The Performance Demand of Softball Pitching: A Comprehensive Muscle Fatigue Study

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ABSTRACT
Purposive muscle fatigue patterns have been defined for fast-pitch baseball pitchers (McGuely et al 2004) but little is known about fatigue patterns in softball pitchers. The purpose of this study was to examine muscle fatigue after fast-pitch softball pitching.

METHODS: Bilateral strength measurements (hand-held dynamometer: Lafayette Manual Muscle Tester, Experimental Protocol) were made on 10 female softball pitchers (age 15±2.1 yr) prior to and after pitching a game (99±21 pitches, 5±1 innings). 20 tests were performed on the dominant (dom) and nondominant (ndom) sides; forearm (grip, wrist flexion/extension, pronation/supination), shoulder (flexion, scapula abduction/adduction, external/external rotation, empty can test), hip (flexion, lower/lower extremity rotation, romboid) and knee (flexion, adduction/extension). Fatigue (% strength loss) was categorized based on bilateral vs. unilateral presentation: Bilateral Symmetric (% strength loss on dom and ndom only, or greater than ndom), Bilateral Asymmetric (% strength loss was different between sides), or Unilateral Equivocal (significant on dom only but not different from ndom).

RESULTS: Fatigue (% strength loss) was present in all upper and lower extremity muscles, primarily unilateral in shoulder but bilateral in the proximal musculature (scapula and hip). By contrast, McGuely et al (2004) showed that fatigue was predominantly in the dominant shoulder, with minimal scapular and no lower extremity fatigue. Thus fast-pitch softball pitching appears to involve a greater performance demand than baseball pitching (see graph below). However, McGuely et al (2005) studied college baseball pitchers while high school softball pitchers were studied here. Therefore, age is a confounding variable in comparing these studies.

DISCUSSION
Following a fast-pitch softball pitching performance, fatigue was evident through the entire kinematic chain. Fatigue was present in all upper and lower extremity muscles, primarily unilateral in later but bilateral in the proximal musculature (scapula and hip). By contrast, McGuely et al (2005) showed that fatigue was predominantly in the dominant shoulder, with minimal scapular fatigue and no lower extremity fatigue. Thus fast-pitch softball pitching appears to involve a greater performance demand than baseball pitching (see graph below). However, McGuely et al (2005) studied college baseball pitchers while high school softball pitchers were studied here. Therefore, age is a confounding variable in comparing these studies.

REFERENCES