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Comparing Perceived Sleep Quality, Practices, and Behaviors of Male and Female Elite Rugby Union Athletes with the Use of Sleep Questionnaires

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Abstract

Objective To evaluate the differences in subjective sleep quality, quantity, and behaviors among male and female elite rugby union athletes through two common sleep questionnaires.

Materials and Methods A sample of 38 male and 27 female elite rugby union athletes filled out the Athlete Sleep Behavior Questionnaire (ASBQ) and the Pittsburgh Sleep Quality Index (PSQI). Global scores and individual items for each questionnaire were compared to assess differences between sexes.

Results Male athletes reported significantly longer sleep duration (7 h 50 m ± 50 m versus 7h 12 m ± 58 m respectively; $p \leq 0.01$; $d = 0.70$) and higher habitual sleep efficiency (88% versus 83% respectively; $p < 0.05$; $d = 0.54$) when compared with female athletes. Individual items of the ASBQ revealed significant differences between male and female athletes for five questions. Male athletes displayed higher instances of taking stimulants before training or competition and consuming alcohol within 4 hours of going to bed. Conversely, female athletes expressed greater thought or worry while in bed and a higher instance of training late at night.

Discussion Male athletes displayed better self-reported sleep quality and quantity than female athletes; however, the present study highlighted that male and female elite rugby union athletes face specific challenges that differ. It appears that the differences observed between male and female elite rugby union athletes may be due to differing levels of professionalism or differences in training or competition schedules.

Keywords

- team sports
- sleep hygiene
- sleep health
- sleep education
- athlete sleep behavior questionnaire
- Pittsburgh sleep quality index

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Introduction

Sleep is regarded as one of the best tools available to athletes to recover from training and competition.[1] As such, sleep has received considerable attention within competition and training settings, especially over the last decade.[2,3] Moreover, it has been suggested that athletes may require greater amounts of sleep than the general population to recover from the considerable physiological and psychological stress of training and competition.[4] Despite the need for increased sleep duration, research has highlighted that athletes face several unique challenges that can affect the amount of sleep they gain each night.[5] Sleep challenges relevant to athletes are often associated with training, travel, and competition,[6,7] and they include waking up tired, excessive daytime sleepiness,[8] problems falling asleep, waking up throughout the night, and sleeping in unfamiliar environments (such as hotels).[9] Disturbed sleep has been repeatedly reported[2] to negatively affect daytime physical and cognitive performance; therefore, it is a relevant area of concern within athlete populations.

Previous research[9] has suggested that while sleep may be poor across athlete populations, challenges and habits differ between individual and team-sport athletes. Indeed, previous research[5,10] has shown significant differences between total sleep time and sleep efficiency between team and individual sports athletes. Furthermore, within team-sport athletes, sleep challenges may differ depending on the athlete's level. Caia et al.[11] showed that habitual sleep-wake patterns were different between senior and junior male rugby league athletes, and that sleep differs among playing levels in rugby league. Numerous sleep challenges have been reported by team-sport athletes, which include caffeine consumption,[12] increased training volume,[13] scheduling of training and competition,[14] obstructive sleep apnea, movement while asleep,[15] muscle soreness,[16] and domestic or international travel.[17]

One method that may help to improve sleep quality and quantity among athletes is the use of sleep hygiene education, which has been previously described as adopting behavioral changes that promote and facilitate sleep and avoiding behaviors that have been suggested to interfere with sleep.[18] Sleep hygiene education provides athletes with tools and strategies to maximize the quality and quantity of sleep by focusing on lifestyle and environmental factors.[18,19] Driller et al.[20] reported that individualized sleep education provided to elite cricket athletes through the Athlete Sleep Behavior Questionnaire (ASBQ) can improve subjective and objective sleep measures. Additionally, O'Donnell and Driller[21] reported that sleep hygiene education was effective in improving sleep quantity in female elite athletes.

