

Association between war-induced stress and sleeping patterns of university students in Sudan, 2025

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Abstract

Background

Stress is a psychological reaction to challenges that exceeds coping capacity. It can lead to sleep disturbances like insomnia, which can negatively affect mental health and daily life, especially in conflict zones like Sudan. While university students are highly vulnerable to the psychological consequences of war, including distress and insomnia, limited research has been conducted to identify the relationship between war-induced stress and insomnia in Sudan following the outbreak of armed conflict in 2023.

Aim

This research aims to assess the relationship between insomnia and war-induced stress in Sudan among university students.

Method

This cross-sectional study was conducted from March to April 2025 among university students aged 17–35 in Sudan. A self-administered Arabic online questionnaire was distributed. It included socio-demographic data, the validated Perceived Stress Scale (PSS), the Insomnia Severity Index (ISI), and the Exposure to War (EW). Descriptive and inferential analyses were performed with $p < 0.05$ considered significant.

Results

The study included 922 participants with a mean age of 21.1 years, revealing moderate-to-high stress levels (PSS-14 mean = 29.8) and prevalent insomnia (ISI mean = 14.0) among participants, in addition to clinical insomnia among 49.1% of the sample. War exposure (82.3%) was correlated with stress and sleep disturbances; however, direct bomb exposure paradoxically correlated with insomnia ($p = 0.019$). Emigration from the family home was associated with increased insomnia ($p = 0.022$). Females represented 76.7% of the respondents and reported higher stress ($p = 0.001$) and insomnia ($p = 0.002$). Predictably, economic decline worsened insomnia ($p = 0.010$), while emigration increased stress but decreased insomnia severity ($p < 0.001$).

Conclusion

This study reveals a significant association between war-related stress and insomnia, especially among female students and internally displaced individuals, emphasising the urgent demand for accessible mental health and psychosocial support services.

Background

Stress can be defined as any external or internal factor that influences the stability or the internal sense of balance of an individual. However, perceived stress refers to the evaluation of an individual of how much pressure they are under at a given point or period of time (1). People who suffer from high stress levels can be affected by insomnia, which is a sleep disorder characterised by difficulty initiating and maintaining sleep or experiencing short sessions of sleep that are insufficient in total and may lead to depleted daytime functioning (2).

The armed dispute in Sudan between the Sudanese Armed Forces and the Rapid Support Forces broke out on April the 15th, 2023, causing casualties and preventing humans from their life-sustaining support. The conflict expanded to Aljazeera, Darfur, Kordofan, and Sinnar, causing very high tension among the community. However, it is not a separate incident but only an addition to Sudan's history of civil wars, the two civil wars in the south (1955–1972, 1983–2005) (3). In this conflict, 13 million people were displaced, as reported by the United Nations (UN) on 9th April 2025 (4).

Students, especially when loaded with work and study, can be subjected to more stress (5). In a recent study conducted in 2020 among Sudanese medical students about sleeping disorders, the majority of the students (82.5%) suffered from poor sleep quality, and 56.5% were facing severe daytime sleepiness (6). In a six-year-long study before and after the announcement of COVID-19, 11,597 students from 60 different countries reported a score indicative of insomnia, and 5,442 reported daytime sleepiness. Additionally, 73.6% of the students reported their sleeping duration as insufficient (5).

In the context of war, it has been shown that exposure to armed conflict among students is related to increased stress and sleep disturbances. In a study conducted among Ukrainian university students during the Ukrainian war, more than half of the students were shown to have sleep problems, and 48.1% had post-traumatic stress (7). On a regional level, a study in Yemen displayed that war-related stress was the second highest source of perceived stress among Yemeni dental students (8). Moreover, a Syrian study reported a high level of war-related posttraumatic stress among university students in Deir-ez-Zor (9). Furthermore, a study conducted among war-exposed students in Gaza displayed that 56% of the participants reported having recurrent post-traumatic nightmares (10).

High levels of war-induced stress were also shown among Sudanese students following the onset of the war. In 2024 a Sudanese study showed high levels of psychological stress among Khartoum University students in war-afflicted regions (11). In addition, a study conducted among Darfuri female university students at Ahfad University in Omdurman displayed a significant relationship between war-related trauma and Post-Traumatic Stress Disorder (12). However, there is inadequate data on the impact of war-related stress on insomnia and sleeping patterns among Sudanese students. Sleeping issues, if not addressed properly, can cause adverse consequences (4). Although low hours of sleep are known to cause impaired functioning of the brain (13), it is not determined to what extent this impairment is persistent.

Mental issues are often a neglected subject, with developing countries neglecting the issue more during disasters (14). Understanding the impact of the war-induced mental issues on Sudanese university students will help to develop coping mechanisms to address the issue properly. Our research aims to investigate the effect of war-induced stress on the sleeping patterns of university students.

Methodology

Study Design:

An observational cross-sectional study was conducted online from 15 March to 29 April 2025.

Study population

All participants were university students from different disciplines, including medicine, dentistry, nursing, pharmacy, engineering, computer fields and others. It included students from the first year of college to the 6th year, provided that they had experienced war. The study excluded students who were unwilling to participate in the study.

Sample Size and Sampling Technique

This study employed a non-probability convenience sampling approach to investigate the effect of war-induced stress on the sleeping patterns of university students in Sudan. This was due to the unavailability of lists of the entire student population, along with the lack of connection and sustainable access to all students. Therefore, non-probability sampling was deemed a more suitable alternative, allowing for the selection of participants based on availability and accessibility.

