The current status and associated factors of fatigue in Chinese patients with gout: A cross-sectional study

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Abstract

Background

Fatigue is a common symptom in patients with rheumatism that is easy to ignore. In the absence of previous studies, our study aims to investigate the fatigue status, explore the potential predictors of fatigue and the effects of fatigue on health-related quality of life (HRQoL) among Chinese gout patients.

Method

This cross-sectional study was conducted from the Affiliated Hospital of Nantong University. A series of questionnaires were applied: Fatigue Scale-14 (FS-14), the 10 cm visual analog scale (VAS), the Patient Health Questionnaire (PHQ-9), the Generalized Anxiety Disorder questionnaire (GAD-7), the Pittsburgh Sleep Quality Index (PSQI), Health Assessment Questionnaire(HAQ), the Short Form 36 health survey (SF-36). Laboratory examinations were taken to obtain some biochemical indicators. Independent samples t-test, Mann–Whitney U-test, Chi-square analysis, Pearson /Spearman correlation, Stepwise linear regression and binary logistic regression were used to analyze the data.

Results

410 gout patients were included in this study. Among them, more than 50% patients reported physical fatigue in FS-14, severe disease, poor psychological status and reduced HRQoL were associated with fatigue. Multiple stepwise linear regression and binary logistic regression were applied and showed that pain, sleep quality, anxiety and depression were the potential predictors of fatigue. In addition, we found that the more severe the fatigue, the lower the patient's HRQoL.

Conclusions

Fatigue among gout patients is exceedingly common. The results of this study suggested that rheumatologists should pay closely attention to gout patients who suffer from serious fatigue, especially those with pain, poorer sleep quality, anxiety and depression.

Significance And Innovations

1. We firstly reported the relationship between fatigue and gout, fatigue is exceedingly common among gout patients.
2. We firstly reported that pain, sleep quality, anxiety and depression were the potential predictors of fatigue in gout patients.
3. We firstly investigated the effects of fatigue on health-related quality of life among gout patients, we found that fatigue is closely related to health-related quality of life (HRQoL), the more severe the fatigue, the lower the patient's HRQoL.

1. Introduction

Gout is a type of repetitive, inflammatory, metabolic disorder disease due to the crystallization of uric acid in joints and soft tissues with certain familial aggregation and certain genetic predisposition, which is closely related to hyperuricemia, uric acid product excessive and/or uric acid metabolism reduction(1). In recent years, with the improvement of people's living standard and the change of diet, the prevalence of gout in the world is increasing steadily(2, 3). The prevalence of gout to be 1.14 per 100 in China(4). Gout is not only associated with complications such as diabetes and hypertension, but also lead to gout nephropathy, even renal insufficiency and disability, these problems seriously affect the quality of life and bring serious burden to the social economy and endanger the family(5, 6).

Gout patients regularly suffer from signs and symptoms of gout, the swelling and pain of joint and deformity cause different degrees of dysfunction, leading to patients' cannot take care of themselves(7). A research provides a result that physical and mental health assessments play an important role in measuring disease and making clinical treatment decision(8). Our previous research also showed that excruciating arthritic pain and injury impose a huge physical and mental burden on gout patients, leading to functional disability and adverse psychological states such as anxiety and depression, and lower quality of life than healthy person(9, 10). These studies showed us that the quality of life in gout patients is very poor and need more attention.

Fatigue, which is an important component of health-related quality of life, is only rarely assessed and remains poorly understood. As a health problem, fatigue is a prevalent phenomenon among many patients with chronic, metabolic, rheumatic, inflammatory arthritis diseases, such as chronic obstructive pulmonary disease, diabetes, rheumatoid arthritis, systemic lupus erythematosus and osteoarthritis(11-14). While fatigue is usually regarded as a fairly somatic phenomenon, they often report fatigue as one of their most debilitating symptoms(15). We all know, symptoms of fatigue, pain, depression and anxiety are common symptom may contribute to work impairment in chronic health conditions. In chronic fatigue syndrome, fatigue lower labor productivity, increased the economic burden, it represent an important cause of impaired quality of life(16). Fatigue has poor effect on patients' clinical disease state, psychological function and quality of life. Gout, as a chronic, metabolic, rheumatic, inflammatory arthritis diseases, yet there are currently no known reported studies about fatigue in gout patients, especially from China, the relationship between influence factor and fatigue among gout patients has not yet been fully explored. Thus, the objectives of this study were (1) to describe the status of fatigue in gout; (2) to explore the independent associate factors for fatigue in gout patients.

