

Assessment of Injuries During Brazilian Jiu-Jitsu Competition

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Investigation performed in Honolulu, Hawaii, USA

Background: Brazilian jiu-jitsu (BJJ) is a unique style of martial arts with rapid growth in the United States and internationally. Although studies have examined injuries in other martial arts and combat sports, to date, no published medical study has examined injuries in BJJ competitions.

Purpose: (1) To estimate the incidence of injuries in BJJ competitions and (2) to identify and describe the types and mechanisms of injuries associated with competitive BJJ.

Study Design: Descriptive epidemiology study.

Methods: Injury data were obtained from records of on-site medical coverage at 8 statewide BJJ tournaments in Hawaii, USA, between 2005 and 2011.

Results: The identified injury incidence on the day of matches was 9.2 per 1000 exposures (46 injuries out of 5022 exposures, ie, match participations). Orthopaedic injuries were the most common and accounted for 78% of all injuries (n = 36), followed by costochondral or rib injuries (n = 7) and lacerations requiring medical care (n = 3). The elbow was found to be the joint most commonly injured during BJJ competitions, with the arm bar being the most common mechanism. We propose that this BJJ-specific injury mechanism, the “arm bar,” be recognized as another mechanism of hyperextension injury to the elbow in sports.

Conclusion: Comparison of the BJJ injury data with injury data reported for judo, taekwondo, wrestling, and mixed martial arts showed that BJJ competitors were at substantially lower risk of injury compared with these other sports. With orthopaedic injuries being most common and the elbow being the area most vulnerable to injury in BJJ, it is important that participants, referees, and physicians be properly educated about the unique mechanisms of injury that can occur, particularly to the elbow.

Keywords: jiu-jitsu; Brazilian jiu-jitsu; mixed martial arts; martial arts; elbow injury; arm bar; elbow hyperextension; hyperextension injury; jiu-jitsu elbow

Brazilian jiu-jitsu (BJJ) is a unique style of martial arts with rapid popularity growth in the United States and internationally. The BJJ style emphasizes takedowns, joint locks, leverage, and strategy to immobilize, control, submit, and disable an attacker. The BJJ system allows a smaller or physically weaker person to successfully subdue a larger, stronger opponent by using proper technique, including joint locks and chokeholds. While the art of BJJ traces its origins to the Japanese martial art of Kodokan judo, it is a modern martial art first developed in the early 20th century. Brazilian jiu-jitsu is most closely associated with the

Gracie family from Rio de Janeiro, Brazil, who founded, developed, and continue to promote BJJ. The Gracie family played an instrumental role in bringing BJJ to international prominence and popularity, and the art has been referred to as Gracie jiu-jitsu. Royce Gracie further popularized BJJ in the 1990s when he won multiple Ultimate Fighting Championships using BJJ techniques. As mixed martial arts (MMA) evolved, BJJ has remained a core skill set of MMA fighters, as well as a sport in its own right and a self-defense system. The sport is a complex blend of strategy and technique, often compared to a chess match.

Today, BJJ is a well-organized and structured martial art with various ranks, competition rules, and regular world, regional, state, and national championships. BJJ tournaments continue to grow in popularity worldwide and reflect the growth in BJJ participation by amateur and professional athletes alike. For example, the Pan American, a major international BJJ tournament, grew from fewer than 200 participants in 1995 to 450 in 1998, 800 in 2001, 1700 in 2007, and to more than 2800 in 2010.⁸

Competitions allow practitioners of BJJ to test their skills and abilities against one another in a controlled environment, with rules, regulations, a referee, and judges. Tournaments have multiple competitors, each competing in matches between 2 individuals. The goal of each match is for a competitor to take down his opponent, advance his

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own position, and force his opponent to “submit” or “tap out.” This requires skill and strategy. A referee oversees each contest from within the match area. The referee has the power to award points as well as to disqualify or penalize competitors for rule infractions.

Each match begins with both opponents standing and progresses as each athlete attempts to score points based on a scoring system. Each athlete may score points by taking the opposing athlete to the mat, as in wrestling or judo. Competitors then try to advance their position to a stronger position with the aim of ending the match with a submission. If one competitor is able to successfully execute a “submission hold,” such as an “arm bar,” “kimura,” “triangle choke,” or other choke, the other opponent will “tap-out” with his hands, feet, or verbally, thus signaling defeat and the end of the match. The referee also has the power to end the competition if a lock or choke is applied and poses the risk of serious physical damage to the competitor if further applied. In the event that an athlete has not submitted and the scheduled amount of time expires, the winner of the match is determined by the judges’ scores and points awarded for takedowns and position advancements.