The sample size was calculated using Cochran's formula for single-proportion estimates in cross-sectional studies:

$$n = Z^2 P(1 - P)/d^2$$

Where $Z = 2.326$ for 98% confidence, $P = 0.5$ (assumed prevalence for maximum variability), and $d = 0.04$ (margin of error). This yielded a minimum sample size of 849. We ultimately got 922 participants, which exceeds the minimal required sample size.

Data Collection

Data was collected using a self-designed Arabic Google Forms questionnaire that is distributed through different social media platforms: Facebook, WhatsApp, etc. It applies two valid scales and is composed of seven sections. All participants were fully informed that all collected data is anonymous, ensuring confidentiality.

The first section requests the participants' written consent to participate in the research. In addition, it asks whether they were present in a war zone in Sudan during the past year and whether they are university students.

The second section enquires about the participants' demographics, university, and faculty, as well as the academic year, employment status, monthly income, displacement status (internally displaced, emigrant, or still in a conflict zone), and, finally, current residence.

The third section enquires about the general health of the participants in terms of how they would rate their overall health, substance use, presence of any chronic illnesses, recent illness or injuries (past month), any current medication, diet, physical activity, and how often they follow the news.

The fourth section investigates the effects of war on the continuity of the participants' university education as well as the generic effects of war, including displacement, emigration, injury, violence, sexual violence, financial difficulty, malnutrition, and loss of a loved one (family/friends).

The fifth section is titled "Exposure to War", which was used in a previous study (15). In the context of the Russia-Ukraine war, it was designed by the researchers themselves. However, one question was removed, which is "Hiding in a bomb shelter", due to the absence of bomb shelters in Sudan. Note that this section was translated from English to Arabic and then translated back to English by two different bilingual speakers. A comparison between versions was conducted and revised by an expert to ensure clarity and accuracy. The sixth section involves the Arabic version of the validated Perceived Stress Scale (PSS) (Cronbach's alpha is 0.80) (16). The Perceived Stress Scale (PSS; Cohen et al., 1983) is a 14-item instrument designed to measure the degree to which situations in one's life are appraised as stressful. PSS items were designed to tap the degree to which respondents found their lives unpredictable, uncontrollable, and overloading. The scale also includes a number of direct queries about current levels of experienced stress (17).

The seventh section applies the Arabic version of the validated Insomnia Severity Index (ISI) (18) (internal consistency reliability was 0.84). Designed as a brief screening tool for insomnia, the seven-item questionnaire asks respondents to rate the nature and symptoms of their sleep problems using a Likert-type scale. It includes four categories of insomnia: 0–7, no clinically significant insomnia; 8–14, subthreshold insomnia; 15–21, moderate clinical insomnia; and 22–28, severe clinical insomnia. Questions relate to subjective qualities of the respondent's sleep, including the severity of

symptoms, the respondent's satisfaction with his or her sleep patterns, the degree to which insomnia interferes with daily functioning, how noticeable the respondent feels his or her insomnia is to others, and the overall level of distress created by the problem (19).

To minimise the misunderstanding of questions of the questionnaire, we started with a pilot study on a small sample and received students' feedback on the survey's clarity. It included 31 participants. Pilot results showed acceptable internal consistency with a Cronbach's alpha of 0.79.

Data Analysis:

Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise socio-demographic, health, educational, and war exposure characteristics of the participants. Bivariate analyses were conducted to examine differences across key variables. Multiple linear regression models were applied to identify socio-demographic, health, and war exposure predictors of stress and insomnia. Regression coefficients (Est.), standard errors (SE), 95% confidence intervals (CI), and p-values were reported. Independent variables included gender, age, academic year, marital status, monthly income, university continuity post-war, news follow-up frequency, conflict zone experience, health conditions, and specific war-related exposures such as displacement, emigration, economic challenges, malnutrition, and loss of relatives or friends. Interaction effects between stress and insomnia were also tested by including each as a predictor in the regression models of the other. Statistical significance was set at $p < 0.05$.

Results

Demographic, Health, and Educational Characteristics:

A total of 922 participants were included in the study, with the majority being female (76.7%) (Table 1). The mean age was 21.1 years (SD = 2.2), ranging from 17 to 35 years. A significant proportion (82.3%) reported experiencing the ongoing conflict in Sudan. In terms of education, most students (75.2%) continued their studies via online learning, while a small fraction (9.1%) attended in-person education inside or outside Sudan. Regarding health status, 41.3% reported having a very good general health condition, while 8.4% had chronic illnesses, and 26.8% had experienced a specific illness or injury in the past month. Socioeconomic data revealed that 39.8% had a monthly income between 100,000 and 400,000 SDG, and dietary balance varied, with 55.9% reporting a somewhat balanced diet and only 14.1% consuming a fully nutritious diet.

War Exposure Indicators:

Participants reported varying degrees of exposure to war-related events (Table 2). Direct exposure to bomb explosions was uncommon, with 83.3% never experiencing such an event, while 5.6% encountered it once. Hospitalisation due to war injuries was rare, affecting only 2% of the sample. Emigration from family homes was widespread, with 28.9% having to relocate once and 23.9% more than twice. Nearly half (49.1%) had relatives actively involved in combat, and 35.4% reported having a relative who was hospitalised or deceased due to war-related incidents. Economic deterioration was a major concern, with 38.3% experiencing severe financial losses. Additionally, 71.3% of participants had friends or relatives who emigrated due to the conflict, reflecting the widespread impact of war-related displacement (Fig. 1).

