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Sleep Quality and Fatigue in the General Arab Population: A Multi-Country Cross-Sectional Study

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Article

Keywords:

Posted Date: November 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11151806/v1

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Additional Declarations: No competing interests reported.

Abstract

Poor sleep quality and fatigue are common, but evidence from Arab populations is limited. This study examined their prevalence and associated factors among adults from four Arab countries. A cross-sectional study was conducted between July and September 2026. Sleep quality, fatigue, and psychological distress were assessed using the Pittsburgh Sleep Quality Index, Fatigue Severity Scale, and Kessler Psychological Distress Scale, respectively. Multivariable logistic regression identified factors associated with poor sleep quality and fatigue. Among 1,582 participants (mean age 24.9 ± 8.1 years; 45.9% female), 68.0% had poor sleep quality and 45.7% had fatigue. Psychological distress showed a graded association with poor sleep quality, with higher odds among participants with moderate (AOR = 2.29; CI: 1.66, 3.16), high (AOR = 3.36; CI: 2.42, 4.69), and very high distress (AOR = 8.29; CI: 5.76, 12.05). Rural residence was associated with lower odds of poor sleep quality (AOR = 0.67; CI: 0.51, 0.88). Fatigue was associated with moderate (AOR = 2.12; CI: 1.38, 3.34), high (AOR = 6.61; CI: 4.34, 10.34), and very high psychological distress (AOR = 15.60; CI: 10.09, 24.76), as well as poor sleep quality (AOR = 1.54; CI: 1.18, 2.00). Male sex and sufficient family income with savings were associated with lower odds of fatigue. Given their prevalence, the findings underscore the importance of considering sleep, fatigue, and psychological well-being together.

Introduction

Sleep is a fundamental biological process that is essential for physical recovery, cognitive functioning, and overall health [1]. However, these benefits depend not only on getting enough sleep, but also on its quality [2]. Sleep quality encompasses more than sleep duration and includes factors such as continuity, timing, and how restorative the sleep is [3]. This is important because poor-quality sleep, even when sleep duration is adequate, has been associated with impaired mood and concentration [4], reduced daytime functioning [4, 5], and a range of adverse physical and psychological outcomes [5, 6]. Notably, poor sleep can be attributed to a range of behavioural, environmental, physical, and psychological factors, including irregular sleep schedules, underlying health conditions, and psychological distress [7–9]. Over time, persistent poor-quality or non-restorative sleep may also be accompanied by daytime fatigue, which can further impair overall quality of life [10].

Fatigue is a common experience that can substantially affect a person's ability to function physically and mentally. It encompasses persistent tiredness, reduced endurance, or difficulty sustaining physical or cognitive activity [11]. Importantly, fatigue can arise from a wide range of physical, psychological, and social factors, including acute or chronic illness, psychological distress, and sustained occupational or social demands [12]. Unlike transient tiredness that may resolve with rest, persistent fatigue can interfere with concentration, productivity, daily activities, and quality of life [11, 13]. It has also been associated with poorer mental health across diverse populations [14], representing an important health outcome in its own right.

Notably, both poor sleep and fatigue are common in the general population, although their reported prevalence varies considerably according to the definitions and assessment methods used. Globally, insomnia is estimated to affect approximately 16.2% of adults, corresponding to more than 850 million people worldwide [15]. Broader definitions capture an even larger burden, with around one-third of adults reporting at least one nocturnal insomnia symptom, while approximately 10%–15% meet criteria when daytime consequences are also required [16]. Similarly, fatigue is frequently reported among adults, with a systematic review and meta-analysis estimating a prevalence of 20.4% for general fatigue and 10.1% for chronic fatigue lasting more than six months [17]. These findings indicate that sleep problems and fatigue represent substantial and distinct health burdens in the general population.

Evidence from the Middle East and North Africa (MENA) region indicates a substantial burden of sleep problems and fatigue, although estimates vary considerably across countries and populations. For instance, a recent systematic review reported poor sleep quality estimates ranging from 28% to 60% across MENA populations [18]. Prevalence estimates for insomnia also vary considerably across general adult populations, ranging from 3.0% in Qatar using DSM-5 criteria to 37.6% in Saudi Arabia [19, 20]. Fatigue has also been frequently reported with equally high variations in estimates across studies. For instance, a multi-country survey of 1,333 adults from six Arab countries reported suspected fatigue in 36.6% of participants [21], while other studies have reported estimates as low as 13.5% among Kuwaiti male undergraduates [22], and as high as 88.6% among Saudi university students [23]. Taken together, these findings indicate a substantial burden of sleep problems and fatigue across several Arab populations, while highlighting considerable variation in reported estimates across settings and study populations.

