Observational Study

Medicine

OPEN

Prevalence and determinants of depression and anxiety among Sudanese during the ongoing civil conflicts

A cross-sectional study

Ramy Mohamed Ghazy, DrPH[a,b], Yasmine Yousry Mohammed, DrPH[c], Basma Tolba, MD[d,e], Hebatalla Abdelmaksoud Ahmed, MD[f,*], Assem Gebreal, MBBCh[g], Alaa Yahia Fadle Modawy, MD[h], Marwa Omer Mudawi Mohamed Ahmed, MBBCh[i,j], Nafisa M.K. Elehamer, MD[k,l], Mohammed Fathelrahman Mohammed Ahmed Adam, MD[m], Faisal Saeed Al-Qahtani, MD[n], Mohamed Fakhry Hussein, DrPH[o]

Abstract

Armed conflicts have profound effects on mental health, including elevated rates of depression and anxiety among affected populations. The ongoing civil conflict in Sudan since April 2023 has exacerbated these challenges. This study aimed to determine the prevalence and identify the determinants of depression and anxiety among Sudanese residents affected by the ongoing civil conflict. This cross-sectional study was conducted between April 1st and May 30, 2024. Data were collected through online surveys and face-to-face interviews. The validated Arabic versions of the Beck Depression Inventory and Hamilton Anxiety Rating Scale were used to assess depression and anxiety levels, respectively. In total, 920 Sudanese participants were included with a mean age of 35.0 ± 12.2 years; 52.3% were females and 90.1% had migrated due to civil conflicts. Of the participants, 99.3% and 98.6% reported varying levels of depression and anxiety, respectively. Predictors of depression were female sex (β = 4.71, $P < .0001$), living in the Eastern state (β = 4.13, $P < .0001$), living in a rural area (β = 2.33, $P = .012$), noncompletion of formal education (β = 7.36, $P = .026$), working individuals (β = –5.58, $P < .0001$), larger household sizes (16–20 members) (β = 6.79, $P = .026$), sufficient income (β = –10.22, $P < .0001$), those with the ability to save money (β = –11.56, $P < .0001$), and individuals with insufficient income (β = –5.61, $P < .0001$). The predictors of anxiety were being female (β = 6.05, $P < .0001$), and noncompletion of formal education (β = 7.11, $P = .024$), current working (β = –5.56, $P < .0001$), larger household sizes (16–20 members) (β = 6.12, $P = .035$), sufficient income ((β = –5.60, $P < .0001$), ability to save money (β = –5.52, $P = .004$), and insufficient income (β = –2.60, $P = .006$). These findings underscore the impact of war on mental health. Effective humanitarian interventions targeting vulnerable groups and addressing socioeconomic determinants are critical for mitigating the psychological toll of ongoing conflict in Sudan.

Abbreviations: BDI = Beck Depression Inventory, CI = confidence interval, G*power = Statistical Power Analysis Software, HAM-A = Hamilton Anxiety Rating Scale, PTSD = post-traumatic stress disorder, R^2 = R-Squared (a measure of model fit), SE = standard error, SPSS = Statistical Package for the Social Sciences, β = unstandardized coefficient (in regression analysis).

Keywords: anxiety, Beck Depression Inventory, civil conflict, depression, Hamilton Anxiety Rating Scale, internal displacement, mental health, Sudan, war

The authors have no funding and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

[a] Family and Community Medicine Department, College of Medicine, King Khalid University, Abha, Saudi Arabia, [b] Tropical Health Department, High Institute of Public Health, Alexandria University, Alexandria, Egypt, [c] Family Health Department, High Institute of Public Health, Alexandria University, Egypt, [d] Neuropsychiatry Department, Faculty of Medicine - Ain Shams University (ASU), Cairo, Egypt, [e] Harvard Medical School Associated Alumni, [f] Public Health and Community Medicine Department, Faculty of Medicine, Kafrelshiekh University, Egypt, [g] Faculty of Medicine, Alexandria University, Alexandria, Egypt, [h] Pharmaceutical biotechnology lecturer at Pharmacy College/Al Mughtaribeen University, Khartoum, Sudan, [i] Medical Graduate and Research Assistant at the University of Medical Sciences and Technology, Khartoum, Sudan, [j] Medical Intern at Banha University Hospital, [k] Department of Public Health and Epidemiology, Faculty of Medicine, University of Debrecen, Debrecen, Hungary, [l] Department of Health Education, Faculty of Public and Environmental Health, University of Khartoum, Khartoum, Sudan, [m] Faculty of Pharmacy, University of Science and Technology, Khartoum, Sudan, [n] Department of Family and Community Medicine, College of Medicine, King Khalid University, Abha, Saudi Arabia, [o] Department of Occupational Health and Industrial Medicine, High Institute of Public Health, Alexandria University, Alexandria, Egypt.

** Correspondence: Hebatalla Abdelmaksoud Ahmed, Public Health and Community Medicine Department, Faculty of Medicine, Kafrelshiekh University, 5 ELgiesh Street - Kafrelsheikh 33516, Egypt (Heba_Abdelmasoud@med.kfs.edu.eg).*

How to cite this article: Ghazy RM, Mohammed YY, Tolba B, Ahmed HA, Gebreal A, Modawy AYF, Ahmed MOMM, Elehamer NMK, Adam MFMA, Al-Qahtani FS, Hussein MF. Prevalence and determinants of depression and anxiety among Sudanese during the ongoing civil conflicts: A cross-sectional study. Medicine 2025;104:11(e41553).

Received: 25 September 2024 / Received in final form: 7 December 2024 / Accepted: 29 January 2025

http://dx.doi.org/10.1097/MD.0000000000041553

1. Introduction

War produces massive relocation of people because of the loss of homes, the environment, religious sites, political persecution, and economic needs. Armed conflicts entail a wide range of compelling issues, including negative short- and long-term consequences on mental health, alongside the loss of life, all of which heavily impact the lives of survivors.[1] On April 15, 2023, severe hostilities between Sudan's Armed Forces and Rapid Support Forces resulted in the displacement of over 8.6 million people, worsening preexisting issues such as violence, disease outbreaks, economic instability, and climate disasters, affecting Sudan's second-largest refugee population.[2]