Table 1
Demographic, Health, and Educational Characteristics of Survey Participants (N = 922)

Category	Response	Frequency (Percentage)
Conflict Zone Experience in Sudan	Yes	759 (82.3%)
	No	163 (17.7%)
Gender	Male	215 (23.3%)
	Female	707 (76.7%)
Age	Mean (SD)	21.1 (2.2)
	Range	17.0–35.0
Academic Year	First Year	251 (27.2%)
	Second Year	214 (23.2%)
	Third Year	262 (28.4%)
	Fourth Year	100 (10.8%)
	Fifth Year	76 (8.2%)
	Sixth Year	19 (2.1%)
Marital Status	Single	889 (96.4%)
	Married	33 (3.6%)
Monthly Income (SDG)	Less than 100,000	204 (22.1%)
	100,000–400,000	367 (39.8%)
	400,000–700,000	173 (18.8%)
	700,000–1,000,000	91 (9.9%)
	More than 1,000,000	87 (9.4%)
University Continuity Post-War	Continued with in-person education in several centers (inside & outside Sudan)	84 (9.1%)
	Continued in-person education in another country outside Sudan	24 (2.6%)
	Continued attending school in another state inside Sudan	45 (4.9%)
	Continued distance learning (online)	693 (75.2%)
	No	76 (8.2%)
News Follow-Up Frequency	Never	87 (9.4%)
	Several times a week	192 (20.8%)
	Several times a day	243 (26.4%)
	Once a day	117 (12.7%)
	Rarely	283 (30.7%)
General Health Condition	Good	278 (30.2%)

Category	Response	Frequency (Percentage)
	Very Good	381 (41.3%)
	Bad	34 (3.7%)
	Excellent	229 (24.8%)
Chronic Diseases	No	845 (91.6%)
	Yes	77 (8.4%)
Past Month Specific Illness/Injury	No	675 (73.2%)
	Yes	247 (26.8%)
Current Treatment for any Disease	No	776 (84.2%)
	Yes	146 (15.8%)
General Diet Balance	Unbalanced and not nutritious (lacking necessary nutrients)	55 (6.0%)
	Not balanced or nutritious enough	217 (23.5%)
	Very balanced and nutritious	5 (0.5%)
	Very balanced and nutritious (contains all necessary nutrients)	130 (14.1%)
	Balanced and somewhat nutritious	515 (55.9%)

Stress and Insomnia Characteristics:

The mean Perceived Stress Scale (PSS-14) score was 29.8 (SD = 7.7), indicating moderate to high stress levels among participants. Insomnia was also prevalent, with a mean Insomnia Severity Index (ISI) score of 14.0 (SD = 6.4). Severe clinical insomnia was reported by 12.0% of participants, while 37.1% experienced clinical moderate insomnia. An additional 33.4% had sub-threshold insomnia, leaving only 17.5% with no significant sleep disturbances (Table 3).

Table 2
War Exposure Indicators among Survey Participants (N = 922)

Indicator	0	1	2	3	4	5	6	7
EW1: Direct exposure to a bomb explosion	768 (83.3%)	52 (5.6%)	38 (4.1%)	25 (2.7%)	4 (0.4%)	35 (3.8%)	—	—
EW2: Hospitalization for war injuries	901 (97.7%)	12 (1.3%)	4 (0.4%)	2 (0.2%)	—	3 (0.3%)	—	—
EW3: Emigration from the family home	186 (20.2%)	266 (28.9%)	220 (23.9%)	137 (14.9%)	38 (4.1%)	75 (8.1%)	—	—
EW4: Fighting soldiers among relatives	453 (49.1%)	150 (16.3%)	98 (10.6%)	66 (7.2%)	24 (2.6%)	131 (14.2%)	—	—
EW5: Hospitalization or death of relatives	326 (35.4%)	215 (23.3%)	148 (16.1%)	68 (7.4%)	28 (3.0%)	137 (14.9%)	—	—
EW6: Emigration of relatives or friends	83 (9.0%)	45 (4.9%)	78 (8.5%)	38 (4.1%)	21 (2.3%)	657 (71.3%)	—	—
EW7: Deterioration of economic status	85 (9.2%)	125 (13.6%)	153 (16.6%)	151 (16.4%)	55 (6.0%)	353 (38.3%)	—	—
Number of types of exposure to war experienced	14 (1.5%)	27 (2.9%)	60 (6.5%)	190 (20.6%)	309 (33.5%)	244 (26.5%)	67 (7.3%)	11 (1.2%)
<i>Note.</i> The response scale differ for particular items: EW1 (0 = never, 5 = very often), EW2 and EW3 (0 = not once, 5 = 5 times or more), EW4, EW5 and EW6 (0 = nobody, 5 = 5 persons or more), EW7 (0 = no changes, 5 = big loss, big deterioration).								

Socio-Demographic Predictors of Stress and Insomnia:

Regression analyses revealed significant associations between various demographic factors and stress or insomnia severity (Table 4). Female participants had significantly higher PSS-14 and ISI scores compared to males ($p = 0.001$ and $p = 0.002$, respectively). Age was positively associated with stress ($p = 0.007$) but was not a significant predictor of insomnia. Academic standing played a role, with final-year students exhibiting lower stress and insomnia scores compared to third-year students. Monthly income did not significantly influence stress or insomnia scores. Interestingly, participants in conflict zones reported significantly lower ISI scores ($p = 0.019$), suggesting possible adaptation or resilience mechanisms.

