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Functional Capacity in Patients with Rheumatoid Arthritis and Its Correlation with Disease Activity

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Author`s Contribution

[1,2]Substantial contributions to the conception or design of the work; or the acquisition, [3]Final approval of the study to be published, [1,5]Drafting the work or revising it critically for important intellectual content,[6]Active participation in active methodology, analysis, or interpretation of data for the work,

Funding Source: None

Conflict of Interest: None

Received: Aug 11, 2025

Revised: Nov 24, 2025

Accepted: Dec 18, 2025

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ABSTRACT

Objective: To identify the functional capacity in RA patients on the basis of the HAQ and to determine its correlation with the disease activity on the basis of DAS-28 ESR in a tertiary care hospital in Pakistan.

Methodology: This cross-sectional study was conducted in the Rheumatology Department of Pakistan Institute of Medical Sciences (PIMS) Islamabad from Nov, 2024 to April, 2025. A sample of 196 patients with Rheumatoid Arthritis (RA) who were all adults and fulfilled the 2010 ACR/EULAR classification criteria. The Health Assessment Questionnaire (HAQ) was used to measure functional status, and Disease Activity Score in 28 joints (DAS28) with erythrocyte sedimentation rate (ESR) was used to measure disease activity. We analyzed the correlation between the DAS28 and HAQ scores based on the descriptive statistics, Pearson and Spearman correlation, linear regression, and multinomial logistic regression. The adjusted regression models were based on age, disease duration and socio-demographic factors.

Results: The average age of the participants was 43 (SD±12.4) years and the average disease duration of the participants was 8.7 (SD ±7.2) years. Mean DAS28 score was 4.56 (SD ±1.06) and Health Assessment Questionnaire (HAQ) was 0.86 (SD ±0.56). Approximately eighty-eight percent of the patients had moderate to high disease activity, and seventy-one percent had moderate disability. There was a strong positive correlation between DAS28 and HAQ scores (r 0.630, p 0.001). Linear regression identified DAS28 (β = 0.518), age (β = 0.296), and disease duration (β = 0.202) as significant predictors of HAQ (R^2 = 0.566, p < 0.001). Multinomial logistic regression also supported the fact that DAS28 category, age (OR 1.013, 95% CI 1.009–1.018, p < 0.001), disease duration (OR 1.016, 95% CI 1.0081024, p < 0.001) and educational status had a statistically significant effect on HAQ disability levels.

Conclusion: There is a strong correlation between functional disability and disease activity in rheumatoid arthritis patients, with higher scores on DAS28 correlating with greater impairment.

Keywords: Rheumatoid arthritis, Disease Activity Score with ESR (DAS28-ESR), the Health Assessment Questionnaire (HAQ), Functional Disability, Pakistan

Cite this article as: Rehman A, Farhan U, Rasheed U, Rahman B, Zamarrud S, Aleem S, Khan MS. Functional Capacity in Patients with Rheumatoid Arthritis and Its Correlation with Disease Activity. Ann Pak Inst Med Sci. 2025; 21(4):711-715. doi. 10.48036/apims.v21i4.1609

Introduction

Rheumatoid arthritis (RA) is an autoimmune, inflammatory disease characterized by chronic inflammation of the joints, pain, and progressive functional disability, eventually reducing the quality of life and socio-economic productivity of patients.[1] Rheumatoid arthritis has a worldwide prevalence of about 0.5 to 1 percent but there is significant interregional variation with higher prevalence estimates in Western countries and

lower estimates in many Asian countries.[2] The Stanford Health Assessment Questionnaire (HAQ), as a self-reported assessment scale that is valid and reliable, is most often used to measure functional capacity in patients with Rheumatoid Arthritis (RA) and helps to evaluate their competence in carrying out daily activities such as dressing, rising, eating, walking, hygiene, reaching, gripping, and other functional activities.[3] The temporal change in the Health Assessment Questionnaire (HAQ) scores can also be used as a measure of the trend of disability in longitudinal studies. Disease activity is regularly measured using the Disease Activity Score in 28 joints (DAS28) which is a composite index that combines tender and swollen joint counts, patient global perception of disease activity and erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) levels. Based on the DAS28-ESR, patients can be categorized as being in remission or having low, moderate, or high disease activity. [4]

In Pakistan, various conditions exacerbate the effects of rheumatoid arthritis on the functional capacity of patients such as late diagnosis, delayed treatment, lack of awareness of the disease by the patient, and lack of healthcare resources.[5] Early diagnosis and proper treatment in rheumatoid arthritis is a key factor in stopping the progression of the disease and maintaining functional capacity.[6] In countries with a low number of rheumatology specialists, such as Pakistan, the routine use of standardized instruments, such as the Health Assessment Questionnaire (HAQ) and the Disease Activity Score in 28 joints (DAS28), may substantially enhance patient treatment by identifying early functional impairment. These quantitative instruments assist clinicians in monitoring the progress of the patient, and it is easier to make decisions about adjusting treatment and forecasting the outcomes. In addition, the combination of the HAQ and DAS28 in clinical studies offers additional information on the efficacy of treatment measures on various treatment approaches.[3] The method can be used to explain the comparative effectiveness of conventional, targeted and biologic disease modifying anti-rheumatic drugs.

