Incidence, site, and nature of injuries in amateur rugby league over three consecutive seasons

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Abstract

***Objectives*—To report the incidence, site, and nature of injuries in amateur rugby league over three consecutive seasons.**

***Methods*—Six hundred players registered with an amateur rugby league organisation were studied over three consecutive seasons. All injuries sustained during the amateur rugby league matches were recorded. Information recorded included the date and time of injury, name of injured player, anatomical site and nature of injury, and position of the player.**

***Results*—The incidence of injury was 160.6 per 1000 player-position game hours, with forwards having a significantly higher incidence of injury than backs (182.3 per 1000 *v* 142.0 per 1000, $\chi^2 = 14.60$, df = 1, p<0.001). Over 25% of the total injuries (40.6 per 1000) sustained during the three year period were to the head and neck, while injuries to the face (21.3 per 1000, 13.3%), abdomen and thorax (21.3 per 1000, 13.3%), and knee (17.8 per 1000, 11.1%) were less common ($\chi^2 = 21.83$, df = 8, p<0.01). Muscular injuries (haematomas and strains) were the most common type of injury (45.7 per 1000, 28.5%, $\chi^2 = 17.98$, df = 7, p<0.05). Significantly more injuries occurred in the latter stages of the season ($\chi^2 = 22.94$, df = 1, p<0.001), with most injuries (70.8%, $\chi^2 = 162.29$, df = 1, p<0.001) sustained in the second half of matches.**

***Conclusions*—The results show that muscular injuries and injuries to the head and neck are the most commonly sustained injuries in amateur rugby league. Furthermore, injuries are more often sustained in the latter stages of the season and during the second half of matches. These findings suggest that fatigue or accumulative microtrauma, or both, may contribute to injuries in amateur rugby league players.**

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Rugby league is an international body contact sport played at amateur, semiprofessional, and professional levels.[1–3] The intense physical nature of the game requires players to draw upon a variety of fitness components, including muscular strength and power, endurance, speed, acceleration, and agility.[4–7] However, as a result of the high number of physical collisions and the dynamic nature of rugby league, musculoskeletal injuries are extremely common.[8]

Several studies have reported the incidence of injury in rugby league,[1 3 9–18] with most of these studies being performed on professional players.[1 3 9 10 12–18] Gibbs defined an injury in terms of subsequent missed matches in a three year study of one Australian professional rugby league club, and reported an overall incidence of injury of 44.9 per 1000 player-position game hours.[1] Gissane and colleagues classified injuries according to time away from training or playing and reported that the incidence of injury in a British professional rugby league club was 114.3 per 1000 player-position game hours.[10 14] Despite the high injury rates described by Gibbs[1] and Gissane *et al*,[10] considerably higher injury rates have been reported when all injuries sustained during matches, including those that did not result in subsequently missed training sessions or matches, were recorded.[3 13 16] Injury rates of 214[3] and 277.78[16] per 1000 player-position game hours have been reported for professional rugby league. Furthermore, Hodgson Phillips *et al* found a progressively increasing incidence of injury (from 277.6 to 490.2 per 1000 player-position game hours) in one professional rugby league team over four consecutive seasons.[13] Although the different injury rates between studies can be attributed to many factors,[3 13 14] a high incidence of injury is a recurrent theme throughout most rugby league injury studies.

Although injury rates of professional rugby league players have been reported, the incidence of injury in amateur rugby league is unknown. It is possible that owing to differences in fitness and skill,[19] ground conditions, refereeing standards, and attitudes towards aggression and violence,[20] injury rates may be higher in amateur rugby league players. Therefore, the purpose of this study was to report the incidence, site, and nature of injuries in amateur rugby league over three consecutive seasons.

Methods

The incidence of injury was studied in nine rugby league teams over three competitive seasons (1995, 1996, and 1997). All teams were registered with the same open-age amateur rugby league organisation and played in the same amateur rugby league competition. Each season was played from March through September.

