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Fibromyalgia with psoriatic and rheumatoid arthritis: relationship with disease activity and serum vitamin D level

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Abstract

Background The study of the relationship between the presence of fibromyalgia (FM) with rheumatoid (RA) and psoriatic arthritis (PsA) patients can affect the main disease outcome and the treatment decision. The research aims to assess the associated fibromyalgia and vitamin D level in rheumatoid and psoriatic arthritis patients.

Results A cross-sectional study included 60 RA, 30 PsA, and 40 healthy controls, all of them were evaluated for the diagnosis of FM and serum vitamin D level, disease activity score 28 (DAS28), and health quality of life. The mean age of RA was 47.75 ± 11.11 SD, for PsA 44.17 ± 10.8 SD, and for the controls 44.35 ± 13.64 with no significant differences. FM was diagnosed in 21.7% of RA, 13.3% of PsA, and 2.5% of healthy controls with a significant difference among the three groups (*P* value = 0.025). RA and PsA patients with concomitant FM showed statistically significant higher disease activity scores, significantly worse quality of life than those without FM, and significantly lower serum vitamin D than those without FM.

Conclusion Vitamin D deficiency and the presence of FM can be related to higher disease activity and less response to treatment, early recognition and treatment of FM and vitamin D deficiency in RA and PsA patients could be important to obtain a good response to therapy and achieve remission.

Key messages

- There is a strong association between FM and autoimmune diseases.
- Vitamin D level plays an important role in the link between FM and RA or PsA disease activity.
- Concomitant FM with PsA or RA affects the disease outcome and the treatment decision.
- Type of drug therapy cs-DMARDs or b-DMARDs may affect the risk for the association of FM in these patients.

Keywords Fibromyalgia, Psoriatic arthritis, Rheumatoid arthritis

Background

The pathophysiology of rheumatoid arthritis (RA) and psoriatic arthritis (PsA) is not fully understood; although, it is believed that a combination of genetic factors and environmental stimuli causes autoimmune inflammatory responses in both RA and PsA with a significant distinctions exist [1].

Inheritance HLA alleles have been proven to influence illness susceptibility and severity in both PsA and RA.

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However, the fundamental genotypes linked with each disease are distinct.

There is an overlap in the onset of inflammation between psoriatic arthritis and rheumatoid arthritis. Inflammatory reactions are defined by the increased production of pro-inflammatory chemicals that cooperate synergistically to propagate chronic inflammation [2].

In both RA and PsA, most patients have polyarthritis but oligoarticular joint involvement is also possible [3–5].

Fibromyalgia (FM) is one of the most prevalent conditions encountered by rheumatologists. FM is a prevalent chronic ailment characterized by widespread pain, discomfort, exhaustion, sleep, memory, mood disturbances, and cognitive and emotional impairment. Many vague symptoms, like irritable bowel syndrome, anxiety, and depression, are often present when the diagnosis is made [6].

As the etiology and pathogenesis of FM remain unknown, some experts suggest a hypothesis of the pathogenesis of central sensitization [7] with neurobiology-based and supported by empirical and impartial evidence.

Others suggested a neuropathy-induced autoimmune toward nerve tissue, the central sensitization hypothesis can be explained mechanically by the autoimmune theory, this means that the two hypotheses are consistent with each other [8, 9].

The autoimmunity hypothesis originated from the subsequent observations. FM has a similar epidemiological profile to autoimmunity in that it is most common in middle-aged women [10]. FM is linked to a group of autoimmune diseases, such as Sicca syndrome, systemic lupus erythematosus, rheumatoid arthritis, irritable bowel syndrome, thyroiditis, interstitial cystitis/painful bladder syndrome, and restless legs syndrome. FM is commonly associated with the presence of "specific" autoantibodies for certain autoimmune disorders. When they are identified in FM, they are reclassified as secondary FM [11].

The symptoms and signs of FM are similar to those of some autoimmune diseases [12, 13].

The prevalence of vitamin D deficiency among individuals with autoimmune illnesses such as RA, PsA, and axial Spondyloarthropathy (SPA) is substantial, and vitamin D deficiency may be associated with a higher disease activity score in RA and PsA patients. Vitamin D is essential for immune system regulation [14, 15].