However, there are differences in sleep quality between male and female athletes.[8,22] Research on differences in sleep according to sex[23] has revealed that female athletes display better quality and quantity than male athletes when sleep is assessed via polysomnography, including longer total sleep time, shorter sleep onset latency, shorter wake time, and improved sleep efficiency. Furthermore, it appears that differences occur within sleep architecture, with males spending more time in stages 1 and 2 of sleep and a reduced time in slow-wave sleep and rapid-eye-movement sleep compared with females.[23,24] However, when research has utilized subjective measures to assess sleep differences between sexes, females report greater sleep problems than males, including shorter sleep duration, difficulties falling asleep, and more wake periods throughout the night.[8] Conversely, male athletes are reported to be at a greater risk of snoring, increased risk of obstructive sleep apnea, increased sleep latency, and decreased sleep efficiency.[15]

Research[23] has highlighted that there may be several causes for the differences observed in sleep quality and quantity between sexes. Differences in sex hormones may play a role in sleep quality. In males, testosterone levels have been linked to sleep quality, with low testosterone levels being shown to decrease sleep efficiency and increase nocturnal awakenings.[22] Furthermore, research suggests that sleep in females is sensitive to hormonal changes in ovarian steroids.[25] Differences in circadian rhythms may also play a role in sleep quality and quantity, and they appear to differ between sexes,[22,24] with core temperature nadir and peak secretion of melatonin observed to be earlier in females than males.[26] Despite the earlier circadian timing in females, sleep times are reported to be similar between both sexes,[22] potentially causing desynchronization between circadian and sleep timing, which may contribute to females subjectively reporting more subjective sleep problems than males.

While to date it is clear that there are differences in sleep between the sexes, research investigating sleep challenges and habits in elite team-sport athletes has focused mostly on male athletes. Given the increasing professionalism of women in team sports, it is important to understand the challenges pertinent to female elite team-sport athletes and if they are different to those reported in male athletes. Therefore, the current study aimed to evaluate the differences in subjective sleep quality, quantity, and behaviors among male and female elite rugby union athletes through two common sleep questionnaires: the ASBQ and the Pittsburgh Sleep Quality Index (PSQI).

Material and Methods

Participants

A convenience sample of 65 male and female elite rugby union athletes participated in the current study. Based on the recommendations by Lakens,[27] when the entire target population is measured, there is no need to perform a hypothesis test. Therefore, due to the fact that we sampled the entire population available (international level rugby union athletes representing their country), sample size calculation was deemed unnecessary in this instance. The participants included 38 male (age: mean ± standard deviation [SD] = 26.6 ± 3.3 years) and 27 female (mean age: 25.7 ± 4.3 years) athletes who were of international standard and represented their country in the sport of rugby union. The study was approved by the institutional Human Research Ethics Committee (HREC#2017–19). The study was outlined to all participants, and informed consent was obtained from them before they filled out the questionnaires.

Procedures

Each participant was required to fill out two separate sleep questionnaires, the PSQI[28] and the ASBQ,[29] which were applied through an online electronic survey (Google Forms, Google LLC, Mountain View, CA, United States). Both questionnaires were filled out in a single sitting, and the participants were required to be at least four weeks into their competition phase of the season, which typically involves four field training sessions, three gym-based sessions, and one game per week for elite male athletes. Typically, elite female athletes in season complete three field training sessions, three gym-based sessions, and one game per week. The questionnaires asked participants questions relating to their typical sleep patterns over the month prior to taking part in the study, in accordance with the official instructions for each questionnaire.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a 19-item self-rated questionnaire that aims to assess sleep quality and sleep disturbances over a 1-month period. It is commonly used in sports settings due to the ease of application and quick completion time.[2] Specific questions are grouped to create seven components: 1) subjective sleep quality; 2) sleep latency; 3) sleep duration; 4) habitual sleep efficiency; 5) sleep disturbances; 6) use of sleep medication; and 7) daytime dysfunction. Each of these components is equally weighted on an interval scale ranging from 0 to 3, and the component scores are summed to produce a global score ranging from 0– to 21, with higher scores suggesting lower sleep quality. It has been recommended that a global score > 5 equates to poor sleep behaviors, severe sleep difficulties in at least two components, or moderate sleep difficulties in more than three components.[28] The test-retest reliability of the PSQI has been shown to be strong, with a test-retest correlation r value of 0.85.[28]

Athlete Sleep Behavior Questionnaire (ASBQ)

