Available online on 15.1.2017 at <http://ujpr.org>
Universal Journal of Pharmaceutical Research
 An International Peer Reviewed Journal

Open access to Pharmaceutical research
 This is an open access article distributed under the terms of the Creative Commons Attribution-Non
 Commercial Share Alike 4.0 License which permits unrestricted non commercial use,
 provided the original work is properly cited

Volume 1, Issue 2, 2016

Open Access

RESEARCH ARTICLE

PREVALENCE OF DYSLIPIDEMIA AND ITS ASSOCIATION WITH DISEASE ACTIVITY IN PATIENTS WITH RHEUMATOID ARTHRITIS IN SULAIMANI GOVERNORATE

Soran Mohammed Gharib

Ministry of Higher education and Scientific researched KRG, Ministry of Health KRG, Sulaimani City, Iraq-Kurdistan.

ABSTRACT

Objectives: Rheumatoid arthritis is a systemic inflammatory disease characterized by chronic and erosive polyarthritis it is the most common inflammatory arthritis, affecting from 0.5-1% of the general population. Dyslipidemia is a quite important problem in Rheumatoid arthritis (RA) patient, which causes morbidity and mortality. Objectives are to measure prevalence of dyslipidemia in patients with Rheumatoid Arthritis compared with healthy control peoples and to find out correlations between dyslipidemia and disease activity in patients with Rheumatoid Arthritis.

Methods: A total of one hundred patients with RA (80 female and 20 male) were included in the study, they were attending consultation clinic and division of rheumatology in the General Medical Teaching Hospital in Slemani city from (October 2015 to September 2016) who fulfilling the 2010 American College of Rheumatology/European league against Rheumatism classification criteria for RA and one hundred healthy age and sex-matched controls. Fasting lipid profiles of cases and control were estimated after an overnight fast of 12 hours.

Results: RA patients showed a higher prevalence of associated dyslipidemia (48%) in comparison to control (4%) p-value less than 0.001. Results showed a significant reduction in serum high density lipoproteins (HDL) p-value less than 0.001, with significant elevation of serum total cholesterol, triglyceride, low density lipoprotein and very low density lipoprotein p-value 0.001, 0.007, 0.01 and 0.5 respectively in comparison to controls. There is a significant association between dyslipidemia and high DAS 28 score ($p=0.02$).

Conclusion: There is a significant association between high ESR of RA patients and dyslipidemia ($p=0.001$). A significant association was observed between high CRP level and RA patients with no dyslipidemia ($p<0.001$). Dyslipidemia are frequent among the patients with rheumatoid arthritis and highly associated with active RA. Serum HDL significantly reduced while other parameters of lipid profiles significantly increased in comparisons to control.

Keywords: Activity, disease, dyslipidemia, rheumatoid arthritis.

Article Info: Received 5 October 2016; Revised 26 November; Accepted 30 December, Available online 15 January 2017

Cite this article-

Gharib SM. Prevalence of dyslipidemia and its association with disease activity in patients with rheumatoid arthritis in Sulaimani Governorate, Universal Journal of Pharmaceutical Research 2016; 1(2): 19-24.

DOI: <http://doi.org/10.22270/ujpr.v1i2.R4>

Address for Correspondence:

Soran Mohammed Gharib, Ministry of Higher education and Scientific researched KRG, Ministry of Health KRG, Sulaimani City, Iraq-Kurdistan, E-mail: dr.soran_medicine@yahoo.com

INTRODUCTION

Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease characterized by chronic and erosive polyarthritis¹, associated with persistent inflammatory synovitis, progressive joint destruction, and an excess mortality when compared to the general population^{2,3}. It is characterized by symmetric erosive synovitis³. Female are 2.5 times more likely to be affected than male⁴. The onset of disease can occur at any age but peak incidence occurs within fourth and fifth decade of life⁵. Its clinical diagnosis made on the basis of symptoms, physical examinations, X-ray and laboratory investigations⁶. Patients with RA have an increased mortality when compared with age-matched

controls, primarily due to cardiovascular disease. This is most marked in those with severe disease, with reduction in expected life span by 8-15 years⁷. Dyslipidemia are being increasingly recognized as an important contributory factor toward the development of cardiovascular disease⁸. Premature cardiovascular disease (CVD) is very common in RA patients^{9,10}. RA is associated with 50% increase in incidence of myocardial infarction (MI) and cardiovascular diseases as compared to general population¹⁰. It has been observed that increased inflammation and active disease has an impact on lipid patterns in blood¹¹. Atherosclerosis is now considered as an inflammatory disease as it is a result of inflammation and