Aim of the research

Estimate the frequency of fibromyalgia associated with rheumatoid and psoriatic arthritis, and to evaluate the relationship between the presence of fibromyalgia (FM) with rheumatoid (RA) and psoriatic arthritis (PsA) disease activities. In addition to the assessment of serum 25 vitamin D level and its relationship with of fibromyalgia in these patients.

Patients and methods

It is a cross-sectional study involving 60 rheumatoid arthritis patients diagnosed according to the 2010 American College of Rheumatology/European League Against Rheumatism classification criteria [16], 30 psoriatic arthritis patients diagnosed based on CASPAR categorization criteria [17], and 40 healthy controls. All the participants' onset of disease was after the age of 16 years old. Fibromyalgia diagnosed according to the ACR 2010 diagnostic criteria for fibromyalgia [18].

Patients with any collagen illness other than rheumatoid and psoriatic arthritis were excluded from the study.

All patients were subjected to full medical history, full general and musculoskeletal examination.

In addition, we acquired the following: disease activity index for rheumatoid arthritis, DAS28, and disease activity index for psoriatic arthritis DAS28. Questionnaire on the quality of life for RA and PsA patients Health Assessment Questionnaire (HAQ) [19].

Possible Widespread Pain Index (WPI) points (locations with pain in the previous week); areas include left/right for each shoulder girdle, upper/lower arm, hip/buttock/trochanter, upper/lower leg, mouth, chest, abdomen, upper/lower back, and neck. The WPI consists of a list of 19 painful regions (score range 0–19). Patients indicate whether each spot is painful or not.

The Severity of symptoms scale (SSS) of FM consists of two components: part SS2a (0 to 3) assesses the intensity of weariness, unrefreshed awakening, and cognitive problems. Part SS2b is comprised of a list of 41 symptoms. Patients must indicate whether they are experiencing these symptoms. Patients fall into one of four score groups based on the number of symptoms: 0 symptoms (score of 0), 1 to 10 symptoms (score of 1), 11 to 24 symptoms (score of 2), and 25 or more symptoms (score of 3). The SS score range (0–12) is obtained from the total of the scores for components SS2a (score range (0 to 9) and SS2b (score range (0 to 12) (0–3) [18].

Either a WPI > = 7 and SS > = 5 or a WPI between 3 and 6 and SS > = 9 must be met to diagnose FM.

-The duration of symptoms must be at least 3 months.

-Laboratory investigations includes routine lab, ESR, CRP, serum 25 vitamin D level immunoassay measurement of total 25-hydroxyvitamin D (25OHD) in human serum using commercial kits. This test technique measures a total of 25OHD following solid-phase serum extraction. It assays 25OHD2 and 25OHD3 with identical precision and makes no distinction between the two. And the measured result was deficient at concentrations below 50 nmol/l (20 ng/ml). Insufficient for 20–30 ng/

ml (50–75 nmol/l) and adequate for 75–250 nmol/l (30–100 ng/ml).

Statistical analysis

Statistical analysis was carried out using (SPSS Inc. Chicago, IL), Continuous variables were displayed as mean ± standard deviation, compared by Student's *t* test and chi-square test, and one-way analysis of variance (ANOVA) test to compare means of more than two groups. Mann–Whitney test was used instead of Student's *t* test when the data are nonparametric.

Pearson chi-square test was used to compare percentages of qualitative variables.

Pearson correlation test to compare two quantitative variables and Spearman correlation test instead if the data are non-parametric.

Simple linear regression analysis using a one-way analysis of variance (ANOVA) test to assess the type of relationship among different variants. *P* value ≤ 0.05 is considered significant.

Results

A total of 90 patients was included in our study, of which 60 were diagnosed with RA (71.7% females 28.3% males), 30 were diagnosed with PsA (36.7% females 63.3% males), in addition to 40 healthy adults as the control group (65% females 35% males) (Table 1).

The comparison among the three groups showed no significant differences in the age.

Serum vitamin D in RA patients ranged from 12.95 to 23.8 ng/ml; the mean was 18.47 ± 7.73 ng/ml. In PsA patients ranged from 17.9 to 31 ng/ml, with a mean of 23.04 ± 9.58 ng/ml. In the control group ranged from 20.45 to 30.47 ng/ml, the mean was 25.76 ± 6.74 ng/ml. There was a highly statistically significant difference among the three groups as regards serum vitamin D level (*P* value = 0.001).