Impact of War-Related Effects on Stress and Insomnia:

War-related adversities were significant predictors of both stress and insomnia (Table 5). Emigration was associated with significantly higher stress levels ($p < 0.001$) but lower insomnia severity ($p < 0.001$), while internal relocation alleviated sleep disturbances and increased distress. Economic challenges ($p < 0.001$) and malnutrition ($p = 0.018$) were linked to lower stress scores, while malnutrition was a significant predictor of higher insomnia severity ($p < 0.001$). The loss of a relative or close friend was significantly associated with increased insomnia severity ($p = 0.030$). Notably, higher insomnia scores were predictive of greater stress levels ($p < 0.001$), reinforcing the strong interplay between sleep disturbances and psychological distress.

War Exposure Predictors of Stress and Insomnia:

Further regression analysis (Table 6) examined the specific effects of different war exposure types. Direct exposure to bomb explosions was associated with significantly lower ISI scores ($p = 0.019$), possibly due to habituation or resilience factors. Emigration from the family home ($p = 0.022$) and economic deterioration ($p = 0.010$) were significant predictors of

increased insomnia severity. Conversely, hospitalisation or death of a relative significantly reduced stress scores ($p = 0.007$), which may indicate emotional numbing or coping mechanisms among affected individuals. These findings highlight the complex relationship between war exposure and psychological well-being, with certain traumatic events exacerbating sleep disturbances while others contribute to varied stress responses.

Table 3
Stress and Insomnia Characteristics of Survey Participants (N = 922)

Measure	Mean (SD)\ Frequency (%)	95% CI	Range
PSS-14 Score	29.8 (7.7)	[29.3, 30.3]	2.0–50.0
Insomnia Severity Index	14.0 (6.4)	[13.6, 14.4]	0.0–28.0
Insomnia Severity Categories			
Clinical insomnia (severe)	111 (12.0%)	[10.0%, 14.3%]	
Clinical insomnia (moderate severity)	342 (37.1%)	[34.0%, 40.3%]	
Sub-threshold insomnia	308 (33.4%)	[30.4%, 36.5%]	
No clinically significant insomnia	161 (17.5%)	[15.1%, 20.1%]	

Table 4

Combined Regression Results for socio-demographic predictors of PSS-14 Score and Insomnia Severity Index (N = 922)

Predictor	PSS-14 Score					Insomnia Severity Index				
	Est.	SE	Lower	Upper	p	Est.	SE	Lower	Upper	p
Conflict Zone (No – Yes)	0.1262	0.669	-1.186	1.4386	0.850	-1.3080	0.555	-2.398	-0.218	0.019
Gender (Female – Male)	1.9769	0.620	0.760	3.1935	0.001	1.5815	0.515	0.571	2.592	0.002
Age	0.4633	0.173	0.124	0.8026	0.007	0.1761	0.144	-0.106	0.458	0.220
Academic Year: First Year – Third Year	-0.2021	0.696	-1.569	1.1646	0.772	-0.0823	0.578	-1.217	1.052	0.887
Academic Year: Second Year – Third Year	-1.0370	0.738	-2.485	0.4114	0.160	-0.4062	0.613	-1.609	0.796	0.508
Academic Year: Fourth Year – Third Year	-0.0234	1.024	-2.033	1.9859	0.982	0.2834	0.850	-1.385	1.952	0.739
Academic Year: Fifth Year – Third Year	-0.3613	1.248	-2.811	2.0880	0.772	-1.2436	1.036	-3.277	0.790	0.230
Academic Year: Sixth Year – Third Year	-3.8674	1.963	-7.719	-0.0153	0.049	-4.3942	1.630	-7.592	-1.196	0.007
Marital Status (Married – Single)	-1.6828	1.402	-4.434	1.0687	0.230	-0.5394	1.164	-2.824	1.745	0.643
Monthly Income in SDG: Less than 100,000–400,000/700,000	0.8058	0.804	-0.772	2.3837	0.316	-0.7038	0.668	-2.014	0.606	0.292
Monthly Income in SDG:100,000–400,000–400,000/700,000	-0.3926	0.710	-1.786	1.0003	0.580	-0.4647	0.589	-1.621	0.692	0.431
Monthly Income in SDG:700,000–1,000,000–400,000/700,000	-0.5883	1.007	-2.564	1.3877	0.559	-0.1017	0.836	-1.742	1.539	0.903
Monthly Income in SDG: More than 1,000,000–400,000/700,000	-1.9274	1.011	-3.912	0.0569	0.057	0.1736	0.839	-1.474	1.821	0.836
University Continuity: Continued physical education in another country – In-person education	-0.7948	1.793	-4.313	2.7232	0.658	-0.8094	1.488	-3.730	2.111	0.587
University Continuity: Continued	1.3033	1.424	-1.492	4.0989	0.360	-0.8780	1.183	-3.199	1.443	0.458

