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ORIGINAL ARTICLE

Evidence of sub-optimal sleep in adolescent Middle Eastern academy soccer players which is exacerbated by sleep intermission proximal to dawn[†]

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Abstract
The purpose was to assess sleep patterns, quantity and quality in adolescent (16.2 ± 1.2 yr) Middle Eastern academy soccer players ($n = 20$) and the influence of an intermission upon these characteristics. On a 17-day training camp (located one time zone west of home) including three discrete matches, sleep was assessed pre- (PRE) and post-match (POST) via wrist actigraphy. Retrospective actigraphy analysis identified sleep characteristics, including if players experienced a sleep intermission (YES) or not (NO) proximal to dawn, and bedtime (hh:mm), get-up time (hh:mm), time in bed (h), sleep duration (h) and sleep efficiency (%). Within YES two bouts were identified (BOUT1 and BOUT2). No differences were seen between PRE and POST, nor between BOUT1 and BOUT2 ($p > .05$). Overall players did not meet National Sleep Foundation (NSF) guidelines (7:04 ± 1:16 h vs. recommended 8–10 h for 14–17 yr). Sleep duration was significantly reduced (~ −13% or −1:06) in YES compared to NO (6:33 ± 1:05 vs. 7:29 ± 1:17, $p < .01$). Despite players in YES waking earlier due to an intermission, they did not compensate for this with a later wake time, rising significantly earlier compared to NO (09:40 ± 00:38 vs. 10:13 ± 00:40, $p < .05$). These players on average do not obtain sufficient sleep durations relative to NSF guidelines, with decrements increased by an intermission proximal to dawn. High inter- and intra-individual variance in the players sleep characteristics indicates the need for individualized sleep education strategies and interventions to promote appropriate sleep.

Keywords: *Team sport, ethnicity, health, recovery, youth*

Highlights

- Middle Eastern adolescent soccer players obtain insufficient sleep durations (compared to NSF guidelines) while on a training camp the night pre- and post-game.
- These sleep duration deficiencies are negatively exacerbated if a sleep intermission proximal to dawn is experienced by a player.
- Sleep education programmes should be considered for similar cohorts of players.
- The large intra- and inter-individual variation observed in these data highlights the need for individualized education and strategies to improve sleep habits.

Introduction

Psychophysiological recovery between training and matches is integral to soccer performance (Nédélec, Halson, Abaidia, Ahmaidi, & Dupont, 2015) and holistic adolescent player development (Bergeron et al., 2015). Globally many adolescents (14–17 yr) fail to meet National Sleep Foundation (NSF) guidelines of 8–10 h of sleep per night (Hirshkowitz et al., 2015; Merdad, Merdad, Nassif, El-Derwi, & Wali, 2014; Taylor, Chrismas, Dascombe, Chamari, & Fowler, 2016a), which is concerning given team sport players and

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practitioners consistently report sleep favourably as a recovery strategy (Venter, 2014). Sleep deficiencies within these populations are generally attributed, but not limited to, negotiable (e.g. social media, caffeine intake, etc.) and non-negotiable (e.g. chronotype, academic commitments, etc.) socio-psychological factors (Romyn, Robey, Dimmock, Halson, & Peeling, 2016; Taylor et al., 2016a; Taylor, Chrismas, Dascombe, Chamari, & Fowler, 2016b). Athletes in general (Lastella, Roach, Halson, Martin, et al., 2015; Lastella, Roach, Halson, & Sargent, 2015) and particularly adolescent soccer players may face further population specific non-negotiable (e.g. fixture congestion, travel demands, media/ sponsor commitments, etc.) challenges to obtaining NSF endorsed sleep durations (Fullagar et al., 2015; Taylor et al., 2016a).

