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Injuries in a Japanese Division I Collegiate American Football Team: A 3-Season Prospective Study

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Context: Previous research on American football injuries in Japan has focused on incidence proportion in terms of the number of injuries divided by the number of players. This is the first study to examine injury rates over several seasons.

Objective: To conduct a prospective study of injuries in a Japanese Division I collegiate American football team over the 2007 through 2009 seasons.

Design: Cohort study.

Setting: Collegiate football team at Doshisha University, Kyoto, Japan.

Patients or Other Participants: All 289 athletes who played on the collegiate Division I football team during the 2007 through 2009 seasons.

Main Outcome Measure(s): A certified athletic trainer kept a daily record of all practice and game injuries. Injury rates were calculated according to season, injury type, body part, severity, and mechanism. Injuries were also analyzed according to position of player, school year, and playing experience.

Results: The game injury rate (GIR; 32.7 injuries/1000 athlete-exposures) was higher than the practice injury rate (PIR; 10.9 injuries/1000 athlete-exposures) over the 3 seasons ($P < .05$). The PIR was higher among Japanese players than the comparable United States collegiate football injury rates (5.8–7.0 injuries/1000 athlete-exposures). Ankle and foot injuries occurred more frequently during games, whereas thigh and gluteal injuries occurred more frequently during practices.

Conclusions: Our data show differences between games and practices in terms of injury rates, body parts injured, and positions of players injured. The high PIR in Japan may be due to the increased contact during practices and length of practices compared with the United States. Further research involving multiple teams is recommended to validate the trends noted in this study. The expanded data set could assist in the development of safety regulations and preventive interventions for Japanese football.

Key Words: Japanese football, American football, college football, injury rates

Key Points

- The practice injury rate for Japanese collegiate football players was higher than in the United States. This may be explained by the increased contact during practice and unregulated practice length in Japan.
- Ankle and foot injuries occurred more often during games, whereas thigh and gluteal injuries were more frequent during practices.

American football is 1 of the most popular sports in the United States, played by more than 60 000 college-level male athletes in 2008 and more than 1 million high school male athletes in 2009.[1,2] Football has a high injury risk,[3] and as the number of players has grown, so has the number of injuries experienced.[4] Previous researchers[3,5–13] have examined football injuries in a variety of conferences, divisions, and schools. Football had the highest number of reported injuries among the 5 fall collegiate sports.[3] The National Collegiate Athletic Association (NCAA) reported 266 943 injuries during the 2004–2005 through 2008–2009 seasons. Hootman et al[14] noted that football had the highest number of serious sport-related injuries (eg, anterior cruciate ligament injury, concussion) among the 15 collegiate sports. Ramirez et al[13] found that the estimated cost per football injury increased by approximately 20% from 1977 to 1986. Injured athletes may also experience psychological trauma such as fear of reinjury or surgery.[15] The NCAA has implemented measures to reduce injury risk. In 1998, limits were placed on the number of practices and the number of contacts allowed during spring football practices in an attempt to reduce the injury rate, which was twice as high during spring football practices as during fall practices.[5]

Data released in 2008 by the Japanese Football Association[16] indicated that approximately 20 000 football players participated on 402 teams, including 11 junior high school teams, 112 high school teams, 218 university teams, and 61 adult club teams. Despite the relatively large number of players, research regarding football injuries in Japan is limited.[17–21] Moreover, unlike in the United States, no evidence-based rule changes have been implemented to try to reduce injuries in Japanese football.

Previous Japanese studies have focused on incidence proportion, calculated as the number of injuries divided by the number of players. Although incidence proportion can directly measure the risk of injury, which is useful information for the general public, this value is rarely used in the sport-injury literature and is difficult to compare among different sports.[22] Injury rate is easier to compare among different sports and permits comparisons within the sport, both nationally and internationally.

