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Case Study

Cricket Scotland Women's Twenty-20 International Cricket Council World Cup Qualifier: A Pilot Prospective Cohort Injury Study

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Abstract

Background: Cricket is the world's second most popular spectator sport with the Twenty-20 form emerging as one of the most popular match formats for male and female players. Little research has been conducted into the injury profile of Women's Twenty-20 cricket. As a first step toward implementing injury reduction and prevention strategies, injury surveillance was conducted for Cricket Scotland during the Women's Twenty-20 International Cricket Council World Cup Qualifier (held from 29th August-07th September 2019). **Objectives:** To describe the incidence, nature, anatomical location and mechanisms of new medical attention injuries sustained by Cricket Scotland Women's Twenty-20 Team during the Women's Twenty-20 International Cricket Council World Cup Qualifier in order to best inform appropriate stakeholders regarding future injury reduction and prevention strategies. **Design:** Prospective cohort study. **Methods**: Injury data was collected prospectively by the team physiotherapist during the period 28th August-07th September 2019 for Cricket Scotland Women's Twenty-20 Team during the Women's Twenty-20 International Cricket Council World Cup Qualifier (held from 29th August-07th September 2019). Data was entered into an Excel ® (Microsoft Office Excel 2010) spread-sheet. New medical attention injuries were included and coded according to the Orchard Sports Injury Classification System, Version 10.1. Injuries were classified regarding player availability and injury severity. Following the international consensus definition, injuries were categorised by player role at time of injury, along with the activity, mechanism of injury and mode of injury onset. Calculations were made for training and match injury incidence per 10,000 player hours along with injury incidence proportion values related to anatomical location and nature of injury. **Results:** 14 (nine match, 5 training) new medical attention injuries were sustained during the 11 day period from 28th August-07th September 2019. Total match injury incidence was 1020.4 injuries per 10,000 player hours. Total training injury incidence was 438.6 injuries per 10,000 player hours. Contractile structures had the greatest injury prevalence (78.6%). Knee (35.7%) and shoulder (28.6%) were the most commonly injured body parts. Of all injuries, the majority were attributed to non-contact (78.6%) or overuse (78.6%) aetiologies. Bowling was the player role allocated to the greatest number of injuries: accounting for 67% of all tendon, knee (60%) and elbow (100%) injuries. Bowlers had the greatest injury incidence proportion value (0.57) compared to other specialisations. There were no time loss injuries. **Conclusions** : There is a need to focus on specific interventions to reduce knee injuries in this cohort due to their high prevalence, and also for tendon related injuries again due to their high prevalence and potential to adversely affect performance through their chronic nature. Players specialising as bowlers, and the technical aspects related to optimal bowling biomechanics, deserve attention as players specialising in this role sustained the greatest number of injuries.

Main Recommendation

Multi-disciplinary team collaboration could utilise findings from robust injury surveillance and evidence based injury screening to develop individualised player injury reduction programmes.

Introduction

Cricket is the world's second most popular spectator sport which is played in 105 member countries of the International Cricket Council (ICC) [1]. A short form of cricket, called Twenty-20 (T20), has arisen to become one of the most common forms of match play with popularity for this format increasing in the women's game also. However, there is a dearth of research into the injury profile for women's T20 cricket [2,3].

It is surprising that there is a lack information available regarding the injury profile in women's T20 cricket [2,3] given the increase in popularity of women's T20 cricket from a spectator and participation perspective. Further, in comparison to other sports, cricket researchers were unique in their pioneering studies involving publishing international consensus injury definitions [4] with the work of Orchard et al.(2016) [5] updating these for emerging T20 format.

High quality evidence exists in the literature extoling the importance of high performance sporting organisations implementing strategies to reduce the occurrence of injuries, particularly when the causes of injury are known, as injuries result in time missed competing and could have a negative impact on performance [6-8].

Injury surveillance is a crucial initial step towards injury prevention [8] and therefore it is prudent to undertake such injury monitoring on behalf of Cricket Scotland (CS) for their Women's T20 Team (WT20T) during the Women's T20 ICC World Cup Qualifier (WCQ), held in Scotland during the period 29th August-07th September 2019.

