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Original Research

Injury Incidence and Prevalence in a Sample of Wrestlers Based in Britain: A Retrospective Study

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Background and Aim

Britain has competed in Freestyle Wrestling since it first featured in the Olympic Games in 1904 and the Commonwealth Games in 1930. Despite Britain's long history with the sport, there are currently no studies that have aimed to quantify injury incidence and prevalence. Therefore, the aim of this study was to estimate the injury incidence and prevalence in a sample of wrestlers based in Britain.

Methods

A self-reported, cross-sectional study design was used. All participants were registered British Wrestling Association Club members and had at least 12 months of prior wrestling experience. Data was collected via a questionnaire offered to participants in both online and paper format at the English Wrestling Championships 2022 and via coaches from each British wrestling club. Injury incidence was calculated by estimating injuries /1000 athletic exposures (AE). Injury site, type, mechanism and severity were measured. One variable chi-square tests (X^2) were used to calculate if observed values were significantly different from expected values.

Results

One hundred and forty-six (n=146) wrestlers (30.1 ± 8.6 years, 85.4 ± 15.6 kg, 176.6 ± 10.37cm) completed the injury survey. Over 12 months, the participants sustained one hundred and ninety-five (n= 195) injuries, equating to an average of 1.3 ± 1.2 per participant. The overall incidence rate was 3.40/1000 AE (95% CI 3.16 to 3.6). The competition injury incidence of 42.01/1000 AE (95% CI 26.97 to 57.05) and 2.92/1000 AE (95% CI 2.69 to 3.14) for wrestling training activities. The knee was the most common injury site, accounting for 26.1% of all injuries, whilst strains or sprains occurred most often (36.3%). Takedowns were the leading mechanism of injury (36.4%), and most injuries were categorised as slight (28.7%).

Conclusions

This is the first study to estimate the prevalence, severity, and mechanism of injury in Wrestlers based in Britain. Data is comparable to previous studies in American high school and college wrestlers. Future studies should consider a medically reported method to confirm these results further.

Practical Implications

The reported data from this study allows for the development of injury risk reduction strategies by region and injury type.

INTRODUCTION

Freestyle wrestling is a combat sport that has featured in the Olympic Games since 1904 and the Commonwealth Games since 1930. As with any contact sport, injury occurrence is inevitable, although wrestling has previously been shown to have the highest severe injury rate (1.73/1000 athletic exposure (AE)) compared to other American collegiate sports.[1]

The goal of a freestyle wrestling match is for both wrestlers to attempt to pin their opponent's shoulders to the mat, resulting in an instant win. Points can also be accumulated by executing throws, takedowns, or forcefully turning an opponent to expose an opponent's back to the mat temporarily.[2,3] Whilst injury rates in sports such as

boxing and mixed martial arts have been estimated in Britain, no published studies report injury rates in British freestyle wrestling.[4,5] To date, knowledge of injury patterns and trends in freestyle wrestling comes predominately from studies based in America, the Middle East and Europe.[6-9] Studies using samples of 16> males and females have reported injury incidence to range between 2.3-19.6 injuries/1000AE,[10-13] with injury rates increasing from high school (2.3 injuries/1000 AE)[7] to college (19.6/1000 AE).[14] In terms of injury location, studies have reported the cervical spine, hand, and knee to be frequently injured regions amongst wrestling cohorts.[9,14-17] This range of anatomical regions is unsurprising due to the whole-body contact nature of the sport and perhaps partially explains why takedowns, which usually produce unpredictable and unnatural movements, are frequently reported as the leading mechanism of injury.[10,17-19] Injury type varies amongst studies, with bruising,[16] fractures,[20] strains[21] and sprains[14] listed as the most common injury types. Differing ranges can be seen in injury severity, with one study reporting that the majority of injuries fall into a lower severity category of 3 to 6 days (61.8%)[7] and another reporting a higher severity of 21> days (43.6%).[14] In Britain, wrestling is a sparsely funded sport due to a previous lack of success in world championships and Olympic games.[22] Most British wrestlers are amateur athletes and hobbyists, making direct comparisons of previously published injury rates on professional cohorts challenging. Understanding the incidence and prevalence of injuries in this specific wrestling cohort is essential to increase athlete safety and focus medical staff or coaches in their future injury risk reduction practices. Therefore, the aim of this study was to estimate injury incidence and prevalence rates in a sample of British wrestlers.

