THE COST OF SCHOOL BOY CRICKET IN KWA ZULU NATAL, SOUTH AFRICA

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ABSTRACT

Accompanying the glamour of the game of cricket is the musculoskeletal pain and injury. This study documented the prevalence of cricket related musculoskeletal pain among recreational adolescent male cricketers residing in the High Way area of Kwa-Zulu Natal, South Africa (n=234). Subjects completed a self-report musculoskeletal pain questionnaire, which gathered their demographical, epidemiological and exercise history over the last 12 months. In addition the cricketers' body mass, stature and quadriceps angles were measured. The following descriptive statistics (mode, mean, frequency, percentages) and inferential statistics (chi-square and t-tests set at a probability of 0.05) were employed to analyse the data. One hundred and eighty-eight (80.34%) cricketers of the cohort sustained musculoskeletal pain within the last 12 months ($p< 0.001$). The most prevalent anatomical sites that sustained cricket related musculoskeletal pain were; back (29.84%), knee (26.41%), shoulder (10.69%) and ankle (8.33%) ($p<0.001$). The majority of the players attributed their musculoskeletal pain to being struck with a ball (39.45%), over-use (21.08%), struck with a bat (17.68%), rapid rotational movement (11.56%) and collisions with other players (10.20%) ($p<0.001$). Recreational adolescent school boy cricketers residing in Kwa-Zulu Natal, South Africa experienced a high prevalence of back, knee, shoulder and ankle musculoskeletal pain.

Key Words: Cricket, back, knee, musculoskeletal pain

INTRODUCTION

Cricket is a world renowned sport. All aspirations of becoming a cricket superstar begins at school cricket initiatives. Accompanying the glamour of the game of cricket is the musculoskeletal pain and injury. International epidemiological investigations on school boy cricket have documented the prevalence of cricket related musculoskeletal pain and injury (Elliot et al. 1990; Hardcastle, 1993; Orchard et al. 2002; Stretch & Venter, 2003). Cricket related

musculoskeletal pain and injuries are attributed to direct physical trauma and overuse (Stretch & Venter, 2003; Davies et al. 2009). Mechanisms of musculoskeletal pain as a result of direct physical trauma are (i) being struck with a ball, (ii) being struck with a bat and (iii) collision with another player (Milsom et al. 2008; White et al. 2011). The repetitive poor biomechanics of bowling and the batting stance precipitates cricket related musculoskeletal pain and injury (Milsom et al. 2008; Finch et al. 2010).

The most prevalent anatomical site of musculoskeletal pain and injuries are the upper extremities (14.61%), thoracic region (14.45%) and lower extremities (30.73%) (Stretch & Venter, 2003). The anatomical sites of musculoskeletal pain at the upper extremities were shoulder (5.19%), elbow (1.81%) and hand (7.61%) (Stretch & Venter, 2003). The thoracic vertebrae (1.81%), lumbar vertebrae (10.56%) and ribs (2.07%) comprised the thoracic anatomical sites vulnerable to musculoskeletal pain (Stretch & Venter, 2003). The lower extremities anatomical sites which sustained musculoskeletal pain included the groin (3.89%), hamstrings (9.09%), quadriceps (5.19%), knees (6.83%) and ankles (5.71%) (Stretch & Venter, 2003). Musculoskeletal lower back pain is common among young bowlers, resulting in many of these young cricketers prematurely terminating their careers (Evans et al. 1989; Davies et al. 2009). Cricket related musculoskeletal lower back pain has been positively correlated to a high incidence of pars interarticularis defect (54%) and inter-vertebral disc degeneration (63%) (Hardcastle et al. 1992). Rehabilitative and surgical strategies have been implemented but have not been successful in returning young players to cricket (Evans et al. 1989).

Cricket is one of the most popular professional and recreational sports enjoyed by South Africans. The South African protea team is ranked 4th in the One Day International and 2nd in test match rankings in the world (ICC cricket, 2011). The popularity and success of cricket has been attributed to the developmental infra-structures that have been implemented in each

province of South Africa, at school level to nurture the young cricket talent (Morgan, 2011). However the identification, prevention and rehabilitation of cricket related musculoskeletal pain and injuries has been lacking in comparison to cricket skills development (ICC cricket, 2011). There has been studies conducted which investigated the incidence of cricket related musculoskeletal pain and injuries among elite adolescent players (Stretch, 1995; Milsom et al. 2008; Davies et al. 2009). The above published research has focused their attention on the identification of cricket related musculoskeletal pain and injuries among elite adolescent cricketers. There has not been any literature published on the prevalence of musculoskeletal pain of adolescent recreational cricketers. The aim of this study was to compare the present findings of the prevalence of musculoskeletal pain among adolescent male recreational cricketers to that of adolescent male elite cricketers. The uniqueness of the study is the proposed mechanism of musculoskeletal back and knee pain among batsmen and wicket keepers.