Only 1 Japanese study[20] has examined injury rates according to athlete-exposures (AEs). However, that study was conducted during a single season, and no studies have followed a team over several seasons. In comparison, research in the United States has examined injury rates based on multiple-year records.[5,7,10,11,13,14] We aimed to examine practice and game injury rates according to season, injury type, body part, severity, and mechanism in a Japanese Division I collegiate football team over 3 consecutive seasons. Injuries were also analyzed according to position of player, school year, and playing experience.

METHODS

Participants

During the 2007 through 2009 seasons, a total of 289 athletes played on the Doshisha University football team (Kyoto, Japan; Japanese Division I Collegiate Football League). Of these, 97 played during 2007 (age = 20.5 ± 1.2 years, playing experience = 3.4 ± 2.1 years), 100 played during 2008 (age = 20.8 ± 1.3 years, playing experience = 3.5 ± 2.1 years), and 92 played during 2009 (age = 20.3 ± 1.5 years, playing experience = 3.6 ± 1.5 years).

Unlike collegiate football in the United States, more than half of the players started playing football at the university (55.7% of 2007 players, 65.0% of 2008 players, and 59.8% of 2009 players). Game starters by grade were sophomores (0% in 2007, 2.0% in 2008, and 9.1% in 2009), juniors (59.1% in 2007, 31.8% in 2008, and 31.8% in 2009), and seniors (40.9% in 2007, 59.1% in 2008, and 59.1% in 2009); no players started during their freshman year. For data analysis, players were grouped by position into defensive back (DB), linebacker (LB), defensive lineman (DL), offensive lineman (OL), running back (RB), tight end (TE), wide receiver (WR), or quarterback (QB). This study was approved by the Institutional Review Board of Kyoto University. Informed consent was obtained from all participants.

Descriptions of Seasons, Practices, and Games

Japanese collegiate football consists of spring and fall seasons. The spring season runs from May to early July, and the fall season runs from September to mid-December. In the present study, data for each season were collected from the beginning of full-contact preseason practices until the end of the final game of the season, including any postseason playoff games. The preseason practices typically lasted for 1 month before the first game of the season.

Practices consisted of all types of skill training on the field, including scrimmage and position training. Field practice time was approximately 4 hours per day, 5 or 6 days per week. During the fall season of each year, 7 league games were played, with a game played every 2 weeks, plus 1 postseason game in each of 2007 and 2008. In addition, 6 exhibition games were played during the spring season of each year.

Injury Definitions

All injuries that occurred during practices or games during the 2007 through 2009 seasons were recorded by a certified athletic trainer. We defined an *injury* as any event that (1) occurred during a regular practice or game, (2) caused the player to seek medical care from the team physician or athletic trainer, and (3) caused a player to miss a subsequent practice or game. All fractures and dental injuries were included regardless of any time loss. Injuries were classified into 3 categories of severity: minor (time loss 1–7 days), moderate (time loss 8–21 days), and major (time loss >21 days).[11] The team physician made the final diagnosis in all cases and determined the return-to-play time. We defined an *AE* as 1 athlete participating in 1 game or practice.[22] Game and practice AEs were calculated by multiplying the average number of players participating in each game or practice by the number of games or practices.

Statistical Analysis

We calculated injuries per 1000 AEs by dividing the number of injuries by the number of AEs and multiplying by 1000.[22] The practice injury rate (PIR) and game injury rate (GIR) were calculated with 95% confidence intervals (CIs).[22] The injury rate ratio (IRR) was calculated by dividing the GIR by the PIR. Injury rate ratios with 95% CIs[22] were calculated according to season, injury type, body part, severity, and mechanism. The difference between GIR and PIR was considered to be statistically significant if the 95% CI for IRR did not include 1.[5] The IRRs for games and practices were compared among the 3 seasons using the χ^2 test. The α level was set at $P \leq .05$. We also calculated the numbers and percentages of injuries in practices and games according to position of player, school year, and playing experience. For all analyses, SPSS software for Windows (Japanese version 17.0; SPSS Japan Inc, Tokyo, Japan) was used.