As with any sport, injuries can occur despite all precautions. The goal of this article is to document the specific incidences, types, and mechanisms of injuries that are commonly seen in BJJ competition. As this sport continues to increase in popularity, it is important for orthopaedic surgeons to recognize the unique mechanisms of injury that can occur.

MATERIALS AND METHODS

This is an epidemiology study of 8 statewide BJJ tournaments in Hawaii between 2005 and 2011, to determine what injuries occurred, their incidence, and their mechanism of injury. The study was approved by the Institutional Review Board at Hawaii Pacific Health, Oahu, Hawaii, USA. Only tournaments where the authors (J.F.S. and B.H.I.) provided on-site medical coverage for the entire tournament were included. Tournaments included the following: Hawaiian Open of Brazilian Jiu-Jitsu, Hawaiian Championship of Brazilian Jiu-Jitsu, Aloha State Championship of Brazilian Jiu-Jitsu, and Hawaiian Triple Crown of Brazilian Jiu-Jitsu tournaments. All injuries requiring on-site medical care were recorded at each event. Diagnosis was based on history and physical examination at the events performed in every case by 1 of 2 board-certified orthopaedic surgeons (J.F.S. and B.H.I.), both with expertise in sports medicine and training in BJJ with intermediate or advanced belts.

Data were collected for 2511 matches, resulting in 5022 exposures. Each “match” is a competition between 2 individuals, according to the rules of the event. Each “exposure” is represented by 1 competitor in 1 match and is considered to represent 1 potential exposure to injury. Many athletes compete in more than 1 match per event. The matches included “gi” and “no gi” matches and competitors of a wide range of ages and experience levels. In the gi matches, competitors wear the traditional martial arts garment similar to judo. In the no gi matches, competitors typically wear shorts and a lycra shirt. The rules and goals are the same

for the gi and no gi competitions. Gi competitions, however, allow the competitors to grab their opponent’s garment. This allows for a wide array of grips and techniques using the gi itself against the opponent.

One of 2 board-certified orthopaedic surgeons (J.F.S. and B.H.I.) was stationed on-site next to the mat for every match in every event included in this study. All injuries requiring on-site medical evaluation were recorded. Injured athletes were brought to the attention of the physicians by direct observation, by the referees, by their coaches, by their family members, or by the athletes themselves.

In every case, a history was taken of the mechanism of injury, and physical examination of the area of injury was performed. The clinical diagnosis was recorded. No imaging facilities were available at the competition sites. Clinical diagnosis was based on the history and physical examination by 1 of the 2 board-certified orthopaedic surgeons (J.F.S. and B.H.I.).

RESULTS

Incidence and Types of Injury

Of the 5022 exposures to injury risk, 46 resulted in injuries. Orthopaedic injuries were the most common category and accounted for 78.3% (n = 36) of all injuries. Costochondral or rib fractures were less common and accounted for 15.2% (n = 7) of all injuries. Lacerations requiring medical care were the least common type of injury, accounting for 6.5% (n = 3) of all injuries.

The identified injury incidence on the day of matches in BJJ tournaments amounted to 9.2 per 1000 exposures, while the incidence of orthopaedic injuries was 7.2 per 1000 exposures.

Incidence of Injury by Age

Of the 5022 exposures, 1234 involved BJJ competitors 15 years or younger. These competitors sustained a total of 5 injuries, resulting in the overall incidence of injury of 4.1 per 1000 exposures in this age group. Of the 3788 exposures in competitors 16 years and older, a total of 41 injuries occurred, with the injury incidence of 10.8 per 1000 exposures in this age category.

Types and Mechanisms of Orthopaedic Injuries

Since orthopaedic injuries were found to be the most common injury type in BJJ competitions, accounting for 78.3% of all injuries, we next examined the specific types and mechanisms of these injuries. Table 1 summarizes the types and mechanisms of the orthopaedic injuries encountered during the BJJ tournaments included in this study. The mechanism of injury was based on the history provided by the competitor or by direct observation.

