



## Performance Research Reviews

July 2024

### Baseball

***A framework for using virtual reality to enhance psychological performance in baseball. Journal of Sport Psychology in Action, Ahead of Print: 1-17, 2024.***

**Abstract** - Virtual reality (VR) has become an increasingly popular tool for use in sports, particularly with regards to enhancing the psychological performance of athletes. Despite this, a systematic approach in exactly how sporting organizations can apply the technology appears to be lacking. This paper proposes the Baseball Framework for Applying Virtual Reality (Baseball-FAVR) which aims to guide practitioners within professional baseball as to how, when, and with whom VR can be used to enhance the performance of their players. The framework outlines six specific use cases which are reflected by their suggested prioritization at each affiliate level from Major League down to Rookie (newly drafted to an organization). It is hoped that the Baseball-FAVR will enable baseball organizations to take advantage of the many potential benefits that VR technology offers to the sport.

***An examination of pre-activity and post-activity training practices in NCAA Division I and Division III baseball coaches. International Journal of Sports Science & Coaching, Ahead of Print: 1-10, 2024.***

**Abstract** - Baseball includes complex multi-joint and multi-planar activities involving a majority of the musculature of the body. Research pertaining to training practices including pre-activity and post-activity stretching continues to evolve along with related sport science recommendations. Therefore, the purpose of this study is to assess the pre-activity and post-activity warm-up, stretching, and training practices of National Collegiate Athletic Association (NCAA) Division I and Division III baseball coaches. A total of 686 questionnaires were distributed via email to head collegiate baseball coaches from NCAA Division I and III universities. The questionnaire was designed to gather demographic, professional, and educational information, as well as specific pre-activity and post-activity stretching usage by the coaches. The responses were examined by computing frequency counts and means where applicable. For the statistical analysis, both SPSS version 27.0 and JMP version 13.0 software packages were utilized. Pearson's Chi-squared tests were run where applicable. Results indicated just over 77% of coaches in the present study affirmed the importance of a pre-activity



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dynamic warmup. When comparing coaching specific certification to pre-activity flexibility practices, it is clear not all coaches comply with suggested pre-activity flexibility recommendations. This study indicates it is important for baseball coaches to re-evaluate their own practices, perhaps cross-checking them with practices of their peers and staying current with ongoing research.

### ***Classifying batted ball outcomes from Division I collegiate baseball players. Journal of Sports Sciences, Ahead of Print: 1-8, 2024.***

**Abstract** - Modern technology challenges anecdotal beliefs on baseball performance. The study's purpose examines these beliefs by classifying batted ball outcomes. Three categories of independent variables (anthropometry, in-game situation, technique-based), from 1,922 batted ball outcomes produced by 230 players, were used to classify the likelihood of hits during 2021 college baseball games. Anthropometry included player's heights and weights. In-game situation entailed batter side, same side, ahead count, and pitch type. Technique-based variables measured by TrackMan radar included exit speed (ExSp), launch angle (LA), batted ball distance (BBD), and hang time (HT). Binary logistic regression analysis was performed with batted ball outcome as the dependent variable. Independent variables provided a good fit ( $\chi^2(10) = 522.358, p < 0.01$ ) and correctly classified nearly three-fourths of outcomes. Height ( $\beta = 0.030, p < 0.05$ ), ExSp ( $\beta = 0.023, p < 0.05$ ), LA ( $\beta = 0.028, p < 0.01$ ), and BBD ( $\beta = 0.067, p < 0.01$ ) each had significant positive associations, yet HT ( $\beta = -1.661, p < 0.01$ ) had a significant negative association, with batted ball outcomes. TrackMan provided four significant independent variables. Anthropometry's contribution to batting outcome was modest, while in-game situation's impact was non-significant; results contradict anecdotal beliefs of their importance.

### ***Comparison of glenohumeral and scapulothoracic kinematics between fastballs and curveballs during baseball pitching. Sports Biomechanics, Ahead of Print: 1-14, 2024.***

**Abstract** - Shoulder injuries are common in baseball pitchers and primarily involve the glenohumeral joint. Past analyses have examined shoulder biomechanics during different pitch types simply as the motion of the upper arm relative to the thorax. In this study, glenohumeral and scapulothoracic kinematics were compared between fastballs and curveballs at key timepoints throughout a pitch. Upper extremity kinematics of thirteen collegiate pitchers were collected during fastball and curveball pitches with motion capture. A linear model approach was utilized to estimate



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scapular kinematics based on measurable humerothoracic motion. Glenohumeral kinematics were computed from the scapular and humeral motion data. Comparisons of scapulothoracic and glenohumeral kinematic variables at times of maximum glenohumeral external rotation, ball release, and maximum glenohumeral internal rotation between pitch types were made using paired t-tests with Benjamini-Hochberg corrections. There were no significant differences in glenohumeral kinematics. Fastballs elicited significantly less scapulothoracic internal rotation and more posterior tilt at maximum glenohumeral external rotation. Fastballs produced significantly less scapulothoracic internal rotation and anterior tilt at maximum glenohumeral internal rotation. This study provides further evidence that risk of injury to the glenohumeral joint may be consistent between fastballs and curveballs and offers insights into subtle differences in scapular kinematics between pitch types.

### **Basketball**

***Describing the distribution of training loads in the microcycles and mesocycles of competitive basketball. Italian Journal of Sports Rehabilitation and Posturology, 11(31): 2;1; 2872-2896, 2024.***

**Abstract** - Planning the periodization of training loads in harmony with the different periods of the season is a unique role for members of the sports team staff. Therefore, the objective of this study is to describe the distribution of training loads in microcycles and mesocycles in competitive basketball through a narrative review of the literature. In a consultation in three electronic databases (Google Scholar, PubMed and Science Direct) in Portuguese, English and/or Spanish, a total of 45 primary scientific articles were chosen that addressed the distribution of training loads in basketball and team sports in set with 21 complementary secondary references on the main thematic. It was demonstrated that compulsory load is a basic entity necessary to raise performance levels in the sporting form. Monitoring and numerically controlling the external load imposed can result in favorable responses in the internal load of athletes. In this aspect, some key metrics collaborate effectively, such as: acute-chronic workload ratio, monotony index and strain index. Short-term microcycles make it possible to see the horizontal distribution of loads, built session after session. In contrast, mesocycles group several consecutive microcycles to adjust loads vertically. Invariably, a rational and logical long-term distribution can result in improvements in athletic performance and low injury incidence. However, to achieve these objectives through the systematic periodization of loads, it is necessary to face pedagogical problems that belong to a multidimensional sphere. That is, we are manipulating an extremely complex and imperfect construct, with great dependence on the interpretation made by responsible practitioners.



