Journal of Coaching and Sports Science
Volume 3, Issue 2, 90-98.
e_ISSN: 2963-1483
https://www.journal.foundae.com/index.php/jcss/index

Sex Differences in Wellness Scores in Collegiate Athletes

Jennifer A. Bunn*
Sam Houston State University,
UNITED STATES OF AMERICA

Michael R. Jiroutek
Campbell University,
UNITED STATES OF AMERICA

Article Info

Article history:
Received: March 15, 2024
Revised: April 23, 2024
Accepted: May 12, 2024

Keywords:
Academic load;
Health status;
Sport psychology;
Stress;
Team sports.

Abstract

Subjective wellness scores reflect athlete responses to training, fatigue, personal experiences, and recovery, and evidence suggests these scores may differ between athletes based on sex. This study aimed to evaluate the differences in daily wellness scores between sexes in collegiate soccer, swimming, and basketball athletes. Athletes (n = 294, 63% female) completed daily wellness surveys for energy, health status, mood, muscle readiness, sleep quality, sleep duration, stress, diet, and overall wellness. Variables were evaluated on a 5-point Likert scale, except sleep duration, quantified in hours. Repeated measures, mixed linear models, repeated measures, and ordinal logistic models were used to assess sex differences in wellness outcomes. In basketball, females have 0.30 times the odds (95% CI 0.19, 0.48) of males of a worse health status score. For soccer, females have 2.45 times the odds (95% CI 1.32, 4.44) of males with a worse stress wellness score. In swimming, females, on average, slept 0.40 more hours of sleep per night (95% CI 0.02, 0.79) as compared to males. These data suggest that differences in wellness subcomponents are nuanced by sport. This information can be used to provide targeted programming for athletes to improve wellness and reduce stress, which may subsequently enhance mental health, academic performance, and sports performance.

To cite this article: Bunn, J. A., & Jiroutek, M. R. (2024). Sex differences in wellness scores in collegiate athletes. *Journal of Coaching and Sports Science, 3*(2), 90-98. https://doi.org/10.58524/002024336800

INTRODUCTION

Wellness is pursuing choices, activities, and lifestyle behaviours to improve physical and mental health, ultimately leading to holistic health (Meiselman, 2016). Wellness surveys for athletes in collegiate and professional settings have become a common practice for subjectively assessing an athlete's response to training and stress in conjunction with a system to evaluate the athletes' external load (Impellizzeri et al., 2019; Saw et al., 2017). Wellness surveys are usually short and centred on fatigue, muscle soreness, sleep quality, sleep duration, stress, hydration, and nutrition (Saw et al., 2016). Subjective wellness scores reflect physiological responses to acute and chronic training volume changes (Saw et al., 2016). Several studies have shown that wellness responses are linked to athlete performance across a variety of sports (Buchheit et al., 2013; Crouch et al., 2020; Gallo et al., 2016; Govus et al., 2018; Thorpe et al., 2016). The scores not only predict athlete well-being, fatigue, and recovery but can also predict an athlete's external and internal load for later in the day. In elite male soccer players, low pre-training wellness scores were associated with reduced player load output (Gallo et al., 2016; Malone et al., 2018), high-speed distance, and maximum velocity (Malone et al., 2018). Sleep, a sub-factor within athlete wellness, impacts external load (Crouch et al., 2020; Leduc et al., 2022), and sleep is affected by travel for games (Leduc et al., 2022).

Most of these studies have been conducted on male athletes from professional and collegiate ranks, with only a few on female athletes. Female athletes tend to have lower representation in sports science literature, which is concerning because there are differences in physiological and psychological responses to training by sex (Cowley et al., 2021). LaFountaine et al. (2016) showed that female athletes scored lower than their male athlete counterparts in 14 out of 20 of the wellness categories they assessed. The lowest wellness scores in female athletes were in spirituality, stress management, nutrition, and total wellness, and there were sex differences observed, with females scoring lower than males for a sense of worth, stress management, and leisure (LaFountaine, 2016). These sex differences have also been linked to athletic coping skills (Von Guenthner &

*** Corresponding author:**
Bunn J. A., Sam Houston State University, UNITED STATES OF AMERICA. jab229@shsu.edu

Hammermeister, 2007). Collegiate males and females with optimal wellness also tended to have high scores for coachability, mental preparation, and concentration (Von Guenthner & Hammermeister, 2007).