MATERIALS AND METHODS

DESIGN

A cross-sectional, self-reported study design was used to estimate the frequency and type of musculoskeletal injuries sustained by a cohort of wrestlers based in Britain over a 12-month. The study was approved by the School of Health ethics committee at Leeds Becket University (ethics number 108011).

PARTICIPANTS AND PROCEDURE

To be deemed eligible for inclusion in the study, participants had to classify themselves as wrestling athletes and have at least 12 months of experience. Additionally, all participants had to be registered British wrestling association club members. Registered clubs were contacted via British wrestling. Participants were recruited via the coaches at each wrestling club who acted as gatekeepers for the research team. Additionally, two research team members attended the English Wrestling Championships on the 11th of February 2023 to advertise the study and to directly recruit participants.

All participants were provided with a participant information sheet and required to provide informed consent prior to any data collection. Included in the consent form was the option to withdraw from the study, which was set three weeks after the closing date of the study (25th of March 2023). This timeframe was selected to include withdrawal from the study and not delay the data analysis process. Self-reported injury data was collected using a survey method which could be completed online via a secure Microsoft forms link or a paper version. Distribution of the online version was completed by gatekeepers, whilst paper copies were managed by the research team at the attended wrestling event. Handwritten data were then transposed onto a password-protected Excel file and collated with the online data collected via Microsoft Forms.

INJURY DEFINITIONS AND QUESTIONNAIRE

The questionnaire asked for participants' age, weight, height, gender, and years of wrestling experience. Additionally, the number of weekly hours performing wrestling-based training and the amount of time spent competing in the past year was recorded in the number of bouts so that athlete exposure could be calculated. AE is defined as "one athlete participating in a competition or practice during which they are exposed to a possibility of athletic injury".[23] Weight categories were recorded to determine the percentage of injuries per category. The options for weight categories were the same as those used in the English Championship and other British wrestling championships as determined by United World Wrestling.[24] Wrestlers were asked to recall the environment in which reported injuries occurred. This was split into practice drilling, practice sparring, competition matches and conditioning. The injury site, type, mechanisms of injuries, severity, and environment were also recorded.

Injury was defined as "Any physical complaint, which was caused by a transfer of energy that exceeded the body's ability to maintain its structural and/or functional integrity, that was sustained by a player during a wrestling-based training or in a competition match, irrespective of the need for medical attention or time-loss from wrestling activities". This definition of injury was adapted from a previously published Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union.[25]

The site of injury was split into 19 anatomical locations.[25] The injury types sub-category was adapted from a previous wrestling study[7] but with the addition of Abrasions and Cartilage tears, as these were recommended by the British wrestling medical team and have been frequently used in other wrestling injury surveillance studies.[14,17,26] Participants were asked to report the profession of those who diagnosed their injury so that injuries could be separated between medical diagnoses assessed by an allied health professional and diagnoses by untrained individuals. The options were a Doctor, Sports/Physiotherapist, Chiropractor, Osteopath, Coach, Self-diagnosed, not diagnosed and other. Wrestling-based mechanisms of injury (MOI) were categorised as a takedown, near fall, fall, wrestling conditioning, escaping, reversal, riding, unknown and other.[7,11,14,27] The environment where injuries occur

was split into practice drilling, practice sparring, competition and wrestling conditioning.[1,7,11,14,27] Injury severity was measured by time loss (TL) and categorised as slight (0-3 days), minor (4-7 days), moderate (8-28 days), and major (>28 days), as per previous injury studies across multiple sports.[28,29]

DATA AND STATISTICAL ANALYSIS

The data was analysed once the withdrawal period for the last response had passed. Descriptive statistics were expressed as tally counts and percentages with 95% confidence intervals (CI). One variable chi-squared tests (x^2) were used to assess whether observed values significantly differed from expected values, that were calculated using a percentage determined by the number of options in each category. The following variables were tested: anatomical site, injury type, mechanism of injury and injury severity. Package for the Social Sciences (SPSS) version 29 was used for all descriptive and inferential statistics, with statistical significance set at p <0.05. Fisher F and chi-square functions were used to calculate lower and upper binomial confidence intervals. The injury incident rate confidence intervals were calculated using the equations upper Limit = (1000 / n) (d + (1.96 x square root of d)) and lower Limit = (1000 / n) (d - (1.96 x square root of d)). The incidence of injury in relation to wrestling training and competition exposure was calculated using the equation wrestler injury incident rate = the total number of injuries/total athlete exposure for the year x 1000.[23]

