ORIGINAL RESEARCH ARTICLE

Correlation of Body Mass Index and Disease Activity Score (DAS-28) in Patients with Rheumatoid Arthritis

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ABSTRACT

Background: Rheumatoid Arthritis (RA) is the most common autoimmune disease. RA can cause permanent deformity and loss of productivity. The primary objective of the study was to evaluate the relationship of BMI with Disease Activity Score in RA patients. The secondary objective was to evaluate the presence of comorbidities such as diabetes, thyroid, hypertension, periodontitis, and pregnancy outcomes (in the case of females) in the RA patients population presented at the tertiary healthcare centre.

Method: The presented study was a cross-sectional study. 100 Patients presented to the joint clinic were recruited. RA diagnosis of patients was based on the ACR/ELULAR criteria. Their demographic and clinical data was collected through one-on-one interviews.

Results: The recruited population shows that BMI has a moderate positive correlation (r=0.347, p=0.001) with disease activity scores. 51% of RA patients have one or more comorbidities. 45.2 % of female RA patients suffered one or two miscarriages during their pregnancy. It is significantly higher as compared normal female population.

Conclusions: Active control of BMI may be required to prevent RA symptom aggravation. RA patients are prone to develop comorbidities and females with RA may need close monitoring during their pregnancy period.

Keywords: Demographic profile, Rheumatoid Arthritis, Body-Mass Index, periodontitis

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INTRODUCTION

Rheumatoid Arthritis (RA) is the most common autoimmune disease with a prevalence of 0.5% to 1% worldwide.[1] It is characterized by its bilaterally, progressive and destructive nature.[2] RA can cause permanent deformity[3], loss of productivity, and decline in quality of life[4]. Extension of pathogenesis shows extra-articular effects on patients including dryness of mouth, skin, and eyes. Pulmonary dysfunction and weakening of vital organs are also observed.[5]

RA is a disease with unknown etiology, but according to the literature, there are some factors known to trigger the disease such as smoking, family history, and Body Mass Index (BMI).[6] Body Mass Index (BMI) was found to correlate with many other human diseases. However, only a few studies reported the correlation between Body Mass Index and disease activity in the case of RA.[7,8] However, there are controversies in different studies. A group from France has reported the role of BMI in the progression of diseases.[9] Another study on the validation of different markers also gives a positive correlation between BMI and disease activity[10] whereas, Albrecht et al. [11] in their article concludes that increased body mass is responsible for the delayed onset of RA.

Family history is considered one of the predictors of the onset of disease.[12] Many studies claim that patients with a positive family history are at a high risk of the onset of RA.[13] Females are affected with RA three times more than males.[14] The high prevalence rate of the disease among females is associated with hormonal fluctuations.[15] Pregnancy also alters the frequency and severity of flares in the presentation of the disease.[16,17]

The purpose of the presented study was to evaluate the disease profile of RA patients presented to our tertiary care centre. The primary objective of this study was to evaluate the correlation of BMI with the Disease Activity Score-28 (DAS-28) score in the RA population. The secondary objective was to evaluate the presence of comorbidities and distribution of RA disease in the context of, age of disease onset, gender ratio, presence or absence of RA disease history in the family and the pregnancy outcomes among females with RA.

METHODOLOGY

This study was a cross-sectional study. It was based on the descriptive research methodology. The present study is part of a study for which protocols[18] were approved by the Institutional Ethics Committee (ISIC\RP\ 2015\045). The study included 100 patients treated in the joint clinic at a tertiary health care centre. The sample size was calculated statistically with 99% C.I. using the formula; $N= Z^2_{1-\alpha/2}* p(1-p)/d^2$, where Z= 2.58, p=0.9%, and d=10%.[19] The calculated sample size was 60 and rounded-off to 100.

Patients diagnosed with RA based on ACR/EULAR-2010 guidelines were recruited in the study after their informed consent.[20] Details of the patient like demography, comorbidity, disease history, and other clinical information including pregnancy and miscarriage history, were recorded in one-on-one interviews.