RESULTS

Injury Rates Over the 3 Seasons

A total of 545 injuries were reported over the 2007 through 2009 seasons. Of these, 447 (82.0%) occurred during practices and 98 (18.0%) during games (Tables 1 and 2). The overall PIR and GIR were 10.9 and 32.7, respectively. The overall IRR was 3.0 (95% CI = 2.4, 3.7), indicating that the overall GIR was higher than the overall PIR ($P \leq .05$).

Injury Types

Sprains were the most common injuries (28.8% of all injuries), followed by strains (23.5%) and contusions (14.3%; Table 3). Sprains had the highest PIR (3.0 injuries/1000 AEs, 95% CI = 2.5, 3.5) and GIR (11.3 injuries/1000 AEs, 95% CI = 7.5, 15.1) among injury types (Table 3). Dislocation or subluxation had the highest IRR (7.7, 95% CI = 3.1, 19.1), followed by fractures,

Table 1. Injury Rates in a Japanese Collegiate Football Team from the Japanese Division I Collegiate Football League, Fall and Spring Seasons, 2007–2009[a]

	Preseason				Season			
Variable	2007	2008	2009	Subtotal	2007	2008	2009	Subtotal
Spring season								
No. of injuries during practices	11	13	14	38	41	41	20	102
No. of injuries during games	0	0	0	0	7	23	11	41
No. of practices	20	22	29	71	34	43	36	113
No. of games	0	0	0	0	6	6	6	18
Practice AEs	1840	1892	2407	6139	3128	3698	2988	9814
Practice injuries per 1000 AEs (95% CI)	6.0 (2.5–9.5)	6.9 (3.2–9.6)	5.8 (2.8–8.8)	6.2 (4.2–8.2)	13.1 (9.1–17.1)	11.1 (7.7–14.5)	6.7 (3.8–9.6)	10.4 (8.4–12.4)
Game AEs	NA	NA	NA	NA	450	456	408	1314
Game injuries per 1000 AEs (95% CI)	NA	NA	NA	NA	15.6 (4.1–27.1)	50.4 (29.8–71.0)	27.0 (11.1–42.9)	31.2 (21.6–40.8)
Injury rate ratio (95% CI)	NA	NA	NA	NA	1.2 (0.5–2.7)	4.5 (2.7–7.5)	4.0 (1.9–8.3)	3.0 (2.1–4.3)
Fall season								
No. of injuries during practices	44	41	21	106	71	86	21	178
No. of injuries during games	0	0	0	0	20	31	6	57
No. of practices	25	31	27	83	60	64	62	186
No. of games	0	0	0	0	7	7	7	21
Practice AEs	2300	2666	2241	7207	5520	5504	5146	16170
Practice injuries per 1000 AEs (95% CI)	19.1 (13.4–24.8)	15.4 (8.8–22.0)	9.4 (5.4–13.4)	14.7 (11.9–17.5)	12.9 (9.9–15.9)	15.6 (12.3–18.9)	4.1 (2.4–5.8)	11.0 (9.4–12.6)
Game AEs	NA	NA	NA	NA	525	532	476	1533
Game injuries per 1000 AEs (95% CI)	NA	NA	NA	NA	38.1 (21.4–54.8)	58.3 (37.8–78.8)	12.6 (2.3–20.3)	37.2 (27.5–46.9)
Injury rate ratio (95% CI)	NA	NA	NA	NA	3.0 (1.8–4.9)	3.7 (2.5–5.6)	3.1 (1.1–6.9)	3.4 (2.5–4.6)

Abbreviations: AEs, athlete-exposures; CI, confidence interval; NA, not applicable.

[a] Injury rate ratio = game injury rate/practice injury rate. χ^2 test: Practice injury rate differed between seasons ($P < .05$). Game injury rate did not differ between seasons ($P > .05$). Average number of players at practices by year: 92 (2007), 86 (2008), 83 (2009). Average number of players at games by year: 75 (2007), 76 (2008), 68 (2009).