The ASBQ is an 18-item self-rated questionnaire that asks questions about sleep behaviors and habits over a 1-month period. The questionnaire was designed as a tool to identify areas of practical improvement in sleep habits and behaviors thought to be of common concern for elite athletes rather than a clinical screening tool (Driller et al.[29]). Each question asks participants how often specific behaviors have occurred on an interval scale ranging from 1 to 5 (1 = never; 2 = rarely; 3 = sometimes; 4 = frequently; 5 = always). A global score is produced by adding the individual answers on each item. A global score ≤ 36 indicates 'good' sleep behaviors, while a score ≥ 42 indicates 'poor' sleep behaviors.[29] The test-retest reliability of the ASBQ has been shown to be very high, with a test-retest correlation r value of 0.88 and an intraclass correlation coefficient (ICC) of 0.87.[29]

Statistical Analyses

Descriptive statistics are shown as mean ± SD values, unless otherwise stated. The statistical analysis was performed using the IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY, United States) software, version 27.0. A comparison of male and female athletes was performed for both questionnaires and for each of their items using independent samples *t*-tests, with statistical significance set at $p < 0.05$. There were no outliers in the data, as assessed by boxplot inspection. Global scores and each individual question were normally distributed as assessed by the Shapiro-Wilk test ($p > 0.05$), and there was homogeneity of variances as assessed by the Levene test for equality of variances ($p > 0.05$). Cohen effect sizes (d) were calculated between male and female athletes for both questionnaires and each question. Effects sizes were interpreted using thresholds of 0.2, 0.5, and 0.8 for *small*, *moderate*, and *large* respectively. An effect size of 0.2 was considered *trivial*, and the effect was deemed *unclear* if the 95% confidence interval (95%CI) overlapped the thresholds for both positive and negative effects.[30]

Results

The analysis of the PSQI global scores revealed a significant difference ($p < 0.01$; $d = 0.78$; ►**Table 1**) between athlete groups, with male athletes displaying a lower score. Additionally, 3 of the 7 individual components of the PSQI revealed significant differences ($p < 0.05$; ►**Table 2**) between groups. There was no significant difference between males and females in terms of ASBQ global scores ($p = 0.08$; ►**Table 1**). However, the effect size analysis revealed a *small* effect size between groups, with the male group displaying lower global scores (►**Table 1**). In total, 5 (Q2, Q3, Q4, Q9, and Q10) of the 18 individual items of the ASBQ questionnaire revealed significant differences ($p < 0.05$, ►**Fig. 1**) between the male and female groups.

The self-reported sleep time, wake time, and sleep duration from the PSQI showed significant differences ($p < 0.05$; ►**Table 2**) between male and female groups. The female group reported that they went to bed significantly earlier than male athletes (10:10 p.m. ± 0:47 a.m. and 10:35

Table 1 Comparison of effect size regarding global scores on Athlete Sleep Behavior Questionnaire (ASBQ) and Pittsburgh Sleep Quality Index (PSQI) between male ($n = 38$) and female ($n = 27$) elite rugby union athletes

Questionnaire	Male: mean ± standard deviation	Female: mean ± standard deviation	*p*-value	Effect size (*d*)
ABSQ (global score)	43.9 ± 5.3	46.5 ± 6.5	0.08	0.44; *small*
PSQI (global score)	5.0 ± 2.2	7.2 ± 3.3	< **0.01**	0.78; *moderate*

Table 2 Comparison o effect size regarding individual component scores on the Pittsburgh Sleep Quality Index (PSQI) between male ($n = 38$) and female ($n = 27$) elite rugby union athletes

	Male: mean ± standard deviation)	Female: mean ± standard deviation	*p*-value	Effect size (*d*)
Component 1: subjective sleep quality	1.0 ± 0.5	1.2 ± 0.6	0.28	0.27; *small*
Component 2: sleep latency	1.0 ± 0.6	1.2 ± 0.6	0.10	0.42; *small*
Component 3: sleep duration	0.0 ± 0.2	0.4 ± 0.6	< **0.01**	0.76; *moderate*
Component 4: habitual sleep efficiency	0.3 ± 0.6	0.8 ± 0.8	**0.03**	0.54; *moderate*
Component 5: sleep disturbances	1.5 ± 0.6	1.6 ± 0.7	0.49	0.16; *trivial*
Component 6: use of sleep medication	0.1 ± 0.4	0.6 ± 0.8	< **0.01**	0.71; *moderate*
Component 7: daytime dysfunction	0.8 ± 0.6	1.1 ± 0.9	0.08	0.41; *small*