This variation in prevalence estimates of poor sleep quality and fatigue across studies may reflect differences in demographic, socioeconomic, health, and psychological characteristics, in addition to differences in measurement approaches. For instance, sex and age differences have been reported for both sleep quality and fatigue [17, 24], while financial circumstances, health status, and psychological factors have also been associated with these outcomes [7, 8, 12, 17]. Psychological distress is also of particular interest because it has been associated with both poor sleep and fatigue [9, 25, 26]. Notably, studies in Arab populations have also examined these relationships, including associations between psychological distress and sleep quality in Saudi adults [27] and Jordanian medical students [28]. However, differences in populations, measurement tools, and study settings make direct comparison across studies difficult. A multi-country assessment using the same measures can therefore provide a more consistent estimate of the burden of poor sleep quality and fatigue and their sociodemographic and psychological correlates across Arab populations. Accordingly, this study aimed to estimate the prevalence of poor sleep quality and fatigue among Arab adults, and to examine their associations with psychological distress and key sociodemographic characteristics.

Methods

Study design and setting

A multinational cross-sectional analytical study was conducted between July and September 2026. The study targeted adults from the general population of four Arab countries, each selected to represent one of the four major Arab sub-regions: Egypt (the Nile Valley), Libya (the Maghreb), Jordan (the Levant), and Yemen (the Arabian Peninsula), based on the availability of local collaborators. Eligible participants were individuals aged 18 years or older who resided in one of the four target countries and provided informed consent. Individuals younger than 18 years, those residing outside the selected countries, participants with conflicting sleep timing entries, and those who declined consent were excluded.

Sample size

Sample size estimation was performed using the samplingbook package [29] on the R software [30]. A conservative prevalence of 50% was assumed to maximize the required sample size. Based on a 95% confidence level and a 5% margin of error, the initial calculated sample size was 385 participants. To account for non-probability sampling across the four participating countries, a design effect of 4 was applied, yielding a minimum required sample size of 1,540. Ultimately, a total of 1,582 participants were included in the final analysis.

Sampling technique and data collection approach

The required sample size was proportionally distributed across the four selected countries based on their population counts from the World Bank Group website [31]. Accordingly, the planned target allocation was roughly 66.2% for Egypt, 23.1% for Yemen, 6.6% for Jordan, and 4.2% for Libya.

Data were collected using a self-administered electronic questionnaire hosted on Google Forms via convenience sampling. Local data collection collaborators who are university students coordinated survey distribution within their respective countries. The survey link was disseminated across popular social media platforms (e.g., WhatsApp, Facebook, Telegram, and X/Twitter). Participants were informed that participation was voluntary, anonymous, and uncompensated. Owing to the open online distribution of the survey, a response rate could not be calculated. A total of 2,080 responses were received across the four target countries. Participants were excluded because their reported actual sleep duration exceeded their total time spent in bed (n = 498), resulting in a final analyzed sample of 1,582 eligible participants.

Study tool and outcome definitions

Data were collected using an Arabic self-administered electronic questionnaire (Supplementary File 1). The first section captured sociodemographic and health characteristics: age, sex, country of residence (Egypt, Yemen, Jordan, or Libya), area of residence (urban or rural), perceived sufficiency of family income (insufficient, sufficient without saving, or sufficient with saving), employment status (student, employed, or unemployed), marital status (single or married), and highest educational attainment (high

school or less, or tertiary education). Participants were also asked about their smoking status (non-smoker or smoker) and whether they had a diagnosed chronic disease (yes/no).

The second section evaluated sleep quality using the validated Arabic version [32] of the Pittsburgh Sleep Quality Index (PSQI) [33]. The PSQI assesses sleep quality over the previous month across seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored from 0 to 3, yielding a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality. A global score > 5 was used to define poor sleep quality [33].

The third section evaluated fatigue using the validated Arabic version [34] of the Fatigue Severity Scale (FSS) [35]. The FSS is a 9-item instrument used to assess the severity of fatigue and its impact on daily life during the past week. Each item is rated on a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"), producing a mean score between 1 and 7. A mean score of ≥ 4.05 was used to define the presence of fatigue [34].

The fourth section evaluated psychological distress using the validated Arabic version [36] of the 10-item Kessler Psychological Distress Scale (K10) [37]. The K10 measures non-specific psychological distress (symptoms of anxiety and depression) experienced over the past month. Each item is scored on a 5-point Likert scale ranging from 1 ("none of the time") to 5 ("all of the time"), generating a total score between 10 and 50. Total scores were categorized into low (10–15), moderate (16–21), high (22–29), and very high (30–50) psychological distress [38].