Many adolescent academy soccer players combine academic and sporting commitments, which compete directly with the time available for sleep (Robey et al., 2014; Taylor et al., 2016a). In addition, daytime academic commitments can preclude the use of napping to off-set night-time sleep debt. Culture and region-specific nuances seen in the Middle East can further reduce the time available for sleep (Merdad et al., 2014; Taylor et al., 2016a). Middle Eastern soccer academies have predominately evening matches and evening/morning training sessions due to high daytime temperatures, with evening competition known to reduce sleep quantity and quality (Fullagar et al., 2016). The Middle East is a predominately Muslim region, thus players who practice *salat al-fajr* (dawn prayer) are required to wake at dawn for 10–15 minutes to pray, often then returning to sleep. These sleep intermissions can combine with culturally expected evening 'family time' to promote early wake and late bedtimes, respectively. Many of these players therefore obtain sleep in two separate bouts.

Given the extreme and prolonged high summer temperatures in the Middle East, for example Doha, Qatar sees historical daily high temperatures exceeding 30°C for 7–8 months of the year, overseas training camps and/or competition is common for soccer teams, including academies. Elite soccer involves highly variable travel demands for training (e.g. a warm/cool weather training camp during winter/summer weather extremes) and competition (Asian and UEFA Champions Leagues, FIFA World Cup, etc.). These travel demands can involve medium- to long-haul air travel, including transmeridian directionality (inducing jet-lag) and long-haul flights without significant time zone changes (inducing travel fatigue) (Fowler, Duffield, & Vaile, 2015). Jet-lag and the travel schedule (e.g. departure/arrival times and stop-over's) can induce sleep disruption and negative mood states which are associated with reduced physical performance and increased illness symptoms at the destination (Fullagar et al., 2015). It is therefore plausible that these travel demands and associated psychophysiological responses may compromise player preparations (e.g. training outcomes) and performance (e.g. match-play outcomes). Furthermore, adolescent soccer players may be particularly susceptible to sleep disturbances and thus travel to a training camp/competition and the change in sleep environment, even without the presence of jet-lag (Pitchford et al., 2017), may expose them to additional challenges to obtain NSF endorsed sleep quantities.

Considering these region-specific challenges, together with the favourable interaction between appropriate sleep and athletic performance (Skein, Duffield, Edge, Short, & Mundel, 2011; Skein, Duffield, Minett, Snape, & Murphy, 2013), recovery (Fullagar et al., 2016; Skein et al., 2013), cognitive function (Lucas, Anson, Palmer, Hellemans, & Cotter, 2009), academic performance (Sivertsen, Glozier, Harvey, & Hysing, 2015), illness/injury prevention (Milewski et al., 2014; Prather, Janicki-Deverts, Hall, & Cohen, 2015), holistic psychosocial development and promotion of general health (Sivertsen, Harvey, Pallesen, & Hysing, 2015; Taylor et al., 2016a); it is likely individualized best practice is required to promote adequate sleep in Middle Eastern adolescent soccer players (Fullagar & Bartlett, 2015). However, these nuances, including the impact of a training camp and their influence upon sleep characteristics within the identified players are yet to be characterized, which precludes the employment of individualized sleep maintenance strategies within such region-specific populations (Fullagar & Bartlett, 2015).

Therefore, the aims of the present study were to (1) determine sleep characteristics within adolescent Middle Eastern academy soccer players during a training camp and (2) the influence of a sleep intermission within aim (1). It was hypothesized that average sleep durations would not reach NSF minimum recommendations, with such deficiencies increased by a sleep intermission.

Methods

Participants

Twenty male adolescent Middle Eastern academy soccer players (mean ± standard deviation [SD]; age 16.2 ± 1.2 yr, height 1.73 ± 0.05 m, body mass 62.56 ± 7.40 kg) participated. Data were analysed retrospectively and collected based on procedures cleared by the institutional human research ethics committee and as part of routine sports science servicing that the players and parents'/guardians consent to as part of their team duties.

