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Original Article

Are there any differences among psoriasis, psoriatic arthritis and rheumatoid arthritis in terms of metabolic syndrome and cardiovascular risk factors?

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Abstract

Objective: Although the frequency of metabolic syndrome has been studied separately in psoriasis, psoriatic arthritis (PsA), and rheumatoid arthritis (RA) patients, there is no study that compares the prevalence of metabolic syndrome in all three diseases. The purpose of this study is to evaluate the relationship between metabolic syndrome (MetS) and chronic low-grade inflammatory diseases, and to determine the frequency of MetS and insulin resistance in psoriasis and PsA as compared to RA.

Methods: A total of 155 patients were included in this cross-sectional study. Fifty patients who were diagnosed with psoriasis, 55 PsA patients who were diagnosed according to the CASPAR criteria, and 50 seropositive RA patients who were diagnosed according to the ACR/EULAR 2010 classification criteria were included in this study. MetS was diagnosed by the 2005 criteria of International Diabetes Federation. The cardiovascular risk factors and parameters associated with MetS were evaluated.

Results: The patients' mean age was significantly higher in the RA. MetS was determined in 33.5% of all patients and MetS and insulin resistance showed no significant difference among the three groups (psoriasis: 36%, PsA: 29%, RA: 36%; p: 0.684 and psoriasis: 70%, PsA: 64%, RA: 66%, respectively; p: 0.785). Triglyceride levels were higher in psoriasis and PsA as compared to the RA (psoriasis: 34%, PsA: 32.7%, RA: 16%, respectively; p: 0.045). The frequency of hypertension was 38% in the RA, which was higher than PsA and psoriasis (p: 0.011).

Conclusion: In all three groups, the prevalence of MetS was shown to be higher than the general population. The lack of difference between these groups may be due to the small number of patients, the retrospective study design, and the inequality of the population with respect to age and gender.

Keywords: Metabolic syndrome, insulin resistance, psoriasis, psoriatic arthritis, rheumatoid arthritis

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Introduction

Psoriasis is a chronic inflammatory skin disease characterized by plaques. It is estimated to affect 0.9-8.5% of the world's population (1). Psoriatic arthritis (PsA) is an inflammatory type of arthritis that belongs to the spondyloarthropathy group, and its prevalence is between 0.3% and 1%. PsA is characterized by chronic inflammation of the peripheral joints and the axial skeleton (2, 3).

Metabolic syndrome (MetS) consists of a group of metabolic risk factors including central obesity, glucose intolerance, hypertension (HT), hypertriglyceridemia, low levels high-density lipoprotein (HDL), and insulin resistance (IR). It leads to a systemic proinflammatory and procoagulant state that plays a role in the development of cardiovascular disease. In recent studies, MetS has been associated with chronic low-grade inflammation and studies have focused on the relation of PsA and psoriasis with MetS (4, 5). It was observed that MetS is significantly higher in psoriasis (psoriasis 44.9%, PsA 25.5%, p: 0.037) patients in studies that compare the frequency of MetS in psoriasis and PsA (6). However, in other studies, the incidence of MetS in PsA has been reported at a higher rate of 44-59%, similar to psoriasis (5, 7-9). Furthermore, a higher MetS frequency was reported in studies on RA, another inflammatory disease (10, 11).

In this study, our purpose is to compare the frequency of MetS and IR in psoriasis and PsA with RA, and to contribute in achieving an understanding of the parameters of MetS.

Methods

Fifty patients who were diagnosed with psoriasis and 55 PsA patients who were diagnosed according to the Classification for Psoriatic Arthritis study group criteria (CASPAR), were included in this cross-sectional study from April 2014 to May 2015 (12). Patients who were admitted to the outpatient clinic were randomly assigned to this study. The age range of this group was between 18-88 years old. Fifty seropositive RA patients who were diagnosed according to the ACR/EULAR 2010 classification criteria were enrolled as the control group (13). Patients with diabetes mellitus type 2, pregnant women, and those younger than 18 years were not included in the study.

In addition to the general physical examination, joint and skin examination was performed in all the patients. The patients' age, gender, age at onset of arthritis, age at onset of psoriasis, family history, alcohol and smoking history, and medications were recorded. The psoriasis area and severity index (PASI) was used to evaluate the disease severity. The health assessment questionnaire (HAQ) and disease activity score (DAS28) in rheumatoid arthritis and DAS28 score in psoriatic arthritis were calculated for disease activity.

