



Performance Research Reviews

November 2025

Baseball

Developing or Just Playing? Team effects on individual performance in a collegiate summer baseball league. Journal of Sport Behavior, 48(2): 54-66, 2025.

Abstract - Collegiate Summer Baseball Leagues offer development opportunities to college players. Overall, a significant number of Major League Baseball players once played in a summer league, suggesting at least some positive effect from the experience. However, teams within each league are individually owned and likely approach both business and baseball operations in different manners, leading to different opportunities for players based on their team affiliation. This investigative and exploratory study examines differences in player performance and from their collegiate season to their following collegiate summer league season. Results suggest that some summer league teams, such as the Savannah Bananas, have significant effects on individual player performance compared to their collegiate teams. Qualitative interviews with Bananas' players are then conducted to add context and explanations for the quantitative results. Interviews suggest that the team environment in which they play improve their performance. Benefits to mindset, self-confidence, and goals to improve on and off the field are cited as beneficial.

Effect of finger-ball friction on upper limb movement during fastball pitching in baseball. Scientific Reports, 15: 27759, 2025.

Abstract - This study investigated the effect of the friction between the ball and fingertips (finger-ball friction) on upper limb movement during four-seam fastball pitching in terms of the centrifugal force acting on the ball. Eight skilled pitchers threw four-seam fastballs at approximately 130 km/h toward a target behind the home base. Water was applied as a low-friction condition and rosin powder was applied as a high-friction condition between the fingertips and the ball. Hand velocity and pitching radius (i.e., radius of the motion trajectory of the hand) were calculated from motion capture data. Centrifugal force evaluation index was calculated as the square of hand velocity divided by the pitching radius. Statistical parametric mapping was performed to compare the time-series of each variable between foot contact and ball release. Although no significant differences were observed, a tendency



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for hand velocity to decrease under low-friction conditions during the acceleration phase was observed. Additionally, the pitching radius was significantly greater under low-friction conditions around the maximum shoulder rotation timing, and consequently, the centrifugal force index significantly

decreased during the first half of the acceleration phase. These findings deepen our understanding of how pitchers adjust their throwing motion under different finger-ball friction conditions.

Effects of weight, height, and related parameters on elbow varus torque in collegiate and professional baseball pitchers. The Orthopaedic Journal of Sports Medicine, 13(7): 1-8, 2025.

Background: Ulnar collateral ligament (UCL) injuries are prevalent in baseball pitchers. Epidemiological research has identified body weight as a risk factor.

Purpose/hypothesis: The purpose of this study was to evaluate the influence of anthropometric characteristics (ie, height, weight, and related measures) on elbow varus torque in adult baseball pitchers. It was hypothesized that weight and height would each be correlated with elbow varus torque.

Study design: Descriptive laboratory study.

Methods: Anthropometric and fastball pitching biomechanical data from 627 collegiate and professional pitchers were analyzed. Elbow varus torque during pitching was computed using the pitcher's weight, height, pitching biomechanics, and inverse dynamics. Pearson correlation coefficients were calculated between individual anthropometric characteristics and elbow varus torque. Stepwise multivariate regression was also performed.

Results: There was a strong correlation of elbow varus torque with weight and weight $\times$ height; a moderate correlation with body mass index; and a weak correlation with forearm length, height, and upper arm length. Stepwise regression explained 38% of elbow varus torque, with weight as the main contributor.

Conclusion: Larger pitchers, particularly heavier pitchers, produced greater elbow varus torque.

Clinical relevance: Pitchers with a greater weight may be at a higher risk of UCL injuries.



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Evidence of ostarine cross-contamination via sweat in 2 athletes sharing the same neoprene hamstring sleeves. An original situation of drug transfer where the anti-doping rule violation was suspended by the sport authorities. Clinica Chimica Acta, 559: 119688, 2024.

Abstract - The presence of ostarine, a selective androgen receptor modulator (SARM) in an athlete's sample constitutes one of the most frequent anti-doping rules violation. It is possible to challenge this violation but it is the athlete who has to demonstrate he / she is innocent. The conditions to evidence no fault or negligence are mostly based on 2 points: 1. the athlete or his/her legal representative must present verified circumstances of contamination and the source of contamination must be identified; and 2. there must be verified claims by the athlete about the fact that he / she did not knowingly take the prohibited substance, i.e. that the violation was not intentional. During a 2-weeks period, a male athlete tested two times positive for ostarine in urine (<0.1 ng/ml) and he challenged these results. His hair and nail tests returned negative (LOQ at 0.5 pg/mg). He admitted using two neoprene hamstring sleeves of another athlete who confessed abusing ostarine. This was confirmed in his hair (190 pg/mg), his fingernail clippings (780 pg/mg) and his toenail clippings (45 pg/mg). To document the presence of ostarine in the hamstring sleeves and therefore possible drug transfer, the hamstring sleeves were analysed. Ostarine was identified in 12 different selected pieces (about 1 g) of the sleeves at concentrations ranging from 3 to 142 pg/g. Sport authorities (USADA) agreed that the most likely source of contamination was the hamstring sleeves, thus confirming the scenario of drug transfer and gave the athlete a no fault.

Pelvic control and pelvic-trunk coordination as key determinants of pitching velocity in baseball pitchers. The Orthopaedic Journal of Sports Medicine, 13(7): 1-9, 2025.

Background: Pelvic control and pelvic-trunk coordination are essential for efficient energy transfer during a baseball pitch. Proper pelvis control ensures the smooth transmission of forces from the lower extremities through the trunk to the upper body. Although the importance of pelvic control has been acknowledged in baseball mechanics, its specific role during pitching remains underexplored.

Purpose/hypothesis: The purpose of this study was to examine the relationship between pelvic control, pelvic-trunk coordination, and pitching velocity in baseball pitchers. It was hypothesized that better pelvic control and coordination would significantly correlate with higher pitching velocity.

Study design: Descriptive laboratory study.



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Methods: A total of 34 asymptomatic male baseball pitchers were recruited from high school and collegiate teams. Pelvic control was assessed using inertial measurement units during a single-leg balance with movement test and the pitching motion. Pelvic-trunk coordination, assessed from foot contact to maximal external rotation and from maximal external rotation to maximal internal rotation, was analyzed using angle-angle plots of pelvic and trunk rotation. Coupling angles are categorized as in-phase (same direction) and anti-phase (opposite direction) coordination, with percentages calculated for each phase. Pitching velocity was measured using a radar gun.

Results: Significant correlations were found between pelvic control in the axial plane in the single-leg stance test condition and pitching velocity (stride leg: $r = -0.76$, $P < .01$; drive leg: $r = -0.65$, $P < .01$). During pitching, pelvic angle variation in the axial plane also had a strong negative correlation with velocity ($r = -0.78$, $P < .01$). In addition, pelvic control showed distinct coordination patterns at different phases of the pitching motion. A higher percentage of anti-phase coordination from foot contact to maximal external rotation was positively correlated with pitching velocity ($r = 0.74$, $P < .01$), while a higher percentage of in-phase coordination from maximal external rotation to maximal internal rotation showed a positive correlation with pitching velocity ($r = 0.58$, $P < .01$).

Conclusion: This study highlights the role of pelvic control and pelvic-trunk coordination in achieving higher pitching velocities, particularly in the axial plane. The findings highlight the significance of these factors in maximizing pitching velocity.

Clinical relevance: These findings highlight the importance of incorporating specific pelvic control and coordination exercises into training regimens for baseball pitchers to optimize pitching velocity.

Basketball

A dual-tech approach to measuring defensive physical demands in basketball pick and rolls during official games: Inertial sensors and video analysis. Applied Sciences, 15: 3860, 2025.