Experimental design

Following familiarization with all experimental measures and procedures, data were collected during a 17-day training camp located in Sarajevo, Bosnia and Herzegovina. The camp was reached by a westward 8 h 30 min flight across 1 time zone. At the time of data collection the time of sunrise and sunset at home was 05:00 and 18:20, and 05:30 and 20:00 at the destination. Supplementation, nutrition (including caffeine) and medication (acute and chronic) use was overseen by suitability qualified team staff members. Such provision did not deviate from what is typically seen during training and competition at home. Sleep medication was not administered to any player during the camp. The squad had received education at home regarding caffeine intake during the evening meal and prior to bedtime, this was provided within a general sleep hygiene education session. Sleep was assessed the night prior to (PRE) and night of (POST) three discrete matches (MATCH 1, 2 and 3; Kick-Off 17:30) on day 4, 8 and 12, with quantitative values obtained by wrist actigraphy (wActiSleep+, Actigraph, Pensacola, FL) and analysed using commercially available software (ActiLife v6, Actigraph, Pensacola, FL). Players shared rooms in pairs and resided in the same hotel during the camp. Training load, match load and a general description of training content/other commitments/activities are provided within Table I. Training loads (arbitrary units, [AU]) were calculated by multiplying each players training session or match duration (min) by their session rating of perceived exertion provided approximately 30 min after (Foster, Daines, Hector, Snyder, & Welsh, 1996).

Experimental procedures

Wrist (non-dominant) actigraphy data analysis determined when players were awake and asleep. Time was scored as wake unless the activity counts were low enough according to the Sadeh Algorithm, which is validated for use in children and young adults (Sadeh, Sharkey, & Carskadon, 1994), for the player to be determined immobile (i.e. epoch activity count less than the defined Sadeh threshold). The following variables were derived:

Bedtime (*hh:mm*): estimated clock time at which players went to bed to attempt to sleep.

Get-up time (*hh:mm*): estimated clock time at which players got out of bed and stopped attempting to sleep.

Time in bed (*h*): the amount of time spent in bed attempting to sleep between bedtime and get-up time.

Sleep duration (*h*): the amount of time spent in bed asleep.

Sleep efficiency (*%*): sleep duration expressed as a percentage of time in bed.

Activity count interpretation determined whether a player did (YES) or did not (NO) experience a sleep intermission proximal to dawn. Within YES sleep was separated into two bouts – prior to (BOUT1) and after (BOUT2) the intermission. Though no set criteria was used for the intermission (i.e. time [hh:mm] it occurred or duration it occurred for), visually it was very clear from the actigraphy data files whether a player experienced a sleep intermission proximal to dawn or not. In an attempt to improve the accuracy of the data interpretation, all initial raw actigraphy data analysis was blinded and performed by a research scientist with significant experience with such analysis. This was subsequently verified by a second independent research scientist with a similar level of experience. Out of a possible maximum of 120 nights of data (20 participants × 3 matches × 2 nights), 104 were deemed accurate enough for statistical analysis (85% compliance rate), with 50 nights categorized as YES and 54 nights as NO.

Statistical analysis

Assumptions for normality were assessed graphically and deemed plausible in all instances. Data are presented as mean ± SD. Differences between match (MATCH 1, 2 and 3), day (PRE, POST), intermission (YES, NO) and bout (BOUT1, BOUT2) for all sleep characteristics were analysed using linear mixed models (IBM-SPSS statistics for Windows, Version 21, Armonk, NY). The most appropriate model for each variable was chosen using the smallest Akaike's Information Criterion in accordance with the principal of parsimony. Least Significant Difference *post hoc* tests were used on significant comparisons, with two-tailed significance set at $p < .05$. 95% confidence intervals are provided for significant differences ($p < .05$).

Results

No significant differences ($p > .05$) were seen between PRE and POST when treated as separate matches (MATCH 1, 2 and 3) or when the data were collapsed into PRE and POST for all matches.

Table I. Mean ± SD training load and general description of training content. Grey highlighted area indicates sleep data collection periods.