Further, sex differences have been reported among collegiate athletes; males with high wellness also tended to do well under pressure, whereas females reported higher scores in coping with adversity and freedom from worry (Von Guenthner & Hammermeister, 2007). The results of an NCAA survey conducted in 2021 showed that females commonly have higher rates of mental distress, with 94% of female sports participants admitting to feeling overwhelmed by all that they do, 88% feeling mentally exhausted, and 72% feeling overwhelming anxiety (*NCAA*, 2020). These numbers far outweigh those from male sports. The results from the NCAA studies have helped shine a light on the disparities between sexes of athlete mental health. Still, they do not disaggregate the data by sport to identify specific areas that may be more problematic within sporting culture. It is unknown if male and female athletes competing in the same sports assess their wellness differently by their sex-based experiences, resources, and support. Gaining a better understanding of sex differences in wellness responses is important to providing wrap-around services for athletes, such as support for academic success, mental health, and nutrition.

Understanding specific wellness differences by sport is imperative in creating sport-specific mental health interventions and improving the culture within a sport. Daily wellness assessments are used as a check-in for coaches and athletes and as a communication tool to provide a general concept of the athletes' well-being. To date, there is little evidence to support how coaches of female athletes can utilize these daily wellness scores, especially within a specific sport. Further, there is little evidence to indicate if there are indeed differences in how athletes grade their wellness by sex. This study evaluated the differences in daily wellness scores between sexes across three collegiate sports: soccer, basketball, and swimming. Wellness scores included a composite wellness score and sub-components related to energy level, health status, mood state, muscle readiness, sleep quality, sleep duration, stress, and diet. The aim of this research is to provide a comprehensive understanding of how male and female athletes in these sports experience and assess their wellness, in order to inform better support systems and interventions tailored to each sex's unique needs.

METHOD

Research design

This was a secondary analysis of de-identified data from an athlete monitoring system. Athletes used the system as part of their collegiate team monitoring. Participants identified their sex via a binary question; the only two responses were male or female. Therefore, the athletes were categorized using this sex variable. This study was approved by the institutional review board as exempt status (IRB-2022-380). Still, participants did not complete an informed consent due to the retrospective, secondary analysis, and de-identified nature of the data and analyses.

Participants

De-identified data included 121 collegiate soccer athletes (72% females) utilizing the daily wellness survey platform from January 2019 through January 2022, providing 74.6 (70) ± 50.9 [mean (median) ± SD] observations per athlete. For basketball, 92 athletes (60% females) used the platform from October 2018 through March 2022, providing an average of 214.2 (164) ± 218.2 observations for each athlete. Eighty-one swimmers' (53% females) data, collected from May 2016 through January 2022, were used for analysis, averaging 61.2 (48) ± 51.8 observations per athlete. While competitive leagues and divisions of these athletes were unknown, all athletes were participating in their teams' activities (practices, games, etc). No data was collected for any seasons lost to COVID-19 (or games/seasons due to injuries for individual athletes). All data were de-identified and provided via convenience sampling from Metrifit (Health and Sport Technologies, Metrifit, Millgrange, Greenore, Co., Louth, Ireland). Data was available for swimming, soccer, and basketball athletes only. Separate analyses were conducted for each sport.

Instrument

Athletes completed wellness surveys through the Metrifit software application in alignment with previous literature (Hamlin et al., 2017, 2019). Daily subjective wellness assessments are a

common practice in evaluating athletes' tolerance and recovery despite limited studies on survey validity (Saw et al., 2016). The survey consisted of each variable name followed by a sliding electronic scale to indicate scoring. Athletes were provided with the name of the sub-score, and responses to each were supplied via a slider entry mechanism to select their desired response. The sub-score variables were mood state, the previous day's diet, sleep quality, energy, health status, muscle readiness, and stress. All variables were scored on a scale of 1 to 5, with higher scores representing a positive effect. Athletes also provided their sleep duration from the previous evening. The sub-scores were used to calculate the Metrifit ready-to-perform (RTP) overall wellness score, provided as a percentage ranging from zero to 100.

Procedures

Athletes accessed the Metrifit platform to respond relative to that day. Wellness responses were collected in the morning before engaging in any activity. Athletes completed the wellness survey daily, but compliance was variable. As this was a secondary analysis of data, we have reported the mean and variance in observations per athlete per sport observed. Data were collected over six years, de-identified, and analyzed. Thus, some athletes may have been observed for more than one year, while others were observed for only a short time.

Analysis plan

Sleep duration (hours per night) and RTP (0 to 100 scale) were analyzed as continuous outcomes to utilize repeated measures mixed linear models (PROC MIXED, SAS Institute, Inc., Cary, NC) to assess whether any differences by sex were evident for either outcome. Athletes were included as a random effect, while sex was considered a fixed effect. The default covariance structure (variance components) was utilized in all the models (several other structures were considered, but none improved model fit in any meaningful way). These models were repeated separately across the basketball, soccer, and swimming athletes (SAS Institute Inc, 2018).