Table 2. Injury Rates in a Japanese Collegiate Football Team from the Japanese Division I Collegiate Football League, Postseason, 2007–2009

Variable	2007	2008	2009	Subtotal	Total
No. of injuries during practices	14	9	NA	23	447
No. of injuries during games	0	0	NA	0	98
No. of practices	10	11	NA	21	474
No. of games	1	1	NA	2	41
Practice AEs	920	946	NA	1866	41 196
Practice injuries per 1000 AEs (95% CI)	15.2 (7.2–23.2)	9.5 (3.3–15.7)	NA	12.3 (7.3–17.3)	10.9 (9.9–11.9)
Game AEs	75	76	NA	151	2998
Game injuries per 1000 AEs (95% CI)	0.0	0.0	NA	0.0	32.7 (26.2–39.2)
Injury rate ratio (95% CI)	0.0	0.0	NA	NA	3.0 (2.4–3.7)

Abbreviations: AEs, athlete-exposures; CI, confidence interval; NA, not available.

contusions, sprains, and tendinitis. The GIR was higher than the PIR for all these injury types ($P < .05$ for all; Table 3).

Sprains were most common at the foot and ankle (66/157 injuries, 42.0%), followed by the knee (43/157 injuries, 27.4%), shoulder and elbow, and finger (each 18/157 injuries, 11.5%). Strains were most common at the thigh (94/128 injuries, 73.4%), and contusions were most common at the knee (26/78 injuries, 33.3%).

Injury Rates According to Body Part

The major body area most frequently injured was the lower limb (328/545 injuries, 60.2%), which had a PIR of 6.6 injuries/1000 AEs (95% CI = 5.8, 7.4) and GIR of 18.7 injuries/1000 AEs (95% CI = 13.8, 23.6; Table 4). The next most common body major body area injured was the upper limb, which had a PIR of 2.4 injuries/1000 AEs (95% CI = 1.9, 2.9) and GIR of 8.7 injuries/1000 AEs (95% CI = 5.4, 12.0).

Injury Severity and Mechanisms of Injury

Almost half of all injuries were minor (272/545 injuries, 49.9%; Table 5). During practices, the injuries were most frequently minor (5.8 injuries/1000 AEs, 95% CI = 5.1, 6.5), and during games, the injuries were most frequently moderate (13.3 injuries/1000 AEs, 95% CI = 9.2, 17.4; Table 5). Calculation of IRRs showed that the GIR was higher than the PIR for all injury severities ($P \leq .05$; Table 5).

Contact was the most common mechanism of injury in both practices (222/447 injuries, 49.7%) and games (62/98 injuries, 63.3%; Table 6). Calculation of IRRs showed that the GIR was higher than the PIR for both contact and noncontact injuries ($P \leq .05$; Table 6).

Injuries According to Position of Player

Overall, the highest number of injuries occurred in RBs (104/545 injuries, 19.1%), followed by WRs (98/545 injuries, 18.0%) and LBs (90/545 injuries, 16.5%; Table 7). During practices, the highest numbers of injuries occurred in WRs (89/447 injuries, 19.9%), followed by RBs (87/447 injuries, 19.5%) and LBs (73/447 injuries, 16.3%). During games, the highest numbers of injuries occurred in DBs (19/98 injuries, 19.4%), followed by DLs (18/98 injuries, 18.4%), and RBs and LBs (each 17/98 injuries, 17.3%). Offensive units accounted for 56.5% of all injuries and defensive units for 43.5%.

