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Correlation of Body Mass Index with Disease Activity in Rheumatoid Arthritis

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Author`s Contribution

[1]Conception, synthesis, planning of research and writing of manuscript, Data collection, data entries and data analysis
[2]Final approval of the study to be published, critical review
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ABSTRACT

Objective: To evaluate the correlation between body mass index and disease activity in patients with rheumatoid arthritis.

Methodology: This comparative case-control observational study was conducted at the Pakistan Institute of Medical Sciences, on patients with rheumatoid arthritis visiting the (Out Patient Departments) between July 2021 and December 2021. Body mass index and disease activity score were calculated for patients with rheumatoid arthritis in OPD. Mean ± S.D was calculated for age, body mass index and disease activity. Pearson's correlation coefficient was used to establish an association between variables. P value less than 0.05 was considered significant. A simple scatter with a fit line was plotted to show graphical association between body mass index and disease activity.

Results: Total 60 patients, 35 (58.3%) were females and 25(41.7%) were males. The mean age was 47.21 years. The mean DAS-28 for the normal weight group was 2.74 and for the overweight group was 4.17. There was a positive correlation between body mass index and DAS-28 with r was 0.584 ($p<0.05$). When correlation on a gender basis was calculated, for female patients, r was 0.653 and for males, 0.529, respectively.

Conclusion: Body mass index is associated with disease activity in patients with rheumatoid arthritis. Evaluation of this requires trials on large scale, thus, helping in tailoring a new management plan, including, weight reduction rather than escalating drug treatment for disease control and improving quality of life in patients with rheumatoid arthritis.

Keywords: Rheumatoid arthritis, Body mass index (BMI), Disease Activity Score 28 joints (DAS-28).

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Introduction

Among autoimmune diseases, rheumatoid arthritis is characterized by chronic synovial inflammation and destructive arthritis.[1] The prevalence of Rheumatoid arthritis has been extensively evaluated over last three decades, showing global distribution and variation.[2] It is affecting 1% of population worldwide with female predominance.[3] If untreated appropriately, it may lead to intractable pain, disability, and morbidity, effecting quality of life as inevitable consequences.[4]

Different incidence rates have been reported in different geographical areas suggesting environmental factors interplaying with background susceptible genetics. The underlying mechanism for etiology and pathogenesis of rheumatoid arthritis is unclear. Among the factors affecting rheumatoid arthritis are gender, age, alcohol, cigarette smoking, hormonal levels, dietary habits and socioeconomic status.[5] Environmental pollution is associated with raised levels of C-reactive protein, increased disease activity and biological therapy failure.[6]

A relation between chronic autoimmune disease occurrence and obesity is apparent, as, obese people are at greater risk of being affected by rheumatoid arthritis.[7] This may be due to adipokines inflammatory effect.[8] There is aberrant expression of adipokines and cytokines (e.g., interleukin, adiponectin, tumor necrosis factor and leptin) leading to the inflammatory process.[9]

Obesity has been defined by the World Health Organization (WHO) as accumulation of excessive fat that has a risk to general health and its rough estimate is body mass index (BMI). [10] Among world's population one-third is overweight or obese, with BMI>25 kg/m^2 and BMI >30kg/m^2, respectively.[11] This percentage is elevated to 50% in patients with rheumatoid arthritis.[12] This dilemma of obesity and its effects on rheumatoid RA has gained attention of researchers.[13] Obesity is poor prognostic marker in rheumatic disease patients as evidenced by observational studies.[14] The effects of BMI and disease activity in RA was unclear. There was a positive correlation between obesity and disease activity in a study.[15] Body mass index depicts an abnormal deposition of adipose tissue inside the body. Thus, changes in body mass index may aggravate disease activity and co-morbidities.

The current study evaluates the correlation between body mass index and disease activity of rheumatoid arthritis patients. If increased body mass index has effects on disease activity, management of rheumatoid arthritis not only needs an escalation of drug treatment for attaining remission but also controlling the patient's body mass index will play a pivotal role.

Methodology

This case control study was conducted at Pakistan Institute of Medical Sciences (PIMS), Islamabad, from July 2021 to December 2021. Ethical approval for the study was granted by the Hospital Ethics Committee in June 2021. Patients were selected for this study by employing non-probability convenient sampling. 60 cases of RA were selected from the Rheumatology outpatient clinics. After apprising the patients of the nature of the study and obtaining consent, patients were consecutively included in the study.

The sample size was calculated using the WHO sample size calculator, with 95% confidence interval. RA was diagnosed according to the ACR/ EULAR 2010 classification criteria for RA.[16] Patients with previous history of other rheumatological diseases and taking treatment (medical or surgical) for weight reduction were excluded from the study. A detailed history and clinical examination were carried out for each patient. Hospital ID, name, age and gender were recorded for each patient. They were further divided into two groups: normal weight patients with RA (BMI<25) and overweight patients with RA (BMI ≥25). DAS-28 was calculated for each patient with RA and duly recorded. DAS-28 < 2.6 was considered a dormant disease, while DAS-28 > 2.6 was considered an active disease.[17]

Data was analyzed by using IBM SPSS version 26. Gender was assessed by descriptive statistics. Means and standard deviations were calculated for quantitative variables like age, BMI and DAS-28. Percentages were calculated for categorical variables like gender. Significance was set at a p value <0.05. A correlation between BMI and DAS-28 was established with Pearson's correlation coefficient. Frequencies were shown by graphs and simple scatter with fit line was plotted for BMI and DAS-28.

