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Effect of caffeine ingestion on free-throw performance in college basketball players. Journal of Exercise Science and Fitness. 18: 62-67, 2020.

Evolution of game-play characteristics within season for the National Basketball Association. International Journal of Sports Science and Coaching. 14(3): 355-362, 2019.

Illusion of persistence in NBA 1995-2018 regular season data. Physica A: Statistical Mechanics and its Applications. 520: 250-256, 2019.

Is there any association between foot posture and lower limb-related injuries in professional male basketball players? A cross-sectional study. Clinical Journal of Sport Medicine. 30: 46-51, 2020.

Jumping in the Pool: What determines which players the NBA considers in the draft? International Journal of Sport Finance. 14: 43-53, 2019.

Key anthropometric and physical determinants for different playing positions during National Basketball Association Draft Combine Test. Frontiers in Psychology. 1-9, October 2019.

Key game indicators in NBA players' performance profiles. Kinesiology. 51: 92-101, 2019.

Momentum effects in the NBA: Exploiting the fine line between winning and losing. SSRN: 1-31, 2019.

NBA player outcomes following the implementation of the One-And-Done Rule: Do top players really benefit from attending college first? Journal of Sports Economics and Management. 8(3): 137-149, 2018.

NBA team home advantage: Identifying key factors using an artificial neural network. PLOS One: 1-9, 2019.

Performance and return to sport after hip arthroscopy in the National Basketball Association. Arthroscopy: The Journal of Arthroscopic and Related Surgery, Ahead Print: 1-6, 2019.

Return to play and performance after shoulder instability in National Basketball Association athletes. Journal of Shoulder and Elbow Surgery. 29: 50-57, 2020.

The effect of Superstars on game attendance: Evidence from the NBA. Journal of Sports Economics. 21(2): 152-175, 2020.

Using in-game shot trajectories to better understand defensive impact in the NBA. arXiv:1905.00822. 1-14, 2019.

Visual fixation in NBA free throws and the relationship to on-court performance. Journal of Sports and Performance Vision. 2(1): 1-7, 2020.

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Evolution of game-play characteristics within season for the National Basketball Association. International Journal of Sports Science and Coaching. 14(3): 355-362, 2019.

Abstract The aim of this study was to explore the (dis)similarity of game-play characteristics throughout an in-season period within the National Basketball Association. Thirteen performance-related indicators of all 1230 games of the regular 2016–2017 season in the National Basketball Association were analyzed. Non-metric multidimensional scaling was used to examine (dis)similarity of team profiles. The two-dimensional multivariate matrix showed that team profiles generally presented similarity, while the beginning and ending of the season (October and April) showed relative dissimilarity. Although each team presented unique paths throughout the in-season period, the dominant teams in the National Basketball Association presented similar game styles. In addition, the game-play of the teams evolved into effective interactions in terms of offence and defense as the competition progressed while presenting an increased trend in the number of three-point field-goals made ($p<0.000$, small effect size ($\eta2$) 0.011) throughout the in-season period. The analytics performed in this study could be used practically to evaluate temporal changes of game-play characteristics in basketball as well as inform strategic periodization plans within season periods.

Effect of caffeine ingestion on free-throw performance in college basketball players. Journal of Exercise Science and Fitness. 18: 62-67, 2020.

Background: It is currently unclear whether pre-exercise caffeine ingestion can improve free-throw shooting performance, a vital skill in basketball. The purpose of this study was to investigate the effects of caffeine on free-throw shooting performance in college-aged basketball players.

Methods: Twelve males (23.1 ± 1.9 years; 180.1 ± 8.8 cm; 77.1 ± 12.4 kg) and six females (22.0 ± 1.3 years; 169.4 ± 8.9 cm; 67.0 ± 11.1 kg) who competed at the college level ingested 6 mg per kg of body mass of (a) caffeine or (b) maltodextrin (placebo) on two separate occasions in a random order. After 60 min, they performed five sets of a match-simulated basketball protocol comprising six sideline-to-sideline sprints on a standard basketball court followed by two free-throws after each set. The number of successful shots was counted. Heart rate and rating of perceived exertion (RPE) after each sprint set were also recorded.