2. Methods

2.1 Participants

We conducted a cross-sectional study among patients with gout fulfilling the American College of Rheumatology (ACR) criteria (1977 and 2015) for gout. Gout patients were inpatients or outpatients of

Rheumatology setting from October 2016 to February 2018 at Affiliated Hospital of Nantong University. A total of 427 gout patients were consecutively recruited to participate in this study and 411 (96.25% of the patients) complete the relevant questionnaire under the researchers' supervision. Patients were excluded based on either of the following: (1) under 18 years old; (2) hearing and cognitive impairment; (3) not complete the questionnaire. All other patients were included. The study was approved by the Ethics Committee of the Affiliated Hospital of Nantong University (2017-K003), and a written informed consent was obtained from each gout patient participant.

2.2 Demographics and clinical characteristics

Demographic characteristics and clinical variables were measured using a baseline questionnaire. Demographic variables included sex, age, body mass index (BMI), place of residence, education level, marital status, employment, yearly per capita income, hospitalization, tobacco and alcohol usage, comorbidities, and family history. Clinical variables contained the following: the presence or absence of tophi, stage of disease, disease duration, etc. Several serological markers including erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and serum Uric Acid (sUA) were examined in this study. All demographic, clinical, and laboratory data were collected at the same time point.

2.3 Clinical measurements

The Visual Analogue Scale (VAS) was used to assess total pain. Patients were asked to estimate their experiences of total pain during the last week, the score ranges from 0–10, with higher score indicating more severe pain(17).

2.4 Psychological functional status:

Fatigue was assessed with the Fatigue Scale-14 (FS-14). FS-14 includes a two-factor solution (physical and mental fatigue) was used to assess fatigue (0= no fatigue, and 1=severe fatigue)(18). Fatigue is calculated by summation of the scores of the individual items (scores range from 0–14, with higher scores indicating more severe tired).

The patient's level of anxiety was measured by the Generalized Anxiety Disorder questionnaire (GAD-7). The scale has 7 items and each item scored from 0 (not at all) to 3 (nearly every day), the total score of each item can measures of the severity of anxiety. (Scores range from 0-21, with higher scores indicating severe anxiety). The GAD-7 have good reliability and validity(19).

The Patient Health Questionnaire (PHQ-9) was applied to measure the patient's level. The scale has 9 items and each item scored from 0 (not at all) to 3 (nearly every day), the total score of each item can measures of the severity of depression. (Scores range from 0-27, with higher scores indicating severe depression). The PHQ-9 have good reliability and validity(20).

Physical function was assessed with The Health Assessment Questionnaire-disability index (HAQ-DI). It contains 20 items were broken into eight dimensions. Each item had a 4-point Likert scale and was

scored between 0 and 3. Physical function is calculated by summation of the highest scores in each dimension (Scores range from 0-3, with higher scores indicating more limited the functionality). The HAQ-DI is a valid and reliable instrument for measuring functioning in patients with gout(21).

Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI). The PSQI was used to assess sleep quality in the past month. It includes 19 items were divided into seven dimensions, respectively is: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disorders, use of hypnotics, and daytime dysfunction. Each item scored from 0 (no difficulty) to 3 (severe difficulty), the total score of each item can figure out the quality of sleep. (Scores range from 0-21, with higher scores indicating worse sleep quality)(22). The PSQI have good reliability and validity(23).