Abstract - This study aimed to quantify the physical load of defensive pick-and-roll (PnR) actions according to court location (middle or side), defensive option employed (switch, drop/ice, or trap), and effectiveness (successful or unsuccessful) during official basketball games. Twenty-four male basketball players (age: 20.5 ± 1.1 years; stature: 191.5 ± 8.7 cm; body mass: 86.5 ± 11.3 kg; playing experience: 8.5 ± 2.4 years) from two teams competing in the Lithuanian third division were recruited, with data collected across six official games. Participants were monitored using a combination of video-based time-motion analysis (TMA) and inertial measurement units (IMUs), allowing the calculation of duration, PlayerLoad (PL), and PL-min-1 for each of the 364 defensive PnR actions identified. No significant



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differences were found based on court location or defensive option employed ($p > 0.05$). By contrast, unsuccessful plays resulted in significantly higher physical loads than successful ones (duration: $p < 0.001$, $ES = 0.46$; PL: $p < 0.001$, $ES = 0.41$; PL·min⁻¹ : $p = 0.047$, $ES = 0.24$). Overall, these findings highlight a consistent physical load based on court location and defensive option adopted and an increased physical load when the defensive effort failed. Therefore, basketball coaches are suggested to consider the physical load of different defensive PnR scenarios when planning training drills, defining performance profiles of defensive strategies, and managing team rotations during games.

Detecting optimal gaze behavior of successful basketball free throwing via machine learning system. Human Movement Science, 102: 103381, 2025.

Abstract - Eye tracking in sport is an emerging field that explores the relationships between visual function and motor performance. However, research has shown that visual behaviors are distinct enough to detect superior performance; and serve as a suitable input for designing machine learning systems, few studies have been tested yet the eye tracking machine learning in sport tasks. The current research investigated the eye movement behaviors for detecting successful performance using machine learning. The gaze behavior of 25 student basketball players during the hit and miss free-throwing's trials was collected and analyzed by statistical (JMP pro) and machine learning (Python) approaches. Results showed significant differences between saccade duration in hit and miss trials. In previous studies of free throwing, fixations were used as a measure of visual information processing, but our results showed that the metrics related to saccades were more important for successful performance than those related to fixations. These findings highlight the importance of eye tracking machine learning in sport domain and suggest that successful performance can be reliably predicted from performers' eye movement data. Our results provide primary insights as well as inspiration for future research focusing on developing eye-tracking machine learning systems to detect proficiency in motor skills.

Effect of different individualized strength training approaches to improve physical performance in male basketball players. Sports, 13: 214, 2025.

Abstract - Training individualization is a key principle for maximizing improvements in players' performance, but there are still few approaches to individualization of training in basketball players. The aims of this study were as follows: (I) to analyze the effects of two individualized training approaches on performance in male basketball players; (II) to compare



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the inter-individual differences in adaptations of these physical abilities; and (III) to assess differences in physical performance between two time periods of training intervention. Forty-five male basketball players (age, 22.3 ± 4.18 years; body height, 1.86 ± 0.15 m; body mass, 86.3 ± 7.85 kg) were divided into three groups: a vertical group ($n = 15$), who performed an individualized training program based on a force–velocity profile; a horizontal group ($n = 15$), who underwent individualized intervention based on change of direction deficit; and a control group ($n = 15$). The assessments included jump and speed tests. Strength training was administered twice weekly for 8 weeks. Both intervention groups demonstrated large significant group x time interactions in jump ($\eta^2 \geq 0.24$, $p < 0.01$) and speed ($\eta^2 = 0.23$, $p < 0.01$), with no significant changes in the control. The largest performance gains were achieved in the specific force orientation targeted by each intervention. These findings suggest that addressing the individual needs of each player and the specificity of the physical ability are key considerations for training programming in basketball players.

Evaluation of hierarchical clustering methodologies for identifying patterns in timeout requests in EuroLeague basketball. Mathematics, 13: 2414, 2025.

Abstract - This study evaluates hierarchical clustering methodologies to identify patterns associated with timeout requests for EuroLeague basketball games. Using play-by-play data from 3743 games spanning the 2008–2023 seasons (over 1.9 million instances), we applied Principal Component Analysis to reduce dimensionality and tested multiple agglomerative and divisive clustering techniques (e.g., Ward and DIANA) with different distance metrics (Euclidean, Manhattan, and Minkowski). Clustering quality was assessed using internal validation indices such as Silhouette, Dunn, Calinski–Harabasz, Davies–Bouldin, and Gap statistics. The results show that Ward.D and Ward.D2 methods using Euclidean distance generate well-balanced and clearly defined clusters. Two clusters offer the best overall quality, while four clusters allow for meaningful segmentation of game situations. The analysis revealed that teams that did not request timeouts often exhibited better scoring efficiency, particularly in the advanced game phases. These findings offer data-driven insights into timeout dynamics and contribute to strategic decision-making in professional basketball.



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Factors differentiating change of direction performance in NCAA Power 4 male basketball athletes. International Journal of Sports Science & Coaching, Ahead of Print: 1-8, 2025.

Abstract - The aim of this study was to investigate COD performance in an elite basketball cohort to determine which phase specific qualities are most strongly associated with COD performance. One hundred and twenty-four male basketball athletes (age =20.9 $\pm$ 1.23 years, height =195 $\pm$ 14.3 cm, body mass =89.9 $\pm$ 10.2 kg) from 10 different NCAA Power 4 basketball programs participated in this study. COD performance was assessed using a modified 505 (m505) COD test with phase specific and overall COD performance times measured via a portable motorized resistance device. Multiple linear regression was used to explore how total time to complete the m505 was influenced by the different phase-specific outcome measurements and differences between bigs (n=54) and guards (n=70) calculated using independent t-tests and Cohen's effect size. Four phase specific COD metrics significantly associated with m505 COD time to completion, including: time phase 1a (r =0.90, p < 0.001), time phase 1b (r =0.77, p < 0.001), maximal acceleration 1a (r=-0.73, p < 0.001) and maximal deceleration (r =-0.42, p < 0.001). These findings highlight the importance of phase specific outcome measures when assessing COD performance in elite basketball athletes.

Football

An analysis of Guardian Cap use and changes in the concussion rate in National Football League preseason practices from 2018 to 2023. The American Journal of Sports Medicine, Ahead of Print: 1-8, 2025.

Purpose: To study the effect of Guardian Cap NXT use on the incidence of concussions in National Football League (NFL) preseason practices from 2018 to 2023.

Study Design: Cohort study; Level of evidence, 3.

Methods: Using data from the NFL Injury Surveillance System, concussion rates in preseason practices during the 2018 to 2023 preseasons (excluding the 2020 preseason) were compared before and after the NFL required players in certain positions (offensive linemen, defensive linemen, tight ends, and linebackers) to wear the Guardian Cap NXT during practices in 2022. Several secondary analyses, including 2 Poisson regression models, were conducted to evaluate the effects of preseason, player position, practice intensity (pads vs no pads), collision partner, helmet shell involvement, and Guardian Cap NXT requirement.



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Results: A total of 139 concussions occurred during the preseason Guardian Cap NXT requirement period in 2018, 2019, 2021, 2022, and 2023. After the Guardian Cap NXT requirement was implemented, the concussion rate in the group of affected positions decreased 54% ($P = .001$) in the univariate analysis and 62% ($P = .004$) in the regression model. For concussions involving the helmet shell (as opposed to the facemask) ($n = 76$), there was no significant association between Guardian Cap NXT use and the concussion rate ($P = .122$), indicating that the reduction in concussions could not be attributed solely to the energy-absorbing effects of the Guardian Cap NXT.