Results: Caffeine ingestion did not improve overall free-throw success (caffeine ¼ 6.1 ± 1.7 vs. placebo ¼ 5.5 ± 2.0; p ¼ 0.34) compared with placebo across all five sets. There was no change in shooting accuracy across sprint sets in either trial despite significant increases in both heart rate and RPE. Caffeine increased heart rate (p ¼ 0.02) but had no effect on RPE (p ¼ 0.57) across five sets compared with placebo.

Conclusions: Ingestion of 6 mg of caffeine per kg of body mass did not improve basketball free-throw performance. Free-throw performance did not deteriorate with increasing number of sprint sets.

Illusion of persistence in NBA 1995-2018 regular season data. Physica A: Statistical Mechanics and its Applications. 520: 250-256, 2019.

Abstract: Among the sports fans beliefs about "hot hands" and "winning streaks" are widely spread, while the scientific debate about these effects is still ongoing. Recently in a paper by P.Ferreira [Physica A 500: 92–96] detrended fluctuation analysis was applied to the NBA teams' win records. It was shown that 28 considered NBA teams exhibit persistence in the win record time series. In this paper we take the same data set and compare the obtained results against various random models. We find that the empirical results are consistent with the results obtained from various simple random models.

Is there any association between foot posture and lower limb-related injuries in professional male basketball players? A cross-sectional study. Clinical Journal of Sport Medicine. 30: 46-51, 2020.

Background: Several studies have shown that foot posture is related to the incidence of ankle sprains in athletes and in nonathletic populations, but this association has not previously been considered in basketball players. This study investigates the relationship between foot posture and lower limb injuries in elite basketball players.

Design and Method: Two hundred twenty participants were recruited as a convenience sample. The players had a mean age of 22.51 ± 3.88 years and a body mass index of 23.98 ± 1.80. The players' medical records were accessed from the preceding 10 years, and injuries were recorded according to their location (knee, foot, and/or ankle). In addition, the Foot Posture Index (FPI) was scored for each player, and their playing positions were noted.

Results: An average FPI score of 2.66 was obtained across all players, with guards presenting a significantly lower average FPI of - 0.48 (P < 0.001) compared with the rest of playing positions, indicating a more supinated foot. However, center players presented an average FPI of 5.15 (P < 0.001), indicating a more pronated foot. The most common injuries observed were lateral ankle sprain (n = 214) and patellar tendinopathy (n = 126). Patellar tendinopathy was more common in supinated feet (30.08%) compared with 20.7% and 19.8% in pronated and neutral feet, respectively.

Conclusions: The most common lower limb injuries observed in basketball players were lateral ankle sprain and patellar tendinopathy. Patellar tendinopathy was more commonly associated with the supinated feet. Guard players tended to have a more supinated foot, whereas centers presented a more pronated foot.

Sports Science Research Update

Jumping in the Pool: What determines which players the NBA considers in the draft? International Journal of Sport Finance. 14: 43-53, 2019.

Abstract: Each year the National Basketball Association (NBA) drafts a small number of college players from a very large pool of potential college talents. This purpose of this study is to explore how NBA decision-makers decide which players are in the group of selected players. The reported results confirm—as prior studies have indicated—that points scored dominates the evaluation of playing talent. In addition, evidence also suggests that decision makers have trouble separating the player from the college team that employs the player.

Key anthropometric and physical determinants for different playing positions during National Basketball Association Draft Combine Test. Frontiers in Psychology. 1-9, October 2019.