2.5 Health related quality of life:

Health related quality of life (HR-QoL) was assessed using the 36-item short-form health survey (SF-36). The SF-36 includes 36 items assessing two dimensions about Physical Composite Score (PCS) and Mental Component Summary (MCS) with the following eight scales: physical functioning (PF), physical role functioning (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), emotional role functioning (RE), and mental health (MH).It aims to measure HR-QoL within the previous 4 weeks (scores range from 0–100, with higher scores indicating better health status). The SF-36 has been shown to have good reliability and strong validity(24).

2.6 Data analysis

Descriptive statistics are provided using mean, standard deviation (SD), median, and interquartile range (IQR), or number (percentage) depending on parametric distribution of measured variables. The association of demographic variables, disease parameters, psychological status, and fatigue were examined with Spearman rank correlation analysis. Variables shown to be significant in the univariate tests were included into multiple regression with fatigue as the dependent variables, respectively. The group differences were evaluated by two-tailed t test, chi-square test, and/or Mann-Whitney U test. Variables with a significant association with fatigue were entered into a multiple stepwise logistic regression model. Statistical significance was considered when $P < 0.05$ (two-sided). All analyses were performed using SPSS version 22.0.

3. Results

3.1 Correlations between demographic, clinical, and psychological characteristics and total fatigue

As shown in Table 1, Table 2, Results indicated that 96.3% gout participants were male, the media (IQR) age of the gout respondents was 54 (38,64) years, a mean $\pm$ standard deviation of BMI was 25.37 ± 3.48 , 58.3% come from urban, 60.2% of the patient's educational level no more than 9 years, and more than one-third of the patients' yearly per capita family income was less than 15000 RMB. In addition, more than half of participants have tophi (51%) and comorbidities (52.4%), it suggests a severe disease

burden. Among the gout participants, more than half of gout patients (64.9%) are in the acute stage, the median (IQR) of disease duration were 5 (2,12) years and laboratory indexes include ESR, CRP, sUA were 15 (6, 35.25) mm/h, 13.65 (4.83, 33.65) mg/l, and $473.62 \pm 124.36 \mu\text{mol/L}$, respectively. According to the cut-off scores, depression disorder was presented in 12.9%, 6.1% had anxiety. Not only that, we found 199 (48.5%) gout patients have sleep disorders. Spearman rank correlation coefficients were computed to identify the relationships among two dimensions of FS-14, demographic, clinical, and psychogenic variables in present sample of gout patients. Patients with live in urban, low level of education, have no job, longer disease duration and hospitalization, severe total pain, have tophi, comorbidity, higher degree of depression and anxiety, have sleep disorder, higher level of ESR and CRP were more likely to have higher scores of fatigue ($P < 0.05$).

3.2 Differences between psychological, clinical characteristics and quality of life of gout patients grouped by each item of FS-14

Figure S1 [Additional file 1] presented the proportion of each fatigue item in FS-14, we found that in physical fatigue Question (Q1-8), the proportion of each fatigue item more than 50% and patients with physical fatigue showed higher degree of anxiety, higher degree of depression, worse sleep quality, more severe pain ($P < 0.05$), lower quality of life: PCS ($P < 0.001$), MCS ($P < 0.001$). Except Q1, gout patients with fatigue showed more serious functional disability ($P < 0.05$). Comparing patients without fatigue, except Q1 and Q3, patients with fatigue had increased disease activity.

In addition, we compared patients with and without mental fatigue (Q9-14). In Q9, gout patients with fatigue showed higher degree of anxiety ($P < 0.001$), higher degree of depression ($P < 0.001$), worse sleep quality ($P < 0.001$), more severe pain ($P = 0.015$), more serious functional disability ($P = 0.001$). In Q11, gout patients with fatigue showed worse sleep quality ($P = 0.038$), more serious functional disability ($P = 0.041$). In Q12, gout patients with fatigue showed higher degree of anxiety ($P = 0.002$), higher degree of depression ($P = 0.007$). In Q13, gout patients with fatigue showed higher degree of depression ($P = 0.026$). In Q14, gout patients with fatigue showed higher degree of anxiety ($P = 0.012$), higher degree of depression ($P = 0.001$). Patients with mental fatigue had lower quality of life in MCS ($P < 0.05$). The results are shown in Table S1 [Additional file 2].

