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## THE EPIDEMIOLOGY OF SPORT-RELATED SHOULDER INJURIES AMONG YOUTH: A SYSTEMATIC REVIEW

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**Background** Youth around the globe place their shoulders at risk for injury when participating in sports. Shoulder injuries may vary in severity, produce the potential for time-loss from sport, and result in functional disability.

**Objective** To explore youth sport-related shoulder injuries by identifying injury rates, risk factors, injury mechanisms, and injury prevention strategies.

**Design** Systematic review.

**Setting** All relevant full-text articles identified from searching MEDLINE, EMBASE, CINAHL, Sport Discus, and Cochrane Controlled Trials Registry (no date restrictions; final search August 3<sup>rd</sup>, 2021)

**Participants** All full-text studies reporting original research describing the burden of sport-related shoulder injury among female and/or male youth from 5 to 18 years old. Studies were excluded if they were synthesis/review papers, were small case series (<10 participants), the participants included >10% adult participants; or if the full-text was not available.

**Main Outcome Measures** Injury rates, risk factors, injury mechanisms, and injury prevention modalities as they relate to youth sport-related shoulder injuries.

**Results** Of 3,889 studies screened, 97 described shoulder injury in youth sport. Shoulder injuries were identified in 23 unique sports. Median seasonal prevalence of shoulder injury was 10.9% (range 1.2–28.2%). The most common injury mechanisms identified were contact with another player, contact with the playing environment, and falling to the ground. Risk factors for shoulder injury identified were side-to-side strength imbalances, weak external rotator muscles, and scapular dyskinesia. Two studies evaluated successful training strategies to prevent shoulder injury, but two others demonstrated no effect.

**Conclusions** Sport-related shoulder injuries are prevalent among youth athletes. Injury risk factors identified included modifiable intrinsic factors such as strength, range-of-motion, and training load. The most common injury mechanism was direct contact with either another person or an object in the playing environment. Innovative shoulder-specific strategies are needed to reduce shoulder injuries in this population.

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## RISK FACTORS FOR SHOULDER PAIN IN JUNIOR FLATWATER KAYAK ATHLETES

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**Background** Shoulder injuries are common among flatwater kayak athletes and are predominantly characterised by features of overuse.

**Objective** This study investigated whether body composition and physical characteristics differ between junior flatwater kayak athletes with and without shoulder pain.

**Design** Cross-sectional study.

**Participants** The study included 178 Japanese junior kayak athletes (116 boys and 62 girls) (age  $13.4 \pm 0.9$  years, height  $162.1 \pm 7.1$  cm, weight  $54.1 \pm 8.5$  kg) who participated in a national junior training camp (2015–2018). Participants were categorised into 2 groups based on a self-reported history of kayaking-induced shoulder pain.

**Main Outcome Measurements** Body composition was measured using the Body Impedance Analyser (InBody 720) device, and range of motion was evaluated using a goniometer. Shoulder pain was assessed based on a questionnaire, interview, and physical examination performed during the national training camp. Logistic regression analysis was performed to determine the factors associated with shoulder pain.

**Results** In this study, 42.1% ( $n = 75$ ) of the participants experienced shoulder pain. Multivariate analysis revealed that lower trunk muscle mass per body weight was the most significant predictor of shoulder pain. Trunk muscle mass per body weight (odds ratio [OR] 0.81, 95% confidence interval [CI] 0.74–0.90) and age (OR 1.74, 95% CI 1.31–2.32) were associated with shoulder pain in junior kayak athletes.

**Conclusions** This study suggests that screening for body composition is essential to treat and perhaps prevent shoulder pain. In addition to evaluation of total and regional body composition, evaluation of muscle characteristics may be useful for injury prevention. Lower trunk muscle mass was shown to be associated with shoulder pain. Therefore, appropriate trunk movements and core strengthening should receive attention in junior kayaking athletes.

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## JOINT HYPERMOBILITY IN ATHLETES IS ASSOCIATED WITH SHOULDER INJURY AND SHOULDER PAIN: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Background** Joint hypermobility in athletes is associated with increased risk of knee injuries, but currently it is unclear if joint hypermobility is associated with increased risk of shoulder injuries.

**Objective** To assess the association between joint hypermobility and shoulder injuries in athletes.

**Design** Systematic review and meta-analysis. Odds ratios (OR) for having shoulder injuries in exposed (joint hypermobility) athletes compared with non-exposed (without joint hypermobility) athletes were estimated using a random effects meta-analysis. We performed subgroup analyses to explore the effect of sex, type of sport, sports level, study type, risk of bias, and exposure definition (generalised joint hypermobility (GJH) or shoulder joint hypermobility). Risk of bias was assessed using Newcastle-Ottawa Scale, and overall quality of evidence