The diagnosis of metabolic syndrome was determined according to MetS diagnostic criteria, which was described and recommended by the International Diabetes Federation (IDF) in 2005 (14). Accordingly, the diagnosis of MetS requires at least one of the following:

- DM
- Impaired glucose tolerance
- IR

At least two of the following:

- HT (systolic pressure greater than 130 mmHg, diastolic pressure greater than 85 mmHg or use of antihypertensive drugs)
- Dyslipidemia (triglyceride level greater than 150 mg/dL or HDL level lower than 40 mg/dL in men and 50 mg/dL in women)
- Abdominal obesity (body mass index [BMI] greater than 30 kg/m^2 or waist circumference greater than 94 cm in men and 80 cm in women)

Fasting blood glucose, lipid profile, hemoglobin (Hb)A1c, insulin, and C-peptide levels were examined in all patients and in the control group. Height, weight, waist-hip circumference, and arterial pressure were measured in all subjects. IR was defined as an elevated homeostasis model assessment (HOMA-IR=insulin [μIU/mL]×glucose [mmol]/22.5) value of >2.5 (15).

The study was commenced after obtaining the approval of the Clinical Trials Ethics Committee of Kocaeli University. Written informed consent was obtained from each subject.

Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences software for Windows version 13.0 (SPSS Inc.; Chicago, IL, USA). Descriptive values were provided as mean±SD and the Kruskal-Wallis test was used to compare nonparametric variables. Categorical data were compared using the Chi-square test.

Results

A total of 155 patients (50 psoriasis, 55 PsA, and 50 RA patients) were included in this study. The female to male ratio was 24/26, 36/16, and 39/11 in psoriasis, PsA and RA, respectively. MetS was diagnosed in 33.5% (52/155) of the patients and its prevalence was similar between women and men (women: 33.3%, men: 33.9%; p=0.937). The demographic data of the patients are given in Table 1. DAS28 was similar in PsA and RA (PsA: 3.06±1.4, RA: 3.05±1.17; p=0.931), HAQ was higher in RA (PsA: 0.41±0.49, RA: 0.85±0.73; p=0.001).

No significant differences were observed between the groups with respect to IR (psoriasis: 70%, PsA: 64% and RA: 66%; p=0.785) and MetS frequency (psoriasis: 36%, PsA: 29% and RA: 36%; p=0.684).

The frequency of smoking was higher in psoriasis (psoriasis: 40%, PsA: 31%, RA: %14; p=0.04) patients, while the frequency of HT was higher in RA (psoriasis: 16%, PsA: 20%, and RA: 38%; p=0,011) patients (Table 2). The frequency of elevated triglyceride levels was 34% and 32.7% in psoriasis and PsA, respectively. It was determined to be two-fold higher than the RA group (p=0.045). The frequency of decreased HDL level was also lower in psoriasis and PsA as compared to RA (psoriasis: 6%, PsA: 16.4%, and RA: 32%; p=0.016). Statistical significance was observed only with respect to HDL levels (p=0.000) according to numeric values. No significant difference was found in the other parameters (Table 2, 3).

There was no difference in the frequency of MetS when all the groups were compares on the basis of sex. HT was significantly more frequent in women with RA (psoriasis: 13%, PsA: 18% and RA: 44%; p=0.008). Significant between-group differences were observed in male patients with respect to total cholesterol (psoriasis: 31%, PsA: 75% and RA: 27%; p=0.022), decreased HDL (psoriasis: 69%, PsA: 38% and RA: 18%; p=0.005), increased very low density lipoprotein (VLDL) (psoriasis: 46%, PsA: 56% and RA: 9%; p=0.047), and increased tri-

Table 1. The demographic characteristics of psoriasis, PsA and RA patients.