3.3 Differences between demographic, psychological, clinical characteristics and quality of life of gout patients in single item subjective report fatigue of FS-14

In Q1: Do you have problems with tiredness? According to patients choose “yes” or “no”, the comparison in demographic, psychological, clinical characteristics and quality of life were exhibited in Table S2,3 [Additional file 3,4], gout patients with fatigue showed higher degree of anxiety, higher degree of depression, worse sleep quality, more severe pain, the occurrence of fatigue significantly reduces the quality of life in gout patients both physically and psychologically.

3.4 Determinants of Fatigue in gout patients

Stepwise multiple linear regression analysis was conducted to investigate contributors of fatigue in Table 3. Depression ($r=0.366$, $P<0.001$) and pain ($r=0.237$, $P=0.005$) were significantly accounted for fatigue.

Stepwise logistic regression analyses were used to identify a model to predict gout patients who would have tiredness problem in single item. The results indicated that anxiety (OR=9.848) and sleep quality (OR=2.397) were significant risk factors for fatigue in gout patients (Table 4).

3.5 Correlations between Quality of life and fatigue in gout patient

Correlations among quality of life and fatigue in gout patients was summarized in Table 5. We found that fatigue have a significant negatively correlated with each component of SF-36 by Spearman rank correlation analysis ($P<0.05$).

3.6 Fatigue lower the quality of life in gout patients

Total fatigue scores in gout patients were divided into four subgroups, G1 (P_0 - P_{25}), G2 (P_{25} - P_{50}), G3 (P_{50} - P_{75}), G4 (P_{75} - P_{100}), corresponding to 0-3 points, 4-5 points, 6-8 points, 9-14 points, respectively. The rank-sum test was used to analyze the difference of life quality in gout patients with different fatigue degrees. In conclusion, we found that patients with higher fatigue scores had significantly lower HR-QoL in all domains of the SF-36 scale. Table 6 and Figure S2 [Additional file 5] presented that the more severe the fatigue, the lower the patient's HR-QoL.

4. Discussion

To our knowledge, this is the first cross-sectional study investigating potential risk factors of fatigue and the relationship between fatigue and HR-QoL in people with gout from China. Disease characteristics and psychological functional status significantly correlated with fatigue in Chinese gout population. In the current study, pain, poor sleep, anxiety and depression were both independent risk predictors of fatigue in gout patients. What's more, with severe fatigue gout patients had poorer HR-QoL. It is important for rheumatologists pay attention to gout patients and address their fatigue issues.

Previous studies have suggested that fatigue is associated with demographic factors and work conditions, older age, being female, long working hours and occupational stress may be a key factor associated with fatigue. However, the negative relationship of fatigue and employment was found in the present study, it may be that they are too old to work, consistently with previous studies(25).

As we all know, the impact of disease activity on fatigue in inflammatory diseases remains a controversial issue. Some investigators claim that fatigue increases with high disease activity, while others have not confirmed such a relationship(26-28). This issue has not yet been thoroughly studied in gout patients. Pain was highly prevalent in fatigued patients with chronic inflammatory diseases like psoriasis, contributing independently to functional impairment, due to the inflammatory response, pain may increases the likelihood of insomnia and aggravates fatigue, those factors interact with each other

and have a huge impact on patients' quality of life(26). In rheumatoid arthritis, reduced functional status and mental health deterioration have been reported to be associated with fatigue, not only that, sleep disturbances and increased activity in illness have also been found to be significantly associated with fatigue(27). In an Internet survey, gout patient reported frequent sleep disorders and daytime sleepiness, sleep disturbances aggravated rheumatic fatigue(13, 29). Poor sleep quality has been identified as a contributing factor to fatigue by the present study, we firstly reported that relative factors of disease play a key role in gout patients with fatigue, the conclusions suggested us that fatigue interventions should address pain and improve sleep quality.

