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Sleep quality, anxiety, depression, and quality of life in rheumatoid arthritis patients and impact of disease activity

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Abstract

Background Rheumatoid arthritis (RA) is an autoimmune lifelong disease. Systemic manifestations represent a significant aspect of the disease burden. This study aimed to assess sleep quality and psychosocial aspects among RA patients and the impact of disease duration and activity.

Results The mean age for included RA patients was 50.00 ± 9.37 years. The median disease duration was 9.50 (Interquartile range (IQR)=5–15) years and 90% of patients were females. Disease activity score 28 was 4.65 ± 1.66. Anxiety and depression were significantly higher among RA participants. Regarding sleep quality assessment, RA group had significantly higher levels of insomnia than the control group (Insomnia Severity Index median (IQR) was 4.5 (0–15) versus 1 (0–3); *p* value = 0.013) and daytime sleepiness (Epworth Sleepiness Scale median (IQR) was 4 (1–11.25) versus 1 (0–3); *p* value = 0.002). RA patients showed significantly higher values of Pittsburgh Sleep Quality Index components as well as the global score indicating poor sleep quality. The 36-item short-form health survey domains, representing physical and mental health, were significantly lower among RA cases versus control subjects. Higher disease activity was positively correlated with anxiety, depression, insomnia, sleep quality, sleep efficiency, and daytime dysfunction, while negatively correlated with all domains of the 36-item short-form health survey.

Conclusions RA patients have increased anxiety and depression levels in addition to poor sleep quality. High disease activity is linked to increased anxiety and depression levels, impaired quality of life, and poor sleep quality.

Keywords Rheumatoid arthritis, Sleep quality, Quality of life, Anxiety, Depression, DAS 28

Background

Rheumatoid arthritis (RA) is a chronic condition principally involving synovial joints causing their damage and loss of function with prevalence more among females. However, there is a systemic inflammatory process underlying this condition [1]. Etiology is yet to be determined, although genetic predisposition and autoimmunity have an important role [2].

Systemic chronic inflammation may contribute to the high frequency of depression and impaired health-related quality of life (HRQoL). Subjects without psychiatric morbidity who have high C-reactive protein (CRP) levels were shown to have lower HRQoL scores [3].

The estimated anxiety and depression rates in RA are 26–46% and 14.8–34.2% respectively [4]. This could be attributed to the impact of diagnosis of chronic disease, chronic pain, functional and social impairment, loss of employment due to disability, and medication side

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effects. Another inflammatory hypothesis explains the subsequent effect of systemic inflammation in RA on brain functions [5]. Psychiatric comorbidity in RA results in greater pain, poor functional status, and poor HRQoL [6]. Lower remission rates and higher mortality rates are linked to depression and anxiety [7].

Poor quality of sleep and sleep disturbances are reported in RA, specifically in association with high disease activity [8]. RA patients are highly susceptible to obstructive sleep apnea (OSA) [9]. Screening for and treating these disorders may improve prognosis and avoid rheumatoid-associated morbidities. This study aimed to assess anxiety, depression, sleep quality, and HRQoL in RA patients and their link to disease activity and duration.

Patients and methods

Study participants and ethical approval

This case–control study included 30 RA patients and 30 healthy subjects. We recruited patients who attended inpatient and outpatient settings of the Department of Rheumatology, Rehabilitation, and Physical Medicine at a tertiary hospital. The study was conducted from July to October 2023.

Ethical approval was obtained from the local ethics committee. Before participation, we provided study subjects with an adequate explanation of the protocol and alternatives. All participants signed an informed consent. Subjects with evidence of end organ failure such as kidney and liver failure, history of psychological disorders, or substance abuse were excluded. We enrolled patients in the study if they were at least 18 years old, had established RA diagnosis according to 2010 the American College of Rheumatology/European League against Rheumatism classification criteria [10] and could understand and give consent to study participation. The primary outcome measure of this study is an assessment of anxiety, depression, sleep quality, and HRQoL in RA patients in comparison to healthy subjects. The secondary outcome measure is to determine the correlation of those parameters with disease activity. We obtained a complete medical history. Clinical examination and routine laboratory investigations including Erythrocyte sedimentation rate (ESR), rheumatoid factor (RF), complete blood count, blood urea nitrogen, serum creatinine, and liver enzymes were done.

