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Epidemiology of injuries in British basketball: a retrospective cross-sectional study

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ABSTRACT

Objectives To describe injury epidemiology in British basketball, assess sex-based differences and injury risk factors.

Methods 122 athletes from British basketball leagues and national teams completed an online questionnaire collecting demographic, sporting and injury data from the 2021/2022 season. A medical-attention and 24-hour time-loss injury definition was used. Injury incidence rate (IIR) (injuries/1000 athlete-exposure (AE) hours) was calculated as (number of injuries/season AE-hours)×1000. Mann-Whitney tests assessed sex differences in IIRs. X^2 tests assessed sex differences in injury proportions. Linear regression assessed relationships between IIR and reported risk factors.

Results 46 men and 76 women (median age (IQR): 23.0 years (19.0–26.0)) reported 140 injuries. Median IIR was 2.1 injuries/1000 AE-hours (IQR: 0.0–3.5). Lower limb injuries were most common (70.7%), specifically ankle (32.9%) and knee (25.7%). No significant sex differences were noted in injury site, type, mechanism, timing or severity. Higher IIR was associated with advancing age (B=0.182, 95% CI: 0.038 to 0.325, p=0.014), increased weight (B=0.140, 95% CI: 0.071 to 0.210, p≤0.001), female sex (B=2.214, 95% CI: 0.424 to 4.003, p=0.016), comorbidities (B=2.782, 95% CI: 0.967 to 4.598, p=0.003) and 1–3 years of elite experience (B=2.950, 95% CI: 1.561 to 4.340, p≤0.001 vs 3–8 years). Guards (B=4.996, 95% CI: 3.603 to 6.389, p≤0.001) and forwards (B=3.180, 95% CI: 1.627 to 4.732, p≤0.001) were associated with higher IIR than centres.

Conclusion Lower limb injuries were most common. IIR was positively associated with age, weight, female sex, comorbidities and 1–3 years of elite experience. Guards and forwards had the strongest associations compared with centres. Findings may inform targeted injury prevention strategies. Future research should prospectively assess injury risk.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Epidemiological studies exploring injury incidence and severity are regarded as a fundamental step in the development of targeted, evidence-based prevention programmes.
⇒ Current injury epidemiology research in basketball predominantly focusses on the North American leagues.
⇒ Despite growth in the women's game, research remains male dominated, as such, little is known regarding sex-based differences and the factors associated with injury occurrence.
⇒ Previous studies within British basketball have been limited to specific male-only populations, namely academy athletes or the Great Britain men's national team.
⇒ No published studies have examined injury epidemiology among athletes in the top British basketball leagues, nor among female athletes in the British leagues or national teams.

INTRODUCTION

Basketball is the second most played team sport in Great Britain, with over one million people participating monthly.[1] Professional basketball is a high-intensity sport that demands a combination of speed, agility, change of direction and endurance, which places athletes at significant injury risk.[2 3] The physical demands can adversely impact player health, performance and career longevity.[4–6] While evidence suggests that basketball injuries are preventable,[7] the development of effective prevention programmes requires a clear understanding of injury burden through robust epidemiological studies.[8 9]

To date, research on professional basketball has predominantly focused on North America,[10 11] with injuries sustained in the British leagues remaining unreported. While a recent study presented a six-season overview of injuries sustained in the Great Britain men's basketball team, many of the players were likely not domestically based.[12] A retrospective six-season cohort study comparing Women's NBA (WNBA) and NBA athletes identified a significantly higher game injury rate among WNBA players (24.9 per 1000 athlete-exposures (AE) vs 19.3 per 1000 AE; p<0.05),[10] with most injuries affecting the

WHAT THIS STUDY ADDS

⇒ This study provides the most comprehensive overview of injury epidemiology in British basketball to date. It is the first to include athletes from the British leagues and also the first to include female players (62% of the sample).
⇒ Lower limb injuries were most common (71%), specifically ankle (33%) and knee (26%).
⇒ Multiple linear regression revealed that advanced age, increased weight, female sex and the presence of medical comorbidities were associated with higher injury rates.
⇒ Guard and forward positions were strongly associated with higher injury rates compared with centre positions. Guards had the strongest association, possibly due to their high-speed, extensive court coverage.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study provides an inaugural overview of injury epidemiology in players from the British basketball leagues and national teams, assessing for sex differences and factors associated with injury occurrence. Future studies would benefit from consulting athletes medical records, ensuring a sex-balanced sample and employing a prospective design spanning multiple seasons. Ideally incorporating workload and performance data to investigate differences in preparation, participation and injury incidence.
⇒ Additionally, future studies should, as in our study, adopt standardised definitions of injury rate and methodologies recommended by the International Olympic Committee consensus statement which would facilitate valid cross-study comparisons.
⇒ Our study's finding that female sex was positively associated with higher injury rates emphasises a need for research into why female athletes are at higher injury risk. Follow-up could include a sex-based approach to injury surveillance to better understand how social and cultural factors, alongside biological differences, influence injury surveillance.
⇒ Athletes with 1–3 years of elite experience had higher injury rates. Coaches and medical staff should closely monitor this group and provide tailored support.

lower limb (65% of cases), predominantly the knee (20.3%) and ankle (16.2%).[10] Similarly, an integrative review of 11 studies across the USA, Nigeria, Brazil and France, identified lower limb injuries as the most common (63.7%) among male and female basketball athletes at a variety of age and skill levels; but ankle injuries (21.9%) predominated over knee injuries (17.8%).