RESULTS

In total, one hundred and forty-six (n=146) wrestlers (30.1 ± 8.6 years, 85.4 ± 15.6 kg, 176.6 ± 10.37cm) completed the injury survey. Of these, one hundred and twenty-three (n=123) were males (30.0 ± 8.6 years, 75.6 ± 14.6 kg, 179.1 ± 8.9cm, BMI 23.60) and twenty-three (n=23) were females (30.5 ± 9.0 years, 64.1 ± 9.6 kg, 163.7 ± 7.9 cm, BMI 24.10). Over 12 months, the participants sustained one hundred and ninety-five (n= 195) injuries, equating to an average of 1.3 ± 1.2 per participant. On average, participants trained for 7.45 (± 7.36) hours per week and competed in 4.89 (± 5.18) bouts per year. There were one hundred and seventy-five (n=175) injuries reported in the males (89.7%, 175/195, 95%, CI 84% to 94%) and a further twenty (n=20) in the females (10.2%, 20/195, 95% CI 6% to15%). Allied health professionals diagnosed 62% (121/195) of all injuries, with a doctor being the most frequent source of diagnosis (48.7%, 59/121, 95% CI 40% to 58%), followed by physiotherapists (46.2%, 56/121 95% CI 37% to 56%) and self-diagnosis (25.1%, 49/195, 95% CI 19.2 to 31.8%). Most often, participants reported having 1-3 years of wrestling experience, 36.3% (53/146, 95% CI 29% to 45%). A total of 714 competition bouts were recorded, equating to a competition injury incidence of 42.01/1000 AE (95% CI 26.97 to 57.05) and 2.92/1000 AE (95% CI 2.69 to 3.14) for wrestling training activities. The overall incidence rate was 3.40/1000 AE (95% CI 3.16 to 3.6).

ANATOMICAL SITE

The knee was the most common injury site, accounting for 26.1% (51/195, 95% CI 20% to 33%) of all injuries, followed by the fingers (10.2%, 20/195, 95% CI 6% to 15%), and the shoulder/clavicle (8.7%, 17/195, 95% CI 5% to 14%). A one-variable chi-squared test found a significant difference between expected and observed values in anatomical sites (X^2 (17) = 222.14, p = <0.001). Table 2 and figure 1 present the frequencies for each anatomical site.

INJURY TYPE

In the injury entries where an allied health professional had diagnosed the injury, the most frequent types of injury were a strain or sprain (36.3%, 44/121, 95% CI 28% to 48%), followed by cartilage tears (17.3%, 21/121, 95% CI 11% to 25%) and fractures (14.0%, 17/121, 95% CI 8% to 22%). A significant difference between expected and observed values in injury type was seen in injury type (X^2 (14) = 579.69, p = <0.001). Of the thirty injuries reported in competition, twenty-three were diagnosed by an allied health professional, with strains or sprains accounting for 26.0% (6/23, 95% CI 10% to 48%) of these injuries, followed by lacerations (17.3%, 4/23, 95% CI 5% to 39%) and dislocations (17.3%, 4/23, 95% CI 5% to 39%). Table 2 and figure 1 show the frequencies for each injury type.

MECHANISM OF INJURY AND ENVIRONMENT

The leading MOI was takedowns (36.4%, 71/195, CI 30% to 44%), followed by escaping (25.13%, 49/195, 95% CI 19% to 32%). A total of 16.4% (32/195, 95% CI 12% to 22%) injuries had no known MOI. A one-variable chi-squared test found a significant difference between expected and observed values in the mechanism of injury (X^2 (8) = 214.25, p = <0.001). 65.1% (127/195, 95% CI 58% to 72%) of all injuries happened during practice sparring. This was followed by competition at 15.3% (30/195, 95% CI 11% to 21%) and practice drilling at 14.8% (29/195 95% CI 10% to 21%). Table 3 shows the number of injuries by severity category and environment.