mean ± sd (min-max; median)	Psoriasis (n= 50)	PsA (n= 55)	RA (n= 50)	p
Age (year)	46.3 ± 1.7 (18-88; 45)	49.9 ± 1.3 (28-81; 51)	56.9 ± 1.4 (24-84; 56.5)	0.002*
Age at on set (year)	34.1 ± 15.4 (13-70; 31)	39.3 ± 11.8 (17-73; 40)	45.4 ± 13.1 (17-68; 46.5)	0.000*
Age of diagnosis (year)	34.7 ± 1.6 (13-70; 31)	40.9 ± 1.2 (17-73; 41)	48.4 ± 1.4 (19-77; 49.5)	0.000*
Mean psoriasis duration (year)	12.1 ± 11.8 (1-50; 8)	14.7 ± 10.2 (1-44; 13)	0	0.000*
Mean arthritis duration (year)	0	9.5 ± 8.0 (1-39; 7)	11.2 ± 8.2 (1-35; 10)	0.000*

sd: standart deviation; n: number; PsA: psoriatic arthritis; RA: rheumatoid arthritis.
*p<0.05 is statistically significant

Main Points

- Metabolic syndrome is one of the cardiovascular risk factors.
- Metabolic syndrome has been associated with chronic low-grade inflammation.
- In chronic inflammatory diseases, the prevalence of MetS was shown to be higher than the general population.
- According to our study, there were no differences among psoriazis, psoriatic arthritis and rheumatoid arthritis in terms of metabolic syndrome.

Table 2. The frequencies of the metabolic syndrome and the risk factors for cardiovascular disease in psoriasis, PsA and RA groups.

n (%)	Psoriasis (n= 50)	PsA (n= 55)	RA (n= 50)	p
Sex (F/M)	24/26 (48/52)	39/16 (71/29)	39/11 (78/22)	0.04*
Smoking	20 (40)	17 (30,9)	7 (14)	0.04*
Alcohol Consumption	4(8)	4 (7,3)	1 (2)	0.201
Increased Fasting Glucose	10 (20)	14 (25,5)	16 (32)	0.172
Increased HbA1c	11 (22)	17 (30,9)	12 (24)	0.82
Increased Triglycerides	17 (34)	18 (32,7)	8 (16)	0.045*
Increased Total Cholesterol	21 (42)	32 (58,2)	23 (46)	0.69
Increased LDL	21 (42)	22 (40)	18 (36)	0.54
Decreased HDL	3 (6)	9 (16,4)	16 (32)	0.003*
Increased VLDL	18 (36)	14 (25,5)	8 (16)	0.023*
Obesity	15 (30)	22 (40)	16 (31)	0.834
Metabolic Syndrome	18 (36)	16 (29,1)	18 (36)	0.684
Insulin Resistance	35 (70)	35 (64)	33 (66)	0.785
Hypertension	8 (16)	11 (20)	19 (38)	0.011*

n: number; PsA: psoriatic arthritis; RA: rheumatoid arthritis; F: female; M: male; HbA1c: hemoglobin A1c; LDL: low density lipoprotein; HDL: high density lipoprotein; VLDL: very low density lipoprotein.
*p<0.05 is statistically significant.

glyceride levels (psoriasis: 42%, PsA: 63% and RA: 9%; p:0.04).

The treatments of three groups were as follows: Psoriasis: methotrexate (MTX) in 11 patients (22%), low-dose steroids in 36 patients (72%), and biological agents in only one patient; PsA: MTX in 34 patients (61.8%), leflunomide in eight patients (14.5%), low-dose steroids in 35 patients (63.6%), and biological agents in 13 patients (23.6); RA: MTX in 27 patients (54%), leflunomide in 19 patients (38%), low-dose steroid in 47 patients (94%), and biological agents in 11 patients (22%). When all the groups were compared in terms of steroid usage, there were no differences in the frequency of MetS and IR (for MetS; psoriasis: 16/36, PsA: 12/35, RA: 15/47; p=0.477 and for IR; psoriasis: 26/36, PsA: 24/35, RA: 30/47; p=0.715).

Discussion

MetS is a disorder that is associated with cardiovascular risk factors. In recent studies, it was found to be related to chronic inflammatory diseases. The general MetS prevalence is approximately 30-40% in adults (16-18). The incidence of MetS was 34% (52/155) (women: 33%, men: 34%) in our study group, which was similar to the general incidence in healthy adults. When MetS incidence was evaluated in patient groups, it was found to be similar to the general Turkish population on average (psoriasis: 36%, PsA: 29%, and RA: 36%) (18).