Most studies have overlooked sex-specific trends. Lian *et al*[11] conducted a systematic review of 49 studies reporting injury incidence in the NBA and WNBA; however, only four of the studies investigated injuries among WNBA athletes, and no two studies investigated the same injury pattern, preventing a synthesis. This highlights the scarcity of injury epidemiology research among female basketball athletes and explains why little is known regarding sex disparities at the professional level. Both Lian *et al*[11] and Andreoli *et al*[13] identified inconsistent reporting of injury incidence and frequent use of indirect comparisons across the literature. The authors recommended a standardised calculation of injuries per 1000 AE-hours, in line with the recent IOC consensus recommendation on reporting of sports injury rate to allow comparison of injury burden among studies.[9] Furthermore, Andreoli *et al*[13] called for more epidemiological data to better understand the injury burden in basketball and validate preventative interventions.

British basketball is distinct from its North American counterpart, with longer preseasons, shorter game quarters, smaller courts and less frequent time-outs, which may uniquely influence injury epidemiology and thus limit generalisability.[14] Despite these differences, injury data from British basketball remain scarce with prior studies limited to male-only populations, such as academy athletes or the Great Britain men's national team.[12 15] Addressing these gaps is critical for informing evidence-based injury prevention strategies tailored to this population.

Positional risk factors also warrant attention. Basketball teams consist of five on-court players, typically divided into guard, forward and centre positions. Studies of FC Barcelona and NBA athletes both reported that injury rates are highest among guards, followed by forwards then centres.[16 17] Identified risk factors for guards include age, height, weight and training duration, while across all positions, heavier athletes are reported to sustain more injuries than lighter counterparts.[18] Contact mechanisms are a major contributor to injury and accounted for 61% of anterior cruciate ligament injuries in European men's professional leagues[19] as well as the majority of ankle sprains (67.6%) and other acute injuries (69.7%) in senior Dutch men's and women's basketball.[20] The Dutch study also noted that contact with an opponent was significantly more common than any other injury mechanism.

In the 2021/2022 season, the top-tier men's and women's leagues in Britain were the British Basketball League (BBL) and the Women's BBL (WBBL), respectively. These leagues represented the highest level of basketball in Britain, featuring teams composed of both professional and semiprofessional athletes. Beneath them, the National Basketball League (NBL) and Women's NBL (WNBL) operated multiple divisions across England and Wales, forming semiprofessional to amateur tiers of competition. In Scotland, the Scottish National League provided a parallel competitive structure for both men's and women's teams.

This study aims to provide an overview of injury epidemiology among athletes in the British basketball leagues and national teams during the 2021/2022 season. It also aims to compare injury incidence between male and female athletes and identify factors associated with injury occurrence. By using standardised methods of reporting injury epidemiology, this study seeks to inform future research and support the development of targeted injury prevention strategies within British basketball.

METHODS

Study design and participants

This online questionnaire-based, cross-sectional study included athletes aged≥16 years old who were squad members in the BBL, WBBL, NBL, WNBL, Scottish National League or a UK-based national team (England, Northern Ireland, Scotland, Wales or Great Britain) during the 2021/2022 season. Athletes were excluded if they were under 16 years old or not part of one of the specified leagues or national teams during the 2021/2022 season.

Participants were recruited via email advertisement to 'Basketball England' members and Twitter/Instagram direct messaging between 31 May 2022 and 31 July 2022 after being identified from online player databases. Of the 149 athletes who expressed interest, 26 did not meet the inclusion criteria (7 were <16 years old, 18 were not competing at the required level and 1 athlete did not provide all necessary information). One further athlete did not report match play exposure, preventing injury rate calculation. Therefore, 122 athletes (46 men, 76 women) were included in the analysis.

An information sheet (online supplemental file 1) was embedded at the start of the questionnaire, and participants provided informed consent via a tick box. Participants were encouraged to consult their training logs and medical documents when completing the questionnaire to help with the validity of responses. Reminder messages were sent at 2-week intervals to maximise response rate.

Procedures

The self-administered injury questionnaire (online supplemental file 2) was adapted from the validated National Collegiate Athletics Association Injury Surveillance System (NCAA ISS)[21] and was hosted by 'online surveys' between 31 May 2022 and 31 July 2022. Modifications were made to tailor the questionnaire for a retrospective, self-report design and to reflect the context of British professional basketball. These included adding UK-specific competition levels (eg, BBL, WBBL, NBL) and incorporating questions on training and match-play hours to enable exposure calculation. The changes aimed to maintain the validated structure of the original tool while improving contextual relevance and recall accuracy.

The anonymous questionnaire contained three sections providing demographic, sporting and injury data. Demographic data included age (years), sex (male, female, non-binary and prefer not to say), height (cm) and weight (kg). Sporting data included competition level (BBL, WBBL, NBL Division 1–3, WNBL Division 1–2, Scottish National League or UK-based national team) and training and playing loads (hours/week). Injury data included injury number, anatomical site (head, nose, shoulder, clavicle, wrist, hand, thumb, fingers, upper back, lower back, spine, pelvis/hip/groin, upper leg, knee, lower leg, ankle, heel/Achilles' tendon, foot or toes), type (bruise/haemorrhage, bursitis, tendinopathy, ligamentous sprain, muscle/tendon strain, cartilage tear, dislocation, fracture, stress fracture, concussion, inflammation, nerve injury or disc herniation), mechanism (injured player coming down on another player, another player coming down on injured player, other contact with another player, contact with floor, contact with ball, contact with out-of-bounds apparatus or no apparent contact), timing (match play or training/recreation), position (centre, guard or forward) and time-loss from participation (days).

