

## Effect of concentric exercise-induced fatigue on proprioception and motor control of the upper limb in handball players

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**Background:** Shoulder injuries are prevalent among handball athletes. The majority of these injuries occur during the latter stages of official matches as a result of fatigue. Muscle fatigue can reduce the muscle's ability to absorb external loads, increasing the risk of injury. In addition, muscle fatigue has been associated with decreased proprioception and neuromuscular control. The objective of this study was to examine how concentric exercise-induced fatigue in the rotator cuff affects the proprioception and motor control of the upper limb in handball athletes.

**Methods:** Forty-six male handball players (all right-handed) were included in this Test-retest design experiment. Proprioception was assessed using joint reposition sense (JRS), threshold to detection of passive movement (TTDPM), muscle onset latency (MOL). Motor control was evaluated using Y balance test upper quarter (YBT-UQ) and athletic shoulder test (ASH). All variables were tested before and immediately after fatigue using maximal effort, concentric, isokinetic training. The fatigue protocol was executed on the right hand. The criterion for determining muscle fatigue was a consecutive decline of 40% in peak torque across three repetitions.

**Results:** A substantial increase in the absolute angular error (AAE) was detected in all target angles ( $p < 0.01$ ). Furthermore, there was a notable rise in TTDPM following the fatigue intervention ( $p=0.020$ ). Moreover, the study revealed statistically significant variations in the anteromedial (AM) ( $p=0.041$ ) and superolateral (SL) reach directions ( $p=0.005$ ), as well as the composite score ( $p=0.009$ ) in the right hand. Additionally, a statistically significant difference was seen in the inferolateral (IL) reach direction in the left hand ( $p=0.020$ ) in the YBT-UQ. Furthermore, there was a notable decrease in isometric strength (measured by the ASH test) in the I position of the right hand ( $p=0.010$ ) and in all locations of the left hand ( $p<0.05$ ). In addition, there was an increase in MOL scores following fatigue, however, the increase did not reach statistical significance ( $p > 0.05$ ).

**Conclusions:** Elite male handball players experience significant impairments in joint position awareness, kinesthesia, and motor control of the upper extremity as a result of concentric fatigue. While fatigue does decrease reflex reaction time, the impact is not statistically significant.

### Biography

Mr. Stelios Hatzisavvas is an adjunct faculty at the University of Nicosia. He completed a Bachelor of Science degree in Physiotherapy and earned two Master's degrees. The first specialization is in sports physiotherapy, while the second specialization is in musculoskeletal physiotherapy and manual therapy. He is currently doing his PhD at the University of Nicosia, focusing on researching shoulder injuries among handball players.