Various studies have shown a higher incidence of MetS in psoriasis (psoriasis: 40-50%, control: 25%) (19-21). The MetS incidence was reported to be 25-59% in PsA (4-9), which was lower than its incidence in psoriasis (psoriasis: 45%, PsA: 26%, p=0.04) (6). In our study, the MetS incidence was 36% in psoriasis and 29% in PsA. There was no statistically significant difference as compared to RA (36%) which was used as the control group. MetS incidence in our PsA and psoriasis patients was found to be close to the values reported by Bosteon et al. (6). The study conducted in 2014 by Labitigan et al. (22) is the only study that compares the incidence of MetS between RA and PsA, and it was reported that MetS incidence is 27% in PsA (n=294) and 19% in RA (n=1662) (p=0.002) according to the IDF criteria. Although MetS incidence in their PsA patients was similar to our study, we found that MetS was two-fold higher in RA. The number of patients in our study was far lower than the number of patients in their study. In the study conducted by Özmen et al. (11), the number of RA patients was similar to ours, but MetS incidence was very close to what was reported by Labitigan et al. (22) (17%). Therefore, we do not think that this proportional difference is based on the sample size alone.

Haroon et al. (7) reported the incidence of IR as 16% (41/263) in PsA by HOMA-IR. In the present study, it was reported that IR was more frequent in patients with high BMI (OR 1.2, p<0.001), in severe PsA (OR 3.5, p<0.03), and in patients with a long history of psoriasis (OR 1.1, p<0.001). With the same method, the frequency of IR was three-fold higher in our three patient groups as compared to Haroon et al. (7) study (psoriasis: 70%, PsA: 64%, RA: 66%; p=0.785).

In the study by Labitigan et al. (22), it was reported that there was a significant difference between RA and PsA patients with respect to hypertriglyceridemia (PsA: 38%, RA: 28%; p:0.003), and no difference was found in the HDL levels (PsA: 36%, RA: 33%; p:0.98). In the study by Bostoen et al. (6), there was no difference between the groups with regard to HDL and triglyceride levels (hypertriglyceridemia psoriasis: 27%, PsA: 22%, p=NS; decreased HDL psoriasis: 12%, PsA: 7%, p=NS). In the study of Raychaudhuri et al. (8), it was reported that the hypertriglyceridemia level was 54% and the low HDL level was 51% in PsA patients. In our patients, hypertriglyceridemia and low HDL levels were close to the first two studies. However, our results were quite lower than the rates reported by Raychaudhuri. In the present study, the male patient population (100/105) was high and the female gender dominance may have contributed to this difference.

In the study by Sharma et al. (9), the frequency of HT in male patients with PsA was 67%, which was higher than the female patients, but there was no statistically significant difference (p=0.367). Raychaudhuri et al. (8) reported a rate of 56% HT in PsA, whereas Labitigan et al. (22) reported no difference in the prevalence of HT between RA and PsA (PsA: 36%, RA: 40%, p: 0.67). In our study, the prevalence of HT was found to be significantly higher in RA (psoriasis 16%, PsA 20%, RA 38%, p=0.011). The lower frequency of HT in our PsA group as compared to the other studies may be due to the high mean age of PsA patients (mean age in Labitigan's study was 56±12, and it was 60 years in Raychaudhuri's) and the high male patient proportion in these two studies.

One of the limitations of this study was the small study groups. Patients who were admitted to the outpatient clinic were randomly assigned to this study. Therefore, we could not match the groups in terms of age and gender.

We determined that there was no significant difference between the groups. This may be due to the small number of patients, retrospective evaluation, and the unequal distribution of gender and age in the groups. Therefore, we believe that larger studies with more homoge-

Table 3. The laboratory findings in psoriasis, PsA and RA groups.