Conclusion: Required use of the Guardian Cap NXT was associated with a 54% to 62% reduction in the overall incidence of NFL practice concussions. However, when only concussions involving a helmet shell impact were considered, there was no longer a significant relationship between Guardian Cap NXT use and the incidence of concussions.

Analysis of Z-score and total score of athleticism on drafted and undrafted players from the NFL Scouting Combine. Scientific Reports, 15: 21742, 2025.

Abstract - This study aims to evaluate the effectiveness of z-score and Total Score Athleticism (TSA) in distinguishing between drafted and undrafted NFL players, with a focus on different positional groups. We analyzed NFL Scouting Combine data (2000-2024) using z-score and TSA calculated for both the entire sample and specific positional groups (Skill player, big skill player and linemen), with a final sample of 3,446 players included after filtering. Examine the differences between drafted and undrafted players, as well as the differences among the three positional groups. The classification accuracy was evaluated by ROC analysis and binary logistic regression. Significant differences were observed in z-scores ($P < 0.001$) and TSA ($P < 0.001$) between drafted and undrafted players under the two calculation methods across all positions, with drafted players generally outperforming undrafted ones. ROC analysis indicated that all z-scores on NFL SC demonstrate good performance ($AUC > 0.6$, $P < 0.001$). Z-score for the 40-yard dash provided the highest AUC (0.637-0.719), while the bench press lowest (0.556-0.631). Position-specific z-score and TSA calculations showed better discriminatory performance compared to the calculation based on the overall sample. This study confirms that both z-scores and TSA are effective in differentiating drafted from undrafted players, with position-specific calculations offering enhanced discriminatory power. The results underscore the importance of tailoring athletic assessments to specific positional needs to improve talent identification. Coaches can understand how z-scores and TSA can be used on National Football League Scouting Combine, and these metrics perform across various positions.



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Anterior cruciate ligament injuries in National Football League players from 2012 to 2022: A descriptive epidemiology study. The Journal of Knee Surgery, Ahead of Print: 1-25, 2025.

Abstract - There is a high incidence of anterior cruciate ligament (ACL) tears in National Football League (NFL) players. There is a relative paucity of long-term data characterizing the effects of artificial versus natural playing surfaces on ACL tear incidence. A comprehensive search of publicly available data identified any NFL player who sustained an ACL injury from 2012 to 2022. The publicly available databases allowed for characterization of playing surface, player position, timing of injury in season, mechanism of injury, and player age. Incidence of ACL injuries by playing surface, player position, and position group relative to all other positions or position groups were compared by chi squared test. Correlates of in-game ACL injury were determined by stepwise multivariate logistic regression. There were 520 NFL players who experienced an ACL tear between seasons 2012-13 and 2022-23. There was no significant difference in incidence of ACL tears on artificial turf versus natural playing surfaces (265 versus 255, $p=0.670$). Wide receivers ($p=0.027$) were associated with a significantly higher incidence of ACL tears compared to other positions. Receivers (wide receivers and tight ends) ($p=0.007$) were associated with significantly higher incidence of ACL tears compared to other position groups, while specialists (punters, kickers, and long snappers) ($p<0.001$) were associated with significantly lower incidence of ACL tears compared to other position groups. No significant difference between mechanism of injury between playing surfaces was found ($p=0.765$). More ACL tears occurred before week 9 than on or after week 9 in-season, and the proportion of ACL tears occurring during a game (67%) was significantly higher than those occurring during practice. There was no statistically significant difference in incidence of ACL tears in NFL players from the 2012-13 to 2022-23 seasons based on playing surface (artificial versus natural). Wide receivers had a significantly higher incidence of ACL tears compared to other positions and tears were more common during games and before week 9 in-season.

Full return to sport after suture-button fixation for syndesmotic injuries in all athletes: Faster recovery was seen in NCAA football players compared with National Football League players. Arthroscopy, Sports Medicine, and Rehabilitation, Ahead of Print: 1-21, 2025.

Purpose: The purpose of this study was to determine the rate and time to return to sport (RTS) for NCAA Football and NFL players following suture-button fixation for the treatment of unstable tibiofibular syndesmotic injuries and to identify possible risk factors associated with a delay in RTS.



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Methods: NCAA and NFL players who underwent suture-button fixation for an isolated syndesmotic ankle injury between 2017 and 2023 were evaluated. All player information and data were retrieved from publicly available internet sources. Information was gathered on each player's career, NFL participation, number of seasons played before and after surgery, number of games played before and after surgery, and time between surgery and RTS. RTS is defined as time until first game after syndesmotic suture-button fixation.

Results: Seven NCAA and fourteen NFL players (21 ankles) were included. The mean age at surgery was 24.90 ± 4.66 years (range, 18-34 years). A total of 100% of patients were able to RTS at their respective level of sport. The mean time between surgery and the first game played was 139.4 ± 123.6 days (range, 12 - 427 days). Players played in 23.48 ± 21.9 games after surgery (range, 3-72). NCAA players were able to RTS significantly earlier than NFL players (39.0 ± 20.4 vs 189.6 ± 123.2 days, respectively, $P = 0.005$, with a p-value of 0.05 denoting significance). There was no significant difference in workload following surgery for both NCAA and NFL players.

Conclusion: In this study, we found that athletes, regardless of whether they were NCAA or NFL players, were able to successfully return to their respective sports after ankle surgery. While NCAA players returned to play significantly faster, both groups were able to achieve similar performance levels postoperatively in terms of the number of games played.

Level of evidence: Level III, retrospective cohort study

Impact of cervical and lumbar spine surgeries on National Football League (NFL) player performance and return-to-play outcomes. Cureus, 17(6):e85706, 2025.

Introduction: American football players face a higher risk of spine injuries due to the sport's high-impact nature, especially in the lumbar and cervical spine regions. These injuries may require surgical interventions aimed at allowing athletes to return to the sport. However, the effects of these surgeries on players' performance and career longevity have yet to be comprehensively studied.

Objective: This study aims to evaluate the impact of spine surgeries on National Football League (NFL) players' return-to-play rates and performance. We hypothesize that players undergoing lumbar surgeries would demonstrate greater performance improvement and return-to-play rates compared to those undergoing cervical surgeries, with differences influenced by player position and injury location. Study design and methods: This is a retrospective cohort study (III) for which NFL injury reports from 2005 to 2022 were reviewed to identify players who had undergone spine surgery. Data

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collected included player position, return-to-play, and years played following the procedure. Performance metrics were gathered using Super Bowl wins and Pro Football Focus (PFF) player performance ratings. Statistical analysis was conducted using Python version 3.10.12 (Python Software Foundation, Wilmington, DE, USA) to evaluate differences in return-to-play rates, performance changes, and career duration post-surgery.

Results: The study identified 144 spine surgeries (77 lumbar, 67 cervical) among 136 players. Players who had lumbar surgery had a 61% return-to-play rate, with an average performance rating increase of 6.3%. In contrast, those who had cervical surgery had a 47% return-to-play rate and an average performance rating decrease of 5.8%. Lumbar surgeries were more common among linemen with higher BMIs, while cervical surgeries were more frequent in skill positions. Players with a history of lumbar surgeries were more likely to return to play than those without previous surgeries.

Conclusion: Spinal surgeries significantly impact the careers of NFL players. Lumbar surgeries show better outcomes in terms of return-to-play rates and performance improvements compared to cervical surgeries. The differences in surgical outcomes based on injury location and player position highlight the need for tailored rehabilitation protocols. This study provides valuable insights for medical practitioners, team management, and athletes, contributing to a broader understanding of the implications of spine surgeries in professional football.