Predictor	PSS-14 Score					Insomnia Severity Index				
	Est.	SE	Lower	Upper	p	Est.	SE	Lower	Upper	p
attending school in another state – In-person education										
University Continuity: Continued distance learning (online) – In-person education	1.4492	0.910	-0.336	3.2345	0.111	-0.7249	0.755	-2.207	0.757	0.337
University Continuity: No – In-person education	-0.0199	1.251	-2.476	2.4361	0.987	-1.7385	1.039	-3.778	0.301	0.095
How much do you follow the news? Never – Once a day	0.2019	1.094	-1.946	2.3498	0.854	0.2472	0.909	-1.536	2.031	0.786
News Follow-Up: Several times a week – Once a day	-0.8828	0.909	-2.667	0.9013	0.332	0.3086	0.755	-1.173	1.790	0.683
News Follow-Up: Several times a day – Once a day	0.3802	0.873	-1.334	2.0945	0.664	0.5446	0.725	-0.879	1.968	0.453
News Follow-Up: Rarely – Once a day	-0.7864	0.850	-2.455	0.8818	0.355	0.8661	0.706	-0.519	2.251	0.220

Table 5

Combined Regression Coefficients for war related effects predictors of PSS-14 Score and Insomnia Severity Index

Predictor	PSS-14 Score					Insomnia Severity Index				
	Est.	SE	Lower	Upper	p	Est.	SE	Lower	Upper	p
Displacement (No – Yes)	0.14371	0.6000	– 1.034	1.321	0.811	0.2193	0.4912	– 0.745	1.1833	0.655
emigration (No – Yes)	2.04555	0.4888	1.086	3.005	< .001	– 2.8633	0.3928	– 3.634	– 2.0925	< .001
Injury (No – Yes)	0.00263	0.8368	– 1.640	1.645	0.997	0.4693	0.6850	– 0.875	1.8137	0.493
Violence (No – Yes)	– 1.37736	0.8025	– 2.952	0.198	0.086	0.0125	0.6581	– 1.279	1.3041	0.985
Sexual Violence (No – Yes)	– 2.23502	2.3329	– 6.813	2.343	0.338	3.0809	1.9083	– 0.664	6.8262	0.107
Economic Challenges (No – Yes)	– 2.43649	0.5673	– 3.550	– 1.323	< .001	– 0.2823	0.4691	– 1.203	0.6383	0.547
Malnutrition (No – Yes)	– 1.39164	0.5895	– 2.549	– 0.235	0.018	– 1.7719	0.4806	– 2.715	– 0.8287	< .001
Friends/Relatives Death (No – Yes)	– 0.59108	0.5096	– 1.591	0.409	0.246	– 0.9058	0.4165	– 1.723	– 0.0884	0.030
Insomnia Severity Index (Predictor in PSS-14 model)	0.36251	0.0386	0.287	0.438	< .001	–	–	–	–	–
PSS-14 Score (Predictor in ISI model)	–	–	–	–	–	0.2430	0.0259	0.192	0.2938	< .001

Table 6

Combined Regression Coefficients for war exposure predictors of PSS-14 Score and Insomnia Severity Index Models

Predictor	PSS-14 Score					Insomnia Severity Index				
	Est.	SE	Lower	Upper	p	Est.	SE	Lower	Upper	p
Direct exposure to a bomb explosion (No – Yes)	-0.8071	0.709	-2.198	0.584	0.255	-1.357	0.577	-2.49	-0.2253	0.019
Hospitalization for war injuries (No – Yes)	-0.0350	1.747	-3.464	3.394	0.984	-0.553	1.422	-3.34	2.2380	0.698
Emigration from the family home (No – Yes)	0.6910	0.670	-0.624	2.006	0.303	-1.253	0.545	-2.32	-0.1825	0.022
Fighting soldiers among relatives (No – Yes)	0.0318	0.531	-1.010	1.073	0.952	-0.516	0.432	-1.36	0.3321	0.233
Hospitalization or death of relatives (No – Yes)	-1.5318	0.566	-2.643	-0.421	0.007	-0.853	0.461	-1.76	0.0513	0.064
Emigration of relatives or friends (No – Yes)	0.1414	0.950	-1.723	2.006	0.882	-0.494	0.773	-2.01	1.0235	0.523
Deterioration of economic status (No – Yes)	-1.9759	0.921	-3.783	-0.169	0.032	-1.932	0.749	-3.40	-0.4621	0.010

Discussion

Although numerous studies have found a relationship between exposure to war and insomnia (15)(20), there is little known regarding the prevalence and associations of war-induced stress and sleep disturbances among the Sudanese population. This study reveals a significant prevalence of psychological distress and insomnia among university students in Sudan during the ongoing conflict.

The mean Perceived Stress Scale (PSS-14) score among the participants was 29.8, and the mean Insomnia Severity Index (ISI) score was 14. Approximately half of the student participants met the diagnostic criteria for clinical insomnia. Furthermore, our findings revealed that high insomnia scores are associated with increased stress levels, indicating that managing insomnia could be a key to alleviating stress.