Disease activity assessment was done via disease activity score (DAS) 28-ESR. It involves measuring tender joint count, swollen joint count, ESR and the patient's global assessment of disease activity, which ranges from 0 to 100 with higher ratings suggestive of worse disease activity [11, 12]. High disease activity is indicated by DAS 28 > 5.1 while moderate disease activity is suggested by a score of 3.2–5.1. A score ranging from 2.6 to 3.2 suggests low disease activity and a score < 2.6 indicates remission [13].

Anxiety and depression assessment

Hamilton Anxiety Rating Scale (HAM-A)

HAM-A is an evaluation performed by the clinician. It includes 14 items that evaluate psychic and somatic anxiety. Each item's score ranges from 0 to 4. The cumulative score ranges from 0 to 56. A score ≤ 17 is indicative of mild anxiety, an 18–24 score indicates mild to moderate anxiety, while a score of 25–30 is suggestive of moderate to severe anxiety, and scores > 30 indicate severe anxiety [14, 15].

Hamilton Depression Rating Scale (HAM-D)

It is a 21-item scale, but scoring depends on the first 17 items only. A normal response is indicated by scores ≤ 7. Suspected depression is indicated by scores of 8–13 (mild degree), 14–18 (moderate degree), 19–22 (severe degree), and > 22 (very severe degree) [16, 17].

Sleep quality assessment

Insomnia severity index (ISI)

It evaluates sleep difficulties and their influence on daily functioning. It is a seven-domain survey completed by the clinician. Each domain's score ranges from 0 to 4. The cumulative score ranges from 0 to 28. Severe insomnia is suggested by high scores [18, 19].

Epworth sleepiness scale (ESS)

ESS is completed by subjects to assess OSA-associated behavioral morbidity. On a scale from 0 to 3, respondents describe how often they fall asleep during different activities. The final score ranges from 0 to 24. Subjective excessive daytime sleepiness is indicated by a score ≥ 10, while a score > 16 suggests a high level of daytime sleepiness [19, 20].

Pittsburgh Sleep Quality Index (PSQI)

It is based on 19 domains that assess sleep quality throughout the preceding month. The first 4 domains are open questions, while the other 15 are assessed on a scale from 0 to 4. The 19-domain scores yield 7 components (sleep duration, sleep disturbance, sleep latency, daytime dysfunction due to sleepiness, sleep efficiency, overall sleep quality, and sleep medication use). The scores for each component are summed to get the final score which ranges from 0 to 21. Subjects are classified as poor sleepers if they have a score > 5 [21, 22].

Health-related quality of life assessment

The 36-item short-form health survey (SF-36)

It is based on 36 questions. Thirty-five questions are grouped into 8 scales. The score of each scale ranges from 0 to 100. A higher score indicates a higher quality of life. The remaining question evaluates changes in health over the last year but is not used to calculate scale scores. The eight scales are physical functioning, limitations due to physical problems, limitations due to emotional problems, emotional well-being, bodily pain, general health, vitality, and social functioning [23, 24].

Statistical analysis

We used Statistical Package for Social Sciences (SPSS) (version 20, IBM, USA) for data analysis. Categorical data were expressed as frequencies and percentages. Numerical data were expressed as the mean and standard deviation for normally distributed data/ median and interquartile range (IQR) for data that were not normally distributed. Chi-square test compares the proportion between groups. Independent Sample *t* test/ Mann–Whitney *U* test was used to compare the mean/ median difference between the two groups. We identified the correlation of both DAS-28 and disease duration with other different variables by applying Spearman's correlation. The probability value of less than 0.05 was used as a cut-off point for considering the significance of the statistical test. We used the Open Epi V.3.01 computer program to calculate the sample size.

Results

The study group included predominantly females (90%). No significant difference was found between 2 groups regarding age, sex, smoking, and body mass index (Table 1). RA patients had a median disease duration of 9.50 (IQR = 5–15). Arthralgia was the most frequent musculoskeletal feature (86.7%), and dry eye was the most prevalent extra-articular symptom (20%). According to DAS 28, 80% of the study group showed moderate to high disease activity (Table 2).

The therapeutic history included non-steroidal anti-inflammatory drugs, methotrexate, hydroxychloroquine, leflunomide, sulfasalazine, and corticosteroids.