Over the three year period, 817 players were registered with the organisation. During the course of the study some teams left owing to

financial difficulties or lack of player numbers. When teams left the competition, other teams were formed or recruited to take their place. Two teams were unable to participate in two of the three competitive seasons. Three teams played two competitive seasons, while the remaining four teams played in all three competitive seasons. The total number of teams for the 1995, 1996, and 1997 competitive seasons was 6, 7, and 7, respectively.

The total number of registered players over this period was 271, 280, and 266, respectively. Most players (73.4%) played two or more competitive seasons. This provided a total sample of 600 registered players. All players were aged 18 or over and no training or match payments were offered to players.

Injury data were collected from 196 games, which included all pre-season, fixture, exhibition, and finals matches (table 1). All fixture, exhibition, and finals matches lasted for 70 minutes (35 minutes each half), whereas pre-season matches were 60 minutes long (30 minutes each half). For each team, matches were played at the same ground, on the same day so that three matches were typically played each week. In the 1996 and 1997 competitive seasons, teams were allocated one bye (rest from that week's matches) for each six matches played. Matches were separated by at least seven days.

A single head trainer, employed to provide first aid coverage to all clubs in the amateur rugby league competition, assessed all injuries. The head trainer held tertiary qualifications in exercise and sport science and was nationally accredited in injury prevention, assessment, and management. Although individual club sport trainers were permitted to enter the field freely during the course of a match, the head trainer was prevented from entering the field of play unless summoned by the referee. Therefore, for the purpose of this study, an injury was defined as any pain or disability suffered by a player during an amateur rugby league match, and subsequently assessed by the head trainer during, or immediately after an amateur rugby league match.[3 13 21] All injuries sustained during matches were recorded, regardless of their severity[22] and were assessed and managed by established procedures.[23 24] Information recorded included the date and time of injury, name of injured player, anatomical site and nature of injury, and position of the player. Throughout the three year period, all teams were permitted a maximum of seven replacements for each match, and once replaced, players were not allowed to return to the field of play.

Table 1 Matches played in one amateur rugby league competition over three consecutive seasons

	Matches played			
Type of match	*1995*	*1996*	*1997*	*Total*
Pre-season	9	9	9	27
Fixture	45	52	54	151
Exhibition	2	2	2	6
Finals	4	4	4	12
Total	60	67	69	196

Injuries were categorised according to the site of injury[16]—namely, the head and neck, face, abdomen and thorax, shoulder, arm and hand, thigh and calf, knee, ankle and foot, and "others". Injuries were also described according to the type (nature) of injury sustained. Muscular injuries were classified as either haematomas or strains. Additional categories for the type of injury included contusions, concussions, joint injuries, fractures and dislocations, and "others". All cuts and abrasions requiring management within the "blood-bin" replacement rule were reported as lacerations. Under this rule, players were temporarily removed from the field of play to minimise the risk of transmission of bloodborne infectious diseases. Players removed to the blood-bin were allowed to return to the field of play if the wound was adequately cleansed and dressed and continuing play posed little additional threat to the injured area.

STATISTICS

Injury rates were calculated as described previously.[1 10] Over the three competitive seasons, 196 matches were played. Twenty seven matches lasted 60 minutes and the remaining 169 matches were 70 minutes in duration. Therefore, the average duration of matches was 1.15 hours. The overall injury exposure for all players was 5860.4 playing hours at risk (13 players × 2 teams per match × 1.15 hours × 196 matches). Forwards were at risk for 2704.8 playing hours (6 forwards × 2 teams per match × 1.15 hours × 196 matches) and backs for 3155.6 playing hours (7 backs × 2 teams per match × 1.15 hours × 196 matches). Expected injury rates were calculated as described by Hodgson Phillips *et al*.[13] Expected injuries were the same proportion of the total injuries as that season's exposure hours were of the total hours.[13] The χ^2 test was used to assess the difference between observed and expected injuries and was applied to the proportions in each category of each variable. The level of significance was set at $p<0.05$.