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### ***Determination of change of direction deficit thresholds across a spectrum of angles in basketball players. Journal of Sports Sciences, Ahead of Print: 1-9, 2024.***

**Abstract** - Change of direction deficit (CODD) offers valuable insights into a player's balance between linear and multidirectional speed. However, there are still no established reference values for CODD. The objectives of this study were to determine CODD thresholds for various change of direction angles in basketball players according to gender and analyze the relationships between CODD and execution time in speed tests. One hundred and thirty basketball players (46% female; age:  $23.7 \pm 5.29$  years; height:  $189.1 \pm 11.1$  cm; body mass:  $84.3 \pm 15.7$  kg) undertook 10-m linear and change of direction speed test at  $45^\circ$ ,  $90^\circ$  and  $180^\circ$ . A k-means cluster analysis was conducted to standardize CODD thresholds and a one-way analysis of variance to identify the differences between clusters. The results revealed angulation-specific CODD thresholds, ranging from 3% to 8%, 17% to 25% and 43% to 51% for  $45^\circ$ ,  $90^\circ$  and  $180^\circ$  cutting angles, respectively for the pooled sample. Furthermore, differences inter-clusters ( $p < 0.05$ ) were observed for execution time at all cutting angles for both genders. Therefore, strength and conditioning coaches are encouraged to assess CODD as a highly valid variable for evaluating change of direction performance and to use current CODD thresholds to tailor training programs according to each athlete's needs.

### ***Influence of vertical-oriented vs horizontal-oriented combined strength training in young basketball players. Journal of Strength and Conditioning Research, Ahead of Print: 1-8, 2024.***

**Abstract** - This study aimed to compare the effects of 8-week combined vertical-oriented vs. horizontal-oriented training interventions in basketball athletes. Eighteen highly trained U-16 basketball players participated in this study and were randomly assigned to either a combined vertical-oriented training group (CVG,  $n = 9$ ) or a combined horizontal-oriented training group (CHG,  $n = 9$ ). Bilateral and unilateral vertical jump height, unilateral horizontal jump distance, 5-m, 10-m, and 20-m sprint times, change-of-direction sprint times, and a limb symmetry index were among the measured performance variables. Combined strength training was performed twice a week for 8 weeks. CVG was compounded by the squat exercise (3 sets of 6–8 R at 30–45% 1 repetition maximum [1RM]), jump squats (2 sets of 6 R, at 5–12.5% body mass [BM]), and vertical jumps (3–4 sets  $\times$  6 R). CHG included the hip thrust exercise (3 sets of 6–8 R at 30–45% 1RM), sled towing sprints (2–3 R, at 5–12.5% BM), and sprints (3–4 R of 20-m). Within-group differences showed significant ( $p < 0.05$  and statistical power  $>80\%$ ) improvements in unilateral vertical jumping with the right leg after both training interventions. By contrast, only CHG improved 5-m, 10-m, and 20-m sprint times ( $p < 0.05$  and statistical power  $>80\%$ ). Significant effects were observed for CHG compared with CVG in 5-m, 10-m, and 20-m sprint times ( $p < 0.05$  and



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statistical power >80%). This study reinforces the importance of oriented-combined training based on force-vector specificity target, mainly in horizontal-oriented actions.

**Practical Applications** - This study underscores the influence of force-vector specificity in combined strength training, demonstrating its potent role in enhancing diverse performance variables in young basketball players. Our findings suggest that combined training with a horizontal force-vector predominance, using hip thrust with low/moderate loads (30–45% 1RM) and a low training volume (4–8 reps per set) combined with sled towing (5–12.5% BM) and sprints may produce a better effect on running sprint performance than a combined training with a vertical force-vector predominance. These findings suggest that integrating specific force vector training may be essential for targeted performance improvements, highlighting the need for specificity in strength training protocols.

***Investigation of the effect of circadian rhythm on the performances of NBA teams.***

***Chronobiology International: The Journal of Biological and Medical Rhythm Research, Ahead of Print: 1-11, 2024.***

**Abstract** - Professional athletes competing in the NBA are frequently exposed to time-zone-shifting travels. These time zone changes may cause circadian rhythm (CR) phase shifts and these shifts affect sportive performance. The aim of this study was to investigate the effects of CR phase shifts on the performance of NBA teams. 25016 regular season games across 21 consecutive seasons were included in the CR phase shift calculations. To examine the CR phase shift effect on team performance, teams were divided into three groups regarding Coordinated Universal Time (UTC): the same internal UTC as the local UTC (LS); the internal UTC ahead of the local UTC (LA); and the internal UTC behind the local UTC (LB). With a different approach, teams were divided into another three categories: the same internal UTC as its opponent's internal UTC (OS); the internal UTC ahead of its opponent's internal UTC (OA); and the internal UTC behind its opponent's internal UTC (OB). 24985 game data were used to compare these groups in terms of 25 variables. Statistical analyses were conducted separately for home and away teams. For home games, it was found that LA and OA are the most and LB is the least successful group in winning and scoring performances. For away games, it was determined that LS is the most advantageous group with the best winning percentage. These results revealed that teams from more west may have a CR advantage in regular season home games. However, it is thought that the performance of away teams depends more on travel fatigue than CR phase shifts.



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### Football

***Effects of combined uphill-downhill sprinting vs resisted sprinting methods on sprint performance: A systematic review and meta-analysis. Sports Medicine, 54(1): 185-202, 2024.***

**Background:** Two specific sprint training methods that are present to varying degrees in research and practice are combined uphill-downhill sprinting (UDS) and resisted sprint training methods (RS). Both methods seem to improve sprint performance, but to the author's knowledge a comparison does not exist investigating the differences between the two training protocols and traditional sprinting.

**Objective:** The present systematic review and meta-analysis investigated sprint performance changes between combined uphill-downhill sprinting and resisted sprinting methods (sleds, cables/bands, vests, uphill) and how these compared with traditional sprinting.

**Methods:** A literature search was performed on 19 December 2022, in the databases PubMed, SPORTDiscus, Web of Science and SCOPUS, which from 22 studies yielded a total of 24 eligible groups (UDS, n = 6; RS, n = 18). Studies that measured sprint performance, had a traditional sprinting control, and used either training intervention in healthy individuals of any age for  $\geq 4$  weeks were eligible for the meta-analysis. The change in sprint performance from baseline to post intervention was compared between the interventions and their traditional sprinting control group. Outcomes were expressed as standardized mean differences (SMD).

**Results:** The standardized changes in sprint performance between intervention groups and traditional-sprinting controls (negative in favor of intervention, positive in favor of traditional sprint) and 95% confidence interval (CI) were as follows: small for UDS (SMD - 0.41 [- 0.79, - 0.03]; p = 0.03), trivial for RS (SMD - 0.14 [- 0.36, 0.07]; p = 0.19).

**Conclusion:** Combined uphill-downhill sprinting was more effective than traditional sprinting, while resisted sprinting was not. It appears that resisted sprint interventions do not increase sprint performance any more than traditional sprinting. Subgroup analysis and meta-regression appear to show differences between sled loads and possible differences across distances tested. The results of this review and meta-analysis seem to warrant further investigations into the possibility that UDS may be a superior sprint training method to resisted and traditional sprinting.

### Key Points

- Both resisted sprinting and combined uphill-downhill sprinting improve sprint performance.

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- Resisted sprinting was not significantly more effective than the control (traditional sprinting).
- Combined uphill–downhill sprinting was significantly more effective than traditional sprinting (small differences).
- Combined uphill–downhill sprinting appears to be a more effective sprint training method. As the characteristics of a hill cannot be altered, combined uphill–downhill sprinting is limited by the inability to modify the overload and overspeed properties like that seen with other methods (cables, sleds, vests).

### ***Fantasy football points capture performance declines in National Football League offensive skill players following an ankle injury. Journal of Orthopaedics, Ahead of Print: 1-24, 2024.***

**Background:** The ankle is one of the anatomic sites most frequently injured in National Football League (NFL) players. Ankle injuries have previously been shown to have long-lasting negative impacts, and have been associated with impaired athletic performance. The aim of this study was to use fantasy football points as a metric to evaluate the impact of ankle injuries on NFL offensive skill player performance.