The frequency of FM is 13 RA patients out from 60 patients (21.7%), 4 PsA patients out from 30 patients (13.3%), and 1 healthy person out from the 40 control (2.5%), there was a significant difference among the three groups as regards the frequency of FM (*P* = 0.025).

Fibromyalgia score

The mean ± SD in the control group (2 ± 3), in RA (7 ± 5), in PSA (4 ± 5), with a highly statistically significant difference among the three groups (*P* = 0.009).

Disease duration

In RA patients mean ± SD was 9.7 ± 7.3, but in PsA patients was 6.8 ± 3.8, with a significant difference (*P* = 0.04).

Age at the disease onset mean ± SD in RA patients was 38.1 ± 10.8 years but in PSA patients was 37.3 ± 11.4 with no significant difference (*P* = 0.7).

Student's *t* test and chi-square test were used in the comparison between fibromyalgia patients and non-fibromyalgia patients:

The range of age in the fibromyalgia group was 42–52 years with a mean of 46.56 ± 9.48. In the non-fibromyalgia group range 34–52 years old with a mean of 43.0 ± 4.83, *P* value = 0.1.

For the disease duration and age at disease onset in the FM patients 9 ± 6.3, 35.8 ± 11.9 years respectively but 5.6 ± 6.7, 24.6 ± 20.3 years respectively in the non-fibromyalgia patients, the duration of the disease was significantly higher in the FM (*p* = 0.04).

Table 1 Comparison between the studied group population as regard socio-demographic characteristics, serum vitamin D level, fibromyalgia frequency, and fibromyalgia score

Parameter		Rheumatoid arthritis *N* = 60		Psoriatic arthritis *N* = 30		Controls *N* = 40		*P* value
		No	*%*	*No*	*%*	*No*	*%*	
Gender	Females	43	71.7%	11	36.7%	26	65.0%	0.005
	Males	17	28.3%	19	63.3%	14	35.0%	
Age (years)	Mean + SD Median (interquartile range)	47.75 ± 11.11 48.50 (39_55)		44.17 ± 10.8 44 (36_50)		44.35 + 13.64 44(36_55)		0.2
Serum vitamin D level Mean + SD Median (IQR)		18.47 + 7.73 17.9 (12.95_23.8)		23.04 + 9.58 24.15 (17.90_31)		25.76 + 6.74 26.85 (20.45_30.75)		0.001
Fibromyalgia frequency	Absent	47	78.3%	26	86.7%	39	97.5%	0.025
	Present	13	21.7%	4	13.3%	1	2.5%	
Fibromyalgia score Mean + SD Median (IQR)		7 ± 5 6 (2–10)		4 ± 5 3 (0–7)		2 ± 3 0 (0–3)		< 0.009

Significance at $P \leq 0.05$

Laboratory investigation

There is a very high significant difference between both groups (FM and non-FM) as regards CRP and ESR (p value < 0.007 and < 0.004) respectively but there is no significance as regards complete blood count (CBC) parameters, liver enzymes, and renal function.

The comparison between the fibromyalgia and the non-fibromyalgia groups as regards VAS, DAS28, and HAQ, all of them showed a high statistically significant difference between both groups. This means that the fibromyalgia group showed statistically significant higher disease activity, and worse HAQ than the non-fibromyalgia group (Table 2).

Regarding serum vitamin D level, the mean level in the FM group is 10.94 ± 4.86 ng/ml but in the non-FM group is 23.51 + 7.67 ng/ml with a highly significant difference (p < 0.004).

Sufficiency of serum vitamin D level

Sufficient level in 25% of the non-FM group but 0% in the FM group, insufficient level in 37.5% of the non-FM group but only 5.6% in the FM, 33.9% of the non-FM group showed mild to moderate deficiency while 33.3% of the FM group showed mild to moderate deficiency, severe deficiency occurred in 3.6% of the non-FM group and 61.1% of FM group showed a severe deficiency, there was a highly significant difference between both groups. Non-FM showed significantly higher serum vitamin D than the FM with a p < 0.001 (Fig. 1).