In this regard, there is a paucity of regional epidemiological data and this study was designed to clarify the correlation between functional capacity, measured by HAQ scores, and disease activity, measured by DAS-28 scores, in patients with Rheumatoid Arthritis.

Methodology

This was a cross-sectional observational study with a six-month period of study in the Department of Rheumatology at the Pakistan Institute of Medical Sciences (PIMS), Islamabad, from Nov, 2024 to April, 2025. Convenience sampling was used to recruit patients. The eligibility criteria were adults aged 16 years or more who had rheumatoid arthritis (RA) diagnosed on the basis of the 2010 American College of Rheumatology/European League against Rheumatism (ACR/EULAR) classification criteria. Patients were excluded if they were under the age of 16 or had pre-existing comorbid conditions, including but not limited to complicated diabetes mellitus, hypertension, cardiovascular or cerebrovascular disease, history of major trauma or accidents, chronic liver or kidney disease, malignancy, epilepsy, psychiatric illness, or other forms of inflammatory arthritis.

The study protocol (Ref No. F 5 2 /2024(ERRC)/PIMS) was approved by the Institutional Review Board of PIMS and is provided in Annex A. Informed consent was provided by all participants, in a language that they comprehended, before enrolment. The research was in line with the ethical principles of the Declaration of Helsinki.

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A required sample size was determined and gave a minimum of 196 participants, which was based on the assumption of a small effect size (Cohen d = 0.2), a significance level of 0.05, and a statistical power of 80 percent. The sample size was calculated using the formula $n=z^2*(P*(1-P))/E^2$. Prevalence value was taken from the study by Farooqi et al.[15]

Participants were recruited consecutively as outpatients. The structured questionnaire was used to collect the data with the help of an interviewer and was based on validated tools.AR Author conducted a standardized 28-joint count of swelling and tenderness, and documented the global assessment of the patient along with the ESR value to

obtain the Disease Activity Score in 28 joints (DAS28-ESR). The standardized Stanford Health Assessment Questionnaire was used to assess functional status. A series of 20 questions covering 8 functional domains were asked and marked on a scale of zero to three with zero signifying no functional impairment and three signifying inability to perform the task. The collection of responses was digitized using Google Forms.

The data obtained were demographic, disease duration, current pharmacologic treatment (including disease-modifying anti-rheumatic drugs (DMARDs) and corticosteroids), and DAS28-ESR and HAQ scores.

The statistical analyses were all conducted using SPSS V 29. The histograms were used to analyze the distributions of the data. The continuous variables were presented in the form of means and standard deviations (SD). Frequencies and proportions were used to present the categorical variables in terms of 95 per cent confidence intervals (CI). ANOVA was used when comparing groups, provided that the data met the requirements of normality. Multivariate regression analysis was done to examine the relationship between HAQ scores and disease activity (DAS28) and a two-tailed p-value below 0.05 was considered significant.

The standardized questionnaires in this study, such as the HAQ and DAS28 assessment forms, are also given as additional material. The informed consent form in the local language is also provided in written form.

Results

The mean age of the participants was 43 years (SD ±12.43). The participants had an average of 8.69 years (SD ±7.17) of living with the disease. The mean DAS28 score was 4.56 (SD ±1.06), showing that the disease activity on average was moderate. The mean HAQ was 0.86 (SD ±0.56), which indicated mild to moderate disability.

Table I delineates the demographics and pharmacotherapy of the study population. More than 90 percent of the study participants were female. More than half of the patients did not have a formal education (61.7 %) and only 20 % had an education level till matriculation. Only one percent of the study population were smokers. The patients mostly belonged to the urban areas with 60% hailing from the twin cities of Islamabad and Rawalpindi. The overwhelming majority of the patients were using conventional synthetic disease modifying agents including Methotrexate, Leflunomide, sulfasalazine and Hydroxychloroquine with only 3.5% using Tofacitinib which is a targeted synthetic disease modifying agent. Three quarters of the study population was using Corticosteroids with the mean dose being 3.9 mg.

Table I: Sociodemographic Characteristics.

Characteristics	N	%
Gender		
Female	179	91.3%
Male	17	8.7%
Educational Status		
Masters	2	1.0%
Bachelors	8	4.1%
Matric	41	20.9%
No formal education	121	61.7%
Primary	7	3.6%
Secondary	17	8.7%
Smoking Status		
Yes	2	1.0%
No	194	99.0%
Pharmacotherapy		
Methotrexate monotherapy	73	37.2 %
Leflunomide monotherapy	20	10.2 %
Methotrexate plus Leflunomide	23	11.7%
Tofacitnib	7	3.5%
Prednisolone	150	76.5%
Average dose of Prednisolone	3.9 mg	

Table II shows the details of the HAQ and DAS-28 scores. More than two thirds of the study participants had mild to moderate disability (65%) and 6.6% had severe disability. The proportion of participants who were in remission (5.6%) and who had low disease activity (6.1%) was very low. Most of the patients had moderate (55.1%) or high disease activity (33.2%).