The aim of this pilot study was to describe the incidence, nature, anatomical location and mechanisms [9, 5, 10,11] of new medical attention injuries [5] sustained by CS' WT20T during the Women's T20 ICC WCQ in order to best inform appropriate stakeholders regarding future injury reduction and prevention strategies.

Methods

Injury data for CS WT20T was collected prospectively by the team physiotherapist during the period 28th August-07th September 2019 at the Women's T20 ICC WCQ, held in Scotland, from 29th August-07th September 2019, then forwarded to the study author for analysis. Injury data was coded by the author according to the Orchard Sports Injury Classification System 10.1 (OSICS 10.1) [9]. Injury surveillance and the OSICS have both evolved over time [5,10,11,4]. The OSICS is currently used across a range of sports, including cricket [12], as an injury surveillance tool with OSICS 10.1 having improved inter-user agreement and more able to cater for all possible diagnoses within a sports medicine setting [9].

The international consensus statement definition for medical attention injuries was used [5]. All new medical attention injuries were included in this study regardless of whether or not they resulted in a time-loss. New medical attention injuries that would potentially affect cricket playing or training were included in this study. A match-time-loss injury was defined as an injury that resulted, or would result, in a player being unable to bat, bowl or wicket keep during a match [5]. Injured players were categorised during the study period as available, modified or unavailable for training or a match as defined by Panagodage Perera et al. (2019) [2].

Injury data was inputted to an Excel ® (Microsoft Office Excel 2010) spread-sheet. Injuries which did not conform to the definition given previously were excluded. Injury severity was defined as per [5] with time loss injuries categorised according to Timpka et al. (2014) [13]. Match injury incidence per 10,000 player hours was calculated as defined by Orchard et al . (2005) [14] with the number of player hours (exposure) used in the calculation being 14.7 player hours per team per T20 match [5]. Training injury incidence values per 10,000 player hours were also calculated. The injury incidence proportion (IIP) was calculated according to Knowles, Marshall and Guskiewicz (2006) for anatomical location and nature of injury [15]. Players were classified as either a pace-bowler; spin-bowler; wicketkeeper; batter or all-rounder as advised by CS coaching and management staff. Following the international consensus definition, injuries were categorised by player role at time of injury; along with the activity; mechanism of injury (MOI) and mode of injury onset [9,5].

All data was anonymised with the lead physiotherapist for CS approving the study.

Results

The mean age of the CS WT20T was 25.9 +/- 6.4 years. From the 14 player squad, 14 new medical attention injuries were sustained: seven lower limbs (50%), six upper limbs (42.9%) and one neck (7.1%). See Figure 1 for categorisation of injured body parts. Total match injury incidence was 1020.4 injuries per 10,000 player hours (Table 1). Total training injury incidence was 438.6 injuries per 10,000 player hours from five injuries sustained during

114 hours of group training exposure.

Table 1: Match Injury Incidence per 10,000 Player Hours for CS WT20T at Women's T20 ICC WCQ

Match/Date	Total Exposure (hours)	Number of injuries	Match injury incidence per 10,000 player hours
*Scotland v Namibia (29/08/19)	14.7	3	2040.8
Scotland v USA (31/08/19)	14.7	2	1360.5
Scotland v PNG (01/09/19)	14.7	2	1360.5
Scotland v Bangladesh (03/09/19)	14.7	2	1360.5
Scotland v Namibia (05/09/19)	14.7	0	0
Scotland v Netherlands (07/09/19)	14.7	0	0
Total	88.2	9	-

*Warm-up match; CS – Cricket Scotland; WT20T – Women's Twenty-20 Team; ICC – International Cricket Council; WCQ – World Cup Qualifier; USA – United States of America; PNG – Papua New Guinea.