Erythrocyte Sedimentation Rate (ESR) was detected in whole blood by the Westergine method. Disease Activity Score-28 is used to assess the severity of the disease.[21] DAS 28 calculation takes the number of swelled joints (SJC28) and the number of tender joints (TJC28), the Erythrocyte Sedimentation Rate (ESR) as acute phase inflammatory marker and visual Analogue Scale (VAS) between 0-100 into account, Formula for the calculation of DAS-28 is as follows:

$$DAS28 = 0.56*\sqrt{(TJC28)} + 0.28*\sqrt{(SJC28)} + 0.70*Ln(ESR) + 0.014*VAS$$

Based on DAS-28 patients were divided into four groups: High (DAS-28 >5.1), moderate (3.2-5.1), Low (2.6-3.2), and remission (<2.6).

Ethical Approval: Protocols were approved by the Institutional Ethics Committee, ISIC, with approval number ISIC\RP\ 2015\045.

Statistical Analysis: Statistical summaries for continuous data were presented as mean ± SD and categorical data were presented in frequency and percentage. Scatter chart was presented for data visualization. The Karl-Pearson correlation coefficient was calculated between the Body-Mass Index (BMI) and Disease Activity Score. IBM SPSS version 26 was used for data analysis and graph.

RESULTS

A hundred patients with definite rheumatoid arthritis were recruited from the joint clinic at the tertiary health centre. Out of 100 patients, 84 were female and 16 were male. The female: Male ratio is found to be 5.25:1. The mean and median age of the recruited patient were 48.02±10.63 years and 49.5 years respectively. The patient distribution according to the age of disease onset is represented in Table 2 The peak of onset of disease was obtained in two age groups, 31-40 years (n=35) and 41-50 years (n=30) with a median of age in both groups was 35 years and 45 years respectively. The median of disease history was 5 years (range: 6 months to 15 years).

Recruited patients were categorized into four categories according to BMI; Obese (17%, ≥30 kg/m^2), Overweight (38%, 25-29.9 kg/m^2), Underweight (6%, <18.5 kg/m^2) and healthy (39%, 18.5-24.9 kg/m^2). It was observed that obese and overweight patients show high or moderate disease activity. The distribution of patients among different BMI categories is shown in Table 3. To evaluate the relation between BMI and DAS, we calculated the correlation and regression coefficient between these two.

Table 1: Represent demographic data of Rheumatoid Arthritis patients recruited for the study. S.D.: Standard Deviation

Parameter	Total	Female	Male
Number of patients	100	84	16
Female: Male ratio	5.25:1	-	-
Average age (years)	48.02±10.63	47.88±10.53	48.75±11.06
Height (cm) (Mean ± S.D.)	159.58±8.83	158.43±8.3	165.64 ± 8.9
Weight (Kg) (Mean ± S.D.)	64.87±11.11	63.95±11.41	69.75±7.8
BMI (Kg/m^2) (Mean ± S.D.)	25.63 ± 4.87	25.65 ± 5.11	25.53±3.3
Duration of disease (years) (Mean ± S.D.)	7.82 ± 7.09	6.70 ±6.09	9.09±11.2
Age of onset (years)(Mean ± S.D.)	40.11± 1.04	40± 10.8	40.7±12.3
DAS-28 (Mean ± S.D.)	4.66 ±1.39	4.57 ±1.3	3.9 ±1.8