Statistical Analysis

Statistical analyses and data summaries were performed using R software [30] and jamovi [39], with tables prepared using the SummaryTables module in jamovi [40]. Categorical variables were presented as frequencies and percentages, while continuous variables (e.g., age) were summarized using means and standard deviations (SD). Factors associated with poor sleep quality and fatigue were identified using univariable and multivariable logistic regression analyses, with crude odds ratios (COR) and adjusted odds ratios (AOR) reported alongside 95% confidence intervals. A p-value < 0.05 was considered statistically significant.

Results

Participant Demographics

A total of 1,582 eligible individuals were included in the study (mean age 24.9 ± 8.1 years; 45.9% female). Most participants were single (84.3%), students (71.3%), resided in urban areas (77.3%), and reported a sufficient family income (88.6%, including 53.6% without saving and 35.0% with saving). Regarding educational attainment, 60.2% had a high school education or less, while 39.8% had attained tertiary education. Geographically, more than half of the participants were from Egypt (58.2%), followed by

Yemen (27.8%), with smaller cohorts from Jordan (7.6%) and Libya (6.3%). A minor proportion were smokers (12.6%) and reported a diagnosed chronic disease (12.1%), while 57.9% exhibited high or very high psychological distress. The overall prevalence of poor sleep quality was 68.0% (95% CI = 65.7%, 70.3%), and the prevalence of fatigue was 45.7% (95% CI = 43.3%, 48.2%) (Table 1).

Sleep Characteristics and Disturbances

Participants reported an average time to fall asleep of 29.1 ± 26.5 minutes, an actual sleep duration of 6.6 ± 2.0 hours per night, an average time spent in bed of 10.6 ± 5.4 hours, and a mean sleep efficiency of 72.1 ± 26.2%. About one-quarter of participants (25.5%) rated their overall sleep quality as fairly bad or very bad, 19.7% reported using sleep medications in the past month, and 45.4% experienced trouble staying awake during daytime activities (Table 2).

Regarding specific sleep disturbances occurring at least once a week, difficulty falling asleep within 30 minutes was the most prevalent complaint (45.0%), followed by waking up in the middle of the night or early morning (38.6%), and having to get up to use the bathroom (34.5%). Other notable disturbances included feeling too cold (21.5%), feeling too hot (19.6%), having bad dreams (22.8%), and having pain (19.1%) (Table 3).

Associated Factors of Poor Sleep Quality

In the multivariable logistic regression analysis, psychological distress, rural residence, and country of residence were significantly associated with poor sleep quality (Table 4). Psychological distress was by far the strongest factor, demonstrating a pronounced dose-response relationship: compared to participants with low distress, those with moderate distress had over two times higher odds of poor sleep quality (AOR = 2.29, 95% CI = 1.66, 3.16, $p < 0.001$), those with high distress had over three times higher odds (AOR = 3.36, 95% CI = 2.42, 4.69, $p < 0.001$), and those with very high distress had more than eight times higher odds (AOR = 8.29, 95% CI = 5.76, 12.05, $p < 0.001$). Conversely, participants residing in rural areas had 33% lower odds of poor sleep quality compared to urban residents (AOR = 0.67, 95% CI = 0.51, 0.88, $p = 0.004$). In addition, participants from Jordan had significantly lower odds of poor sleep quality compared to those from Egypt (AOR = 0.62, 95% CI = 0.40, 0.97, $p = 0.035$). None of the other evaluated variables showed a statistically significant association in the adjusted model.

Associated Factors of Fatigue

The multivariable logistic regression analysis identified psychological distress, sex, sleep quality, and family income as independent factors significantly associated with fatigue (Table 5). Psychological distress was the strongest factor; compared to participants with low distress, the odds of experiencing fatigue were more than two-fold higher for moderate distress (AOR = 2.12, 95% CI = 1.38, 3.34, $p < 0.001$), over six-fold higher for high distress (AOR = 6.61, 95% CI = 4.34, 10.34, $p < 0.001$), and over fifteen-fold higher for very high distress (AOR = 15.60, 95% CI = 10.09, 24.76, $p < 0.001$). Male participants had 60% lower odds of fatigue compared to females (AOR = 0.40, 95% CI = 0.31, 0.51, p <

0.001). Having poor sleep quality was independently associated with 54% higher odds of fatigue compared to good sleep quality (AOR = 1.54, 95% CI = 1.18, 2.00, p = 0.001). In addition, reporting sufficient income with saving was associated with reduced odds of fatigue compared to sufficient income without saving (AOR = 0.66, 95% CI = 0.51, 0.85, p = 0.001). None of the remaining sociodemographic or health variables reached statistical significance in the multivariable model.