Wars have long-lasting effects on mental and physical health, economic security, and political stability.[3] War-torn places tend to be associated with elevated levels of psychological distress, making the population more vulnerable to mental disorders. As a result, there has been an increasing interest in understanding the mental health of those living in conflict zones.[4] With increasing fragility, conflict, and violence, understanding the prevalence of mental disorders and their risk factors is crucial for aiding vulnerable groups. The burden of mental disorders among conflict-affected populations is notably high. According to the World Health Organization's review of 129 studies across 39 countries, approximately 1 in 5 individuals (22%) who have experienced war or other conflicts in the past decade will suffer from conditions such as depression, anxiety, post-traumatic stress disorder (PTSD), bipolar disorder, or schizophrenia.[5] A systematic review investigated the prevalence of depression, anxiety, and post-traumatic stress symptoms among civilian and military populations exposed to war. It estimated a 28.9% aggregate prevalence rate for depression, 30.7% for anxiety, and 23.5% for post-traumatic stress, with higher rates during wars compared with postwar.[6]

An online survey was used to examine levels of depression, anxiety, PTSD, and insomnia among Sudanese residents during the 2023 Armed Forces battle. A total of 221 participants spent an average of 39 days in the battle zone, and 91.8% heard gunshots and explosions. The results revealed that 87.3% of the subjects had depression (25.3% moderate-severe and 62.0% severe), 89.1% had anxiety (36.2% moderate and 52.9% severe), 58.8% had PTSD, and 57.5% had subthreshold.[7]

The rationale for conducting a study of the psychological impact of war is based on several key theories. First, war-related trauma is recognized as a traumatic event that threatens life or health, directly exposing individuals to violence and causing them to witness brutality.[8] Second, emotional suffering from war may arise from direct exposure and indirect sources such as viewing war scenes via television or social media. According to indirect exposure theory, people concerned about the war but living outside the war zone can develop adverse mental health consequences. Third, societal changes during war often lead to the breakdown of existing protective networks, resulting in increased depression and anxiety. Lastly, the war can strip individuals of their sense of identity without any ability to prepare for it, further exacerbating psychological distress.[9]

This study hypothesized that Sudanese citizens affected by the ongoing civil conflict were experiencing considerable levels of depression and anxiety. This study aimed to investigate the prevalence and determinants of these mental health illnesses in conflict-affected communities, including internal displacement. The findings of this study would provide evidence to guide targeted mental health interventions and support strategies tailored to the needs of individuals experiencing conflict trauma.

2. Subject and methods

2.1. Study setting and design

This cross-sectional study was conducted in Sudan between April 1 and May 30, 2024, using both online surveys and face-to-face interviews.

2.2. Sample size and study population

Using G*power software, based on a previous study conducted early in Sudan[7] the prevalence of depression was 87.3%, with a 95% confidence interval (CI) and a 5% margin of error, an effect size of 0.069 and the minimum sample size was 521. We increased the sample to 900 to compensate for missing, incomplete data and a response rate of 58.0%. The effect size, which denotes the practical significance of a study's outcome, was calculated based on the reported prevalence of depression at 28.9% and 22.1%, respectively.[5,6]

We included Sudanese adults aged 18 years or older who had witnessed the war either until the study period or briefly before being internally relocated. Participants had to have been directly or indirectly affected by the civil conflict since April 2023, be able to understand and complete the survey in Arabic, and be willing to provide informed consent. We excluded military personnel, individuals with communication impairments such as deafness or muteness, and those with preexisting mental illnesses diagnosed to focus specifically on conflict-induced depression and anxiety.

2.3. Sampling technique

Convenience and snowball sampling strategies were used to recruit the study participants. Participants were asked to take part in the study through in-person interviews conducted in locations without Internet access, as long as the interviewers and interviewees were safe, in collaboration with local community leaders and humanitarian organizations. In areas with internet availability, participants were recruited via commonly used social media platforms like Facebook, WhatsApp, and Messenger through posts shared in relevant community groups and networks, targeting those directly affected by the conflict.

3. Data collection tools

3.1. Pilot testing

Before the main study, a pilot study was conducted to assess the feasibility, accessibility, question clarity, completion time, and response rate of the study. Four researchers solicited feedback from 5 to 10 subjects to achieve a total of 30 responses. The questionnaire was feasible and clear for most of the participants. The time required to fill out the questionnaire averaged between 10 and 15 minutes. Adjustments were made to clarify certain sentences to improve understanding. The nonresponse rate was 42.0%. The responses of these participants were excluded from the final analysis to ensure unbiased results.

3.2. The questionnaires consisted of three sections

The first section asked about socio-demographic characteristics, including gender (female or male), age groups (<20, 20–34, 35–50, or ≥50), current living states (Blue Nile, Central, Darfur Region, Eastern, Kordofan, or Northern), residential areas (urban, rural, or desert), educational attainment (primary, secondary, university, postgraduate, or none), marital status (single, married, divorced, or widowed), occupation categories (healthcare and medical, business and commerce, agriculture and mining, administration and management, engineering and technical, unskilled and skilled labor, student, others, or not working/

retired), current residence in conflict areas (no or yes), migration due to current conflict (no or yes), household size (≤5, 6–10, 11–15, 16–20, or ≥20), and income level (sufficient with savings, sufficient, insufficient, or insufficient with debt). Finally, participants were asked whether they were internally displaced. Internally displaced persons are individuals who are forced to leave their homes due to armed conflicts, widespread violence, human rights abuses, or natural disasters but remain within their country's borders.[10]

The second section assessed depression. We used the validated Arabic version of the Beck Depression Inventory (BDI).[11] It is a 21-item multiple-choice inventory employing Guttman scaling, specifically designed to assess the severity of depression in adults. Each item allows respondents to choose from 4 statements scored from 0 to 3 points, yielding a total score range of 0 to 63. The suggested score ranges indicate mild depression (10–19), moderate-to-severe depression (20–30), and severe depression (31 or higher).[12] The BDI demonstrates high internal consistency, with Cronbach's alpha coefficients of 0.86 and 0.81 for psychiatric and nonpsychiatric populations, respectively.[13]

In the third section, we assessed anxiety using the validated Arabic version of the Hamilton Anxiety Rating Scale (HAM-A).[14,15] The scale assesses both psychological and somatic symptoms associated with anxiety, including irritability, fear, memory dysfunction, insomnia, somatic symptoms, and emotional dysregulation across 14 items. Each item uses a 5-point Likert scale: "0" indicates no symptoms, "1" mild symptoms, "2" moderate symptoms, "3" severe symptoms, and "4" very severe symptoms. The total score ranged from 0 to 56. Scores less than 17 suggest mild anxiety, scores between 18 and 24 indicate mild-to-moderate anxiety, and scores above 24 suggest moderate-to-severe anxiety.

4. Ethical approvals

The researchers applied for approvals to perform the study from the Sudanese Ministry of Health and Social Development and the Ethics Committee of the High Institute of Public Health, Alexandria University, Egypt (IRB number: 00013692). The researchers followed the International Guidelines for Research Ethics. Each participant provided informed consent after learning about the goals and benefits of the study. The participants' involvement in the study was entirely voluntary, and individuals were free to withdraw at any time without consequences. Confidentiality and anonymity were assured and strictly maintained.

5. Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences" SPSS 22.0 software (IBM Microsoft, New York). Referring to previous population-based observational studies, participants with missing data were excluded from the final analysis.[16] The normality of the quantitative data were tested using Kolmogorov-Smirnov's test. Qualitative variables were presented as numbers and percentages; the chi-square test was used for analysis, and the Monte Carlo exact test was used if more than 20% of the expected cell value was less than 5. Numerical variables were expressed as means and standard deviations or as medians with interquartile ranges (IQR). Mann-Whitney *U* test and Kruskal–Wallis test were used to compare the groups if the data were not normally distributed. A linear regression model was used to assess the effect of various study factors on anxiety and depression, and the results were tabulated as unstandardized coefficients (β), standard errors (Se), and standardized coefficients (B). The model's overall fit was evaluated using the R-squared (R^2) and F-tests. *A P*-value of <.05 was adopted as the level of significance.

6. Results

Table 1 illustrates the socio-demographic and personal characteristics of the 920 Sudanese participants; the sample comprised 52.3% females, with a mean age of 35.0 ± 12.2 years, 58.5% resided in the Eastern state, 63.5% lived in urban areas, 57.1% had a university education, 45.7% were single, 16.3% were not working or retired. Most participants (86.4%) did not reside in conflict areas, though 90.1% had migrated due to ongoing conflicts. As to household size, 51.3% had 6–10 family members. Financially, 32.6% reported insufficient income, and 37.2% were in debt.

Figure 1 shows the prevalence and severity of depression and anxiety among the participants. Of the studied participants, 45.8% had mild depression, 23.4% had moderate depression, 17.4% had severe depression, and 12.8% had major depression, with only 0.7% showing no signs of depression. Regarding anxiety, 43.5% of participants had mild anxiety, 19% had mild-to-moderate anxiety, 13.2% had severe anxiety, 20.3% had very severe anxiety, and only 1.4% had no anxiety Figure 2.

Table 2 displays the prevalence and severity of depression and anxiety among the participants based on whether they had migrated due to the current conflict. Among the 829 participants who migrated, 0.6% had no depression, 43.9% had mild depression, 23.6% had moderate depression, 18% had severe depression, and 13.9% had major depression. In contrast, among the 91 participants who had not migrated, 1.1% had no depression, 62.6% had mild depression, 20.9% had moderate depression, 12.1% had severe depression, and 3.3% had major depression, with statistically significant differences ($P = .004$).

The median (IQR) total BDI score was significantly higher in those who had migrated (22 [14–34]) than in those who had not migrated (17 [10–27], $P < .0001$). Regarding anxiety, 1.1% of the migrants had no anxiety, 42.3% had mild anxiety, 19.2% had mild to moderate anxiety, 14% had severe anxiety, and 21% had very severe anxiety. Among nonmigrants, 4.4% had no anxiety, 53.8% had mild anxiety, 17.6% had mild to moderate anxiety, 5.5% had severe anxiety, and 14.3% had very severe anxiety, with statistically significant differences ($P = .006$). The median [IQR] total HAM-A score was also significantly higher in those who had migrated (19 [10–29]) than in those who had not migrated (15 [10–21]) ($P = .015$).

Table 3 displays the associations between sociodemographic and personal characteristics and mental health indicators of depression and anxiety. Female participants had significantly higher depression and anxiety scores than male participants ($P < .0001$). Younger participants (20–34 years) and those aged 50 years or older had higher depression scores, while anxiety scores did not differ significantly by age. Participants from the Darfur Region and rural areas had the highest depression scores, whereas anxiety scores were not significantly different across regions or residential areas. Those with no formal education had the highest depression and anxiety scores, whereas postgraduate participants had the lowest scores ($P < .0001$). Widowed participants had the highest scores for both depression and anxiety ($P = .008$). Participants who were not working or retired had the highest depression and anxiety scores, while those in business and commerce had the lowest scores ($P < .0001$). Larger household size was associated with higher depression scores ($P = .005$), and participants with insufficient income and debt had the highest depression and anxiety scores ($P < .0001$).

Table 4 illustrates the linear regression analysis of the predictors of depression and anxiety among the participants. Females had higher depression ($\beta = 4.71$, $P < .0001$) and anxiety scores ($\beta = 6.04$, $P < .0001$) than males. Residing in the Eastern state ($\beta = 4.13$, $P < .0001$) and rural areas ($\beta = 2.33$, $P = .012$) predicted higher depression scores. Lower educational levels, particularly not completing any educational level, were associated with higher depression ($\beta = 7.36$, $P = .026$) and anxiety scores ($\beta = 7.11$, $P = .024$). Current working

Table 1

Sociodemographic and personal characteristics of the study participants.

Studied variables	(N = 920)	%
Gender		
Female	481	52.3
Male	439	47.7
Age (years)		
Mean ± SD	35.0 ± 12.2	
<20	33	3.6
20–34	505	54.9
35–50	250	27.2
≥50	132	14.3
Current living states		
Blue Nile	8	0.9
Central	158	17.2
Darfur region	17	1.8
Eastern	538	58.5
Kordofan	16	1.7
Northern	183	19.9
Residence area		
Urban area	584	63.5
Rural area	320	34.8
Desert area	16	1.7
Educational level		
Did not complete any educational level	19	2.1
Primary education	42	4.6
Secondary education	53	16.6
University education	525	57.1
Postgraduate studies	181	19.7
Marital status		
Single	420	45.7
Married	399	43.4
Divorced	64	7.0
Widowed	37	4.0
Occupation category		
Healthcare and medical	161	17.5
Business and commerce	36	4.0
Agriculture and mining	13	1.4
Administration and management	161	17.5
Engineering and technical	80	8.7
Unskilled and skilled labor	70	7.6
Student	142	15.4
Others	107	11.6
Not working/retired	150	16.3
Currently living in conflict area		
No	795	86.4
Yes	125	13.6
Migration due to current conflict		9.9
No	91	
Yes	829	90.1
Household size		
≤5	256	27.8
6–10	472	51.3
11–15	144	15.7
16–20	17	1.8
≥20	31	3.4
Income level		
Sufficient and able to save some money	44	4.8
Sufficient	234	25.4
Insufficient	300	32.6
Insufficient and in debt	342	37.2

Values are presented as N (%) or Mean ± SD.

participants had lower scores for both depression (β = −5.58, $P < .0001$) and anxiety (β = −5.56, $P < .0001$). Larger household sizes (16–20 members) predicted higher depression (β = 6.79, $P = .026$) and anxiety scores (β = 6.12, $P = .035$). Sufficient income was associated with lower depression (β = −10.22, $P < .0001$) and anxiety (β = −5.60, $P < .0001$) scores. The models explained 26.5% of the variance in depression scores and 17.9% of the variance in anxiety scores, both with significant F-tests ($P < .0001$).