**Methods:** An open-access online database was used to identify NFL players who sustained ankle injuries from 2009 to 2020. Another public online database was used to determine fantasy points and other performance metrics for injured offensive skill players in the seasons before and after their ankle injury. Injured players were matched to a healthy control by position, age, and BMI. Paired T-tests were performed to evaluate performance metrics before and after the ankle injury. An ANCOVA was performed to assess the effect of return to play (RTP) time and injury type on fantasy performance.

**Results:** 303 players with ankle injuries were included. Fantasy output, including average points per game (PPG) and total fantasy points accrued in one season, significantly decreased in the season following a player's ankle injury ( $p < 0.0001$ ). In running backs, tight ends, and wide receivers, performance significantly decreased in every metric evaluated ( $p < 0.0001$ ). In quarterbacks, there was no significant change in performance, except for a decrease in the number of games played ( $p = 0.0033$ ) and in the number of interceptions thrown ( $p = 0.029$ ).

**Conclusion:** Assessing fantasy football output revealed a decrease in player performance in the season following an ankle injury, especially in route-running players. These results can be used to inform injury prevention and rehabilitation practices in the NFL.



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### ***Risk reduction of concussion in athletes: Do neck size or neck strength make a difference? American Journal of Physical Medicine & Rehabilitation, Ahead of Print: 1-24, 2024.***

**Abstract** - Medical provider's ability to detect, diagnose, and treat sport-related concussion (SRC) has greatly improved in recent years. Though more is known about the biomechanical forces involved in concussion, it is still uncertain whether there are preventative measures athletes can take to prevent a SRC from occurring. The objective of this review was to determine if either neck size or neck strength is related to a decreased risk of sustaining a SRC. A literature review was conducted on Google Scholar and Ovid MEDLINE for pertinent articles. Findings indicate that isometric neck strength, but not neck size, has been shown to be a predictor for SRC prevention. Formal neck strengthening programs are feasible and lead to decreased SRC risk. Additionally, there may be greater opportunity to increase neck strength in amateur athletes compared to professional. In conclusion, cervical strengthening programs have been shown to be feasible and beneficial for athletes to decrease their risk of sustaining a SRC, though the optimal duration, intensity, and frequency has yet to be determined.

### ***Tackle risk factors for Head Injury Assessments (HIAs) in sub-elite rugby league and recommendations for prevention: Head contacts from upright tackles increase the HIA risk to both ball carrier and tackler. Sports Medicine – Open, 10:43, 2024.***

**Background:** The rugby league tackle has been identified as the game event with the greatest propensity for a clinically diagnosed concussion. This study aims to replicate the work conducted in professional rugby league and rugby union by examining Head Injury Assessment (HIA) events to determine the associated tackle characteristics that increase concussion risk in sub-elite rugby league players. This comparison between competition levels is important due to the less developed physiological and tackle proficiency characteristics of sub-elite rugby league players and the fewer resources available for an on-field diagnosis, compared to the elite level of the sport.

**Results:** Tackles resulting in Head Injury Assessments (HIAs,  $n = 131$ ) and 2,088 tackles that did not result in a head injury were identified and coded from one season of the 2019 Queensland Cup. The body position of both ball carrier and tackler, tackle height, and body contact areas were evaluated. The propensity for tacklers to undergo a head injury assessment was 1.49 HIAs per 1,000 tackles, equating to a 2.5-fold higher risk than that of the ball carrier (0.59 HIAs per 1,000 tackles). The risk for an HIA was 2.75-fold greater when the tackler was upright (2.89 HIAs per 1,000 tackles) compared to a bent-at-the-waist tackler (1.05 HIAs per 1,000 tackles). The greatest risk for the tackler and ball carrier





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sustaining an HIA occurred when the tackle height was high, with head-to-head contact having the greatest propensity for an HIA (44.37 HIAs per 1,000 tackles). HIA risk was also greater for both players when the ball carrier did not employ an evasion strategy (3.73 HIAs per 1,000 tackles).

**Conclusions:** The study replicates results from research in elite rugby league and rugby union. A combination of higher head contact/proximity and upright body position significantly increase an HIA risk. Tackler head position and ball carrier evasion behaviors also affect risk, suggesting that injury prevention strategies designed to reduce tackle height and improve tackle technique by focusing on head position, body position, and in a novel finding, ball carrier evasion, may reduce head injury risk in sub-elite rugby league players.

***The Sprint Mechanics Assessment Score: A qualitative screening tool for the in-field assessment of sprint running mechanics. The American Journal of Sports Medicine, Ahead of Print: 1-9, 2024.***

**Background:** Qualitative movement screening tools provide a practical method of assessing mechanical patterns associated with potential injury development. Biomechanics play a role in hamstring strain injury and are recommended as a consideration within injury screening and rehabilitation programs. However, no methods are available for the in-field assessment of sprint running mechanics associated with hamstring strain injuries.

**Purpose:** To investigate the intra- and interrater reliability of a novel screening tool assessing in-field sprint running mechanics titled the Sprint Mechanics Assessment Score (S-MAS) and present normative S-MAS data to facilitate the interpretation of performance standards for future assessment uses.

**Study design:** Cohort study (diagnosis); Level of evidence, 3.

**Methods:** Maximal sprint running trials (35 m) were recorded from 136 elite soccer players using a slow-motion camera. All videos were scored using the S-MAS by a single assessor. Videos from 36 players (18 men and 18 women) were rated by 2 independent assessors blinded to each other's results to establish interrater reliability. One assessor scored all videos in a randomized order 1 week later to establish intrarater reliability. Intraclass correlation coefficients (ICCs) based on single measures using a 2-way mixed-effects model, with absolute agreement with 95% CI and kappa coefficients with percentage agreements, were used to assess the reliability of the overall score and individual score items, respectively. T-scores were calculated from the means and standard deviations of the male and female groups to



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present normative data values. The Mann-Whitney U test and the Wilcoxon signed-rank test were used to assess between-sex differences and between-limb differences, respectively.

**Results:** The S-MAS showed good intrarater (ICC, 0.828 [95% CI, 0.688-0.908]) and interrater (ICC, 0.799 [95% CI, 0.642-0.892]) reliability, with a standard error of measurement of 1 point. Kappa coefficients for individual score items demonstrated moderate to substantial intra- and interrater agreement for most parameters, with percentage agreements ranging from 75% to 88.8% for intrarater and 66.6% to 88.8% for interrater reliability. No significant sex differences were observed for overall scores, with mean values of 4.2 and 3.8 for men and women, respectively ( $P = .27$ ).

**Conclusion:** The S-MAS is a new tool developed for assessing sprint running mechanics associated with lower limb injuries in male and female soccer players. The reliable and easy-to-use nature of the S-MAS means that this method can be integrated into practice, potentially aiding future injury screening and research looking to identify athletes who may demonstrate mechanical patterns potentially associated with hamstring strain injuries.

