Sleep Disorders in Female Military Personnel

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INTRODUCTION

- Sleep is an essential biological function and insufficient sleep or the presence of a sleep disorder can negatively impact health.

- Men are more commonly diagnosed with obstructive sleep apnea (OSA) whereas women are more commonly diagnosed with insomnia.

- Comorbid insomnia and OSA (COMISA) negatively impacts health with increased rates of heart disease and mood disorders. There have been few studies that assess the different baseline characteristics of men vs women diagnosed with COMISA.

- The purpose of this study was to assess whether military women with insomnia, OSA, or COMISA have different military service-associated factors or biologic characteristics than military men with the same sleep disorder.

METHODS

- This is a prospective study of active duty service members who presented with a sleep disturbance and were subsequently diagnosed with OSA, insomnia, or COMISA.

- All participants completed a clinical evaluation and questionnaires including baseline demographics and validated clinical assessments.
  - Clinical assessments included the Epworth Sleepiness Scale (ESS), Insomnia Severity Index (ISI), Patient Health Questionnaire (PHQ-9), and Generalized Anxiety Disorder 7-Item (GAD-7).

- All participants underwent level I in-laboratory polysomnography (PSG).
  - For this study, OSA = apnea-hypopnea index (AHI) > 5 events/hour with symptoms consistent with OSA.

- All participants were clinically assessed for insomnia.

Table 1. Sample demographic characteristics

	Entire sample (N=87)	Males (n=66)	Females (n=21)	Un-adjusted p Value
Demographics				
Age, years M±SD	37.7±6.98	37.5±6.99	37.5±7.12	0.882 [A]
BMI, M±SD	28.3±3.39	29.0±3.25	26.4±3.10	0.002 [A,D]
Normal weight, % (No.)	14.9% (13)	9.10% (6)	33.3% (7)	-
Overweight, % (No.)	56.3% (49)	57.6% (38)	52.4% (11)	-
Obese, % (No.)	28.7% (25)	33.3% (22)	14.3% (3)	-
Self-reported measures				
ESS score, M±SD	13.1±4.40	13.2±4.25	12.6±4.93	0.579 [A]
Elevated daytime sleepiness (ESS>10), % (No.)	70.1% (61)	72.7% (48)	61.9% (13)	0.414 [C]
ISI score, M±SD	16.9±5.06	16.6±4.69	17.9±6.07	0.366 [A]
ISI score ≥15, % (No.)	66.6% (58)	68.2% (45)	61.9% (13)	0.605 [C]
GAD score, MD (IQR)	8 (10)	7.5 (9.25)	10 (10)	0.237 [B]
PHQ score, M±SD	9.98±4.85	10.1±4.76	9.62±5.24	0.716 [A]

[A] Comparison with t-test
[B] Comparison with the Wilcoxon Rank Sum test
[C] Comparison with Fishers Exact test
[D] Statistically significant based on post-hoc analysis with the BH-FDR controlling procedure
BMI body mass index in lb/in²; *ESS* Epworth Sleepiness Scale; *ISI* Insomnia Severity Index; *GAD* General Anxiety Disorder 7-Item; *PHQ* Patient Health Questionnaire-9

Table 2. Associated illnesses by sleep disorder and gender

Sleep disorder group	Associated illnesses	Males % (No.)	Females % (No.)	p Value [A]	Odds ratio of females compared to males (95% CI)
OSA only (n=29)	Anxiety	14.8% (4)	50.0% (1)	0.215	-
	Depression	29.6% (8)	0% (0)	0.345	-
Insomnia only (n=26)	Anxiety	54.6% (6)	53.3% (8)	0.257	-
	Depression	81.8% (9)	46.7% (7)	0.101	-
Comorbid Insomnia and OSA (n=32)	Anxiety	60.7% (17)	50.0% (2)	0.583	-
	Depression	64.3% (18)	50.0% (2)	0.413	-