The remaining seven outcome variables of interest (stress, health, yesterday's diet, sleep quality, muscle readiness, energy level, mood state) were assessed on a 1 to 5 scale, with higher scores indicating better for each variable. For these outcomes, repeated measures ordinal logistic marginal models (PROC GENMOD, SAS Institute, Inc., Cary, NC) were constructed to assess whether any differences by sex were evident for any of these seven 5-level outcomes. These models used the multinomial probability distribution with a corresponding default cumulative logit link function and an independent correlation structure. The probabilities of levels of the outcome variables having lower ordered values were modelled (i.e., five was considered the outcome variable reference level). This was due to the higher end of the 5-point scale for each model having more responses, allowing for more precise and stable parameter estimates (SAS Institute Inc, 2018). A small number of entries for the 5-point scale outcomes were recorded in the dataset, including a '.5'. These values were rounded down to the next lower number in all such instances. For example, if '2.5' was reported, it was considered as '2' in all analyses.

Model parameter estimates, associated confidence intervals (CIs) and *p*-values are reported. While the authors have included *p*-values for all inferential results, following the current thinking regarding the best practices for significance testing, no cutoff for a *p*-value is indicated as the basis for a decision about the meaningfulness/importance of an effect (Wasserstein et al., 2019). Further, focusing on the provided confidence intervals is urged to ensure the readers' awareness of both interval width (narrower being more precise) and location (further from zero indicating increasing importance). For the mixed models, parameter estimates are slope estimates describing the mean difference in the outcome (sleep duration or RTP) between sexes (females relative to males). That is, a positive estimate suggests females have, on average, a higher value for the given outcome variable than males.

In contrast, a negative estimate would suggest females have, on average, a lower value for the given outcome variable than males. For the ordinal logistic regression models, a positive parameter estimate indicates an increase in the log odds (and hence odds) of a lower (worse) outcome for females compared to males, thus suggesting males are better off for that particular outcome. Conversely, a negative parameter estimate indicates a decrease in the log odds (and hence odds) of a lower (worse) outcome for females compared to males, thus suggesting females are better off for

that particular outcome. This was a secondary data analysis of a fixed and known-in-advance sample size, so no power analysis was conducted (Jiroutek & Turner, 2018).

RESULTS AND DISCUSSION

Results:

Table 1 contains the results of the 27 individual univariable models evaluating differences by sex for each outcome of interest. The parameter estimates for the seven 5-point scale outcomes (stress, health, yesterday's diet, sleep quality, muscle readiness, energy level, mood state) from the ordinal logistic regression models are in terms of the log of the odds. The mathematical function log is applied to the odds of the event, where the odds of an outcome are the number of individuals with the event of interest divided by the number of individuals without the event. Since the log of the odds has little practical applied meaning. In contrast, the odds are the scale of interest, exponentiating these parameter estimates and associated CI bound yields estimates on this more interpretable scale. In basketball athletes, the health status model parameter estimate (95% confidence interval [CI]) of -1.21 (-1.68, -0.74) indicates that females have 0.30 (0.19, 0.48) times the odds of males of a lower (worse) health status score (i.e., female basketball players have better health relative to males). For stress amongst soccer athletes, the model parameter estimate of 0.89 (0.28, 1.49) indicates that females have 2.45 (1.32, 4.44) times the odds of males of a lower (worse) stress wellness score (i.e., female soccer players have more stress relative to males). For sleep duration amongst the swimming athletes, the model parameter estimate of 0.40 (0.02, 0.79) in this repeated measures mixed linear model indicates that females get, on average, 0.40 (0.02, 0.79) more hours of sleep per night than males. Based on the available data, there is little evidence of any differences of important magnitude between the sexes for any of the other outcomes evaluated.

Table 1. Univariable linear mixed models and ordinal logistic regression marginal models for differences by sex for outcomes of interest in soccer, basketball, and swimming athletes*