Discussion

In this study of a sample of adults from four Arab countries, poor sleep quality and fatigue were relatively common, affecting 68% and 45.7% of participants, respectively. Participants reported an average of 6.6 hours of actual sleep per night, with a mean sleep latency of 29 minutes. Difficulty initiating sleep within 30 minutes and nighttime or early-morning awakening were among the more frequently reported sleep disturbances. In multivariable analyses, psychological distress showed the most consistent association with both outcomes, with progressively higher odds of poor sleep quality and fatigue across increasing levels of distress. Poor sleep quality was also associated with lower odds among participants residing in rural areas and those from Jordan compared with the respective reference groups, while fatigue was associated with sex and family income after adjustment.

Poor sleep quality was reported by 68.0% of participants in our study, which appears higher than those reported in several global studies. For instance, a systematic review of sleep health in low- and middle-income countries [41] reported a pooled prevalence of poor sleep quality of 33.2%, although estimates varied widely across studies. Similarly, a large international survey across ten countries found that approximately 24% of participants reported that they did not sleep well [42]. Within the MENA region, a recent systematic review reported poor sleep quality estimates ranging from 28% to 60% across populations [18]. Our estimate of 68.0% therefore falls toward the upper end, and above, the range reported in that review, suggesting a relatively high burden of poor sleep quality in our sample. One possible explanation is the composition of our sample, which consisted predominantly of young university students. This is consistent with evidence suggesting a substantial burden of poor sleep quality among university students. A systematic review and meta-analysis of African university students reported a pooled prevalence of 63.3% [43], while a meta-analysis among medical students reported poor sleep quality in approximately 55% of participants [44]. Nevertheless, the exact reasons for these differences cannot be inferred from the present study, and direct comparisons should be interpreted cautiously given differences in populations, sampling methods, and definitions of poor sleep.

Notably, participants reported an average of 6.6 ± 2.0 hours of actual sleep per night, which was shorter than the global average of 7.01 ± 1.07 hours reported by Coutrot et al. in a large international sample of 730,187 participants across 63 countries [45]. More recent cross-national evidence also demonstrates substantial variation in sleep duration across countries, with average durations differing by more than 1.5 hours between countries in a 20-country study [46]. The relatively short sleep duration observed in our sample may partly relate to its demographic composition, as 71.3% of participants were university students. Supporting this possibility, Coutrot et al. reported shorter sleep duration among young adults

in tertiary education compared with those with secondary education [45]. On the other hand, nearly 45% of our study's participants reported not being able to get to sleep within 30 minutes at least once weekly, and the mean sleep latency in our sample was 29.1 ± 26.5 minutes. This was slightly longer than the global mean of 24.8 minutes reported in a 2005 ten-country international survey [46], but comparable to the mean sleep onset latency of 31 minutes reported in a recent analysis of objective sleep recordings from 116,879 individuals across 41 countries [47]. These findings suggest that the relatively long sleep latency observed in our sample is broadly within the range reported internationally, although direct comparisons are limited by differences in measurement methods, particularly between self-reported, questionnaire-derived, and objectively measured sleep latency.

In our study, psychological distress was the strongest and most consistent factor associated with poor sleep quality, with a graded association across increasing levels of distress. This pattern is consistent with previous systematic review and meta-analysis of studies conducted during the COVID-19 pandemic that found moderate associations between sleep problems and depression and anxiety in the general population [9]. We also found that rural residence was associated with lower odds of poor sleep quality compared with urban residence. This finding is consistent with some studies reporting a higher prevalence of insomnia or poor sleep among urban populations, including studies from China [48] and India [49]. However, urban-rural differences in sleep have not been consistent across populations, with some studies reporting no significant difference or even higher insomnia prevalence among rural residents [50, 51]. Differences in environmental conditions, socioeconomic circumstances, mental health, and access to services may contribute to these variations [8], although the present study cannot determine the mechanisms underlying the observed association. Importantly, the significant lower odds observed among participants from Jordan should be interpreted cautiously given the relatively small size of this subgroup.

Fatigue was reported by 45.7% of participants in our study, indicating a substantial burden in this population. This estimate was higher than the pooled prevalence of general fatigue of 20.4% reported in a systematic review and meta-analysis of adults from the general population worldwide [17]. It was also higher than the 21.9% prevalence reported in a population-based study of adults aged 45–86 years [52] which similarly utilized the FSS, and the 36.6% prevalence reported in a multi-country survey of 1,333 adults from six Arab countries [21]. Differences in age, fatigue definitions, measurement instruments, and sampling methods likely contribute to these variations and limit direct comparisons. The relatively high prevalence observed in our study may also partly reflect its predominantly young and student-based sample, which often report higher fatigue estimates [23], although this cannot be established from the present data.