Results

A total of 60 patients were included in the study with 35 (58.3%) females and 25 (41.7%) males (Table 1.). The mean of age was 47.21, BMI was 25.166 and DAS-28 ESR was 3.59. (Table I)

Table I: Demographic and clinical variables

Variable	Rheumatoid arthritis (60)
Female N (%)	35(58.3%)
Male N (%)	25(41.7%)
Age years	47.21±8.78
DAS-28	3.59±1.30
BMI	25.16±2.73

The mean of DAS-28 for male was 3.064 while for female was 3.977. (Table II)

Table II: Mean of DAS-28 on gender basis

Male	N	Valid	25
		Missing	0
	Mean		3.0640
Female	N	Valid	35
		Missing	0
	Mean		3.9771

The mean DAS-28 for normal weight group was 2.74±0.931 and for overweight group was 4.17±1.213. (Figure 1.)

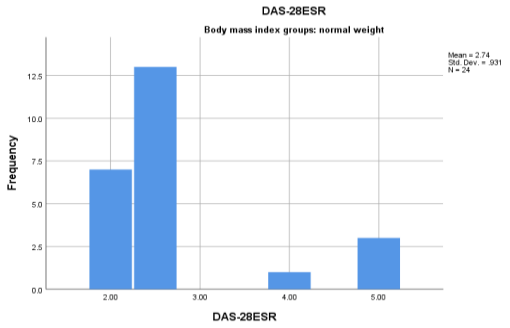

Figure 1. Comparison between mean of BMI subgroups regarding DAS-28.

There was positive correlation between BMI and DAS-28 with r of 0.584(p =0.000). (Table III)

When correlation was calculated for both genders separately, for males r was 0.529 (p=0.000) and for females r was 0.653(p= 0.000) respectively. (Table IV)

Discussion

In our study, the mean DAS-28 for the normal weight group was 2.74±0.931 and for overweight group was 4.17±1.213. It was higher for the overweight group compared to the normal weight group. As in our study, significantly increased RA disease activity was found in obese as compared with non-obese patients in systemic review and meta-analysis by Vidal C et al.[18] A meta-analysis revealed that patients with RA with obesity had higher DAS-28 as a measure of disease activity as compared to non-obese patients.

To our understanding, few studies had explored the correlation between body mass index with disease activity in Asian RA patients. There is variation in body composition of Asians as compared to Caucasians and our study evaluated the influence of BMI on disease activity in Asian patients with RA. The identification of risk factors which are modifiable having impact on RA response is crucial factor in improving disease outcome. Meta-analysis by Liu Y et al reported 40% lower odds for obese patients in attaining disease remission.[14] Gremse et al have extensively summarized immunological alterations that adipose cells bring in instigating and propagating disease activity.[19]

A higher incidence of RA is present in obese population as shown in medical literature.[20] Although there may be disparities in association due to confounding factors such as disease duration, patient population, and treatment type provided. Zhou et al meta-analysis showed that in obese population the incidence of RA was higher.[21] QUEST-RA study, including 1561 patients, demonstrated that in patient with RA's disease activity increased as BMI increases.[22] The exact process by which obesity induces oxidative stress and pro-inflammatory conditions is unknown. It is an fact that adipose tissue accelerates production of pro-inflammatory cytokines like IL-6 and TNF-alpha.[23] CRP production increases due to increased IL-6. CRP activates the complement cascade and thus effect disease activity of patients with RA. Our study also supports this idea as demonstrate by r= 0.584.

In our study, gender-based variation in disease activity was noted in patients with RA. With increasing BMI, more significant association for increase in disease activity was found in the female population. This could be due to more female candidates in the sample size. In our study, there was another highlighted finding, mean of disease activity was higher for females than for males. A significant association of gender and BMI groups was observed in study by Javaheer D et al[22] and when statistical analyses were reviewed separately it revealed an association only for female gender. A seven studies meta-analysis revealed that patients with RA, with obesity had higher DAS-28 as a measure of disease activity as compared to non-obese patients.

Table III: Correlation of BMI AND DAS-28

		DAS-28	Body Mass Index
DAS-28	Pearson Correlation	1	.584**
	Sig. (2-tailed)		.000
	N	60	60
Body Mass Index	Pearson Correlation	.584**	1
	Sig. (2-tailed)	.000	
	N	60	60

**. Correlation is significant at the 0.01 level (2-tailed).

Table IV: Correlations of BMI and DAS-28 for both genders separately

			DAS-28	Body Mass Index
Male	DAS-28	Pearson Correlation	1	.529**
		Sig. (2-tailed)		.007
		N	25	25
	Body Mass Index	Pearson Correlation	.529**	1
		Sig. (2-tailed)	.007	
		N	25	25
Female	DAS-28	Pearson Correlation	1	.653**
		Sig. (2-tailed)		.000
		N	35	35
	Body Mass Index	Pearson Correlation	.653**	1
		Sig. (2-tailed)	.000	
		N	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

The limitations in our study were limited number of patients were recruited for data analysis. secondly, as already mentioned by increasing male patient number in our study better association differences on gender basis could be composed. BMI has been used to determine body fat in patients with RA due to non-availability of tools required for appropriate measurement of body fat in our out-patient setting. As, there was no certainty to what extant body fat percentage contributed to total BMI in females and males, respectively. Finally, patients included in study were already taking treatment (DMARD'S) and effects exerted by medication on patients' BMI were also included.

Conclusion

In patients with rheumatoid RA, the body mass index is positively correlated with disease activity. Evaluation of this requires trial on large scale, thus, helping in tailoring new management plan, including, weight reduction rather than escalating drug treatment for disease control and improving quality of life in patients with rheumatoid arthritis.

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