Psychological states like anxiety and depression are important risk factors affecting fatigue of patients in chronic autoimmune and inflammatory disease(30). Fatigue and depression have traditionally been regarded as psychological origin(31). It is generally believed that living with depressive symptoms can lead to a lack of energy, yet researchers think that depressive and fatigue may coexist and be separate entities due to they found 14.9% of patients reported fatigue without depressive symptoms in chronic disease(32). In this study, it is significance when we took it into linear and logistic regression. The survey results indicated that psychological health was a problem for a large number of gout patients. Through multiple linear regression analysis and binary logistic regression, anxiety and depression were the potential predictors of fatigue. This suggests that targeted intervention for gout patients with psychological disorders plays a very important role in reducing the burden of fatigue.

Pain may cause difficulty falling asleep, and pain-induced sleep disorders can lead to anxiety and depression, which further exacerbates sleep disorders. Moreover, there is a lot of overlap in symptoms between pain, depression and fatigue. Thus, many patients enter a vicious cycle and in turn leads to fatigue, which strongly affects the patient's ability to function and reduce quality of life. In this study, we found that the negative relationship between fatigue, disease activity, psychological health, and HR-QoL is not necessarily a causal relationship. There may be a two-way relationship and Interact with each other between the factors, or the relationship may actually be caused by another factor.

In chronic inflammatory disease, proinflammatory cytokines keep signaling constantly active and cause fatigue(26). Fatigue is constituting a survival mechanism, warning signs of ongoing or impending tissue damage, as a defense mechanism and action to protect and warn an organism from harm(31). In an animal experiments found that proinflammatory cytokines and IL – 1 β causes the body to produce symptoms are similar to fatigue, thus, researchers have applied this to rheumatism, by cytokine injections to induce fatigue, after treatment with biologics to reduce fatigue, support this hypothesis, and could offer understanding treatment in the future(30). In addition, previous studies have shown that 9.6% of Chinese gout patients adhered to urate lowering therapy (ULT), they have poor compliance and high sUA(33). In this study, we found that sUA is not significance for fatigue. Nevertheless, this mechanism has not yet been thoroughly studied in patients with gout, it suggests that researchers should pay more attention to this direction.

Improving HR-QoL of patients and functional disability are considered to be the core areas of gout research(34). HR-QoL is considered as one of the important outcome measures for gout patients and fatigue represents a central component of HR-QoL. It has reported that gout is a chronic condition associated poor HR-QoL and patients with gout experience substantially impaired health compared to the general population(10, 35). In this study, Fatigue significantly correlated with HR-QoL in Chinese gout population, this correlation suggests that there is a relationship between reduced HR-QoL and the degree of fatigue in Systemic Lupus Erythematosus (SLE)(36). The decreased HR-QoL maybe an outcome or predictor of fatigue in patients with gout. It is also possible that other causes, such as anxiety, depression, complications, tophi, sUA, and other objective indicators(37). Thus, fatigue may lower the quality of life by affecting the mental health and disease status of gout patients.

In spite of we firstly reported the relationship between the demographic, clinical, psychological characteristics and fatigue and the effects of fatigue on HR-QoL in Chinese patients with gout, however, we also had several limitations: (1) We just assess fatigue and associated factors with self-report questionnaires, while FS-14 is an good reliability and validity tool, a good objective measure of fatigue is still needed. (2) The sample was from a single clinic that the results were not necessarily generalizable to a broader population. (3) Since the study was cross-sectional in design, it does not allow examining causal relationships between variables.

5. Conclusions

In summary, it has been found that gout patients have fatigue phenomenon and that fatigue was strongly associated with pain, sleep, depression and anxiety. Results from the present study suggest, a better understanding of the link between gout and fatigue indicate health care could promote better nursing and self-management options for these patients, the purpose to improve quality of life and lay the foundation for more effective treatments in the future.

