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Original research

Monitoring loads and non-contact injury during the transition from club to National team prior to an international football tournament: A case study of the 2014 FIFA World Cup and 2015 Asia Cup

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ABSTRACT

Objectives: Injured and non-injured national team footballers were compared for external and internal loads during transition from club to National team training camp.

Design: Prospective Case Study.

Methods: Load and injury data were collected from the same National team prior to and during training camps of 2 tournaments; World (n = 17) and Asian Cups (n = 16). External (number sessions) and internal (s-RPE) loads were collected 4-weeks prior to and during camps. The acute:chronic load ratio was calculated for the first week of camp based on the mean of previous 4-weeks. Respective loads and ratios were compared between injured and non-injured players for non-contact injuries occurring during camp.

Results: Seven non-contact injuries occurred during World Cup camp and 1 during Asian Cup (preventing statistical analyses). Small-to-moderate effect sizes were found for lower chronic internal loads (ES = 0.57; 90% CI: 0.39–1.08) and higher acute:chronic ratio (ES = 0.45; 90% CI: 0.31–0.87) for injured compared to non-injured players. Moderate-large effects (ES = 0.83; 90% CI: 0.56–1.60) were evident for increased acute:chronic ratio for number of sessions in injured compared to non-injured players. However, small-moderate effect sizes were present for lower chronic training and match loads (ES = 0.55; 90% CI: 0.38–1.06) in injured players prior to the World Cup camp, alongside an increased number of sessions in week 1 of camp (ES = 0.47; 90% CI: 0.33–0.91).

Conclusions: Players incurring non-contact injury during training camp prior to an international tournament performed less prior chronic external and internal load and a concomitant higher relative increase in camp, thus representing a practical marker to monitor in national teams.

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1. Introduction

Injury rates at the Fédération Internationale de Football Association (FIFA) World Cups have steadily decreased since 2002, with time-loss injury rates from matches reducing from 50.7 to 29.3/1000h between 2002–2014 World Cups.¹ However, non-contact injuries, which represent the main (and potentially avoidable)^{2,3,4} injury source in elite football have not changed since the 2002 World Cup. Medical support staff working in elite National

teams perceive that players' work load before and during training camps are among the most important risk factors for non-contact injury.⁵ To avoid non-contact injuries in these settings, medical support staff require evidence-based guidelines to assist appropriate decision making on risk factors contributing to non-contact injury in the National team context.

The anecdotal perceptions of practitioners operating within the National team context resonate with growing evidence of an important relationship between prior (chronic) and current (acute) loads with injury in a variety of team sports.⁶ In particular, the 2016 International Olympic Committee consensus statement⁶ on load and injury risk highlighted sharp and excessive increases in loads compared to recent loads as a potential injury precursor. Unfortunately,

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in the highest echelons of international football there is limited evidence as to how prior loads in club environments may impact injury during the transition from club to National team. Currently only one study exists, in which 60% of players performing a higher number of matches in the 10 weeks prior to the 2002 World Cup incurred an injury during the tournament.⁷ Such lack of evidence from this environment is likely due to the logistical difficulties of National team players being based in a multitude of club locations in other countries and continents; along with varied support staff and the transient, infrequent nature of major international tournaments. Thus, further evidence on the loads encountered during the transition from club to National team environments is required to better understand injury risk and provide insights into how practitioners may be able to implement load monitoring strategies.

Concerning load, it is the combination of both external (the stimulus placed on an athlete) and internal (the psycho-physiological response of an athlete) loads that will provide the most complete picture of overall 'load'. However, in the context of transitioning from club to National teams, this represents great difficulty. In particular, the lack of comparability between types and measures of external load monitoring devices,⁸ as are typically used in different clubs, often limits the transferability of such information to the National team, and thus requires simple and reliable measures of load.⁹ The most simple measure of external load is the duration and quantity of training sessions and matches. Furthermore, a simple and reliable method to quantify internal load that can be transferable from club team to National team is the rating of perceived exertion (RPE; CR-10 Borg scale)¹⁰ multiplied by the duration of the training session or match.¹¹ This method for measuring internal load has been validated for use in football,¹² is easy to collect, and allows load quantification from a variety of training methods (e.g. field and gym).

Accordingly, the aim of this case study was to investigate whether the external (number of sessions – training + matches and matches alone) and internal (measured using s-RPE) load profiles of national team players differed between those who did and did not incur a non-contact injury.