Injury definition and severity

A 24-hour time-loss and medical-attention injury definition was used as per the IOC consensus recommendations.[9] Injury was defined as one that:

1. Occurred during organised professional-level basketball training or competition.
2. Required medical attention by a team physiotherapist/doctor/sports therapist.
3. Resulted in participation restriction for ≥1 day beyond the day of injury.

The severity of injury was defined according to NCAA ISS using time-loss from full participation in training and competition (1–2 days, 3–6 days, 7–9 days, 10+ days).[22]

Calculation of AE and injury incidence rate (IIR)

To assess training and match exposure, athletes were asked to report their typical weekly match play and training hours. Where exposure was given as a range, the median value was used for the calculation. Where exposure was given as a minimum value and above, the stated minimum value was used, for example, for 15+ hours/week, the value of 15 hours was used.

Individual weekly AE was calculated by totalling reported match play and training hours/week. Season AE (AE-hours) was calculated as: weekly exposure hours × length of season. Online supplemental appendix table 1 summarises the season lengths for each competition level.[23–25] Season lengths account for a 6-week preseason as recommended by Basketball England.[26]

IIR (injuries/1000 AE-hours) was calculated for each athlete using the formula (number of injuries/season AE-hours)×1000, following IOC recommendations.[9]

Analysis of data

Data were analysed using IBM's SPSS Statistics V.27. Non-parametric data were presented as medians and IQR. Frequency data were presented as numbers and percentages. Sex-based differences in IIR (injuries/1000 AE-hours) were analysed by Mann-Whitney tests. Sex-based differences in the proportion of the various types of injuries were determined using χ^2 and, where appropriate, Fisher's exact test. Simple and multiple linear regression analyses were used to assess the relationship between IIR and the following reported risk factors for injury: age (years), height (cm), weight (kg), sex, comorbidities, elite basketball experience (<1, 1–3,

Table 1 Participant characteristics

	All athletes (n=122)	Men (n=46)	Women (n=76)
Age (years), median (IQR)	23.0 (19.0–26.0)	23.0 (18.8–28.3)	23.0 (19.0–26.0)
Height (cm), median (IQR)	180.7 (170.2–190.6)	193.0 (187.8–198.0)	174.0 (167.6–180.3)
Weight (kg), median (IQR)	77.0 (68.0–89.5)	90.4 (82.8–98.0)	69.0 (61.0–77.0)
Elite experience, n (%)			
<1 year	8 (6.6)	2 (4.3)	6 (7.9)
1–3 years	33 (27.0)	11 (23.9)	22 (28.9)
3–8 years	48 (39.3)	20 (43.5)	28 (36.8)
≥9 years	33 (27.0)	13 (28.3)	20 (26.3)
Competition level, n (%)			
BBL/WBBL	43 (35.2)	8 (17.4)	35 (46.1)
NBL/WNBL Division 1	47 (38.5)	23 (50.0)	24 (31.6)
NBL/WNBL Division 2	17 (13.9)	9 (19.6)	8 (10.5)
NBL Division 3	2 (1.6)	2 (4.3)	
Men's/Women's Senior National team	12 (9.8)	4 (8.7)	8 (10.5)
Scottish National League	1 (0.8)	1 (0.0)	1 (1.3)

Injuries/1000 AE-hours=injuries per 1000 AE-hours. Continuous data are presented as median (IQR). Categorical data are presented as number of athletes, n (percentage of athletes, %).
AE, athlete exposure; BBL, British Basketball League; NBL, National Basketball League; WBBL, Women's British Basketball League; WNBL, Women's National Basketball League.

3–8, ≥9 years), competition level (BBL, WBBL, NBL Division 1–3, WNBL Division 1–2, Scottish National League or UK-based national team) and player position. Confounder selection was based on a review of current models examining injury risk factors.[27–29] Statistical significance was set at p<0.05.

RESULTS

Participant characteristics

Overall, 122 athletes (median age (IQR): 23.0 years (19.0–26.0 years)) were included in the analysis (38% men, 62% women) with 66.3% of athletes having ≥3 years elite basketball experience (table 1). Participants represented eight leagues and two national teams.

Number of injuries, AE and IIR

A total of 90 athletes (73.8%) reported 140 injuries, including 34 men (73.9%) and 56women (73.7%) reporting at least 1 injury (online supplemental appendix table 2).

Overall, 68627.2 AE-hours (51035.5 training and 17591.7 match play hours) were reported by 122 athletes. The median IIR was 2.1 injuries/1000 AE-hours (IQR: 0.0–3.5), with no significant sex-based differences (men: 1.9 injuries/1000 AE-hours (0.0–3.3; women: 2.2 injuries/1000 AE-hours (0.0–3.6), U=1665.0, p=0.658) (table 2).

Table 2 AE and IIR stratified by sex

	All athletes (n=122)	Men (n=46)	Women (n=76)
AE-hours, median (IQR)	494.1 (351.4–721.9)	619.9 (375.7–838.4)*	492.0 (349.3–669.8)*
Training hours, median (IQR)	352.9 (225.4–533.6)	450.8 (240.1–700.0)	351.4 (211.7–527.1)
Match play hours, median (IQR)	112.7 (70.6–145.7)	112.7 (72.9–212.1)	105.9 (70.3–141.2)
IIR (injuries/1000 AE-hours), median (IQR)	2.1 (0.0–3.5)	1.9 (0.0–3.3)	2.2 (0.0–3.6)

Values are expressed as median (IQR).
*A significant difference between values. (U=1318.0, p=0.022, with Mann-Whitney U test).
AE, athlete exposure; IIR, injury incidence rate.