### Gymnastics

***Technological advances in artistic gymnastics and the impact on its development. Journal of Human Sport and Exercise, 19(3): 846-861, 2024.***

**Abstract** - This paper looks at the history of technology development in Artistic Gymnastics (AG) by reviewing patent registrations, test procedures for the AG competition equipment by the official control laboratory of the International Federation of Gymnastics (FIG), and major apparatus advances by manufacturers. Equipment became lighter and more resistant with synthetic materials, with a clear tendency to increase elastic (repulsive) capacity. It is noteworthy that the testing laboratory becomes an arbiter for the industry and the FIG when the technological developments and equipment of manufacturers are evaluated for official use. Only 23 companies have equipment approved by the FIG, 12 of them manufacturing AG apparatuses. Suppliers are located in nine different countries (2 in Asia; 4 in Europe; 2 in America; 1 in Oceania). There is still an unequal distribution of access to technologies, which are concentrated in the northern hemisphere. More access to the actual technology is clearly required when we consider that 156 national member federations are affiliated with the FIG as of this writing.



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***Jumping interval training: An effective training method for enhancing anaerobic, aerobic, and jumping performances in aerobic gymnastics. Journal of Sports Science and Medicine, 23: 410-417, 2024.***

**Abstract** - The aim of this study was to compare the effects of jumping interval training (JIT) and running high-intensity interval training (HIIT) on the aerobic, anaerobic and jumping performances of youth female aerobic gymnasts. A randomized controlled study was conducted over an 8-week period, involving 73 youth female athletes ( $16.2 \pm 1.3$  years old) of aerobic gymnastics. The study comprised two experimental groups (JIT and HIIT) and a control group. Participants in the experimental groups engaged in two additional training sessions per week alongside their regular training regimen, while the control group followed their usual training routine. Before and after the intervention period, gymnasts were assessed for their performance in the countermovement jump test (CMJ), the specific aerobic gymnastics anaerobic test (SAGAT) and the 20-m multistage fitness test. Significant interactions time  $\times$  group were found in SAGAT ( $p < 0.001$ ;  $\eta^2 = 0.495$ ), CMJ ( $p < 0.001$ ;  $\eta^2 = 0.338$ ) and 20-m multistage fitness test ( $p < 0.001$ ;  $\eta^2 = 0.500$ ). The time  $\times$  group analysis post-intervention revealed significantly lower scores in SAGAT for the control group compared to the JIT ( $p = 0.003$ ) and HIIT ( $p = 0.034$ ). Additionally, significantly higher scores were observed for the JIT group in the CMJ test compared to the HIIT ( $p = 0.020$ ) and control ( $p = 0.028$ ) groups following the intervention. Finally, the 20 m multistage fitness test post-intervention revealed significantly lower scores for the control group compared to JIT ( $p < 0.001$ ) and HIIT ( $p < 0.001$ ). Both JIT and HIIT are recommended training strategies to adopt in aerobic gymnastics for significantly improving the aerobic and anaerobic performances of athletes. However, JIT may be particularly relevant to use as it offers additional benefits in improving vertical jumping performances.

***Common upper extremity gymnastics injuries and gymnastic specific return to play protocols. Journal of the Pediatric Orthopaedic Society of North America, 6:100016, 2024.***

**Abstract** - Young gymnasts use their upper extremities as weight-bearing joints, imparting high repetitive loads onto the growing upper limb. The purpose of this review is to provide orthopaedic and sports medicine clinicians practical information on the etiology, presentation, and treatment of 5 common upper extremity injuries in the young gymnast: (1) "gymnast wrist" (distal radial physeal injury); (2) grip lock (acute radius and ulna fracture); (3) osteochondritis dissecans of the capitellum; (4) medial tensile injuries of the elbow (medial epicondylar apophysitis, medial epicondyle fractures, and partial or full ulnar collateral ligament tears); and (5) glenohumeral instability (including labrum tears).



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Specific return to gymnastics protocols are provided to guide providers and athletes through safe return to participation following these injuries.

### Key Concepts:

- 1) Gymnastics is a unique sport in which the arms are used as weight-bearing limbs resulting in distinct injuries.
- 2) Orthopaedic and sports medicine providers should understand these five diagnoses: Gymnast Wrist (distal radial physeal injury and the sequela), Grip Lock (acute radius and ulna fracture), elbow osteochondritis dissecans (OCD), Medial tensile injuries (medial epicondylar apophysitis, medial epicondyle fractures, and partial or full UCL tears), and shoulder instability (including labrum tears) if they will be evaluating gymnasts in their clinic.
- 3) Pre-determined “return-to-gymnastics” protocols may aid successful progression back to training and competition after upper limb injury.

### Golf

#### ***Test-retest reliability of putting-related variables in medium to high handicap golf players. Scientific Reports, 14: 11516, 2024.***

**Abstract** - This manuscript aims to study the reliability of different variables related to performance and acceleration during the golf putt in players with medium-to-high handicaps and to determine the number of attempts necessary to find reliable values for these variables. Eight males and two females [55.67 (13.64) years, 78.4 (11.4) kg, 1.75 (7.95) m] participated in two experimental sessions separated by one week. In these sessions, they performed three blocks of 10 putts trying to stop the golf ball at the center of a dartboard painted 2 m away. The performance was assessed depending on the area of the dartboard where the ball stopped, and the acceleration signals were acquired using the Xsens Dot. The results showed that to evaluate performance, 18 trials were necessary to reach reliable values using the 0–10 scoring system, and 28 trials were necessary for the 0–3 scoring system. Regarding the reliability of the accelerometer-related variables, 7 attempts were necessary to obtain good-to-excellent reliability values for most of the variables. It could be concluded that putting in medium-to-high handicap golf players can be reliably measured using the abovementioned protocol.



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***Epidemiology of musculoskeletal injury in professional and amateur golfers: A systematic review and meta-analysis. British Journal of Sports Medicine, 58(11): 606-614, 2024.***

**Objective:** To determine the prevalence and incidence of musculoskeletal injury in amateur and professional golfers, and to identify common injury sites and factors associated with increased injury frequency.

**Design:** Systematic epidemiological review and meta-analysis.

**Data sources:** PubMed (Medline), Embase, the Cochrane Library and SPORTDiscus were searched in September 2023.

**Eligibility criteria:** Studies published in the English language reporting the incidence or prevalence of musculoskeletal injuries in golfers at all anatomical sites.

**Results:** 20 studies (9221 golfers, 71.9% male, 28.1% female) were included, with mean age 46.8 years. Lifetime injury prevalence was significantly greater in professional golfers (73.5% (95% CI: 47.3% to 93.0%)) than amateur golfers (56.6% (95% CI: 47.4% to 65.5%); relative risk (RR)=1.50,  $p<0.001$ ). Professional golfers had a significantly greater lifetime prevalence of hand and wrist (RR=3.33,  $p<0.001$ ) and lower back injury (RR=3.05,  $p<0.001$ ). Soft tissue injuries were most common, and diagnoses were typically non-specific. Injury frequency was not associated with age or sex. Two studies reported a greater injury risk in amateur golfers playing more than three and four rounds per week.

**Conclusion:** Over half of golfers are at risk of sustaining a musculoskeletal injury during their lifetime. Risks and patterns of injury differ between professional and amateur golfers, with professionals significantly more likely to develop lower back, and hand and wrist injuries. A recent international consensus statement on the reporting of injury and illness in golf should aid consistency in future research assessing the epidemiology of specific diagnoses, informing golf injury prevention and management strategies.