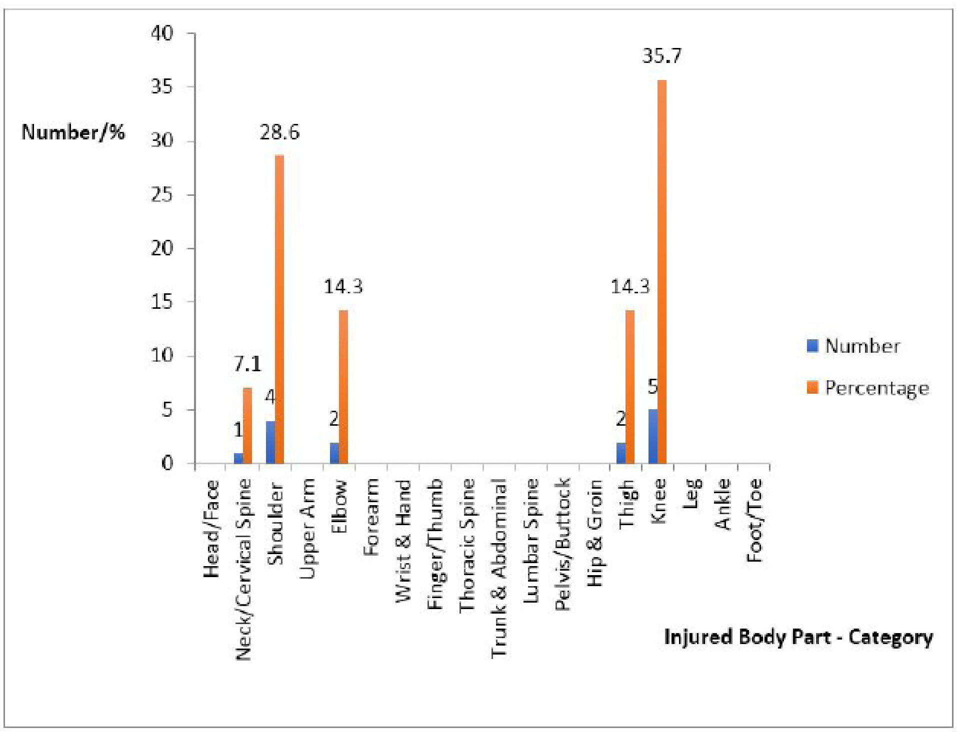

Figure 1: Women's Cricket Scotland 28/08-07/09/19 injured Body Part –category.

Muscle and tendon were the most prevalent type of injury, being 78.6% of all injuries (Figure 2). The majority of these had no specific identifiable MOI (Figures 3 and 4).

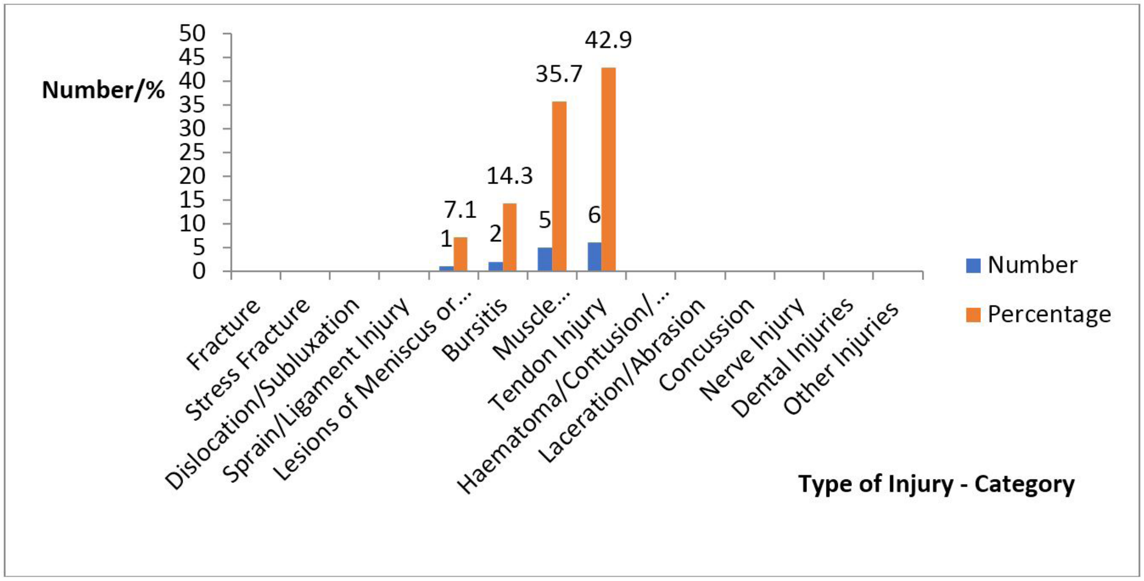

Figure 2: Women's Cricket Scotland 28/08/-07/09/19 Type of Injury – Category.