mean ± sd (min-max; median)	Psoriasis (n= 50)	PsA (n= 55)	RA (n= 50)	p
Fasting Glucose (mg/dL)	96.1 ± 1.4 (76-142; 92)	98.1 ± 2.2 (65-191; 94)	95.0 ± 1.6 (64-122; 91.5)	0.865
HbA1c (%)	5.8 ± 0.5 (5-7; 5.7)	5.9 ± 0.6 (5-7.5; 5.7)	5.7 ± 0.6 (4.1-7.1; 5.7)	0.235
Total Cholesterol (mg/dL)	195.4 ± 46.2 (102-311; 189.5)	209.0 ± 42.2 (74-350; 211)	199.4 ± 39.7 (109-282; 196)	0.217
LDL (mg/dL)	124.7 ± 37.1 (58.2-221; 121.9)	129.5 ± 35.4 (37.4-275; 121)	122.7 ± 32.3 (65-179; 116.8)	0.508
VLDL (mg/dL)	27.9 ± 1.5 (8.8-69.6; 25.6)	28.0 ± 1.8 (8.8-103; 23.6)	21.7 ± 1.0 (8.6-51.4; 19.6)	0.067
HDL (mg/dL)	42.6 ± 1.0 (21-66; 42)	51.0 ± 1.1 (24-84; 50)	55.3 ± 1.3 (21-87; 52.5)	0.000*
Triglycerides (mg/dL)	138.7 ± 74.0 (44-348; 126)	142.2 ± 87.0 (44-515; 122)	109.3 ± 51.6 (43-257; 98)	0.063
Insulin (µünite/mL)	15.3 ± 1.1 (1.7-57.2; 12.3)	16.2 ± 1.1 (4.5-49.2; 12.9)	16.5 ± 1.2 (4.3-56.9; 12.2)	0.917
C-peptide (pmol/mL)	2,.9 ± 2.0 (1.2-11.1; 2.2)	2.8 ± 2.3 (1.1-17.3; 2.2)	3.0 ± 1.7 (1.0-9.7; 2.7)	0.306
HOMA	3.7 ± 2.6 (1.3-13.0; 2.8)	4.0 ± 3.2 (0.9-13.6; 2.8)	4.3 ± 3.7 (0.9-16; 3.0)	0.902
BMI (kg/m²)	27.0 ± 4.9 (19-40; 26.5)	28.8 ± 4.4 (18-38; 29)	27.9 ± 6.0 (15-47; 28)	0.115
CRP (mg/dL)	1.0 ± 1.9 (0.1-12.2; 0.5)	0.7 ± 1.3 (0.02-6.5; 0.3)	1.5 ± 3.7 (0.03-26.2; 0.7)	0.013*
ESR (mm/h)	16.2 ± 1.2 (2-66; 13)	18.6 ± 1.7 (2-74; 14)	24.6 ± 2.0 (2-91; 18.5)	0.089

n: number; PsA: psoriatic arthritis; RA: rheumatoid arthritis; F: female; M: male; HbA1c: hemoglobin A1c; LDL: low density lipoprotein; HDL: high density lipoprotein; VLDL: very low density lipoprotein; HOMA: homeostasis model assessment; BMI: body mass index, CRP: c-reactive protein; ESR: eritrocyte sedimentation rate.
*p<0.05 is statistically significant.

neous patient populations are needed to verify our results.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of the Kocaeli University.

Informed Consent: Written informed consent was obtained from the parents of the patients who participated in this study.

