ORIGINAL RESEARCH ARTICLE

Cricket injuries – a longitudinal study of the nature of injuries to South African cricketers

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Abstract

Objective. To determine the incidence and nature of injuries sustained by elite cricketers during a 6-season period (1998 - 2004).

Design. Physiotherapists and doctors working with the provincial and national teams completed a questionnaire for each cricketer who presented with an injury in order to determine: (*i*) anatomical site of injury; (*ii*) month of injury during the season; (*iii*) the diagnosis; (*iv*) mechanism of injury; (*v*) whether it was a recurrence of an injury sustained in a previous season; (*vi*) whether the injury had recurred again during that season; and (*vii*) biographical data.

Results. The 1 606 injuries occurred primarily during first-class matches (32%), limited-overs matches (26%) and practices (27%) during the early part of the season. The lower limbs (49%), upper limbs (23%) and back and trunk (23%) were most commonly injured. Acute injuries made up 66% of the injuries, while chronic and acute-on-chronic made up 12% and 22%, respectively. Soft-tissue injuries were predominantly muscle injuries (41%). Bowling (40%) and fielding (33%) accounted for the majority of the injuries, while the primary mechanism of injury was the fast bowler's delivery and follow through (25%) and running, diving, catching and throwing the ball when fielding (23%).

Conclusion. The results indicate a pattern of cause of injury which coaches and medical support staff need to be aware of for long-term injury prevention. Fast bowlers are at the greatest risk of injury, while all cricketers are at risk of sustaining acute soft-tissue injuries to the lower limb, as well as role-specific injuries.

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Introduction

The identification of any evidence of injury patterns is fundamental to a process of successful long-term injury prevention.[11] Over the past number of years cricket injury surveillance has been done in Australia, England and South Africa in order to present an injury profile and to identify any injury patterns. In Australia a 3-season retrospective and 3-season prospective study was carried out[4] while in England two studies have been reported.[2,3]

The injury data for the first 4 seasons of the South African study have been published previously.[6-10] This paper includes the injury data for these 4 seasons, viz. 1998 - 1999 (S1), 1999 - 2000 (S2), 2000 - 2001 (S3), 2001 - 2002 (S4), as well as the new data for the 2002 - 2003 (S5), and 2003 - 2004 (S6) seasons.

Methods

The doctors and physiotherapists working with the South African team and the 11 provincial teams were required to complete a questionnaire for all cricketers who presented with an injury. The questionnaire was designed to obtain the following information: (*i*) anatomical site of injury; (*ii*) month of injury during the season; (*iii*) the diagnosis; (*iv*) mechanism of injury; (*v*) whether it was a recurrence of an injury sustained in a previous season, (*vi*) whether the injury had recurred again during the season; and (*vii*) biographical data.

The injuries were grouped according to the anatomical region injured, as follows: (*i*) the head, neck and face, (*ii*) the upper limbs; (*iii*) the back and trunk; and (*iv*) the lower limbs. These injuries were classified according to whether they were sustained during batting, bowling or fielding. The time in the season when the injury occurred was recorded. The off-season was defined as that part of the season when no specific cricket practice or training was performed. The pre-season, a 2-month period, was that part of the season when specific cricket practice and training were undertaken before the commencement of matches. The season was defined as that part of the season where matches were played and included international tours. For the purpose of this survey the incidence of injury in the various phases was expressed as a percentage of the total number of injuries recorded.

An injury was defined as any pain that occurred which prevented the player from completing that particular match, prac-

tice or training session and caused the player to seek medical attention. Acute injuries were defined as those injuries of rapid onset, while chronic injuries involved a prolonged or extended onset. Acute-on-chronic injuries were defined as increased symptoms of a chronic injury, which were brought about by movements causing rapid onset. The BMDP Statistical Software Package (BMDP, 1993, Los Angeles, BMDP Statistical Software Inc.) was used to compute descriptive statistics.

Results

During the period under review the physiotherapists and doctors working with the 11 provincial teams and the national team, recorded 1 606 injuries sustained by 783 cricketers, with an average of 2.1 injuries per player (Table I). The 48 physiotherapists recorded 1 428 (89%) injuries, while the 14 doctors recorded 178 (11%) injuries. The biographical data for players are presented in Table II, with the players aged 19 - 24 years being more susceptible to injury than the other players.

