



Original research

Transitioning from club to national teams: Training and match load profiles of international footballers



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ABSTRACT

Objectives: To quantify and profile the training and match loads of international footballers as they transition from club-to-camp-to-tournament contexts during multiple international tournaments.

Design: Retrospective single-cohort observational study.

Methods: External (session duration and count) and internal (session Rating of Perceived Exertion [s-RPE]) load data of all outfield players from the same national team were compared between club, pre-tournament camp and initial tournament phases of 3 recent international competitions. Further, load profiles were compared between each phase based on the acute:chronic (A/C) ratio using a 7 to 21-day ratio.

Results: Moderate-to-large effect sizes existed for increased number of sessions (ES = 1.92; 90% CI: 1.56, 2.27) and s-RPE training load (ES = 1.16; 0.84, 1.48) from club to camp. Conversely, transitioning from camp-to-tournament showed very large effects for decreased number of training sessions (ES = -3.17; -3.47, -2.86) and s-RPE training load (ES = -2.05; -2.35, -1.75), alongside increased number of matches (ES = 1.87; 1.55, 2.18) and s-RPE match load (ES = 1.57; 1.25, 1.89). Consequently, a moderate effect was evident for increased A/C ratio during the club-to-camp transition (ES = 1.02; 0.70, 1.33), while a moderate decrease in the A/C ratio occurred during the tournament (ES = -0.76; -1.06, -0.46).

Conclusions: International footballers showed expected increased training load when entering into pre-tournament camps, predominately via increased number of training sessions. Subsequent reductions in training volume coincide with increased match volume, though total load decreases. Such profiles provide insight into load accumulation transitioning from club to national teams in international footballers.

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Practical implications

- Simple measures of load (i.e. s-RPE, training and match exposure) can be applied as an easy and cost-efficient method to continuously monitor their players during the transition between club and national team environments.
- Knowledge of the players' club-based loads may be useful to national team practitioners to help plan and manage camp and tournament training according to the players' individual load and recovery needs.

- Calculation of the A/C ratio may be a useful approach to evaluate international players training and match loads during the transition between club and national teams, although future research is needed to determine which load variables and acute/chronic time periods are most relevant within this context.

1. Introduction

Contemporary international football tournaments are characterised by a high number of matches condensed into a short period of time.¹ Consequently, pre-tournament training camps function to ensure that the players are tactically, physically and mentally prepared for tournament demands. However, complicating this pre-tournament planning is the need to appropriately balance training load and recovery within a truncated period between domestic club commitments and the tournament.^{2,3} Therefore, a

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challenge for national team staff is to manage the physical preparation of players during this transition; particularly, given the variable prior exposure to heterogeneous standards of competition and training types/volumes from a multitude of clubs in different countries.² Accordingly, optimal preparation for international tournaments may be possible by monitoring player's training and match load within club and national team contexts. Currently information on training and match loads in international footballers is sparse, thus profiling the distribution and accumulation of load from club-to-camp-to-tournament can provide valuable insight for national team practitioners.⁴

In recent years, the integration of load monitoring practices have been widely adopted in professional football to provide practitioners with objective evidence to guide appropriate loading strategies.^{5,6} Primarily utilised as a systematic approach to improve performance and injury prevention,⁷ numerous studies have analysed load data to infer on fitness,^{8,9} fatigue,^{10–12} recovery^{13,14} and injury risk.^{15–17} However, load monitoring research in football emanates predominantly from professional club settings and limited information exists in national team contexts. Indeed, a recently published case study was the first to demonstrate the load profiles of international footballers transitioning from club to national teams, with emphasis on injury outcomes during training camp.⁴ Whilst these results provide initial insight into load 'spikes' during the transition from club to national teams, data was only analysed from one national team during a single international tournament.⁴ Nevertheless, case studies of this nature are helpful in guiding subsequent larger studies to understand the distribution of load in international footballers transitioning into national teams.