Injury cause occurred almost twice as frequently during matches (64.3%) compared to training (35.7%), and to a much greater extent through non-contact (78.6%) versus contact (21.4%). The majority of injuries resulted from overuse (78.6%) as opposed to a precipitating trauma (21.4%). With eight (57.1%) of the 14 injuries being classified as having an insidious onset the majority of injuries had no definitive cause attributed to them. Specific MOI were identified from diving during fielding activities and throwing; three (21.4%) each (Figures 3 and 4).

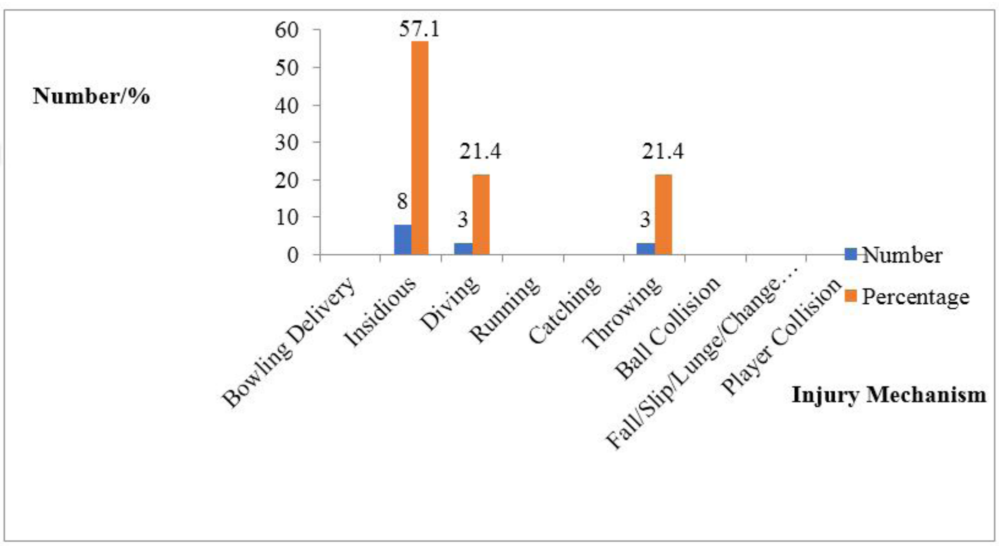

Figure 3: Womens's Cricket Scotland 28/08-07/09/19 injury Mechanism.

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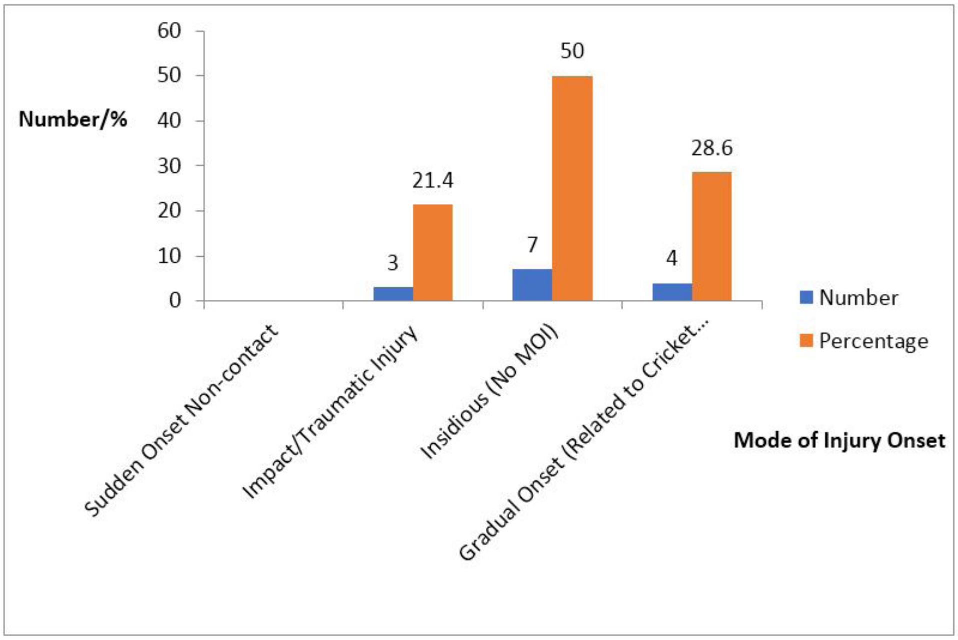

Figure 4: Women's Cricket Scotland 28/08-07/09/19 Mode of injury Onset.