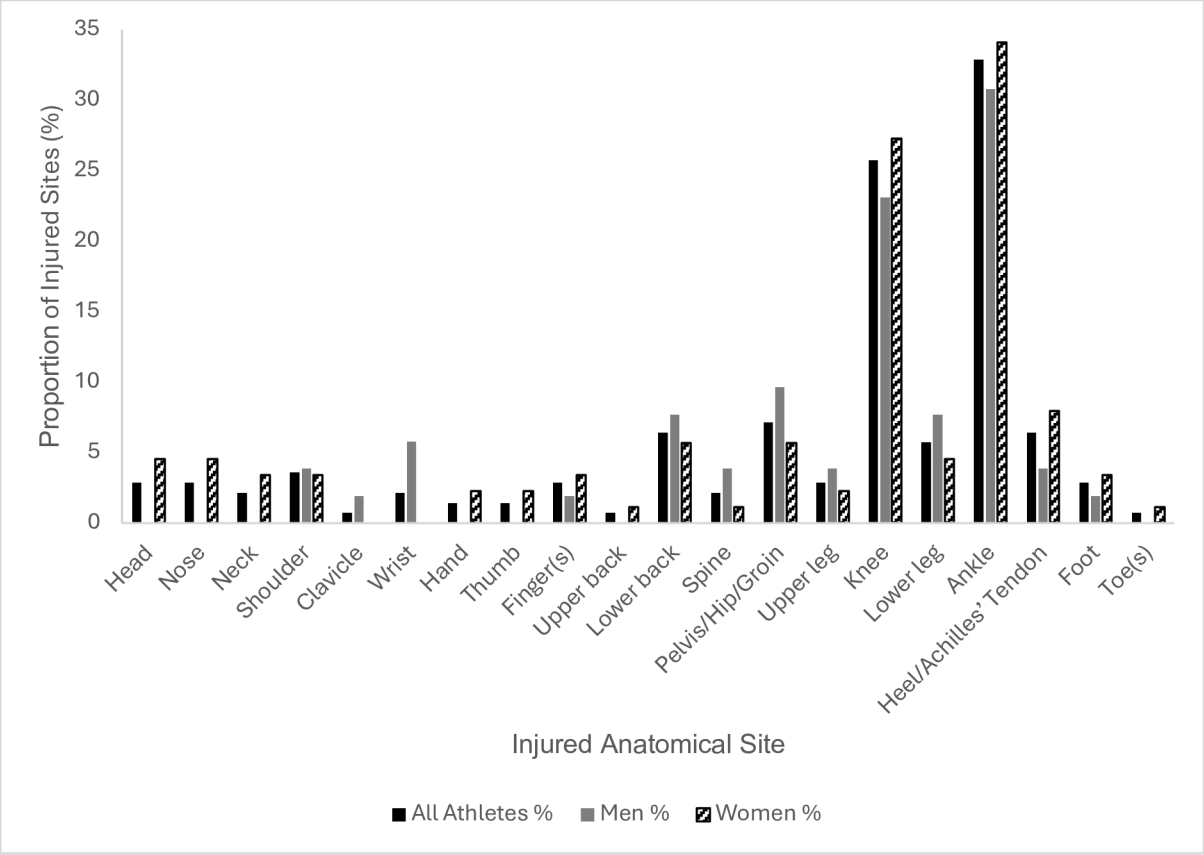

Figure 1 Anatomical site of injuries sustained throughout the 2021/2022 basketball season stratified by sex. Values are expressed as percentages (%) of the total number of injuries.

Injuries by anatomical site

Injuries most frequently affected the ankle (32.9%) and knee (25.7%) (figure 1), with the ankle the most injured site for both men (30.7%, n=16) and women (34.1%, n=30), followed by the knee (23.1%, n=12 and 27.3%, n=24). Ankle IIR was statistically the same for men (1.8 injuries/1000 AE-hours (1.3–3.7 injuries/1000 AE-hours)) and women (2.0 injuries/1000 AE-hours (1.5–3.5 injuries/1000 AE-hours)), U (N_{male}=16, N_{female}=30)=217.0, z=−0.531, p=0.596. Similarly, there was no significant difference in knee IIR between men (1.5 injuries/1000 AE-hours (1.1–2.2 injuries/1000 AE-hours)) and women (2.0 injuries/1000 AE-hours (1.6–3.2 injuries/1000 AE-hours)), U (N_{male}=12, N_{female}=24)=89.0, z=−1.847, p=0.067.

The next most injured sites were the pelvis/hip/groin region (7.1%, n=10) and the lower back (6.4%, n=9). There were no statistically significant sex-based differences in injury site.

Injury type

The most common injury types were ligamentous sprains (46.2% in men, 41.0% in women) and muscle/tendon strains (13.5% of men, 17.1% of women). Most ankle (80.5%) and knee (41.7%) injuries were ligamentous (table 3).

Mechanism of injury

Contact injuries (63.6%) were more common than non-contact injuries (34.3%), also observed in men (55.8% vs 40.4%) and women (68.2% vs 30.7%) (table 4). Contact with another player accounted for 42.9% of injuries.

Timing of injury

Most injuries were training/recreational (52.9%) rather than match-play (45.0%) injuries (online supplemental appendix table 3). There was no significant difference between match-play and training/recreational IIR (U=2328.5, p=0.991). Match-play IIR was slightly higher (2.0 injuries/1000 AE-hours (1.4–3.2 injuries/1000 AE-hours)) than training/recreational IIR (1.8 injuries/1000 AE-hours (1.3–2.7 injuries/1000 AE-hours)). Although not statistically significant, women had higher training/recreational (U=533.0, p=0.254) and match-play (U=364.0, p=0.141) IIR compared with men.