[A] Statistical comparisons between females and males based on multiple logistic regression analysis. P-values adjusted for the effect of age and BMI
[B] Statistically significant according to post-hoc analysis with the BH-FDR controlling procedure
OSA Obstructive Sleep apnea

Table 3. Polysomnographic variables

PSG variables	Entire sample (N=87)	Males (n=66)	Females (n=21)	Un-adjusted p-value	Effect size
SOL (min), MD (IQR)	8.0 (14.3)	7.15 (12.6)	16.5 (20.7)	0.014 [B,C]	0.263 [E]
REM latency (min), MD (IQR)	100 (68)	96.5 (72)	122 (61.8)	0.107 [B,C]	0.173 [E]
TST (hrs), M±SD	6.04±0.609	6.21 (0.690)	5.82±0.697	0.101 [A,C]	0.468 [D]
SE (%), MD (IQR)	88.7 (9.40)	89.5 (7.75)	85.2 (13.8)	0.045 [B,C]	0.214 [E]
N1 (%), MD (IQR)	5.40 (6.30)	6.15 (6.93)	4.00 (5.40)	0.070 [B,C]	0.194 [E]
N2 (%), M±SD	58.6±10.4	57.9±10.8	60.5±8.87	0.292 [A]	-
N3 (%), M±SD	15.3±8.73	14.8±9.06	16.7±7.59	0.349 [A]	-
Stage REM (%), M±SD	19.5±6.59	19.9±6.61	18.4±6.50	0.348 [A]	-
WASO (min), MD (IQR)	34.5 (31.0)	34.5 (31.3)	40.5 (47.8)	0.463 [B]	-
Arousal index (events/h), MD (IQR)	17.9 (10.0)	18.7 (9.0)	15.4 (9.40)	0.064 [B,C]	0.198 [E]
AHI (events/h), MD (IQR)	10.7 (12.9)	12.2 (13.9)	1.8 (8.05)	<0.001 [B,C]	0.457 [E]
SpO2 Nadir (%), MD (IQR)	90 (5)	89.0 (6.00)	93.0 (4.50)	< 0.001 [B,C]	0.420 [E]
REM AHI, MD (IQR)	17.5 (28.5)	20.6 (26.6)	4.15 (18.8)	0.002 [B,C]	0.332 [E]
Non-REM AHI, MD (IQR)	7.9 (11.7)	9.2 (12.4)	1.1 (3.95)	< 0.001 [B,C]	0.482 [E]
PLM index, MD (IQR)	0 (1.5)	0 (1.63)	0 (2.3)	0.749 [B]	-

[A] Statistical comparisons between females and males with t-test
[B] Statistical comparisons between females and males with Wilcoxon rank sum test
[C] Statistically significant according to post-hoc analysis with the BH-FDR controlling procedure
[D] Effect size analysis based on Hedges' g
[E] Effect size analysis based on r
SOL sleep onset latency; *TST* total sleep time; *SE* sleep efficiency; *WASO* wake after sleep onset; *AHI* apnea hypopnea index

DISCUSSION

- Females typically have a higher rate of insomnia with the risk increasing with age. In this study insomnia was more prevalent in females whereas OSA and COMISA were more prevalent in males.
  - On PSG, women had an increased sleep onset latency, shorter total sleep time, and decreased sleep efficiency compared to men. This is consistent with the higher prevalence of insomnia in women.
  - With the exception of BMI, baseline demographics between active duty men and women were similar to include age and self-reported questionnaire scores.

- There was an inverse relationship with years in service and insomnia with a decreased prevalence of insomnia amongst Soldiers with more years in service.
  - Men with insomnia had significantly higher rates of depression compared to other groups.

CONCLUSION

- It appears military women have an overall worse objective sleep quality than men despite a lower diagnostic rate of sleep disordered breathing.

- The scores on the ESS and ISI were the same despite different diagnoses. In the military population, the self-assessments for sleep disorders are not indicative of respective sleep diagnoses.

- It is important to delineate the differences in sleep diagnoses and causative factors between men and women to provide improved recognition and treatment.

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