p.m. ± 0:39 a.m. respectively; $p = 0.02$). Additionally, the female group reported getting up significantly earlier than the male group (6:54 a.m. ± 1:08 a.m. and 07:31 a.m. ± 1:07 a.m. respectively, $p = 0.03$). The male group reported a significantly longer sleep duration compared with the female group (7 h 50 m ± 50 m and 07h 12 m ± 58 m respectively; $p < 0.01$; $d = 0.70$). In total, 35% of the male and 70% of the female athletes had PSQI global scores > 5, indicating that most female athletes displayed poor subjective sleep quality.[28] Furthermore, 69% of the male and 66% of the female athletes had ASBQ global scores > 42, indicating poor overall sleep behaviors.[29] Additionally, 7% of the female and 2% of the male athletes had scores < 36, which indicates good overall sleep behaviors.

Discussion

The present study aimed to investigate the differences in sleep behaviors, habits, and subjective sleep quality between male and female elite rugby union athletes through two common sleep behavior questionnaires. The main findings were that male athletes reported longer perceived sleep duration and better sleep efficiency than female athletes. Female athletes went to bed significantly earlier and got up significantly earlier than male athletes; additionally, female athletes displayed sleep behaviors consistent with having problems falling asleep. The results from the current investigation highlight that male and female elite rugby union athletes display sleep complaints which are consistent with those reported by other athlete populations. Moreover, sleep behaviors appear to differ between male and female elite rugby union athletes.

In the current study, the male athletes reported a sleep duration of 7 h 50 m, which was significantly longer than the self-reported sleep duration of 7 h 12 m in the female cohort. The self-reported sleep duration was similar to those previously reported among highly-trained male and female athletes. Swinbourne et al.[14] reported that 152 male athletes and 23 female highly trained athletes displayed self-reported sleep durations of 8.0 h and 7.1 h respectively. The current study and the study conducted by Swinbourne et al.[14] used self-reported sleep duration via the PSQI; therefore, it is interesting that the highly-trained male and female athletes in their study perceived their sleep duration to be similar to that reported by elite male and female rugby union athletes in the current investigation using the same sleep questionnaire.

The discrepancies observed in sleep duration in the current investigation may have been influenced by numerous factors, which may include differences in training loads,[31] sex hormones,[23] and circadian rhythms.[26] However, we suggest that the disparities in sleep duration may be caused by the impact of training schedules due to differences in levels of professionalism between male and female elite rugby union athletes. Indeed, the New Zealand rugby union players association[32] reported that female elite rugby union athletes could receive a maximum retainer of $20,000 NZD per year, while their male counterparts receive approximately $75,000 to $195,000 NZD annually. This discrepancy in salary would suggest that female elite rugby union athletes may be required to have other part-time jobs, which would classify them as semiprofessional. Previous research by Pink et al.[33] has shown that semiprofessional athletes are required to manage double careers, and face the challenge of substantial work or study commitments in addition to training and competing at high standards. The requirements of managing a double career may dictate that training occurs early in the morning or late at night to accommodate commitments such as work or study. Previous research by Swinbourne et al.[14] reported that when highly-trained athletes are required to train before 8 a.m., there is a reduction in sleep duration. Additionally, training after 6 p.m. has been associated with delaying sleep onset and decreasing sleep duration in elite football athletes.[34] Female athletes within the current study

