

A 16 year study of injuries to professional kickboxers in the state of Victoria, Australia

T R Zazryn, C F Finch, P McCrory

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See end of article for authors' affiliations

Correspondence to:
Associate Professor Finch,
Department of
Epidemiology & Preventive
Medicine, Monash
University Medical School,
Alfred Hospital,
Commercial Road,
Prahran, Vic 3181,
Australia;
caroline.finch@
med.monash.edu.au

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Objectives: To determine the rate and type of injuries occurring to registered professional kickboxers in Victoria, Australia over a 16 year period.

Methods: Data describing all fight outcomes and injuries sustained during competition for the period August 1985 to August 2001 were obtained from the Victorian Professional Boxing and Combat Sports Board.

Results: A total of 382 injuries were recorded from 3481 fight participations, at an injury rate of 109.7 injuries per 1000 fight participations. The most common body region injured was the head/neck/face (52.5%), followed by the lower extremities (39.8%). Specifically, injuries to the lower leg (23.3%), the face (19.4%), and intracranial injury (17.2%) were the most common. Over 64% of the injuries were superficial bruising or lacerations.

Conclusion: The nature of kickboxing, whereby kicking the opponent is the prime movement and the head a prime target, is reflected in the distributions of body regions most commonly injured by participants. Further research into injury patterns in different styles of kickboxing and the mechanism of injury occurrence is required. Exposure adjusted prospective studies are needed to monitor injury rates over time.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted.¹ The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted.^{1–3} Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge. One of these papers was a case report of a kickboxer with a spontaneous rupture of a tendon.⁴ A second study monitored renal and liver function and muscle injuries during training and after competition in 10 Thai kickboxers aged 14–17 years who had been participating in the sport for at least two years.⁵ Although damage to skeletal muscle was found to occur in both training and competition, no detrimental effect on liver or renal function was found.

Only one published study has provided a broad profile of kickboxing injuries, sustained during participation in the kickboxing style of Muay Thai.² Gartland *et al*² described injuries during training and practice in 152 Muay Thai kickboxers in the United Kingdom and Holland. Face to face interviews were conducted at gymnasiums and formal competitions to collect information about age, sex, practice time, level of contact (none, touch sparring, full contact, or competition), level of proficiency (beginner, amateur or professional), and any injuries that occurred during training and the practice of Muay Thai within the preceding 12 months. No information was provided on validation of the questionnaire, the time period for data collection, whether the sample was random, or the response rate achieved.

In this study,² injuries to the lower extremity were the most common across all proficiency levels: 75.0% of all injuries in beginners, 64.1% in amateurs, and 53.4% in professionals. Although the second most common injury site in beginners was the trunk (15.9%), for both the amateurs (31.0%) and professionals (42.5%) the head was the second most commonly injured site. In contrast, only 2.3% of the injuries reported by beginners were to the head. Different levels of contact related to different levels of proficiency in the sport

may have influenced which body regions were injured. Soft tissue injuries, including lacerations and contusions, were the most common types of injuries across all three participation levels (79.1–92.1% of all injuries).

Overall, there is a lack of formal data describing injuries sustained by participants in kickboxing in general and within Australia, in particular. It is important that injury data for this sport are collected to form the basis for the development and implementation of injury prevention measures. Further, descriptive injury data provide the basis for hypothesis generation for future research. The Victorian Professional Boxing and Combat Sports Board (hereafter referred to as VPBCSB) has maintained a database of prospectively collected data on all fight outcomes, including injuries, for Victorian registered kickboxers during competitions in Victoria for the past 16 years. The aim of this study was to analyse the kickboxing injury data collected by the VPBCSB.