Sex Parameter Estimate (associated 95% CI) P-value			
Model Outcome	Basketball (N=55 female, 37 male)	Soccer (N=87 female, 34 male)	Swimming (N=43 female, 38 male)
Stress**	0.31 (-0.34, 0.97) 0.3462	0.89 (0.28, 1.49) 0.0041	0.49 (-0.29, 1.28) 0.2194
Health**	-1.21 (-1.68, -0.74) <0.0001	0.22 (-0.28, 0.72) 0.3844	0.15 (-0.72, 1.01) 0.7393
Diet (yesterday)**	0.45 (-0.47, 1.37) 0.3411	0.21 (-0.34, 0.77) 0.4505	-0.33 (-1.17, 0.51) 0.4380
Sleep quality**	0.22 (-0.41, 0.84) 0.4974	-0.17 (-0.53, 0.19) 0.3631	0.10 (-0.62, 0.82) 0.7940
Muscle readiness**	-0.10 (-0.78, 0.58) 0.7793	0.23 (-0.25, 0.72) 0.3465	-0.12 (-0.94, 0.70) 0.7791
Energy level**	0.16 (-0.35, 0.67) 0.5317	0.07 (-0.33, 0.47) 0.7425	0.01 (-0.86, 0.89) 0.9767
Mood state**	0.49 (-0.17, 1.16) 0.1459	0.02 (-0.42, 0.46) 0.9224	0.11 (-0.76, 0.98) 0.8062
Sleep duration†	-0.20 (-0.48, 0.08) 0.1590	0.21 (-0.07, 0.49) 0.1350	0.40 (0.02, 0.79) 0.0408
RTP†	3.23 (-0.14, 6.59) 0.0602	-0.99 (-4.29, 2.31) 0.5555	-2.46 (-6.82, 1.90) 0.2687

*Separate univariable models were constructed for each outcome of interest (Stress, Health, Diet (yesterday), Sleep quality, Muscle readiness, Energy level, Mood state, Sleep duration and RTP) and each sport (soccer, basketball, swimming), resulting in 27 separate models. The reported parameter estimates are for females relative to males.

**Possible scores for each outcome were 1-5. PROC GENMOD modelled the probabilities of levels having lower ordered values (i.e., 5 was the outcome variable reference level).

†Sleep duration (range 1 to 12 hours per night) and ready-to-perform (RTP, range 0-100) were modelled as continuous outcomes, utilizing PROC MIXED.

Discussion:

Implications

This study evaluated the differences in daily wellness scores and eight sub-scores between sexes across three collegiate sports: soccer, basketball, and swimming. This is the first study to evaluate longitudinal wellness evidence in collegiate athletes with sport-specific sex comparisons. The results indicate that sex differences existed in terms of health status in basketball athletes, stress in soccer athletes, and sleep in swimmers. Soccer was the only sport that aligned with the previous literature on collegiate athletes, suggesting that females experience a more negative effect on wellness compared to males (LaFountaine, 2016). Basketball and swimming showed contrasting results, with females having a more positive effect than males regarding health status and sleep duration, respectively. Collegiate athletic departments and coaches are beginning to monitor athlete wellness daily, but with little alteration in the support mechanisms for the athletes if something out of the ordinary happens. Hamlin et al. (2019) showed that athlete wellness scores fluctuated according to exam periods and training workloads, so ensuring that coaches and researchers view and follow the pattern of an athlete's wellness is also important. Further, resources between sports are not always the same. These data can be used to help collegiate athletic departments create cost-effective programs and access to resources based on the sex- and sport-specific needs of the athletes.

The health status question within Metrifit is a question with latitude for interpretation. Athletes may understand this question to be strictly related to being healthy versus ill, or they may have chosen to interpret it as more inclusive about general feelings of health, well-being, injury, or general fatigue. Because the survey asked specifically about other health factors, such as nutrition and sleep, we assumed that these components were not considered as part of the health status question. The results indicate that male basketball athletes had a greater likelihood of reporting a worse health status compared to their female counterparts. Previous literature has reported differences in cardiovascular health measures, such as blood pressure, with males generally measuring worse than females (Garber et al., 2011; Jones et al., 1985). Concerning injuries research suggests that female athletes may be more prone to certain injuries, such as anterior cruciate ligament tears.

In contrast, male athletes may have a higher risk of concussions and other contact-related injuries (Lincoln et al., 2011). These disparities may be influenced by physiological and anatomical factors and differences in athletic exposures, sports participation, and playing style (e.g., variations in aggressiveness and intensity) (Lincoln et al., 2011). Previous literature has typically only captured cross-sectional data when making sex-based comparisons, so this longitudinal lens may result from an accumulation of these factors over time that have been previously overlooked (Hamlin et al., 2019; LaFountaine, 2016).