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### Hockey

#### ***“This is fine”: The impact of blowouts on subsequent game performance in the National Hockey League (NHL). *Frontiers in Sports and Active Living*, 5: 1241014, 2024.***

Abstract - Blowouts in sports involve large margins of victory or loss between teams and have long been perceived as influencing subsequent performances by athletes, coaches, fans, and other stakeholders. Under the backdrop of the hot hand phenomenon, the current study explores the impact of blowouts on subsequent game performance in the National Hockey League (NHL). Specifically, we examine the potential carryover of a “hot (or cold) hand” on the subsequent game following a large win or loss. In our study, we defined blowouts as outlying goal differentials for regular season games (i.e., a difference of approximately 6 goals between teams in a single game based on 3 standard deviations from the mean goal differential during the sampled period). Using this criterion, data from 285 games over the 2005–06 to 2018–19 NHL regular seasons were gathered for analysis. We performed a series of multiple regressions using blowout goal differential as the main predictor, adjusting for location of the subsequent game, number of time zones from the home base city, whether the subsequent game was a back-to-back, and winning percentages of the team and opponent. Our results revealed no significant over or under performance by teams that either won through a blowout or those that lost by a blowout. Our findings are consistent with previous work in other and similar sports contexts. Practical applications and future directions for research are discussed.

#### ***Concussions in ice hockey: Mixed methods study including assessment of concussions on games missed and cap hit among National Hockey League players, systematic review, and concussion protocol analysis. *Neurosurgery Focus*, 57(1): E11, 2024.***

**Objective:** Concussions can occur at any level of ice hockey. Incidence estimates of concussions in ice hockey vary, and optimal prevention strategies and return-to-play (RTP) considerations have remained in evolution. The authors performed a mixed-methods study with the aim of elucidating the landscape of concussion in ice hockey and catalyzing initiatives to standardize preventative mechanisms and RTP considerations.

**Methods:** The authors performed a five-part mixed-methods study that includes: 1) an analysis of the impact of concussions on games missed and income for National Hockey League (NHL) players using a publicly available database, 2) a systematic review of the incidence of concussion in ice hockey, 3) a systematic review of preventative strategies, 4)



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a systematic review of RTP, and 5) a policy review of documents from major governing bodies related to concussions in sports with a focus on ice hockey. The PubMed, Embase, and Scopus databases were used for the systematic reviews and focused on any level of hockey.

**Results:** In the NHL, 689 players had 1054 concussions from the 2000-2001 to 2022-2023 seasons. A concussion led to a mean of  $13.77 \pm 19.23$  (range 1-82) games missed during the same season. After cap hit per game data became available in 2008-2009, players missed 10,024 games due to 668 concussions (mean  $15.13 \pm 3.81$  per concussion, range 8.81-22.60 per concussion), with a cap hit per game missed of  $\$35,880.85 \pm \$25,010.48$  (range  $\$5792.68$ - $\$134,146.30$ ). The total cap hit of all missed games was  $\$385,960,790.00$ , equating to  $\$577,635.91$  per concussion and  $\$25,724,052.70$  per NHL season. On systematic review, the incidence of concussions was 0.54-1.18 per 1000 athlete-exposures. Prevention mechanisms involved education, behavioral and cognitive interventions, protective equipment, biomechanical studies, and policy/rule changes. Rules prohibiting body checking in youth players were most effective. Determination of RTP was variable. Concussion protocols from both North American governing bodies and two leagues mandated that a player suspected of having a concussion be removed from play and undergo a six-step RTP strategy. The 6th International Conference on Concussion in Sport recommended the use of mouthguards for children and adolescents and disallowing body checking for all children and most levels of adolescents.

**Conclusions:** Concussions in ice hockey lead to substantial missed time from play. The authors strongly encourage all hockey leagues to adopt and adhere to age-appropriate rules to limit hits to the head, increase compliance in wearing protective equipment, and utilize high-quality concussion protocols.

### Lacrosse

***Metabolic equivalent distance across game quarters and athlete position in female collegiate lacrosse players. American Journal of Sports Science, 12(2): 10.11648, 2024.***

**Abstract** - As a sport, field lacrosse requires seamless transitions between acceleration and deceleration. Unfortunately, linear displacement variables at a constant speed underestimate the energy demand in team sports, as they fail to account for the additional energy expended during acceleration and deceleration. In order to address these additional energy costs and offer a more precise measure of an athlete's workload, the metric called metabolic equivalent distance (MED) was developed. The purpose of the study was to assess the differences in MED across game quarters and athlete positions among female collegiate lacrosse players and determine potential relationships between MED and other workload variables. Seventeen female collegiate lacrosse players wore global positioning systems units, and data were



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collected over the course of 17 games. Performance variables were analyzed per minute played (min PT) and included: MED (m), total distance (m), accelerations (count), decelerations (count), total sprints (count), metabolic peak power (J), metabolic energy cost (J/kg/m), and equivalent distance index (%). No difference was found between athlete position. Performance variables did not differ between game quarters, except for playing time ( $p < .001$ ). Athlete playing time was reduced in the 3rd and 4th quarters compared to quarter 1 ( $p < .001$ ). MED showed a perfect correlation with total distance and metabolic energy cost ( $r = 1$ ;  $p < .001$ ) and a near-perfect correlation with accelerations and total sprints ( $r = .93$ ;  $p < .001$ ). Decelerations exhibited a strong correlation with MED ( $r = .86$ ;  $p < .001$ ). MED was moderately correlated with metabolic peak power ( $r = .34$ ;  $p < .001$ ); whereas equivalent distance index displayed a small correlation ( $r = .15$ ;  $p = .02$ ). Athletes exhibited a consistent output in metabolic workload variables across position and game per minute of play. MED could serve as a surrogate workload variable to better understand the athlete's energy expenditure during high-intensity training and game play.

***Descriptive epidemiology of injuries sustained in NCAA men's and women's lacrosse, 2004-2005 through 2013-2014 season. HSS Journal: The Musculoskeletal Journal of Hospital for Special Surgery, 20(2): 288-297, 2024.***

**Background:** Men's and women's lacrosse operate with significantly different rules, equipment, and contact. Previous studies have assessed injury rates (IRs) in either men's or women's lacrosse, but a few studies have compared injury patterns in the National Collegiate Athletic Association (NCAA) men's and women's lacrosse.

**Purpose:** We sought to examine whether there were differences in injury type, mechanism, setting, and time loss in men and women playing lacrosse in the NCAA.

**Methods:** We performed a retrospective case-control study using data collected by the NCAA Injury Surveillance Program (ISP) during a 10-season period (2004–2005 to 2013–2014). The data were assessed for potential differences in injuries between male and female lacrosse players and analyzed to obtain descriptive statistics through calculations of rates, percentages, and confidence intervals (CIs). Main outcomes measured were IRs per 1000 athletic exposures (AEs) and injury rate ratios (IRRs) with 95% CIs.

**Results:** The IRs were 5.19 per 1000 AEs in women's lacrosse and 6.52 per 1000 AEs in men's lacrosse. Men had more injuries overall than women in competitions and practices and in preseason, regular season, and postseason play. Preseason IRs were higher than the regular season, and competition injuries were greater than practice injuries in both

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sexes. Women had more injuries to the head/face, knee, lower leg, and foot. Sprains, strains, concussions, and contusions were the most common types of injuries in both sexes. Overuse/gradual onset, cartilage, concussion, inflammation, and tendinosis injuries were more common in women than men. Injuries in men resulted in time loss more often than injuries in women.