METHODOLOGY

An Excel database of fight statistics describing the results of all Victorian fights participated in by Victorian registered kickboxing contestants during August 1985 to August 2001 was obtained from the VPBCSB. This database collected information on all fight outcomes—for example, fight result, whether or not an injury was sustained, and, if so, what the injury was. After each bout, an accredited doctor examined all kickboxers and recorded information on any injury sustained (either reported by the participant or observed) on a standardised injury data collection form. Victorian registered kickboxers who fought interstate were required legally to inform the VPBCSB of their fight outcome, including any injuries they sustained, and this information was also recorded on the database. In such cases, a medical practitioner did not validate the injury data. Concussion was appropriately assessed through a clinical examination and a battery of simple neuropsychology tests incorporating measures of orientation and memory.⁶

Exposure was quantified in terms of the number of kickboxing fight participations determined by the number of

Table 1 Rate of injury to broad body regions in Australian kickboxers (n=382 injuries)

Body region injured	Percentage of all injuries	Rate of injury per 1000 fight participations
Head/face/neck	51.6	56.6
Lower extremities	39.8	43.7
Upper extremities	2.9	3.2
Trunk	2.1	2.3
Not specified	3.6	4.0

records in the provided database. Each fight recorded in the database potentially had one or two records. Fights with one record in the database were for Victorian registered kickboxers who were either fighting an interstate kickboxer in Victoria or fighting interstate against an interstate kickboxer. No information on the interstate kickboxers competing in these fights was available. Therefore, these fights were analysed as one kickboxing fight participation (just for the Victorian kickboxer). Where two records for the one fight were recorded, this corresponded to two Victorian registered kickboxers fighting each other—that is, fight results were recorded under each contestant's name and therefore duplicate results for that fight were recorded in the database. In this circumstance, the two separate records were analysed as two kickboxing participations. Each kickboxer within the database could have participated in more than one fight over the data collection period and therefore the number of kickboxing participations exceeded the number of registered kickboxers.

The injury data were extracted and transferred into SPSS (Statistical Package for Social Sciences) version 11.0 for analysis. The injury details were coded according to the *Australian sports injury data dictionary*⁷, by one of the authors (PMcC). Descriptive statistics were used to determine the proportion of kickboxing fight participations for each response. For each fight outcome, information was collected on the number of rounds scheduled for the bout (maximum number to complete bout) and the number actually completed by participants. Bouts were ended early if a kickboxer appeared unable to defend him/herself (decided by the referee) or was knocked out. Paired *t* tests were performed to determine any significant differences in the average number of scheduled rounds and the average number actually completed for fight participations.

RESULTS

There were a total of 3481 records in the database. Therefore the total amount of exposure for kickboxers was 3481

kickboxing fight participations. Most (90.4%) of the 345 fight participations that led to injury involved participants sustaining only one injury, 29 fight participations involved kickboxers having sustained two injuries, and four fight participations led to participants sustaining three injuries. Therefore the total number of reported injuries during the 345 fight participations was 382. The overall injury rate was 109.7 injuries per 1000 fight participations. For all but 12 of the 345 fight participations resulting in injury, the injured kickboxing contestant (96.5%) was male. Injured participants had a mean age (at the time of the fight/injury) of 24.9 years (median 24.2; range 18.0–43.0) and a mean weight of 74.5 kg (median 71.0; range 52.0–118.0).

Almost two thirds (62.9%) of the fight participations in which contestants were injured resulted in a loss to the contestant, with 30.1% being a win, and the remaining 7.0% a draw. About half (49%) of the injury fights were decided by points, and a further 49.5% by a knock out or the referee stopping play. Four fight participations (1.3%) were decided through disqualification of a competitor. On average, injured participants completed significantly fewer rounds than expected for a normal fight (3.2 v 4.1; $p < 0.001$).