Results

Over the three year period 941 injuries were recorded, with an incidence of injury of 160.6 (95% confidence interval (CI) 150.3 to 170.9) per 1000 player-position game hours. In the 1995, 1996, and 1997 seasons the numbers of injuries were 271 (28.8%), 301 (32.0%), and 369 (39.2%), respectively. The overall injury exposure for all players during the 1995, 1996, and 1997 seasons was 1794, 2003.3, and 2063.1 playing hours at risk, respectively. Over the three competitive seasons the respective injury exposure for forwards and backs was 828, 924.6, and 952.2, and 966, 1078.7, and 1110.9 playing hours. The expected injuries for the 1995, 1996, and 1997 seasons were 288, 322, and 331, respectively. Significant differences were found between the 1995 (151.1 (95% CI 133.1 to 169.1) per 1000), 1996 (150.3 (95% CI 133.2 to 167.4) per 1000),

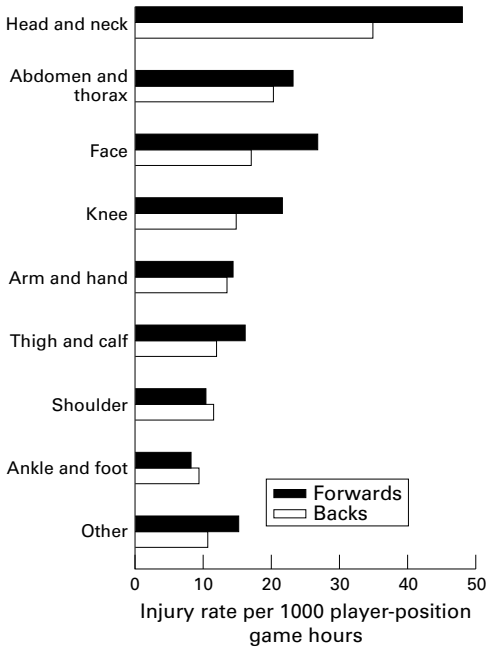

Figure 1 Site of injuries sustained in amateur rugby league forwards and backs.

and 1997 (178.9 (95% CI 160.7 to 197.1) per 1000) seasons for observed and expected injuries ($\chi^2 = 6.74$, df = 2, $p<0.05$).

Figure 1 shows the site of injuries sustained in amateur rugby league. Over 25% (40.6 (95% CI 35.4 to 45.8) per 1000) of the total injuries sustained throughout the three year period were injuries sustained to the head and neck. Injuries to the face (21.3 (95% CI 17.5 to 25.1) per 1000, 13.3%), abdomen and thorax (21.3 (95% CI 17.5 to 25.1) per 1000, 13.3%), and knee (17.8 (95% CI 14.3 to 21.3) per 1000, 11.1%) were less common ($\chi^2 = 21.83$, df = 8, $p<0.01$). Significant differences were found among the 1995 (12.3 (95% CI 7.2 to 17.4) per 1000), 1996 (16.5 (95% CI 10.8 to 22.2) per 1000), and 1997 (23.8 (95% CI 17.1 to 30.5) per 1000) seasons for the incidence of knee injuries ($\chi^2 = 7.41$, df = 2, $p<0.05$).

When injuries were expressed relative to overall game time exposure, forwards had a significantly higher incidence of injury than backs (182.3 (95% CI 166.2 to 198.4) per 1000, 52.4% *v* 142.0 (95% CI 128.8 to 155.2) per 1000, 47.6%, $\chi^2 = 14.60$, df = 1, $p<0.001$). There were no significant differences ($p>0.05$) between the injury rates of the abdomen and thorax, arm and hand, thigh and calf, shoulder, and ankle and foot between forwards and backs. However, forwards more commonly sustained head and neck injuries than backs ($\chi^2 = 6.10$, df = 1, $p<0.05$). Injuries to the face ($\chi^2 = 6.30$, df = 1, $p<0.05$) and knee ($\chi^2 = 3.87$, df = 1, $p<0.05$) were also more often sustained by forwards.