TABLE I. Number of players and injuries

	S1	S2	S3	S4	S5	S6	S Total
Players (*N*)	88	160	188	158	95	94	783
Injuries (*N*)	163	258	391	343	175	276	1606
Mean (*N*)	1.9	1.6	2.1	2.4	1.8	2.9	2.1

S1 = 1998 - 1999 season, S2 = 1999 - 2000 season, S3 = 2000 - 2001 season, S4 = 2001 - 2002 season, S5 = 2002 - 2003 season, S6 = 2003 - 2004 season, S Total = 1998 - 2004 seasons.

TABLE II. Biographical data

	S1 (%)	S2 (%)	S3 (%)	S4 (%)	S5 (%)	S6 (%)	S Total (%)
Age (yrs)							
12 - 18	1	10	5	5	4	2	4
19 - 24	45	47	49	44	35	37	43
25 - 29	28	25	23	33	35	38	31
29 >	26	18	24	19	26	23	22
Role							
All-rounder	34	26	31	34	26	21	28
Batsman	28	21	25	24	30	33	26
Fast bowler	27	35	35	31	36	32	33
Spin bowler	2	11	8	6	5	11	7
Wicket-keeper	9	7	2	5	3	4	5

S1 = 1998 - 1999 season, S2 = 1999 - 2000 season, S3 = 2000 - 2001 season, S4 = 2001 - 2002 season, S5 = 2002 - 2003 season, S6 = 2003 - 2004 season, S Total = 1998 - 2004 seasons.

The injuries occurred predominantly when practising or playing for provincial (30%), provincial 'B' (41%) and international (9%) teams. When representing club and school teams 14% of the injuries occurred for each. Players attending the various provincial and national cricket academies suffered 6% of the total injuries.

More injuries occurred during first-class matches (32%), with limited-overs matches (26%) and practices and training (27%) resulting in a similar number of injuries. Fifteen per cent of the injuries were of gradual onset which may have been as a result of a combination of factors such as training, practising and playing matches over a period of time.

The chronicity of injuries is shown in Fig. 1, with the majority of injuries classified as acute injuries. First-time injuries accounted for 65% of the injuries, with the younger players (up to 24 years) sustaining 49% of these injuries (Fig. 2). The new or first-time injuries were primarily sustained when fielding (26%), bowling (24%) or as a result of overuse (14%) or impact injuries (10%). Recurrent injuries from the previous season made up 22% of the injuries, while the players over 24 years of age sustained 58% of these injuries, with these injuries primarily recurring again as a result of bowling (38%), overuse (23%) and fielding (18%). The rate of injuries sustained during the season and recurring again during the same season accounted for 12% of the total injuries. Injuries sustained during the season and recurring again during the same season were lower for the players up to 24 years (42% of total injuries) than for those over 24 years (58% of total injuries). The relationship between both the mechanism of injury (Fig. 3) and the nature of injury (Fig. 4) and the number of injuries sustained for the first time, recurrent injuries from the previous season and those that recurred again during the same season are shown.

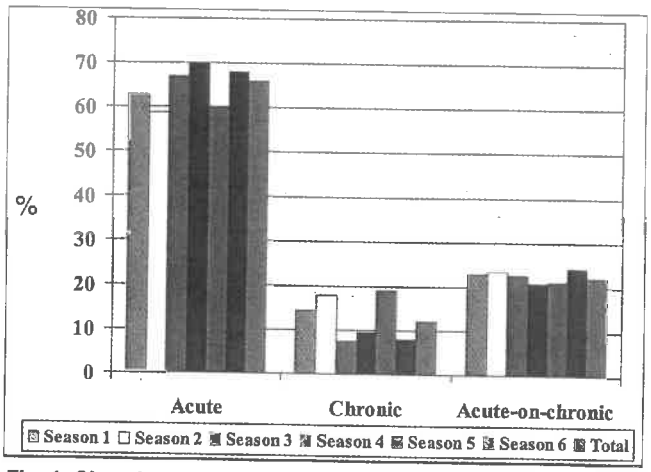

Fig. 1. Chronicity of injuries.