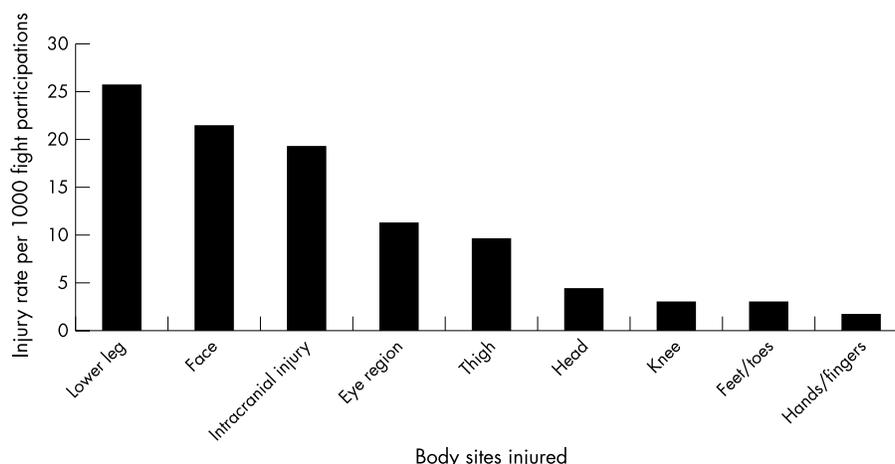
Table 1 lists the proportion of injuries to each body region. The most commonly injured body region was the head/neck/face, accounting for over half of the injuries (51.6%), a rate of 56.6 injuries per 1000 fight participations. The second most common body region injured was the lower extremities (39.8%), occurring at a rate of 43.7 injuries per 1000 fight participations.

The most commonly injured body site was the lower leg, reflecting the nature of the sport. The rate of injury was 25.6 injuries/1000 fight participations (fig 1). The second most commonly injured site was the face, with an injury rate of 21.3 injuries/1000 fight participations. Intracranial injury was the third most common injury, with almost 18% of fight participations resulting in this type of injury, corresponding to an injury rate of 19.2/1000 fight participations.

Table 2 lists the five most commonly reported injury pathologies for the 382 kickboxing injuries. Together, these accounted for 90% of all injuries. The most common types of injury were superficial (including bruising and blistering) which occurred at a rate of 43.4 injuries per 1000 fight participations. Lacerations to the skin were also common, accounting for 25% of all injuries, corresponding to an injury rate of 27.3 per 1000 fight participations.

DISCUSSION

This is the first study of injuries sustained by professional kickboxers in Australia. It is also only the fourth study to concentrate on kickboxing injuries in the international literature.

**Figure 1** Injury rates for the nine most often injured body sites in professional kickboxers (382 injuries).

Descriptive data on injuries in kickboxing are required because of the increasing number of people involved in the sport or various fitness programmes that use training techniques born from kickboxing movements—for example, Tae Bo. The VPBCSB database has documented kickboxing fights for a number of different kickboxing styles and rules—that is, kickboxers competed under Australian rules, American rules, International rules, and the rules of Muay Thai kickboxing at different times. Each kickboxing style's rules differ in what is acceptable and what is not. For example, Muay Thai kickboxing allows the use of kneeling and elbowing, whereas the Australian rules allow only punching and kicking. Unfortunately, the limitations of the database meant that we could not differentiate the type of kickboxing associated with the injuries.

Different scoring targets for striking are relevant for each style of kickboxing. As such, injuries to different areas of the body may be reported for each kickboxing style, because both the target areas for scoring and the body regions that can be used offensively are altered. Consistent across all styles, however, is the allowance of kicking and punching to the area above the waist where participants can score points against their opponent. Therefore it would be expected that the head, arms, and trunk would be the major sites of injury for kickboxers. In this study, most injuries sustained by professional kickboxers occurred to the head/neck/face (51.6% of all injuries). Injuries to the trunk, however, were low at only 2.1% of all injuries, indicating that the head region is the prime strike target. Lower extremity injuries were the second most common (39.8% of all injuries), reflecting the nature of the sport where kicking is the primary technique and movement.¹ The high level of injuries to the lower extremities may also be explained by the fact that some styles of kickboxing include the legs in the scoring area, making them a target.