Year in School and Playing Experience

The highest overall number of injuries occurred in athletes in their junior year (162/545 injuries, 29.7%). The highest number of game injuries also occurred in athletes in their junior year (39/98 injuries, 39.8%; Table 7). The highest number of practice injuries occurred in athletes in their junior and sophomore years (each 123/447

Table 3. Injury Rates by Injury Type for a Japanese Collegiate Football Team from the Japanese Division I Collegiate Football League, 2007–2009

	Practice		Game			
Injury Type	n	IR (95% CI)	n	IR (95% CI)	IRR (95% CI)	Total
Sprain	123	3.0 (2.5–3.5)	34	11.3 (7.5–15.1)	3.8 (2.6–5.6)[a]	157
Strain	115	2.8 (2.3–3.3)	13	4.3 (1.9–6.7)	1.5 (0.8–2.7)	128
Contusion	60	1.5 (1.1–1.9)	18	6.0 (3.2–8.8)	4.0 (2.4–6.8)[a]	78
Fracture	18	0.4 (0.2–0.6)	7	2.3 (0.6–4.0)	5.8 (2.4–13.9)[a]	25
Dislocation/subluxation	14	0.3 (0.1–0.5)	7	2.3 (0.6–4.0)	7.7 (3.1–19.1)[a]	21
Concussion	17	0.4 (0.2–0.6)	3	1.0 (0.0–2.1)	2.5 (0.7–8.5)	20
Tendinitis	17	0.4 (0.2–0.6)	4	1.3 (0.0–2.6)	3.3 (1.1–9.8)[a]	21
Meniscus tear	22	0.5 (0.3–0.7)	2	0.7 (0.0–1.6)	1.4 (0.3–6.0)	24
Nerve injury	21	0.5 (0.3–0.7)	4	1.3 (0.0–2.6)	2.6 (0.9–7.6)	25
Wound	3	0.1 (0.0–0.2)	1	0.3 (0.0–1.0)	3.0 (0.3–28.8)	4
Other	37	0.9 (0.6–1.2)	5	1.7 (0.2–3.2)	1.9 (0.7–4.8)	42

Abbreviations: CI, confidence interval; IR, injury rate = injuries per 1000 athlete-exposures; IRR, injury rate ratio = game injury rate/practice injury rate.

[a] $P \leq .05$. Athlete-exposures: practice = 41 196, game = 2998.

Table 4. Injury Rates According to Body Part for a Japanese Collegiate Football Team from the Japanese Division I Collegiate Football League, 2007–2009

	Practice		Game			
Body Part	n	IR (95% CI)	n	IR (95% CI)	IRR (95% CI)	Total
Head and neck	27	0.7 (0.5–0.9)	6	2.0 (0.4–3.6)	2.9 (1.2–7.0)[a]	33
Head and neck	24	0.6 (0.4–0.8)	5	1.7 (0.2–3.2)	2.8 (1.1–7.3)[a]	29
Face and scalp	3	0.1 (0.0–0.2)	1	0.3 (0.0–1.0)	3.0 (0.3–28.8)	4
Upper limb	98	2.4 (1.9–2.9)	26	8.7 (5.4–12.0)	3.6 (2.3–5.5)[a]	124
Shoulder and upper arm	44	1.1 (0.7–1.3)	13	4.3 (1.9–6.7)	3.9 (2.1–7.2)[a]	57
Elbow and forearm	11	0.3 (0.2–0.6)	7	2.3 (0.6–4.0)	7.7 (3.0–19.9)[a]	18
Wrist, hand, and finger	43	1.0 (0.7–1.3)	6	2.0 (0.4–3.6)	2.0 (0.9–4.7)	49
Trunk and back	43	1.0 (0.7–1.3)	9	3.0 (1.0–5.0)	3.0 (1.5–6.2)[a]	52
Chest, abdomen, and upper back	16	0.4 (0.2–0.6)	3	1.0 (0.0–2.1)	2.5 (0.7–8.6)	19
Lower back (pelvis)	27	0.7 (0.5–0.9)	6	2.0 (0.4–3.6)	2.9 (1.2–7.0)[a]	33
Lower limb	272	6.6 (5.8–7.4)	56	18.7 (13.8–23.6)	2.8 (2.1–3.7)[a]	328
Thigh and gluteus	93	2.3 (1.8–2.8)	11	3.7 (1.5–5.9)	1.6 (0.9–3.0)	104
Knee	79	1.9 (1.5–2.3)	21	7.0 (4.0–10.0)	3.7 (2.3–6.0)[a]	100
Lower leg	33	0.8 (0.5–1.1)	8	2.7 (0.9–4.5)	3.4 (1.6–7.4)[a]	41
Ankle and foot	67	1.6 (1.2–2.0)	16	5.3 (2.7–7.9)	3.3 (1.9–5.7)[a]	83
Other						
Systemic sport-related illness, etc	7	0.2 (0.1–0.3)	1	0.3 (0.0–1.0)	1.5 (0.2–12.2)	8

