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Sleep health and its correlates among male and female military recruits in Jordan: a cross-sectional study

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Abstract

Introduction Determining sleep quality and duration and the factors influencing the quality of sleep among the military is crucial for designing e□ective interventions. Given the strict and demanding nature of the military setting, it becomes essential to explore factors impacting sleep quality in such a context. Additionally, research in the Middle East and among females on this subject is scarce. This study aims to investigate sleep quality and di□erent sleep-related variables such as sleep duration and sleep hygiene practices in addition to the correlates of sleep quality among recruits.

Methods di□erent sleep association between sleep hygiene

ed by gender.

n average had short sleep duration and poor sleep quality. Results showed
ally among women) and more sleep knowledge (particularly among men)
nterventions that use cognitive and behavioral change methods to pro-
owledge are recommended to improve sleep quality among military

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Introduction

Poor sleep health is an underrecognized global public health problem that is strongly associated with morbidity and mortality [1]. Accumulative evidence suggests that insu cient sleep increases the risk of obesity, metabolic syndrome and cardiovascular diseases [2, 3]. Moreover, sleep disruption is also consistently linked to psychiatric symptoms and diseases such as post-traumatic stress disorder (PTSD), substance abuse, and suicidal ideation [4].

Sleep has a significant impact on military personnel as well [5]. A study which was conducted in the U.S. found that short sleep duration (< 5 h) was reported by around 42% of active-duty military personnel [6]. Another study that included around 2000 service members across all branches of the U.S. armed forces found that approximately 18% of the military service members reported using sleep medication [7]. Moreover, evidence showed that military personnel with insomnia symptoms had more absence days from work, poorer self-rated health and a higher probability of discharge from the military [8]. Inadequate sleep among military personnel has also shown to impair attention, judgment, responsiveness, decision-making, and operational readiness [9, 10]. For instance, a study of U.S. Navy personnel who participated in Afghanistan found more accidents among those with fewer sleeping hours [11]. Although studies included both males and females, they seldom included separate results for genders.

Military leaders are becoming increasingly cognizant of the importance of sleep for sustaining performance, safety, and health [5]. However, translating this expanding appreciation for the importance of sleep into practice during military operations constitutes a significant challenge. e military lifestyle often involves stressors like 24-h operations, deployment that involves changes in the sleeping environment, noise, and shift work, hindering restorative sleep [7].

Recruits during basic military training are at high risk of poor sleep health due to the nature of rigorous and unique training schedules [12]. Two studies on basic military training recruits in the US and Australia found reduced sleep duration and quality compared to baseline levels [12, 13].

Sleep quality is a better predictor of health, cognitive, and physical performance and more comprehensive than sleep duration alone [14, 15]. Understanding sleep health, including quality and duration, is essential before developing interventions to improve sleep quality in the military. In addition, it is crucial to assess the etiology of poor sleep quality and then potentially change military

substantial research gap possibly due to less females joining the basic military training than males [26]. Existing studies fall short in providing evidence of whether gender di erences persist when accounting for other sociodemographic and lifestyle factors [27]. Hence, there is a compelling need for further exploration of the factors influencing changes in sleep quality during basic military training, particularly when considering gender di erences. We will assess gender di erence especially regarding the correlates of sleep quality due to limited evidence. Such an exploration is expected to o er valuable insights into the design of military interventions that enhance sleep health and optimize the performance of military personnel.

is study aims to evaluate overall sleep health, encompassing aspects such as sleep quality, daily sleep duration, weekly nap frequency, and sleep hygiene practices. Furthermore, the study aims to explore the correlates of sleep quality among Jordanian military recruits in addition to the potential gender variations in these correlates.

ese possible determinants include sleep hygiene practices, sleep knowledge, age, gender, and BMI. Also, ifestyle correlates will include smoking status, screen time, physical activity, and specific dietary habits (e.g., breakfast, fruit and vegetable consumption).

Methods

Study design

e study applied a cross-sectional design following the guidelines set by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for reporting observational research [28]. A simple random sample was taken from two military colleges of the Jordanian Royal Medical Services in April 2022.

Participants and the military context

A total of 178 first-year military recruits actively participated in this study. One of the military colleges exclusively enrolled females, while the other included both males and females. erefore, the sample consisted of a larger number of females (127) compared to males (51). Eligibility for admission to medical military colleges in Jordan is based on individuals being 18–20 years old, single, possessing a high school diploma, and meeting military medical and fitness criteria. ese recruits undergo 2–4 years of training to qualify as military medical personnel, including roles such as nurse and physiotherapist. Typically, young adults pursuing this training spend their weekdays within the military accommodation and return home for the weekend. e weekly military regimen involves daily physical activities like aerobics and military exercises such as marching, alongside medical training and lectures. Both male and female recruits adhere to the same daily schedule. e military provides three nutritionally balanced meals, designed by licensed dietitians in the military kitchen. Additionally, recruits have the choice to purchase snacks from nearby canteens. Regarding sleeping arrangements, recruits are permitted to rest from 10 p.m. to 5 a.m., with approximately six recruits sharing a room. Moreover, naps are allowed for recruits at the mid of the day.