Severity of injury

Over half of injuries (54.3%, n=76) required ≥10 days' time-loss (online supplemental appendix table 4). Though not statistically significant, men reported more injuries requiring ≥10 days' time-loss (63.5%) than women (48.9%) (X^2 (1, n=140)=2.807, p=0.094).

Table 3 Frequency and proportion of injuries by injury type categorised according to sex and anatomical site

	Sex			Anatomical site		
	Men	Women	All athletes	Ankle	Knee	Pelvis/hip/groin
Bruise/haemorrhage	4 (7.7%)	2 (2.3%)	6 (4.3%)	1 (2.2%)	1 (2.8%)	1 (10%)
Bursitis	1 (1.9%)	0 (0.0%)	1 (0.7%)		1 (2.8%)	
Tendinopathy	5 (9.6%)	12 (13.6%)	17 (12.1%)		10 (27.8%)	
Ligamentous sprain—incomplete tear	21 (40.4%)	29 (33.0%)	50 (35.7%)	32 (69.6%)	10 (27.8%)	1 (10%)
Ligamentous sprain—complete tear	3 (5.8%)	7 (8.0%)	10 (7.1%)	5 (10.9%)	5 (13.9%	
Muscle/tendon strain—incomplete tear	7 (13.5%)	13 (14.8%)	20 (14.3%)	1 (2.2%)	2 (5.6%)	5 (50%)
Muscle/tendon strain—complete tear	0 (0.0%)	2 (2.3%)	2 (1.4%)	1 (2.2%)		
Cartilage tear	1 (1.9%)	2 (2.3%)	3 (2.1%)		2 (5.6%)	1 (10%)
Dislocation	1 (1.9%)	2 (2.3%)	3 (2.1%)		2 (5.6%)	
Fracture	2 (3.8%)	7 (8.0%)	9 (6.4%)	3 (6.5%)		
Stress fracture	1 (1.9%)	1 (1.1%)	2 (1.4%)	1 (2.2%)		
Concussion	0 (0.0%)	3 (3.4%)	3 (2.1%)			
Inflammation	2 (3.8%)	3 (3.4%)	5 (3.6%)		1 (2.8%)	1 (10%)
Nerve injury	1 (1.9%)	2 (2.3%)	3 (2.1%)			
Unknown	1 (1.9%)	3 (3.4%)	4 (2.9%)	2 (4.3%)	2 (5.6%)	1 (10%)
Disc herniation	2 (3.8%)	0 (0.0%)	2 (1.4%)			

Values are expressed as number of injuries and percentages of total injuries for that category (%).

Multiple linear regression

The selected variables were significantly associated with higher IIR F(16, 154)=6.468, p<0.001, explaining 40.2% of the variance in IIR (R^2=0.402) (table 5). In the adjusted model, higher IIR was associated with advancing age (B=0.182, 95% CI: 0.038 to 0.325, p=0.014), increased weight (B=0.140, 95% CI: 0.071 to 0.210, p≤0.001), female sex (B=2.214, 95% CI: 0.424 to 4.003, p=0.016) and the presence of comorbidities (B=2.782, 95% CI: 0.967 to 4.598, p=0.003). Having 1–3 years of elite experience compared with 3–8 years was also positively associated with IIR (B=2.950, 95% CI: 1.561 to 4.340, p≤0.001). Lastly, guards (B=4.996, 95% CI: 3.603 to 6.389, p≤0.001) and forwards (B=3.180, 95% CI: 1.627 to 4.732, p≤0.001) were associated with higher IIR compared with centre positions.

DISCUSSION

This study analysed injury patterns among players in the British basketball leagues and national teams during the 2021/2022 season, examining sex differences and factors associated with injury occurrence. Among 122 athletes, 140 injuries occurred, affecting 73.8% of participants (73.9% of men, 73.7% of women). Minor sex-based differences in IIR, site, mechanism and severity were observed, but lacked statistical significance. Multiple linear regression revealed higher IIRs associated with advancing age,

Table 4 Frequency and proportions of injuries by injury mechanism stratified by sex and anatomical site

	Sex			Anatomical site		
Mechanism	Men	Women	All athletes	Ankle	Knee	Pelvis/hip/groin
Injured player coming down on another player	8 (15.4%)	12 (13.6%)	20 (14.3%)	17 (37.0%)	2 (5.6%)	
Another player coming down on injured player	3 (5.8%)	8 (9.1%)	11 (7.9%)	4 (8.7%)	2 (5.6%)	
Other contact with another player	10 (19.2%)	19 (21.6%)	29 (20.7%)	7 (15.2%)	8 (22.2%)	1 (10.0%)
Contact with floor	7 (13.5%)	19 (21.6%)	26 (18.6%)	8 (17.4%)	11 (30.6%)	1 (10.0%)
Contact with ball	1 (1.9%)	1 (1.1%)	2 (1.4%)	1 (2.2%)		
Contact with out-of-bounds apparatus (eg, tables, seating, cameras)	0 (0.0%)	1 (1.1%)	1 (0.7%)			
No apparent contact	21 (40.4%)	27 (30.7%)	48 (34.3%)	8 (17.4%)	13 (36.1%)	8 (80.0%)
Unknown	2 (3.8%)	1 (1.1%)	3 (2.1%)	1 (2.2%)		

Values are expressed as number of injuries and percentages of total injuries for that category (%).