Camp Day	1	2	3	4	5	6	7
AM (10:00)	Conditioning 437 ± 52.9	Gym 203 ± 44.4	Injury Prevention + technical 323 ± 122	OFF	Recovery 104 ± 58	OFF	Conditioning + technical 311 ± 71.1
PM (17:00)	Injury prevention + technical 291 ± 35.3	Conditioning + technical 304 ± 66.6	Tactical 139 ± 81	Match (17:00) 690 ± 122	Technical 242 ± 87	OFF	Technical 207 ± 47.4
Camp Day	8	9	10	11	12	13	14
AM (10:00)	OFF	Recovery 66 ± 24.1	OFF	Gym 404 ± 99.5	OFF	OFF	Conditioning + technical 340 ± 63.2
PM (17:00)	Match (17:00) 467 ± 120	Technical & tactical 155 ± 36.2	OFF	Tactical 269 ± 66.3	Match (17:00) 660 ± 108	OFF	Gym 227 ± 42.2
Camp Day	15	16	17				
AM (10:00)	OFF	OFF	OFF				
PM (17:00)	Technical & tactical 375 ± 96.5	Injury prevention + tactical 152 ± 46.7	Match (17:00) 640 ± 122.2				

There were also no differences in load between YES and NO for training/match load (Table I). Means (± dispersions) and inferential reporting are presented within Table II for all data (A), data from (A) according to YES or NO (B) and data from (B) according to BOUT1 or BOUT2 (C). Individual responses for the data in Table II are presented in Figure 1.

Sleep duration was significantly reduced (~ −13% or −1:06; 95% CI 0:17–1:14) in YES compared to NO (6:33 ± 1:05 vs. 7:29 ± 1:17, $p < .01$). Average sleep efficiencies were ~80–83% (Table II). No differences in any sleep characteristics were observed between BOUT1 and BOUT2. Despite YES waking earlier along with having shorter sleep durations and bi-phasic sleep, they did not compensate for this with a later wake time, rising significantly earlier (~ −7% or 0:33; 95% CI 0:04–0:34) compared to NO (09:40 ± 00:38 vs. 10:13 ± 00:40, $p < .05$).

Discussion

On average adolescent Middle Eastern academy soccer players do not meet NSF endorsed minimum sleep durations PRE and POST match on a training camp. These deficiencies are significantly exacerbated if a sleep intermission is seen proximal to dawn (YES compared to NO). These data accept the stated experimental hypothesis. Despite YES waking earlier along with having shorter sleep durations and bi-phasic sleep, results indicate they do not compensate for this with a later wake time and instead rise significantly earlier compared to NO. Within YES simply going to bed earlier could off-set sleep intermission mediated reductions in sleep quantity. However, cultural nuances outlined above and elsewhere (Merdad et al., 2014; Taylor et al., 2016a, 2016b) likely render this simple solution practically challenging.

The players did not obtain sufficient sleep relative to NSF guidelines, with the problem exacerbated in YES. One plausible explanation for this could be the bias towards later bedtimes with a mean bedtime of 01:07 ± 01:10 and latest of 03:45. Indeed, Arab Societies, compared to Western Societies, appear to "have a culture associated with a lifestyle that does not promote sufficient hours of sleep each night" (Merdad et al., 2014). However, the players in the present study were on an overseas training camp away from region-specific cultural and familial influences, which often promote late bedtimes. Moreover on the night sleep was assessed, kick-off times were early evening (17:30) and there was no next-day early morning training or academic commitments. Indeed, if academic and/or training commitments enforced early waking, further decrements in sleep duration may have been observed compared to those characterized by the present data. Though, it cannot be excluded that players consciously (or otherwise) selected a later bedtime given the absence of morning commitments. Speculation such as this requires clarification in future research

Table II. Sleep characteristics of players pre- and post-games.