In multivariable analysis, we found that males had significantly lower odds of fatigue than females. This finding is consistent with a systematic review and meta-analysis of fatigue in the general population, which found that females had approximately 40% higher odds of fatigue than males [17]. Similarly, the Northern Sweden MONICA study found higher fatigue scores among women across multiple dimensions, particularly among participants younger than 55 years [53]. Several explanations for this

difference have been proposed, including differences in psychological distress, social and occupational demands, and biological responses to stress [54], although the mechanisms underlying the sex difference cannot be determined from our cross-sectional data. We also found that participants who reported that their income was sufficient with saving had significantly lower odds of fatigue. This direction is broadly consistent with the Northern Sweden MONICA study, which also found lower fatigue scores among participants with higher socioeconomic status across several fatigue dimensions [53], while other community-based studies have similarly reported greater fatigue among lower-income or lower-social-class groups [55]. However, the absence of a statistically significant association among participants whose income was sufficient without saving suggests that the relationship in our study was not linear. This finding should therefore be interpreted cautiously, particularly because income was assessed using broad self-reported categories.

Notably, psychological distress showed a clear graded association with fatigue, with adjusted odds increasing from 2.12 for moderate distress to 15.60 for very high distress compared with low distress. Poor sleep quality was also independently associated with fatigue after adjustment. Together with the strong association between psychological distress and poor sleep quality observed in our study, these findings suggest that fatigue, sleep problems, and psychological distress frequently coexist and may represent interrelated aspects of overall well-being among Arab adults. From a practical perspective, the findings support considering sleep and fatigue alongside psychological distress when assessing well-being in this population. Nevertheless, future longitudinal research could help clarify how changes in psychological distress and sleep quality relate to subsequent fatigue and whether addressing these factors is associated with improvements in fatigue.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the cross-sectional design precludes establishing temporal or causal relationships between psychological distress, sleep quality, and fatigue. Second, the use of online convenience sampling through social media platforms may have introduced selection bias, which may limit the generalizability of the findings to the broader Arab population. Third, sleep quality, fatigue, and psychological distress were assessed using self-administered screening tools rather than clinical assessments and may therefore be subject to reporting and measurement biases. Fourth, although the multivariable models adjusted for several sociodemographic and health-related factors, residual confounding from unmeasured factors, such as caffeine intake, physical activity, work or academic schedules, and medication use, cannot be excluded. Finally, the sample included only one country from each of the four Arab regions, which may limit the extent to which the findings represent populations across the wider Arab region.

Conclusions

Poor sleep quality and fatigue were common among the sampled adults from the four Arab countries included in this study. Psychological distress showed a consistent and graded association with both

outcomes, with higher levels of distress associated with greater odds of poor sleep quality and fatigue. Poor sleep quality was also associated with fatigue after adjustment for other factors. These findings suggest that psychological distress, sleep quality, and fatigue frequently coexist in this population and may warrant consideration together in future research and health assessment. Longitudinal studies using more representative samples are needed to clarify the temporal relationships between these factors.

Declarations

Ethics approval and consent to participate

Ethical approval was granted by the Mansoura Faculty of Medicine Institutional Research Board (MFM-IRB), Mansoura University, Egypt (approval code: R.26.06.3765.R1). The study was conducted in accordance with the principles of the Declaration of Helsinki. Participation was voluntary and anonymous, with all participants providing electronic informed consent before completing the online survey at their convenience.

Consent for publication

Not applicable.

Clinical trial number

Not applicable.

Conflict of interest

The authors declare no conflicts of interests.

Funding

No funding or sponsorship was received from any companies, groups, individuals, organizations, or any other entities.

Data Availability

The data of this study is available from the corresponding author upon reasonable request.

Author contributions

MAE, SAK, and AE-G contributed to the conceptualization of the study. MAE, SAK, SA, HK, AA and the Neutromedica Team of Collaborators contributed to data collection. NED conducted the statistical analysis and interpretation of the results. NED, YMO, MAE, SAK, SA, HK, and AA contributed to the writing of the manuscript. NED, YMO, MAE, SAK, and AE-G contributed to the critical intellectual revision of the manuscript. All authors approved the final version of the manuscript.

Acknowledgements

None.

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Tables

Tables 1 to 5 are available in the Supplementary Files section.

Supplementary Files

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- SupplementaryFile1StudyQuestionnaireSleep.docx

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