The elbow was the area most prone to injuries. Of the 36 orthopaedic injuries, 14 (38.9%) were injuries to the elbow. This included 2 lateral collateral ligament (LCL) sprains, 1 elbow dislocation, 6 medial collateral ligament (MCL) sprains, 1 case of both MCL and LCL sprains, 3 cases of

TABLE 1
Distribution of Orthopaedic Injuries by Injury Area, Type, and Mechanism (n = 36)^a

Injury Area	No. of Injuries	Injury Type	Injury Mechanism
Elbow (n = 14)	4	MCL sprain	Arm bar
	1	MCL sprain	Kimura
	1	LCL sprain	Arm bar
	1	LCL sprain	Takedown (FOOSH)
	1	MCL and LCL sprain	Arm bar
	1	Elbow dislocation	Takedown (FOOSH)
	1	Anterior sprain (distal biceps)	Takedown (FOOSH)
	3	Posterior tenderness at olecranon	Arm bar
	1	Anterior sprain (distal biceps)	Arm bar
	1		
Knee (n = 7)	1	MCL sprain	Passing guard
	1	MCL sprain	Takedown
	1	MCL sprain	Unknown
	1	LCL sprain	Direct pressure
	1	LCL sprain	Varus stress with knee flexed
	1	LCL sprain	Sweep
	1	LCL sprain (lateral meniscus tear)	Passing guard
Foot and ankle (n = 5)	1	Ankle ATFL sprain	Takedown
	1	Ankle ATFL sprain	Footlock
	1	Turf toe	Pushing forward
	1	Turf toe	Pushing forward
	1	Hyperflexion sprain, great toe MTP joint	Pushing forward
Hand (n = 4)	1	DIP sprain	Applying arm bar
	1	Thumb sprain	Caught in gi
	1	Dislocated index finger PIP joint	Blocking opponent
	1	Ring finger metacarpal fracture	Caught in gi
Shoulder (n = 4)	1	Grade I AC separation	Kimura
	1	Anterior dislocation	Takedown, landed on outstretched hand
	1	Anterior subluxation with spontaneous reduction	Pushing opponent
	1	Nonspecific pain	Unknown
Hip (n = 1)	1	Hip contusion	Impact with opponent
Cervical (n = 1)	1	Cervical strain	Triangle choke

^aAC, acromioclavicular; ATFL, ankle anterior talofibular ligament; DIP, distal interphalangeal; FOOSH, fall on outstretched hand; LCL, lateral collateral ligament; MCL, medial collateral ligament; MTP, metatarsophalangeal; PIP, proximal interphalangeal.

tenderness in the posterior olecranon, and 2 cases of anterior sprains (distal biceps). The arm bar was the most common mechanism that caused elbow injuries (10 of 14 elbow injuries), followed by the takedown (n = 3), and a “kimura” (n = 1).

The knee was the second most frequent area of orthopaedic injury. There were 7 (19.4%) injuries to the knee: 3 MCL sprains and 4 LCL sprains. These injuries occurred from direct pressure, passing guard, a sweep, a takedown, varus stress on a flexed knee, and 1 unknown cause.

There were 5 (13.9%) injuries to the foot and ankle: 2 cases of turf toe, 2 ankle anterior talofibular ligament (ATFL) sprains, and 1 hyperflexion sprain of the metatarsophalangeal joint of the great toe. The ankle injuries occurred from a takedown and a footlock. The toe injuries each occurred from the competitor pushing forward against the opponent with the foot planted on the mat.

There were 4 (11.1%) injuries to the hand: a distal interphalangeal strain, a thumb sprain, dislocation of the index finger at the proximal interphalangeal joint, and a ring finger metacarpal fracture. These injuries occurred while applying an arm bar, getting caught in a gi, and/or while blocking an opponent.

There were 4 (11.1%) injuries to the shoulder, which included 1 grade I acromioclavicular (AC) separation, a left

shoulder anterior dislocation, an anterior subluxation with spontaneous reduction, and 1 nonspecific pain in or strain of the right shoulder. These injuries were caused by a “kimura,” a takedown, and an unknown cause.

There was also 1 right hip contusion caused by impact with an opponent. Finally, there was 1 (2.8%) cervical strain injury that was caused by a “triangle” choke.

Specific Mechanisms of Injuries

We found the elbow to be the area most commonly injured in BJJ competition, with the most common mechanism being the jiu-jitsu arm bar (Figure 1A). A competitor executes this technique by securing an opponent’s arm at the wrist and trapping it by squeezing the legs firmly around the arm. The opponent’s elbow is pressed against the other competitor’s pelvic region and hyperextended by the competitor exerting downward pressure on the opponent’s wrist. This results in a powerful direct hyperextension force to the elbow, forcing the athlete on the receiving end to “submit,” or give up, signified by “tapping out” (Figure 1B).

