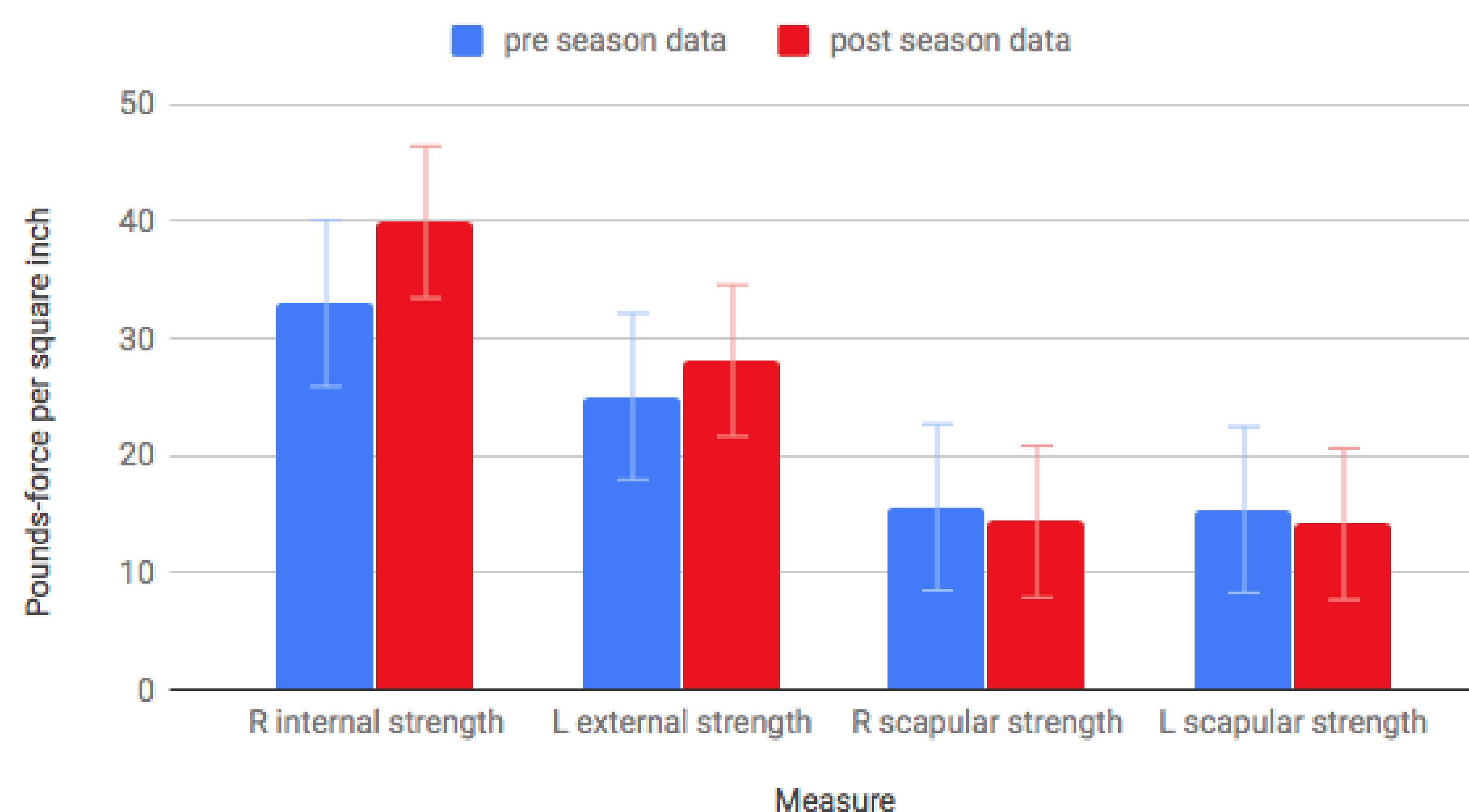
- Thirty four collegiate swimmers were recruited to participate (males n=15, females=19, mean age =19.38).
- Each participant was fully aware of their participation in the study. It was understood that this was voluntary for them.
- A university institutional review board approved this study, and all participants provided informed consent prior to testing.

## RESULTS

Shoulder flexibility data



Shoulder strength data



## TESTING



## CONCLUSIONS

Paired samples t-tests were used to compare preseason and postseason results. The results that were significant are as follows, right internal rotation ( $t=7.378$ ,  $p=0.000$ ), right external rotation ( $t=5.123$ ,  $p=0.000$ ), right total range of motion ( $t=6.804$ ,  $p=0.000$ ), left internal rotation ( $t=8.511$ ,  $p=0.000$ ), left external rotation ( $t=7.155$ ,  $p=0.000$ ), left total range of motion ( $t=10.998$ ,  $p=0.000$ ), right internal strength ( $t=-3.213$ ,  $p=0.003$ ), right scapular strength  $t=2.551$ ,  $p=0.017$ ), left internal strength ( $t=-2.235$ ,  $p=0.034$ ), left scapular strength ( $t=2.484$ ,  $p=0.020$ ). Independent samples t-tests were performed between strength and end of season performance. The results that were significant are as follows, left internal strength preseason and 1 personal best swim at the end of the season ( $t=-1.556$ ,  $-2.835$ ,  $p=0.026$ ), and left internal strength postseason and 1 personal best swim at the end of the season ( $t=-1.752$ ,  $-4.131$ ,  $p=0.026$ .)

## PRACTICAL APPLICATIONS

This study helps to develop a better understanding of the differences in strength, and ROM in the shoulder joint of swimmers throughout a competitive season. The significant changes in both strength and ROM values collected clearly demonstrate that strength can be improved throughout a season, and may certainly impact performance, while the emphasis on maintaining shoulder ROM should be of concern for coaches, as all ROM measures decreased. Such findings may suggest that strength training and the swim practices made significant improvements in strength while decreasing ROM. These results may be used to help swimmers and their coaches better understand the relationship between strength, ROM, and athletic performance.