Only five of the 14 injuries were allocated an injury severity, all being of minor severity (one to seven days).

Anatomical Location and Nature of Injuries Along With Player Specialisation Categorised by Player Role at Time of Injury and Injury Incidence Proportion (IIP) Values (Table 2)

Table 2: Anatomical Location and Nature of Injuries Along With Player Specialisation Categorised by Player Role at Time of Injury and Injury Incidence Proportion (IIP) Values.

Player Role at Time of Injury (%)				
	Batting (2)	**Bowling (7)**	**Fielding (5)**	**Wicket-Keeping**
Anatomical Location (n Injuries)				
Neck/Cervical Spine (1)	-	-	100	-
Sholuder (4)	25	25	50	-
Elbow (2)	-	100	-	-
Thigh (2)	-	50	50	-
Knee (5)	20	60	20	
Nature of Injury				
Meniscus (1)	-	-	100	-
Bursitis (2)	50	50	-	-
Muscle (5)	20	40	40	.-
Tendon (6)	-	67	33	-
Player Specialisation				
All-rounder (1)	-	100	-	-
Batter (5)	40	-	60	-

Blowler (pace & Spin) (8)	-	75	25	-
Wicket-Keeper (0)	-	-	-	-
Anatomical Location (n) Injuries	**IIP**			
Neck/Cervical Spine (1)	0.07			
Sholuder (4)	0.29			
Elbow (2)	0.14			
Thigh (2)	0.14			
Knee (5)	0.36			
Nature of Injury	**IIP**			
Meniscus (1)	0.07			
Bursitis (2)	0.14			
Muscle (5)	0.36			
Tendon (6)	0.43			
Player Specialisation	**IIP**			
All-rounder(1)	0.07			
Batter (5)	0.36			
Blowler (pace & Spin) (8)	0.57			
Wicket-Keeper (0)	-			

Bowling was attributed to seven of the 14 injuries (50%), followed by fielding, five of the 14 injuries (35.7%), and batting, two of the 14 injuries (14.3%). Muscle injuries occurred equally during bowling and fielding (40% each) whilst tendon injuries (67%) predominately took place during bowling. Knee injuries were sustained mostly during bowling (60%), and elbow injuries were all allocated to be from bowling. Fielding was given as a common player role during which shoulder injuries took place. Bowlers were the most injury prone, succumbing to 57.1% of all injuries sustained (Table 2). From the data available, no time loss injuries were sustained and all players were available during the entire competition period.

Discussion

This pilot prospective cohort injury study was undertaken to provide insight into the injury profile for CS WT20T during an intensive 11 day competition period; namely the Women's T20 ICC WCQ for 2020. The total match injury incidence of 1020.4 injuries per 10,000 player hours is much greater than that found by Panagodage Perera et al. (2019) of 600.4 per 10,000 player hours [2]. The study by [2] was conducted over two seasons (March 2014-16), for 121 Australian elite female cricket players, compared to the 14 players in this pilot study. Therefore, this pilot study could be considered underpowered. Also, when interpreting results from this pilot study, it is advisable to be mindful of the short period of time (11 days) during which data was collected.