MATERIALS AND METHODS

Two hundred and thirty-four male adolescent cricketers aged 15-17 years old participated in a retrospective epidemiological study by voluntary, parental informed consent. Subjects were scholars of the following secondary schools; Glenwood, Durban Boys, Kloof, Westville Boys and Pinetown Boys all of which participated in the High Way Secondary School Cricket League. The High Way Secondary School League consisted of 48 teams (n=240) which were applicable to the age and gender inclusion criteria of the study. Each school affiliated three teams within the applicable age range. A sample population of 234 subjects were secured via voluntary participation (which represen-ted 97.5% of the above men-tioned cricket population of the High Way Secondary School League). The statistical rule of thumb pertaining to the minimum percentage of subjects participating in a study, yielding power of significance of the findings of the study is 30% of the population that is being

researched (Terre-Blanch et al. 2008). The sample group (n=234) was also representative of racial demographics of the cricket population of the High Way Secondary School league. The majority of subjects were of White (65.38%), followed by Indian (17.52%), Black (14.10%) and mixed heritage (2.99%).

Information on the subjects' demographics, sport epidemiological and training history were obtained using a validated questionnaire (adapted from Van Heerden, 1996). The fundamental problem concerning international sport epidemiological investigations is the inconsistent definition of musculoskeletal injury (Orchard et al. 2002; Hagglund et al. 2005). Hagglund et al (2005) proposed that the prevalence of musculoskeletal injury can be established if the following has being documented; anatomical site of musculoskeletal pain, symptoms of musculoskeletal pain and intensity of pain that renders the person incapacitated or unable to play and / or practice sport. The definition of musculoskeletal pain employed in this study was any sensation of distress to the musculoskeletal system ranging from uncomfortable to worst pain ever experienced, which inhibited the adolescent male cricketers from engaging in practise and / or competing for a minimum duration of 24 hours (adapted from van Herdeen, 1996). Subjects were requested to indicate only cricket - related musculoskeletal pain, and not musculoskeletal pain contracted from other sport and/or recrea-tional activities. The intensity of the musculoskeletal pain sustained was assessed using the Kee and Seo Pain Rating Scale (2008) which determined the severity of the pain from uncomfortable, low, moderate, high and worst pain ever experienced.

The inclusion criteria for eligibility to participate in the study were gender specific (male), age specific (15-17 years), affiliation to the High Way Secondary School Cricket League, voluntary participation, parental informed consent and a minimum cricket playing experience of three years. The study being retrospective in nature, recorded the prevalence of cricket related musculoskeletal pain over the last 12

months. In addition, kin-anthropometry was used to measure body mass, stature, and quadriceps angles. The quadriceps angle was measured according to the method described by Livingstone and Spaulding (2002). The subject lay supine on the plinth with their feet in a neutral position. The anterior superior iliac spine (ASIS), the centre of the patella and the tibial tuberosity were marked using a pen. The centre of the goniometer was placed on the centre of the patella (found by the intersecting width and length lines). The stationary arm of the goniometer was aligned with ASIS and the movable arm was aligned with the tibial tuberosity. A third vertical line which extended from the tibial tuberosity along the femur allowed the formation of an angle. Three readings were taken for each subject by the same investigator (to ensure test-retest reliability). The data were analysed descriptively (mean, frequency and percenttages) and inferentially using chisquare and t-tests ($p \leq 0.05$).

RESULTS

The cohort's demographical data such as age, body mass, stature and body mass index are found in Table 1. One hundred and eighty-eight players (80.34%) experienced cricket related musculoskeletal pain (X^2, $p<0.001$). The anatomical sites most vulnerable to musculoskeletal pain were; back, knee, shoulder, ankle, neck, hand, forearm and the tibia and fibula (Figure 1) (X^2, $p<0.001$). The mean quadriceps angle value for the cohort was 12.14° (±5.18) for the right and 11.07° (±3.81) for the left leg. However the mean quadriceps angle values of cricketers (n=75) who experienced musculoskeletal knee pain were 14.37° (±5.15) ($p<0.001$) and 11.52° (±5.05) ($p<0.05$) for right and left knees (indep. t-test, Table 3).