Gymnastics

Enhancing Lower-Body Power in Highly Trained Female Athletes: Effects of Velocity-Based Strength Training. Journal of Functional Morphology and Kinesiology, 10: 411, 2025.

Background: Only a limited number of studies have examined the effects of short-term, strength-speed-oriented velocity-based training (VBT) on lower-body power in female junior volleyball players and elite female artistic gymnasts. The present study aimed to investigate the impact of a four-week VBT intervention on jump performance and force-velocity characteristics in these athletes.

Methods: Seven junior female volleyball players (age: 17.4 ± 0.9 years; height: 179.4 ± 6.5 cm; weight: 74.01 ± 3.5 kg) (top-league team members), and seven elite female artistic gymnasts (age: 17.6 ± 2.9 years; height: 159.6 ± 7.2 cm; weight: 59.3 ± 6.3 kg) (National Team members) completed two weekly training sessions for four weeks, each consisting of four sets of six repetitions of parallel back squats (PBSs) and hip thrusts (HTs). Training loads were regulated using barbell velocity targets (PBSs: 0.46-0.72 m/s; HTs: 0.36-0.60 m/s). Pre- and post-intervention assessments included loaded (15-60% body mass) and unloaded squat jumps (SJs) and countermovement jumps (CMJs) to determine peak power output, jump height, and force-velocity profiles.



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Results: Volleyball players showed significant improvements in peak power predominantly during loaded SJs (SJ45%: +5.5%, $p < 0.01$; SJ60%: +5.7%, $p < 0.05$), whereas gymnasts exhibited greater gains in loaded CMJs (CMJ60%: +7.7%, $p < 0.01$). In contrast, unloaded SJ and CMJ performances remained largely unchanged for all athletes. Both groups demonstrated a significantly steeper post-intervention force-velocity profile ($p < 0.001$), indicating an enhanced capacity to produce force at lower movement velocities under external loading.

Conclusions: Strength-speed-oriented VBT was effective in improving power production under loaded conditions but had limited transfer to unloaded jump performance. These findings highlight the necessity of subsequent training blocks emphasizing high-velocity, sport-specific movements to optimize explosive performance. Future studies should further investigate low-velocity-loss training protocols as a potential means of enhancing unloaded jump outcomes.

Is Hip and Lumbar-Spine Pain Related to Physiological Characteristics in Young Elite Gymnasts? International Journal of Sports Physiology and Performance, Ahead of Print: 1-10, 2025.

Purpose: Gymnastics performances entail complex and extensive movements that require specific body morphology, strength, and flexibility that may lead to hip and lumbar-spine injuries. The present study aimed to evaluate the prevalence of hip and lumbar-spine pain and their associated physiological characteristics in young gymnasts.

Methods: Two hundred seventy-four female rhythmic, acrobatic, and artistic gymnasts age 9 to 16 years were physically examined for hip and lumbar-spine pain and reported pain experienced during training on a visual analog scale. In addition, gymnasts were assessed for impact of training, anthropometric parameters, hip muscle strength, and hip and spine joint range of motion (ROM).

Results: Fifty gymnasts (18.2%) presented hip pain, 40 (14.6%) presented lumbar-spine pain, 63 (20.3%) presented hip and lumbar-spine pain, and 121 (44.2%) were pain free. Gymnasts with hip and lumbar-spine pain were significantly older and had greater body mass than injury-free gymnasts ($P = .028$ and $.044$, respectively). Group effect showed that gymnasts with hip pain and gymnasts with hip and lumbar-spine pain had weaker muscle strength and greater joint ROM than pain-free gymnasts ($P < .05$). Puberty effects showed that postpubertal gymnasts were significantly stronger and had reduced joint ROM compared with prepubertal gymnasts. Group $\times$ puberty interaction for hip-abduction ROM ($F_{3,243} = 4.2$, $P = .006$) indicated that postpubertal gymnasts with hip and lumbar-spine pain had significantly lower joint ROM than prepubertal gymnasts with pain.



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Conclusions: Young competitive gymnasts are at high risk of experiencing hip and lumbar-spine pain. Clinically, it is suggested that young gymnasts should be routinely screened for musculoskeletal pain and physiological abilities by an expert from a very young age.

Golf

Showing Eye Movement Modelling Examples in Virtual Reality Increases Quiet Eye Duration and Improves Real World Motor Skill Performance. Perceptual and Motor Skills, Ahead of Print: 1-27, 2025.

Background: Virtual Reality (VR) can be used to train elite athletes using innovative ways such as through point-of-view (POV) observation and visual augmentation.

Purpose: The purpose of this study was to examine how, independent of physical practice, VR may be used to train visuomotor skills, especially the Quiet Eye (QE).

Research Design: In a pre-post design, 42 golf novices either watched a training video in a VR headset that was based on Eye-Movement-Modelling-Examples (EMME) or did not receive gaze training (Control). One EMME variation showed the eye-gaze cursor of an expert while putting using a circle (i.e., cursor-only, termed Cursor), and a second variation showed the same gaze cursor but with peripheral information blurred (i.e., hereafter Blurred). Participants were not given any instructions about Quiet Eye. Subsequent putting performance and eye-movement behavior were evaluated.

Results: The results indicated that the Cursor visualization significantly increased holed putts, reduced putting radial error, and improved putt line and length pre-to-post. There was also a significant reduction in radial error pre-to-post for the Blurred condition, but not for the Control condition. QE duration increased for all conditions pre-to-post, but improvement was largest for the Cursor condition, followed by Blurred, then Control.

Conclusions: The findings indicate an enhanced learning effect of Cursor video training on longer QE duration and improved putting performance, including holed putts. Observing expert eye movement videos using VR augmentation may facilitate motor skill learning through visuomotor skill development, independent of physical practice.



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Drive for Show, Putt for Dough? Reevaluating the Impact of Driving vs. Putting in Modern Golf Performance. The National High School Journal of Science, Online: 1-7, 2025.

Abstract - The popular adage drive for show, putt for dough has long framed putting as the primary determinant of success in professional golf. This study reevaluates that assumption using performance data from the top 100 players on both the 2024 Professional Golfers Association (PGA) and DP World Tours ($n = 200$), stratified by official rankings. Statistical methods included simple linear regression, paired t-tests, Welch's t-tests, bootstrap confidence intervals, and Generalized Additive Models (GAM). Regression analyses demonstrated that strokes gained off the tee (SG: OTT) accounted for 28% of the variance in overall scoring (SG Total; $R = 0.28$, slope = 0.96, $p < 0.001$), compared with 19% explained by strokes gained putting (SG: P; $R = 0.19$, slope = 0.71, $p < 0.001$). Thus, driving explained approximately 9% more variance and contributed more strongly to overall performance. Paired t-tests confirmed higher within-player averages for SG:OTT: in the PGA Tour, SG: OTT = 0.205 vs. SG: P = 0.052 (Cohens $d = 0.232$, small); in the DP World Tour, SG: OTT = 0.205 vs. SG: P = 0.127 (Cohens $d = 0.143$, very small). Welch's t-tests with bootstrap intervals further showed that on the PGA Tour, SG: OTT exceeded SG: P by 0.0340.271 strokes per round (95% CI, $p = 0.0122$), whereas on the DP World Tour, the interval was 0.0270.183 (95% CI, $p = 0.1466$, not significant). These findings suggest that while putting remains critical in close contests, driving is the more consistent predictor of performance variation among elite professionals (1,3,6). Limitations include reliance on an elite-only dataset, a single-season timeframe, and omission of approach and short-game metrics. Future research should extend across multiple seasons, incorporate additional strokes-gained categories, and examine contextual influences such as course conditions and player strategy.

Hockey

Age effects in NHL draftees: A data-driven review of a multi-dimensional concept. Frontiers in Sports and Active Living, 7: 1593409, 2025.