7. Discussion

In this study, we aimed to address the prevalence of depression and anxiety among Sudanese individuals during the ongoing conflict. Additionally, we explored the determinants of these mental disorders, including internal displacement.

7.1. The study's main findings

The study found high prevalence rates of mental disorders among participants: 99.4% had depression (45.8% mild depression, 23.4% moderate, 17.4% severe, and 12.8% major depression). Regarding anxiety, 98.6% had anxiety (43.5% mild, 19% mild to moderate, 13.2% severe, and 20.3% very severe anxiety). Females, younger (20–34 years) and older participants (≥50 years), and those from Darfur and rural areas had higher depression scores. Female gender, living in the Eastern state, rural residence, noncompletion of formal education, and living in a large household (16–20) increased the depression score while income level (insufficient income, sufficient, sufficient and able to save some money), and working reduced the depression score. The same variables, except rural residence and living in the Eastern state, had predicted the anxiety score.

8. Interpretation of the study findings

Regarding the prevalence of depression and anxiety among the general nonmilitary population during the ongoing conflict, this study showed that nearly all participants had depression and anxiety, regardless of their degree. Similarly, in another ongoing conflict in the Eastern Mediterranean Region, a study conducted in Baghdad, Iraq reported that the majority of women (91.1%) had experienced war-related trauma over the past 2 decades.[17] The situation in Syria is comparable. A Lower prevalence was repoted in a study conducted by Perkins et al,[18] which found that 60.5% of adolescents had at least one probable psychological disorder. PTSD was the most common (35.1%), followed by depression (32.0%) and anxiety (29.5%).

Likewise, in Yemen, where the average 25-year-old adult has lived through 18 armed conflicts, approximately 19.5% of the population suffers from mental disorders, with anxiety, depression, trauma, and schizophrenia being the most prevalent.[19] Children have been especially impacted, with studies showing that 55% of children feel sad or depressed, 19% are consistently fearful, and 79% of school-aged children in Sana'a exhibit symptoms of PTSD.[20]

A similar high prevalence of mental disorders has been reported outside the Eastern Mediterranean Region. A study conducted in Tigray found a high prevalence of depression among internally displaced persons, with 81.2% (95% CI, 79.4–83%) experiencing depressive symptoms and over 60% suffering from moderate-to-severe depression.[10]

Furthermore, a study conducted during the ongoing crisis in Ukraine indicated that 83.3% of respondents experienced anxiety symptoms in the first month of the war, decreasing to 65.6% in the second month. Similarly, 52.8% of respondents reported experiencing depressive symptoms in the first month, increasing to 64.7% in the second month.[21] On the contrary, a meta-analysis of 70 studies reported A lower prevalence of depression (34.7%) and anxiety (38.6%).[6] Additionally, another study conducted in Ukraine found that 46.5% of participants had high scores for depression, while 46.3% had high scores for anxiety.[9]

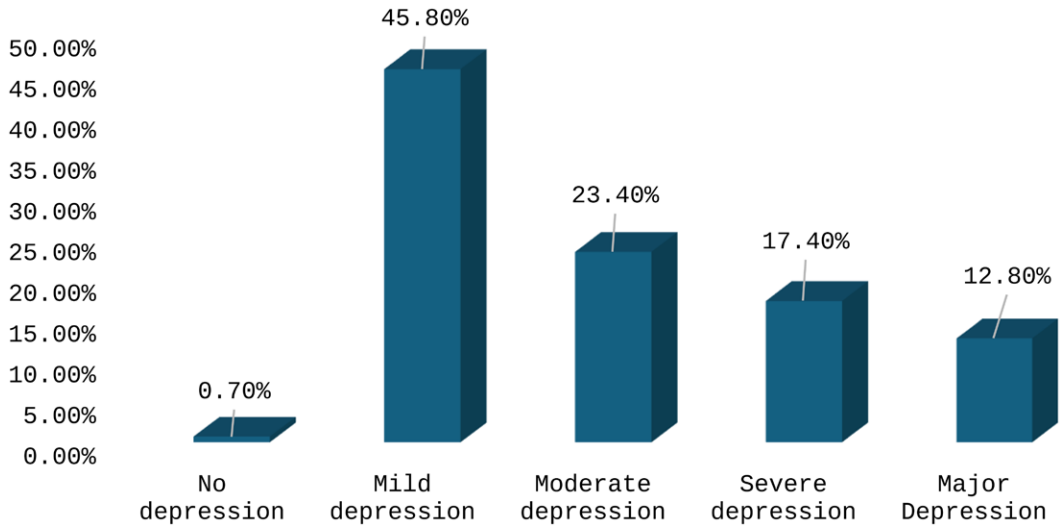

Figure 1. Prevalence and severity of depression among the Sudanese population during the war.

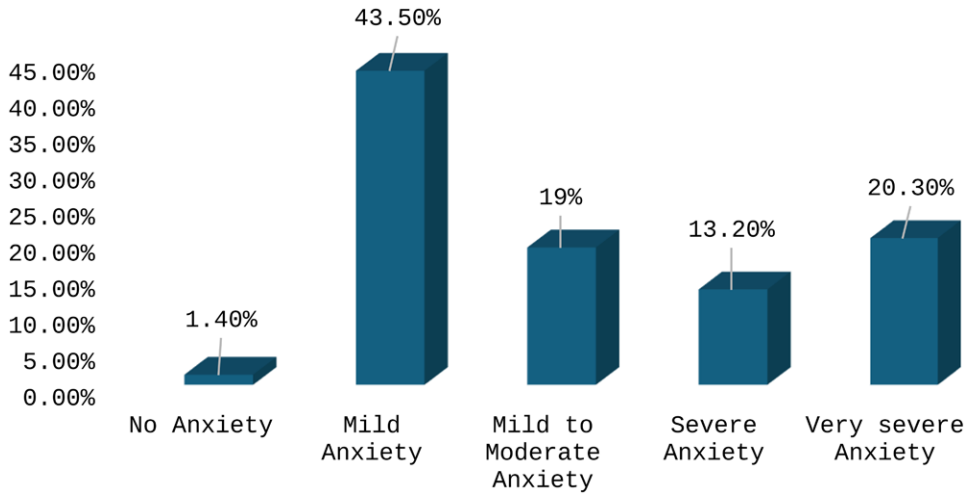

Figure 2. Prevalence and severity of anxiety among the Sudanese population during the war.