Previous research illustrates that students are more liable to experience insomnia compared to the general population (21). In a conflict zone like Sudan, the risk of developing insomnia among university students is heightened due to facing potential stress caused by war exposure. In our study, only 17.5% of participants reported no significant sleep disturbances, while 12% reported severe clinical insomnia and 37.1% experienced moderate insomnia. That points to a problematic situation, as insomnia negatively affects concentration and memory, resulting in a poor quality of life (22)(23) (24). Regarding this high prevalence of insomnia among the participants, other studies have also displayed similar levels of sleep disruptions and insomnia among war-exposed civilians, as sleepless nights were exhibited among individuals in Gaza (25); 38% of participants developed insomnia during the Gulf War (26); and 58% of participants of a Ukrainian study reported bad sleeping quality or chronic sleep problems (27). In addition, a study conducted among Sudanese civilians in 2023 (28) displayed that the majority of participants (57.7%) exhibited subthreshold insomnia, in contrast with this current study, which was conducted in 2025 and which indicates that more participants displayed moderate or severe

insomnia (49.1%) than subthreshold insomnia (33.4%). This indicates an increase of sleep disruptions among Sudanese civilians following the onset of the war, possibly attributable to the prolonged, unpredictable nature of the Sudanese war, justifying why insomnia levels in Sudan are higher than those reported during the Gulf War. However, it is lower than Ukraine, reflecting cultural variations in acknowledging sleep issues or methodological differences, as they used the Pittsburgh Sleep Quality Index, not ISI like us.

The study results indicate moderate to high-stress levels among participants. This finding is consistent with similar studies among war-torn populations, such as Syria (29), Ethiopia (30), and Ukraine (15), which reflect significantly alarming stress levels among populations of war-torn areas cross-culturally.

As previously mentioned, we found a positive correlation between stress and insomnia levels. That supports the findings of a study among university students from western Ukraine (15) that concludes that war-related stress has a central effect on insomnia. Our study confirms the findings of the mentioned study in a more representative context, as it included university students from all the universities of Sudan, in conflict and non-conflict areas, in contrast to the mentioned study, which took place in western Ukraine, which is a non-conflict area.

The present study additionally demonstrates that war-related adversities are in general significant indicators of stress and insomnia. The Ukrainian study (15), however, indicated that exposure to war has an impact on insomnia specifically, which indirectly increases war-related PTSD. This study used network analysis in examining the associations between exposure to war, insomnia, and stress, which may indicate the need to conduct more in-depth studies in Sudan in order to explore the relationships and interactions between the different variables and to gain a more nuanced understanding of them in order to be able to identify the key factors that need to be targeted.

Surprisingly, direct exposure to bomb explosions correlated with lower ISI scores. This could be attributed to resilience factors. Nevertheless, participants who were exposed to such an event represent only a small percentage of our sample (83.3% declare no bomb exposure at all). Thus, it is possible that the finding reflects a statistical anomaly, perhaps due to the very small sample size within that specific exposure group limiting the generalisability of this particular finding. This outcome is comparable with the result of a study conducted among combat veterans who were deployed to Iraq and Afghanistan (31), which concludes that self-reported blast exposure without concurrent symptoms does not contribute to poor sleep quality or insomnia. A systematic review also concludes that stress was two- to three-fold higher amongst people exposed to armed conflict compared to unexposed civilians (32), contrasting the results of our present study, which reveals that participants in conflict zones reported lower stress levels. This, as mentioned, may be attributed to resilience factors and may indicate higher intrapersonal resilience among Sudanese civilians exposed to the conflict, as it has been found in a study among civilians exposed to the 2014 Gaza conflict (33) that individuals with higher levels of intrapersonal resilience, such as optimism, hope, etc., show lower PTSD symptoms than those with lower intrapersonal resilience.

Gender differences in psychological responses to war-related events have been proved in literature, with female participants being more vulnerable to stress (34). The prevalence of poor sleep among conflict-affected Palestinian adults was 34.6%, which was higher than that of males (24.3%) (35). In our findings, this trend was evident in the domain of both sleep disturbances and stress levels, as female students had significantly higher PSS-14 and ISI scores compared to males ($p = 0.001$ and $p = 0.002$, respectively). This can be attributed to hormonal shifts and the higher risk females face for developing psychiatric disorders (36)(37)(38). Previous studies also display similar outcomes regarding the association between gender and war-related stress, as they also indicate that females have higher war-related stress levels than males (25, 32, 27). Even in non-conflict contexts, female college students are more subjected to stress (39).

A cross-sectional study found resilience demonstrated through coping mechanisms such as religious faith and social support among internally displaced Sudanese nations (40). That may justify why we reported that hospitalisation or death of a relative significantly reduced stress scores ($p = 0.007$). However, our analysis also revealed a significant association

between the loss of a relative or a close friend and increased insomnia ($p = 0.030$), underscoring the complex interplay of war-related stressors and demographic factors in sleep disturbances among Sudanese university students. This aligns with the findings of a previous study in Ukraine and Palestine (15) (41), which shows that these factors are key types of war exposures that influence the occurrence of insomnia and sleep disruptions.

The nature of the Sudanese war is geographically unstable as it expands to include more areas unpredictably, causing a sense of insecurity even among those who were displaced in safe areas (42). That may explain why immigration outside the country was associated with lower insomnia severity ($p < 0.001$), while internal displacement emerged as a predictor for insomnia symptoms ($p = 0.022$). Displacement difficulties were found to be related to poorer sleep in another study conducted among Syrian refugees published in 2022 (43) but contradicted another study in the United States that shows low insomnia levels among the Bhutanese refugee community as they receive social support (44). That means post-displacement or post-migration status can affect insomnia. High insomnia levels can persist even after long periods. In a study that used ISI and PSS too, among internally displaced persons (IDPs) from Abkhazia, strong associations were found between stress and insomnia even after 15 years of displacement, suggesting the need for interventions in both recent and prolonged stressors in post-displacement contexts.