INJURY SEVERITY

Most injuries were categorised as slight (28.7%, 56/195, 95% CI 22% to 36%), followed by minor (27.1%, 53/195, 95% CI 21% to 34%) and moderate (24.6%, 48/195, 95% CI 19% to 31%). No significant difference was found between expected and observed values for the severity of injury (X^2 (3) = 3.83, p = 0.28). In total, 69.7% (136/195, 95% CI 63% to 76%) of the participants acknowledged that they had trained or competed with the presence of an injury at some point in the last year. This may have impacted the reported injury severity periods, with athletes returning before injuries were resolved. Table 4 highlights the frequencies for each injury severity category.

Table 1. Distribution of injuries by anatomical location and type.

Injury Site	Frequency (Injury Tally)
Abdomen	1 (2/195)
Ankle	6.1 (12/195)
Elbow	7.6 (15/195)
Fingers	10.2 (20/195)
Foot/heel/toe	7.6 (15/195)
Head/face/lips/tongue	6.6 (13/195)
Hip/groin	2.5 (5/195)
Knee	26.1 (51/195)
Lower arm	0 (0/195)
Lower back/sacrum/pelvis	5.5 (11/195)
Lower leg/Achilles	1 (2/195)
Neck/cervical spine	8.2 (16/195)
Shoulder/clavicle	8.7 (17/195)
Sternum/rib	2.5 (5/195)
Thigh	1 (2/195)
Thumb	1.5 (3/195)
Upper arm	1.5 (3/195)
Upper back	0.5 (1/195)
Wrist	2 (4/195)
Diagnosis	
Strain/sprains	36.3 (44/121)
Dislocation	9.9 (12/121)
Fracture	14 (17/121)
Concussion	7.4 (9/121)
Laceration (Cut)	4.1 (5/121)
Tendinopathy	1.6 (2/121)
Severe Bruising (Contusion)	3.3 (4/121) ,
Cartilage tear	17.3 (21/121)
Bursitis	2.4 (3/121)
Disc herniation	0.8 (1/121)
Nerve injury	1.6 (2/121)
Heart Attack	0.8 (1/121)

Table 2. Distribution of injuries by mechanism and environment.

Injury Mechanism (MOI)	Frequency (Injury Tally)
Takedown	36.4 (71/195)
Near Fall	2.5 (5/195)
Fall	4.6 (9/195)
Wrestling conditioning	6.6 (13/195)
Escaping	25.1 (49/195)
Reversal	5.1 (0/195)
Riding	0.5 (1/195)
Unknown	16.4 (32/195)
Other	2.5 (5/195)
Environment	
Sparring	65.1 (127/195)
Drilling	14.8 (29/195)
Competition	15.3 (30/195)
Gym based Wrestling conditioning	3.5 (7/195)
Other	1 (2/195)

Table 3. Distribution of injuries by severity.

Injury severity (Time missed)	Frequency (%)
Slight (0-3 days)	28.72 (56/195)
Minor (4-7 days)	27.18 (53/195)
Moderate (8-28 days)	24.62 (48/195)
Major (>28 days)	19.49 (38/195)