Data set		Sleep duration (hh:mm)		*p*-Value	Sleep efficiency (%)		*p*-Value
A	Mean ± SD	7:04 ± 1:16	–	–	82.13 ± 7.04	–	–
	Range (min–max value)	5:17 (4:58–10:15)	–	–	31.49 (66.64–96.12)	–	–
B		**NO**	**YES**		**NO**	**YES**	
	Mean ± SD	7:29 ± 1:17	6:33 ± 1:05	*p* = .002*	83.24 ± 6.17	80.96 ± 7.74	*p* = .458
	Range (min–max value)	5:03 (5:12–10:15)	4:24 (4:58–9:22)	–	24.93 (69.20– 94.13)	31.49 (64.64–96.12)	–
C		**BOUT1**	**BOUT2**		**BOUT1**	**BOUT2**	
	Mean ± SD	3:23 ± 0:54	3:09 ± 0:47	*p* = .256	80.60 ± 9.64	80.94 ± 9.22	*p* = .646
	Range (min–max value)	3:41 (0:54–4:35)	3:20 (1:59–5:19)	–	46.82 (50.67–97.49)	33.46 (61.57–95.03)	–
		Bedtime (hh:mm)		***p*-Value**	**Get-up time (hh:mm)**		***p*-Value**
A	Mean ± SD	01:07 ± 01:10	–	–	09:58 ± 00:42	–	–
	Range (min–max value)	05:36 (22:09–03:45)	–	–	03:38 (08:13–11:51)	–	–
B		**NO**	**YES (initial[#])**		**NO**	**YES (final[$])**	
	Mean ± SD	01:16 ± 01:13	00:55 ± 01:05	*p* = .736	10:13 ± 00:40	09:40 ± 00:38	*p* = .013*
	Range (min–max value)	05:17 (22:09–03:26)	04:43 (23:02–03:45)	–	03:32 (08:19–11:51)	02:53 (08:13–11:06)	–
C		**BOUT1**	**BOUT2**		**BOUT1**	**BOUT2**	
	Mean ± SD	00:55 ± 01:05	05:45 ± 00:33	–	05:10 ± 00:27	09:40 ± 00:38	–
	Range (min–max value)	04:43 (23:02–03:45)	01:58 (04:39–06:37)	–	01:42 (04:16–05:58)	02:53 (08:13–11:06)	–
		Time in bed (hh:mm)		***p*-Value**			
A	Mean ± SD	8:35 ± 1:13	–	–			
	Range (min–max value)	5:51 (5:37–11:28)	–	–			
B		**NO**	**YES**				
	Mean ± SD	8:56 ± 1:12	8:09 ± 1:06	–			
	Range (min–max value)	4:32 (6:56–11:28)	5:31 (5:37–11:08)	*p* = .013*			
C		**BOUT1**	**BOUT2**				
	Mean ± SD	4:15 ± 1:03	3:54 ± 0:43	–			
	Range (min–max value)	4:36 (1:14–5:50)	03:01 (2:51–5:52)	*p* = .083			

Note: A = all player data; B = data grouped by whether a sleep intermission proximal to dawn was seen (YES) or not (NO); C = within YES sleep characteristics pre (BOUT1) and post (BOUT2) sleep intermission; [#]intial bedtime = onset of sleep for BOUT1; [$]final get-up time = wake up time for BOUT2;*YES significantly different to NO ($p < .05$).

designs via incorporation of appropriate subjective measures.