Total training injury incidence was 438.6 injuries per 10,000 player hours. Of interest, the last training session took place on the penultimate day of the competition period in which 80% of training injuries were sustained. In contrast, all the match injuries were sustained during the first four of the six matches played. This could suggest an element of player acclimatisation to the demands of match play as the competition period progressed. Alternatively, it is possible that a lack of player resilience to the intensive 11 day schedule existed with injuries being sustained latterly in schedule. The work of Gabbett (2016) identifies the role of the correct balance between an athlete's acute training load (most recent session, previous weekly load or micro-cycle) with their longer term chronic training load (fortnightly, monthly or meso-cycle) [16]. A correct balance lowers the risk of injury if the acute/chronic workload is within 0.8-1.3; so called sweet-spot. If the acute/chronic workload is greater than 1.5, the risk of injury is increased significantly [16]. The work of Gabbett (2016) is applicable here, as much of his work involved cricket players. The emphasis is on a protective chronic training load to build resilience to cope with high acute training loads.

Workload can often determine the type of injury sustained

[1]. For this cohort the contractile structures, tendon (42.9%) and muscle (35.7%), were the most prevalent injury types. Given that tendons are designed to take tensile loads, compressive loads can cause and perpetuate tendinopathy [17], with the pathology within the tendon structure following a continuum from normal tendon onto reactive tendinopathy; tendon disrepair and degenerative tendinopathy [18]. It is possible that some of the tendinopathies identified within this cohort could be attributed to compressive loads (Hamstring tendinopathy from hip flexion; patellar tendinopathy from deep knee flexion and rotator cuff tendinopathy from shoulder adduction). Such chronic compressive loads could be best addressed via neuroplastic training [19] to optimally load the injured tendon allowing it regress along the tendinopathy continuum and perform functionally with no re-injury. Such neuroplastic training addresses strength and motor control. The most common injury in T20 is the hamstring strain, 8.7 injuries/100 players per season [20]. This was not the case in this pilot study. However, the overall prevalence of muscle injuries in this cohort is in reasonable agreement with that found by Panagodage Perera et al. (2019) [2] of 31.8%.

Female athletes are at greater risk of knee injuries due to several factors including increased: Q-angle; knee valgus angle; hip internal rotation and hip adduction moment as well as decreased knee flexion; weaker quadriceps strength and weaker hip external rotation, extension and abductor strength [21]. Within this cohort, the most frequently injured body part was the knee (35.7%) which is much greater than the 9.1% found by Panagodage Perera et al. (2019) [2] and does not agree with the findings from a systematic review with meta-analysis that the knee was the third most commonly injured anatomical location after ankle and hand [3]. Of the five knee injuries sustained, two were tendinopathies, and could be addressed by methods previously described. A further two of the knee injuries could be as a consequence of poor neuromuscular control with bursitis being the diagnosis. Some of the factors attributed for female knee injuries discussed by Boling et al. (2009) [21] are modifiable; such as addressing strength deficits and neuromuscular control. Interventions targeting appropriate modifiable risk factors for knee injuries could be addressed via a multi-disciplinary team (MDT) approach involving physiotherapy colleagues, strength and conditioning coaches and the wider coaching and management personnel within CS. Ideally, a broader support network bringing in musculoskeletal podiatry, video and/or sports science analysis along with nutrition advice could enhance the MDT effectiveness.

The majority of knee injuries (60%) were related to the player role of bowling. Given the highly technical nature of the bowling action [22,23] and the inherent risks of bowling workload related injuries [24,25] and the long known three to four week delay between high bowling workload and increased risk of injury [26], coupled with a plethora of risk factors known to exist for knee injuries in females, it is not surprising that knee injuries are prevalent in this cohort.

Arguably, the most important risk factors for knee injuries from the bowling action are biomechanical in nature. During the delivery stride, the greater knee extension produced at front foot contact (FFC), the greater is the ground reaction force (GRF) produced [27]. Further, bowlers with greater knee extension at FFC reach peak GRF more quickly compared to those with a more flexed knee [22]. Such large impulses, from large and rapidly produced GRF, through a relatively stiff extended knee may increase knee injury risk. However, a greater extension of the knee at FFC allows a desirable performance gain to be met through ball delivery from a greater height and at faster velocities. Four of the knee injuries were consequential to non-contact and overuse mechanisms, whilst the fifth knee injury was precipitated by a traumatic event, diving whilst fielding.