Abbreviations: CI, confidence interval; IR, injury rate = injuries per 1000 athlete-exposures; IRR, injury rate ratio = game injury rate/practice injury rate.
[a] $P \leq .05$. Athlete-exposures: practice = 41 196; game = 2998.

injuries, 27.5%). Analysis of injuries according to playing experience showed that the highest number of overall injuries occurred in players with 2 years of experience (118/545 injuries, 21.7%). The highest number of practice injuries also occurred in players with 2 years of experience (103/447 injuries, 23.0%). The highest number of game injuries occurred in players with 3 years of experience (27/98 injuries, 27.6%).

DISCUSSION

Our 3-year prospective observational study examined current injury patterns among players on a collegiate football team in Japan. The overall injury rate, including practice and game injuries, was higher in Japanese players (12.3 injuries/1000 AEs, 95% CI = 11.3, 13.3) than in collegiate American football players (8.6–10.5 injuries/1000 AEs).[3,8] This difference is explained by the relatively higher number of practice injuries in Japanese players.

Practice Versus Game Injuries

We found that the overall GIR was higher than the PIR ($P \leq .05$). This is consistent with the findings of previous studies conducted in the United States.[3,8] Although the GIR in Japan (32.7 injuries/1000 AEs) was similar to the GIR reported in the United States (35.9 injuries/1000 AEs),[7] the PIR in Japan (10.9 injuries/1000 AEs) was higher than the PIR reported in the United States (5.8–7.0 injuries/1000 AEs).[3,8]

Practice length is not regulated in Japan, although it is strictly regulated by the NCAA in the United States.[23] It is therefore possible that the higher PIR in Japan is due to a longer average practice time (4 hours per day) than in the United States. Another possible explanation for the higher PIR is the emphasis placed on scrimmage during practices by Japanese football coaches, which may be related to the high proportion of players who start playing football during their time at the university.[20] This may lead to an increased number of contacts (eg, tackling or blocking), resulting in cumulative trauma, which could raise the injury rate.

American football is regarded as a high-risk sport. Many efforts in the United States have been directed at decreasing the risks by rule changes, new regulations, and the development of protective equipment.[7] Importantly, these changes have been evidence based.[7] However, such efforts to decrease the risks have not been made in Japan. We suggest that the Japanese PIR could be reduced if the number of scrimmages and length of practices were modified by individual coaches or by league regulations.

Table 5. Injury Rates According to Severity of Injury for a Japanese Collegiate Football Team from the Japanese Division I Collegiate Football League, 2007–2009

	Practice		Game			
Injury Severity	n	IR (95% CI)	n	IR (95% CI)	IRR (95% CI)	Total
Minor	239	5.8 (5.1–6.5)	33	11.0 (7.2–14.8)	1.9 (1.3–2.7)[a]	272
Moderate	121	2.9 (2.4–3.4)	40	13.3 (9.2–17.4)	4.6 (3.2–6.6)[a]	161
Major	85	2.1 (1.7–2.5)	25	8.3 (5.0–11.6)	4.0 (2.6–6.2)[a]	110
Unknown	2	0.0 (0.0–0.1)	0	0.0 (0.0–2.7)	0.0 (0.0–0.0)	2

Abbreviations: CI, confidence interval; IR, injury rate = injuries per 1000 athlete-exposures; IRR, injury rate ratio = game injury rate/practice injury rate.
[a] $P \leq .05$. Athlete-exposures: practice = 41 196; game = 2998.