6. Abbreviations

HRQoL: health-related quality of life; FS-14: Fatigue Scale-14; VAS: the 10 cm visual analog scale; PHQ-9: the Patient Health Questionnaire; GAD-7: the Generalized Anxiety Disorder questionnaire; PSQI: the Pittsburgh Sleep Quality Index; HAQ: Health Assessment Questionnaire; SF-36: the Short Form 36 health survey; ACR: American College of Rheumatology; BMI: body mass index; ESR: erythrocyte sedimentation rate; CRP: C-reactive protein; sUA: serum Uric Acid; PCS: Physical Composite Score; MCS: Mental Component Summary; PF: physical functioning; RP: physical role functioning; BP: bodily pain; GH: general health; VT: vitality; SF: social functioning; RE: emotional role functioning; MH: mental health; SD: standard deviation; IQR: interquartile range; Q: Question; G: Group; ULT: urate lowering therapy; SLE: Systemic Lupus Erythematosus.

Declarations

Ethics approval and consent to participate

This study was approved by Ethics Committee of the Affiliated Hospital of Nantong University (ethics approval number:2017-K003), and all subjects provided written informed consent.

Consent for publication

Prior to participation, all subjects provided written informed consent according to the Declaration of Helsinki. Individual person's data in any form, consent to publish had be obtained from that person, or in the case of children, their parent or legal guardian.

Availability of data and materials

The datasets used and/or analysed during the present study are available from the corresponding author on reasonable request.

Conflict of interest

There was no conflict of interest between the authors of this study.

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Authors' contributions

CD, ZFG were involved in the design of the study; JXG, WZ, MM were involved in the acquisition, analysis, interpretation of data and finalizing the manuscript; JLG, YLW, RZ, JFL, TF, JJ, YFB, XYG, LRL assisted in questionnaire survey. All authors read and approved the manuscript.

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Tables

Table 1. Correlations among demographic and FS-14 in gout patients (total number of subjects enrolled=410)

Characteristic	Descriptives	Fatigue total points		Physical Fatigue		Mental fatigue	
		<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>
Gender, male ^a	395 (96.3)	0.005	0.917	-0.006	0.898	0.031	0.527
Age, (years) ^b	54 (38, 64)	0.067	0.175	0.085	0.085	0.001	0.977
BMI, (kg/m ²) ^c	25.37 ± 3.48	-0.049	0.321	-0.070	0.155	0.034	0.490
Place of residence ^a		0.115	0.020*	0.109	0.027*	0.048	0.329
Urban	239 (58.3)						
Rural	169 (41.2)						
Education, years ^a		-0.109	0.028*	-0.120	0.015*	-0.036	0.468
≤ 9 years	247 (60.2)						
> 9 years	161 (39.3)						
Marital status ^a		-0.027	0.580	-0.025	0.616	-0.027	0.580
Married	369 (90.0)						
Other marital	40 (9.8)						
Employment, yes ^a	234 (57.1)	-0.129	0.009*	-0.152	0.002*	-0.022	0.660
Yearly per capita income, (yuan) ^a		-0.089	0.074	-0.070	0.162	-0.066	0.185
<15000	142 (34.6)						
15000-33000	121 (29.5)						
>33000	142 (34.6)						
Medical insurance, yes ^a	319 (77.8)	-0.034	0.494	0.001	0.988	-0.088	0.077
Tobacco use, yes ^a	134 (32.7)	0.017	0.737	0.034	0.494	-0.031	0.525
Alcohol use, yes ^a	147 (35.9)	-0.021	0.669	0.005	0.915	-0.057	0.250

Notes: SD: standard deviation; IQR: interquartile range; ^a Number (percentage); ^b Median (IQR); ^c Mean ± SD; BMI: body mass index; FS-14: Fatigue Scale-14.