Another intriguing finding of our study was that monthly income didn't influence stress or insomnia. We suggest other risky consequences of war neutralise the effect of monthly income. An additional possible explanation for this is the cultural norms in Sudan, where financially stable individuals provide continuous financial support for their families who are still in war zones (40).

It is worth noting that final-year students scored significantly lower PSS-14 scores (p -value 0.007) compared to third-year students, possibly due to better psychological adaptation and developing coping mechanisms (45).

Due to the lack of access to mental health care and the destruction of mental health facilities during the war, the study indicates a need for community-based mental health approaches, non-governmental agencies, and local support groups targeting females, displaced individuals and families, and those suffering from the loss of a loved one, in addition to providing electronic mental health support (eMHPSS) in order to provide remote mental health support to compensate for the lack of mental health facilities (25) (46).

It was also found that those suffering from malnutrition and economic deterioration exhibited high levels of insomnia and sleep disruptions, indicating the need for interventions in conflict and displacement areas that ensure food security and humanitarian aid. Moreover, it was shown that integrating mental health and psychological support groups (MHPSS) into economic inclusion programmes for economically affected internally displaced people improves mental health outcomes (47).

Screening for mental health issues in universities and internally displaced people centres must be provided. The provision of mental health support and intervention programmes in universities is also crucial, especially programmes targeting female students.

Cultural negative beliefs about mental health in Sudan, which may result from lack of awareness, traditional interpretations of distress, or stigma associated with mental health issues, prevent people from reaching out regarding mental health problems. Educational programmes should be implemented, spreading awareness about the importance and cruciality of mental health and the severe effects of poor mental health, in addition to ensuring education about self-recognition of symptoms of mental health disorders (46). People exposed to war must be encouraged to come forward and reach for help if they are suffering from stress or sleep problems.

Psychotherapeutic interventions such as cognitive behavioural therapy, combined with pharmacological interventions, can be used in treating insomnia, in addition to integrating these interventions into evidence-based PTSD treatments

when treating insomnia patients who were exposed to war (48).

Regarding treatment of mental stress, training on improving self-efficacy, utilising the strong religious base of the Sudanese community to raise hope and optimism, and fostering resilience could help reduce the effects of post-war stress among students and internally displaced people (30).

Our study was a cross-sectional study aiming to determine the association of exposure to war with stress and insomnia and of war-induced stress with insomnia and sleep disruptions. Further longitudinal studies could be conducted, including exposed and non-exposed participants, in order to establish the causality relationship between exposure and stress and insomnia, in addition to using methods such as network analysis to establish the directionality of the relationship between war-induced stress and insomnia. Moreover, more generalisable and representative studies can be carried out, targeting all areas of Sudan, in addition to using proportionate sampling methods, ensuring the representation of conflict and non-conflict areas and the generalisability of the results.

Our study targeted university students within the age range of 17–35 years old. Further studies can target a broader age range, ensuring the representation of all age groups, to establish the relationship between age and war-induced stress and insomnia. Additional studies could target other specific age groups, such as children. In addition, the present study, alongside other studies, revealed the association between displacement and stress and insomnia, confirming the need to conduct further studies targeting displacement centres in Sudan to determine the prevalence of mental health issues and sleep disruptions among internally displaced people and to study mechanisms targeting displaced individuals and families that reduce the effects of war exposure and displacement on stress and sleep disruptions.

The study has several strengths, validating the findings of the study. The study targeted students from all universities in Sudan, providing a more representative sample. Moreover, the sample was significantly large, providing stronger results. In addition, the questionnaire employs two validated scales for measuring perceived stress (PSS) and insomnia severity (ISI).

However, the study has a number of limitations. First, non-probability convenient sampling was used through online Google Forms, which restricted participation to students with an internet connection who probably resided in more stable areas and had less exposure to conflict, limiting the generalisability of the results. Second, the self-administered questionnaire approach may have led to recall bias, social desirability bias, and misunderstanding questions. Third, although we used standardised tools to measure self-perceived stress, which is generally more valid than self-designed ones, it might not capture the full clinical diagnosis of psychological stress. Fourth, some factors influencing insomnia, such as anxiety, depression, or excessive screen time, were not measured, as they are already well documented in local literature (49) and (50) and (11).

Fifth, the cross-sectional design of the study can only establish a correlation between the studied factors, not causality or directionality of the relationship. Longitudinal studies should be done to explore the long-term effects of exposure to conflict regarding stress and sleep disruptions.

Conclusion

This study contributes to existing knowledge by highlighting the negative consequences of Sudanese conflict on sleeping patterns among university students, revealing a significant association between sleep disturbances and war-induced stress. The findings demonstrate a high level of insomnia and stress among participants, especially females and displaced people. We found an unexpected inverse relationship between stress and exposure to war, hospitalisation, and death of relatives, which may reflect emotional numbness or resilience among participants.

A number of recommendations can be made based on the results of this study. The study indicates the need for mental health approaches targeting Sudanese university students, especially females, internally displaced students, and students who have experienced the loss of a loved one. Moreover, aid must be provided for malnourished individuals and families suffering from economic deterioration in conflict areas. Lastly, strengthening the resilience and optimism of the Sudanese population using their strong religious foundations and social support networks could contribute to improving mental conditions.

Abbreviations

PSS-14

Perceived Stress Scale-14

ISI

Insomnia Severity Index

EW

Exposure to War

HEIs

Higher Education Institutions

Est.