Abstract: Annual draft combine test of National Basketball Association (NBA) is a key player testing process where prospective players with extraordinary athletic abilities are evaluated and the assessment results would further inform the determination of prospective players for the league during draft day. Nonetheless, key attributes from the combine test that distinguished successful players in the draft from those unselected has yet to be investigated. The study was aimed to: (i) compare the difference between NBA drafted and undrafted players from five playing positions, considering anthropometric characteristics and physical fitness ability during draft combine test; and (ii) determine the key combine test factors that most effectively discriminate between draft groups. A total of 3,610 players participating in the 2000–2018 NBA draft combine test were included. Independent t-test was applied to compare difference between drafted and non-drafted players in variables related to anthropometrics, and strength and agility test. A descriptive discriminant analysis was subsequently used to identify which variables could best discriminate between two draft groups in each playing position. The significance level was set at $p < 0.05$. The drafted players from five positions outperformed the undrafted in height, wingspan, vertical jump height and reach, line agility and three-quarter sprint test ($p < 0.01$, ES = 0.26–0.87). The discriminant functions for each position ($p < 0.001$, 3 = 0.81–0.83) were emphasized by specific variables that discriminated both draft groups. The findings revealed that in addition to height and wing span, leg power served as key determinants for being drafted as guards, as did agility and speed for power forwards and centers.

Key game indicators in NBA players' performance profiles. Kinesiology. 51: 92-101, 2019.

Abstract: The aim of the present study was to identify and describe players' performances in NBA games using individual and team-based game variables. The sample was composed of 535 balanced games (score differences below or equal to eight points) from the regular season (n=502) and the playoffs (n=33). A total of 472 players were analyzed. The individual-based variables were: minutes on court, effective field-goal percentage, free-throws/field-goals ratio, offensive rebound percentage, turnover percentage and playing position. The team-based variables were: team points minus opponent's points (on and off court), NET score (player's on values minus his off values), maximum negative and positive point difference, team's winning percentage, game pace, defensive and offensive ratings. A two-step cluster analysis was performed to identify player's profiles during regular season and playoff games. The results identified five performance profiles during regular season games and four performance profiles during playoff games. The profiles identified were mainly characterized by the game quarter and the negative NET indicator (players' performance on court minus their performance off court) in the regular season games and the positive NET indicator during the playoff games and the second and third game-quarters. Coaching staffs can fine-tune these profiles to develop more team-specific models and, conversely, use the results to monitor and rebuild team formation under the constrained dynamics of the game and competition stages.

Momentum effects in the NBA: Exploiting the fine line between winning and losing. SSRN: 1-31, 2019.

Abstract: Competition in the National Basketball Association takes on two formats in a single season. This provides a pair of fronts on which to test the existence of momentum effects, which have been analyzed extensively in finance and sports. We assess whether a team that wins a match has a higher probability of winning the next match. Since winning is endogenous, we identify the causal effect of winning a game using a regression discontinuity design with NBA data from 1950 to 2018. Like other recent studies, we find evidence of a positive momentum effect of approximately 4 percentage points in the regular season. In contrast, we find a negative momentum effect of approximately 18 percentage points for the playoffs. We argue that the tournament design of the playoffs theoretically provides a better set-up to estimate the momentum effect because opponents match up consecutively and repeatedly (allowing us to better control for unobserved factors such as team strength, home-court advantage, and rest time), and that the two parts of the NBA season are not comparable because the incentives of teams and the league shift during the playoffs. Our findings highlight the importance of defining both the nature and domain of momentum, and that, even within a sports league, the existence of momentum depends on context.

NBA player outcomes following the implementation of the One-And-Done Rule: Do top players really benefit from attending college first? Journal of Sports Economics and Management. 8(3): 137-149, 2018.

ABSTRACT: Following the NBA's 2006 'one-and-done' rule, players have to be at least one year out of high school before being eligible for the annual draft. This study finds that, whereas an array of NBA player performance measures, often referred to as 'advanced statistics,' are strongly significant in explaining both minutes per game and draft order, there is no support for any additional impact on playing time associated with college basketball experience. Although those attending a top college basketball program do appear to get an extra boost in draft order, even after controlling for performance, there is otherwise no evidence that attending college confers any significant advantage for the players themselves.

NBA team home advantage: Identifying key factors using an artificial neural network. PLOS One: 1-9, 2019.