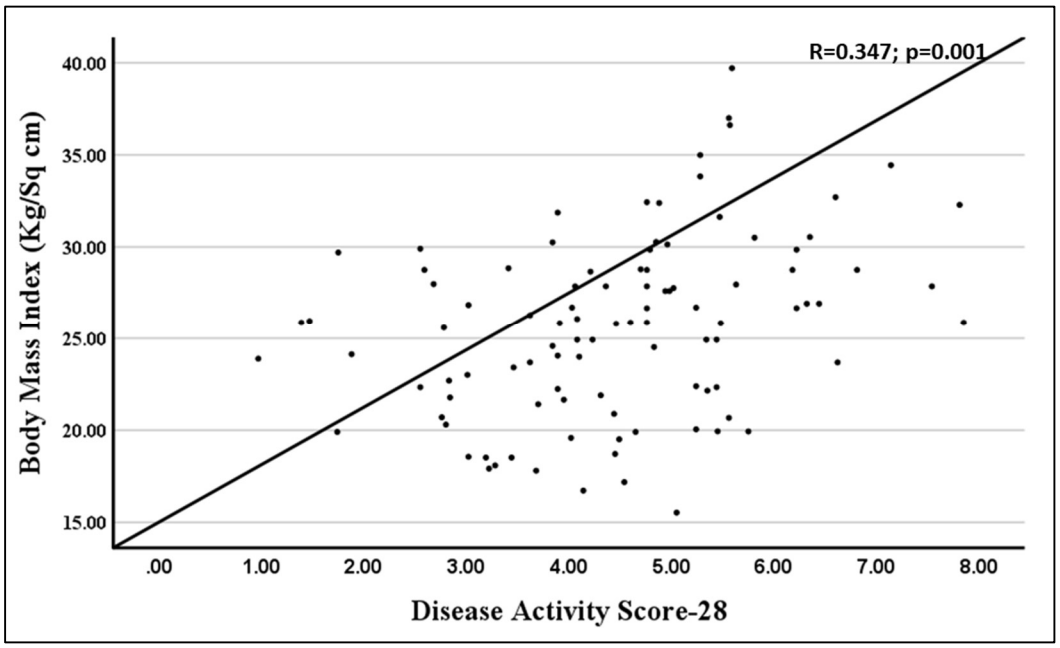

Figure 1: Scatter graph to present the Correlation between DAS-28 and Body Mass Index

Table 2: Distribution of patients in different demographic categories according to Age Groups of disease onset, Family History

Variables	Patients (%)
Age groups (years)	
≤20	4 (4%)
21-30	11 (11%)
31-40	35 (35%)
41-50	30 (30%)
51-60	19 (19%)
≥61	1 (1%)
Pregnancy Outcomes (n=84)	
No issue	39 (46.4%)
Abortion	5 (5.9%)
Stillbirth	1 (1.19%)
Misscarriage	38 (45.2%)
Child death (day3)	6 (7.14%)
Family History	
No History	62 (62%)
1st Degree relative	32 (32%)
2nd degree relative	6 (6%)

BMI shows a moderately significant correlation with DAS-28 (r=0.347, p=0.000). whereas, adjusted r^2=0.111 with a significant value of 0.00 (i,e, a change in BMI with 1 unit will cause the change in DAS-28 with 2 units). The scatter graph for the correlation between BMI and DAS-28 is shown in Figure 1. The mean of descriptives i.e. BMI, duration of disease, DAS-28, and age of onset are indicated in Table 1.

The recruited cohort was shown to have, 38% of patients with a family history of RA, out of which 32% had first-degree relatives suffering from the disease, Table 2. Out of 84 female patients, 45.2% of the females experienced multiple miscarriages during the first trimester of their pregnancy, 7.14% of females lost their child within three days of their birth and one female had a stillbirth Table 2.

The patient consulted different types of care providers (Alternate systems of medicine) before visiting the tertiary care centre. Some of them tried to have a combination of different modalities. Data are summarized in Table 4.

35% of patients reported having an oral problem including tooth decay, frequent cavities, Pieria, etc. 51% of patients reported comorbidity, data are shown in Table 4. 75% reported having extra-articulate including skin, eye, and mouth dryness, hair fall, lose of appetite (Table 4).

Table 3: Distribution of patients according to Body Mass Index and different DAS-28.

DAS-28	Obese	Overweight	Underweight	Normal	Total
High	11 (11.0%)	11 (11.0%)	0	10 (10.0%)	32 (32.0%)
Moderate	6 (6.0%)	19 (19.0%)	6 (6.0%)	18 (18.0%)	49 (49.0%)
Low	0	3 (3.0%)	0	7 (7.0%)	10 (10.0%)
Remission	0	5 (5.0%)	0	4 (4.0%)	9 (9.0%)

Table 4: Distribution of patients according to the duration of Early Morning Stiffness (EMS) EMS was defined as the duration it takes to start feeling better, comorbidity, and alternate therapy taken. Different extra-articulate reported by patients. HTN: Hypertension