**Conclusions:** Our retrospective study's findings suggest that there were differences in injury patterns between men's and women's lacrosse. Future prospective research should assess whether these disparities are due to differences in equipment and rules and whether changes to these factors can reduce injuries.

### Soccer

#### ***Summarizing physical performance in professional soccer: Development of a new composite index. Scientific Reports, 14: 14453, 2024.***

**Abstract** - The aims of this study were to create a composite index to measure the overall players' physical performance in professional soccer matches and analyze the effect of individual playing time and positional differences on this composite index. A total of 830 official matches from LaLiga men's first division and Spanish Copa del Rey were analyzed, which resulted in 24,980 match observations collected from 1138 male players (forwards, n= 286; midfielders, n= 441; defenders, n= 411). The physical performance variables, which represent the locomotor demands, were collected using electronic performance tracking systems. A Partial Least-Squares Structural Equation Model (PLS-SEM) was used to measure performance. The PLS-SEM output had three significant latent components, which explained 95% of the initial variability, that were related to the acceleration specific performance (component 1), high-intensity running-related variables (component 2), and medium intensity actions variables (component 3). Also, a linear regression analysis was used to explore relationships between playing activity time (hours—X axis) and the composite index (10-point scale—Y axis), in which a strong and positive correlation was observed between individual playing time and the composite index ( $r = 0.76$ ;  $p < 0.001$ ;  $R^2 = 0.58$ ). Also, significant positive correlations were observed in forwards ( $r = 0.85$ ;  $p < 0.001$ ;  $R^2 = 0.74$ ), midfielders ( $r = 0.80$ ;  $p < 0.001$ ;  $R^2 = 0.64$ ), and defenders ( $r = 0.67$ ;  $p < 0.001$ ;  $R^2 = 0.45$ ). However, significant differences between playing positions with a small effect size ( $p < 0.05$ ;  $\eta^2 = 0.01$ ) were found. From a practical perspective, this study may serve as a reference for sports performance practitioners to create a composite index that measures the overall players' physical performance. The instructions to create this index are available in the manuscript.



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***Between-microcycle variability of external soccer training loads through the evaluation of a contemporary periodization training model 'CUPs'. International Journal of Sports Science & Coaching, Ahead of Print: 1-11, 2024.***

**Objective:** Variation in training load is consistently demonstrated within weekly microcycles in soccer, yet less is known of load variations between the same weekday sessions across different microcycles. Our study aim was to examine between-microcycle variability in key measures of external training load.

**Methods:** Thirty-seven professional soccer players participated in this observational study which took place across the clubs' initial 8-week in-season mesocycle of the 2022/23 season. During this mesocycle, each 1-week microcycle consisted of four distinct classifications of training session (Matchday (MD)-4, MD-3, MD-2, and MD-1, and one match (Saturday). External load data (total distance, high-intensity (>5.5 m.s) distance, high-intensity accelerations (>3 m/s<sup>2</sup>), and percentage (%) of maximal speed attained) were collected across 564 training sessions (MD-4 =123, MD-3 =148, MD-2 =130, MD-1 =163). Data were analyzed with mixed linear modelling.

**Results:** When compared to the first microcycle, substantial week-to-week variation was evident for each of the four training session classifications, ranging from 1244 m to 2248 m for total distance, 80 m to 197 m for high-intensity distance, 11 to 25 for high-intensity accelerations, and 10.2 percentage points to 15.4 percentage points for % maximal speed.

**Conclusion:** Our data show that despite training sessions having a consistency of planned training stimulus across an 8-week mesocycle, external load varied between microcycles. Nevertheless, within-player variability on the same day relative to matchday indicated a more consistent stimulus for key training variables relevant to specific training days.



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### ***Practitioners' perspective of non-contact injury risk factors and injury prevention programming in professional North American male soccer. *Physical Therapy in Sport, 68: 51-59, 2024.****

**Objective:** To evaluate non-contact injury prevention strategies of professional men's soccer clubs in elite North American league soccer. To understand the application, perceived effectiveness and barriers to implementation.

**Design:** Online cross-sectional study.

**Setting:** North American elite soccer teams.

**Participants:** 96 medical and performance support staff of elite North American teams.

**Main outcome measure:** The survey consisted of 20 questions and captured 1) practitioners' demographics; 2) perceptions of risk factors; 3) the use of assessment and monitoring strategies; and 4) perceptions of the implementation of injury prevention programs.

**Results:** Injury prevention programs were perceived as 'effective' (Median 4, Interquartile range 4-4) and reduced injury rates ( $n = 94$ , 98%, 95 CI% 93 to 99). A range of potential risk factors were rated as "very important" ( $4.58 \pm 0.52$  Likert scale points; mean  $\pm$  standard deviation). A multi-disciplinary approach to the design, application and monitoring of programs was generally adopted. Competing training priorities ( $n = 75$ , 78%, 95 CI% 69 to 85) and game schedules ( $n = 71$ , 74%, 95 CI% 64 to 82) were the most prevalent barriers to injury prevention implementation.

**Conclusions:** Injury prevention programs were perceived as effective in reducing non-contact injuries. Managing the conflicting priorities between scheduling training, tactical and conditioning goals were considered the key barriers to desired implementation.



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### Softball

***A model for causality of pitching-related overuse injuries in women's fastpitch softball. International Journal of Sports Medicine, Ahead of Print: 1-6, 2024.***

**Abstract** - Fastpitch softball is a popular women's sport, and athletes, particularly pitchers, are at high risk for overuse injury. Softball-related injury rates are low; however, the prevalence of overuse injuries is high. Injuries at the high school and collegiate levels occur early in the season, and approximately 50% of shoulder and elbow injuries in softball are attributable to overuse. Survey research showed 77% of high school pitchers pitch with pain, and 73% of collegiate pitchers reported an overuse injury in the previous season. Modifiable and non-modifiable intrinsic and extrinsic risk factors contribute to injury risk in a model that can be used in history taking, clinical examination, and management of softball-related injuries. In this manuscript, we present a scoping review of fastpitch softball injury research by competitive levels from 1990 to present. We also introduce a model for overuse injury causality in this athlete population. With this information, clinicians will be able to identify risk factors related to injury in softball pitchers. More research is needed to make evidence-based recommendations for injury prevention in this athlete population.

***Sport-related concussion in baseball and softball: Do mechanisms of injury affect recovery? Neurosurgery Focus, 57(1): E13, 2024.***

**Objective:** Baseball and softball pose unique risks for sport-related concussion (SRC). Although these are not collision sports, concussions in baseball and softball can nonetheless involve high-speed impacts. In a regional, single-institution cohort of baseball and softball athletes who sustained an SRC, the current study sought to 1) describe the mechanisms of injury that led to SRC, and 2) compare initial symptom burden and recovery metrics across mechanisms, including time to return to learn (RTL), time to symptom resolution, and time to return to play (RTP) by mechanism of injury.

**Methods:** A retrospective cohort study was performed of baseball and softball athletes 12 to 23 years old who sustained an SRC between November 2017 and April 2022. Mechanisms of injury were divided into two categories: 1) contact mechanism (i.e., what initiated contact with the injured player, such as head-to-ball), and 2) player mechanism (i.e., the action the injured player was performing at the time of injury, such as fielding). The recovery outcomes of time to RTL, symptom resolution, and RTP were compared between mechanisms using bivariate analysis and multivariable regression analysis, controlling for sex, age, time to present to concussion clinic, and initial total symptom score.