**P* < 0.05; ** *P* < 0.001.

Table 2. Correlations among clinical disease, psychological variables and FS-14 in gout patients (total number of subjects enrolled=410)

Characteristic	Descriptives	Fatigue total points		Physical Fatigue		Mental fatigue	
		<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>
Disease duration, (years) ^b	5 (2, 12)	0.110	0.027*	0.126	0.011*	0.006	0.912
Hospitalization, yes ^a	91 (22.2)	0.104	0.036*	0.122	0.013*	0.027	0.584
Tophi, yes ^a	209 (51)	0.104	0.040*	0.097	0.055	0.080	0.112
Comorbidities, yes ^a	215 (52.4)	0.124	0.012*	0.138	0.005*	0.037	0.463
Family history, yes ^a	94 (22.9)	0.089	0.072	0.077	0.123	0.042	0.400
Disease activity ^a	266 (64.9)	0.154	0.002*	0.152	0.003*	0.097	0.055
Acute stage	46 (11.2)						
Inter-critical stage	79 (19.3)						
Chronic stages							
ESR, (mm/h) ^b	15 (6, 35.25)	0.210	<0.001**	0.207	<0.001**	0.089	0.137
CRP, (mg/l) ^b	13.65 (4.83, 33.65)	0.199	0.012*	0.172	0.031*	0.111	0.164
sUA, (μmol/L) ^c	473.62 ± 124.36	0.013	0.803	0.020	0.698	-0.010	0.838
VAS ^b	3 (0, 6)	0.237	<0.001**		0.249	<0.001**	0.080 0.111
HAQ-DI ^b	0.125 (0, 0.625)	0.311	<0.001**		0.338	<0.001**	0.091 0.067
Total sleep quality ^a	199 (48.5)	0.330	<0.001**		0.334	<0.001**	0.132 0.007*
Fatigue total points ^b	6 (4, 9)	1.000	---		0.921	<0.001**	0.600 <0.001**
Physical Fatigue ^b	5 (3, 7)	0.921	<0.001**		1.000	---	0.268 <0.001**
Mental fatigue ^b	2 (1, 3)	0.600	<0.001**		0.268	<0.001**	1.000 ---
Depression, yes ^b	53 (12.9)	0.366	<0.001**		0.343	<0.001**	0.227 <0.001**
Anxiety, yes ^b	25 (6.1)	0.260	<0.001**		0.236	<0.001**	0.195 <0.001**

Notes: SD: standard deviation; IQR: interquartile range; ^a Number (percentage); ^b Median (IQR); ^c Mean ± SD; erythrocyte sedimentation rate: ESR; C-Reactive Protein: CRP; sUA: serum uric acid; VAS: the 10 cm visual analog scale; HAQ-DI: The Health Assessment Questionnaire disability index; FS-14: Fatigue Scale-14.

**P* < 0.05; ** *P* < 0.001.

Table 3. Results of stepwise multiple linear regression model in patients with total fatigue

Predictors	β	S.E.	<i>t</i>	<i>P</i>	B 95%CI	
					Lower	Upper
Depression	0.395	0.663	4.908	<0.001**	1.941	4.565
VAS	0.229	0.076	2.842	0.005**	0.066	0.369
Constant	---	0.386	13.865	<0.001**	4.588	6.116

Adjust $R^2=0.256$, $F=23.236$.

Notes: VAS: the 10 cm visual analog scale.

* $P < 0.05$; ** $P < 0.001$.

Table 4. Results of stepwise multiple logistic regression model in single item subjective report fatigue of FS-14

Predictors	B	SE	Wals	<i>P</i>	95% CI		
					OR	Lower	Upper
Anxiety	2.287	1.033	4.903	0.027*	9.848	1.300	74.578
Total sleep quality	0.874	0.229	14.641	<0.001**	2.397	1.532	3.752

Notes: OR: odds ratio, CI: confidence interval. FS-14: Fatigue Scale-14. *P* values were obtained with stepwise multiple logistic regression analysis.

* $P < 0.05$; ** $P < 0.001$.