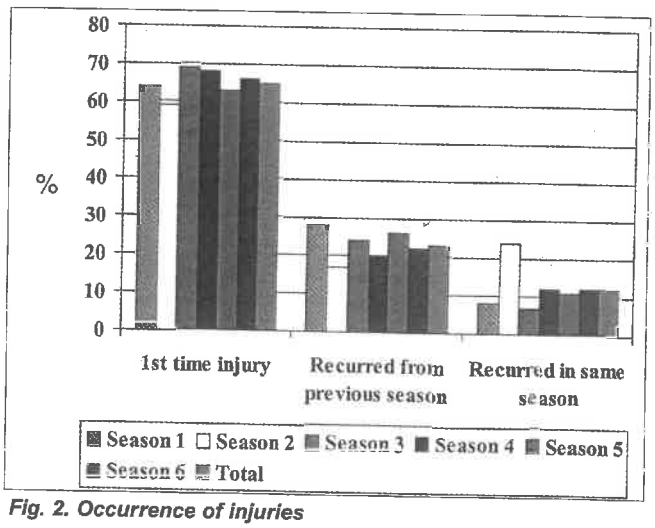

Fig. 2. Occurrence of injuries

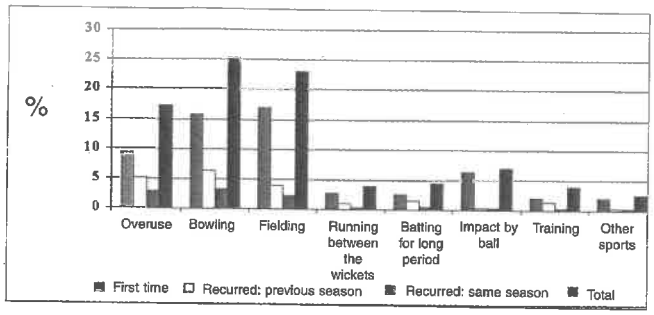

Fig. 3. Relationship between the mechanism and recurrence of injury.

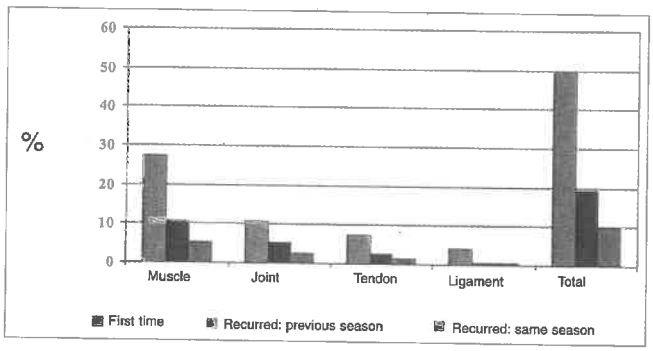

Fig. 4. Relationship between the nature and recurrence of injury.

The regional distribution of the injuries is presented in Table III. Lower-limb injuries accounted for nearly half of the injuries (49%), while injuries to the knee (13%), hamstring (18%) and quadriceps (11%) muscles, ankle (12%) and groin (7%), comprised the majority of the 788 lower-limb injuries. The hamstring injuries were mainly muscle strains (*N* = 102) and tears (*N* = 24), while injuries to the quadriceps were mainly muscle strains (*N* = 62). The knee and patella femoral joint injuries were mainly muscle strains (*N* = 42) and ligament tears (*N* = 10). The ankle injuries were primarily sprains (*N* = 28), impingement (*N* = 14) and ligament tears (*N* = 13), while the groin injuries were primarily strains (*N* = 35). These injuries were primarily caused by bowling (hamstring 44, quadriceps 36, patella femoral joint and knee 28, ankle 28, groin 15), fielding (hamstring 22, quadriceps 16, patella femoral joint and knee 38, ankle 22, groin 11), overuse (hamstring 17, quadriceps 6, patella and knee 35, ankle 10, groin 9) and training (hamstring 10, quadriceps 8, patella and knee 8, ankle 5, groin 3).

The 365 upper-limb injuries were predominantly to the phalanges and metacarpals (33%), gleno-humeral joint (23%) and the elbow joint (13%). Injuries to the phalanges and metacarpals (*N* = 122) were predominantly caused by impact from the ball while batting (*N* = 40) and fielding (*N* = 63), mainly resulting in fractures (*N* = 36) and joint (*N* = 45) injuries. The gleno-humeral injuries (*N* = 81) were predominantly muscle (*N* = 28), tendon (*N* = 22) and joint (*N* = 23) injuries caused by fielding, including throwing (*N* = 45), overuse (*N* = 13) and bowling (*N* = 10). The 47 elbow joint injuries were predominantly muscle (*N* = 7), tendon (*N* = 9) and joint (*N* = 5) injuries.

Injuries to the lumbar spine (46%), thoracic spine (9%), soft tissues (14%) and ribs (9%) made up the majority of the 364 back and trunk injuries. The 169 lumbar spine injuries were made up mainly of joint (*N* = 64) and muscle (*N* = 59) injuries and stress fractures (*N* = 19). These injuries were caused by overuse (*N* = 57), bowling (*N* = 53), fielding (*N* = 16) and batting for a long period (*N* = 18).