Procedure

Recruits filled out paper-based questionnaires in Arabic, in a large lecture hall. We prioritized ensuring that participation was voluntary and anonymous, with recruits fully aware of the study's objectives and providing written consent. e majority of recruits (95%) agreed to take part, and the average completion time for the questionnaire ranged from 20 to 30 min.

Variables and measurements

e data collected for the present paper were part of a bigger study that gathered data on several health-relevant behaviours (see our last publication on the motivation determinants of physical activity [29] and for a comparable study in the United Arabic Emirates on the correlates of dietary behaviours [30]). Data for the present study was collected from military recruits by asking the participants to complete the Sleep Hygiene Index (SHI) [31], the Pittsburgh Sleep Quality Index (PSQI) [32] and the Arab Teens Lifestyle Study (ATLS) questionnaire [33]. We also added three questions related to sleep knowledge which are mainly related to the negative consequences of not sleeping the recommended hours. In addition, one question was added related to the stage of change of sleeping 7–9 h [22]. Moreover, self-report data on smoking status, weight and height were collected besides sociodemographic information such as age, sex and place of residency.

Sleep Hygiene Index (SHI)

e SHI is a self-report scale developed by Mastin et al., comprising 13 questions, to evaluate the frequency of engagement (ranging from always to never) in various sleep hygiene practices such as daytime napping, tobacco consumption, and screen usage before bedtime [34]. Each item was rated on a five-point Likert scale (ranging from 0 [never] to 4 [always]). e total scores ranged from 0 to 52. Higher scores indicate more maladaptive sleep hygiene practices. Test–retest reliability of the original questionnaire was evaluated with a sample of approximately 600 subjects and revealed consistent and stable reliability over the testing period (Pearson $r=0.71$) [34]. Evidence for the construct validity was also found as the SHI score was strongly correlated with all features of

inadequate sleep hygiene and significant daytime sleepiness demonstrated by the Epworth Sleepiness scale [34]. In our study, an Arabic-validated version of the SHI was used [35] and showed an internal consistency (Cronbach's alpha) of 0.65.

The Pittsburgh Sleep Quality Index (PSQI)

PSQI is a widely used validated scale, consisting of 19 self-rated items, that di erentiates "poor" from "good" sleep by measuring seven domains: subjective sleep quality, sleep duration, sleep latency, habitual sleep e ciency, sleep disturbances, use of sleep medication, and daytime dysfunction over the last month [36]. e scoring of each domain is ranging from "0" to "3". e global PSQI score is calculated by summing the seven domains. So, the total score of global PSQI ranges from 0–21. A total score of 5 or greater indicates poor sleep quality, while a score below 5 suggests good sleep quality [32]. We used an Arabic-validated version of the PSQI with a convergent validity supported by correlation with insomnia severity index ($r = 0.76$) and acceptable internal homogeneity and consistency as demonstrated by Cronbach's $\alpha = 0.65$ [37]. Our study showed that the internal consistency of this Arabic version of the PSQI (Cronbach's alpha) was 0.74.

e actual sleeping hours per night was assessed by one of the PSQI questions.

Sleep knowledge, stages of change items and number of naps

ree questions were used to assess sleep knowledge. For instance, one question assessed the extent to which participants thought that sleeping less than 6 h sleep a day can lead to severe health problems, such as metabolic disorders and cardiovascular disease. Each item was rated on a five-point Likert scale (ranging from 1 [totally disagree] to 5 [totally agree]). Question scores were summed, so higher scores indicate higher agreement and better knowledge. One item addressed the participant's stage of change regarding the intention of sleeping the recommended hours according to the transtheoretical model [38]. Participants were categorized in one of the five stages of change according to their answers. For instance, those who were not considering sleeping the required hours "I have not even considered sleeping 7 to 9 h a day" were in the pre-contemplation stage while those who slept the recommended hours for the last 6 months were in the maintenance stage. Additionally, we added one question related to the number of naps taken per week.