Introduction: Relative age effects (RAEs) have been extensively documented in youth sports, where artificial age cut-offs create advantages for relatively older athletes throughout development. Despite four decades of research, these effects persist in many sports, particularly in ice hockey, where misaligned cut-off dates between developmental systems and professional selection create unique challenges. This study examines varying age cut-off dates, athletes' development trajectories and career outcomes in elite ice hockey.

Methods: Using one of the most comprehensive longitudinal datasets to date, the present paper also explores whether an "underdog effect" (i.e., where relatively younger athletes who survive selection barriers may achieve greater success)



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is present within the current sample of athletes. We analyzed the complete population of 10,485 NHL-drafted players spanning 44 years (1980-2024), examining birth quarter distributions, time to league entry, and career permanence (defined as playing ≥ 5 seasons and ≥ 268 games). Using Cox proportional hazards models and multinomial regression analyses, we investigated how birth quartile influenced player career trajectories while controlling for draft position, nationality, anthropometrics, and playing position.

Results: Results revealed that while relatively younger players were significantly underrepresented in the draft, those who were drafted demonstrated superior career trajectories. In standard analyses, Q4 players showed a faster time to enter the NHL after getting drafted (HR = 1.32, 95% CI = 1.15-1.52), and Q3 players showed significantly higher likelihood of achieving permanence (HR = 1.39, 95% CI = 1.10-1.75). When accounting for the September 15 draft cut-off (2005-2024), a "dual disadvantage" was identified within the sample, with Q3 athletes showing the strongest effects, with 61% higher likelihood of achieving permanence (HR = 1.61, 95% CI = 1.27-2.05).

Discussion: These findings support the "underdog hypothesis," suggesting that relatively younger athletes who overcome systemic disadvantages develop compensatory skills that enhance long-term performance. Future athlete development systems should consider implementing strategies such as bio-banding or "future teams" to better support relatively younger athletes, potentially increasing talent retention across the entire player pool.

Study of correlations between on-ice test performance and heart rate variability in ice hockey defensemen. Russian Medicine, 31(4): 1-6, 2025.

BACKGROUND: Heart rate variability indicators in ice hockey athletes have been explored very poorly thus far. Investigating correlations between the indicators of heart rate variability and on-ice testing (the most efficient method for assessing special work capacity, energy supply, and adaptation of ice hockey players) is highly crucial given the labor intensity, high cost, and invasiveness of on-ice testing. AIM: To study heart rate variability indicators in ice hockey defensemen during on-ice tests and to identify correlations between the metrics resulting from the examination using two methods.

METHODS: The study involved ten defensemen from a major league hockey team aged between 19 and 34 during the season of play. The study methods included: pulse measurement using the PolarTeamPro2 team system; determination of lactic acid content in blood using a photometric method; estimation of special work capacity, energy supply, and blood buffer capacity of players through on-ice testing; 5-minute rhythmocardiography using the KFS-01.001



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Cardiometer-MT electrocardiograph (MIKARD-LANA, Russia). Results data were statistically processed using the Excel-2017 software.

RESULTS: Seven out of ten athletes (70%) had type 3 heart rate regulation according to Shlyk's classification. Based on the median spectral indicators, it turned out that the central heart rate regulation circuit (low-frequency waves and very low-frequency waves) was dominant in defensemen. The total wave spectrum growth significantly correlated with the heart rate recovery indicators in the sample of defensemen (the correlation coefficient was -0.69) and suggested that the characteristics of the defensemen were close to the model characteristics of on-ice testing (correlation coefficient of 0.689). The value of the parasympathetic component of the wave spectrum (high-frequency waves) significantly negatively correlated with the test completion time (correlation coefficient of -0.48) (special work capacity) and blood lactate in on-ice testing (correlation coefficient of 0.515).

CONCLUSION: Improvements in the cardiovascular system's adaptation to special ice work and the approximation of defensemen's characteristics to model characteristics are closely related to an increase in overall heart rate variability and the central heart rate regulation circuit. The dynamics of heart rate variability indicators can be used as an operational control over ice hockey defensemen.

Lacrosse/Field Hockey

Examining the Gaze Behaviour and Decision-Making of Field Hockey Players In Situ.
European Journal of Sport Science, 25: e70062, 2025.

Abstract - Gaze behaviour is associated with decision-making in team sports. For instance, the final fixation of basketball players typically reflects the decision they make. However, it is not clear how athletes adapt in invasive team sports where they also control the ball using an implement (e.g., field hockey or lacrosse). In these sports, decision-making might be related to information fixated earlier on rather than the final fixation. This study investigated the relationship between gaze behaviour and decision-making in the dynamic sport of field hockey. We recorded the in situ gaze and decision-making accuracy of 15 skilled youth field hockey players in specific 3 versus 3 small-sided scenarios. Gaze behaviours were compared between players who made correct and incorrect decisions. Results indicated all players looked towards the ball in their final fixation before executing their decision, reflecting a critical difference from other invasive team sports such as basketball, where the ball carrier is in direct contact with the ball. Strikingly, it was the first fixation, rather than the last or second-to-last, in each scenario which was most associated with correct decisions. In particular, players who directed their first fixation towards the open space appeared most likely to make correct



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decisions in the scenarios we presented. The results emphasise the sport-specific nature of gaze behaviour and raise doubts about the transferability of gaze behaviour between closely related sports. These findings contribute to our knowledge of gaze behaviour and the decision-making processes of athletes in dynamic team sports.

Identifying future champions: A comprehensive framework for talent identification and development in field hockey. American Journal of Sustainable Cities and Society, 15(1): 1-6, 2025.

Abstract - The purpose of this research is to design a comprehensive and practical framework for identifying and developing talent in field hockey at the grassroots and university levels in India. With the increasing competitiveness in international sports, structured talent identification models are crucial for nurturing athletes from an early stage. This study explores the key physiological, psychological, technical, and tactical parameters that can be used to recognize promising players early in their careers.

The methodology involved a mixed-method approach combining literature reviews, expert interviews, field surveys, and performance data analysis. Data was collected from field hockey academies across Punjab and Haryana, using standardized fitness testing protocols (Yo-Yo Test, Illinois Agility Test, Anthropometric analysis), psychological assessments, and skill evaluation metrics. Statistical tools such as SPSS were used to analyze and interpret the data.

The findings suggest that a combination of physical attributes (speed, endurance, flexibility), cognitive abilities (decision-making, game IQ), and emotional resilience strongly correlates with long-term athletic success in field hockey. A proposed model has been drafted to streamline talent identification and suggest developmental pathways tailored to individual profiles.

The conclusion emphasizes that an integrated, evidence-based model will bridge the gap between potential and performance, leading to consistent excellence in national and international arenas.

Limitations include sample size and regional focus, which may limit generalizability. This study contributes significantly to sports sciences, coaching strategies, and youth development frameworks.



Performance Research Reviews

Soccer

Effects of mental fatigue on psychophysiological responses, kinematic variables and technical actions in small-sided soccer games: A time course analysis. Frontiers in Psychology, 16: 1654701, 2025.