Table 5 Simple and multiple linear regression model of factors associated with IIR

	Unadjusted B coefficient (95% CI)	P value	Adjusted B coefficient (95% CI)	P value
Age (years)	0.149 (0.012 to 0.286)	0.033	0.182 (0.038 to 0.325)	0.014
Height (cm)	−0.036 (−0.090 to 0.018)	0.187	−0.088 (−0.196 to 0.020)	0.108
Weight (kg)	0.013 (−0.030 to 0.055)	0.556	0.140 (0.071 to 0.210)	<0.001
Sex (female)	1.262 (−0.026 to 2.551)	0.055	2.214 (0.424 to 4.003)	0.016
Presence of comorbidities	3.256 (1.260 to 5.253)	0.002	2.782 (0.967 to 4.598)	0.003
Experience in elite basketball				
<1 year	−0.627 (−3.093 to 1.839)	0.616	−1.117 (−3.289 to 1.055)	0.311
1–3 years	1.886 (0.328 to 3.444)	0.018	2.950 (1.561 to 4.340)	<0.001
3–8 years	Reference		Reference	
≥9 years	0.576 (−0.982 to 2.134)	0.466	−0.228 (−1.672 to 1.217)	0.756
Competition level				
BBL/WBBL	Reference		Reference	
NBL/WNBL Division 1	0.150 (−1.328 to 1.628)	0.841	0.845 (−0.450 to 2.140)	0.199
NBL/WNBL Division 2	−0.434 (−2.462 to 1.595)	0.673	1.421 (−0.481 to 3.323)	0.142
NBL Division 3	0.521 (−4.400 to 5.441)	0.835	−0.159 (−2.013 to 1.696)	0.866
Senior National Team	−0.270 (−2.496 to 1.955)	0.811	0.996 (−3.160 to 5.152)	0.637
Scottish National League	−3.713 (−12.105 to 4.680)	0.384	1.988 (−5.033 to 9.008)	0.577
Player position				
Centre	Reference		Reference	
Guard	3.398 (1.998 to 4.798)	<0.001	4.996 (3.603 to 6.389)	<0.001
Forward	2.238 (0.562 to 3.914)	0.009	3.180 (1.627 to 4.732)	<0.001
Unknown	3.038 (−1.591 to 7.667)	0.197	−0.010 (−4.374 to 4.355)	0.997

BBL, British Basketball League; IIR, injury incidence rate; NBL, National Basketball League; WBBL, Women's British Basketball League; WNBL, Women's National Basketball League.

increased weight, female sex, comorbidities, playing position (guards and forwards compared with centres) and having 1–3 years of elite-level experience compared with 3–8 years.

AE and IIR

The median IIR (2.1 injuries/1000 AE-hours (IQR: 0.0–3.5)) was lower than that of other European professional leagues. A prospective six-season study on 61 elite EuroLeague players reported a higher injury rate of 12.59 injuries/1000 player-hours.[30] The discrepancy may be due to their prospective design and a non-time-loss injury definition capturing more trivial injuries. Methodological disparities, including differing IIR calculations, definitions and reporting formats, complicate direct comparisons across studies.[10]

Prior research has reported higher IIRs among female basketball athletes. A single-season retrospective questionnaire-based study of 89 male and 53 female Croatian league athletes reported 2.25 injuries/1000 AE-hours among women and 1.62 injuries/1000 AE-hours among men, with an overall IIR of 1.75 injuries/1000 AE-hours.[31] These rates are consistent with our results of 2.2 injuries/1000 AE-hours among women and 1.9 injuries/1000 AE-hours among men. However, the difference was not statistically significant (p=0.658), possibly due to our single-season sampling frame. A larger, multiseason analysis may be needed to detect consistent sex-based differences in injury risk. Supporting this, a six-season retrospective cohort study found significantly higher game injury rates among 443 WNBA compared with 702 NBA athletes (24.9 per 1000 AE (95% CI: 22.9 to 26.9) vs 19.3 per 1000 AE (95% CI: 18.3 to 20.4); p<0.05).[10] This aligns with our regression finding that female sex is associated with higher IIR (B=2.214, 95% CI: 0.424 to 4.003, p=0.016), though direct comparisons of IIR are limited by their use of AEs rather than AE-hours despite known limitations of the former.[9]

Sex-based differences and influencing factors

The higher injury risk associated with female athletes is likely multifactorial, involving biological and biomechanical factors. Women exhibit greater knee valgus in landing and lateral movement,[32 33] increasing forces on the anterior cruciate ligament and potentially tripling injury risk.[34] Women typically exhibit greater joint flexibility and laxity, which necessitates increased muscle activation to maintain joint stability. This heightened demand on surrounding soft tissues may lead to an increased injury risk.[35 36] Hormonal factors, such as menstrual

cycle-related changes in joint laxity, may further exacerbate these risks, though the link between menstrual phases and injury remains inconclusive.[37 38] Additionally, women have lower collagen synthesis rates and smaller tendon growth responses to training, which could impair recovery and heighten injury risk.[39 40]

Beyond biological factors, societal and cultural influences may also play a role. Female athletes often face disparities in access to elite training facilities, medical resources and recovery support compared with their male counterparts.[41] These inequalities may limit opportunities for and quality of injury prevention and rehabilitation, contributing to the higher IIR associated with female athletes. Conversely, male athletes may be influenced by cultural norms that discourage injury reporting or seeking treatment, leading to potential underreporting.[42] Future studies should explore how these extrinsic factors interact with intrinsic differences to better understand sex-specific injury risks.