The Arab Teens Lifestyle Study Questionnaire (ATLS)

e ATLS questionnaire is a standardized and validated instrument to assess physical activity levels and other lifestyle behaviors such as nutritional and sedentary behaviors among Arabic adolescents. e evidence of the convergent validity of the questionnaire has been provided by the questionnaire developer [33]. Regarding physical activity, the questionnaire collects complete information on the frequency, duration, and intensity of various activities during a typical week. Moreover, the questions cover di erent domains such as transport, the household, fitness (e.g., calisthenics) and sports activities (e.g., swimming).

e total Metabolic Energy of Task (METs)-min /week is a standardized metric that represents the total energy expenditure during the week by multiplying the intensity of each exercise by the time spent on the exercise and frequency per week. ere are three categories for physical activity levels according to the total METs/week: low, medium and high. e inactive level is assigned for those with less than 600 METs-min/week; while the minimally active is for those with 600–1499 METs-min/week and finally the highly active level for those who perform 1500 or higher METs-min/week [39].

Ten questions assess di erent healthy and unhealthy dietary behaviors by asking participants how many times per week they consume breakfast, vegetables, fruit, milk/dairy products, donuts/cakes, sugar-sweetened drinks, sweets and chocolates, energy drinks, and fast foods. Subjects can choose answers ranging from zero intake to a maximum intake of 7 days per week [39]. e total screen time is collected by asking about di erent sedentary activities such as television viewing, and computer and internet use [39].

Ethics

e study was approved by the Royal Medical Services Human Research Ethics Committee in Jordan (3/2022) in accordance with the Declaration of Helsinki.

Statistical analysis

e IBM SPSS Statistics version 28 was used for all analyses. Firstly, descriptive analysis was performed for all variables including the demographic variables in addition to sleeping, dietary, and physical activity behaviors, using means, standard deviations, and proportions. Secondly, bivariate Spearman correlation analysis was conducted to assess correlations between possible correlates and the global sleep quality score as variables were not normally distributed. Potential correlates included age, BMI, total screen time, total METs-min/week, sleep knowledge score, dietary behaviors (e.g., the frequency of breakfast intake), sleep knowledge and the sleep hygiene index score. Finally, hierarchical multiple regression was conducted to assess the association between sleep quality and possible correlates. We were especially interested

in whether sleep-related variables were related to sleep quality after controlling for socio-demographic and lifestyle variables. Socio-demographic variables were entered in Model 1 (age, sex and BMI). In Model 2, lifestyle variables (screen time, smoking, dietary and physical activity behaviors) were entered after adjusting for the socio-demographic variables. Finally scores on the sleep hygiene index and knowledge were entered in Model 3, after adjusting for socio-demographic and lifestyle variables. All assumptions of multiple linear regression such as multicollinearity, homoscedasticity and normal distribution of residuals were met. e selection of the best model was done according to the adjusted R^2 and R^2 change, the F statistic change, and the statistical significance of this change. All analyses were conducted for the overall sample and for males and females separately. To justify starticification by gender, sleep hygien and sleep knowedge terms variables will be created and entered in the regression model to test their association with the global sleep quality score.

Results

Participants

Table 1 presents the basic descriptive characteristics of the sample. e median age of participants was 19 years, while the median BMI was around 22 kg/m^2. Approximately, one-third of the participants were males and two-thirds were females. e majority of the participants (70%) were from the Royal Medical Services College of Allied Professions, 30% were from Prince Muna College of Nursing. Also, 17% of participants were current smokers. Participants' permanent residence included all Jordanian governorates; 15% of them lived in Amman. A post-hoc power analysis was performed using G*Power software for multiple regression, indicating that the sample size ($n = 178$) was su cient, with an achieved power of 0.92. e analysis was based on an e ect size of 0.15, a significance level (α) of 0.05, and 14 predictors [40].

Table 1 Characteristics of the sample of recruits ($n = 178$)

Variables	Mean	Standard deviation
Age (years)	19.2	0.7
BMI (kg/m2) Mean ± SD	22.3	2.8
	Percentages	
Military college		
Prince Muna College of Nursing	30.5%	
Royal Medical Services College of Allied Professions	69.5%	
Gender		
Males	29.7%	
Females	70.3%	
Current smoking		
Yes	17.3%	
No	82.7%	
Original residency		
Amman	14.6%	
Outside Amman	85.4%	