A relatively lower prevalence was observed in Myanmar during the "triple crises" of conflict, COVID-19, and economic collapse. Approximately one-third of adults (34.9%) reported probable mental disorders, with PTSD, depression, and anxiety affecting 8.1%, 14.3%, and 22.2% of the population, respectively.[22]

The discrepancies in reported prevalence rates of depression and anxiety across studies examining conflict-affected populations highlight the multifaceted nature of mental health assessments in crisis settings. While some studies have reported near-universal levels of despair and anxiety among participants, the findings of the present Sudan study reveal high prevalence rates. This can be attributed to the severe and prolonged nature of the conflict in Sudan, which exposes individuals to extreme hardships, including forced displacement, loss of loved ones, personal injury, destruction of homes and property, and pervasive uncertainty about the future. Prolonged exposure to such trauma exacerbates mental health challenges, resulting in widespread depression and anxiety across all segments of the population, irrespective of individual coping mechanisms. Furthermore, the insufficient provision of humanitarian aid—both from the government and international organizations—has compounded the psychological distress experienced by affected individuals.

These variations in prevalence rates can be ascribed to several factors. First, differences in study populations—whether they are directly affected by conflict, enduring political instability, or facing economic collapse—significantly influence mental health outcomes. Second, methodological variations, such as the use of different assessment tools and diagnostic criteria, play a critical role in shaping reported prevalence rates. Third, the timing of data collection in relation to the intensity and duration of conflicts or crises affects symptom reporting and mental health assessments. Finally, cultural and regional factors influence how individuals perceive and report symptoms, contributing to the heterogeneity in observed prevalence rates. Understanding these factors is essential for accurately interpreting and contextualizing research findings, which in turn can inform effective mental health interventions and advocate for tailored support measures in crisis-affected communities.

9. Determinants of depression and anxiety

9.1. Gender

In the current study, females had a 4.7 times risk of increasing their depression score and 6 times higher anxiety score. A similar finding was reported in different populations,[9] further

Table 2

Prevalence and severity of depression and anxiety among migrants and non-migrants affected by the ongoing conflict in Sudan.

	Migration due to current conflict		
Mental health indicators	**Yes (N = 829)**	**No (N = 91)**	***P* value**
BDI Scale			
No depression	5 (0.6%)	1 (1.1%)	
Mild depression	364 (43.9%)	57 (62.6%)	.004*
Moderate depressions	196 (23.6%)	19 (20.9%)	
Severe depression	149 (18%)	11 (12.1%)	
Major depression	115 (13.9%)	3 (3.3%)	
Total BDI score: Median (IQR)	22.0 (14.0–34.0)	17.0 (10.0–27.0)	<.0001*
HAM-A Scale			
No anxiety	9 (1.1%)	4 (4.4%)	
Mild anxiety	351 (42.3%)	49 (53.8%)	.006*
Mild to moderate anxiety	159 (19.2%)	16 (17.6%)	
Severe anxiety	116 (14.0%)	5 (5.5%)	
Very severe anxiety	174 (21.0%)	13 (14.3%)	
Total HAM-A score: Median (IQR)	19.0 (10.0–29.0)	15.0 (10.0–21.0)	.015*

BDI, Beck Depression Inventory scale; HAM-A, Hamilton Anxiety scale.
*Significant. Values are presented as N (%) or Median (IQR).

emphasizing the gender gap and the heightened burden of humanitarian crises on females. On the other hand, with the increasing participation of women in the military service, there is an observed reduction in gender disparities in mental illness during wars. For instance, 73.4% of women and 81.7% of men report experiencing deployment-related combat exposure.[23] This high vulnerability can be due to several factors, including societal roles, cultural expectations, and the additional challenges women face during crises, such as displacement, loss of family member and support, and caregiving responsibilities for her children. Moreover, fear of exposure to gender-based violence, including sexual harassment and rape, often compounds psychological distress among women.

9.2. Marital status and family size

The present study showed that the participant's marital status did not affect their depression and anxiety scores. On the other hand, 2 previous studies reported a significant association between marital status and the conditions in which married people showed an increased risk of depression and anxiety compared with single.[24,25] In this study, a larger family size (16–20) was associated with higher scores for depression and anxiety. The association between unemployment and an increased risk of depression can be linked to financial issues exacerbated by circumstances such as the siege. When families face larger financial burdens due to a lack of resources, restricted access to banking services, and limited communication, this intensifies the stress and strain they experience. Such economic pressure can lead to heightened anxiety and depression among individuals and families as they struggle to satisfy their basic needs and cope with the ongoing challenges imposed by the siege.

9.3. Occupation

Working at the current job reduced the score for both depression and anxiety by 5.5. Similarly, research done in Ethiopia showed the same findings.[26] However, another Ethiopian study found a negative correlation between jobs and mental health issues.[10] Unemployment or being out of work might increase the risk of depression for a variety of reasons. First and foremost, having a job frequently provides a sense of purpose, structure, and habit, all of which are beneficial to mental health. Second, unemployment can cause financial stress and instability, both of which are known to contribute to depression. Furthermore, the social isolation and lack of social relationships that come with unemployment may increase feelings of loneliness and sadness.

9.4. Education

It is concerning that illiterate people had such large increases in depression and anxiety scores 3.4 times higher for depression and 7 times higher for anxiety than those with greater levels of education. This finding underscores the critical role of education in mitigating mental health challenges and highlights the urgent need for targeted interventions to support the mental well-being of less educated populations, particularly during periods of crisis.

9.5. Migration

Research findings suggest that refugees have higher rates of depression, anxiety, and post-traumatic stress than the general population not affected by war.[27,28] This disparity is attributed to traumatic war-related events and adverse post-war living conditions. In this study, we found that the scores on the BDI and Hamilton anxiety scales were significantly higher in the displaced population than in the nondisplaced population. Displacement is a profoundly stressful experience for affected individuals. It often exposes them to traumatic events such as torture, rape, targeted violence, and even ethnic cleansing, both in their home countries and during their journey to safety.[29]

9.6. Living in the conflict zone

This study discovered that living in a conflict zone did not result in a substantial increase in anxiety and depression scores. In contrast, other studies have consistently found a link between living in conflict zones and higher levels of anxiety and depression.[10,30] This disparity emphasizes the complexity of factors influencing mental health outcomes during conflicts, implying that while geographic location plays a role, other variables, such as individual resilience, social support networks, and specific conflict dynamics, may also heavily influence mental health outcomes.