Game-specific and positional risk factors

Injury risk in basketball is likely influenced by game-specific and environmental factors, such as playing surfaces, court dimensions and style of play.[43 44] In British basketball, smaller courts and a faster-paced game may lead to more frequent contact and less space for safe landings. These conditions may partly explain the high prevalence of contact injuries observed in our study (63.6%), which exceeds reported proportions among NCAA female (51.9%) and male athletes (60.6%).[45 46] In contrast, analysis from the Men's Great Britain National team identified fewer contact injuries (36% of time-loss injuries).[12] This discrepancy may be explained by differences in the level of competition, player experience and training environments. National team players often have access to more advanced conditioning, injury prevention programmes and medical support, which may reduce the incidence and severity of contact injuries compared with the broader player population captured in our study. Unfortunately, comparable data from the NBA and WNBA were unavailable due to a lack of detailed mechanism reporting, preventing direct comparison with professional American leagues.

Given that participants came from eight leagues and two national teams, variability in access to medical care, training quality and style of play likely influenced injury risk but was not directly measured in our study. Acknowledging these differences is important, as athletes with limited access to physiotherapy, conditioning or structured recovery support may be more vulnerable to injuries. These contextual and structural disparities may also interact with sex-based factors, potentially contributing to the higher injury incidence observed among female athletes.

Guards exhibited the strongest association with IIR in our study (B=4.996, 95% CI: 3.603 to 6.389, p≤0.001). This is likely due to the high biomechanical demands of their role, which require large court coverage at high speeds alongside repeated accelerations, decelerations and rapid directional changes. These actions generate high eccentric loads on the lower limbs and potentially increase soft tissue injuries and joint stress.[47] Forwards were also associated with elevated IIR, likely due to their frequent aerial duels, contact under the basket and repeated jump landing sequences. These findings are supported by NCAA data from the 2014/2015 to 2018/2019 seasons, which reported that guards accounted for the highest proportion of injuries among both male (48.9%) and female (51.4%) athletes, followed by forwards (29.6% and 27.4%) and centres (15.5% and 14.4%).[45 46] Additionally, both guards and forwards may experience higher game intensities and reduced recovery between high-intensity efforts, contributing to neuromuscular fatigue and increased injury susceptibility.[48] These positional differences in injury risk emphasise the importance of tailored prevention strategies, such as agility and deceleration training for guards, and landing mechanics and lower limb strengthening for forwards, to address the specific movement demands and exposure profiles of each role.

Injuries by type and anatomical site

In our study, the most frequently injured sites were the ankle (32.9%) and knee (25.7%), consistent with existing research highlighting the lower limb as the most injury-prone region in basketball. However, the proportion of ankle injuries in our population was notably higher than in some previous studies. For example, NCAA surveillance data reported ankle injuries comprised 22.2% of men's and 19.0% of women's basketball injuries, while knee injuries accounted for 13.0% and 17.3%, respectively.[45 46] Šola and Gregov reported ankle injuries as the most frequent (39%), with knee injuries comprising 15% of cases, a pattern more consistent with our findings.[31] In contrast, Deitch *et al*[10] found that knee injuries were the most common in both the NBA (19.1%) and WNBA (22.5%), followed by ankle injuries (16.9% and 15.0%).

Ligamentous ankle sprains accounted for 80.5% of ankle injuries and 26.4% of all injuries, a prevalence higher than reported in the NBA and WNBA (13.2% and 20% of all injuries, respectively).[3 49] Most ankle injuries were attributed to contact mechanisms, particularly jump-landing on another player. The more crowded game situations in British leagues, due to stylistic differences and smaller court dimensions compared with American leagues, may increase the risk of such contact injuries. Prevention protocols should primarily focus on key strategies such as appropriate workload prescription, structured strength and conditioning, and periodised training.[50] Proprioceptive and balance exercises have also been shown to reduce ankle injury incidence[51 52] and should be incorporated as a complementary component within these programmes.

Both sexes reported ligamentous sprains as the predominant injury type, particularly affecting the ankle and knee (table 3). These findings align with prior research in professional Nigerian basketball, where sprains

accounted for the majority (45.6%) of injuries.[53] The absence of sex-based differences in injury sites suggests that intrinsic and extrinsic factors influencing injury risk may operate similarly across sexes in this context.

Injury timing and severity

In our study, most injuries occurred during training/recreational activity (52.9%) rather than match-play (45.0%), although match-play IIR was marginally higher (2.0 injuries/1000 AE-hours) than training/recreational IIR (1.8 injuries/1000 AE-hours). However, this difference was not statistically significant (U=2328.5, p=0.991). These findings are consistent with previous literature. Drakos *et al* reported that 49.9% of injuries in the NBA were match-related, a proportion closely aligned with our findings.[3] Similarly, a prospective five-season study on English youth basketball found that, while game injury incidence was significantly higher than training incidence (12.0 vs 2.4 per 1000 AE), the proportions of recorded injuries were comparable between settings (37% in games vs 43% in training). The similarity in training and match injury counts may reflect the greater volume of exposure during training compared with games, even if per-hour risk is lower.

Deitch *et al*[10] reported more game-related injuries in WNBA (47% of injuries) compared with NBA (36%) athletes. While Šola and Gregov[31] found female players had nearly double the game injury rate of male players (43.7/1000 hours vs 24.2/1000 hours). Our study also indicated a higher match-play IIR in women (online supplemental appendix table 3), though not statistically significant, likely due to our smaller sample size.