Table 6. Injury Rates According to Injury Mechanism for a Japanese Collegiate Football Team from the Japanese Division I Collegiate Football League, 2007–2009

	Practice		Game			
Injury Mechanism	n	IR (95% CI)	n	IR (95% CI)	IRR (95% CI)	Total
Contact	222	5.4 (4.7–6.1)	62	20.7 (15.6–25.8)	3.8 (2.9–5.0)[a]	284
No contact	209	5.1 (4.4–5.8)	35	11.7 (7.8–15.6)	2.3 (1.6–3.3)[a]	244
Other or unknown	16	0.4 (0.2–0.6)	1	0.3 (0.0–1.0)	0.8 (0.1–6.8)	17

Abbreviations: CI, confidence interval; IR, injury rate = injuries per 1000 athlete-exposures; IRR, injury rate ratio = game injury rate/practice injury rate.
[a] $P \leq .05$. Athlete-exposures: practice = 41 196; game = 2998.

We hope that our findings will contribute to future legislation governing safety in American football in Japan.

Injury Rates According to Body Part

In our study, the major body area most frequently injured was the lower limb (60.2% of injuries). This is consistent with the results of previous studies.[3,7,11,13] Further analysis showed that the thigh and gluteal area was the most frequently injured part of the lower limb (31.7% of all lower limb injuries), followed by the knee (30.5% of all lower limb injuries) and the ankle and foot (25.3% of all lower limb injuries).

An interesting finding warranting further research was that knee and ankle injuries (predominantly sprains) had higher GIRs, whereas thigh and gluteal injuries (predominantly strains) had higher PIRs. Although specifically analyzing these injuries was beyond the scope of our study, these findings could help to identify appropriate conditioning exercises to prevent and reduce injuries to those body parts.

Table 7. Injuries in Practices and Games According to Position of Player, School Year, and Playing Experience for a Japanese Collegiate Football Team from the Japanese Division I Collegiate Football League, 2007–2009

	Practice		Game		
	n	%	n	%	Total
Player position					
Offensive					
Offensive lineman	72	16.1	14	14.3	86
Tight end	14	3.1	3	3.1	17
Quarterback	2	0.4	1	1.0	3
Running back	87	19.5	17	17.3	104
Wide receiver	89	19.9	9	9.2	98
Defensive					
Defensive lineman	52	11.6	18	18.4	70
Linebacker	73	16.3	17	17.3	90
Defensive back	58	13.0	19	19.4	77
School year					
Freshman	98	21.9	3	3.1	101
Sophomore	123	27.5	19	19.4	142
Junior	123	27.5	39	39.8	162
Senior	103	23.0	37	37.8	140
Playing experience, y					
1	81	18.1	4	4.1	85
2	103	23.0	15	15.3	118
3	75	16.8	27	27.6	102
4	59	13.2	10	10.2	69
5	24	5.4	7	7.1	31
6	42	9.4	14	14.3	56
7	48	10.7	16	16.3	64
>8	15	3.4	5	5.1	20

Injury Severity and Mechanisms of Injury

Most injuries in this study were minor (49.9% of all injuries), which is similar to the findings of previous studies (48.6%–64.5% of all injuries).[5,8] Comparison of IRRs showed that the GIR was highest for moderate injuries, whereas the PIR was highest for mild injuries. This observation suggests that higher intensity and speed during games may explain the more severe injuries. However, Dick et al[7] pointed out that football coaches have more influence during practices than during games, which could increase the use of proper techniques during practices (eg, safe tackling and blocking). This could explain why minor injuries were the most frequent during practices.