The RA group showed higher levels of anxiety ($p = 0.001$), depression ($p = 0.001$), insomnia ($p < 0.013$), and daytime sleepiness ($p = 0.002$) in comparison to the control group (Table 3). All domains of PSQI were significantly higher for the RA group compared to the control group, with PSQI global score significantly higher for RA patients (7.5 (3–10) vs. 1 (0–3); $p < 0.001$). According to PSQI, 63.3% of RA patients suffered poor sleep quality versus 13.3% for the control group (Table 3). All SF-36 domains, representing HRQoL, were significantly lower in the RA group compared to healthy controls ($p < 0.001$) (Table 4).

A significant positive correlation was found between DAS28 on one side and anxiety, depression, and insomnia on the other side ($P < 0.001$, $P < 0.001$, and $P = 0.002$; respectively) (Table 5 and Figs. 1, 2, and 3). Sleep quality ($r = 0.37$; $p = 0.04$), efficiency ($r = 0.43$; $p = 0.02$) in

Table 1 Socio-demographic data of patients with rheumatoid arthritis and control group

Variables	RA patients *n* = 30 (%)	Control group *n* = 30 (%)	*P* value*
Age (years)			
Mean ± SD (range)	50.00 ± 9.37 (30–65)	49.37 ± 8.99 (33–65)	0.790*
Gender			
■ Male	3 (10.0%)	5 (16.6%)	0.448**
■ Female	27 (90.0%)	25 (83.33%)	
Smoking			
■ Smoker	1 (3.3%)	2 (6.7%)	0.725**
■ Passive smoker	8 (26.7%)	6 (20.0%)	
■ Non-smoker	21 (70.0%)	22 (73.3%)	
Marital status			
■ Married	24 (80.0%)	22 (73.3%)	0.542**
■ Single/widow	6 (20.0%)	8 (26.7%)	
Anthropometric measures			
■ Body mass index (kg/m^2)	28.26 ± 4.46	28.717 ± 4.04	0.777*

Data expressed as mean ± SD (range) or frequency (%)

* Independent sample *t* test compares the mean difference between groups

** Chi-square test compares proportions between groups. The *P* value was significant if < 0.05. *RA* rheumatoid arthritis

Table 2 Clinical and laboratory evaluation of patients with rheumatoid arthritis

Variables	*N* = 30	(%)
Disease duration in years	9.50 (5–15)	
Patient global assessment	50 (20–70)	
Physician global assessment	40 (17.5–60)	
DAS 28		
• Mean ± SD (range)	4.65 ± 1.66 (1.60–7.97)	
■ Low disease activity	2	6.7%
■ Moderate disease activity	10	33.3%
■ High disease activity	14	46.7%
■ Remission	4	13.3%
White blood cell count ($\times 10^3/mm^3$)	6.90 ± 2.48	
Neutrophils absolute count ($\times 10^3/mm^3$)	3.70 (2.47–5.81)	
Lymphocytes absolute count ($\times 10^3/mm^3$)	2.05 (1.42–3.02)	
Neutrophils lymphocyte ratio	2.23 ± 0.282	
Hemoglobin (g/dl)	11.55 ± 1.52	
Platelets ($\times 10^3/\mu l$)	315.20 ± 82.92	
Aspartate transaminase (U/L)	17.740 ± 4.50	
Alanine transaminase (U/L)	15.72 ± 4.70	
Serum albumin (g/l)	40.96 ± 6.62	
Blood urea nitrogen (mmol/L)	3.63 ± 1.24	
Serum creatinine (umol/l)	0.73 ± 0.23	
First hr. ESR (mm/h)	31.0 (17.50–45.0)	
Rheumatoid factor		
■ Positive	27(90%)	
■ Negative	3 (10%)	

Data expressed as mean ± SD (range)/median (IQR) or frequency (%). *DAS* disease activity score, *ESR* erythrocyte sedimentation rate

addition to daytime dysfunction ($r = 0.45$; $p = 0.01$) as components of PSQI showed a significant positive correlation with disease activity. Also, the global PSQI score had a significant positive correlation with disease activity (Table 5 and Fig. 4). A significant negative correlation was displayed between high disease activity and all SF-36 domains (Table 5).

Disease duration showed no significant correlation with psychological variables, sleep quality, or HRQoL except for limitation due emotional problems domain ($r = 0.855$; $p = 0.035$).

Comparison between good versus poor sleepers revealed that poor sleep was significantly associated with higher DAS 28, higher HAM-A, and HAM-D scores (Table 6).

Discussion

Eighteen million people suffered from RA worldwide by 2019 and the number is forecasted to reach 31.7 million by 2050 [25]. Disturbed sleep architecture and poor sleep quality represent major health problems with an impact on psychological health, and workdays and eventually may affect national income. Chronic diseases may augment psychological problems [26]. We aimed to assess RA's effect on anxiety and depression levels, sleep, and life quality in a sample of Egyptian RA patients.