Basic characteristics of sleep health, stages to sleep and lifestyle behaviors

Table 2 presents the results on di erent aspects of sleep health (sleep quality score, sleep hygiene index, sleep duration) in addition to physical activity levels and selected dietary behaviors. Around 80% of military recruits showed poor sleep quality (PSQI score > 5) with a rather high mean (PSQI score = 7). Scores within the seven sleep quality domains ranged from 0.3 to 1.4 with higher scores in subjective sleep quality and daytime sleep dysfunction domains indicating reduced overall satisfaction with sleep quality. ese findings suggest a potential impact of sleep on the daily lives of the recruits. Recruits had an average SHI score of 21 with significantly better sleep hygiene practices among females in comparison to males. Moreover, the most common poor hygiene practices included consuming tobacco/ca eine 4 h before sleeping, sleeping in an uncomfortable bed or bedroom and exercising to the point of sweating within 1 h before going to bed. Approximately, 65–75% of recruits stated always or frequently engaging in such habits (see Appendix 1).

e average actual sleep duration was approximately 6 h per night, falling short of the recommended 7 h. Almost one-third of the males report sleeping less than 5 h. Around 35% of recruits had the recommended actual hours of sleep per night with a higher percentage among females than males. Recruits reported to nap on average around 3 days per week.

Concerning the stages of change, 18% of recruits currently were not considering meeting the recommended sleep duration. Around 23% planned to achieve the required hours within the next 30 days, and 13% had intentions to do so in the next 6 months. Furthermore, 11% of recruits stated meeting the 7–9 h of sleep recommendation for less than 6 months, whereas 25% have maintained this duration for more than 6 months. Recruits demonstrated good sleep knowledge as the mean score was around 13 (out of 15). e item reflecting the lowest level of knowledge was that insu cient sleep, below the recommended duration, contributes to serious health issues. Only 66.7% of participants agreed or totally agreed with this statement (refer to Appendix 1).

Correlates of sleep quality

Table 3 depicts the bivariate correlations between the overall score of the PSQI, and possible correlates for both men and women, and for the whole sample. e bivariate correlation analysis of the overall sample revealed that smoking, sleep hygiene and age were positively and significantly correlated with the PSQI score. is implies that recruits with older age, suboptimal sleep hygiene practices and smokers were more prone to poor sleep quality. Additionally, there was a negative correlation between the frequency of weekly breakfast intake and the PSQI score, suggesting that individuals who consumed their breakfast less frequently, generally exhibited

means that the lower the frequency of fruit intake, the poorer the sleep quality. Age was significantly and positively correlated with the PSQI which means that the older the male recruit, the poorer his sleep quality. For females, age and sleep hygiene index scores and total METs/week were positively correlated with the PSQI.

is suggests that among female recruits, those with an older age, suboptimal sleep hygiene practices, and those engaging in higher-intensity physical activity tended to experience lower sleep quality.

Regression analyses

Collinearity diagnostics showed that all VIF values were ≤ 3, indicating no significant multicollinearity among the predictors (see Table 4). A multiple linear regression analysis for the whole sample indicated that age (as demonstrated by model 1) was significantly and positively correlated with the overall PSQI score. Addi-

Our study found poorer scores in most PSQI subdomains compared to the Chinese Armed Forces study, except for better scores in sleep e ciency and sleep

study which was conducted in Ethiopia (although in that study a higher percentage of male had good sleep quality [48]). Several factors may contribute to the observed lower sleep quality and sleep duration among male recruits such as perceiving of less sleeping as a sign of

sleep hygiene practices. ere is a prevalent belief within the military that young individuals need to be hardened as part of their introduction into the military culture [55].

us, it is important to creat a military culture and policies that recognize and address the importance of sleep from a public health perspective at the macrosystem level. is would help to initiate dedicated campaigns that emphasize the importance of sleep health to overall physical readiness.

Conclusion

To the best of our knowledge, this is one of the first studies that aimed to gain insight on sleep health among male and female recruits in Jordan and the Middle East. Additionally, it aimed to assess relevant correlates of sleep quality. Our results showed that sleep hygiene and sleep knowledge were correlated with better sleep quality. Additionally, higher age predict poorer sleep quality. Future interventions should target these correlates through cognitive and behavioral change approaches that include sleep knowledge and sleep hygiene tips. Moreover, creating a supportive military environment that encourages healthy sleeping practices can improve sleep quality among recruits.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-21455-7.

Additional file 1.

Additional file 2.

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Authors' contributions
AM, RM, and SK conceptualized the study. AM performed the statistical analysis and drafted the manuscript. All authors have contributed to the concept of the manuscript, reviewed draft versions and provided critical feedback. All authors have made a significant contribution to this manuscript, and all authors read and approved the final manuscript.

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Data availability
Data is available upon request from the first author.

Declarations

Ethics approval and consent to participate
Ethics approval was obtained from the Royal Medical Services Human Research Ethics Committee in Jordan (3/2022).
Informed consent was obtained from all participants.

Consent for publication
Not applicable.

Competing interests