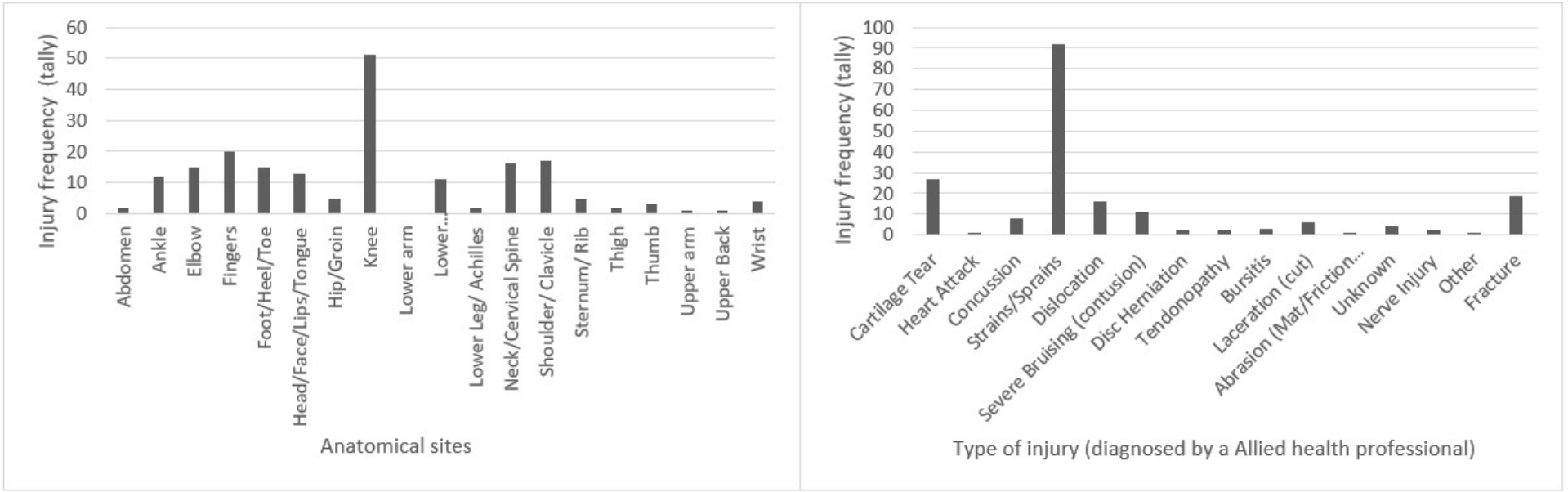

Figure 1. Anatomical site by frequency and Injury type by frequency

Table 4. Injury frequencies according to weight category.

Weight category & gender of category	Injuries per category population	Frequency (Injury Tally)
125kg (Male)	14/12	7.1 (14/195)
97kg (Male)	17/13	8.7 (17/195)
92kg (Male)	12/10	6.1 (12/195)
86kg (Male)	33/23	16.9 (33/195)
79kg (Male)	43/27	22 (43/195)
76kg (Female)	7/4	3.5 (7/195)
74kg (Male)	14/11	7.1 (14/195)
72kg (Female)	3/2	1.5 (3/195)
70kg (Male)	25/13	12.8 (25/195)
68kg (Female)	0/2	0 (0/195)
65kg (Male & Female)	5/5	2.5 (5/195)
62kg (Female)	2/2	1 (2/195)
61kg (Male)	10/6	5.1 (10/195)
59kg (Female)	4/2	2 (4/195)
57kg (Male & Female)	3/7	1.5 (3/195)
55kg (Female)	2/4	1 (2/195)
53kg (Female)	1/2	0.5 (1/195)
50kg (Female)	0/1	0 (0/195)

Table 5. Injuries according to weekly training exposure and athlete experience

Weekly training exposure (Hrs)	Population and Injuries per category population	Injury incident rate (Injuries per 1000 hours of athletic exposure)
<2	2/2	19.2/1000
2+	18/19	121.8/1000
4+	34/51	196.2/1000
6+	32/46	126.4/1000
8+	15/17	36.3/1000
10+	19/25	42.1/1000
12+	14/20	29.6/1000
14+	12/15	18/1000
Athlete experience (in years)	**Population and Injuries per category population**	**Frequency (Injury Tally)**
0-1	33/27	16.9 (33/195)
1-3	56/52	28.7 (56/195)
3-5	26/18	13.3 (26/195)
5-7	19/16	9.7 (19/195)
7-10	27/15	13.8 (27/195)
10+	34/18	17.4 (34/195)

INJURIES BY WEIGHT CATEGORY, GENDER AND EXPERIENCE

Male participants in the 79kg weight were injured most often, accounting for 22.0% (43/195, 95% Cl 16% to 29%) of all injuries reported. The 76kg female weight category accounted for 35% (7/23, 95% CI 35% to 93%) of all injuries seen among female participants. The knee was the highest injury site reported amongst females (50%,10/20, 95% CI 27% to 73%) and male participants (21.0%, 41/175, 95% CI 17% to 30%). Participants with 10+ years of wrestling experience (age = 35.6 ± 8.8) had the highest number of injuries, with 34 recorded injuries out of 18 participants (34/18). This was followed by wrestlers with 7-10 years of experience (age = 32.3 ± 6.2) (27/15) and 3-5 years (age = 33.0 ± 7.9) ranking third (26/18). Table 5 highlights the injuries per weight category and experience levels.