Despite the lack of evidence describing load profiles in international football players, the anecdotal perceptions of practitioners operating within national teams testify to the usefulness of load monitoring procedures to inform decision-making on injury risk.¹⁸ However, the paucity of evidence from this environment is likely due to the significant challenges that exist in implementing monitoring strategies within a national team environment.¹⁹ For instance, continuous monitoring of international players in club and national teams is a logistical challenge given the multitude of clubs around the world, as well as the technical difficulties in exchanging load data between club and national teams.^{2,4} Furthermore, within national team camp and tournament environments additional barriers to implementing monitoring practices may also include match scheduling, travel requirements, player adherence, manager/coach buy-in, and the availability of facilities/equipment.^{4,19} These difficulties in quantifying load in international footballers can also extend back to the players' clubs, whereby international breaks and tournaments may represent a 'black period' within their overall load monitoring profile, which is problematic for club and national team practitioners.^{2,20}

In summary, limited research exists describing the accumulation and distribution of training and match loads of international football teams transitioning from club to national team contexts. Therefore, the aim of this study was to quantify the external (number of sessions – training and matches) and internal (session-RPE, s-RPE) load profiles of a single national football team as players transitioned from club, to camp, to tournament periods over multiple international tournaments.

2. Methods

Training and match load data was used from thirty-five professional male football players (25.9 ± 3.8 years) selected to compete for the Australian National Football Team at three international tournaments. All outfield players from the original 23-man tournament squad for each tournament were eligible for inclusion,

with goalkeepers excluded due to variations in their training methods and match activity. Amongst the players eligible for inclusion, the majority competed in European club competitions (60%), with approximately a quarter (23.3%) playing in Australia, and the remainder in leagues located in Asia (13.3%) and North America (3.3%). The participating players consisted of seven central defenders, four wide defenders, thirteen central midfielders, five wide midfielders and six strikers. Provisional approval for the study was obtained from the National Federation involved, with individual player data previously collected as a condition of national team duty.²¹ Data collection procedures were approved by the institutional Human Research Ethics Committee. Retrospective sharing and conditional usage of the data was undertaken in accordance with a strict data confidentiality agreement, and as such, all data were anonymised before analysis to ensure team and player confidentiality.

The present observational study followed a retrospective single-cohort study design. Individual training and match load data was routinely collected from a single national football team competing at three Fédération Internationale de Football Association (FIFA) sanctioned international football tournaments – 2014 World Cup (WC₂₀₁₄: 13th–23rd June), 2015 Asian Cup (AC₂₀₁₅: 9th–31st January), and 2017 Confederations Cup (CC₂₀₁₇: 19th–25th June). Continuous monitoring of the players began 28 days (4 weeks) prior to the commencement of each official national team training camp, whilst based with respective clubs. Data collection continued as players arrived into camp and persisted throughout the full duration of the training camps and subsequent tournaments (WC₂₀₁₄, 28-days camp/11-days tournament; AC₂₀₁₅, 12-days camp/23-days tournament; CC₂₀₁₇, 16-days camp/7-days tournament). Retrospectively, each tournament was temporally aligned into three distinct periods defined as the club period (i.e. pre-camp), camp period (i.e. in-camp) and tournament period (i.e. in-tournament). However, in order to account for the variations in training camp and competition duration between the tournaments, data analysis of each club, camp, and tournament period were standardised to 1-week durations, as this was the maximum overlapping time period between the three tournaments. Therefore, training load profile analysis was conducted using data measured 7 days pre-training camp arrival (club period), 7 days post-camp arrival (camp period), and 7 days post-1st tournament match (tournament period).

All data was collected by remote upload via a smartphone/tablet application using the same reporting scales and recording protocol (SMARTABASE, Fusion Sport, Brisbane, Australia) while players were with their club teams and then manually entered by players during camps and tournaments. Following the completion of all training sessions and matches (≤ 30 min), players provided a rating of perceived exertion (RPE; Modified CR-10 Borg scale),²² relating to the perceived intensity of the session. All players had ≈ 1 -year prior familiarity with the scale. Session load (s-RPE) was then calculated by multiplying session duration (min) by RPE.²³ External loads were determined as the total exposure time (min) and number of sessions (training and matches) performed per week. In addition, external loads were also categorised according to session type, with data dichotomised as either "training load" or "match load". Global positioning system (GPS) data were not available for all tournaments and club-based GPS data was not comparable given the variety of systems used, and thus is not included here.