There was 1 neck injury, a cervical strain, caused by the BJJ “triangle” technique, a type of choke (Figure 2). This technique is executed by encircling and securing the legs



Figure 1. (A, B) Brazilian Jiu-Jitsu Grand Master Relson Gracie demonstrates the correct technique for an arm bar. The arm is trapped while the elbow is hyperextended. This was the most common mechanism of injury in our study.



Figure 2. There was 1 neck injury, a cervical strain, caused by the “triangle” technique, demonstrated by Brazilian Jiu-Jitsu Grand Master Relson Gracie. This technique is a type of choke executed by encircling and securing the legs around the opponent’s neck and arm, thus putting pressure on the neck.



Figure 3. There were no injuries as a result of other jiu-jitsu chokes, such as the “Mata Leão” choke demonstrated by Brazilian Jiu-Jitsu Grand Master Relson Gracie.



Figure 4. There were 2 injuries resulting from the “kimura” technique, demonstrated by Brazilian Jiu-Jitsu Grand Master Relson Gracie. Both the elbow and the shoulder are forcibly internally rotated, posing a risk of injury to both joints.

around an opponent’s neck and 1 arm, thus putting pressure on the neck, forcing the opponent to “tap out.” There were no injuries as a result of other jiu-jitsu chokes, such as the “mata leão” choke (Figure 3).

In our study, there were 2 injuries resulting from the jiu-jitsu “kimura” technique (Figure 4). A “kimura” is executed by controlling an opponent’s arm by securing their wrist, followed by internally rotating their shoulder and elbow by placing internal rotation pressure on the secured wrist and arm. One of the recorded injuries was to the shoulder (grade I AC separation), while the other was to the elbow (MCL sprain). Injuries due to the use of a “kimura” are of interest since both the elbow and shoulder are manipulated, thus posing a risk of injury to multiple anatomic structures.

DISCUSSION

Despite the popularity of BJJ in the United States and internationally, little is known about injuries in this sport.

TABLE 2
Comparative Injury Rates per Exposure in Martial Arts Competitions

Sport	Injury Rate per 1000 Athlete-Exposures	References
Brazilian jiu-jitsu (BJJ)	9.2	Present study
Mixed martial arts (MMA)	236-286	Ngai et al (2008), ¹⁸ Scoggin et al (2010), ²⁷ Bledsoe et al (2006) ⁵
Judo	25.3-130.6	James and Pieter (2003), ⁹ Barrault et al (1983), ² Pieter et al (2001), ²³ Green et al (2007), ⁷ Kujala et al (1995) ¹⁵
Taekwondo	20.5-139.5	Beis et al (2001), ³ Pieter et al (1995), ²⁴ Zemper and Pieter (1989), ³³ Kazemi and Pieter (2004), ¹² Kazemi et al (2005), ¹³ Pieter et al (1998), ²¹ Ziaee et al (2010), ³⁴ Pieter (2009) ²⁰
Wrestling	9.0-30.7	Pasque and Hewett (2000), ¹⁹ Yard et al (2008), ³² Jarret et al (1998), ¹⁰ Myers et al (2010), ¹⁷ Strauss and Lanese (1982), ²⁹ Shadgan et al (2010), ²⁸ Kersey and Rowan (1983), ¹⁴ Rechel et al (2008) ²⁵

This is the first study, to our knowledge, to assess and report on the incidences, types, and mechanisms of injuries sustained in BJJ competition in the medical literature. The injury rate of 9.2 per 1000 match participations that we identified in this study of 8 statewide BJJ tournaments involving 2511 BJJ matches was relatively low.

Injury rates in martial arts have been reported to compare favorably with other collision and contact sports.^{4,6,30} Injury rates vary across various martial arts, as do injury types and mechanisms. To put our findings in perspective, we compared the BJJ injury rates and types in our study with those reported for competitive judo, taekwondo, MMA, and wrestling (Table 2). While comparison of injury rates with those in other studies is complicated by methodological differences, the comparison did suggest that BJJ competitors experience a lower injury risk compared with competitors in MMA, wrestling, judo, and taekwondo.