Sleep quantity is a major component of sleep assessment, but sleep's restorative properties are also dependent upon sleep quality (Hirshkowitz et al., 2015). No differences in mean sleep efficiency were observed between YES (81 ± 8%) and NO (83 ± 6%) in the present study. Whilst NSF guidelines are unavailable for sleep quality, comparable mean sleep efficiencies of approximately 85% have previously been reported from wrist actigraphy in a range of athletes from both individual and team sports (Lastella, Roach, Halson, Martin, et al., 2015; Lastella, Roach, Halson, & Sargent, 2015). Lower habitual mean sleep efficiencies were observed in a cohort of Olympic athletes compared to age and sex matched controls (81% vs. 89%), though this remains within the range for healthy sleep (Leeder, Glaister, Pizzoferro, Dawson, & Pedlar, 2012). Thus, of greater concern in this cohort of Middle Eastern academy soccer players is the large inter-individual variation, with sleep efficiencies closer to 60% observed in some players. Fragmented sleep with a similar mean efficiency (58%) can result in less slow wave sleep, which is proposed to be important for physiological recovery (Fullagar et al., 2015; Taylor et al., 2016b) and worse mood states (Finan, Quartana, & Smith, 2015). Therefore, alongside interventions to promote earlier bedtimes and increase sleep duration in the present cohort of athletes, interventions to improve sleep quality are also required, such as good sleep hygiene practices (Nedelec et al., 2015).

It is plausible that travel to the camp itself (Fowler, McCall, Jones, & Duffield, 2016) and the schedule of the camps training and competition (Kolling et al., 2016), in conjunction with social jet-lag (Wittmann,