Of the 89 injuries to the head, neck and face, 47 (53%) were cervical spine injuries, with 9 of these as a result of batting for long periods at a time.

Bowling (40%) and fielding and wicket-keeping (33%) accounted for the majority of the injuries, with batting account-

TABLE III. Regional distribution of the injuries

	S1	S2	S3	S4	S5	S6	S Total
Head, neck and face (*N* = 89)							
Total injuries (*N*)	4	5	3	5	6	10	5
Cervical vertebrae (*N*)	4	7	10	8	7	11	47
Upper limbs (*N* = 365)							
Total injuries (%)	22	20	26	22	21	23	23
Metacarpal/phalanges (*N*)	16	18	33	21	13	21	122
Gleno-humeral joint (*N*)	6	13	22	19	9	12	81
Elbow joint (*N*)	-	2	14	5	7	13	47
Back and trunk (*N* = 364)							
Total injuries (%)	25	25	21	23	25	20	23
Thoracic spine (*N*)	2	8	7	4	4	6	31
Lumbar spine (*N*)	17	30	41	34	25	22	169
Ribs (*N*)	8	5	6	5	4	4	32
Soft tissue (*N*)	7	13	15	10	2	5	52
Lower limbs (*N* = 788)							
Total injuries (%)	50	50	50	50	48	47	49
Groin (*N*)	7	10	15	13	6	5	56
Hamstring (*N*)	20	25	27	33	12	24	141
Quadriceps (*N*)	5	12	24	19	10	16	86
Knee (*N*)	9	13	33	24	10	12	101
Ankle (*N*)	8	20	15	23	13	14	93

S1 = 1998 - 1999 season, S2 = 1999 - 2000 season , S3 = 2000 - 2001 season , S4 = 2001 - 2002 season, S5 = 2002 - 2003 season , S6 = 2003 - 2004 season, S Total = 1998 - 2004 seasons.

ing for 17% of the injuries sustained. Of the bowling injuries, 55% were lower-limb injuries and 33% were back and trunk injuries. Of these 58% were acute injuries, 16% chronic injuries and 26% acute-on-chronic injuries. The bowling injuries were made up of 61% first-time injuries, 26% recurrent injuries from a previous season and 13% injuries that were recurrent from the same season. The younger bowlers (up to 24 years of age) sustained 49% of the injuries, while the bowlers over 24 years of age sustained 51% of the injuries. Of the 39 stress fractures 79% (*N* = 31) were overuse bowling injuries, with the younger players sustaining 74% of the stress fractures.

Batting injuries were primarily lower-limb injuries (52%) and impact injuries to the upper limbs (23%), with the players over the age of 24 years sustaining 65% of these injuries. Of these 70% were first-time injuries with 22% and 8% recurrent injuries from previous seasons and the same season, respectively. Of these lower-limb injuries 73% were acute injuries, 7% chronic injuries and 20% acute-on-chronic injuries. The primary mechanism of the 273 batting injuries was impact (*N* = 69), batting for long periods of time (*N* = 64) and running between the wickets (*N* = 61),

The fielding including wicket-keeping injuries were predominantly to the upper (43%) and lower (40%) limbs, with 68% of the fielding injuries being first-time injuries. The younger (49%) and the older (51%) players showed a similar incidence of injury. Of these 74% were acute injuries, 9% chronic injuries and 17% acute-on-chronic injuries. Fielding accounted for 20 of the 31 dislocation injuries (65%).

The injuries occurred during the pre-season (11%) (September), the early part of the season (35%) (October and November), mid-season (18%) (December and January), in the latter part of the season (16%) (February and March) and during the 'off-season' (20%) (April to August).

TABLE IV. Diagnosis of the injuries

	S1 %	S2 %	S3 %	S4 %	S5 %	S6 %	S Total %	S Total N
Muscle tears	10	7	4	4	4	2	5	74
Muscle strains	32	33	33	32	18	31	31	491
Muscle spasms	1	3	6	8	8	10	6	101
Haematoma	7	2	5	6	4	7	5	85
Ligament tears	3	5	1	2	5	2	3	44
Tendonitis	12	7	12	11	5	5	5	107
Sprains	9	3	3	7	3	5	5	76
Impingement	1	2	3	5	1	2	3	42
Fractures	7	8	3	4	3	2	4	63
Stress fractures	1	4	3	3	3	1	2	39
Dislocations	1	2	4	1	1	-	1	8
Other	20	35	31	25	45	33	30	476

S1 = 1998 - 1999 season, S2 = 1999 - 2000 season, S3 = 2000 - 2001 season, S4 = 2001 - 2002 season, S5 = 2002 - 2003 season, S6 = 2003 - 2004 season, S Total = 1998 - 2004 seasons.