10. Implication of this research

The study of depression and anxiety among Sudanese affected by ongoing civil strife has far-reaching implications for both policy and humanitarian operations. With such high rates of depression and anxiety among participants, this study emphasizes the critical need for focused mental health interventions in conflict zones. Key findings, such as higher rates of mental health problems among females, those with lower education levels, and persons facing economic difficulty, provide critical insights into establishing successful support measures. Regional variations in mental health outcomes, notably in the Eastern state and rural areas, highlight the need for context-specific interventions and equitable access to mental health care. By incorporating these findings into policy frameworks and humanitarian aid operations, stakeholders can better meet conflict-affected people's complex mental health needs, seeking to reduce long-term psychological effects and build resilience in vulnerable groups.

Future research on the prevalence and determinants of depression and anxiety in conflict settings would benefit from adopting a mixed-methods approach. While quantitative tools like the BDI and HAM-A provide robust measures of mental

Table 3

Association between socio-demographic and personal characteristics and the studied mental health indicators among the study participants

	Depression score	Anxiety score
Studied variables	**Median (IQR)**	**Median (IQR)**
Gender		
Female	23.0 (16.0–34.0)	22.0 (12.0–31.0)
Male	19.0 (11.0–32.0)	14.0 (7.0–24.0)
P-value	**<.0001***	**<.0001***
Age (years)		
<20	22.0 (13.0–38.0)	12.0 (7.0–24.0)
20–34	23.0 (15.0–33.0)	18.0 (10.0–28.0)
35–50	19.0 (12.0–29.0)	17.5 (8.0–27.0)
≥50	22.0 (11.0–37.0)	21.5 (8.5–32.5)
P-value	**.005***	.120
Current living states		
Blue Nile	17.0 (10.0–21.5)	9.0 (8.0–18.5)
Central	19.0 (13.0–28.0)	18.0 (10.0–26.0)
Darfur region	25.0 (23.0–34.0)	18.0 (11.0–31.0)
Eastern	23.0 (14.0–37.0)	19.0 (9.0–29.0)
Kordofan	12.5 (8.0–26.5)	10.5 (4.0–17.0)
Northern	21.0 (13.0–30.0)	17.0 (10.0–29.0)
P-value	**.001***	.068
Residence area		
Urban area	20.0 (12.0–30.0)	18.0 (9.0–28.5)
Rural area	26.5 (16.0–37.0)	20.0 (10.0–29.0)
Desert area	22.5 (16.5–31.0)	19.0 (10.5–23.5)
P-value	**<.0001***	.368
Educational level		
Did not complete any educational level	37.0 (27.0–49.0)	36.0 (26.0–44.0)
Primary education	32.5 (14.0–44.0)	24.5 (11.0–38.0)
Secondary education	24.0 (15.0–37.0)	17.0 (8.0–26.0)
University education	21.0 (14.0–32.0)	18.0 (10.0–28.0)
Postgraduate studies	17.0 (11.0–27.0)	19.0 (9.0–28.0)
P-value	**<.0001***	**<.0001***
Marital status		
Single	23.0 (14.0–33.0)	17.0 (10.0-28.0)
Married	20.0 (11.0–33.0)	19.0 (9.0–29.0)
Divorced	20.5 (15.0–32.0)	18.5 (10.0–30.0)
Widow	30.0 (17.0–41.0)	30.0 (14.0–40.0)
P-value	**.008***	**.008***
Occupation category		
Healthcare and medical	21.0 (14.0–31.0)	18.0 (10.0–28.0)
Business and commerce	11.5 (7.5–21.0)	9.0 (5.0–17.0)
Agriculture and mining	23.0 (13.0–32.0)	17.0 (6.0–23.0)
Administration and management	21.0 (13.0–30.0)	16.0 (9.0–28.0)
Engineering and technical	19.5 (12.5–28.0)	16.0 (9.5–31.0)
Unskilled and skilled labor	20.5 (13.0–33.0)	13.5 (8.0–22.0)
Student	23.0 (15.0–36.0)	16.5 (8.0–27.0)
Others	17.0 (11.0–26.0)	19.0 (10.0–25.0)
Not working/retired	34.5 (20.0–46.0)	28.0 (17.0–37.0)
P-value	**<.0001***	**<.0001***
Household size		
≤5	20.0 (11.0–29.0)	17.0 (10.0–28.0)
6–10	22.5 (13.5–35.5)	18.0 (8.5–28.5)
11–15	30.0 (21.0–34.0)	27.0 (18.0–36.0)
16–20	23.0 (14.0–35.0)	19.0 (10.0–28.0)
≥20	21.0 (16.0–30.0)	23.0 (13.0–32.0)
P-value	**.005***	.059
Income level		
Sufficient and able to save some money	13.0 (7.5–21.0)	12.0 (5.0–27.5)
Sufficient	16.0 (10.0–24.0)	14.0 (7.0–25.0)
Insufficient	20.5 (14.0–31.5)	18.0 (9.0–27.9)
Insufficient and in debt	30.0 (19.0–40.0)	22.0 (13.0–30.0)
P-value	**<.0001***	**<.0001***

*Significant. Values are presented as Median (IQR).

health outcomes, qualitative methods such as in-depth interviews or focus group discussions could complement these findings by capturing the nuanced experiences and cultural contexts of affected populations. Incorporating qualitative data would enable researchers to explore the lived experiences, coping mechanisms, and sociocultural influences on mental health, offering a more holistic understanding of the psychological impact of civil conflicts.

11. Strengths and limitations

This study had several limitations. First, in addition to the inherent limitations of cross-sectional studies like recall bias and selection bias, this design captures only the immediate psychological impact of the ongoing Sudanese War, underscoring the need for longitudinal studies to assess long-term effects. Second, it did not explore other psychiatric morbidities, such as suicidal ideation, eating disorders, substance abuse disorders, or gambling, which may also be prevalent in conflict settings. Third, the study focused solely on adult civilians due to consent and logistical constraints, excluding children, and minors, which limits the generalizability of the findings. Fourth, convenience and snowball sampling techniques that were used can introduce bias and limit the generalizability of study findings due to their nonrandom nature. Lastly, important variables, such as chronic medical diseases, were not adequately defined, which may affect the robustness of the findings. However, this study has several strengths. First, face-to-face interviews were conducted with participants. Face-to-face research methods offer advantages over online methods, such as observing nonverbal cues, establishing rapport, and ensuring fidelity in responses. Second, we conducted the study during the ongoing conflict helping us to timely capture the effect of the ongoing war on depression and anxiety. Finally, using validated tools enhances the internal validity of the study findings.