Disease activity and FM

In RA patients, FM was diagnosed in 92.3% of the patients with severe activity and 7.7% in patients with moderate activity, there was a highly significant difference between RA patients with remission and those with active disease.

As regards frequency of FM (p value < 0.0005). In PsA patients, FM was diagnosed in 50% of the patients with severe activity and 50% in patients with moderate activity, there was a significant difference between PsA patients with remission and those with active disease as regard frequency of FM p value = 0.04 (Fig. 2).

For RA patients with and without FM as regards VAS, DAS28, HAQ, and FM score. The fibromyalgia group had significantly higher disease activity, FM score, and worse HAQ than RA patients without fibromyalgia with a p

Table 2 Comparison between different scoring systems among patients with fibromyalgia and patients without fibromyalgia

Scoring system	No fibromyalgia $N = 112$					Fibromyalgia $N = 18$					p
	Mean	SD	Median	Min	Max	Mean	SD	Median	Min	Max	
VAS	1.75	2.00	1.00	.00	8.00	5.33	2.77	5.00	.00	9.00	< 0.001
DAS28	2.23	1.88	2.40	.00	6.00	5.13	1.50	5.40	.00	7.00	< 0.001
HAQ	.55	.81	.00	.00	3.00	2.00	.84	2.00	.00	3.00	< 0.003

VAS Visual Analog Scale, *DAS28* Disease Activity Score 28, *HAQ* Health Assessment Questionnaire

Significance at $P \leq 0.05$

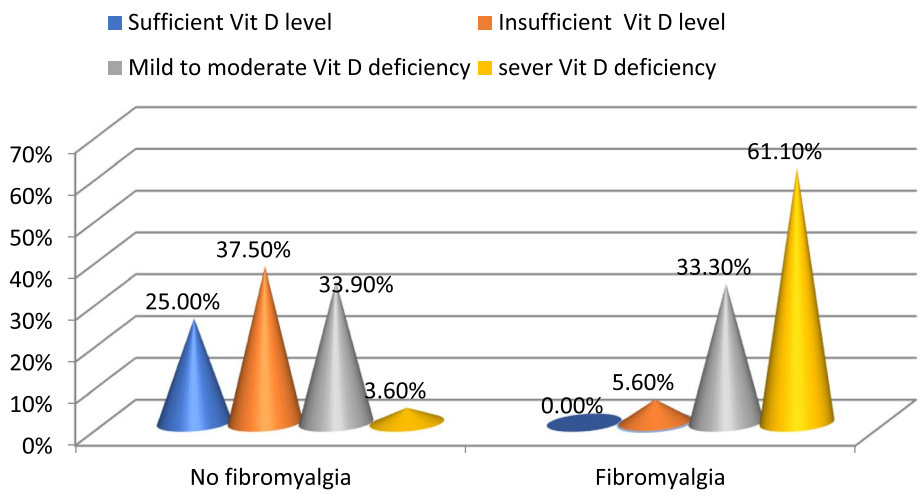

Fig. 1 Vitamin" D" level in patients with or without fibromyalgia

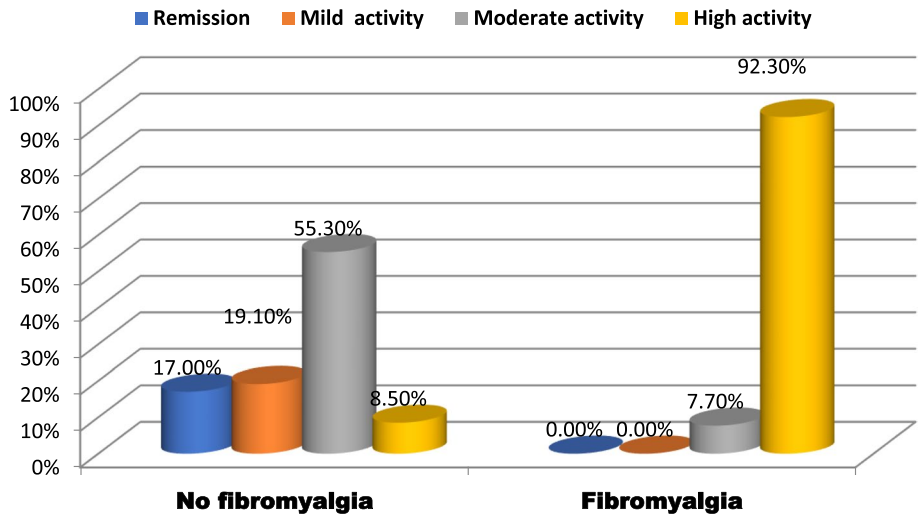

Fig. 2 Disease activity status in relation to presence or absence of fibromyalgia in *rheumatoid arthritis* patients