Figure 2 shows the type of injuries sustained in amateur rugby league. Muscular injuries (haematomas plus strains) were the most common type of injury (45.7 (95% CI 40.2 to 51.2) per 1000, 28.5%), while joint injuries (27.6 (95% CI 23.4 to 31.8) per 1000, 17.2%) and lacerations (23.2 (95% CI 19.3 to 27.1) per 1000, 14.5%) were less common ($\chi^2 = 17.98$, df = 7, $p<0.05$). Forwards more often sustained lacerations than backs ($\chi^2 = 7.57$, df = 1, $p<0.01$). Forwards also had a higher incidence of injury than backs for all other types of injury, but the differences were not significant ($p>0.05$).

Significantly more injuries occurred in the second half of matches than in the first half (70.8% *v* 29.2%, $\chi^2 = 162.29$, df = 1, $p<0.001$) (fig 3). Furthermore, the incidence of injury was significantly different throughout different months of the season ($\chi^2 = 28.56$, df = 6, $p<0.001$) (fig 4). At the beginning of the season (March) the incidence of injury was 133.8 (95% CI 105.1 to 162.5) per 1000 player-position game hours. Injury rates declined in April and progressively increased from May to September. The highest number of injuries sustained in a month was 227 (194.7 (95% CI 169.3 to 220.1) per 1000), recorded in July. Expressed relative to player-position

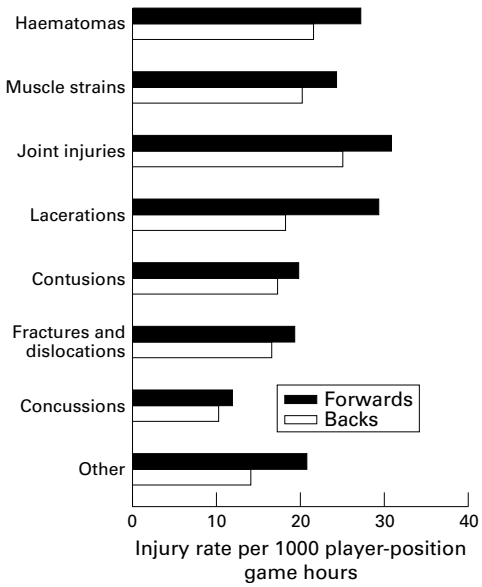

Figure 2 Type of injuries sustained in amateur rugby league forwards and backs.

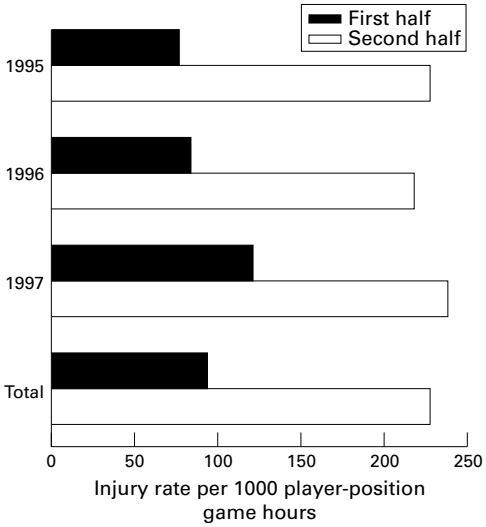

Figure 3 Incidence of injury in the first and second half of amateur rugby league matches.

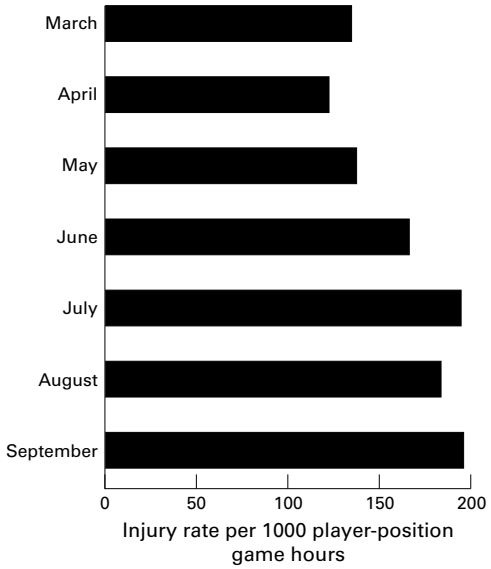

Figure 4 Incidence of injury in amateur rugby league by month of season.