The type of musculoskeletal pain sensations experienced by the players were: sharp (45.45%), dull ache (29.57%), pins and needles (10.74%), numbness (4.95%), burning (4.95%) and radiating (4.13%) (X^2, $p<0.001$). The intensity of musculoskeletal

pain were; moderate (35.16%), low (26.92%), uncomfortable (17.58%), high (15.93%), and worst pain ever experienced (4.39%) (X^2, $p<0.001$). The majority of the players attributed their musculoskeletal pain to being struck with a ball (39.45%), overuse (21.08%), struck with a bat (17.68%), rapid rotational movement (11.56%) and collisions with other players (10.20%) (X^2, $p<0.001$).

The players accumulatively trained and played cricket for a sum of 202.10 (±0.35) hours per year, yielding 285 occurrences of musculoskeletal pain over the retrospective 12 month period of analysis. The players trained and practised cricket for an average of 7.58 (±2.66) months within the last 12 months, averaging 2.93 (±1.16) sessions per week.

Table-1
Demographical data of the cricketers (n=234)

Variables	Mean
Age (years)	15.62 (±1.07)
Body mass (kg)	68.76 (±13.19)
Stature (m)	1.71 (±0.13)
Body mass index (kg/m²)	20.58 (±10.54)

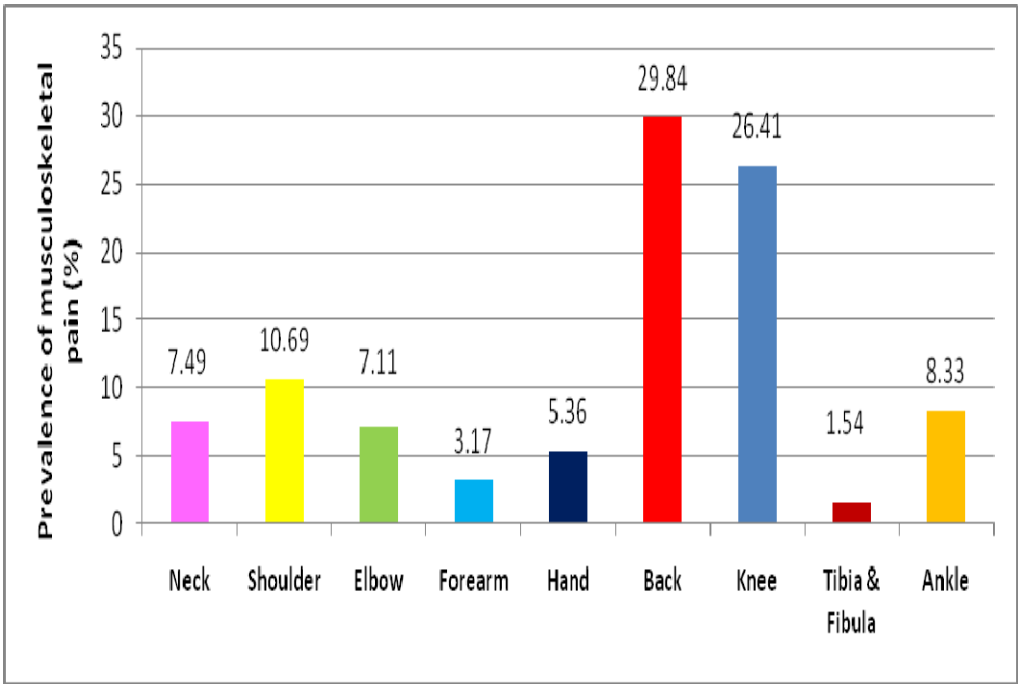
Table-2
The dichotomy of musculoskeletal pain at specific anatomical sites of the different specialization of cricket (n=188)