OSA is caused by airway space reduction that is caused by mechanical and neurological factors [27, 28]. Occipitocervical lesions in RA could affect both mechanisms. Cervical shortening may cause mechanical narrowing of the airway. Moreover, RA-associated occipitocervical lesions will induce vertical translocation that could affect the regulation of the dilator muscles of the airway via compression of the 5th, 7th, 9th, 10th, and 12th cranial nerves [29].

Our results revealed that 63.3% of RA participants showed poor sleep quality (PSQI > 5) which was significantly higher compared to healthy subjects (13.3%). Kontodimopoulos and colleagues evaluated 147 RA patients; stating that 77.6% of them were poor sleepers [30]. Previous reports in literature concluded that 50–70% of RA patients had sleep disturbances [31]. The difference in frequency may be attributed to using different questionnaires. Sleep disturbances associated with RA were even higher than other chronic illnesses like obesity, hypertension, and some chest problems [9, 32].

PSQI global score was significantly higher among RA patients versus healthy subjects (median (IQR) 7.5 (3–10) vs. 1 (0–3); $p < 0.001$) with all 7 domains of PSQI were also significantly higher among RA patients. Son et al. concluded that the global PSQI score was higher in the RA patients than in controls (5.62 ± 4.19, 38.5% vs. 3.57 ± 2.17, 13.4%, $p < 0.001$) [33].

A correlation study regarding disease activity revealed a significant positive correlation with anxiety level ($p < 0.001$), depression ($p < 0.001$), insomnia severity ($p = 0.002$), and impaired sleep quality expressed as global PSQI ($p = 0.009$).

Also, high disease activity assessed via DAS 28 ($p = 0.018$), high anxiety level ($p = 0.012$), and high depression level ($p = 0.012$) were associated with poor sleep quality (PSQI > 5). While Age, gender, disease duration, and ESR showed no relation with sleep quality.

In partial agreement, Son and colleagues stated that older age, higher visual analog scale (VAS) score, and Beck's Depression Inventory (BDI-II) were associated with poor sleep quality (PSQI > 5). Higher RA disease activity was related to impairment among all PSQI domains; increased global PSQI and increased risk of being a poor sleeper [33].

Data analysis from the Korean population sample revealed that RA patients are more prone to develop sleep problems than the normal population [34]. Kim and colleagues showed that 61% of RA patients are poor

Table 3 Psychological and sleep quality assessment among rheumatoid arthritis patients and controls

Psychological assessment	RA ($n=30$)	Control ($n=30$)	*P* value
HAM-A			
Score	4.5 (0–17.25)	0 (0–0)	**< 0.001***
Interpretation			
• Normal	15 (50%)	25 (83.33%)	**0.017****
• Mild	8 (26.67%)	5(16.67%)	
• Mild to moderate	5 (16.67%)	1 (0.0%)	
• Moderate to severe	2 (6.66%)	0 (0.0%)	
HAM-D			
Score	7 (3.75–13.25)	5 (1–5)	**0.001***
Interpretation			
• Normal	17 (56.67%)	28 (93.3%)	**0.009****
• Mild	6 (20%)	2 (6.7%)	
• Moderate	4 (13.33%)	0 (0.0%)	
• Sever	3 (10%)	0 (0.0%)	
ISI			
Score	4.50 (0.0–15.0)	1.0 (0.0–3.0)	**0.013***
Interpretation			
• No clinical insomnia	16 (53.3%)	27 (90.0%)	**0.006****
• Subthreshold	6 (20.0%)	2 (6.7%)	
• Clinical insomnia	8 (26.7%)	1 (3.3%)	
ESS			
Score	4.0 (1.0–11.25)	1.0 (0.0–3.0)	**0.002***
Interpretation			
• *Normal*	21 (70.0%)	29 (96.7%)	**0.020****
• Excessive daytime sleepiness	6 (20.0%)	2 (3.3%)	
• High level of daytime sleepiness	3 (10.0%)	0 (0.0%)	
PSQI			
• Sleep quality	1.0 (0.0–1.0)	0.0 (0.0–1.0)	**0.005***
• Sleep latency	1.0 (1.0–1.25)	0.0 (0.0–1.0)	**< 0.001***
• Sleep duration	1.0 (1.0–2.0)	0.0 (0.0–1.0)	**< 0.001***
• Sleep efficiency	1.0 (0.0–2.0)	0.0 (0.0–0.25)	**0.001***
• Sleep disturbances	1.0 (0.0–2.0)	0.0 (0.0–0.0)	**< 0.001***
• Sleep medications	0.0 (0.0–0.0)	0.0 (0.0–0.0)	**0.040***
• Daytime dysfunction	1.0 (0.0–2.0)	0.0 (0.0–0.0)	**< 0.001***
Global PSQI Score	7.50 (3.0–10.0)	1.0 (0.0–3.0)	**< 0.001***
Interpretation			
• Good	11 (36.7%)	26 (86.7%)	**< 0.001****
• Poor	19 (63.3%)	4 (13.3%)	