Table II: HAQ and DAS 28 Scores.

Categories	N	%
HAQ Score		
Normal	56	28.6%
Mild disability	70	35.7%
Moderate disability	57	29.1%
Severe disability	13	6.6%
Total	196	100%
DAS 28 Score		
Remission	11	5.6%
low disease activity	12	6.1%
moderate disease activity	108	55.1%
high disease activity	65	33.2%
Total	196	100%

There was a strong positive correlation between DAS28 and HAQ20 scores (r 0.630, p 0.001) indicating that higher the disease activity, the greater the functional disability. The reliability of this result is ensured by the 95% confidence interval (0.537-0.707). Annexure B has provided a detailed analysis. (Table III)

Categorized DAS28 and HAQ20 scores had a significant but slightly lower correlation (Pearson r = 0.488, Spearman rho = 0.519, both p = 0.001) which demonstrated the consistency of the relationship between

Table III: Correlation between DAS 28 and HAQ20.

	Confidence Intervals			
	Pearson Correlation	Sig. (2-tailed)	95% Confidence Intervals (2-tailed)[a]	
			Lower	Upper
DAS28 - HAQ20	.630	<.001	.537	.707

a. Estimation is based on Fisher's r-to-z transformation.

Table IV: DAS28 Score and HAQ20 Score. (Categories)

	Confidence Intervals			
	Pearson Correlation	Sig. (2-tailed)	95% Confidence Intervals (2-tailed)[a]	
			Lower	Upper
Das28scoringupdated - haq20scoring	.488	<.001	.373	.588

a. Estimation is based on Fisher's r-to-z transformation.

the two scaling methods. These findings support the hypothesis that, the disease severity is associated with the severity of disability, irrespective of the categorization of the variables. (Table IV)

HAQ20 scores were predicted by DAS28, age, and disease duration in a linear regression model (R 2 = 0.566, p = 0.001). The strongest predictor was DAS28 with the highest standardized beta (0.518). The contributions of age (0.296) and disease duration (0.202) were significant. In case of multinomial logistic regression analysis, variables such as DAS28 category ($p < .001$), age ($p < .001$), disease duration ($p < .001$), and education level ($p = .047$) were found to significantly affect the disability status. The value of R 2 is 0.646 which means that the model has a lot of explanatory power.

Discussion

This cross-sectional study was conducted to determine the correlation between disease activity and functional disability in patients with Rheumatoid Arthritis attending a tertiary care hospital in Pakistan. A significant percentage of the respondents had moderate to severe disease activity (mean DAS28 score 4.56) and 64.8% had at least mild to moderate disability with 6.6% being severely disabled based on the Health Assessment Questionnaire (HAQ). A systemic review parsing literature from 1998-2008 and analyzing 42 studies found a statistically significant association between joint damage and disability.[7] Another extensive systemic review found disease activity and pain to be significant predictors of hand function in patients with Rheumatoid Arthritis.[8] Additionally, longitudinal studies of RA patients show HAQ disability index to be predictive of long-term work disability.[9] The TICORA (Tight Control in Rheumatoid Arthritis) trial was seminal in putting forth the concept of treat-to-target by establishing that intensive disease management led to improved disease activity and subsequently better physical function and quality of life. [10]

The rates of remission and low disease activity states in our cohort is quite low (5.6 and 6.1 percent respectively which is in stark contrast to the reported rates of these indices in the international literature. Remission rates for targeted synthetic DMARDs range from 14.6% to 48% and for methotrexate 7.6% to 29%. Low disease activity rates range from 28% to 60% and 14% to 46% for targeted synthetic DMARDs and methotrexate respectively.[11] While this study was not powered to determine the rates of remission and low disease activity, there are still a number of factors that can explain the difference. The number of patients using drugs other than conventional synthetic DMARDs was only 3.5%. This is mostly due to cost and availability issues. Furthermore, an overwhelming majoring of the patients (61.7%) did not have any formal education and an additional 20% were educated only till matriculation. A number of studies have established a positive correlation between social determinants of health such has education level and disease activity states.[12,13] The level of education also determines diagnostic and therapeutic delays which lead to a higher disease activity in the long-term.[3]

A significant majority of our study cohort (76.5%) was using glucocorticoids for disease control in addition to disease modifying drugs and even though the mean prednisolone dose was 3.9 mg, it is still a testament to the less than ideal control of the disease in these patients. International guidelines recommend only short term glucocorticoids (less than or equal to three months) when starting treatment for Rheumatoid Arthritis. [14]

Conclusion

The study from a tertiary care center shows that there is a strong correlation between disease activity and functional capacity in patients with rheumatoid arthritis. It adds to the growing evidence base of intensive treatment regimens with close follow-up in these patients with a potentially debilitating disease to prevent the development of functional disability.

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