Abstract: What determines a team's home advantage, and why does it change with time? Is it something about the rowdiness of the hometown crowd? Is it something about the location of the team? Or is it something about the team itself, the quality of the team or the styles it may or may not play? To answer these questions, season performance statistics were downloaded for all NBA teams across 32 seasons (83–84 to 17–18). Data were also obtained for other potential influences identified in the literature including: stadium attendance, altitude, and team market size. Using an artificial neural network, a team's home advantage was diagnosed using team performance statistics only. Attendance, altitude, and market size were unsuccessful at improving this diagnosis. The style of play is a key factor in the home advantage. Teams that make more two point and free-throw shots see larger advantages at home. Given the rise in three-point shooting in recent years, this finding partially explains the gradual decline in home advantage observed across the league over time.

Performance and return to sport after hip arthroscopy in the National Basketball Association. Arthroscopy: The Journal of Arthroscopic and Related Surgery. Ahead Print: 1-6, 2019.

Purpose: To determine: (1) return to sport (RTS) rate in National Basketball Association (NBA) players following hip arthroscopy, (2) postoperative career length and games per season, (3) pre- and postoperative performance, and (4) postoperative performance compared with control players.

Methods: NBA athletes who underwent hip arthroscopy and matched controls were identified. RTS was defined as playing in at least 1 game after surgery. Player efficiency ratings were used for performance evaluation. Continuous variables of each group were compared using a 2-tailed paired samples Student t test for normally distributed data. c2 was used to analyze categorical data. RTS was used as the primary outcome with statistical significance defined by a P value < .05. A Bonferroni correction was used to control for the remaining multiple comparisons with statistical significance defined by a P value ≤ .008.

Results: Twenty-three players (24 hips) were analyzed (mean age 27.5   3.1 years; mean experience in the NBA 5.8   2.8 years at time of surgery). Small forwards (n = 8, 33.3%) represented the largest proportion of players that underwent hip arthroscopy. Twenty players (21 surgeries, 87.5%) were able to RTS in NBA at an average of 5.7 ± 2.6 months. The overall 1-year NBA career survival rate of players undergoing hip arthroscopy was 79.2%. Players in the control group (5.2 ± 3.5 years) had a similar career length as (P = .068) players who underwent surgery (4.4 ± 3.0 years). There was no significant (P = .045) decrease in games per season following surgery. There was no significant difference in performance postoperatively compared with preoperatively (P = .017) and compared with matched controls following surgery (P = .570).

Conclusions: The RTS rate for NBA athletes after hip arthroscopy is high. There was no decrease in games played, career lengths, or performance following hip arthroscopy in NBA players versus preoperatively and matched controls.

Return to play and performance after shoulder instability in National Basketball Association athletes. Journal of Shoulder and Elbow Surgery. 29: 50-57, 2020.

Hypothesis: We hypothesized that players in the National Basketball Association (NBA) who sustained a shoulder destabilizing injury could return to play (RTP) successfully at a high rate regardless of treatment type.

Methods: We used publicly available data to identify and evaluate 50 players who sustained an in-season shoulder instability event (subluxation/dislocation) while playing in the NBA. Demographic variables, return to NBA gameplay, incidence of surgery, time to RTP, recurrent instability events, and player efficiency rating (PER) were collected. Overall RTP was determined, and players were compared by type of injury and mode of treatment.

Results: All players (50/50) returned to game play after sustaining a shoulder instability event. In those treated nonoperatively, athletes who sustained shoulder subluxations returned after an average of 3.6 weeks, compared with 7.6 weeks in those who sustained a shoulder dislocation (P = .037). Players who underwent operative management returned after an average of 19 weeks. Athletes treated operatively were found to have a longer time interval between a recurrent instability event (70 weeks vs. 28.5 weeks, P = .001).

Conclusion: We found 100% rate of RTP after a shoulder instability event in an NBA athlete. Players who experience shoulder dislocations were found to miss more time before RTP and were more likely to undergo surgical intervention compared with those who experienced a subluxation. Surgical repair maintained a longer interval between recurrent instability. Future investigations should aim to evaluate outcomes on surgical procedures and identify possible risk factors predictive of recurrent instability or failure to RTP.