Data expressed as frequency (%) or median (IQR)

* Mann–Whitney *U* test compares median between groups

** Chi-square test compares proportion between groups and. The *P* value was significant if < 0.05

RA rheumatoid arthritis, *HAM-A* Hamilton Anxiety Rating Scale, *HAM-D* Hamilton Depression Rating Scale, *ISI* Insomnia severity index, *ESS* Epworth sleepiness scale, *PSQI* Pittsburg Sleep Quality Index

sleepers versus 39.5% in a control group, also the global score of PSQI was significantly higher for RA patients ($p=0.003$). Additionally, higher disease activity was positively associated with worse PSQI values. RA patients with positive RF did not show specific PSQI outcomes. Moreover, the use of Disease-modifying antirheumatic drugs (DMARDs) or biologics showed no association with differing sleep outcomes [35].

There has been a great interest in RA's psychosocial aspects with a focus on interventions that may improve

Table 4 Health-related quality of life assessment among rheumatoid arthritis patients and controls

Variables	RA ($n=30$)	Control ($n=30$)	*P* value*
SF-36 domains			
■ Physical functioning	42.50 (40.00–50.00)	90.00 (80.00–100.00)	**< 0.001**
■ limitations due to physical health	25.00 (0.00–50.00)	75.00 (75.00–100.00)	**< 0.001**
■ limitations due to emotional problems	33.30 (0.00–66.60)	83.30 (66.60–100.00)	**< 0.001**
■ Vitality	40.00 (25.00–50.00)	80.00 (70.00–90.00)	**< 0.001**
■ Emotional well-being	48.00 (40.00–54.00)	70.00 (68.00–80.00)	**< 0.001**
■ Social functioning	50.00 (34.37–50.00)	75.00 (75.00–87.50)	**< 0.001**
■ Pain	45.00 (45.00–55.00)	77.50 (75.00–80.00)	**< 0.001**
■ General health	40.00 (30.00–50.00)	80.00 (70.00–90.00)	**< 0.001**

Data expressed as median (IQR)

* Mann–Whitney *U* test compares median between groups. The *P* value was significant if < 0.05

RA rheumatoid arthritis, *SF-36* short form health survey

Table 5 Correlation of disease activity (DAS 28) with other variables in rheumatoid arthritis patients

Parameters	DAS 28	
	R	*P* value*
Age	0.033	0.861
Disease duration	0117	0.538
HAM-A	**0.71**	**< 0.001**
HAM-D	**0.6**	**< 0.001**
ISI	**0.540**	**0.002**
ESS	0.257	0.170
PSQI		
■ Sleep quality	**0.372**	**0.043**
■ Sleep latency	− 0.075	0.694
■ Sleep duration	0.305	0.101
■ Sleep efficiency	**0.432**	**0.017**
■ Sleep disturbances	0.292	0.118
■ Sleep medications	0.223	0.237
■ Daytime dysfunction	**0.452**	**0.012**
Global PSQI	**0.470**	**0.009**
SF-36		
■ Physical functioning	**− 0.691**	**< 0.001**
■ limitations due to physical health	**− 0.774**	**< 0.001**
■ limitations due to emotional problems	**− 0.770**	**< 0.001**
■ Vitality	**− 0.652**	**< 0.001**
■ Emotional well being	**− 0.713**	**< 0.001**
■ Social functioning	**− 0.631**	**< 0.001**
■ Pain	**− 0.811**	**< 0.001**
■ General health	**− 0.673**	**< 0.001**

** Spearman correlation. The P value was significant if < 0.05*

DAS Disease activity score, *R* correlation coefficient, *HAM-A* Hamilton Anxiety Rating Scale, *HAM-D* Hamilton Depression Rating Scale, *ISI* Insomnia severity index, *ESS* Epworth sleepiness scale, *PSQI* Pittsburgh Sleep Quality Index, *SF-36* short form 36 health survey

psychological comorbidities and impact disease control and HRQoL [36].