To evaluate players accumulated training and match load profiles, the acute:chronic ratio (A/C ratio) was calculated from s-RPE load. The A/C ratio is defined as the ratio of an athlete's short-term (acute) load to the mean of their long-term (chronic) load.^{24,25} The use of the A/C ratio has received significant interest in recent years, particularly in team sports including football, with varying evidence for and against its efficacy as an indicator of injury risk.^{16,17,26} As such, the A/C ratio was calculated for each acute weekly time

period (i.e. club, camp, and tournament periods) based on the mean of the preceding 3-weeks (i.e. chronic workload). Currently, there is no consensus regarding the optimal duration of both the chronic (2 vs. 3 vs. 4 weeks) and acute (1 vs. 3 vs. 7 days) time periods applied to A/C ratio, with the specific schedule likely to determine the most appropriate time periods.²⁴

Descriptive data for each training and match load variables are presented as means \pm standard deviation (\pm SD). Analyses were undertaken on individual and grouped tournament data to reduce interpretation bias due to the specific case study design of investigating data from a single tournament. The magnitude of effect for differences in load variables between club, camp and tournament periods was expressed as a standardised mean difference (Cohen effect sizes, ES) with 90% confidence intervals.²⁷ The criteria used to interpret the magnitude of the ES were as follows: 0–0.2 = trivial, 0.21–0.6 = small, 0.6–1.2 = moderate, 1.21–2 = large, 2.1–4.0 = very large, ≥ 4.1 = nearly perfect.²⁷ To aid in the interpretation, sample means were labelled in reverse order (i.e. mean₁ = camp, mean₂ = club) such that positive ES values indicate an increase and negative ES values indicate a decrease in a load variable.

3. Results

From all three tournaments, a combined total of 47 (club), 60 (camp) and 56 (tournament) player datasets were analysed from each respective time period, with player injury (n = 4) and inconsistent-reporting of load data (n = 13) the primary reasons for player's data exclusion.

Large effects (ES = 1.92; 90% CI: 1.56, 2.27) (Table 1) were evident for an increase in training volume (number of sessions) during the club-to-camp transition, with similar trends evident in individual tournament data; although this profile was most explicit and more pronounced during the WC₂₀₁₄ (ES = 3.46; 2.87, 4.05) (Table 2). Overall, moderate effect sizes showed an increase in total s-RPE load (ES = 1.09; 0.76, 1.42) during this transition period, resultant from a moderate increase in training load (ES = 1.16; 0.84, 1.48), with only small effects for match load (ES = -0.21; -0.54, 0.13) and mean RPE (ES = 0.26; -0.08, 0.61). However, not all individual tournament load profiles share this trend, as a trivial decrease (ES = -0.15; -0.82, 0.52) in training load was reported for the CC₂₀₁₇; possibly due to the moderate increase (ES = 1.08; 0.54, 1.62) in match s-RPE load reported here. Regarding the A/C ratio, a moderate increase (ES = 1.02; 0.70, 1.33) (Fig. 1) in relative load was evident during the club-to-camp transition; though a very large increase of the A/C ratio (ES = 2.42; 1.89, 2.94) was observed for the WC₂₀₁₄.

