

# Shoulder Muscular Fatigue and Strength Ratios in Division III Collegiate Women Swimmers

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## Introduction

Swimmers' shoulder is a term coined due to the number of injuries sustained to the rotator cuff while swimming. Shoulder injuries have been found to occur in 30-91% of swimmers (Beach et al., 1992; Wolf et al., 2009; Walker et al., 2011; Tate et al., 2012) and practice injury rates for collegiate female swimmers were higher than other NCAA sports (Chase et al., 2011).

## Problem Statement

To date there is no standardized shoulder strength testing for NCAA Womens swimmers related to diagonal shoulder motion to replicate the swimming motion.

## Objective

This study was designed to determine the shoulder strength and endurance levels by using an isokinetic dynamometer to screen members of the Womens Swim Team at ECSU. The goal was to identify muscular imbalances/strength ratios, as well as potential muscular endurance deficits.

## Methods

11 young adult women from the Eastern Connecticut State University swim team participated in the study. The study was ECSU IRB approved. Participants were seated in a chair and attached to the isokinetic dynamometer. The first trial was a diagonal shoulder flexion and extension concentric movement for five repetitions at 90 deg/s, followed by the same motion at 180 deg/s for 20 repetitions. The same procedures was repeated on the opposite arm. Results were recorded using the Biodex System 4 Pro 2020 (Shirley, New York) Advantage BX Software.



## Key Findings

1. When pulling diagonally towards the body (shoulder diagonal extension) at an angular velocity of 180 deg/s, 73% of participants recorded a stronger peak torque for their dominant arm in comparison to their non-dominant arm. The average percent difference between dominant and non-dominant peak torque for diagonal shoulder extension was 76.4%.
2. At 180deg/s, the peak torque (ft lbs) of shoulder diagonal extension was greater than shoulder diagonal flexion motion. The average percent difference between the two motions on the dominant arm was approximately 36.8%.
3. 73% of participants had a greater agonist/antagonist (Sh. Flex, Horiz Abd/Sh. E.R.) Sh. Ext/ Horiz Add/Int.Rot) ratio on their non-dominant side in comparison to their dominant arm at 180 deg/s. Of the 73%, 62.5% had greater than a 40% difference.

## Conclusions

There are significant muscular imbalances within this sample of Division III collegiate swimmers. Six swimmers had greater than a 70% difference between their dominant and non-dominant arms for shoulder diagonal extension for both peak torque and total work. Four swimmers had greater than a 40% difference between diagonal extension and diagonal flexion on their dominant arm, while six others had a difference between 20-40%. Seven swimmers had greater than a 40% difference between the agonist/antagonist ratio of their dominant and non-dominant arms, while 3 other swimmers were between 30-40%. These results are preliminary and future data analysis will occur.

This particular screening is important in that it represents an under-studied population of athletes (NCAA Div III Women Swimmers). This is the first known study to involve shoulder diagonal testing which is more sport specific. These procedures could be utilized in future research with a greater number of athletes to acquire more evidence on the trends found in this study. Based upon the identified imbalances specific Interventions were developed.

### Proposed Interventions to Address Identified Imbalances

1. One arm pull downs with cable
2. Seated rows with low weight and higher repetitions
3. Push-up Plus
4. Scaption plane (30 deg. From the frontal plane) moving from medial rotation to lateral rotation