Stress has been identified as a key wellness factor in collegiate sports, and it is believed that stress sources are multi-factorial, relating to personal and academic performance (Bernstein et al., 1996; Reardon et al., 2019). The time required to participate in college sports—training sessions, travel, team meetings, and competitions—is also believed to be a stressor for college athletes (Moreland et al., 2018). Time management has also been cited as a significant challenge for academic performance, and academic stress is associated with reductions in energy and sleep, which may increase an athlete's risk of injury or illness (Hamlin et al., 2019). Female soccer athletes in the present study were shown to have higher odds of having more stress compared to their male counterparts. Although it is unclear why a disparity in stress between sexes among soccer athletes was found, variability in injury risk of the sport, the support provided to the athletes for coping, social pressure, academic pressure, performance pressure, or some combination of the above may account for the observed difference. Specific to soccer, studies indicate that females may have a higher risk of certain injuries, such as ACL tears and ankle sprains, than male players (Agel et al., 2005; Alentorn-Geli et al., 2009).

Further, female soccer players reported higher levels of stress, anxiety, and depressive symptoms compared to their male counterparts (Bernstein et al., 1996). They may face additional stressors related to body image, societal expectations, and balancing academic and athletic commitments (Tillman et al., 2015). Female athletes have been found to experience higher rates of symptoms related to depression, anxiety, and disordered eating compared to male athletes across a variety of sports (Bernstein et al., 1996; Reardon et al., 2019; Rice et al., 2020). Factors including

social pressure, cultural pressures, sport-specific demands, performance expectations, and coping strategies may influence these differences. Athletes, especially those with higher stress levels as measured through longitudinal data collection, may benefit from being taught coping strategies such as deep breathing techniques, reducing time on social media, and positive self-talk. Cross-sectional studies indicate that athletes with strong coping skills experience less stress, but it is unknown which of these factors predicts the other (Surujlal et al., 2013; Von Guenthner & Hammermeister, 2007). Coaches and support staff should consider teaching coping strategies to female athletes to see if this improves their ability to cope with adversity and reduce the stress they experience.

The only difference noted among collegiate swimmers was that the female athletes got more sleep (0.4 hours per night more, on average) than the male athletes. This disagrees with previous literature indicating that female athletes experience more sleep disturbances and inadequate sleep than male athletes and that female collegiate athletes reported higher daytime sleepiness and poorer sleep quality than male athletes (Watson, 2017). Another study revealed that female athletes reported more difficulties falling asleep and maintaining sleep than male athletes (Fullagar et al., 2015). However, both Mah et al. (2018) and Silva et al. (2019) reported results on sleep favourable to female collegiate athletes. Mah et al. (2018) found that male collegiate athletes reported lower sleep quality than females, while Silva et al. (2019), who evaluated sleep in collegiate athletes using both objective and subjective measures, reported that females showed higher sleep efficiency, reduced wake time after sleep onset, and reduced sleep onset latency than males. In comparing the objective and subjective measures, males overestimated total sleep time and underestimated sleep onset latency compared to female athletes. Thus, females were more accurate in subjectively reporting their sleep than males. This may explain the sex difference in swimmers, as the males in the present study may have provided poor estimations of their sleep duration.

The results indicated no sex differences in mood, yesterday's diet, sleep quality, energy, muscle readiness, or RTP (the overall wellness variable) for the three sports. Previous literature also showed no sex differences, with males and females having low scores in spirituality, nutrition and total wellness and high wellness scores in exercise and friendship (LaFountaine, 2016). While it is unknown which divisions athletes from the present study represented, LaFontaine's study was conducted solely on Division III athletes but across various sports. Collectively, these results suggest that males and females perhaps have a general alignment in wellness over time, with few differences in areas of weakness related to female stress management and health status and sleep for males.

Research contribution

This study provides a detailed examination of gender-specific differences in wellness scores among collegiate athletes across three sports: soccer, basketball, and swimming. Utilizing a longitudinal data set, it identifies significant disparities in wellness outcomes related to health, stress, and sleep between male and female athletes. The research contributes to the existing body of knowledge by offering insights into how wellness scores correlate with sex and sport type, highlighting areas where female athletes might require additional support. This work underscores the necessity for tailored wellness interventions and broadens the understanding of how sex-specific responses to athletic demands impact overall athlete wellness. This pioneering study enhances the dialogue on gender equity in sports science. It assists in developing more effective health and wellness strategies tailored to male and female athletes' unique needs.

Limitations

This study was not without both strengths and limitations. The deidentified data were retrospectively evaluated. Thus, there was no consideration or ability to assess if the athletes were in-season or out-of-season. Further, no objective analysis of their external load or sleep was possible for the available data. The wellness survey tool utilised poorly defines health status as a wellness variable. Therefore, interpreting the sex difference noted in basketball with these data requires further investigation. Much of what is known about sex differences in wellness has come from cross-sectional data, whereas this study evaluated longitudinal data. We believe that longitudinal analysis represents a study strength as it provides a new lens to evaluate wellness data. However, athletes may have experienced survey fatigue with daily wellness assessments. Furthermore, having inter-

sport data across basketball, soccer, and swimming allows for at least informal comparisons amongst the sports to gauge relative differences in the outcomes measured between genders.