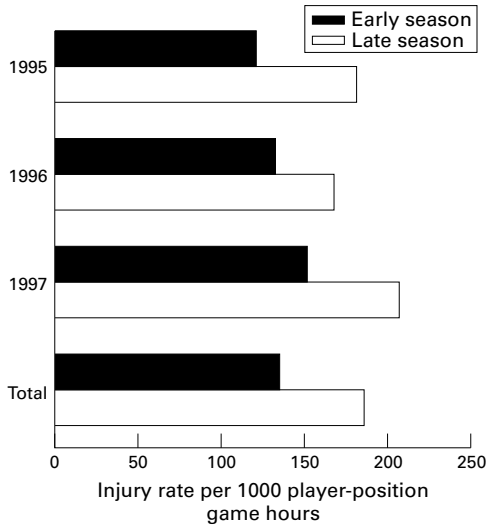

Figure 5 Incidence of injury in amateur rugby league at the beginning and end of each season.

game hours, the highest rate of injury was recorded in September, at the end of the season (41 injuries, 195.9 (95% CI 136.2 to 255.6) per 1000). When injuries at the beginning and end of the season were compared (by dividing each season in half),[13] it was found that more injuries occurred in the second half of the season ($\chi^2 = 22.94$, df = 1, $p<0.001$) (fig 5).

Discussion

The purpose of this study was to report the incidence, site, and nature of injuries in amateur rugby league over three consecutive seasons. The results show that muscular injuries and injuries to the head and neck are the most commonly sustained injuries in amateur rugby league. Furthermore, injuries are more often sustained in the latter stages of the season and during the second half of matches. These findings suggest that fatigue or accumulative microtrauma, or both, may contribute to injuries in amateur rugby league players.

This study found an overall injury rate of 160.6 injuries per 1000 player-position game hours when all injuries sustained during competitive matches were recorded. Previous studies of professional rugby league players, which defined injuries in terms of subsequent missed matches,[1] or missed training sessions and matches,[10 14] reported an overall incidence of injury of 44.9[1] and 114.3[10 14] per 1000 player-position game hours. However, when a definition of injury similar to that used in this study is employed, the incidence of injury in professional rugby league has been reported to be as high as 214,[3] 277.78,[16] and 346[13] per 1000 player-position game hours. These injury rates are approximately 1.3–2.2-fold greater than reported in this study of amateur rugby league players. It has been suggested that owing to a higher intensity of play at the elite level, injury rates would be expected to be higher in professional than amateur rugby league.[1 14 15] The present findings support this suggestion.

The head and neck sustained the highest incidence of injury in amateur rugby league players, which is consistent with other studies of injuries in professional rugby league.[9 10 15 17] It has been shown that first class rugby union players have better endurance than second class players.[19] Additionally, evidence suggests that appropriate training habits are poorly developed in amateur football players[25] and that head and neck injuries are more likely to occur in fatigued players.[26] Possibly, therefore, a poor level of skill and physical fitness[3 19 25 27] might have contributed to the high incidence of head and neck injury in the amateur rugby league players of this study. Alternatively, it has been reported that a high percentage (50–64%) of amateur rugby league players would participate in foul play and violence in an attempt to win a match.[20] An overaggressive playing style might have contributed to the high head and neck injury rates of amateur rugby league players. The findings of this study, together with the results of professional rugby league studies, suggest that appropriate measures are required to decrease the incidence of head and neck injuries in rugby league.