12. Conclusions

This study emphasizes the devastating impact of ongoing civil violence on Sudanese residents' mental health, demonstrating very high rates of depression and anxiety among those affected. The findings highlight the gender gap, economic obstacles, and regional variance as important predictors of mental health outcomes. The frequency of severe psychological distress emphasizes the urgent need for focused interventions and policy initiatives to alleviate the burden of mental illness in conflict zones. To develop resilience and assist recovery, effective methods should prioritize accessibility, cultural sensitivity, and integration of mental health services within broader humanitarian response efforts. By tackling these issues thoroughly, policymakers and humanitarian groups can help reduce the long-term effects of conflict on mental health and enhance overall health outcomes in impacted populations. In addition to the psychological consequences of war, it is important to recognize the profound impact of conflict on individuals' physical activity behaviors, which are closely linked to mental health. Research has shown that during times of war, factors such as security concerns, resource shortages, and disruptions to daily life contribute to a significant decrease in physical activity, an increase in sedentary behavior, and disturbed sleep patterns.[31,32] These changes, along with sleep disturbances, have been shown to be strongly associated with mental health issues, including depression and anxiety. Prolonged exposure to such a lifestyle can further exacerbate mental health problems by increasing inflammation, which negatively impacts both physiological and psychological well-being.[33] Therefore, future interventions in conflict zones should not only focus on psychological treatment but also assess physical activity

Table 4

Linear regression model for predictors of depression and anxiety among the study participants.

	Depression				Anxiety			
Studied variables	**β**	**SE**	**Beta**	***P*-value**	**β**	**SE**	**Beta**	***P*-value**
Gender (ref: Male)								
Female	4.72	0.87	0.17	<.0001*	6.04	0.83	0.24	<.0001*
Age (years)	–0.09	0.05	–0.08	.060	0.03	0.05	0.03	.505
Current living state (ref: Northern)								
Blue Nile	–1.88	4.37	–0.01	.668	–3.99	4.15	–0.03	.336
Darfur region	3.45	3.22	0.03	.285	2.50	3.06	0.03	.414
Central	0.67	1.49	0.02	.652	0.41	1.42	0.01	.775
Eastern	4.13	1.13	0.15	<.0001*	1.30	1.08	0.05	.226
Kordofan	0.14	3.34	0.00	.966	–3.09	3.17	–0.03	.330
Residence area (ref: Urban area)								
Rural area	2.33	0.92	0.08	.012*	–1.01	0.88	–0.04	.253
Desert area	0.26	3.08	0.00	.934	–2.60	2.93	–0.03	.375
Completed educational level (ref: Postgraduate studies)								
Primary education	2.61	2.31	0.04	.259	–0.58	2.19	–0.01	.792
Secondary education	1.99	1.43	0.05	.165	–2.05	1.36	–0.06	.133
University education	0.73	1.10	0.03	.507	–0.59	1.05	–0.02	.574
Did not complete any formal education	7.36	3.31	0.08	.026*	7.11	3.14	0.08	.024*
Marital Status (ref: Married)								
Single	1.45	1.10	0.05	.189	0.20	1.05	0.01	.847
Divorced	1.56	1.64	0.03	.342	–0.37	1.57	–0.01	.814
Widow	0.22	2.35	0.00	.926	0.63	2.23	0.01	.778
Occupation category (ref: Not Working/ Retired)								
Current working	–5.58	1.27	–0.15	<.0001*	–5.56	1.21	–0.17	<.0001*
Household Size (ref: ≤ 5)								
6–10	0.52	0.96	0.02	.590	–0.73	0.91	–0.03	.422
11–15	–0.25	1.30	–0.01	.848	–1.18	1.24	–0.03	.341
16–20	6.79	3.04	0.07	.026*	6.12	2.89	0.07	.035*
≥20	2.67	2.30	0.03	.245	3.87	2.18	0.06	.076
Income Level (ref: Insufficient and in debt)								
Sufficient and able to save some money	–11.56	2.01	–0.18	<.0001*	–5.52	1.90	–0.10	.004*
Sufficient	–10.22	1.10	–0.32	<.0001*	–5.60	1.05	–0.20	<.0001*
Insufficient	–5.60	0.98	–0.19	<.0001*	–2.60	0.93	–0.10	.006*
Currently living in a conflict area	0.08	1.48	0.00	.958	–1.36	1.41	–0.04	.334
Migration due to the current conflict	2.37	1.40	0.05	.090	1.92	1.32	0.05	.149
R								
0.52						0.42		
R^2								
0.26						0.18		
F test								
12.37						7.49		
P value								
<.0001*						<.0001*		

*Significant.

β = unstandardized regression coefficient; Beta = standardized regression coefficient; SE = standard error of the coefficient.

and sleep quality among Sudanesse as crucial components for enhancing mental health.

Acknowledgments

The authors extend their appreciation to the Deanship of Research and Graduate Studies at King Khalid University for funding this work through a large research project under the grant number RGP2/511/45. In addition, Sara Omer Mudawi Mohamed Ahmed (Accountant at World Food Programme, United Nations, Port Sudan, Sudan, sara.modawi.09@gmail.com) helped collect the data.

Author contributions

Conceptualization: Ramy Mohamed Ghazy, Assem Gebreal, Mohamed Fakhry Hussein.
Writing – original draft: Ramy Mohamed Ghazy, Yasmine Yousry Mohamed, Hebatalla Abdelmaksoud Ahmed.
Writing – review & editing: Yasmine Yousry Mohamed.
Methodology: Basma Tolba.
Data curation: Hebatalla Abdelmaksoud Ahmed, Nafisa M. K. Elehamer, Mohammed Fathelrahman Mohammed Ahmed Adam.
Formal analysis: Hebatalla Abdelmaksoud Ahmed, Marwa Omer Mudawi Mohamed Ahmed, Mohamed Fakhry Hussein.

Software: Hebatalla Abdelmaksoud Ahmed, Faisal Saeed Al-Qahtani.
Supervision: Ramy Mohamed Ghazy, Assem Gebreal.
Visualization: Hebatalla Abdelmaksoud Ahmed.
Project administration: Assem Gebreal, Marwa Omer Mudawi Mohamed Ahmed, Mohamed Fakhry Hussein.
Investigation: Alaa Yahia Fadle Modawy, Marwa Omer Mudawi Mohamed Ahmed, Mohamed Fakhry Hussein.
Resources: Alaa Yahia Fadle Modawy, Faisal Saeed Al-Qahtani.