Abstract - The study compares the effects of different cognitive task durations to induce MF on 4-a-side small-sided soccer games (SSGs) in psychophysiological responses, kinematic profile, and technical performance. Sixteen young soccer players (age: 15.2 ± 0.4 years) randomly performed the mental fatigue (MF) conditions (30-, 45-, and 60-min Stroop Task) and CON sessions (30-, 45-, and 60-min documentary) immediately before a 4-a-side SSGs (4 × 4 min, and 4 min rest). Kinematic profiles were analysed with GPS. Heart rate (HR), the rating of perceived exertion (RPE), MF visual analogue scale, enjoyment, and technical performance were assessed during SSGs. The manipulation checks revealed that players experienced increased MF levels in all MF inducement durations compared with the CON [30-min, $CI_{95\%diff} = 5.40$ (3.20 to 7.50), $p < 0.001$; 45-min, $CI_{95\%diff} = 8.30$ (6.00 to 10.50), $p < 0.001$; and 60-min, $CI_{95\%diff} = 12.3$ (10.00 to 14.50); $p < 0.001$]. Technical performance varied with the duration of MF exposure. Successful pass presented higher values for the CON condition in the 30-min [$CI_{95\%diff} = 0.68$ (0.21 to 1.16); $p = 0.035$], but remained similar for the 45- [$CI_{95\%diff} = -0.45$ (-1.17 to 0.26); $p = 0.523$], and 60- min [$CI_{95\%diff} = 0.67$ (-0.08 to 1.43); $p = 0.401$]. For the unsuccessful pass the CON condition presented lower values in the 30-min [$CI_{95\%diff} = -2.36$ (-2.89 to -1.83); $p < 0.001$] and 60-min [$CI_{95\%diff} = -2.80$ (-3.63 to -1.97); $p < 0.001$], but remained similar for the 45- [$CI_{95\%diff} = -0.47$ (-1.03 to 0.09); $p = 0.413$]. Regarding the one touch pass, the CON condition presented higher values in the 30- [$CI_{95\%diff} = 0.63$ (0.31 to 0.94); $p < 0.001$], 45- [$CI_{95\%diff} = 2.21$ (1.76 to 2.64); $p < 0.001$], and 60-min [$CI_{95\%diff} = 1.73$ (1.26 to 2.19); $p < 0.001$]. The findings of this study show that the different durations of cognitive tasks significantly affected several internal load metrics and technical performance, but not external load metrics. Understanding the effects of different cognitive task durations during SSGs allows coaches and sports scientists to customize training and recovery programs better, potentially improving player performance.



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Recovery After an Official Soccer Match: An Analysis of Markers of Muscle Damage and Oxidative Stress, and Endocrine, Neuromuscular and Perceptual Responses. Journal of Functional Morphology and Kinesiology, 10: 351, 2025.

Objectives: This study analysed the recovery process after an official soccer match by monitoring changes in markers of muscle damage and oxidative stress, and endocrine, neuromuscular, and perceptual responses.

Methods: This repeated-measures observational study included thirteen male amateur soccer players. Blood biomarkers, neuromuscular performance in countermovement jump, and perceived wellness were measured at four time-points: the morning of the match-day, immediately post-, and 24 h and 48 h post-match.

Results: Except for CK, which remained elevated at 48 h post-match, lactate dehydrogenase, C-reactive protein, uric acid, testosterone, cortisol, and testosterone to cortisol ratio returned to baseline between 24 h and 48 h post-match ($p < 0.05$). Jump height was significantly decreased at 24 h and 48 h post-match, while peak rate of force development and other countermovement jump time-based metrics (i.e., time to take off, time to peak force, reactive strength index modified, flight time to contraction time ratio) were impaired immediately after the match and recovered earlier ($p < 0.05$). Peak values for perceived fatigue and delayed onset muscle soreness were observed immediately post- and at 24 h post-match, respectively ($p < 0.05$).

Conclusions: While certain physiological, neuromuscular, and perceptual changes may return to baseline levels within 24 h or 48 h post-match, amateur soccer players still manifest exercise-induced muscle damage symptoms and can be considered fatigued after a 48-h recovery period.

Variation in weekly internal training load in professional soccer players. Scientific Reports, 15: 33992, 2025.

Abstract - Quantification of weekly training load (w-TL) in professional soccer players often shows minimal variation at the team level throughout the season. The study aimed (a) to analyze respiratory and muscular weekly perceived exertion, and (b) to determine the variability during pre-season and in-season period considering each player individually. Twenty-one professional soccer players belonging to a 2nd Division soccer team were monitored over 44-weeks (i.e., 6-week of pre-season and 38-week of in-season). Internal load was assessed using differential RPE (dRPE), and statistical analysis included descriptive statistics, coefficient of variation (CV), and the Kruskal–Wallis test. Leg local-



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muscular in weekly training load (w-TL_{mus}) was significantly higher ($p=0.001$ & $p=0.012$) than central-respiratory in weekly training load (w-TL_{res}) during pre-season and in-season period. Moreover, larger w-TL were also greater during pre-season compared to in-season periods. Total weekly loads were also greater in pre-season than in-season. Intra-player variability was higher during pre-season (CV: from 30.4 to 75.4% and from 15.3 to 76.9%) than in-season period (CV: from 21.2 to 46.1% and from 22.1 to 44.2%), respectively. These findings suggest that players perceive and respond to training loads differently across seasonal phases, highlighting the need for individualized monitoring to optimize performance and reduce injury risk.

Evening smartphone exposure impairs sleep quality and next-day performance in elite soccer players: A randomized controlled trial. *Biology in Sport*, 43: 227-242, 2025.

Abstract - This study aimed to examine the effects of pre-bedtime smartphone use on sleep quality and athletic performance in soccer players while also investigating potential time-of-day variations. In this randomized controlled crossover trial, 16 male elite-level players were assigned to either use a smartphone for two hours prior to bedtime or read magazines (control), separated by a one-week washout period. Participants completed morning and afternoon performance tests (cognitive and physical assessments) and sleep quality measurements. Nocturnal smartphone use significantly impaired sleep quality, increasing sleepiness after days 3 and 5 ($p < 0.01$; $d=5.74$, $d=5.72$, respectively), decreasing total sleep time, increasing sleep onset latency, and reducing sleep efficiency (all $p < 0.01$; $d=1$, $d=4.59$). Cognitive performance initially showed improved afternoon results, although following five days of smartphone use, this pattern reversed with enhanced morning performance ($p < 0.01$; $d=0.53$, $d=1.48$). Simple and choice reaction times deteriorated significantly in afternoon sessions compared to both baseline and control conditions ($p < 0.01$; $d=0.96$ – 3.47). Physical performance tests revealed decreased jumping ability and slower reactive agility times following five nights of smartphone use, particularly in afternoon sessions ($p < 0.01$; $d=0.85$ – 0.91). Five consecutive nights of pre-bedtime smartphone use impaired sleep quality and both cognitive and physical performance in elite soccer players, with stronger effects in afternoon sessions. These findings emphasize the importance of implementing device-free periods prior to bedtime and potentially adjusting training schedules when evening screen exposure is unavoidable. Future research should explore countermeasures for managing evening device exposure in elite athletes.



Performance Research Reviews

Softball

Utilizing balance and hand grip strength exercises in improving softball overhand throwing accuracy. USFD Journal of Physical Education Pedagogy and Sports Performance, 1(1): 1-9, 2025.

Abstract - Accurate overhand throwing in softball is vital for defensive performance and overall game success, yet it is often underemphasized in training programs. This quasi-experimental study investigated the comparative effectiveness of handgrip strength exercises and balance exercises in improving softball throwing accuracy. A total of 120 male college students, aged 18-25 years, enrolled in a softball course were assigned to two intervention groups: one performed handgrip strength exercises, and the other underwent balance exercises. The diamond dispatch challenge test was used to assess throwing accuracy before and after an eight-week intervention. Results showed significant improvement in both groups. The handgrip strength group progressed from developing to exceptional precision, while the balance group improved to high accuracy. Statistical analysis using Analysis of Covariance revealed a significant difference between groups, favoring the handgrip exercises group. This suggests that while both interventions enhance overhand throwing accuracy, handgrip strength training produces greater gains. The findings align with biomechanical principles, emphasizing that the mechanics of ball release, particularly control of the forearm, hand, and fingers, are critical to accuracy. Strengthening these areas directly enhances precision and force regulation during release. Although balance contributes to postural stability, its effect on throwing accuracy is more indirect. These results support the integration of handgrip strength training into softball conditioning programs, with balance exercises included to address stability needs. Future studies may explore combined or extended interventions to further enhance effectiveness.