Sports Science Research Update

The effect of Superstars on game attendance: Evidence from the NBA. Journal of Sports Economics. 21(2): 152-175, 2020.

Abstract: Economic models predict that "superstar" players generate externalities that increase attendance and other revenue sources beyond their individual contributions to team success. We investigate the effect of superstar players on individual game attendance at National Basketball Association games from 1981-1982 through 2013-2014. Regression models control for censoring due to sellouts, quality of teams, unobservable team/season heterogeneity, and expected game outcomes. The results show higher home and away attendance associated with some superstar players. Michael Jordan generated the largest superstar attendance externality, generating an additional 4,837/4,236 fans at home/away games.

Sports Science Research Update

Using in-game shot trajectories to better understand defensive impact in the NBA. arXiv:1905.00822. 1-14, 2019.

Abstract: As 3-point shooting in the NBA continues to increase, the importance of perimeter defense has never been greater. Perimeter defenders are often evaluated by their ability to tightly contest shots, but how exactly does contesting a jump shot cause a decrease in expected shooting percentage, and can we use this insight to better assess perimeter defender ability? In this paper we analyze over 50,000 shot trajectories from the NBA to explain why, in terms of impact on shot trajectories, shooters tend to miss more when tightly contested. We present a variety of results derived from this shot trajectory data. Additionally, pairing trajectory data with features such as defender height, distance, and contest angle, we are able to evaluate not just perimeter defenders, but also shooters' resilience to defensive pressure. Utilizing shot trajectories and corresponding modeled shot-make probabilities, we are able to create perimeter defensive metrics that are more accurate and less variable than traditional metrics like opponent field goal percentage.

Sports Science Research Update

Visual fixation in NBA free throws and the relationship to on-court performance.
Journal of Sports and Performance Vision. 2(1): 1-7, 2020.

Purpose: Although hitting a baseball is often described as the most difficult task in all of sports, shooting baskets during a game likely ranks a close second. Previous studies have described the role of vision in basketball and more specifically a concept termed the "quiet eye" is related to basketball performance. How a shooter visualizes the target, how consistent their visual fixation is, and how long they maintain that fixation has been correlated to shooting success. Although the majority of previous reports have included non-professional basketball shooters, we evaluated NBA (National Basketball Association) players to determine if this skill was significant at the professional level.

Materials and Methods: We evaluated 16 professional NBA players before to the 2018-2019 NBA season. All players shot 30 consecutive free-throws while wearing Tobii Pro eye-tracking glasses. Following the completion of the task, several metrics were calculated including shooting success rate, as well as four measures of the position and duration of ocular fixation just prior to, during, and immediately after ball release for each shot of each player. Additionally, player performance statistics from the 2018-2019 season were recorded and compared to the visual fixation data. Descriptive statistics, as well as correlations between the visual fixation metrics and on-court performance metrics, were calculated.

Results: NBA shooters averaged a 79% success rate in free throw (FT%) shooting (SD = 14%, min = 56%, max=100%) during the study. Moderate statistically significant correlations were found between the percentage of successful free throws and the four measures of visual fixation (r=0.539 to 0.687). In addition, visual fixation measures were found to be correlated with on-court metrics suggesting that shooters who had more frequent, as well as longer, fixations on the rim were more likely to have lower Usage Percentage Visual Fixation in NBA free-throws and the Relationship to On-Court Performance (USG%), and Offensive Rebound Percentage (ORB%) as well as higher Three-Point Field Goal Percentage (FG3%). The percentage of successful shots in the study was compared to the on-court FT% and found to be moderately correlated (r=0.536).

Sports Science Research Update

Conclusions: The need to maintain ocular fixation on the rim while shooting seems elementary, but varies greatly among NBA players, as noted in these results. Our data suggest that players who visually fixate longer and more frequently on the rim are more likely to be successful in free throws, as well as more successful in 3-point goals, but less successful in offensive rebounds. The reduced offensive rebound percentage is possibly related to their being more distant from the basket when attempting 3-point goals. This data set appears to describe basketball guards in contrast to forwards/centers and supports previous research on non-professional basketball players