DISCUSSION

To the author's knowledge, no research that represented British wrestling investigated the injury incidence and prevalence compared to other combat sports, such as boxing (Loosemore et al., 2015). The aim of the current study therefore was to estimate the injury incidence and prevalence in a sample of wrestlers based in Britain. Overall injury incidence was 3.40/1000 AE (95% CI 3.16 to 3.6), with injuries more frequent in competition at 42.01/1000 AE (95% CI 26.97 to 57.05) than in training at 2.92/1000 AE (95% CI 2.69 to 3.14). The knee was the most frequently injured anatomical site (26.1%), whilst, in the medically reported injuries, sprains and strains occurred most often (36.3%). Injuries occurred most often during takedown movements (36.4%, 71/195). Recurring injuries accounted for 68.7% of all injuries. Most wrestlers trained between 4 to 6 hours a week (23.3%). Wrestlers with 10+ years of experience reported the highest percentage of injuries per sample size, with 34/18.

INJURY INCIDENCE

The overall injury rates of 3.40/1000 AE (95% CI 3.16 to 3.6) for British wrestlers appear to be low when compared to other countries, with Korean freestyle wrestlers having a reported rate of 4.04 injuries/1000 AE (95% CI 3.76 to 4.33) for heavyweights and 5.25/1000 AE (95% CI 4.93 to 5.58) for lightweights.[30] Indian wrestlers reported a single-point estimate rate of 5.3 injuries/1000 AE,[31] and Iranian wrestlers demonstrated a higher rate of 5.7 injuries/1000AE (95% CI 4.8 to 6.5).[15] British wrestlers do have a higher incidence rate than American high school (14 to 18) wrestlers, with rates reported as a single point estimate of 2.33 injuries/1000 AE,[7] but not collegiate male wrestlers, where overall rates ranged from 5.7 to 19.6 injuries/1000 AE.[10,11,13,27]

The present study included a competition injury incidence rate of 42.01/1000 AE, which appears higher than rates reported in elite collegiate wrestlers. Collegiate studies have ranged from Kerr et al. (2015)[13] 13.1/1000 AE (95% CI 12.3 to 13.9) to Kroshus et al. (2018)[10] 27.59/1000 AE (95% CI 25.66 to 29.53), with most studies falling within these ranges.[7,13,14,27] It is unknown why competition rates were higher in British wrestlers. However, some possibilities include a lack of resources at event venues, such as warm-up areas and athlete and coach knowledge on how to warm up and prepare for exercise, as research has shown in other amateur sports.[32] Previous studies have shown that effective implementation of warm-ups before sports can reduce athlete injury rates.[33-35] Poor weight-cutting methods have been suggested to be a competition injury risk factor in previous wrestling studies due to dehydration and its impact on cognitive function.[36-39] Embedding education on effective warm-up protocols and safe weight cutting procedures into the British wrestling coaching qualifications may help improve competition injury rates.

ANATOMICAL LOCATION AND INJURY TYPE

The present study found that 36.3% of all medically reported injuries were either a strain or a sprain. The questionnaire used in this study mirrored Yard et al. (2008)[7] study and presented this as a single option, so it cannot be stated whether strains or sprains were individually more prevalent. The findings are in agreement with data obtained by Yard et al. (2008),[7] which reported knee strains/sprains (17.1%) as the most frequent injury in collegiate wrestlers. Other wrestling studies have reported sprains and strains as the most common type of knee injury in wrestlers (19.5, 15/77), followed closely by strains (18.2%, 14/77).[26] A Brazilian epidemiology of elite wrestlers witnessed a simpler split between sprains (34.5%) and strains (30.4%).[21] Studies investigating the physical demands of wrestling have reported frequent physiological and accessory movements such as pivoting movement, rapid deceleration, forced hyperextension knee torsion, lateral knee displacement, and excessive force transmitted in the joint in the execution phase.[3,40,41] The kinetic forces seen in these are chief mechanisms in combined strains and sprain injuries.[42-44]

In other wrestling studies, the options for injury type differed, with some offering greater detail of injury diagnosis than others. Brzezińska et al. (2022)[16] reported bruising (100%, 43/43) as the principal injury type with joint structure injury (62.8%, 27/43) and damage to the tendons (55.8%, 24/43). Conversely, a previous study examining injuries in elite Indian wrestlers displayed fractures as the highest reported injury (45%, 9/20), followed jointly by contusions (35%, 7/20) and incisions (35%, 7/20).[20] Although some wrestling studies have differences in leading injury types, ligament injuries are frequently reported as the principal injury at the knee and shoulder region.[14,26,27,45] This information could be used to develop injury prevention programmes or implement established programmes that have pre-existing research showing their effectiveness in reducing need ligament injuries, such as the Fifa 11+, HarmoKnee, Knee injury prevention program (KIPP) and Prevent Injury and Enhance Performance (PEP).[34,46-48] However, such interventions would require modification to ensure specificity to wrestling demands.