value of VAS < 0.001, DAS28 < 0.002, HAQ < 0.002, and *p* values of fibromyalgia score, WPI, SSS are < 0.003, < 0.008, and < 0.003 respectively.

For PsA patients with and without FM as VAS, DAS28, HAQ, and fibromyalgia score. The fibromyalgia group had a significant difference for VAS and HAQ with a *p* value of VAS = 0.05, HAQ = 0.03 while for DAS28, there was a highly significant difference between both groups with *p* value = 0.002.

Study of vitamin D

The RA patients with insufficient vitamin D levels have significantly higher disease activity score (DAS28), fibromyalgia score, and its components WPI, SSS shown as *p* value < 0.001, < 0.0004, < 0.003, = 0.005 respectively, than RA with sufficient vitamin D levels. HAQ showed insignificant difference between them (*p* value = 0.09).

For PsA patients with insufficient vitamin D levels were significantly higher in disease activity score (DAS28) with *p* value = 0.001, HAQ, fibromyalgia score and its components WPI, SSS shown as *p* value = 0.01, 0.01, 0.01, 0.02, respectively, than those with sufficient levels.

RA patients on cs-DMARDS 30% diagnosed with FM, and those on biological DMARDS13.3% diagnosed with FM, while there was no significant difference between them ($p = 0.13$) as regards fibromyalgia scores (*p* value = 0.13). Risk ratio (odds ratio) for FM in RA patients on cs-DMARDS and RA patients on biological DMARDS, the risk ratio = 2.78 means that patients on cs-DMARDS are 2.78 times at risk to develop FM than those on biological DMARDS.

PsA patients on anti-TNF and PsA patients on IL17 inhibitors as regards prevalence of FM, 3(23.1%) patients on anti-TNF have FM but 1(5.9%) of patients on IL17 inhibitors had FM with no significant difference between them as regards FM scores (*p* value = 0.37).

Risk ratio (odds ratio) for FM between both PsA patients on anti-TNF and PSA patients on IL17 inhibitors, the risk ratio = 4.8 means that patients on anti-TNF are 4.8 times at risk to develop FM than those on IL17 inhibitors.

RA patients on cs-DMARDS and RA patients on biological DMARDS as regards the sufficiency of vitamin D; there was no significant difference between them ($p = 0.3$). For PsA patients on anti-TNF and PSA patients on IL17 inhibitors as regards the sufficiency of serum vitamin levels, there was no significant difference between them ($p = 0.3$).

Regression analysis

Regression coefficient analysis between FM and Rheumatoid activity score showed a strong positive regression coefficient EXP(B) 15.66 (> 1), significance = 0.001, B0 = 2.751 Regression coefficient analysis between FM and PSA activity score showed positive regression coefficient score EXP (B) 6.746 (> 1), significance = 0.049, B0 = 1.909.

This means disease activity may be a risk factor for FM in both rheumatoid and psoriatic arthritis patients.

Also, the regression coefficient analysis between fibromyalgia score and serum vitamin D level in rheumatoid showed negative regression coefficient EXP (B) 0.663 (< 1), significance = 0.000, B0 = −0.410.

Regression coefficient analysis between fibromyalgia score and serum vitamin D level in PSA showed EXP (B) = 0.876(< 1), significance = 0.0001, B0 = −0.132.

This means that vitamin D deficiency may be a risk factor for FM in rheumatoid and psoriatic arthritis patients (Table 3).