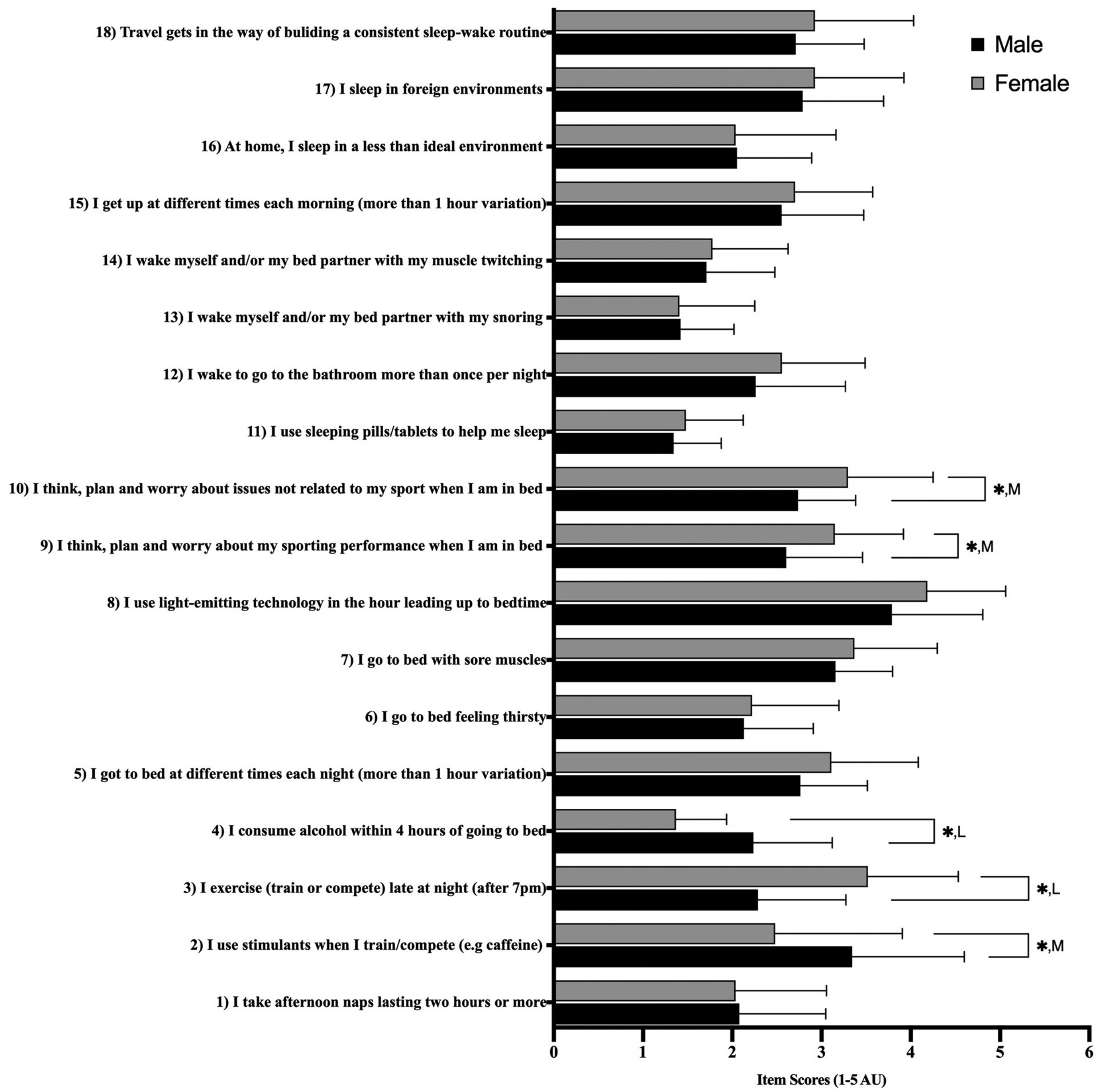

Fig. 1 Mean scores out of 5 for male ($n = 38$) and female ($n = 27$) elite rugby union athletes for the 18 items of the ASBQ. Notes: *significance; Mmoderate effect size; Llarge effect size. A lower score indicates a more desirable sleep behavior.

displayed an average wake up time at 6:54 a.m., which may be due to being required to train earlier in the morning. Furthermore, female athletes reported more frequently training after 7 p.m.. These findings support the suggestion that female athletes have a less than optimal training schedule, which may limit their sleep duration.

Female athletes in the current study reported having more thoughts about *sports and non-sport-related matters while in bed* compared with male athletes. Thought or worry before sleep has been suggested to contribute to increased cognitive arousal,[35] which has been linked to an increase in sleep onset latency and a decrease in sleep quality.[36] A study by Correia and Rosado (2019) with 601 Portuguese athletes highlighted that female athletes presented higher levels of sport anxiety compared with male athletes. Furthermore, Ramis et al.[37] emphasized that female athletes display higher levels of worry than male athletes. It is plausible that the increased levels of anxiety or worry experienced by female athletes may explain why they have reported increased thoughts or worry about sports and non-sport matters while in bed in the current investigation.