The primary mechanism of injury was the delivery and follow-through of the fast bowler (25%), running, diving, catching and throwing the ball when fielding (23%) and overuse (17%), various batting situations such as being struck while batting (7%), running between the wickets (4%) and batting for long periods at a time (4%), training (4%) and participating in various other sports (3%).

The 1 606 injuries sustained were made up mainly of soft-tissue injuries, predominantly muscle injuries (strains (*N* = 491), tears (*N* = 74), spasms (*N* = 101), haematomas (*N* = 85)), tendon injuries (tendonitis (*N* = 107), tears (*N* = 44), ligament sprains (*N* = 76)), fractures (*N* = 63) and stress fractures (*N* = 39), and joint injuries (rotator cuff (*N* = 50), impingements (*N* = 42), dislocations (*N* = 8)) (Table IV).

Discussion

The incidence and nature of injuries sustained by cricketers during a 6-season period have been presented and indicate a pattern of the cause and risk factors. The major types of injuries were acute soft-tissue injuries to the lower limbs as a result of bowling, particularly over-bowling, and fielding and show a number of similarities to the findings of the studies in Australia[4] and England.[2,3]

The lower limb was the most vulnerable to injuries (49%, 54%,[4] 45%[2]). In the lower limb the vulnerability of injury was to the hamstring and quadriceps (29%, 29%[4]), the knee (13%, 22%[4]), ankle (12%, 9%[4]) and groin (7%, 8%[4]). The nature of the game of cricket requires periods of relative inactivity followed by sudden rapid movements making the player susceptible to these acute soft-tissue injuries. With all the players at risk of sustaining hamstring, quadriceps and groin injuries, players, coaches and fitness trainers need to be aware of the importance of an active warm-up in order to reduce these soft-tissue injuries.[1] Particular focus should be placed on the lower limbs, when on the field of play, as well as when waiting to go in to bat,

The bowlers are at the greatest risk of injury and in addition to the lower limb soft-tissue injuries (hamstring, quadriceps and groin) they are most likely to sustain shoulder, elbow, lumbar and thoracic spine and ankle and knee injuries. Further, certain of the injuries appear to be unique to the fast bowlers. These include posterior talar impingement syndrom (PTIS), as a result of extremes of plantarflexion of the front foot in the delivery stride, particularly when the landing area is badly worn; side strain on the side of the non-bowling arm as the front or non-bowling arm is extended and then forcefully pulled downwards just prior to release; and lumbar stress fracture, particularly in young fast bowlers, as a result of repetitive physical loading below the single cycle failure threshold.

In addition to the hamstring, quadriceps and groin injuries, the batsmen were susceptible to cervical vertebrae, as a result of batting for long periods of time, and hand and wrist injuries as a result of being struck by the ball. In addition to the lower-limb soft-tissue injuries the fielders sustained injuries to the shoulder and elbow as a result of injury when falling on the shoulder or as a result of repetitive throwing, and the hand and wrist as a result of being struck by the ball.

The younger cricketer is most likely to sustain an injury and then to sustain a recurrence of this injury either during the season or a subsequent season, with the primary causes of injury a result of overuse and bowling. Injuries to fast bowlers have primarily been associated with bowling technique, volume and intensity and were the reason for the United Cricket Board of South Africa (UCBSA) introducing an extensive educational process in the late 1990s. This involved a large number of primary and high school teachers and coaches and focused on assisting the coaches to identify the correct type of fitness and strength training, the dangers of over-bowling and the correct bowling technique. For various reasons, this coach and player education programme was discontinued after the initial few years.

Conclusion

While a pattern of cause and risk has been indicated, a number of these injury patterns may be reduced through a sound education process focused on all the physical, training, mental and technical components necessary for success in a sport requiring rapid repetitive movements followed by periods of relative inactivity. However, in order to reverse the above trends there is a great need for an educational programme for coaches and young players to be re-introduced and to be sustained on an annual basis. This should further be made more comprehensive to include risk factors for batsmen and fielders.

While these data collected over a 6-year period show definite trends, the method of injury surveillance for international cricketers[5] has set out definitions and methods of calculating injury rates. This will allow comparisons to be made between data collected in various countries and will assist in the identification of injury trends and risks on a broader scale which will further benefit the cricketers.

Acknowledgements

The authors would like to acknowledge the major contribution made by the doctors and physiotherapists in the data collection for this study.

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