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References

1. Griffiths CE, van de Kerkhof P, Czarnecka-Operacz M. Psoriasis and Atopic Dermatitis. Dermatol Ther (Heidelb) 2017; 7: 31-41. [CrossRef]
2. Wilson FC, Icen M, Crowson CS, McEvoy MT, Gabriel SE, Kremers HM. Time trends in epidemiology and characteristics of psoriatic arthritis over 3 decades: a population-based study. J Rheumatol 2009; 36: 361-7. [CrossRef]
3. Kerschbaumer A, Fenzl KH, Erlacher L, Aletaha D. An overview of psoriatic arthritis -epidemiology, clinical features, pathophysiology and novel treatment targets. Wien Klin Wochenschr 2016; 128: 791-5. [CrossRef]
4. Salihbegovic EM, Hadzigrahic N, Cickusic AJ. Psoriasis and Metabolic Syndrome. Medical Archives 2015; 69: 85-7. [CrossRef]
5. Costa L, Caso F, Ramonda R, Del Puente A, Cantarini L, Darda MA, et al. Metabolic syndrome and its relationship with the achievement of minimal disease activity state in psoriatic arthritis patients: an observational study. Immunol Res 2015; 61: 147-53. [CrossRef]
6. Bostoen J, Van Praet L, Brochez L, Mielants H, Lambert J. A cross-sectional study on the pevalence of metabolic syndrome in psoriasis compared to psoriatic arthritis. J Eur Acad Dermatol Venereol 2014; 28: 507-11. [CrossRef]
7. Haroon M, Gallagher P, Heffernan E, Fitzgerald O. High prevalence of metabolic syndrome and of insulin resistance in psoriatic arthritis is associated with the severity of underlying disease. J Rheumatol 2014; 41: 1357-65. [CrossRef]
8. Raychaudhuri SK, Chatterjee S, Nguyen C, Kaur M, Jialal I, Raychaudhuri SP. Increased Prevalence of the Metabolic Syndrome in Patients with Psoriatic Arthritis. Metab Syndr Relat Disord 2010; 8: 331-4. [CrossRef]
9. Sharma A, Gopalakrishnan D, Kumar R, Vijayvergiya R, Dogra S. Metabolic Syndrome in Psoriatic Artrhritis patients: A Cross Sectional Study. Int J Rheum Dis 2013; 16: 667-73. [CrossRef]
10. Dessein PH, Tobias M, Veller MG. Metabolic syndrome and subclinical atherosclerosis in rheumatoid arthritis. J Rheumatol 2006; 33: 2425-32.
11. Özmen M, Yersal Ö, Öztürk S, Soysal D, Köseeoğlu MH. Prevalence of the metabolic syndrome in rheumatoid arthritis. Eur J Rheumatol 2014; 1: 1-4. [CrossRef]
12. Taylor W, Gladman D, Helliwell P, Marchesoni A, Mease P, Mielants H. CASPAR Study Group. Classification criteria for Psoriatic Arthritis: development of new criteria from a large international study. Arthritis Rheum 2006; 54: 2665-73 [CrossRef]
13. Aletaha D, Neogi T, Silman AJ, Funovits J, Felson DT, Bingham CO 3rd, et al. 2010 Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. Ann Rheum Dis 2010; 69: 1580-8. [CrossRef]
14. Alberti KG, Zimmet P, Shaw J. The metabolic syndrome--a new worldwide definition. Lancet 2005; 366: 1059-62. [CrossRef]
15. Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC. Homeostasis model assessment: insulin resistance and β-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia 1985; 28: 412-9. [CrossRef]
16. Ford ES, Lİ C, Zhao G. Prevalance and correlates of metabolic syndrome based on a harmonious definition among adults in the US. J Diabetes 2010; 2: 180-93. [CrossRef]
17. Lim S, Shin H, Song JH, Kwak SH, Kang SM, Won Yoon J, et al. Increasing prevalance of metabolic syndrome in Korea: the Korean National Health and Nutrition Examination Survey for 1998-2007. Diabetes Care 2011; 34: 1323-8. [CrossRef]
18. Kozan O, Oguz A, Abaci A, Erol C, Ongen Z, Temizhan A, et al. Prevalence of the metabolic syndrome among Turkish adults. Eur J Clin Nutr 2007; 61: 548-53. [CrossRef]

19. Love TJ, Qureshi AA, Karlson EW, Gelfand JM, Choi HK. Prevalence of the metabolic syndrome in psoriasis: results from the National Health and Nutrition Examination Survey, 2003-2006. Arch Dermatol 2011; 147: 419-24. **[CrossRef]**
20. Singh S, Young P, Armstrong AW. Relationship between psoriasis and metabolic syndrome: a systematic review. G Ital Dermatol Venereol 2016; 151: 663-77.
21. Akcali C, Buyukcelik B, Kirtak N, İnaloz S. Clinical and laboratory parameters associated with metabolic syndrome in Turkish patients with psoriasis. J Int Med Res 2014; 42: 386-94. **[CrossRef]**
22. Labitigan M, Altuntas AB, Kremer JM, Reed G, Greenberg JD, Jordan N, et al. Higher Rates and Clustering of Abnormal Lipids, Obesity, and Diabetes Mellitus in Psoriatic Arthritis Compared With Rheumatoid Arthritis. Arthritis Care Res 2014; 66: 600-7. **[CrossRef]**