Despite the importance of punching as a method of attack, fewer than 3% of injuries sustained were to the upper extremities, indicating that this method of attack does not cause many injuries. As with other studies into kickboxing and general martial arts,^{2,8,9} most injuries appeared to be lacerations and bruising, occurring at an injury rate of 70.7 per 1000 fight participations. A kickboxer injured in a fight is likely to have the fight discontinued—that is, he/she will not complete the scheduled number of bouts. This may be an indication of the severity or nature of the injuries being sustained, in that it would be unsafe, or the kickboxer be physically unable to, complete the bout. However, except for concussion (sustained on 67 occasions), severe injuries that may require extensive medical attention or time away from the sport appear relatively uncommon, with fractures, dislocations, sprains, and strains sustained by only 30 kickboxers over the 16 year period.

Differences in the proportion of injuries sustained by professional kickboxers in the VPBCSB database were found compared with the results reported for participants of Muay

Take home message

There is a significant risk of injury to kickboxers yet little is known about the mechanism of such injuries. Further research is needed to elucidate the mechanisms so that appropriate preventive strategies can be developed.

Thai kickboxing by Gartland *et al.*² For example, the Victorian kickboxers sustained more head injuries than those from the United Kingdom and Holland (51.6% v 42.5%), but fewer lower extremity injuries (39.8% v 53.4%). A possible explanation is that, in the former, injuries were recorded by a medical practitioner, whereas, in the latter, injuries were self reported. Further, the VPBCSB database did not record under which rules the kickboxer was competing when injured, and therefore information about injury patterns in the different styles of kickboxing could not be determined and compared with the previous study. Accordingly, specific recommendations about injury prevention strategies cannot be made from this study as these are, to a certain extent, dependent on the rules of the sport. It is recommended that further research be undertaken to document injuries in each style of kickboxing to identify priority areas that require the implementation of injury prevention measures.

It should be noted that, at present, the VPBCSB database also does not provide information on how the injury actually occurred. Information about the cause and mechanism of injury—for example, collision with opponent—is important for injury prevention, because, without it, opportunities for strategies to be developed and implemented to prevent another injury occurring in the same fashion cannot be identified.¹⁰ Further, limited information is provided about the outcomes of the injuries, such as treatment time and time out of the sport for rehabilitation. This information is needed to identify the most severe injuries that require priority attention for injury prevention purposes.¹¹ It is important that as much detail as possible about the injured kickboxer and the circumstances in which the injury was sustained is identified to decrease the likelihood of a similar injury occurring.

Conclusion and recommendations

This study provides the first data on injuries sustained by Australian professional kickboxers, and provides a basis for hypothesis generation for further research into the sport. Continued research into injuries that occur in kickboxing is needed, as few international data have been collected on injuries sustained during participation under different rules, beginner and amateur participants, and during training time. It is recommended that a standardised data collection form be developed and implemented by all kickboxing organisations, and this information be analysed on a regular basis to monitor

Table 2 Five most common injury pathologies and corresponding injury rates per 1000 fight participations (382 injuries)

Injury pathology	Number of injuries	Percentage of all injuries	Injury rate per 1000 fight participations
Superficial (includes bruise, blister, graze)	151	39.5	43.4
Open wound/laceration	95	24.9	27.3
Concussion	67	17.5	19.2
Fracture	25	6.5	7.2
Injury to internal organ	6	1.6	1.7
Not specified	19	5.0	5.5
Other (combined)	19	5.0	5.5
Total	382	100.0	-

any trends in injury occurrence over time. Continuing prospective data collections should also include exposure (or participation) data so that injury rates can be monitored over time.

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Authors' affiliations

T R Zazryn, C F Finch, Department of Epidemiology & Preventive Medicine, Monash University Medical School, Prahan, Victoria, Australia

P McCrory, Centre for Sports Medicine Research & Education and Brain Research Institute, University of Melbourne, Melbourne, Australia

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