Large proportions of injuries among men (63.5%) and women (48.9%) required ≥10 days' time loss, and this pattern was not sex related. While most studies have not assessed for sex-based differences,[54 55] our finding is consistent with McKay *et al*.[56]

Factors associated with injury occurrence

Advancing age, increased weight, female sex and comorbidities were significantly associated with higher IIR (table 5). Interestingly, elite experience of 1–3 years had a significantly higher likelihood of injury compared with 3–8 years' experience. The effect size increased when adjusting for other variables (B=1.886 (0.328–3.444 to B=3.043 (1.658–4.429), p<0.02). This may reflect insufficient adaptation to the physical and mental demands of high-level basketball during early career stages. Hewett *et al*[57] and Murphy *et al*[58] found that younger athletes often experience physiological changes that impair neuromuscular control, leading to strength imbalances, postural instability, reliance on the dominant leg and unstable landings, which increase the risk of ankle injuries. In contrast, older players may leverage their experience to develop better techniques and injury prevention strategies. Coaches and medical staff should closely monitor athletes in this early career phase to provide tailored support.

Strengths and limitations

This study provides the most comprehensive overview of injury epidemiology in British basketball to date. It is the first to include athletes from the domestic leagues, the first to include female participants and the first to explore sex differences in injury patterns. The questionnaire was modified from the validated NCAA ISS, aiding data collection accuracy.

Findings should be considered in the context of the study's design. Self-reported data, particularly the number and type of injuries, could introduce error into the described injury epidemiology. Athletes may struggle to accurately distinguish the intricacies of their injuries, which could partly explain patterns observed in the data. For example, the high number of reported ligamentous ankle sprains may reflect misclassification of other soft tissue injuries, such as peroneal muscle strains. Involving medical staff in injury reporting would enhance validity. Season exposure (hours) was calculated by averaging weekly self-reported match-play and training participation; however, the absence of data on how injuries affected individual athletes' training and playing time may have led to an overestimation of exposure among athletes with time-loss injuries. Additionally, assumptions regarding season length (online supplemental appendix table 1) based on the typical duration of each athlete's respective league may have affected the accuracy of exposure estimates. Nonetheless, the uniform data collection method across sexes ensures comparable uncertainty levels. All retrospective studies may be limited by recall bias, although efforts were made to minimise this through a context-specific injury definition providing clear prompts and a recent recall period. Self-reported injury methods and 12-month recall have shown validity, although with limitations for older and less severe injuries.[59] However, given no study has sought to describe the injury risk in the British leagues, perhaps due to the complexity of doing so, this study provides reasonable evidence to build preventative strategies and recommendations on.

The time-loss injury definition used excluded transient injuries or those with <1 days' time-loss, potentially resulting in an undercalculated injury rate and overestimated injury severity. Given the nature of self-reporting, athletes with prior injuries may be more inclined to partake, impacting internal validity. Additionally, our study's predominantly female participants (62.2%), a population underrepresented in current literature[11] but noted to tend towards self-selection for online surveys,[60] potentially limits the study's generalisability. Furthermore, there was a relatively low response rate from certain subgroups, particularly BBL players. Future studies should strive for more balanced representation across groups to increase the statistical power of the findings.

While Mann-Whitney U tests were used due to the non-normal distribution of individual IIRs, we acknowledge that Poisson-based methods (eg, rate ratios and

confidence intervals) are appropriate for comparing incidence rates and could be considered in future studies with larger, prospectively collected datasets.

Sex-based differences exist in British basketball. Intrinsic factors, including strength, limb alignment, joint laxity and hormones, along with extrinsic variables, including warm-ups, diet, equipment and training facilities, support staff volume and quality require consideration. This study lacked data on these variables, preventing adjustment for their potential impact.

Recommendations and implications for practice

The reliability and accuracy of this study could have been enhanced by consulting athletes medical records, ensuring a sex-balanced sample and employing a prospective multi-season design. Future research should adopt similar standardised definitions as recommended by the IOC consensus to facilitate cross-study comparisons.[9]

Neuromuscular and proprioceptive training are demonstrated methods of reducing injury risk in pivoting sports such as basketball. Meta-analyses show a 39–50% reduction in lower limb injury risk.[61] Such programmes are most effective when completed at least two times per week, typically during warm-ups.[62] However, adherence challenges exist due to athlete and coach perceptions and behavioural influences.[63] Investigating these barriers in players competing in British basketball leagues and national teams could inform injury prevention protocols, enhancing athlete adherence.[64]

Guards and forwards are associated with higher IIRs. Guards had the greatest effect size, possibly due to increased contact and extensive court coverage.[47] Research exploring the specific scenarios leading to injuries in these positions is crucial.

This study focused on injuries sustained during the 2021/2022 season, the first full competitive season following major COVID-19 disruptions. As such, some findings may reflect short-term postpandemic effects rather than long-term trends. Pandemic-related restrictions may have impacted athlete conditioning, access to medical and training support and match-readiness, potentially influencing injury patterns. While the data provide important insights into injury occurrence in British basketball, future multiseason studies are needed to determine whether these findings reflect persistent trends or a temporary postpandemic shift.

CONCLUSION

The IIR among athletes from the British basketball leagues and national teams during the 2021/2022 season was 2.1 injuries/1000 AE-hours (IQR: 0.0–3.5 injuries/1000 AE-hours). Lower limb injuries were most prevalent, particularly the ankle and knee. Female athletes and those playing in guard and forward positions were associated with higher injury risk. These findings highlight key injury patterns and risk factors specific to the British basketball context.

The results can inform targeted, position and sex-specific injury prevention programmes such as neuromuscular training and load management. Coaches and medical staff should prioritise preventative approaches for athletes in high-risk playing positions and early career stages. Moreover, the findings underline the need for greater investment in medical support and conditioning resources across all competition levels. Future prospective studies across multiple seasons are warranted to validate these trends and assess the long-term impact of targeted interventions.

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