Very large effects (ES = -3.17; -3.47, -2.86) were evident for a decrease in the number of training sessions during the camp-to-tournament transition, with similar trends to varying extent replicated in the individual tournament data i.e. larger decrease during the AC₂₀₁₅ (ES = -7.14; -7.68, -6.59). Concomitantly, a large increase in the number of matches played during the tournament period was observed (ES = 1.87; 1.55, 2.18), with the extent of this trend again larger during the AC₂₀₁₅ (ES = 2.87; 2.30, 3.44). Overall, only a small decrease (ES = -0.25; -0.56, 0.06) in total s-RPE load was reported during this transition period, with the CC₂₀₁₇ reporting an opposing trend for a moderate increase in total load (ES = 0.95; 0.38, 1.52). However, a counterbalance in how load was accumulated between the two periods was evident; with very large effect sizes found for decrease in training s-RPE load (ES = -2.05; -2.35, -1.75) contrasting with a large increase (ES = 1.57; 1.25, 1.89) in match s-RPE loads evident between the camp and tournament periods. In relation to the A/C ratio, a moderate decrease in relative load (ES = -0.76; -1.06, -0.46) was reported for the tournament period compared to the first week of training camp, with a

Table 1
Internal and external load (mean \pm SD) during Club, Camp and Tournament periods for grouped tournament data (2014 World Cup, 2015 Asian Cup 2015, 2017 Confederations Cup).

| All tournaments | Club | | Camp | | Tournament | | Effect size | | 90% CI | |
|----------------------------------|----------------|----------------|----------------|----------------|-------------------|---------------------|---------------------|--------------|--------------|--|
| | n = 47 | n = 60 | n = 60 | n = 56 | Club vs. camp | Camp vs. tournament | Club vs. tournament | 90% CI | 90% CI | |
| Weekly no. training sessions (n) | 3.3 \pm 1.7 | 5.6 \pm 0.6 | 3.6 \pm 0.6 | 3.6 \pm 0.6 | 1.97 ^b | -3.17 ^c | 0.27 | -3.47, -2.86 | -0.08, 0.62 | |
| Weekly training load (AU) | 874 \pm 616 | 1604 \pm 639 | 580 \pm 281 | 580 \pm 281 | 1.16 ^a | -2.05 ^c | -0.63 ^a | -2.35, -1.75 | -0.98, -0.28 | |
| Weekly no. matches (n) | 0.4 \pm 0.7 | 0.3 \pm 0.4 | 1.6 \pm 0.9 | 1.6 \pm 0.9 | -0.21 | 1.87 ^b | 1.48 ^b | 1.55, 2.18 | 1.16, 1.81 | |
| Weekly match load (AU) | 238 \pm 425 | 162 \pm 316 | 1047 \pm 744 | 1047 \pm 744 | -0.21 | 1.57 ^b | 1.31 ^b | 1.25, 1.89 | 0.99, 1.62 | |
| Mean RPE (1–10) | 4.7 \pm 1.6 | 5.1 \pm 1.0 | 4.9 \pm 0.6 | 4.9 \pm 0.6 | 0.26 | -0.24 | 0.12 | -0.54, 0.06 | -0.24, 0.47 | |
| Mean weekly total load (AU) | 1112 \pm 866 | 1765 \pm 538 | 1627 \pm 569 | 1627 \pm 569 | 1.09 ^a | -0.25 | 0.84 ^a | -0.56, 0.06 | 0.50, 1.17 | |

n, number; AU, arbitrary units; CI, confidence intervals; LL, lower limit; UL, upper limit.

^a Denotes a moderate effect size.

^b Denotes a large effect size.

^c Denotes a very large effect size.

Table 2
Internal and external load (mean \pm SD) during Club, Camp and Tournament periods for individual tournament data (2014 World Cup, 2015 Asian Cup 2015, 2017 Confederations Cup).