Discussion

The prevalence of comorbid FM in rheumatoid arthritis (RA), axial spondylarthritis (axSpA), and psoriatic arthritis (PsA) patients are considerably higher than in the general population [20]. In PSA patients, those with comorbid FM have greater disease activity scores than those without FM. These results are the same as what Cevriye Mülkolu et al., Noha A. Elsawy et al., Duffield et al., and Zhao et al. found in their research [21–23]. In the past, tender spots from PsA and tender spots from FM, as described in the ACR's 1990 Criteria for the Classification of FM, could have made it impossible to differentiate between the two disorders as this score uses tenderness at six frequent entheseal locations that overlap with some FM tender points. With the implementation of the 2010/2011 FM diagnostic criteria (which were used to diagnose our patients in the current study), tender spots have been eliminated from the diagnostic criteria, thereby reducing the level of misunderstanding [24, 25].

Our results showed statistical significant difference in HAQ between patients in the PsA group who have FM and those who do not have FM, concurrent FM may lead to a decline in quality of life, which matched with results of Kancharla et al., who concluded FMS is an important contributor towards poor HRQoL in patients of PsA and is associated with higher values of joint disease activity measures [26]. Consequently, it is essential to determine if the increased disease activity in PsA patients is related to real activity or concurrent FM.

The results showed that FM is more common in people with active disease than in people whose disease is in remission; this result is consistent with earlier research by Graceffa et al. [27]. It is critical to recognize that apparent high disease activity based on disease activity scores may not simply reflect an increased inflammatory burden. If disease remission goals are not met despite optimal treatment, the presence of FM should also be questioned [21].

There is a significant interest in the scientific fields of hypovitaminosis D and FM, particularly in chronic inflammatory arthritic illnesses [28]. In our study serum vitamin D levels in the healthy control group were significantly higher than in the RA and PSA patient groups this result is consistent with Ellis et al. and Martins et al.'s [29]. The vitamin D levels in people with RA and FM are statistically different from those without FM. People with rheumatoid arthritis who do not have enough vitamin D level showed a higher fibromyalgia score and a higher disease activity index (DAS28) than those who have enough vitamin D level; this outcome is similar to Moscovici et al. study [30]. This indicates that serum vitamin D insufficiency in RA and PsA patients may be a determining factor in the development of FM in these patients, and vitamin D supplementation may help to prevent musculoskeletal discomfort and FM [28].

Numerous previous studies showed that concurrent FM in chronic inflammatory arthritis impacts treatment decisions; almost all these studies showed that having FM at the same time may have a negative effect on the development of positive clinical responses. This could lower the overall clinical effectiveness of medications and cause doctors to choose the wrong treatments. In their longitudinal prospective study, Salaffi et al. investigated medication response (conventional synthetic and/or biologic

Table 3 Binary logistic regression between presence of fibromyalgia, DAS28 score, and serum vitamin D respectively

Binary logistic regression between DAS28 score and presence of fibromyalgia							
B	S.E	Wald	df	Sig	Exp (*B*)	95% C.I. for EXP(B)	
						Lower	Upper
Rheumatoid arthritis							
2.751	.820	11.255	1	.001	15.664	3.139	78.162
Psoriatic arthritis							
1.909	.971	3.867	1	.049	6.746	1.006	45.226
Binary logistic regression between vitamin "D" level and presence of fibromyalgia							
B	S.E	Wald	df	Sig	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Rheumatoid arthritis							
−.410-	.117	12.358	1	.000	.663	.528	.834
Psoriatic arthritis							
−.132-	.068	3.796	1	.051	.876	.767	1.001

Significance at $P \leq 0.05$

DMARDs) and potentially relevant characteristics in a cohort of patients with rheumatoid arthritis. Six months later, none of the patients with concurrent fibromyalgia were in remission [31]. In a prospective study Molto et al. [27] investigated the biologic response among patients with axial spondylarthritis and found no difference in C-reactive protein (CRP) lowering response between individuals with and without concomitant fibromyalgia patients with fibromyalgia, on the other hand, showed less improvement in most other ways after 12 weeks of treatment.

Therefore, researchers concluded that the impact of concomitant fibromyalgia on biological drug response is a poor predictor for the achievement of satisfactory clinical responses, resulting in termination of therapy, therapy switch, or addition of another medication (overtreatment). Fibromyalgia should be considered in order to prevent overtreatment of people with inflammatory rheumatic illnesses [32].

