

# Handball load and shoulder injury rate: a 31-week cohort study of 679 elite youth handball players.

**Moller, M., Nielsen, R. O., Attermann, J., Wedderkopp, N., Lind, M., Sorensen, H., & Myklebust, G. (2017). Handball load and shoulder injury rate: a 31-week cohort study of 679 elite youth handball players. *British Journal of Sports Medicine*, 51(4), 231-237. doi:10.1136/bjsports-2016-096927**

## OBJECTIVE

The aim of this study was to investigate the association between load, physical attributes (strength, range of motion [ROM], and scapular dyskinesia) and shoulder pain in junior handball athletes.

## METHODS

A cohort study of 679 junior elite handball players. Primary outcome measures were shoulder strength (internal rotation, external rotation and abduction), ROM (internal and external rotation) and scapular dyskinesia. Following assessment, participants were categorised into "abnormal" or "normal" groups depending on the outcome of the tests. Over 31 weeks the players were monitored weekly for shoulder pain and load. An increase in weekly training and match load relative to the previous four weeks was categorised into three groups: (1) load increase of less than 20% (reference group); (2) load increase of 20% < 60%; and (3) load increase of more than 60%. The association between load, physical attributes and injury were examined.

## RESULTS

Compared to the reference group there was a clear association between shoulder injury and an increased load of 20% in players with either reduced external rotation strength (hazard ratio [HR] 4.0; 95% confidence interval [CI] 1.1 to 15.2,  $p=.04$ ) or scapular dyskinesia. (HR 4.8; 95% CI 1.4 to 12.8,  $p=.01$ ) There was also a clear association between shoulder injury and load in groups that increased their loading by more than 60% (HR 1.91; 95% CI 1.0 to 3.70,  $p=.05$ ).

## CONCLUSION

Large increases in shoulder load are clear contributors to shoulder injury in this sample of adolescent handball players. Athletes with reduced external rotational strength and scapular dyskinesia have heightened sensitivity to shoulder injury with smaller increases in load.

## COMMENTARY

Shoulder pain is a common injury in elite handball players with the average weekly prevalence being approximately 28% during the season (Clarsen, Bahr, Andersson, Munk, & Myklebust, 2014). This condition is also highly prevalent in other throwing and overhead sports such as baseball (Amin et al., 2015). In terms of shoulder injury, load and physical attributes such as scapular dyskinesia, reduced strength and glenohumeral ROM are independent risk factors for injury (Amin et al., 2015; Clarsen et al., 2014; Drew & Finch, 2016; Hulin, Gabbett, Lawson, Caputi, & Sampson, 2016). This however, is the first study to investigate a combination of physical attributes and load and their impact on shoulder injuries.

Pre- and post-season screens were conducted on 679 junior handball athletes who were then categorised into abnormal and normal groups for shoulder strength, ROM and scapular function. Loading and shoulder pain data were collected through the season (31 weeks) using a SMS reporting system (SPEx sports injury surveillance system). Prior to the study, strength (dynamometry) and ROM (inclinometry) measures were deemed reliable through a separate pilot, with the ICC test-retest coefficients all being high (0.95-0.99). Measures of scapular stability had already been examined in a previous reliability study.

This study was of high quality with a large sample size and inclusion of reliable outcome measures. There were however a few limitations. The athletes had to self-report episodes of shoulder pain using a text system and although the response rate was high (88-97%) episodes may have been missed that otherwise may have been reported by a physiotherapist. Random measurement error may have also been present with the categorisation of the physical attributes. The authors reported no systemic bias with their methodology or the four selected physiotherapists that carried out the testing.

Over the season 68 injuries were sustained to the dominant arm. Analysis of the injuries showed that a large increase in exposure/load to handball (>60 %) increased the shoulder injury risk (HR 1.91; 95% CI 1.0 to 3.70,  $p=.05$ ). This has been supported in previous literature in multiple other sports such as Australian football and rugby league (Drew & Finch, 2016; Hulin et al., 2016). However, the most clinically relevant finding of that study was those athletes with reduced external rotation strength/scapular dyskinesia who increased their weekly load between 20% and 60%, were between 4.0 (HR 4.0; 95% CI 1.1 to 15.2  $p=.04$ ) and 4.8 (HR 4.8; 95% CI 1.4 to 12.8  $p=.01$ ) times more likely to sustain an injury when compared to the reference group.

The clinical implications of this paper are significant as it highlights the interaction of risk factors against load. The authors have identified reduced external rotation strength and scapular dyskinesia as the most important physical risk factors that affect shoulder pain in junior handball athletes. Glenohumeral external rotation strength is a risk factor that can be easily addressed through a strengthening programme and accurately measured using the author's dynamometry testing protocol. Dynamometry for strength measurement is becoming a more accessible tool for physiotherapists and can provide a numerical value to help athletes with setting and achieving goals. The findings of this study are relevant to recent literature that supports the use of strengthening exercises to reduce the prevalence of shoulder injuries in handball athletes (Andersson, Bahr, Clarsen, & Myklebust, 2016). The scapular dyskinesia risk factor is slightly harder to address as there are many more variables to consider;

however, if other risk factors could not be addressed, it would be advisable that a more conservative approach to loading is recommended (<20% weekly increase in load).

Shoulder injuries are common in throwing athletes. However, identification of reduced external rotation strength and scapular dyskinesia, accompanied by load modification for athletes with these risk factors, may contribute to reducing the prevalence of injury.

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