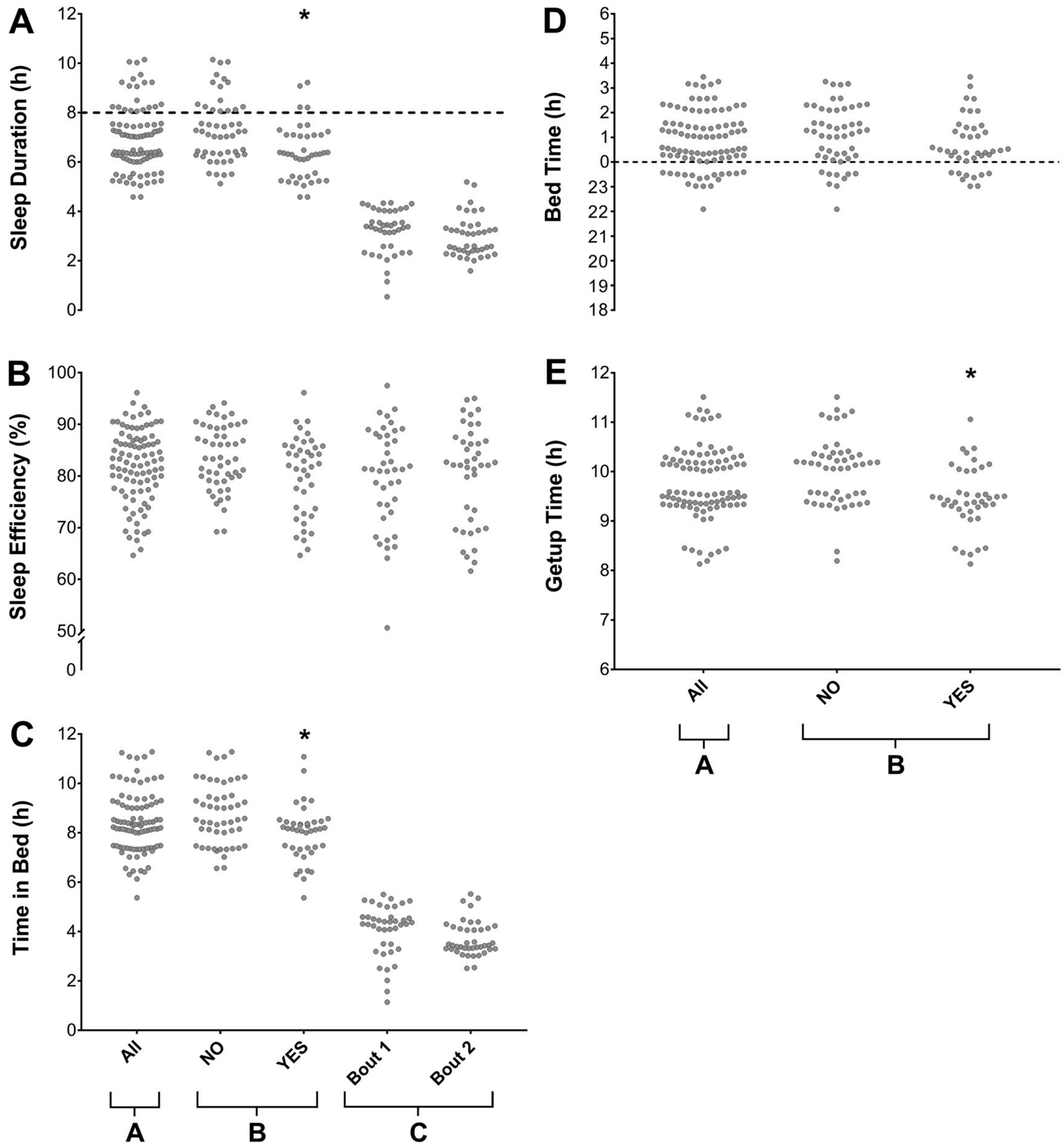

Figure 1. Individual responses for sleep duration (A; dotted horizontal line represents minimum NSF recommendation), sleep efficiency (B), time in bed (C), bedtime (D) and get-up time (E) for all players (A – All), those that did not experience a sleep intermission (B – NO), those that did experience a sleep intermission (B – YES) and the first (C – Bout 1) and second (C – Bout 2) sleep bout within B – YES. NB Similar to Table I, for B – YES, bedtime for Bout 1 and get-up time for Bout 2 are presented.*YES significantly different to NO ($p < .05$).

Dinich, Merrow, & Roenneberg, 2006) and electronic device use (Wood, Rea, Plitnick, & Figueiro, 2013), may have discreetly and/or in combination elicited specific challenges to the players sleep (i.e. whilst factors challenging to sleep at home may have been removed, they could have been replaced by other factors at the camp). Indeed, within a partially adolescent elite cohort of Australian Rules Footballers a change in physical sleep environment, without altered training schedule/loads or under the presence of jet-lag, negatively influenced sleep quality (Pitchford et al., 2017). Whilst the players in the present study's sub-optimal sleep patterns have potential implications for athletic performance (Skein et al., 2011, 2013), recovery (Fullagar et al., 2016; Skein et al., 2013), holistic psychosocial development and health (Sivertsen, Harvey, et al., 2015; Taylor et al., 2016a), academic performance (Sivertsen, Glozier, et al., 2015) and illness/injury prevention (Milewski et al., 2014; Prather et al., 2015) their origins are likely multifaceted, highly individualized and changing day-to-day within the camp. These origins cannot be determined within the present study and future research should seek to determine these origins by employing perceptually orientated subjective measures to complement expanded objective measures, with data compared to habitual baselines obtained during normal training, competition and rest/recovery phases (Saw, Kellmann, Main, & Gastin, 2017).

Given sleep was assessed on the fourth night of the camp, the later bedtimes (mean bedtime of 01:07 ± 01:10 and latest of 03:45) reported are unlikely due to chronobiological disturbance during relocation from home to the camp. If the classical one day per time zone crossed resynchronization interpretation holds true (Fowler et al., 2016), then the one time zone crossed by the players to reach the camp would have been overcome prior to the sleep data obtained on the fourth night of the camp. However, the use of technologies to maintain contact with friends and families in addition to other 'online' pursuits (e.g. gaming, social media, etc.) and their associated light exposure and social engagement mediated unwanted arousal effects may have contributed to the later bedtimes seen (Hale & Guan, 2015; Peiro-Velert et al., 2014; Shochat, Cohen-Zion, & Tzischinsky, 2014). Despite calls for limiting such technology exposure in similar populations as the present study to improve various sleep indices (King, Delfabbro, Zwaans, & Kaptsis, 2014; Romyn et al., 2016), complete removal of electronic devices in a predominately adolescent elite Judo cohort during a training camp did not positively influence sleep indices nor next-day physical or cognitive performance (Dunican et al., 2017). Therefore, while the design employed within the present study cannot determine the precise contribution of technology use relative to the undesirably late bedtimes shown, a simple ban of these devices and pursuits may not have efficacy in practice, at home or on a training camp (Dunican et al., 2017). Indeed, such a robust approach may provoke undesirable psychological responses and behaviours in an adolescent population given their propensity (shown to be pathological/compulsive in some sub-groups) for such electronic device use (King et al., 2014; Romyn et al., 2016).