Anatomical sites	Bowlers (n=60)	All Rounder's (n=98)	Batsman (n=95)	Wicket keepers (n=32)	Total (n=285)	Mean (%) (n=285)
Neck	3	6	9	3	21	7.49
Shoulder	7	12	12	2	33	10.69
Elbow	4	5	4	4	17	7.11
Forearm	2	2	4	1	9	3.17
Hand	6	3	5	1	15	5.36
Back	25	29	19	9	82	29.84
Knee	11	23	31	10	75	26.41
Tibia & Fibula	0	4	2	0	6	1.54
Ankle	2	14	9	2	27	8.33

Table-3
Mean quadriceps angles of cricketer (n=234)

Knee	Cricketers who sustained musculoskeletal knee pain (n=75)	Cricketers who did not sustain musculoskeletal knee pain (n=113)	Significance (p<0.05) (indep. t-test)
Right	14.37° (±5.15)	11.52° (±5.05)	p<0.001
Left	11.80° (±2.88)	10.87° (±4.03)	p<0.05

Figure-1
Visual representation of the prevalence of musculoskeletal pain at specific anatomical sites (n=188) (X^2, p<0.001)



DISCUSSION

Among the 234 school boy cricketers surveyed, 188 (80.34%) experienced cricket-related musculoskeletal pain within the last 12 months ($p<0.001$). These findings correspond with other international injury surveys which recorded the prevalence of male adolescent cricket-related musculoskeletal pain and/or injury (Orchard et al. 2002; Milsom et al. 2008; Davies et al. 2009). Statistical interrogation of the data reveals that the lower extremities (66.12%) experienced the most musculoskeletal pain followed by upper extremities (26.33%) and neck (7.49%) ($p<0.001$). The lower extremities included back, knee, tibia/fibula and ankle whilst the upper extremities included shoulder, elbow, forearm and hand. These findings agree with previous reports that documented the prevalence of lower extremity musculoskeletal pain (Stretch & Venter, 2003; Milsom et al. 2008; White et al. 2011). They also indicate that recreational and elite male adolescent cricketers sustain musculoskeletal pain at similar anatomical sites. Orchard et al. (2002) and Stretch and Venter (2003) reported that over-use is a predisposing factor responsible for lower extremity musculoskeletal pain among cricketers. In this study, cricketers who sustained musculoskeletal pain attributed over-use (21.08%) to be key causal factor of musculoskeletal pain. The school boys trained and played cricket an average of 2.93 days / week. Hardcastle (1993) reported that the game of cricket imposes a tremendous amount of stress on the human body which yields micro-tearing of ligaments and muscle tissue, which produce sharp, dull, aching sensetions. Beynnon et al (2002) and Demartinis and Duki (2007) reported that the more frequent athletes train and / or played sport per week the greater the prevalence of musculoskeletal pain and injury.

The back was the most vulnerable anatomical site of musculoskeletal pain ($p<0.001$). This finding concurs to that of Hardcastle et al. (1992), Stretch (1995) and Milsom et al. (2008) with regards to elite adolescent cricketers. The bowling action applies large amount of forces onto the spine, which adversely acts on it. The bowling actions

are classified into three major techniques; side-on, front-on and mixed. In the side-on technique, at the end of the run the bowler lands with his back foot parallel to the bowling crease; an imaginary line passes through his shoulders while the hips point down the wicket. The bowler is looking over the outside of his front arm before his front foot makes impact with ground (Hardcastle, 1993). In the front-on technique, both feet points down the wicket, with the bowler being chest-on to the batsman. The non-bowling arm is almost vertical and he is looking inside his arm before delivery (Hardcastle, 1993). The mixed technique is a combination of the side-on and front-on techniques. It involves rotation of the shoulders in relation to the pelvis during the action. The lower half of the bowler's body is front-on, whilst his top half attempts to rotate to a side-on position. The mixed technique has been reported to excessively rotate the vertebrae in the transverse plane, in addition to the hyperextension and subsequent anterior translation forces which impact adversely onto the weakest portion of the vertebra (pars interarticularis) producing a stress defect / fracture (Hardcastle, 1993). Subsequent to the application of the excessive forces onto the vertebrae is the compression of the inter-vertebral disc which produces neural sensations of pins and needles, burning and numbness (Brukner & Khan, 2006).