2. Methods

Seventeen professional football players competing in the 2014 Brazil World Cup (26.6 ± 4.7 years; 182.4 ± 7.2 cm; 77.5 ± 7.2 kg) and sixteen players at the 2015 Asian Cup (26.1 ± 3.5 years; 183.3 ± 7.0 cm; 77.3 ± 6.3 kg) were prospectively followed. Goalkeepers were excluded from analysis in both tournaments. Additional exclusions, for the World Cup included: 2 outfield players who did not make the squad for the Brazil training camp, 2 outfield players who were forced to leave the training camp early due to injury, 3 players who incurred contact injuries during week 1 of training camp and finally 3 players whose load data was inconsistent during the 4 weeks prior to the training camp. Three players were excluded from the Asian Cup data due to inconsistent load reporting during the 4 weeks prior to training camp. Load and injury data from players were collected 4 weeks prior to and during the training camps of these 2 major international football tournaments (separated by 6 months). While approval for the study was obtained from the National team involved, these data arose as a condition of National team duty in which player data was routinely collected throughout the year and therefore was not subject to ethical approval in this instance.¹³ However, to ensure team and player confidentiality, all data were anonymised before analysis.

During the 2014 World Cup, data were collected from players for 4 weeks prior to the official training camp (pre-camp) in addition to the 4-week training camp (2 weeks in Sydney, Australia, 2 weeks in Vitoria, Brazil) prior to the Brazil 2014 FIFA World Cup and used in

ensuing analyses. The transition from Sydney to Australia consisted of 3 flights, 19 h and 14,695 km of travel east across 11 time-zones. The pre-camp monitoring period consisted of 28 days (4 weeks) prior to the commencement of the national team training camp while players were still based with their respective club teams. The training camp lasted 25 ± 4 days (depending on the date players arrived into the camp), with a total of 14 days (16th to 29th May 2014) in Sydney, Australia and 13 days (31st May to 12th June 2014) in Vitoria, Brazil. One full day (30th May 2014) was spent travelling from Australia to Brazil.

During the 2015 Asian Cup, data was collected from players 4 weeks prior to the official training camp (pre-camp), during a 12 day training camp in Melbourne, Australia, and throughout the subsequent 2015 AFC Asian Cup, held in Australia. The pre-camp monitoring period consisted of 28 days (4 weeks) prior to the commencement of the national team training camp while players were still based with their respective club teams. The training camp lasted 11 ± 1 days (again depending on the date players joined the team), with a total of 12 days (28th December 2014 to 8th January 2015) in Melbourne, Australia. The 2015 AFC Asian Cup started on the 9th of January 2015 in Melbourne and all 16 players bar one participated in training and competition play until the final day, the 31st of January 2016, in Sydney.

An injury was classified as such when a player was unable to take full part in future on-field training or match due to physical complaints (from a non-contact mechanism).¹⁴ Non-contact injuries were diagnosed by the National Team Doctor and recorded by the Head Physiotherapist. Modified activity was included in the load analysis during the rehabilitation period. Illnesses, disease and mental complaints were not considered as physical complaints, but were taken into account to calculate match and training exposure. Information about circumstances (training or match), location and type of injury was also recorded. Injuries were classified into 4 categories of severity, according to the length of absence from full training sessions and matches, including the day of injury¹⁵: slight (1–3 days), minor (4–7 days), moderate (8–28 days), and major (more than 28 days). A player was considered injured until he was cleared by the National Team Doctor for participation in full training or matches.

The intensity of training sessions and matches was determined using the RPE scale¹⁰ within 30 min after completion of the session/match by the fitness coach. Internal load was calculated using the session RPE multiplied by the duration for each player for each training session or match.¹¹ External loads were determined as the number of sessions (training and matches) performed per week. Loads were derived from on-field sessions, gym and recovery sessions. All data (RPE, duration of session and type of session) was collected by remote upload via a smartphone/tablet application using the same RPE scale and recording protocol (Kinetic Athlete, Canberra, Australia) while players were with their club teams and then manually entered by players during the training camp. The weekly load was calculated as the sum of all of the training sessions and matches for each week. All National team players had prior familiarity with the above procedures, having used such methods for at least 1 year before the present data collection period.

Data were categorised into weekly blocks starting as Day 1 to Day 7 (exactly 4 weeks from each players World Cup training camp start date). The first week of a players' training camp represented the current week (i.e. the week that the load occurred) and was referred to as the 'acute' load. Chronic load was calculated as the 4-week mean of the weekly acute loads. The acute:chronic load was calculated by dividing the acute load by the chronic load – providing the relative size of the acute load compared to the chronic load.¹⁶

For the 2014 Brazil World Cup, results are expressed as means \pm standard deviations (SD). The magnitude of effect

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