Hughes and colleagues included 200 RA patients to assess psychiatric affection and sleep quality using Patient Health Questionnaire 9 and PSQI. The prevalence of depression and poor sleep quality were 30% and 86.5%, respectively. Patient global health visual analog score, tender joint count, and subjective DAS components showed significant correlation and were independent variables to predict both depressive symptoms and poor sleep quality [37]. Our results revealed that the percentage of depression and poor sleep quality in RA patients is 43.3% and 63.33% respectively. The difference in the percentage of depression occurrence between the 2 studies may be due to using different scales.

In a case–control study, Kwiatkowska et al. investigated the prevalence of insomnia and depression among RA patients. Depression symptoms prevalence among RA patients was 75% versus 23% in the control group, and insomnia prevalence (Athens Insomnia Scale ≥ 6) was 71% for RA versus 33% for control ($p < 0.001$) [38].

Previous research concluded that RA patients had high depression and anxiety levels, in accordance with the current results [39]. The occurrence of depression in RA is linked to multiple factors, such as fatigue, which is a common symptom, and the presence of sleep disorders [40].

Gouda and colleagues enrolled 247 RA patients and 60 controls; declaring that PSQI was significantly correlated with the visual analog scale for fatigue severity evaluation (VAS-F), health assessment questionnaire disability index (HAQ-DI), and disease activity assessed via DAS 28-CRP. Using multiple linear regression analysis, disease duration showed no correlation with sleep quality indices, while HAQ-DI and VAS-F were significant predictors of the occurrence of sleep apnoea [41]. This agrees with our results; a comparison between poor and good sleepers

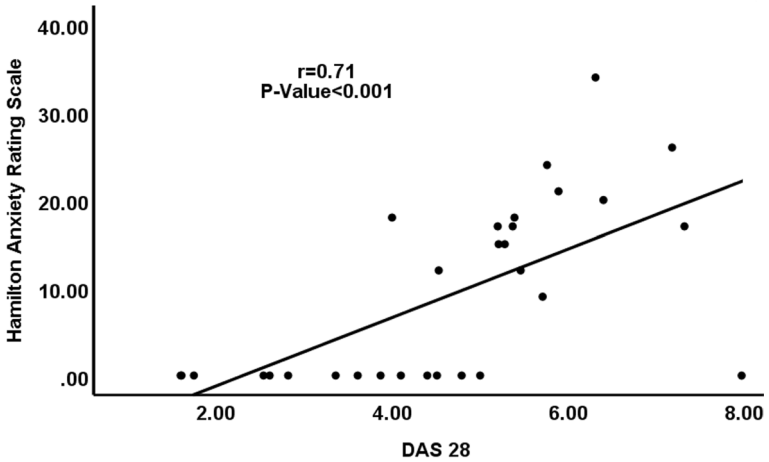

Fig. 1 Scatter diagram for correlation between disease activity score and Hamilton Anxiety Rating Scale

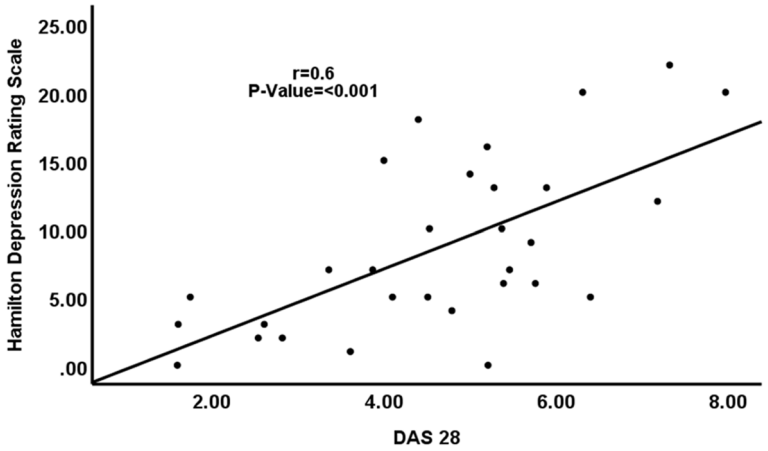

Fig. 2 Scatter diagram for correlation between disease activity score and Hamilton Depression Rating Scale