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**Results:** The sample included 58 baseball and softball players (60.3% female, mean age  $16.0 \pm 1.9$  years). Most SRCs (62.1%) occurred during competition. Head-to-ball (50.0%) was the most common contact mechanism, followed by head-to-head/body (31.0%) and head-to-wall/ground/equipment (17.2%). Fielding (63.8%) was the most common player mechanism, followed by drills (20.7%) and running (13.8%). SRCs sustained in practice had significantly longer RTL (median 10.0 [interquartile range (IQR) 3.3-16.3] vs 4.0 [IQR 2.0-8.0] days;  $U = 421.5$ ,  $p = 0.031$ ) and symptom resolution (37.0 [IQR 18.0-90.0] vs 14.0 [IQR 7.0-41.0] days;  $U = 406.5$ ,  $p = 0.025$ ) compared with SRCs sustained in competition. Multivariable regression analysis revealed that head-to-wall/ground/equipment contact mechanism was associated with longer RTL ( $\beta = 0.30$ , 95% CI 0.07-0.54,  $p = 0.013$ ).

**Conclusions:** The current study found that SRCs in baseball and softball occurred more often in competition than in practice. Head-to-ball and fielding were the most common contact and player mechanisms, respectively. SRCs sustained in practice were associated with longer time to RTL and symptom resolution, and head-to-wall/ground/equipment was associated with longer RTL in multivariable regression analysis. These results provide empirical data to improve concussion safety in baseball/softball.

### Swimming

***Acute effects of dryland muscular endurance and maximum strength training on sprint swimming performance in young swimmers. Journal of Sports Sciences, Ahead of Print: 1-10, 2024.***

**Abstract** - The study examined acute effects of dryland muscular endurance (ME) and maximum strength (MS) sessions on performance, physiological, and biomechanical variables during a subsequent sprint swimming session. Twenty-seven swimmers ( $16.5 \pm 2.6$  yrs) completed three experimental conditions including: i) ME, 55% of 1-repetition maximum, ii) MS, 90% of 1-repetition maximum, and iii) control (CON, no dry-land). Twenty minutes following ME, MS and CON sessions swimmers performed a 10-s tethered swimming sprint, four by 50-m ( $4 \times 50$ -m), and a 100-m front crawl sprints. Performance time, blood lactate, heart rate (HR), stroke rate (SR), stroke length (SL), stroke index (SI), and stroke efficiency ( $\eta F$ ) were measured during  $4 \times 50$ -m and 100-m. Hand grip strength (HG), and shoulder muscles isometric strength (ISO) were measured after each session. Mean  $4 \times 50$ -m time increased in ME compared to CON by  $1.7 \pm 2.7\%$  ( $p = 0.01$ ), while 100-m time was similar among conditions ( $p > 0.05$ ). ISO was lower after dry-land training in all conditions ( $p = 0.01$ ). Tethered force, HG, HR, SR, SL, SI, and  $\eta F$  were no different between conditions ( $p > 0.05$ ). Dryland ME session decrease swimming performance; however, ME and MS sessions did not affect technical ability during a subsequent maximum intensity swimming.



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***Diving into a pool of data: Using principal component analysis to optimize performance prediction in women's short-course swimming. Journal of Sports Science, Ahead of Print: 1-9, 2024.***

**Abstract** - This study aimed to optimize performance prediction in short-course swimming through Principal Component Analyses (PCA) and multiple regression. All women's freestyle races at the European ShortCourse Swimming Championships were analyzed. Established performance metrics were obtained including start, free-swimming, and turn performance metrics. PCA were conducted to reduce redundant variables, and a multiple linear regression was performed where the criterion was swimming time. A practical tool, the Potential Predictor, was developed from regression equations to facilitate performance prediction. Bland and Altman analyses with 95% limits of agreement (95% LOA) were used to assess agreement between predicted and actual swimming performance. There was a very strong agreement between predicted and actual swimming performance. The mean bias for all race distances was less than 0.1s with wider LOAs for the 800 m (95% LOA -7.6 to + 7.7s) but tighter LOAs for the other races (95% LOAs -0.6 to + 0.6s). Free-Swimming Speed (FSS) and turn performance were identified as Key Performance Indicators (KPIs) in the longer distance races (200 m, 400 m, 800 m). Start performance emerged as a KPI in sprint races (50 m and 100 m). The successful implementation of PCA and multiple regression provides coaches with a valuable tool to uncover individual potential and empowers datadriven decision-making in athlete training.

### Tennis

***Exploration and prediction of factors influencing athlete momentum in tennis matches. Highlights in Science, Engineering and Technology, 100: 1-7, 2024.***

**Abstract** - In the field of sports competition, the momentum fluctuation of athletes in a match has an important impact on the final performance, especially in a high-intensity confrontational sport such as tennis. In this paper, based on the men's singles data of the 2023 Wimbledon Tennis Championships, a prediction model based on a decision tree and a BP neural network was established to analyze the momentum and fluctuation of athletes in a match. This study contributes to an in-depth understanding of athletes' performance during matches and provides a scientific basis for their training and tactical adjustments.



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***Periodization in professional tennis: A macro to micro analysis of load management strategies within a cluttered calendar. International Journal of Sports Science & Coaching, 18(3): 772-780, 2023.***

**Aim:** This study analyzed the periodization of internal loads across training and competition blocks of future top 250 (T250) professionally ranked tennis players' professional transitions.

**Methods:** Retrospective data was analyzed from 10 male and 8 female Australian tennis players aged between 16 to 18 who later achieved professional rankings inside the T250. Session-rating of perceived exertion training load (sRPE TL) was collected from all sessions using an online application. Data were collected from official matches, on-court skill-based training, and off-court sessions (i.e., strength, conditioning, body management) and classified according to their occurrence in either training or competition blocks. Weekly sRPE TL was quantified for respective training and competition periods. One-way analysis of variance and effect size analyses compared within-sex training loads between training and competition blocks.

**Results:** Training blocks lasted longer than competitions for both sexes ( $p < 0.05$ ). Training blocks for males had greater daily durations ( $p < 0.01$ ), but not sRPE TL ( $p=0.08$ ). Total load for females was not different between periods ( $p > 0.05$ ). Training blocks had higher on-court and off-court loads compared to competition ( $p < 0.05$ ). No difference in weekly training and competition loads were observed ( $p > 0.05$ ). Skill-based sessions in training periods were longer with higher loads for both sexes ( $p < 0.05$ ), with no difference in duration, rating of perceived exertion (RPE) and sRPE TL observed between periods for off-court sessions ( $p > 0.05$ ).