In addition, female athletes displayed higher use of sleep medication than male athletes within the current investigation. Sleep medication has been previously reported[38] to be used by athletes in an attempt to reduce cognitive arousal following training or competition. Additionally, it has been highlighted[39] among people who have more than one job, which is the case in semiprofessional athletes, that relaxation is an essential component before going to sleep. Relaxation includes time with family or friends, resting or reading, and is an important aspect of recovery from work, and unwinding before sleep.[40] Within the current investigation, female athletes may have found it hard to fit relaxation into their prebed routine due to training schedules caused by double careers. As previously mentioned, female athletes in the current investigation trained late at night more frequently; additionally, they reported going to bed at 10:10 p.m.. Due to the proximity between training and bedtime in the current investigation, female athletes would likely have minimal time to undertake relaxation before bed. Indeed, research has highlighted that relaxation strategies are an important requirement in preventing sleep-onset insomnia by reducing anxiety.[41] Therefore, it is plausible that female athletes may have utilized sleep medication to reduce arousal in the absence of relaxation in an attempt to reduce worry or thoughts, and to reduce the latency of sleep onset. It is important to note that sedatives have been shown to be addictive in athlete populations, and they can cause long-term health and performance issues.[42] Therefore, it may be important for female athletes who utilize sleep medication to seek alternative methods to improve their sleep.

An interesting finding from the current investigation was that male athletes reported higher frequencies of alcohol consumption within our hours of going to bed. Research has highlighted that alcohol can negatively affect the quality and quantity of sleep[43] by affecting sleep architecture and causing an increased number of awakenings or light stage-1 sleep in the second half of the night.[44] Alcohol consumption is common among rugby union athletes, specifically in the hours following a match,[45] and it has been previously reported[46] to be higher amongst male than female rugby union athletes. We suggest that the differences observed in alcohol consumption within four hours of going to bed might be due to scheduling regarding male rugby union matches. International rugby union matches are commonly scheduled to kick off at night, around 7 to 8 p.m. Due to the length of a match, night-time kick-offs result in matches typically finishing between 9 and 10 p.m. Furthermore, Shearer et al.[47] reported that male elite rugby union athletes go to bed at 0:49 a.m. the night of a match. Therefore, it is plausible that any postmatch alcohol consumption among male elite rugby union athletes is likely to occur within 4 hours of bedtime on match day.

Male rugby union athletes also displayed a higher instance of stimulant use before training and competition than female athletes. Anecdotally, male rugby union athletes are more likely to have greater access to stimulants due to supplements being supplied to professional athletes by team support staff. Furthermore, previous research[48] has reported that males use more preworkout supplements than females, which often contain multiple stimulants, including caffeine, β-alanine, and creatine.[49] Jagim et al.[50] reported that while preworkout stimulants are used among female populations, females are more likely to experience side effects, including skin reactions and nausea. Therefore, the differences in stimulant use observed in the current investigation may be caused by female athletes experiencing greater side effects, resulting in a decrease in use among them. Furthermore, stimulants have been proposed to negatively affect sleep; when caffeine is consumed within 6 hours of an athlete's proposed bedtime, for example, an increase in sleep latency has been observed.[12,43] Additionally, this finding may highlight the need to educate male elite rugby union athletes on the adverse effects stimulant use can have on sleep.

A limitation of the current study was the lack of objective sleep measures. All behaviors, quality and quantity regarding sleep were collected via subjective sleep questionnaires. Including objective sleep measures such as actigraphy or polysomnography may have enabled the researchers to report in greater detail the differences in sleep quality and quantity among male and female elite rugby union athletes. Additionally, a greater understanding of each the training schedules and loads of each group in the month leading up to data collection may have enabled greater insight into the sleep behaviors of athletes.

Conclusion

The current investigation showed different sleep behaviors between male and female elite rugby union athletes. The male athletes displayed significantly longer sleep duration compared with the female athletes. Furthermore, male athletes may benefit from education on the effects alcohol consumption and stimulant use can have on sleep. Female athletes reported having more thoughts about sports and non-sport-related issues while in bed and greater use of sleep medication, so this may be an issue in which education is warranted. The present investigation highlights key differences between male and female elite rugby union athletes. Additionally, the findings may provide practitioners with insights into challenges specific to male and female rugby union athletes and areas in which sleep can be improved.

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Conflict of Interests
The authors have no conflict of interests to declare.

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