Anticipatory information sources in elite softball batting: A qualitative approach. Journal of Human Sport & Exercise, 21(1): 38-50, 2025.

Abstract - Batting performance against high-speed pitches in softball requires effective anticipation skills. While these skills can vary individually, it remains unclear which anticipatory cues players rely on. The aim is to explore the anticipatory information sources and pitch-related cues perceived and considered by elite softball batters. We interviewed eight elite softball players (25 to 50 minutes each), and their responses were transcribed and analysed using an open-coding approach. Subsequently, the responses were thematically organized into higher and lower-order



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themes. Seven higher-order themes emerged: consciousness, contextual information sources, kinematic information sources, tactical awareness, mentality/confidence, batting technique and strategy, and skill acquisition/training. These themes highlight the various anticipatory information sources players use, as well as the role of kinematic and contextual cues in batting performance. Further analysis revealed detailed lower-order themes within each higher-order theme. A temporal model was developed to illustrate the sequence and interaction of both kinematic and contextual information sources that influence the anticipation skills of expert softball players.

Swimming

Lumbar spine injuries among high-school and college-aged competitive swimmers associated with various training methods and stroke specialties. Research in Sports Medicine, Ahead of Print: 1-10, 2025.

Abstract - Lumbar spine injuries are a frequent overuse injury among competitive swimmers, yet prevention strategies have not been well studied. This retrospective study evaluated 285 swimmers (mean age 18.7 ± 3.1 years) to identify risk factors. Demographics, stroke specialties, training characteristics, and injury history were collected. Group comparisons were conducted with t-tests and chi-square analyses, and logistic regression was used to calculate odds ratios (OR) with 95% confidence intervals (CI). Twenty-nine swimmers (10.2%) reported lumbar spine injuries, including spondylolysis, lumbar strain, disc pathology, and facet joint pain. Injured athletes were older, trained more hours in the pool, competed at a higher level, were hypermobile, and used kickboards less often. Adjusted regression demonstrated that higher pool training volume (OR = 2.28, 95% CI [1.20, 4.35]) and hypermobility significantly increased the risk (OR = 4.25, 95% CI [1.19, 15.24]), whereas greater kickboard use reduced risk (OR = 0.62, 95% CI [0.40, 0.96]). These findings suggest that training load and equipment use are important modifiable factors and should be considered in developing strategies to prevent lumbar spine injuries in swimmers.



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Case Report: Impact of dolphin kick implementation during backstroke finishes on swimming performance. From regional to Olympic-level swimmers. A comparative case study. Frontiers in Sports and Active Living, 7: 1531427, 2025.

Abstract - According to the World Aquatics (WA) an updated swimming regulation (SW) concerning the backstroke finish has been implemented, allowing, the swimmers to fully submerge their bodies at once when some part of their head pass the 5-meter mark immediately before touching the wall. Therefore, the present comparative case study aims to apply the new regulation on backstroke finish, examining the swimming efficiency and underwater kinematics of an elite Olympic-level swimmer, and comparing the data with the published ones from a previous study on regional-level swimmers. A 19-year-old male Olympic-level backstroke swimmer performed three all-out 20 m backstroke swims: (i) touching the wall, breaking the water's surface with one part of their body (Classic), (ii) touching the wall with one hand, submerging the body two strokes after passing the last 5 m (Dive–One Hand) and (iii) touching the wall on streamline position, submerging the body two strokes after passing the last 5 m (Dive–Streamline) Kinematic analysis of the intermediate 10 m and the last 5 m was conducted using a digital video camera. Descriptive statistics and the Crawford-Howell t-test were utilized for the comparisons between elite and regional-level swimmers. Based on the swimmer's analysis, intermediate 10 m were faster than that in regional level swimmers (Elite vs. Regional: 1.68 ± 0.1 vs. 1.29 ± 0.1 m·s⁻¹, $p = 0.00$). Also, the elite-level swimmer increased his transition swimming speed (SS) (from 10 to the last 5 m) in all backstroke finishes (0.05 ± 0.03 vs. -0.07 ± 0.03 m·s⁻¹). Also, in the last 5 m showed an extreme increase in velocity at the sink- to-finish speed (SFS), 2.16 and 2.28 m·s⁻¹ for Dive–One hand, and Dive–Streamline, respectively. However, the tendency in velocity between backstroke finishes was similar between regional and elite-level swimmers. The elite swimmer can utilize the two variations of backstroke finishes more effectively compared to the regional-level swimmers. The swifter dolphin kick ability appears to play a significant role in achieving a successful backstroke finish, However, further investigations involving elite swimmers, differentiating the sinking approach and improving the speed before sinking (SBS) factor, could potentially provide more insights.

Tennis

Talent development in tennis: A qualitative study of emerging regions. Journal of Sports Sciences, Ahead of Print: 1-12, 2025.

Abstract - Talent identification and development are fundamental processes for cultivating high-performance athletes in sport. However, these processes remain insufficiently understood in regions such as the Middle East, Africa, Latin



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America, the Caribbean, Pacific Oceania, and Asia. These areas often face challenges including limited infrastructure, resource constraints, and sociocultural barriers, which complicate the identification and nurturing of emerging talent. This study employs a qualitative approach, drawing on insights from semi-structured interviews with a sample composed of the ten development officers from the International Tennis Federation (ITF) who are based in these regions. Reflective thematic analysis was used to identify four key factors: structures and systems, economic challenges, access, and support influencing the effectiveness of developmental systems. By examining the nuanced interactions between these factors, the study identifies key obstacles and facilitators within these regions. The findings offer practical recommendations to improve talent pathways and ensure a more equitable distribution of opportunities. This work contributes to ongoing discussions in sports science, emphasising the need for inclusive and context-sensitive approaches to athlete development in underrepresented areas of the global tennis landscape.

The effect of a prolonged tennis serve game on shoulder function, speed and precision. Sports Biomechanics, Ahead of Print: 1-21, 2025.

Abstract - Due to the constant high physical strain on tennis players during a match, the effect of a prolonged serve game on torque, power and work of the shoulder external and internal rotations, as well as on serve speed and precision, was investigated. Eighteen male competitive tennis players performed shoulder external and internal rotations (90° of abduction) at 180 and 300°/s on an isokinetic dynamometer before and after 12 points with one flat serve plus forehands and simulated backhands. When comparing pre and post moments, torque and power decreased in external (0.41 ± 0.07 vs 0.39 ± 0.06 N.m/kg and 71.1 ± 27.3 vs 59.7 ± 27.1 W) and internal (0.54 ± 0.10 vs 0.50 ± 0.13 N.m/kg and 91.7 ± 30.7 vs 80.1 ± 38.1 W) rotations at 300°/s, with $p \leq 0.05$. Serve speed decreased after the fifth and sixth point (142.0 ± 20.1 vs 132.5 ± 15.3 km/h) and between clusters 1–6 and 7–12 (141.7 ± 15.5 vs 134.9 ± 12.4 km/h), with $p \leq 0.01$. Serve precision decreased at the fifth and eighth points, with the highest score recorded at the end of the game. Training should focus on improving players ability to maintain performance during consecutive points, enhancing technical proficiency.