Regression coefficients

SEs

Standard Errors

CI

Confidence Intervals

PTSD

Post-Traumatic Stress Disorder

IDPs

Internally Displaced Persons

eMHPSS

Electronic Mental Health and Psychological Support

MHPSS

Mental Health and Psychological Support \

Declarations

Ethical consideration

This study received ethical approval from the Ethics Committee of Omdurman Islamic University, reference number 2.8, date: 11/3/2025. Informed consent about the study aim and purpose was provided to the participants prior to their participation, confidentiality was maintained, and all data was anonymised and reached by authors of this study only.

Data availability

The dataset used and analysed during this study is available upon reasonable request from the corresponding author.

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Consent for publication

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Competing interests

The authors declare no competing interests.

Clinical trial number:

Not applicable.

Authors' contributions

All authors participated in the idea structuring and manuscript revision of this study and approved its final version. Ahmed S. I. Balla was responsible for writing the introduction; Walaa E. A. Ali wrote the methodology section; Logien A. A. Ibrahim worked in referencing and overall edition; data analysis and result writing were performed by Sohaib M. M. Ahmed, while Roaa N. S. Osman and Reela H. A. Moubarak worked in the discussion section. The data collection process was administered by Roaa Osman. Roaa N. S. Osman, Reela H. A. Moubarak, and Logien A. A. Ibrahim contributed equally to this work as first authors.

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Figures

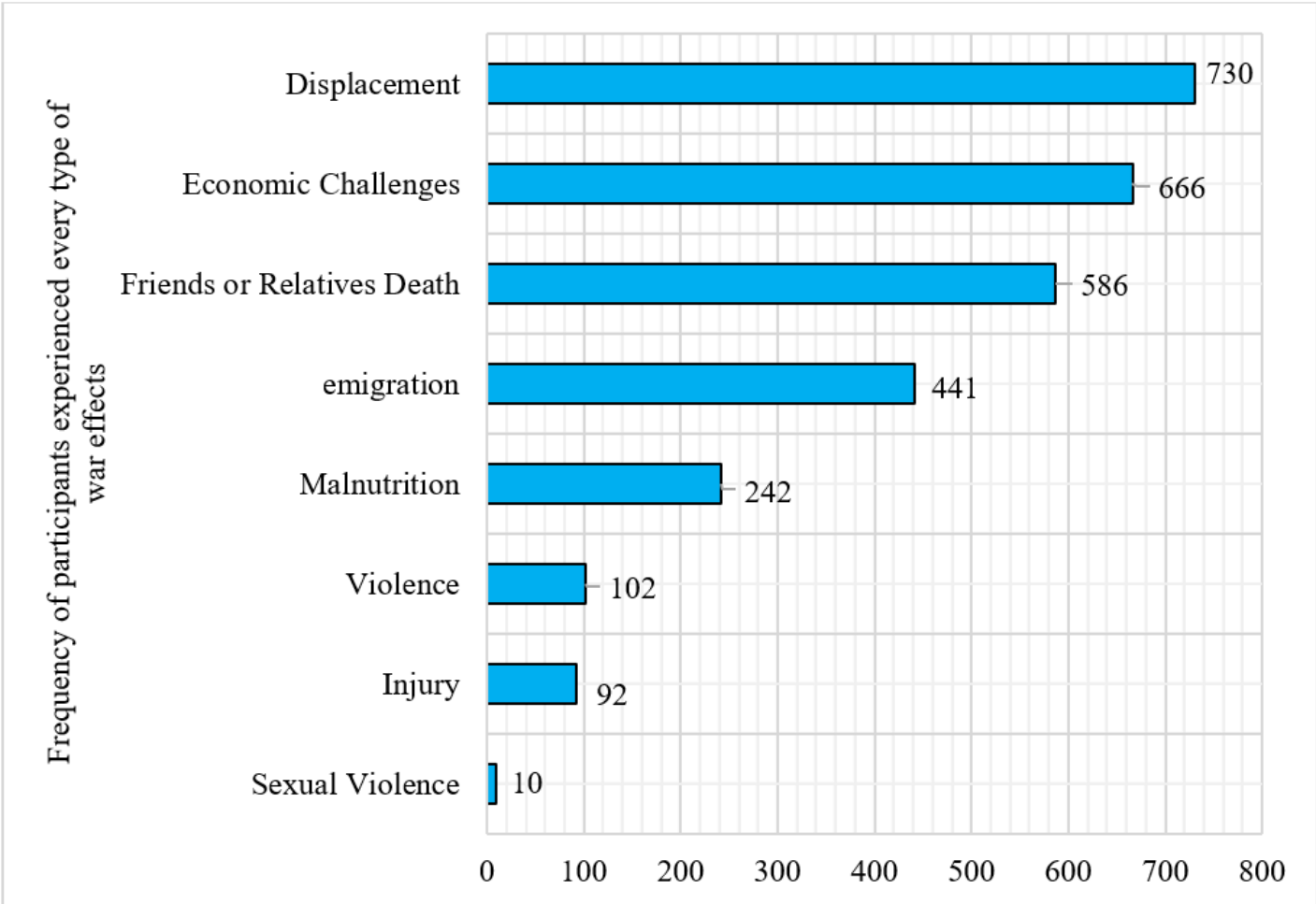


Figure 1

Frequency of participants experienced every type of war effects