Published literature explaining the aetiology of cricket related musculoskeletal back pain only advocates poor bowling biomechanics as the culprit. However batsmen and wicket keepers also sustain musculoskeletal back pain (Table 2). Although Finch et al. (2010) has identified musculoskeletal back pain among batsmen and wicket keepers, the pathomechanics for the prevalence of musculoskeletal back pain among batsmen and wicket keepers is undetermined. It is postulated that the prolonged hip flexion and thoracic vertebral extension adopted during the batting stance simulates a lordotic posture. This lordotic posture changes the normal resting length tension relationship of the agonists (hip flexors) and the antagonists (gluteal muscles) thereby producing asymmetrical

force couple between the hip flexors and the gluteal muscles. This abnormal force couple between the hip flexors and the gluteal muscles produced an asymmetrical muscle imbalance. Prolonged hip flexion shortens the hip flexors while stretching the gluteal muscles, which impinges the sciatic nerve, located in this area. Compression of the sciatic nerve will produce radiating, pins and needles pain. All the batsmen who reported musculoskeletal back pain (n= 75) described the sensation as having numbness, burning, radiating and pins and needles. In addition, prolonged shortening of the hip flexors produces muscle spasms whilst prolonged stretching of the gluteal muscles increases their vulnerability to muscle strains. The batsmen of this cohort have reported sensations of dull aches. Bahr and Maehlum (2004) and Brukner and Khan (2006) documents that symptoms of muscle spasms are dull pain, whilst muscle strains are sharp and dull pain. Similarly wicket keepers also experienced musculoskeletal back pain (Table 2). Wicket keepers predominately adopted crouched stance during the game. This crouched stance incorporates hip flexion and thoracic vertebral extensions for prolonged periods. The crouched stance resembles a lordotic posture. Authors postulate a similar cascade of pathomechanical events precipitating musculoskeletal back among wicket keepers.

The knee was the second most prevalent anatomical site of cricket-related musculoskeletal pain ($p<0.001$). Stretch (1995) documented similar findings indicating that the knee is a susceptible site to cricket related musculoskeletal pain (however the aetiology of knee was undetermined). It is postulated that the aetiology of musculoskeletal knee pain is a result of the deviant quadriceps angles (Table 3). Deviant quadriceps angles (in excess of 10° for males) are indicative of genu valgum which involves femoral internal rotation and tibial external rotation (Houglum, 2004). The medial patellar restraint comprises of the vastus medialis oblique, medial collateral ligament and anterior cruciate ligament (Mansfield & Neumann, 2008). Repetitive and prolonged stressing of the medial patellar restraint reduces its effectiveness against traction force of the

lateral patellar restraint. This medial patellar restraint inefficiency results in lateral patella tracking, indicated by the abnormal quadriceps angle which precipitates the onset of patellar femoral pain syndrome (PFPS). Symptoms of PFPS are localized pain in and around the patellar, reduced range of motion, inflammation and crepitus. Clinical identification of PFPS is the measure of quadriceps angle in excess of 10° for males (Kent, 2005).

The cohort was requested to subjectively describe the type of cricket-related musculoskeletal pain sensation they felt. The options to describe the pain were dull aching, sharp, burning, pins and needles, numbness and radiation. The type of pain sensation commonly experienced by those who sustained cricket-related musculoskeletal pain was dull aching, numbness, burning, sharp, radiating and pins and needles ($p<0.001$). Brukner and Khan (2006) identify dull aching, sharp pain sensations as muscle pain. The sum of the dull aching and sharp sensations equal 75.02% indicative of muscle pathology. It is plausible that when players collide with each other and / or are struck with ball and / or bat, the force of the blow penetrated the skin and was absorbed into the various muscle layers, thereby yielding symptoms of muscle pain such as dull aching and sharp sensetions. The sum of the numbness, burning, radiating and pins and needles equal 24.77% suggestive of nerve pathology (Brukner & Khan, 2006). The combination of the most prevalent anatomical sites of musculoskeletal pain, intensity of musculoskeletal pain assessed by the Kee and Seo pain rating scale (2008) and type of musculoskeletal pain sensation is indicative of musculoskeletal pathology as suggested by Hagglund et al. (2005).

CONCLUSION

The study concluded that the male adolescent recreational cricketers playing in the High Way Secondary School league in Kwa-Zulu Natal, South Africa experienced a high prevalence of back and knee musculoskeletal pain. The predisposing pathomechanical factor of the cricket related mus-

culoskeletal back pain among batsmen and wicket keepers are their adopted lordotic postures while playing. Whilst the predisposing factor of musculoskeletal knee pain was attributed to the abnormal quadriceps angles.

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