Daytime napping is a common symptom of inadequate night-time sleep (Gradisar, Wright, Robinson, Paine, & Gamble, 2008) and may have been employed by these players to off-set inadequate night-time sleep durations. However, although daytime naps were not quantified within the present experimental design, which is recognized as a limitation, practitioners did report that some players did engage in napping. To avoid sleep inertia post-nap, it is recommended that naps are either <30 min or >90 min. However, multiple >90 min naps would be required to off-set accumulated night-time sleep debt in these players, with a minimum sleep duration of 04:58 observed, which is unlikely to be feasible. Thus tailored and individualized education provided by the player support network may be required within these players to address the accumulation of sleep debt. Without this education, such as earlier bedtimes and scheduled daytime naps, player performance, recovery and holistic development may be compromised whilst risk of injury/illness are also increased. Education and potential interventions should be individualized within these populations, for example by chronotype (Laborde, Guillen, Dosseville, & Allen, 2015), as large inter- and intra-individual variance was observed in the present and previous studies (Fullagar & Bartlett, 2015; Fullagar et al., 2016). To further aid this individualization, the origin of the evidenced sleep intermission requires identification (i.e. whether the intermission is due to Morning Prayer, visit to the bathroom, scheduled voice/video call with family/friends, etc.). Considering a 2014 National Collegiate Athletic Association report indicated ~10% of miscellaneous substance use in adolescent athletes was accounted for by sleep medications, maintenance of appropriate sleep without pharmacological intervention is an acknowledged priority and a responsibility of the adolescent athlete support network (Taylor et al., 2016b).

Experimental limitations are present within this study, and as such interpretation of the presented data should be conducted with care relative to these limitations. The origin of the evidenced sleep intermission requires identification (i.e. whether the intermission is due to Morning Prayer, visit to the bathroom, scheduled voice/video call with family/friends, etc.) to enable individualized education and strategies to reduce intermission occurrence. Sleep diaries are typically recorded by athletes in conjunction with actigraphy-derived objective sleep indices. However, such diaries were not completed within the present study due to poor completion rates and adherence within similar populations during pilot data collection. Compliance with wearing the actigraphy watch when required was however robust. Additionally, subjective and/or perceptually orientated data relative to sleep and/or psychophysiological recovery state were not obtained proximal to the actigraphy-derived sleep data. Future designs should incorporate such approaches to provide a more nuanced interpretation of athlete perceived sleep indices and their association with subjectively and/or objectively determined recovery status.

Conclusions

Results from the present study indicate that Middle Eastern adolescent academy soccer players do not obtain sufficient sleep durations on a training camp due to late bedtimes, with further reductions in sleep duration within this particular cohort as a result of an intermission proximal to dawn. Sub-optimal sleep durations in these players may jeopardize athletic development/ recovery and holistic adolescent maturation, though this is yet to be determined. These data are novel given that it is from Middle Eastern adolescent soccer academy players, with the deficiencies towards the lower quartile of those seen in other regional adolescents (Merdad et al., 2014; Taylor et al., 2016a). This is concerning given sufficient sleep affords some protection to injury and illness risk (Milewski et al., 2014; Prather et al., 2015).

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