Our study showed that the leading cause of injury was contact (284 of all injuries, 52.1%). Contact was the mechanism in 49.7% of practice versus 63.3% of game injuries. In comparison, Dick et al[7] and Shanker et al[8] reported higher percentages of injuries due to contact in the United States, especially during games (82.4%–82.9%). This difference may be explained by the superior physical characteristics (body mass, stature, power, and strength) of players in the United States,[24] which are potentially linked to higher forces on impact. For contact injuries, the GIR was approximately 3.8 times higher than the PIR. This may have been because of increased contact and higher intensity and speed during games, resulting in higher impact forces. Another possibility is that, as discussed previously,[7] football coaches have more control during practices than during games, resulting in a lower injury risk during practices.

Injuries According to Position of Player

Our analysis demonstrated that the highest numbers of injuries occurred in RBs, WRs, and LBs. This is consistent with US injury data.[3,7–9,13] The high numbers of injuries occurring in RBs and WRs may be explained by the requirements of these positions, which emphasize running and ball carrying.[12] The high numbers of injuries occurring in LBs may be because they often tackle offensive players moving at high rates of speed.

Our analysis according to offensive and defensive units showed that higher numbers of injuries occurred in offensive units than defensive units, which is consistent with the results of a previous study.[8] This can be explained by the presence of RBs and WRs in the offensive units, as well as OLs, who sustained the fourth highest number of injuries. We examined 3 categories of mechanism of injury (contact, noncontact, and other or unknown), but further

study is needed to analyze more specific mechanisms in offensive and defensive units such as tackling, blocking, or being blocked, to help clarify the reasons for the differences in injuries between the units.

Injuries by Playing Experience and Grade

As most athletes who started playing football during their time at Doshisha University did so during their junior or senior years, higher frequencies of contact during games and practices may have contributed to the higher numbers of injuries during those years. Based on our observations, these players may be more likely to be exposed to repeated and cumulative body trauma, which has also been observed in previous studies.[10,13]

The highest numbers of injuries during practices occurred in players with 1 or 2 years of experience. This observation may be important for identifying underlying causes of injury related to the playing experience. To decrease the high numbers of injuries in these experienced players, coaches and athletic trainers should work together to carefully watch and analyze their injury patterns and trends and identify appropriate types of practice.

LIMITATIONS

Our study has the following limitations. First, we only examined 3 categories of mechanism of injury (contact, no contact, and other or unknown), and practices were not classified into types (eg, scrimmages, conditioning, helmet use), which prevented in-depth analysis of the mechanisms and practice types underlying the injuries. Examination of additional mechanisms, such as tackling, blocking, or sprinting, and classification of practice types would have strengthened the study. Second, we studied only 1 poorly ranked team, whereas the injury data of most studies in the United States were collected from multiple teams and a variety of conferences and divisions.[1,3,5,7,8] This limits the ability to generalize our findings to higher-ranked teams or different conferences or divisions in Japan. Injury data were collected from only 1 team in this study because Japan has no injury-reporting system such as the National Athletic Injury/Illness Reporting System (NAIRS),[11] and few certified athletic trainers work full time at schools and keep injury records. Information regarding injuries is usually not available to the public or shared among institutions. Future authors should examine a number of teams across a variety of conferences and divisions. Finally, we compared PIRs in Japan with those in the United States despite the different practice styles used by coaches in these countries, which may affect PIRs.

CONCLUSIONS

This is the first study to analyze American football injuries per 1000 AEs over a 3-year period in Japan. We found that the GIR was higher than the PIR, which is consistent with research conducted in the United States. A unique finding of this study was that the PIR was higher in our Japanese team than the PIR reported in the United States. This may be explained by the particular style of practices in Japan. Furthermore, lower limb injuries comprised 60% of all injuries, with knee injuries and ankle and foot injuries the most frequent during games and thigh and gluteus injuries the most frequent during practices. To develop an effective strategy to decrease football injuries in Japan, further research is required, especially regarding mechanisms of injury, injuries according to types of practices, injury-prevention interventions, and injury patterns and trends in schools, divisions, and leagues.

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