The influence of geographical regions can be observed in the variation of injury sites between athletes competing in different countries. The present study reported that the knee was the most commonly injured site, with 26.1% (51/195) of all injuries, which is in agreement with Daneshmandi et al. (2020),[9] where knee injuries occurred most often (30.2% (13/43)) in a sample of Iranian wrestlers. Conversely, Brzezińska et al. (2022)[16] suggested that the cervical spine was the most frequently injured location (79.0% (34/43)) in a sample of experienced Polish wrestlers. Kord et al. (2012)[15] stated that the most common site of injury in a group of Iranian wrestlers was the hand, followed by the wrist and knee.

In several American collegiate wrestling injury surveillance studies, the knee has been reported as the most frequent injury in competition and practice (16.7% to 30.4%).[7,10,14,18,27] However, this differs in American high school wrestlers, where the head/face (practices = 19.9%, competitions = 21.4%) and shoulder/clavicle (practices = 14.1%, competitions = 21.0%) were the most common injury sites.[10] Upper body sites such as the head, shoulder and elbow were reported to be the most frequently injured sites in several other high school wrestling epidemiology studies.[7,17,49] Although British wrestlers' injury prevalence rates in the present study are closest to reported American high school wrestlers, the site and type of injury are linked more closely to American collegiate wrestlers.

MOI AND ENVIRONMENT

The current study found that despite a higher injury incident in competition, most injuries occurred during practice sparring (65.1%, 127/195). This concurs with reported data from previous wrestling studies.[7,18,27] It has previously been suggested that this is likely due to the high exposure of practice hours compared to competition matches.[23] Additionally, many of the wrestlers in the current study did not participate in competitions. Practice sparring is generally more fatigue-inducing, competitive and chaotic than practice drilling as it mimics competition

in timing and the ability to win or lose a sparring match.[50] Rest periods between sparring matches can often be shorter than the required 20-minute break seen in British wrestling competitions.[50] Furthermore, wrestlers have strict weigh-in protocols in a competition that ensures both competitors are at the same weight. This is not present in practice sparring, meaning wrestlers have the option to fight heavier opponents, which may increase the chances of sustaining an injury.

Many studies that reported injury location, type and severity did not report MOI. Studies that did report MOI consistently reported that takedowns were the leading MOI in freestyle wrestling, ranging between 39% to 54.3% of all injuries coming from a takedown.[7,10,18,19,27] Knee injuries, the most frequently injured site, were also stated to occur during escaping, reversals and wrestling conditioning but to a lesser extent than takedowns (36.4%, 71/195). The type of takedown, for example, a throw or a sweep, was not provided as an option for wrestlers to choose, nor was it specified if the injury happened to the wrestlers performing the takedown or the wrestler being taken down. Previous research into knee injuries in wrestling showed that knee injuries that happen in the attacking position (34/71; 47.88%) were only slightly higher than in a defensive position (29/71; 40.8%).[26] It is known that both performing and defending takedowns involve collision forces, high-velocity movements with large degrees of knee and dorsiflexion and the possibility of the lower limb twisting with a planted foot.[41,51] Jang et al. (2009)[41] previously suggested the significantly amplified lower limb joint angles in the transverse and frontal planes seen in different takedowns as a primary reason for knee and ankle injuries within wrestling.

INJURY SEVERITY

There was no significance found between the severity categories in the present study. Direct comparison with other published studies is difficult as the categories of injury severities differ between studies. Powell et al. (2021)[14] classified severe injuries as 21> days and reported that 43.6% of all injuries fell into this category. In comparison, Agel et al. (2007)[27] categorised injuries with 10+ days as severe, which account for 62% of all reported injuries. If the current study's moderate and major severity categories were merged to show all injuries with TL of 8+ days, the percentage would be similar or lower than in previous studies (44.1% 86/195).[14,27] The reason that British wrestlers have reported shorter periods of missed wrestling training may be linked to the 68% of wrestlers that report having trained through an injury at some point during the past year. This area requires further exploration of the motives and factors as to why. Previous studies in other wrestling populations have reported that most wrestlers sought no immediate care for their injuries, with approximately 50% being non-compliant with medical recommendations.[15,52] This may indicate a wider issue in wrestling regarding risk taking behaviour and the education of injury management and rehabilitation.