**Conclusions:** Future T250 players experience higher sRPE TL in training blocks, with reductions in both total on-court and off-court load during tournaments. Regardless, limited evidence of periodized weekly loads exists within training and competition periods



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### Volleyball

***Changes in countermovement vertical jump force-time metrics across different competitive levels in women's volleyball. International Journal of Strength and Conditioning, 4(1): 1-8, 2024.***

**Abstract** - As one of the most fundamental skills in volleyball, the countermovement vertical jump (CVJ) has been commonly implemented as a non-invasive and time-efficient method for the assessment of lowerbody neuromuscular function. The purpose of the present study was to examine differences in CVJ performance between three different competitive levels in female volleyball players (i.e., national team [n=20], professional league [n=16], collegiate [n=16]). While standing on a uni-axial force plate system sampling at 1000 Hz, athletes performed three maximal-effort CVJs with no arm swing (i.e., hands on the hips during the entire movement). Each jump was separated by a 10-15 second rest interval to minimize the possible influence of fatigue. Significantly greater eccentric braking impulse, peak velocity, peak force, mean and peak power, vertical jump height, reactive strength index-modified, countermovement depth, and shorter braking phase, eccentric duration, and contraction times were observed for the national team and professional players when compared to collegiate athletes. Also, national team players demonstrated significantly greater eccentric braking impulse, peak velocity, mean and peak power, reactive strength index-modified, and countermovement depth than professional volleyball players. However, during the concentric phase of the CVJ, the only significant differences observed were between national team players and collegiate athletes, where national team players exhibited significantly greater peak velocity, impulse, and mean and peak power. Thus, it can be concluded that higher-level players may be more capable of effectively utilizing the eccentric phase of the CVJ and executing the stretch-shortening action more rapidly, which contributes to better CVJ height.

***Prognostic power of foot mobility in identifying the risk of musculoskeletal injuries: A cross-sectional study of male volleyball players at different competitive levels. Journal of Clinical Medicine, 13: 1189, 2024.***

**Abstract** - (1) Background: The arch structure and mobility of the foot are considered injury risk factors in volleyball. However, there are limited studies presenting differences in injury prevalence and the risk of lower limb injuries in relation to the competitive level in male volleyball. Therefore, the main aim of the current study was to evaluate foot





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mobility (through navicular drop test) as an injury risk factor in volleyball players from different competitive levels. (2) **Methods:** The reliability and usefulness of navicular drop testing were initially assessed in test–retest procedures (based on a sample of eight participants and 16 feet measurements), with primary analyses conducted using foot measurements of the twelve top-level volleyball players (24 feet) and eighteen academic-level volleyball players (36 feet). The modified navicular drop test was conducted, and the feet were classified based on arch height, and injury prevalence was retrospectively assessed with a previously validated questionnaire. Chi-squared tests, receiver operating curves, and logistic regression were used as statistical methods. The navicular drop test was verified as a reliable tool by intraclass correlation coefficient (ICC) (3.1) analysis. (3) **Results:** There were no significant differences in injury prevalence between academic- and top-level volleyball players, though there was a significant relationship between pronated foot and injury risk independent of competitive level. Generally, for both groups, thresholds above 10 mm of the navicular drop were predictors of lower limb injuries. The risk of injury if the foot was pronated ranged from 70% (academic level) to over 90% (top-level players). However, no statistically significant effect of competitive level on the chance of injury was observed. (4) **Conclusions:** Our study found a high prevalence of foot injuries independently of competitive level. There was a relationship between pronation of the foot and the risk of injury. However, the risk of lower limb injury was higher in pronated top-level players. Also, a navicular drop greater than 10 mm was an excellent predictor of injuries at both competitive levels.

### Wrestling/Combat Sports

#### ***Wrestling injuries during the 2016 Rio and 2020 Tokyo Olympic games. British Journal of Sports Medicine, Ahead of Print: 1-8, 2024.***

**Objectives:** To evaluate and compare the injuries of Olympic wrestlers during the 2016 Rio and 2020 Tokyo Olympic Games held in August 2021 due to the COVID-19 pandemic.

**Methods:** In this descriptive epidemiological study, injury report forms were used to collect and analyze injury data during the competitions.

**Results:** During 410 matches in the Rio Olympic Games, 21 injuries were recorded among 346 wrestlers (112=women), a rate of 5.1 injuries/100 bouts and 6.1 injuries/100 athletes. During 322 matches in the Tokyo Olympic Games, 28 injuries were recorded among 287 wrestlers (96=women), with 8.7 injuries/100 bouts and 9.8 injuries/100 athletes. However, these apparent differences in injury rates between Tokyo and Rio were not statistically significant (injuries/bout:  $p=0.057$ , 95% CI: 0.31 to 1.02; injuries/athlete:  $p=0.087$ , 95% CI: 0.33 to 1.08). Mild injuries comprised the greatest



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proportion of injuries in both Olympic Games. Severe injuries accounted for 0%, 16.7% and 36.4% of injuries in Greco-Roman, Freestyle and Women's wrestling, respectively.

**Conclusion:** Most wrestling injuries in the 2016 Rio and 2020 Tokyo Olympic Games were mild skin injuries in the head and face regions due to direct body contact during standing positions in the 1/8-final round of wrestling competitions. No critical injury was observed during the recent Olympic Games. Attention should be drawn to preventing upper limb joint dislocations as common severe injuries in both Olympic Games. While not statistically significant, the Tokyo Games, after the COVID-19 pandemic, witnessed a higher injury occurrence than the Rio Games.

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Olympic-style wrestling, as a contact sport, is associated with a variety of soft tissue and musculoskeletal injuries; therefore, injury prevention is crucial for the health of athletes.

### WHAT THIS STUDY ADDS

⇒ The rate of wrestling injuries was recorded at 6.1 per 100 athletes at the 2016 Rio Olympics and 9.8 per 100 athletes at the 2020 Tokyo Olympics.

⇒ Athlete sex did not emerge as a risk factor; however, wrestlers in lower weight categories had a higher likelihood of injury.

⇒ No critical injuries occurred during the recent Olympic Games' wrestling competitions. Although infrequent, shoulder and elbow joint dislocations were the most concerning injuries in wrestling.

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study broadens our knowledge of injury patterns and epidemiology in Olympic wrestling, which can help to develop more effective injury prevention strategies



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***Acute and chronic weight-making practice in professional mixed martial arts athletes: An analysis of 33 athletes across 80 fights. International Journal of Sport Nutrition and Exercise Metabolism, Ahead of Print: 1-11, 2024.***

**Abstract** - Mixed martial arts' popularity has increased in recent years, alongside descriptive research and evidence-based performance recommendations. Guidelines for (both chronic and acute) weight making exist; however, how these translate in real-life scenarios and detailed investigations on practices in larger groups deserve attention. The present study examined the body mass (BM) and composition of 33 professional mixed martial arts athletes preparing for 80 fights. Athletes were supported by on-site dietitians, who encouraged evidence-based practices. Fasted BM was measured throughout the last ~10 days before all bouts (acute weight management phase). A subset of athletes had body composition assessed before and after the chronic weight loss phase for 40 fights. Most athletes engaged in chronic BM loss, and all engaged in acute weight loss. Many lost fat-free mass (FFM) during the chronic phase, with rates of BM loss.

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ATHLETEALIVE2025 is a student athlete safety initiative, steered by a collaboration of the following organizations: The Coalition for the Registration of Exercise Professionals (CREP), NATA Intercollegiate Council on Sport Medicine (ICSM)

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and the U.S. Council for Athletes Health (USCAH). The purpose of this initiative is to reduce the prevalence of preventable student athlete injuries and deaths, associated with conditioning and training; inclusive of proper emergency management. This initiative reflects the requirements associated with the NCAA Interassociation Recommendations Preventing Catastrophic Injury and Death in Collegiate Athletes. The goal is to reach full compliance by all collegiate Strength and Conditioning Coaches by January 1, 2025.

For Additional Information on this important topic visit: <http://athletealive2025.org/>