The difference in injury risk was particularly pronounced when comparing BJJ with MMA. The injury rate of 9.2 per 1000 exposures found in our study of BJJ competitions was about 26 times lower than the injury rate of 236 per 1000 exposures observed in 635 professional MMA matches (n = 1270 exposures) in 2002-2007 in Nevada¹⁸ as well as the injury rate of 237 per 1000 exposures in 116 professional MMA matches (n = 232 exposures) in 1999-2006 in Hawaii.²⁷ Our findings of orthopaedic injuries as the most common type of injury in BJJ differed markedly from the injury types common in MMA, such as lacerations, abrasions, and concussions.^{18,27} These findings were as expected, since, unlike MMA, BJJ competitions disallow punches, strikes, or kicks of any kind. This reduces the risk of lacerations, head trauma, and spinal injury. The methodology used to determine rates of injury in the jiu-jitsu competition study²⁷ was very similar to the methodology used in the MMA study.

The injury rates in competitive BJJ in our study were substantially lower than the injury rates reported for judo. Studies of injuries in judo competitions reported injury rates ranging from 25.2 to 130.6 per 1000 exposures.^{2,7,9,23} Judo competitors were most at risk for injuries affecting the upper extremities and resulting from grip fighting, being thrown, or attempting to throw.

The BJJ injury rates in our study were also substantially lower than the injury rates reported for taekwondo,

another internationally popular martial art. A recent meta-analysis of studies of taekwondo competitions¹⁶ combined data from 8 studies for a total of 1405 injuries among 10,947 participants and 20,568 athlete-exposures from 15 taekwondo tournaments in 6 countries and reported the overall mean injury rate of 79.3 per 1000 exposures in taekwondo competitions. The injury rate of 9.2 per 1000 exposures observed in our study of 8 BJJ tournaments suggests an almost 9 times lower risk of injuries in BJJ competitions compared with taekwondo competitions. Taekwondo competitors were most at risk for lower limb injuries, followed by head and neck injuries.^{12,16,22} Contusions were by far the most frequent type of injuries in taekwondo competitions, followed by sprains and lacerations.^{12,22,26} In contrast, our study showed that upper extremity injuries, especially of the elbow, were the most common injuries in BJJ competitions, and that sprains were the most common injury type. In contrast, receiving a blow and delivering a blow were the most common injury mechanisms and accounted for most injuries in taekwondo.¹⁶ These results were as expected, since BJJ disallows kicks, whereas taekwondo is characterized by its emphasis on dynamic kicking techniques.

The BJJ injury rates in our study were also substantially lower than the injury rates reported for wrestling. Jarret et al¹⁰ reported an injury rate of 30.7 per 1000 exposures in collegiate wrestling matches. Similarly, Myers et al¹⁷ reported 29.6 injuries per 1000 exposures in high school wrestlers. As in wrestling studies,^{15,17,29} we found that injuries in young athletes were less frequent than in adults. Strauss and Lanese²⁹ found 9- to 14-year-old wrestlers had a tournament injury rate of 3.8% compared with high school and college wrestlers who had a tournament injury rate of 12%. This may be because of differences in strength and weight in the younger athletes when compared with adults.

It is important to note that our study focused on the injuries sustained in BJJ competitions. Athletes typically spend considerably more time training and practicing than competing. Injuries incurred during practice and training were beyond the scope of this study. According to Kujala et al,¹⁵ about 30% of injuries in judo occurred at competitions, with the remainder in training. A study of injuries in collegiate wrestling using the National Collegiate



Figure 5. The “heel hook” is performed by trapping the opponent’s knee and forcibly internally rotating the foot, ankle, and lower leg, as demonstrated by Brazilian Jiu-Jitsu Grand Master Relson Gracie. This technique has been shown to pose a high risk of injury and was not allowed in the tournaments included in the study.

Athletic Association Injury Surveillance System data for 1985-1995 by Jarret et al¹⁰ reported an injury rate of 30.7 per 1000 athlete-exposures for wrestling competition, compared with an injury rate of 7.2 per 1000 exposures for wrestling practice. Future research should examine injuries occurring during BJJ training and strategies to minimize the injury risk. Long-term consequences of BJJ participation were beyond the scope of this study.

Overall, injury levels observed in our study of 8 statewide BJJ tournaments were low. Unlike other martial arts, BJJ disallows punches, strikes, or kicks of any kind, which reduces the risk of lacerations and concussions. Certain techniques such as “heel hooks” (Figure 5) and “knee bars,” which pose high risk for injury,¹ were not allowed in these tournaments.