Several potential demographics/participant characteristics of interest were unavailable in the dataset utilized (e.g., age, ethnicity, race, starter vs. back-up, public vs. private school, school conference, won-loss record, etc. were not collected). It was also unknown in which division (NCAA Division I, II, or III) the athletes included in this study competed. This is notable as the resources available to student-athletes are variable across the divisions (FieldLevel, 2020). Division I sports typically have larger budgets for athlete support resources for academic assistance and mental health but are also believed to demand more of an athlete's time (*College Sports Division Levels*, n.d.). Division I and II athletes may have financial assistance through a partial or full scholarship, whereas all Division III athletes are non-scholarship athletes.

Suggestions

Further studies should broaden the scope to include more sports and detailed demographic information, such as age and ethnicity, to enrich the analysis of wellness differences. Incorporating seasonal changes and more precise tracking of physical loads and sleep metrics could deepen insights. Practically, sports programs might improve outcomes by creating customised wellness interventions for each sport and gender. Additionally, mental resilience and stress management training could be especially advantageous for female athletes in addressing the higher stress levels identified.

CONCLUSION

Results from the present study can help shed light on the use of wellness scores within collegiate athletics. These data, combined with previous literature, provide both cross-sectional and longitudinal views of athlete wellness across various sports. These data suggest that at least some sex-based differences exist by sport within collegiate athletics for wellness. However, more research should be done, including female athletes, to see if these data hold in other longitudinal evaluations. Evaluating sex differences and changes in subjective responses to a four-year collegiate athletic experience would likely be beneficial in creating targeted support programs and resources for athletes at different points of their academic and athletic careers. These results suggest that coaches and sports psychologists should consider providing athletes with coping skills for stress and discuss creating good sleep hygiene habits to improve their sleep. Athletic trainers can be included to help athletes with their health status in an effort for them to perform optimally for training and games. Collectively, these data support the need for interprofessional relationships and communication among coaches, sports psychologists, athletic trainers, and other professionals working with collegiate athletes. These data may also help coaches and other athletics staff to target certain sports for specific wellness areas of concern (e.g., health status for male basketball players). As many universities aim to provide more wrap-around services for their athletes, these data can help athletic departments identify athlete needs by sport to provide more targeted assistance.

AUTHOR CONTRIBUTION STATEMENT

JB and MJ conceptualized the study. JB took the lead in evaluating previous literature and writing. MJ led efforts in data organization, analysis, presentation, and editing.

REFERENCES

Agel, J., Arendt, E. A., & Bershadsky, B. (2005). Anterior cruciate ligament injury in National Collegiate Athletic Association basketball and soccer: A 13-year review. *American Journal of Sports Medicine*, *33*(4), 524–530. https://doi.org/10.1177/0363546504269937

Alentorn-Geli, E., Myer, G. D., Silvers, H. J., Samitier, G., Romero, D., Lázaro-Haro, C., & Cugat, R. (2009). Prevention of non-contact anterior cruciate ligament injuries in soccer players. Part 1: Mechanisms of injury and underlying risk factors. *Knee Surgery, Sports Traumatology, Arthroscopy*, *17*(7), 705–729. https://doi.org/10.1007/s00167-009-0813-1

Bernstein, G. A., Borchardt, C. M., & Perwien, A. R. (1996). Anxiety disorders in children and adolescents: A review of the past 10 years. *Journal of the American Academy of Child & Adolescent Psychiatry*, *35*(9), 1110–1119. https://doi.org/10.1097/00004583-199609000-