INJURIES ACCORDING TO EXPERIENCE, WEIGHT CATEGORY AND GENDER

Many wrestling studies have not previously considered injury types and locations according to weight categories. This study found that the 79kg weight category for the male wrestlers suffered the most injuries, with an average of 1.6 injuries per wrestler (43/27) and the 76kg female weight category for the female wrestlers, with an average of 1.8 per wrestler (7/4). The knee was the most frequently injured site in males and females. When comparisons were made in other wrestling studies, no statistically significant difference among the categories was found.[11,18,23,53] It was found that wrestlers with 10+ years of experience had the most injuries per experience level group, with 34 injuries in 18 participants. This accounted for 17.4% of all reported injuries. This group also had the highest mean age (35.61± 8.89). Several authors have associated increased injury risk in wrestling with greater age, experience and competition level.[17,54,55] This theme has also been reported in other grappling sports, such as Judo and Brazilian Jiu-Jitsu.[56-58] Research has shown that biomechanical variables of the double-leg takedown, such as joint kinematics and kinetics and movement duration, do not differ between elite and non-elite wrestlers.[3] This proposes that there are no significant changes in movement competency between different levels of wrestlers, and with no variance in kinetics in double leg attacks, it suggests that biomechanical injury precursors do not alter with competition level. However, more research is needed to establish how biomechanics differ between competition levels from other regions and in a wider range of frequently used wrestling movements.

LIMITATIONS

The methodology used within this study was self-reported and retrospective. This was the only option due to the lack of medical provisions within British wrestling. With improved medical provision in the sport, a prospective medically reported method could be used to provide a more accurate estimation of diagnosis, injury incidence and prevalence rates. The current resources and structure of the squad would make a prospective, medically reported injury surveillance study very challenging. The two main issues are a lack of trained staff that can diagnose injuries and the frequent rotation within the GB squad.

The questionnaire was designed so that comparisons between other wrestling injury surveillance studies could be made, as well as making it accessible to most British wrestling members. The study replicated Yard et al. (2008)[7] wrestling study that grouped sprains and strains as a single injury type. This was to avoid incorrect reporting as it was not certain if participants (who were non-medically trained) could correctly distinguish between the two diagnoses due to the low level of English literacy skills of the wrestlers at the English championship. Additionally, this limited the number of wrestlers that were willing or able to complete the questionnaire. This means that it is unknown how many injuries were sprains or strains, and therefore, no accurate comparisons can be made with studies that

separated the two injury types. Future studies could distinguish between the two diagnoses.

CONCLUSION

This is the first study to provide estimates of injury incidence and prevalence in a sample of wrestlers based in Britain. It was seen that the competition injury rates were higher than reported rates from elite American collegiate wrestlers. The knee is the most frequently injured site, with sprains and strains being the most common diagnosis. Takedowns were the highest reported MOI, with the most injuries occurring during practice sparring. This research provides data that can be used to progress the sport of wrestling in the Britain by advancing competition safety protocols and developing injury risk reduction strategies such as the adaptation of pre-existing knee injury prevention programmes that are easily accessible to practitioners.

FUNDING

No funding was received for this work.

CONFLICTS OF INTEREST / COMPETING INTERESTS

JB is the head of Sports Medicine for British Wrestling and a qualified British Wrestling coach. This work is in no way influenced by this association.

AVAILABILITY OF DATA AND MATERIAL

Only data available within the publication is available.

AUTHORS' CONTRIBUTIONS

JB was the lead author and conceptualised the study. MD aided in data collection. JB, MD, ET and AJ contributed to the design and proofreading of the manuscript.

ETHICS APPROVAL

The School of Health ethics committee approved the study at Leeds Becket University (ethics number 108011).

CONSENT TO PARTICIPATE

All participants consented to their data to be included in this study.

CONSENT FOR PUBLICATION

Participants and authors have given their consent for the publication of this study.

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SUPPLEMENTARY MATERIALS

Copy of Questionnaire

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