| 2014 World Cup | Club | Camp | Tournament | Effect size | 90% CI | Effect size | 90% CI | Effect size | 90% CI |
|---|----------------|----------------|----------------|--------------------|--------------|---------------------|--------------|---------------------|--------------|
| | <i>n</i> = 16 | <i>n</i> = 20 | <i>n</i> = 19 | Club vs. camp | | Camp vs. tournament | | Club vs. tournament | |
| Weekly no. training sessions (<i>n</i>) | 2.3 \pm 1.1 | 5.5 \pm 0.8 | 3.9 \pm 0.5 | 3.46 ^c | 2.87, 4.05 | -2.38 ^c | -2.92, -1.85 | 2.07 ^c | 1.45, 2.70 |
| Weekly training load (AU) | 526 \pm 330 | 2135 \pm 670 | 732 \pm 322 | 2.94 ^c | 2.41, 3.48 | -2.65 ^c | -3.18, -2.11 | 0.63 ^a | 0.06, 1.21 |
| Weekly no. matches (<i>n</i>) | 0.2 \pm 0.4 | 0.2 \pm 0.4 | 1.3 \pm 0.8 | -0.10 | -0.67, 0.48 | 1.85 ^b | 1.29, 2.41 | 1.70 ^b | 1.15, 2.25 |
| Weekly match load (AU) | 114 \pm 245 | 51 \pm 164 | 865 \pm 730 | -0.31 | -0.91, 0.29 | 1.56 ^b | 0.99, 2.13 | 1.33 ^b | 0.79, 1.87 |
| Mean RPE (1–10) | 4.3 \pm 1.4 | 5.9 \pm 0.9 | 4.7 \pm 0.7 | 1.45 ^b | 0.85, 2.05 | -1.52 ^b | -2.06, -0.98 | 0.41 | -0.21, 1.03 |
| Mean weekly total load (AU) | 640 \pm 298 | 2186 \pm 622 | 1597 \pm 507 | 3.06 ^c | 2.53, 3.59 | -1.04 ^a | -1.57, -0.50 | 2.25 ^c | 1.70, 2.81 |
| 2015 Asian Cup | Club | Camp | Tournament | Effect size | 90% CI | Effect size | 90% CI | Effect size | 90% CI |
| | <i>n</i> = 16 | <i>n</i> = 20 | <i>n</i> = 19 | Club vs. camp | | Camp vs. tournament | | Club vs. tournament | |
| Weekly no. training sessions (<i>n</i>) | 3.8 \pm 2.0 | 5.9 \pm 0.4 | 2.9 \pm 0.5 | 1.50 ^b | 0.84, 2.15 | -7.14 ^d | -7.68, -6.59 | -0.66 ^a | -1.30, -0.02 |
| Weekly training load (AU) | 1034 \pm 691 | 1667 \pm 308 | 510 \pm 247 | 1.23 ^b | 0.61, 1.86 | -4.14 ^d | -4.68, -3.60 | -1.05 ^a | -1.68, -0.42 |
| Weekly no. matches (<i>n</i>) | 0.8 \pm 0.9 | 0.0 \pm 0.0 | 1.4 \pm 0.7 | -1.34 ^b | -2.00, 0.68 | 2.87 ^c | 2.30, 3.44 | 0.70 ^a | 0.11, 1.29 |
| Weekly match load (AU) | 525 \pm 556 | 0 \pm 0 | 867 \pm 587 | -1.42 ^b | -2.08, -0.76 | 2.12 ^c | 1.55, 2.69 | 0.60 | 0.02, 1.17 |
| Mean RPE (1–10) | 4.9 \pm 1.7 | 5.0 \pm 0.7 | 5.2 \pm 0.6 | 0.08 | -0.55, 0.72 | 0.22 | -0.32, 0.76 | 0.20 | -0.43, 0.83 |
| Mean weekly total load (AU) | 1559 \pm 677 | 1667 \pm 308 | 1377 \pm 425 | 0.21 | -0.41, 0.84 | -0.78 ^a | -1.33, -0.24 | -0.33 | -0.93, 0.27 |
| 2017 Confederations Cup | Club | Camp | Tournament | Effect size | 90% CI | Effect size | 90% CI | Effect size | 90% CI |
| | <i>n</i> = 15 | <i>n</i> = 20 | <i>n</i> = 18 | Club vs. camp | | Camp vs. tournament | | Club vs. tournament | |
| Weekly no. training sessions (<i>n</i>) | 3.7 \pm 1.5 | 5.5 \pm 0.6 | 4.0 \pm 0.0 | 1.60 ^b | 0.94, 2.26 | -3.30 ^c | -3.83, -2.77 | 0.27 | -0.41, 0.94 |
| Weekly training load (AU) | 1075 \pm 638 | 1010 \pm 225 | 494 \pm 207 | -0.15 | -0.82, 0.52 | -2.38 ^c | -2.93, -1.83 | -1.28 ^b | -1.93, -0.62 |
| Weekly no. matches (<i>n</i>) | 0.1 \pm 0.4 | 0.7 \pm 0.5 | 2.1 \pm 1.0 | 1.18 ^a | 0.63, 1.74 | 1.86 ^b | 1.28, 2.43 | 2.49 ^c | 1.93, 3.05 |
| Weekly match load (AU) | 64 \pm 232 | 434 \pm 406 | 1430 \pm 796 | 1.08 ^a | 0.54, 1.62 | 1.60 ^b | 1.03, 2.18 | 2.24 ^c | 1.68, 2.80 |
| Mean RPE (1–10) | 5.1 \pm 1.5 | 4.3 \pm 0.7 | 4.7 \pm 0.5 | -0.67 ^a | -1.33, -0.02 | 0.74 ^a | 0.20, 1.28 | -0.28 | -0.94, 0.38 |
| Mean weekly total load (AU) | 1139 \pm 635 | 1444 \pm 332 | 1924 \pm 647 | 0.63 ^a | -0.01, 1.27 | 0.95 ^a | 0.38, 1.52 | 1.22 ^b | 0.63, 1.82 |