00008
Buchheit, M., Racinais, S., Bilsborough, J. C., Bourdon, P. C., Voss, S. C., Hocking, J., Cordy, J., Mendez-Villanueva, A., & Coutts, A. J. (2013). Monitoring fitness, fatigue and running performance during a pre-season training camp in elite football players. *Journal of Science and Medicine in Sport*, *16*(6), 550–555. https://doi.org/10.1016/j.jsams.2012.12.003
Cowley, E. S., Olenick, A. A., McNulty, K. L., & Ross, E. Z. (2021). "Invisible Sportswomen": The sex data gap in sport and exercise science research. *Women in Sport and Physical Activity Journal*, *29*(2), 146–151. https://doi.org/10.1123/wspaj.2021-0028
Crouch, A. K., Jiroutek, M. R., Snarr, R. L., & Bunn, J. A. (2020). Relationship between pre-training wellness scores and internal and external training loads in a Division I women's lacrosse team. *Journal of Sports Sciences*, *39*(9), 1070–1076. https://doi.org/10.1080/02640414.2020.1857106
FieldLevel. (2020). Comparing Competition Levels in College Sports. https://recruiting.fieldlevel.com/2020/03/college-sports-division-levels/level
Fullagar, H. H. K., Skorski, S., Duffield, R., Hammes, D., Coutts, A. J., Meyer, T., Fullagar, H. H. K., Skorski, Á. S., Hammes, Á. D., Meyer, Á. T., Duffield, R., & Coutts, Á. A. J. (2015). Sleep and athletic performance: The effects of sleep loss on exercise performance, and physiological and cognitive responses to exercise. *Sports Med*, *45*, 161–186. https://doi.org/10.1007/s40279-014-0260-0
Gallo, T. F., Cormack, S. J., Gabbett, T. J., & Lorenzen, C. H. (2016). Pre-training perceived wellness impacts training output in Australian football players. *Journal of Sports Sciences*, *34*(15), 1445–1451. https://doi.org/10.1080/02640414.2015.1119295
Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I. M., Nieman, D. C., & Swain, D. P. (2011). Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. *Medicine and Science in Sports and Exercise*, *43*(7). https://doi.org/10.1249/MSS.0b013e318213fefb
Govus, A. D., Coutts, A., Duffield, R., Murray, A., & Fullagar, H. (2018). Relationship between pretraining subjective wellness measures, player load, and rating-of-perceived-exertion training load in American college football. *International Journal of Sports Physiology and Performance*, *13*(1), 95–101. https://doi.org/10.1123/ijspp.2016-0714
Hamlin, M. J., Olsen, P. D., Marshall, H. C., Lizamore, C. A., & Elliot, C. A. (2017). Hypoxic repeat sprint training improves Rugby player's repeated sprint but not endurance performance. *Frontiers in Physiology*, *8*. https://doi.org/10.3389/fphys.2017.00024
Hamlin, M. J., Wilkes, D., Elliot, C. A., Lizamore, C. A., & Kathiravel, Y. (2019). Monitoring training loads and perceived stress in young elite university athletes. *Frontiers in Physiology*, *10*(JAN). https://doi.org/10.3389/FPHYS.2019.00034
Impellizzeri, F. M., Marcora, S. M., & Coutts, A. J. (2019). Internal and external training load: 15 Years on. *International Journal of Sports Physiology and Performance*, *14*(2), 270–273. https://doi.org/10.1123/IJSPP.2018-0935
Jiroutek, M. R., & Turner, J. R. (2018). Why it is nonsensical to use retrospective power analyses to conduct a postmortem on your study. *The Journal of Clinical Hypertension*, *20*(2), 408. https://doi.org/10.1111/JCH.13173
Jones, N. L., Makrides, L., Hitchcock, C., Chypchar, T., & McCartney, N. (1985). Normal standards for an incremental progressive cycle ergometer test. *The American Review of Respiratory Disease*, *131*(5), 700–708. https://doi.org/10.1164/ARRD.1985.131.5.700
LaFountaine, J. (2016). Student athlete wellness: Gender perspectives. *Journal of Coaching Education*. https://doi.org/10.1123/jce.2.2.24
Leduc, C., Weaving, D., Owen, C., Lacome, M., Ramirez-Lopez, C., Skok, M., Tee, J. C., & Jones, B. (2022). The effect of rugby union match play on sleep patterns and subsequent impact on postmatch fatigue responses. *International Journal of Sports Physiology and Performance*, *17*(6), 852–861. https://doi.org/10.1123/IJSPP.2021-0421
Lincoln, A. E., Caswell, S. V., Almquist, J. L., Dunn, R. E., Norris, J. B., & Hinton, R. Y. (2011). Trends in concussion incidence in high school sports. *The American Journal of Sports Medicine*, *39*(5), 958–963. https://doi.org/10.1177/0363546510392326

Mah, C. D., Kezirian, E. J., Marcello, B. M., & Dement, W. C. (2018). Poor sleep quality and insufficient sleep of a collegiate student-athlete population. *Sleep Health*, *4*(3), 251–257. https://doi.org/10.1016/j.sleh.2018.02.005

Malone, S., Owen, A., Newton, M., Mendes, B., Tiernan, L., Hughes, B., & Collins, K. (2018). Wellbeing perception and the impact on external training output among elite soccer players. *Journal of Science and Medicine in Sport*, *21*(1), 29–34. https://doi.org/10.1016/j.jsams.2017.03.019