References

[1] Carpiniello B. The mental health costs of armed conflicts-a review of systematic reviews conducted on refugees, asylum-seekers and people living in war zones. Int J Environ Res Public Health. 2023;20:2840.
[2] UNHCR. Sudan crisis explained Washington DC: USA for UNHCR; 2024 [updated November 14th 2024. Available at: https://www.unrefugees.org/news/sudan-crisis-explained/.
[3] Bogic M, Njoku A, Priebe S. Long-term mental health of war-refugees: a systematic literature review. BMC Int Health Hum Rights. 2015;15:29.
[4] Hamza MK, Hicks MH. Implementation of mental health services in conflict and post-conflict zones: lessons from Syria. Avicenna J Med. 2021;11:8–14.
[5] Charlson F, van Ommeren M, Flaxman A, Cornett J, Whiteford H, Saxena S. New WHO prevalence estimates of mental disorders in conflict settings: a systematic review and meta-analysis. Lancet. 2019;394:240–8.
[6] Lim I, Tam WWS, Chudzicka-Czupala A, et al. Prevalence of depression, anxiety and post-traumatic stress in war- and conflict-afflicted areas: a meta-analysis. Front Psychiatry. 2022;13:978703.
[7] Mohammed Bilal M, Moawia Balla Elnour S, Mohamed Elmahdi ZZ, Mustafa Mudawi Ahmed E. Mental health consequences among Sudanese due to the armed conflicts and civil unrest of 2023: a cross-sectional study. Int J Soc Psychiatry. 2024;70:563–73.
[8] Munjiza J, Britvic D, Radman M, Crawford MJ. Severe war-related trauma and personality pathology: a case-control study. BMC Psychiatry. 2017;17:100.
[9] Chudzicka-Czupała A, Hapon N, Chiang S-K, et al. Depression, anxiety and post-traumatic stress during the 2022 Russo-Ukrainian war, a comparison between populations in Poland, Ukraine, and Taiwan. Sci Rep. 2023;13:3602.
[10] Gebreyesus A, Niguse AT, Shishay F, et al. Prevalence of depression and associated factors among community hosted internally displaced people of Tigray; during war and siege. BMC psychiatry. 2024;24:3.
[11] West J. An Arabic validation of a depression inventory. Int J Soc Psychiatry. 1985;31:282–9.
[12] Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Arch Gen Psychiatry. 1961;4:561–71.
[13] Beck AT, Steer RA, Carbin MG. Psychometric properties of the Beck Depression Inventory: twenty-five years of evaluation. Clin Psychol Rev. 1988;8:77–100.
[14] Clark DB, Donovan JE. Reliability and validity of the Hamilton Anxiety Rating Scale in an adolescent sample. J Am Acad Child Adolesc Psychiatry. 1994;33:354–60.
[15] Obeid S, Azzi V, Hallit S. Validation and psychometric properties of the Arabic version of Hamilton Depression Rating Scale 7 items (HAMD-7) among non-clinical and clinical samples of Lebanese adults. PLoS One. 2023;18:e0285665.
[16] You Y, Ablitip A, Chen Y, et al. Saturation effects of the relationship between physical exercise and systemic immune inflammation index in the short-sleep population: a cross-sectional study. BMC Public Health. 2024;24:1920.
[17] Lafta RK, Merza AK. Women's mental health in Iraq post-conflict. Med Confl Surviv. 2021;37:146–59.
[18] Perkins JD, Ajeeb M, Fadel L, Saleh G. Mental health in Syrian children with a focus on post-traumatic stress: a cross-sectional study from Syrian schools. Soc Psychiatry Psychiatr Epidemiol. 2018;53:1231–9.
[19] Alhariri W, McNally A, Knuckey S. The right to mental health in Yemen: a distressed and ignored foundation for peace. Health Hum Rights. 2021;23:43–53.
[20] Al-Ammar F. Post-traumatic stress disorder among Yemeni children as a consequence of the ongoing war. CARPO. 2018;20:3.
[21] Kasierska M, Suwalska J, Łojko D, Jakubiak-Głowacka M, Tobis S, Suwalska A. Symptoms of anxiety and depression in Polish population in the context of the war in Ukraine: analysis of risk factors and practical implications. Sustainability. 2023;15:14230.
[22] Fan X, Ning K, Ma TS, et al. Post-traumatic stress, depression, and anxiety during the 2021 Myanmar conflict: a nationwide population-based survey. Lancet Reg Health Southeast Asia. 2024;26:100396.
[23] Street AE, Gradus JL, Giasson HL, Vogt D, Resick PA. Gender differences among veterans deployed in support of the wars in Afghanistan and Iraq. J Gen Intern Med. 2013;28 (Suppl 2):S556–62.
[24] Roberts B, Ocaka K F, Browne J, Oyok T, Sondorp E. Factors associated with the health status of internally displaced persons in northern Uganda. J Epidemiol Community Health. 2009;63:227–32.
[25] Roberts B, Ocaka KF, Browne J, Oyok T, Sondorp E. Factors associated with post-traumatic stress disorder and depression amongst internally displaced persons in northern Uganda. BMC Psychiatry. 2008; 8:38.
[26] Gesesew H, Berhane K, Siraj ES, et al. The impact of war on the health system of the Tigray region in Ethiopia: an assessment. BMJ Glob Health. 2021;6:e007328.
[27] Mollica RF, Sarajlić N, Chernoff M, Lavelle J, Vuković IS, Massagli MP. Longitudinal study of psychiatric symptoms, disability, mortality, and emigration among Bosnian refugees. JAMA. 2001;286:546–54.
[28] Smeeth D, McEwen FS, Popham CM, et al. War exposure, post-traumatic stress symptoms and hair cortisol concentrations in Syrian refugee children. Mol Psychiatry. 2023;28:647–56.
[29] Mahmood HN, Ibrahim H, Goessmann K, Ismail AA, Neuner F. Post-traumatic stress disorder and depression among Syrian refugees residing in the Kurdistan region of Iraq. Conflict and Health. 2019;13:1–11.
[30] Surzykiewicz J, Skalski SB, Niesiobędzka M, Gladysh O, Konaszewski K. Brief screening measures of mental health for war-related dysfunctional anxiety and negative persistent thinking. Pers Individ Dif. 2022;195:111697.
[31] You Y, Li J, Zhang Y, Li X, Li X, Ma X. Exploring the potential relationship between short sleep risks and cognitive function from the perspective of inflammatory biomarkers and cellular pathways: insights from population-based and mice studies. CNS Neurosci Therap. 2024;30:e14783.
[32] You Y. Accelerometer-measured physical activity and sedentary behaviour are associated with C-reactive protein in US adults who get insufficient sleep: a threshold and isotemporal substitution effect analysis. J Sports Sci. 2024;42:527–36.
[33] You Y, Chen Y, Wei M, et al. Mediation role of recreational physical activity in the relationship between the dietary intake of live microbes and the systemic immune-inflammation index: a real-world cross-sectional study. Nutrients. 2024;16:777.