The examination of the influence of drug therapy (csDMARDs-biological DMARDs) on the outcome of the FM score was added to our research to determine if therapy type in these patients is a factor in the development of FM. In RA patients, 30 received cs DMARDS and 30 received b-DMARDS (anti-TNF), the incidence of FM in patients treated with csDMARDs is 30%, which is more than the incidence of FM in patients treated with biological anti-TNF (13.3%), that the results showed the probability of developing FM in RA patients on csDMARDS is 2.7 times higher than those on b-DMARDS (anti-TNF), although the difference was not statistically significant, making patients on cs DMARDS more susceptible to develop FM. This could support b-DMARDs are better than csDMARDs at reducing disease activity which agreed with Holdsworth et al. [33].

In PsA patients, the incidence of FM among those taking anti-TNF is 23.1%, which is significantly greater than among those taking IL-17 inhibitors (5.9%). According to treatment, the FM chance ratio is 4.80. This means that the risk of developing FM in PsA patients receiving anti-TNF is 4.8 times higher than in PsA patients receiving IL-17 inhibitors. Those with anti-TNF are therefore more likely to acquire FM. However, no substantial difference was observed. In addition, there was no statistically significant difference between FM score and treatment type for these patients. Therefore, we still cannot use the type of therapy as a predictor; although, it may have a role in the development of FM in these patients.

FM may also be a sign of disease activity due to the cross-sectional nature of our investigation, after the improving disease activity it may be proposed that individuals with FM be routinely contacted for follow-ups and examined to determine if they continue to have FM. Similarly, it might be a good idea to check for FM in patients with more active disease and, if it is there, treat it before giving them new anti-rheumatic drugs.

In addition, a statistically significant link exists between the fibromyalgia score and serum vitamin D levels in RA patients. This significant regression exp *B* value confirms this correlation result. Vitamin D deficiency is another key risk factor for FM in rheumatoid arthritis patients. Patients with RA who don't have enough vit D in their blood are more likely to get FM than those who do.

Study limitations

The number of the studied population is still small, and the cross-sectional study design could not allow follow-up the patients whether they still have FMS after improved disease activity.

Study recommendations

There is a clear need for further studies to evaluate the impact of concomitant FMS on disease activity in various rheumatologic diseases with larger populations.

Conclusion

Our research demonstrates that RA patients have a higher prevalence of FM than PsA patients. In RA and PsA, there is a strong link between the FM score and the disease activity. Early diagnosis and treatment of FM in patients with RA and PsA are crucial for acquiring a favorable response to therapy and establishing remission. The treatment of vitamin D deficiency in RA and PsA patients plays a role in lowering the development of FM in these patients.

Abbreviations

ACR	American College of Rheumatology
Anti-TNF	Anti-tumor necrosis factors
b-DMARDs	Biological Disease-modifying anti-rheumatic drugs
CASPAR	CIASsification criteria for Psoriatic ARthritis
CBC	Complete blood count
CRP	C-reactive protein
cs-DMARDs	Synesthetic Disease-modifying anti-rheumatic drugs
DAS-28	Disease Activity Score-28
ESR	Erythrocyte sedimentation rate
FM	Fibromyalgia
HAQ	Health assessment questionnaire
HLA	Human leukocyte antigens
HRQoL	Health-related quality of life
IL17	Interleukin 17 inhibitors
PsA	Psoriatic arthritis
RA	Rheumatoid arthritis
SPA	Spondyloarthropathy
SSS	Severity of symptoms scale
VAS	Visual Analog Scale
Vit D	Vitamin D
WPI	Widespread Pain Index
25OHD	25-hydroxyvitamin D

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Authors' contributions
Conceptualization, methodology, supervision, validation, writing evaluation, and editing by Hanan S A, Dalia S E, Rabab H A. Data curation, formal analysis, research methodology, resources, and original draft writing by Alshaimaa H K. Project administration, visualization, writing the final draft, and manuscript submission are Hanan S. A's responsibilities. All authors read and approved the final manuscript.

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Availability of data and materials
Available on request.

Declarations

Ethics approval and consent to participate
The study was authorized by the Ethics Committee of the Faculty of Medicine at Sohag University in Egypt, with no (IBR-Soh-Med-21–05-03), and all participants provided written informed consent.

Consent for publication
All authors gave consent for publication.

Competing interests
The authors declare that they have no conflicts of interest.

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