n, number; AU, arbitrary units; CI, confidence intervals; LL, lower limit; UL, upper limit.

^a Denotes a moderate effect size.

^b Denotes a large effect size.

^c Denotes a very large effect size.

^d Denotes a nearly perfect effect size.

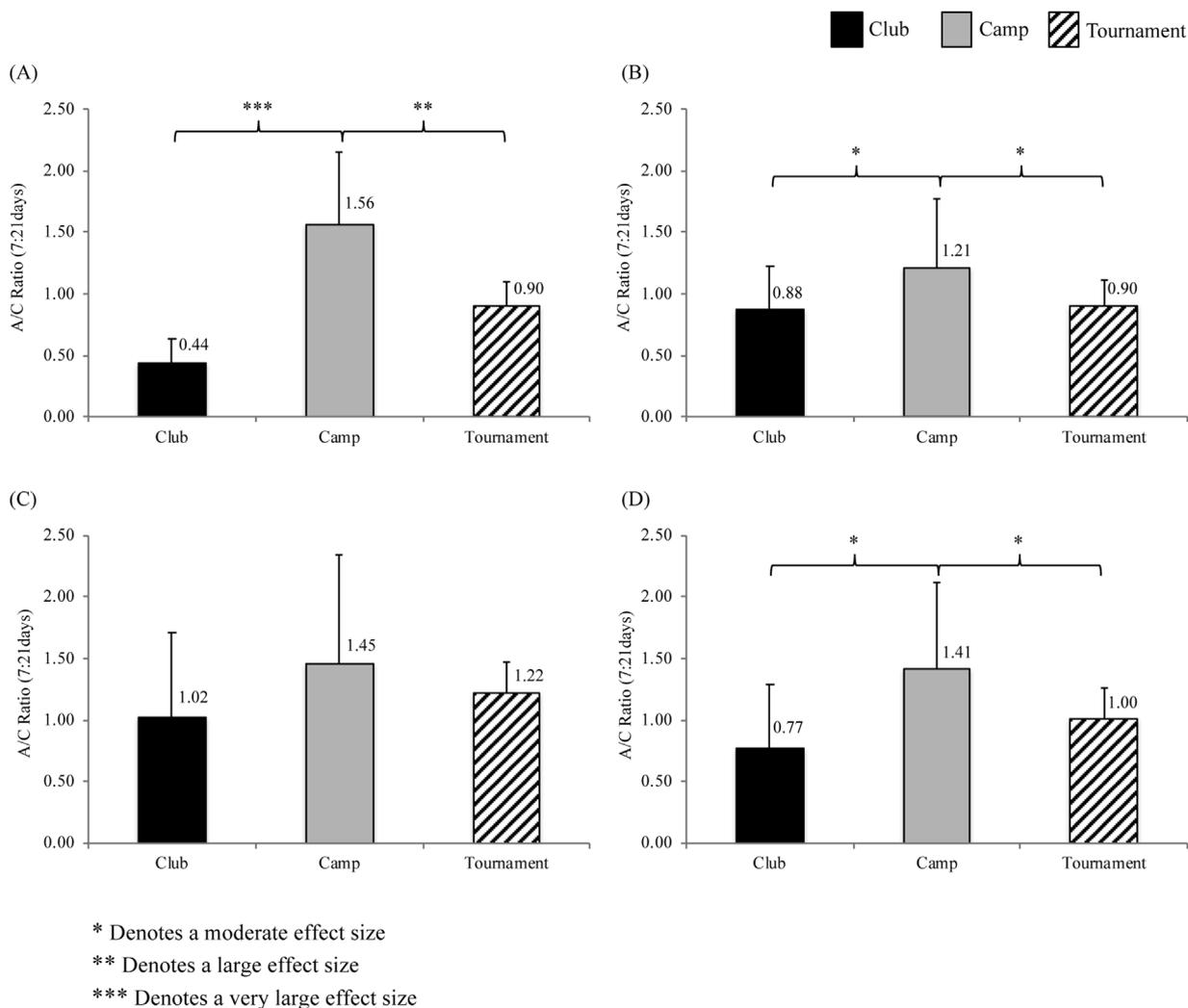


Fig. 1. Comparison of the acute:chronic s-RPE load ratio (7:21 days) between Club, Camp and Tournament periods for each individual tournament – (A) 2014 World Cup, (B) 2015 Asian Cup, (C) 2017 Confederations Cup and (D) grouped tournament data.

* Denotes a moderate effect size.

** Denotes a large effect size.

*** Denotes a very large effect size.

slightly larger decrease of the A/C ratio ($ES = -1.48; -2.01, -0.94$) observed for the WC₂₀₁₄.

4. Discussion

This study compared training and match load profiles of players from a single international football team as they transitioned between club, camp, and tournament periods during three major international tournaments. A large increase in the number of training sessions, resulting in higher s-RPE total load and A/C ratio was apparent when transitioning from club to camp environments. As expected, subsequent reductions in training volumes and increased match loads describe the camp-to-tournament transition. Within tournament trends replicated these patterns, though were not consistent across tournaments and likely were tailored to the specific constraints of each tournament (i.e. AC₂₀₁₅ scheduled mid-domestic season). Thus, the changing dynamic of these training and match loads alters the accumulation and distribution of load profiles in international footballers, highlighting a role for effective load monitoring strategies.

The results of the present study demonstrate that during the transition between club and camp, international football players

experienced a moderate increase in total s-RPE load, resulting from a large increase in training session count rather than training intensity. Such a finding is intuitive given the increased availability of the players during training camp facilitates the primary aim of maximising the player's training exposure to enhance overall team performance. Accordingly, a moderate increase in A/C ratio was also identified, and this increase in load is often perceived as a critical point of player management and highlights the need for communication between club and national team practitioners. Similar A/C ratio results were recently reported from this same cohort comparing the load profiles of injured and non-injured international football players. Players incurring an injury in camp had a greater increase in A/C ratio ($1.7 \pm 0.5 AU$) compared to players not incurring an injury ($1.3 \pm 0.7 AU$).⁴ Although, it should be noted that these results were based on group means and not all players who had a high A/C ratio (>2.0) went on to incur an injury, and some players with A/C ratios between 0.8–1.3 did incur an injury.⁴ Nevertheless, consideration of the player's pre-camp workloads may still be beneficial to help national team staff profile individual player needs and prevent excessive spikes in acute load as an initial periodization strategy.^{16,17}