The finding that muscle haematomas and strains form the vast majority of amateur rugby league injuries is consistent with most professional rugby league studies.[10 15 16] Despite this finding, the prevalence of joint injuries in amateur rugby league (17.2%) is considerably lower than recently reported for professional rugby league (34.7–40%).[18] However, early professional rugby league studies found a remarkably similar prevalence of joint injuries (21.1–23.8%) to those found in this study.[9 14 16 17] In the past decade, professional rugby league has developed into a faster, more exciting game, but owing to the social nature of non-elite competition,[25] the speed and intensity of amateur rugby league might be expected to remain relatively unchanged. The high intensity and speed of the game at the elite level, combined with the requirement for rapid acceleration, deceleration, and changes of direction,[4] may explain the high prevalence of

joint injuries recently seen in professional rugby league.[18]

This study found that more than 70% of all injuries were sustained in the second half of matches. Furthermore, injuries more commonly occurred during the latter stages of the season. This finding differs from the findings of other open-age rugby league studies, which found that second half injuries were not significantly different from,[9] or only slightly greater than,[12] first half injuries. Similarly, the higher incidence of injury towards the end of the season is in agreement with some,[17 28] but not all studies.[9 15] The high incidence of injury in the second half of matches and during the latter stages of the season suggests that player fatigue[3 17 19 21 25 26] or accumulative microtrauma,[3 23] or both, may make a significant contribution to injuries in amateur rugby league. However, the possibility that changes in training and playing intensity contribute to late season injuries cannot be discounted.[15 23]

The results of this study also show an increasing incidence of injury over the three consecutive seasons. Previous investigators have reported a progressive increase in the incidence of injury in one professional rugby league club over four consecutive seasons.[13] Moreover, the incidence of injury was further increased when players were given an insufficient off season to recover from injuries.[13] Given that the amateur rugby league players studied here received a five month off season to recover from injuries sustained during the competitive season, it is unlikely that playing in consecutive seasons contributed to the increased injury rates. Despite the extended off season, these results do not preclude the possibility that a large number of injuries resulted from complications with a pre-existing injury.[3 15] Presently, the reason for the increasing incidence of injury over consecutive seasons is unknown. Clearly, further research is required to determine the influence of player fatigue, and other potential factors, on the incidence of injury in amateur rugby league.

The observation of higher injury rates in forwards than backs (182.3 *v* 142.0 per 1000 player-position game hours) is consistent with previous findings from professional rugby league studies.[1 10 15] In a four year study of one professional rugby league club, Gissane *et al* reported that the overall incidence of injury was higher in forwards (56.3%) than backs (43.7%).[10] In this study the forwards and backs received 52.4% and 47.6% of all injuries, respectively. Given that forwards spend a greater percentage of match play in tackling[2] and physical collisions,[14 29] the finding of a lower incidence of injury in backs is to be expected. Percentage body fat is reported to be higher in forwards than backs.[6 30] Meir has suggested that the higher body fat of forwards may reduce injuries by cushioning the large impact forces experienced during the course of a rugby league match.[30] In this study forwards more often sustained lacerations and injuries to the head and neck, face, and knee regions, while injuries to other body regions (for example, abdomen and thorax) were similar in forwards and backs. Possibly, the forwards in this study had a higher percentage of body fat, which provided protection for some body regions (for example, abdomen and thorax) while providing little protection for other regions (for example, head, face, knee).

In summary, the results of this study show that muscular injuries and injuries to the head and neck are the most commonly sustained injuries in amateur rugby league. Furthermore, injuries are more often sustained in the latter stages of the season and during the second half of matches. These findings suggest that fatigue or accumulative microtrauma, or both, may contribute to injuries in amateur rugby league players.

The author performed this study while employed as head trainer (injury prevention and management) of the Toowoomba Second Division Rugby League, Australia. The author initiated the research, collected and analysed the data, interpreted the findings, and wrote the paper. The support and assistance provided by Mr Graham McCarthy, Mr Ray Edser, Mr Gary Penfold, and Mr Doug Coates of the Toowoomba Second Division Rugby League is appreciated.

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Take home message

This study found a high incidence of injury in amateur rugby league players. Furthermore, amateur rugby league injuries occur more commonly in the latter stages of the season and during the second half of matches. Improving player fitness, reducing match frequency and playing time, and increasing recovery during matches may reduce the incidence of injury in amateur rugby league.