Table 5. Correlations among quality of life and fatigue in gout patients

Characteristic /factor SF-36	Descriptives	Fatigue total points			Physical Fatigue		Mental fatigue	
		<i>r</i>	<i>P</i>		<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>
PF ^b	70 (45, 90)	-0.437	<0.001**	-0.413	<0.001**	-0.248	<0.001**	
RP ^b	0 (0, 75)	-0.394	<0.001**	-0.400	<0.001**	-0.146	0.003*	
BP ^b	41 (22, 62)	-0.348	<0.001**	-0.387	<0.001**	-0.092	0.063	
GH ^b	50 (35, 65)	-0.476	<0.001**	-0.453	<0.001**	-0.251	<0.001**	
VT ^b	65 (50, 75)	-0.613	<0.001**	-0.554	<0.001**	-0.370	<0.001**	
SF ^b	62.5 (50, 87.5)	-0.405	<0.001**	-0.397	<0.001**	-0.187	<0.001**	
RE ^b	66.67 (0, 100)	-0.472	<0.001**	-0.425	<0.001**	-0.309	<0.001**	
MH ^b	68 (56, 80)	-0.567	<0.001**	-0.507	<0.001**	-0.371	<0.001**	
PCS ^b	44.63 (30.88, 67.75)	-0.532	<0.001**	-0.527	<0.001**	-0.244	<0.001**	
MCS ^b	61.19 (42.94, 81.16)	-0.608	<0.001**		-0.559	<0.001**	-0.363	<0.001**

Notes: IQR: interquartile range; ^a Number (percentage); ^b Median (IQR); ^c Mean $\pm$ SD; PF: physical functioning; RP: role physical; BP: bodily pain; GH: general health; VT: vitality; SF: social functioning; RE: role emotional; MH: mental health; PCS: physical Composite Score; MCS: mental Component Summary.
 $*P < 0.05$; $**P < 0.001$.

Table 6. Comparison between total fatigue and quality of life in different groups gout patients

Group	G1	G2	G3	G4	Z/ χ^2	P
The fatigue scores	0~	4~	6~	9~14		
Number ^a	90 (22)	78 (19)	108 (26.3)	134 (32.7)		
PF ^b	85 (70, 95)	80 (60,95)	65, (45,85)	50, (30,70)	73.576	<0.001**
RP ^b	75 (0, 100)	25 (0, 100)	0 (0, 50)	0 (0, 0)	65.573	<0.001**
BP ^b	52 (41, 74)	51.5 (41, 74)	41 (31, 58.75)	31 (22, 51.25)	48.344	<0.001**
GH ^b	62 (54.25, 77)	55 (45, 67)	50 (40, 65)	36 (25, 50.5)	89.395	<0.001**
VT ^b	80 (70, 85)	70 (55, 80)	60 (50, 70)	50 (38.75, 60)	142.176	<0.001**
SF ^b	75 (62.5, 87.5)	75 (62.5, 87.5)	62.5 (50, 75)	50 (37.5, 75)	63.443	<0.001**
RE ^b	100 (100, 100)	100 (0, 100)	50 (0, 100)	0 (0, 66.67)	82.229	<0.001**
MH ^b	80 (72, 92)	72 (60, 84)	64 (56, 80)	56 (44, 68)	119.231	<0.001**
PCS ^b	64.13 (47.25, 80.44)	55.75 (42.5,75.81)	40.25 (32.25, 63.56)	31 (21.44, 45.63)	110.314	<0.001**
MCS ^b	83.5 (72.29, 89.94)	72.38 (54.83, 86.13)	58.75 (44.22, 75.63)	41.13 (31.59, 56.22)	137.342	<0.001**

Notes: G1: 0-3 points; G2: 4-5 points; G3: 6-8 points; G4: 9-14 points; SD: standard deviation; IQR: interquartile range; ^a Number (percentage); ^b Median (IQR); PF: physical functioning; RP: role physical; BP: bodily pain; GH: general health; VT: vitality; SF: social functioning; RE: role emotional; MH: mental health; PCS: physical Composite Score; MCS: mental Component Summary.
 $*P < 0.05$; $**P < 0.001$.

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