Variables	Patients (%)
Alternate therapy	
Stem cell + Homeopathy	1 (1.0%)
Homeopathy + Ayurveda	3 (3.0%)
Ayurveda	29 (29.0%)
Homeopathy	4 (4.0%)
Acupressure	1 (1.0%)
Comorbidity	
HTN	27 (27.0%)
Thyroid	10 (10.0%)
Diabetes	3 (3.0%)
HTN + Thyroid	2(2.0%)
Diabetes+ HTN	8 (8.0%)
Diabetes+ Thyroid + HTN	1(1.0%)
Morning Stiffness	
15-30 min	41 (41.0%)
1 hour	25 (25.0%)
>1 hour	16 (16.0%)
No stiffness	18 (18.0%)
Extra articulate	
Oral dryness	6 (6.0%)
Ocular dryness	28 (28.0%)
Dermal dryness	33 (33.0%)
Vasculitis	8 (8.0%)
Neurological	6 (6.0%)
Digestive system	2 (2.0%)
Pulmonary	5 (5.0%)

Recruited patients were examined for clinical features including joint temperature, change in joint color, Early morning stiffness (EMS), deformity, swelling, and tenderness. Most of the patients (73%) had complaints of a rise in the temperature of their joints and experienced early morning stiffness (41%) for 15-30 minutes (Table 4). 92% of patients showed characteristic deformities, swelling or tenderness or either of the symptoms.

DISCUSSION

In the present study, we are discussing the Demographic and Clinical status of Rheumatoid Arthritis patients visiting the RA clinic at the tertiary health care centre.

The present study found that the highest number of patients showed the onset of disease between the age of 31-50 years. This was varied from a study published by Bullock et al, who reported disease onset between 30-60 years of age.[22]

BMI is known to play a significant role in many autoimmune diseases. This study observed a significant but moderate correlation of BMI with DAS-28.[23] A study conducted in south India also reported a positive association between BMI and different rheumatic conditions.[24] A systematic review article published in 2016 showed a positive linear correlation between BMI and RA[25] whereas a recent meta-analysis establishes a non-linear correlation between RA and BMI.[26]

Our study found that the percentage of females is 5 times higher than males. There is a variability of prevalence in various reported studies, some studies reported female to male ratio is 4.7:1[27], whereas others have reported it 7.1[28]. Our data shows similarity with the study conducted by Vij et al in 2015.[2] Reproductive and hormonal factors including endometriosis can be a reason for the high prevalence of disease among females.[29] Further, Pregnancy in female patients with RA is usually not a smooth journey. Zbinden et al in their article showed that pregnant women with RA had a high risk of pregnancy complications.[30] Spontaneous abortion (SA) is a common phenomenon among RA women.[31] These are associated with the side effects of medication, stress, depression, and deformities due to RA. A study by van den Brandt et al showed active RA disease as an indicator of preterm delivery.[32] Our study results also show a similar higher risk of miscarriage (42.8 %) in female patients with RA. Brouwer in 2015 reported that female with RA tends to conceive at a late age and have a high rate of miscarriage as compared to control.[33] A study conducted in the US reported that the majority of preterm birth among RA was due to premature rupture of the membrane.[34] In 2010, Fojtikova proposed that increased levels of prolactin contribute to increased deformities of RA patients during the post-partum period.[35] In 2016, Gene-Siew reported that increased levels of Prolactin during the post-partum period are responsible for the flares of disease.[36] In 2011 Makol et al gave safety guidelines for disease management during pregnancy and post-partum period.[37]

Rheumatoid Arthritis (RA) and Periodontal disease (PD) both diseases show common pathological symptoms for the progression of the disease which starts with the formation of Rheumatoid Synovium and periodontal lesions respectively.[38] The interdependency of RA and (PD) is well known.[39] Both of them represent chronic inflammation in adjacent bone resorption and its destruction.

Our study shows a high prevalence of oral problems among RA patients. A study by Afilal et al on the Mo-

rocco population shows a high prevalence of RA among patients who follow inadequate oral hygiene practices.[40]

Conclusion

BMI can be a risk factor for poor RA outcomes. Understanding the association between BMI and DAS-28 might help in the management of RA. Future studies are required to investigate the relationship between BMI and inflammation. Further, incidence of miscarriage is high in women with RA. Thus, pregnant women with RA may require close monitoring during their pregnancy.

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