Diving also was identified as a MOI for two of the four shoulder injuries; shoulder injuries being the second most prevalent anatomical location for injury (28.6%) and is greater than that of the 12.5% reported for shoulder injuries by Panagodage Perera et al. (2019) [2]. The reasons for this are unclear, two of the shoulder injuries were muscular lesions and two related to tendons. With fielding being the player role in which shoulder injuries were mostly apparent perhaps the traumatic nature of certain fielding activities (for example diving) along with biomechanical factors related to throwing whilst fielding could account for the muscular and tendon type of injuries respectively at the shoulder.

All the elbow injuries were tendon related, and occurred late on during the study period (the last training session on the penultimate day of the competition period). Possibly these injuries could be due to either accumulated fatigue, or a relative spike in acute training load during the competition period relative to the prior chronic workload history. Repetitive throwing and bowling actions all have the potential to overload the origin of the common flexor tendon through production of a valgus stress to the elbow [28]. Females already have a greater carrying angle compared to males, 20-25 degrees versus 15-20 degrees respectively, [29] and such an increased valgus angle at the elbow may not tolerate increased repetitive valgus directed forces from throwing actions. Lateral epicondylalgia of the common extensor tendon has long been known to occur more frequently than medial epicondylalgia, and is mostly caused through repetitive gripping actions, as in bowling [30]. Again, consideration to biomechanical factors related to cricket specific activities could well attenuate such non-contact, chronic overload related injuries.

In agreement with the findings from Panagodage Perera et al. (2019) [2], this pilot study found players specialising as bowlers to acquire the greatest number of injuries (57.1% of all injuries, IIP of 0.57) with the bowlers sustaining 75% of their injuries during

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the role of bowling. Despite being in agreement with Panagodage Perera et al. (2019), the prevalence of injuries for bowlers in this pilot study exceeds almost two-fold that of the 28.9% found by Panagodage Perera et al. (2019). This could be attributed to the study by Panagodage Perera et al. (2019) quoting data for pace-bowlers only, and the current pilot study not differentiating between pace and spin-bowlers [2]. Other sources confirm a greater injury prevalence for bowlers compared to other specialisations [3,1,20].

Study Limitations

There are several limitations in this pilot study. Most notably, the small cohort of 14 players studied during a brief period of time (11 days) gives a small pool from which to extract data and make reasonable long term inferences, or indeed meaningful comparisons with other more robust studies of adequate power and/or longer study period; this pilot study is but a brief snapshot of an intensive competition period.

No account was made of pre-existing injury status for the players, or attempts to capture data on on-going injuries carried into the competition. This seemed reasonable, as the objective of this pilot study was to conduct injury surveillance for new medical attention injuries arising during the competition period. However, it would be erroneous to assume that pre-existing injuries could not have an impact either directly by acute exacerbation of a chronic issue, or indirectly through alteration of biomechanics to adversely affect other structures thereby pre-disposing such structures to injury. Future studies should try and find methods to mitigate this. The difficulty in attributing severity for each new injury sustained during this study did not allow for prevalence data for the impact of injury severity to be presented. However, it would appear that from all the new medical attention injuries taking place during the competition period, none of them affected player availability adversely.

A further limitation was the lack of, in most cases, a clearly identifiable MOI with by far the vast majority of injuries being classified as insidious. This is a valid classification according to the international consensus definition used [9,5] but is not in of itself overly helpful to aid in the synthesis of precipitating factors which could be further studied in the hope of attenuating specific injuries (with an identifiable MOI) for which modifiable risk factors exist.

Conclusions

This pilot prospective cohort injury study investigated the new medical attention injuries sustained by CS WT20T at the Women's ICC WCQ for 2020. There is a need to focus on specific interventions to reduce knee injuries in this cohort due to their high prevalence, and also for tendon related injuries again due to their high prevalence and potential to adversely affect performance through their chronic nature. Players specialising as bowlers, and the technical aspects related to optimal bowling biomechanics, deserve attention as players specialising in this role sustained the greatest number of injuries.

Recommendations

1. This pilot study could be conducted over a longer term, with improvements, to assimilate more robust data.
2. Findings from this pilot study, and future injury surveillance studies, could be incorporated alongside evidence based injury screening to identify modifiable injury risk factors.
3. Multi-disciplinary team collaboration could utilise findings from robust injury surveillance and evidence based injury screening to develop individualised player injury reduction programmes.

Conflicts of Interest

No conflicts of interest.

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