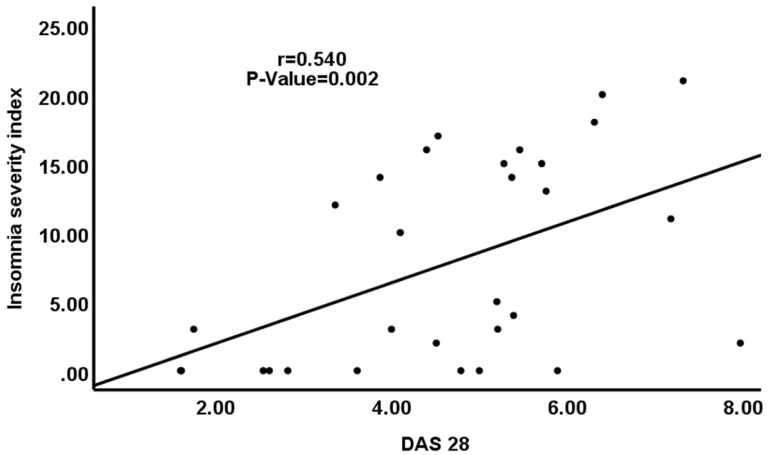

Fig. 3 Scatter diagram for correlation between disease activity score and Insomnia severity index

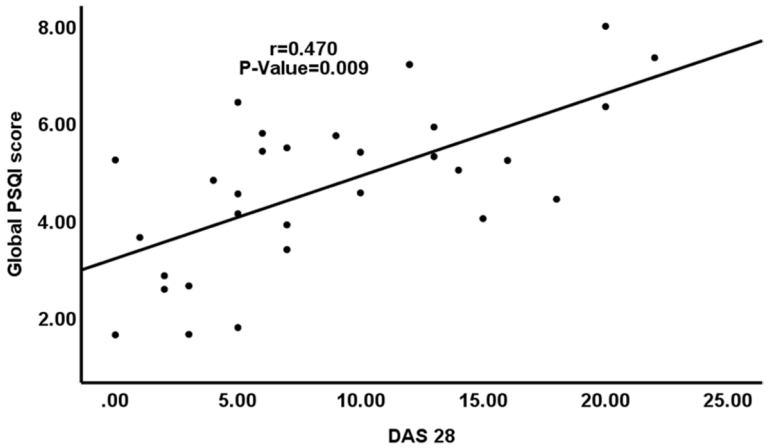

Fig. 4 Scatter diagram for correlation between disease activity and Global Pittsburgh Sleep Quality Index score

Table 6 Comparison of study variables according to good vs. poor sleep quality

Characteristic	Score ≤ 5(*n* = 11)	Score > 5(*n* = 19)	*P* value
Age (years)	53.455 ± 6.23	48 ± 10.414	0.127*
Gender male: female	1:10	2:17	0.9**
Disease duration (years)	8 (5–20)	10 (8–15)	0.778***
ESR (mm/h)	32 (22–45)	20 (10–45)	0.4***
DAS 28	3.728 ± 2.039	5.186 ± 1.151	**0.018**
HAM-A	0 (0–0)	15 (0–20)	**0.012****
HAM-D	10 (6–15)	3 (2–6)	**0.012****

Data expressed as mean ± SD/median (IQR). The *P* value was significant if < 0.05

* Independent sample *t* test compares mean difference between groups

** Chi-square test compares proportions between groups

** *Mann–Whitney *U* test compares median between groups

ESR erythrocyte sedimentation rate, *DAS* Disease activity score, *HAM-A* Hamilton Anxiety rating scale, *HAM-D* Hamilton Depression rating scale

showed no significant difference regarding age, gender, disease duration, and ESR. There is a significant difference between the 2 groups regarding disease activity (DAS 28), Anxiety (HAM-A), and depression (HAM-D).

In agreement with our study, Kontodimopoulos et al. stated that disease activity showed a significant impact on sleep quality in a sample of the Greek population. Significant deterioration in sleep quality was observed as a state of disease activity worsened from remission up to high disease activity [30]. So it is necessary to achieve remission to enhance sleep quality.

A significant negative correlation was demonstrated between disease activity and quality of life assessed via SF-36 domains ($p < 0.001$). In agreement with these results, a study in the Korean population revealed that disease activity is significantly correlated with poor sleep quality and negatively correlated with the SF-36 physical component [31].