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Volleyball

Mental fatigue and sleep restriction effects on perceptual-cognitive performance in trained beach volleyball athletes. *Frontiers in Psychology*, 16: 1537482, 2025.

Introduction: Perceptual-cognitive skills are essential in sports such as beach volleyball. Mental fatigue (MF) and sleep restriction (SR) are known to impair athletes' perceptual-cognitive performance. This study aimed to analyze the effects of MF and SR on perceptual-cognitive performance in beach volleyball athletes.

Methods: Fourteen volunteers participated (12 men; 17.9 ± 1.2 years; 182.0 ± 7.7 cm; 72.3 ± 8.4 kg) and were randomly submitted to four experimental conditions: (a) Control (CT), (b) MF, (c) SR, and (d) SR + MF. The MF cognitive load and SR duration were individualized in MF and SR experimental conditions. Perceptual-cognitive performance was assessed through two visuomotor tests utilizing LED light technology to simulate defensive and blocking actions within a real beach volleyball context. Visuomotor tests assessed reaction time (RT) measures. The Generalized Linear Models were applied to verify the main effects of the conditions for the perceptual-cognitive responses.

Results: The results showed a significant condition effect for both the defense [$X^2_{(3,39)} = 212.2$; $p < 0.001$] and block tests [$X^2_{(3,39)} = 104.0$; $p < 0.001$]. In the defense test, participants in the CT condition had significantly faster RTs (1727.0 ± 113.0 ms; $p < 0.001$) compared to all other conditions (MF: 1806.0 ± 126.0 ms; SR: 1874.0 ± 145.0 ms; and SR + MF: 1906.0 ± 133.0 ms). Additionally, the SR and SR + MF conditions showed slower RTs than MF ($p = 0.004$ and $p < 0.001$, respectively), with no significant difference between SR and SR + MF ($p = 0.41$). In the block test, the CT condition also resulted in faster RTs (631.0 ± 82.2 ms; $p < 0.001$) compared to MF (711.0 ± 77.5 ms), SR (691.0 ± 82.3 ms), and SR + MF (722.0 ± 100.0 ms). SR had better RTs than MF ($p = 0.04$) and SR + MF ($p = 0.01$), with no differences between MF and SR + MF ($p = 0.61$).

Conclusion: Therefore, we conclude that both the isolated and combined effects of MF and SR negatively impact RT in the defense and block visuomotor tests. This suggests that MF and SR conditions may impair athletes' ability to respond quickly to visual stimuli in different scenarios.



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Enhancing lower-body power in highly trained female athletes: Effects of velocity-based strength training. Journal of Functional Morphology and Kinesiology, 10: 411, 2025.

Background: Only a limited number of studies have examined the effects of short-term, strength-speed-oriented velocity-based training (VBT) on lower-body power in female junior volleyball players and elite female artistic gymnasts. The present study aimed to investigate the impact of a four-week VBT intervention on jump performance and force-velocity characteristics in these athletes.

Methods: Seven junior female volleyball players (age: 17.4 ± 0.9 years; height: 179.4 ± 6.5 cm; weight: 74.01 ± 3.5 kg) (top-league team members), and seven elite female artistic gymnasts (age: 17.6 ± 2.9 years; height: 159.6 ± 7.2 cm; weight: 59.3 ± 6.3 kg) (National Team members) completed two weekly training sessions for four weeks, each consisting of four sets of six repetitions of parallel back squats (PBSs) and hip thrusts (HTs). Training loads were regulated using barbell velocity targets (PBSs: 0.46-0.72 m/s; HTs: 0.36-0.60 m/s). Pre- and post-intervention assessments included loaded (15-60% body mass) and unloaded squat jumps (SJs) and countermovement jumps (CMJs) to determine peak power output, jump height, and force-velocity profiles.

Results: Volleyball players showed significant improvements in peak power predominantly during loaded SJs (SJ45%: +5.5%, $p < 0.01$; SJ60%: +5.7%, $p < 0.05$), whereas gymnasts exhibited greater gains in loaded CMJs (CMJ60%: +7.7%, $p < 0.01$). In contrast, unloaded SJ and CMJ performances remained largely unchanged for all athletes. Both groups demonstrated a significantly steeper post-intervention force-velocity profile ($p < 0.001$), indicating an enhanced capacity to produce force at lower movement velocities under external loading.

Conclusions: Strength-speed-oriented VBT was effective in improving power production under loaded conditions but had limited transfer to unloaded jump performance. These findings highlight the necessity of subsequent training blocks emphasizing high-velocity, sport-specific movements to optimize explosive performance. Future studies should further investigate low-velocity-loss training protocols as a potential means of enhancing unloaded jump outcomes.



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Wrestling/Combat Sports

Eating disorders and disordered eating on wrestling sport: A systematic review. BMC Nutrition, 11(1): 198, 2025.

Abstract - Although there are studies on the effects of eating disorders (EDs) among athletes, a limited number of studies have been conducted in wrestling. This systematic review aims to identify the prevalence of eating disorders (ED) and disordered eating (DE) in wrestling, which is important for developing healthier weight control behaviours within the sport. A systematic review was conducted following the PRISMA protocol, focusing on publications from the last 10 years. PubMed, Scopus, PsycINFO, SPORTDiscus and Web of Science were used to identify eligible studies with the searching terms "Eating disorders" AND "wrestlers" OR "Eating disorders" AND "wrestling" OR "Disordered eating" AND "wrestlers" OR "Disordered eating" AND "wrestling" OR "Anorexia Nervosa" AND "wrestlers" OR "Anorexia Nervosa" AND "wrestling" OR "Bulimia Nervosa" AND "wrestlers" OR "Bulimia Nervosa" AND "wrestling" within the timeframe from 2014 to 2024. Eight articles met the inclusion criteria. When all studies were considered as a homogeneous group, the analysis revealed: (a) wrestlers are significantly more susceptible to Eds than other branches, (b) wrestlers have unhealthy weight control behaviors to control weight for optimum performance and to enhance their muscular appearance due to body image issues. It is recommended that future research address eating disorders, which have predominantly been studied in male wrestlers, within female wrestlers as well. Additionally, it is advised to identify potential causes contributing to the elevated risk of eating disorders among wrestlers and to develop targeted prevention strategies.

Analysis of Technical Performance, Recovery and Prevention of Injuries in Wrestling athletes. Cuestiones de Fisioterapia 54(1):167-178, 2025.

Abstract - Injuries in wrestling are often caused by a variety of factors, including poor technique, muscle fatigue due to lack of adequate recovery, and the lack of a structured injury prevention program. This study aims to analyze the relationship between technique performance and the risk of injury in wrestling athletes, by identifying how the quality of the techniques used can affect the potential injury experienced by athletes. The research method used is a quasi-experimental design with experimental procedures that include testing techniques, recovery and structured injury prevention. The experimental design was carried out in two main phases. The sample of the study amounted to 20 students who are members of the State University of Makassar wrestling athletes. Data analysis was conducted using

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SPSS version 23, including descriptive linear regression analysis, ANOVA test and correlation test to evaluate the relationship between technique efficiency, recovery and injury risk. The results showed a Pearson correlation between technique performance and recovery: strong positive correlation ($r = 0.633$; $p = 0.003$). Technique performance and injury prevention: very strong correlation ($r = 0.789$; $p = 0.000$). Recovery and injury prevention: strong positive correlation ($r = 0.658$; $p = 0.002$). These results emphasize that technical performance, recovery and injury prevention are closely interrelated and have a significant positive relationship. A good integration of strategies between these three aspects is important to improve the athlete's performance while reducing the risk of injury. Conclusion Technical performance, recovery and injury prevention show that success in wrestling depends not only on physical strength and competitive ability, but also on maintaining good technique and regular body care.

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