Whilst the present findings provide further evidence to suggest that international footballers are exposed to an increase in relative load during the transition from club-to-camp, the extent and nature of this increase differed between the three included tournaments. For instance, during the WC₂₀₁₄ a very large increase in the A/C ratio was evident, due to a combination of both a large increase in training intensity and very large increase in the number of training sessions. In contrast, the AC₂₀₁₅ and CC₂₀₁₇ only showed small-to-moderate increases in A/C ratio; driven by increases in the number of training sessions. Thus, while club-to-camp loads were more closely aligned for the AC₂₀₁₅ and CC₂₀₁₇ compared to WC₂₀₁₄, variations in the length of the training camps for these tournaments may partly explain these differences – with the condensed scheduling of the AC₂₀₁₅ and CC₂₀₁₇ camps (12–16 days) constraining the relative increase in training load given the need for players to be adequately recovered in a shorter time period before the first tournament match. Indeed, despite the summary data presented in this study, contextual factors of each tournament are important to consider when interpreting the load profiles of international footballers. For example, the scheduling of the AC₂₀₁₅ as a mid-season tournament meant that players arrived directly into camp from their domestic-club competitions resulting in an expected decrease in match load during this transition.

This is the first study to report training and match loads performed by elite international football players as they transition from training camp to in-tournament contexts. During this transition period a counterbalance in training and match load was evident, with large increases in match volume and s-RPE match load offset by very large decreases in training volume and s-RPE training load. This counterbalance in load accumulation intuitively represents the shift in training focus to match preparation and prioritisation of recovery for subsequent matches with the tournament periods.²⁸ Of note, only a small decrease in total s-RPE load existed in this transition and not all tournaments followed this trend, as CC₂₀₁₇ showed a moderate increase in total s-RPE load. Again, the condensed match scheduling that occurs during this tournament likely affects load accumulation in camp. Consequently, a higher relative load was observed during the tournament period for the CC₂₀₁₇, resulting in only a small decrease in the A/C ratio, while the WC₂₀₁₄ and AC₂₀₁₅ had large-to-moderate decreases. These load profiles highlight a novel finding of the counterbalance in training and match loads during the transition from camp-to-tournament periods, though consideration of individual player load profiles is important. In particular, how the reduction in training load may impact the preparedness of fringe players and non-starters who are not exposed to the increases in tournament match load, and thus require additional training during the tournament to maintain fitness.²⁹ Furthermore, tournament load accumulation is also an important consideration for club practitioners when planning training for the start of the next domestic league season, with international match and training loads likely to influence the return dates of players, as well as the content of pre-season club programs. This issue remains a topic for future research, as data was not available in this study to examine the transition of international players returning to club teams.

Despite the novel and practical application of the findings to international football contexts, this study is not without limitations, which reflect the practicality of data collection within national football teams. Firstly, the cohort used here belongs to one national team, which limits the generalisation of the findings, as many contextual factors specific to the national team likely influenced the load periodisation of the players. Secondly, workload data within each period are presented as differences between groups. Therefore, caution should be taken when applying these findings at the individual level, particularly when interpreting the A/C ratio as this represents a relative determination of the acute

load performed by a player compared to their chronic workload. In addition, there are various methods, timeframes, and parameters from which the A/C ratio can be calculated, with continued exploration of the metric within football necessary in order to determine its appropriateness and association to practical outcomes (i.e. injury). Lastly, the use of simple measures of load within this study provides only a general understanding of the load profiles of international footballers, while the inclusion of more detailed objective external load measures may provide more meaningful findings. However, the lack of comparability between types and variables of external load monitoring devices complicates the exchange of such information between clubs and national teams.^{2,4}

5. Conclusion

In summary, this study quantified the external and internal load profiles of a single national football team as players transitioned between club, camp and tournament periods over multiple international tournaments. Distinct variations in international players' load profiles were identified between the time periods, with an increase in training volume, s-RPE load, and A/C ratio evident during the transition between club-to-camp periods. Subsequent reductions in training volume and load coincided with expected increases in match volume and load at the start of the tournament period, resulting in an overall decrease of the A/C ratio between the camp-to-tournament periods. Further research, involving data derived from multiple national teams may also enhance our understanding of players' load profiles across a broader international football context.

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