Pain is thought to be the key factor in deteriorating levels of quality of life, especially the physical component. Pain is a key feature in RA particularly with higher disease activity. Several trials stated that pain will result in poor sleep quality which in turn lowers the pain threshold among those patients [42, 43].

Current results demonstrated that the RA group had significantly lower SF-36 scores than the control group ($p < 0.001$). Meta-analysis revealed that physical health components of HRQoL were significantly affected among RA patients, while mental health domains were less negatively affected [44]. A previous study comparing good vs. poor sleepers among patients with RA, revealed that poor sleepers showed significantly worse physical components of SF36 [35].

Improving HRQoL is among the important goals in the recommendations for treating RA patients, which can be achieved through control of symptoms, inclusion in social activities, and prevention of structural damage [45]. Sanderson et al. stated that HRQoL was one of the most crucial outcomes in evaluating treatment efficacy among RA patients [46].

The mutual interplay between pain, fatigue, depression, and disability may be proposed. Psychological upset and pain exacerbation may be induced by impaired sleep, and the pain itself may compromise sleep quality and HRQoL [47].

Another study included 110 RA patients, who were divided into a group with depressive symptoms (BDI-II > 13; group 1) and a group without depressive symptoms (group 2). Group 1 displayed poorer sleep quality ($p = 0.001$), more fatigue ($p = 0.001$), and higher disease activity (DAS 28; $p = 0.047$). Depressive symptoms

among RA patients (BDI-II > 13) were positively correlated with disease activity ($p = 0.002$), fatigue ($p = 0.001$), and poorer sleep quality ($p < 0.001$). PSQI global score was identified as an independent predictor for depressive symptoms severity using stepwise multiple regression analysis [48]. Some studies have concluded a positive correlation between high disease activity and anxiety and depression symptoms [49, 50]. Uda and colleagues could not detect an association between anxiety and depression symptoms (Hospital Anxiety and Depression Scales) and disease activity (DAS 28-CRP) using multiple regression analysis, while patient global assessment of disease activity, a component of the DAS28, was strongly associated with anxiety and depression, whereas other individual elements of DAS28-CRP were not. They tested the association after adjusting physical disability, pain, and treatment in RA patients, and this caused disagreement with our results [51].

Conclusion

RA patients suffer a higher burden of psychosocial problems including anxiety, depression, and lower quality of life indices. Poor sleep quality among those patients and insomnia are striking features. Disease activity level rather than disease duration is related to worse degrees of psychological, sleep quality, and quality of life status. Great care should be directed toward enhancing sleep quality, controlling psychosocial comorbidities, and attaining a higher level of disease control. Rheumatologists should pay attention to patient education about RA psychological comorbidities. Also, additional trials are warranted to explain if treatment options for RA patients including DMARDs and biologics are associated with better psychosocial profile and better sleep quality or not.

Limitations to our study

Polysomnography (the gold standard tool for sleep disorder assessment) was not used due to socioeconomic problems. Instead, sleep questionnaires were used to assess sleep quality among participants. The sample size was not large although statistically valid. Moreover, none of the included subjects in the current study were receiving biologics.

Abbreviations

BDI-II	Beck's Depression Inventory
CBC	Complete blood count
CRP	C-reactive protein
DAS	Disease activity score
DMARDs	Disease-modifying antirheumatic drugs
E.S.R	Erythrocyte Sedimentation Rate
ESS	Epworth sleepiness scale
HAM-A	Hamilton's anxiety rating scales
HAM-D	Hamilton's depression rating scales
HAQ-DI	Health assessment questionnaire disability index
HRQoL	Health-related quality of life
IOR	Interquartile range
ISI	Insomnia severity index
OSA	Obstructive sleep apnea
PSQI	Pittsburgh Sleep Quality Index
RA	Rheumatoid arthritis
RF	Rheumatoid factor
SF-36	36-Item short form survey
VAS	Visual analog scale
VAS-F	Visual analog scale for fatigue severity evaluation

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Authors' contributions

MSIA, WGEK, AMS, and SF: conception and design. MSIA, EAT, SMS, and SF: data collection. MSIA: statistical analysis. MSIA, WGEK, AMS, and SF: medical writing. All authors revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The used and/or analyzed datasets during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the institutional review board and ethical committee of Faculty of Medicine, Assiut University (IRB No.: 04–2023-300223) in compliance with the Helsinki Declaration. All participants signed written informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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