Meiselman, H. L. (2016). Quality of life, well-being and wellness: Measuring subjective health for foods and other products. *Food Quality and Preference*, *54*, 101–109. https://doi.org/10.1016/j.foodqual.2016.05.009

Moreland, J. J., Coxe, K. A., & Yang, J. (2018). Collegiate athletes' mental health services utilization: A systematic review of conceptualizations, operationalizations, facilitators, and barriers. *Journal of Sport and Health Science*, *7*(1), 58–69. https://doi.org/10.1016/J.JSHS.2017.04.009

NCAA. (2020). *NCAA Student-Athlete Well-Being Study*. https://www.ncaa.org/sports/2020/5/22/ncaa-student-athlete-well-being-study.aspx

Reardon, C. L., Hainline, B., Miller Aron, C., Baron, D., Baum, A. L., Bindra, A., Budgett, R., Campriani, N., Mauricio Castaldelli-Maia, J., Currie, A., Lee Derevensky, J., Glick, I. D., Gorczynski, P., Gouttebarge, V., Grandner, M. A., Hyun Han, D., Sills, A., Stull, T., Swartz, L., & Jing Zhu, L. (2019). Mental health in elite athletes: International olympic committee consensus statement (2019). *Br J Sports Med*, *53*, 30. https://doi.org/10.1136/bjsports-2019-100715

Rice, S. M., Parker, A. G., Mawren, D., Clifton, P., Harcourt, P., Lloyd, M., Kountouris, A., Smith, B., McGorry, P. D., & Purcell, R. (2020). Preliminary psychometric validation of a brief screening tool for athlete mental health among male elite athletes: The athlete psychological strain questionnaire. *International Journal of Sport and Exercise Psychology*, *18*(6), 850–865. https://doi.org/10.1080/1612197X.2019.1611900

SAS Institute Inc. 2018. *SAS® 9.4 In-Database Products: User's Guide: Eighth Edition*. Cary, NC: SAS Institute Inc.

Saw, A. E., Main, L. C., & Gastin, P. B. (2016). Monitoring the athlete training response: Subjective self-reported measures trump commonly used objective measures: A systematic review. *British Journal of Sports Medicine*, *50*(5), 281–291. https://doi.org/10.1136/BJSPORTS-2015-094758/-/DC1

Saw, A. E., Main, L. C., Robertson, S., & Gastin, P. B. (2017). Athlete self-report measure use and associated psychological alterations. *Sports (Basel, Switzerland)*, *5*(3). https://doi.org/10.1136/bjsports-2015-094758

Silva, A., Narciso, F. V., Rosa, J. P., Rodrigues, D. F., da Silva Cruz, A. Â., Tufik, S., Viana, F., Bichara, J. J., Dias Pereira, S. R., da Silva, S. C., & de Mello, M. T. (2019). Gender differences in sleep patterns and sleep complaints of elite athletes. *Sleep Science*, *12*(4), 242. https://doi.org/10.5935/1984-0063.20190084

Surujlal, J., Van Zyl, Y., & Nolan, V. T. (2013). Perceived stress and coping skills of university student-athletes and the relationship with life satisfaction. *African Journal for Physical, Health Education, Recreation, and Dance*, *19*(4:2), 1047–1059.

Thorpe, R. T., Strudwick, A. J., Buchheit, M., Atkinson, G., Drust, B., & Gregson, W. (2016). Tracking morning fatigue status across in-season training weeks in elite soccer players. *International Journal of Sports Physiology and Performance*, *11*(7), 947–952. https://doi.org/10.1123/ijspp.2015-0490

Tillman, K. S., Sell, D. M., Yates, L. A., & Mueller, N. (2015). Effectiveness of one-time psychoeducational programming for students with high levels of eating concerns. *Eating Behaviors*, *19*, 133–138. https://doi.org/https://doi.org/10.1016/j.eatbeh.2015.08.002

Von Guenthner, S., & Hammermeister, J. (2007). Exploring relations of wellness and athletic coping skills of collegiate athletes: Implications for sport performance. *Psychological Reports*, *101*(3_suppl), 1043–1049. https://doi.org/10.2466/pr0.101.4.1043-1049

Wasserstein, R. L., Schirm, A. L., & Lazar, N. A. (2019). Moving to a world beyond "p < 0.05." *The American Statistician*, *73*(sup1), 1–19. https://doi.org/10.1080/00031305.2019.1583913

Watson, A. M. (2017). Sleep and athletic performance. *Current Sports Medicine Reports*, *16*(6), 413–418. https://doi.org/10.1249/JSR.0000000000000418