We found the most common group of orthopaedic injuries to be elbow injuries due to the jiu-jitsu arm bars. Most were hyperextension injuries to the elbow. This typically occurred when the competitor attempted to resist the arm bar or did not “tap out” quickly enough. Although the mechanism is a direct hyperextension injury to the elbow, most commonly, the ulnar collateral ligament was injured. This may be because of the injured athlete externally rotating the elbow in an attempt to escape, resulting in a valgus stress. Hyperextension injury to the elbow in the past has been described as the “hand ball goalies elbow.”³¹ With the rapid increase in popularity of BJJ, we propose that the “jiu-jitsu elbow” be studied as another mechanism of hyperextension injury to the elbow in sports.

The authors also note that the low incidence of injury attributable to jiu-jitsu style chokes (Figure 3). Only 1 injury, a cervical strain due to a triangle choke, was identified in this series. The unpleasant sensation of being in a choke hold induces most competitors to rapidly “tap out” when caught in one of these holds. Attentive referees are imperative to stop the match should a competitor fail to “tap out.” Despite the obvious concerns, we only identified

the 1 injury described above out of 5022 potential exposures in the competitions included in this study.

The authors believe that the first level of injury prevention in BJJ is the athlete himself or herself. BJJ competitors should develop a high level of physical fitness and a thorough understanding of the strategy and the techniques before participating in competitions. The athlete should be able to recognize when he or she is at risk of injury and be willing to “tap out” before injury occurs.

The second level of injury prevention lies with the referee, who should be watching the competition attentively and at close range and should be ready to stop the match immediately if one of the competitors appears to be at risk of injury.

The final level of prevention is with the event physician, who should be readily available to evaluate and attend to the injured athlete. Understanding the unique mechanisms of injury of BJJ can assist in maintaining the highest level of safety for the competition.

BJJ should be of special interest to orthopaedic surgeons. Many of the BJJ techniques, if carried out to their conclusions, such as in a self-defense situation, potentially have orthopaedic consequences. In competitions, the ability to recognize and defend against these submission attempts is a core part of the strategy of BJJ. If avoidance and defense fail, the ability to “tap out” allows the competitor to give up without injury.

This study had potential limitations owing to the nature of the events. Typically, large numbers of BJJ competitors would converge on the competition venue for the day of the event. One of the 2 physician authors of the study was present at a prominent station immediately adjacent to the competition mats throughout the competition events. They were available to attend to any injured athlete throughout the entire event. It is possible that certain injuries may have had delayed onset of symptoms and therefore, might not have been identified on the day of the competition. These would therefore have been missed and not included in the study. Some competitors, for personal reasons, may have concealed or failed to report their injuries to the event physicians. The logistics of the competitions and the fact that the athletes converged on the event venue from around the state made future follow-up difficult, as the competitors returned to their home towns and physicians after the competition ended. These factors may have unintentionally resulted in underreporting of certain injuries.

This study was not meant to provide a comprehensive listing of all possible injuries in BJJ competition. We do feel that this study gives useful information on the mechanism of injury, the location of injury, the clinical diagnosis of injury, and the incidence of identified injury on the date of matches in BJJ competition.

All injuries were diagnosed by history and physical examination by 1 of 2 board-certified orthopaedic surgeons. No imaging devices were available on-site. Although there are obvious limitations of this method of diagnosing injury, we believe it provides useful information comparable to that provided in published studies of injuries in other martial arts and wrestling competitions. In fact, clinical diagnosis is the initial screening tool employed by event physicians in all sports.

Future studies might include evaluating all injuries resulting from jiu-jitsu seen in an orthopaedic surgeon's office or in a given hospital emergency room. Such studies would allow more in-depth diagnostic studies and follow-up, which were not possible in this study.

CONCLUSION

BJJ is a fast-growing martial art form emphasizing take-downs, joint locks, and leverage. We sought to determine what injuries occur in BJJ competitions. We found that orthopaedic injuries constituted the most common group of injuries, with the elbow being the most commonly injured joint. The most common mechanism was the jiu-jitsu arm bar. The knee was the second most frequently injured joint, followed by the foot and ankle. The rate of injury in BJJ competition was substantially lower than the injury rates reported for taekwondo, judo, wrestling, and MMA competitions.

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