inflammatory cytokines are prevalent in atherosclerotic plaques^{12,13}. Although dyslipidemia in RA may be partially governed by a genetic predisposition, it is also influenced by an array of other factors including disease activity¹⁴, reduced physical activity secondary to pain, disability¹⁴, and drug therapy¹⁵⁻¹⁷. Dyslipidemia is highly prevalent in RA affecting between 55-65% of patients^{18,19} and can manifest in RA patients with both early²⁰ and advanced disease²¹. The Disease Activity Score 28 (DAS28) is a major scoring system for evaluating disease activity of RA. In clinical practice CRP and ESR are used in monitoring disease activity and response to the treatment CRP²².

PATIENTS AND METHODS

Study design and setting: A prospective case control was done. This study was conducted at Rheumatology Unit, outpatient clinic in Sulaimani Teaching Hospital, Sulaimani city. The study was carried out over 12 months from October 2015 to September 2016.

Sampling

This study included one hundred patients with RA (80 female and 20 male) fulfilling the 2010 American College of Rheumatology/European league against Rheumatism classification criteria for RA and one hundred healthy sex and age-matched controls patients and controls age were between 20-70 years old.

Exclusion criteria

History of smoking or patients suffering from condition that affect the lipid profile such as diabetes mellitus, hypertension, ischemic heart disease, renal impairment, liver and thyroid functional abnormalities, cushing syndrome and obesity (BMI >30) were excluded. Also any patients received medications affecting lipid metabolism such as beta blocker, diuretics, cyclosporine, oral contraceptive pills (OCP), patients who received oral or intra-articular steroid till one month before study and pregnant women were excluded.

The study protocol

The study protocol includes :-(Questionnaire, clinical examination of RA patients, disease Activity Score (DAS 28), Laboratory investigations) -Laboratory investigations include: (ESR),(RFT), (LFT), (TSH), (FBS or RBS), (ECG), lipid profile, immunological tests, (CRP), (ACCP). The Body Mass Index (BMI) was also measured for all patients

Questionnaire

A protocol was designed to obtain data about the name, age, occupation, residence of the patients, weight, height, and drug history, duration of the disease, history of chronic disease, and history of smoking, number of tender and swollen joints. The results of investigations (RF, ESR, CRP, lipid profile, RFT, LFT, TFT, and ACCP) were recorded on the same questionnaire.

Statistical analyses:

All patients' data entered using computerized statistical software; Statistical Package for Social Sciences (SPSS) version 17 was used. Descriptive statistics presented as (mean±standard deviation) and frequencies as percentages. Kolmogorov Smirnov

analysis verified the normality of the data set. Multiple contingency tables conducted and appropriate statistical tests performed, Chi-square used for categorical variables and Fishers exact test was used when more than 20% of the cells less than 5. In all statistical analysis, level of significance (*p* value) set at ≤0.05 and the result presented as tables and/or graphs. Statistical analysis of the study was done by the community medicine specialist.

Table 1: Distribution of RA patients' lipid profile according to gender.

Variable	Male		Female		X ²	P
	No.	%	No.	%		
Dyslipidemia					0.04	0.8
Yes	10	50	38	47.5		
No	10	50	42	52.5		

RESULTS

A total 100 rheumatoid arthritis (RA) patients were included in present study with mean age of as 57±8.6 years, 36% of them were 50-59 years age. Females were more than males with female to male ratio as 4:1. Disease duration distribution of RA patients RA disease duration of studied patients, 52% of them had disease duration of more than 5 years.

Figure 1: Age distribution of RA patients.

Mean cholesterol level of RA patients was 174.5±42.8 mg/dl, 27% of them had high cholesterol level. Mean triglycerides level of RA patients was 132.1±56.4 mg/dl, 37% of RA patients had high Tg level. Mean LDL level of RA patients was 101.9±39.5 mg/dl, 18% of RA patients had high LDL level. Mean VLDL level of RA patients was 29.8±14.8 mg/dl, 38% of RA patients had high VLDL level. Mean HDL level of RA patients was 55±18.6 mg/dl, 38% of RA patients had low HDL level.

Figure 2: Gender distribution of RA patients.

Dyslipidemia was detected among 48% of RA patients. Mean DAS 28 score of RA patients was 5.3±1.9, 46% of RA patients had moderate score and 35% of RA

patients had high score. There was a significant association between high cholesterol level and RA cases ($p=0.001$). High triglycerides level was significantly higher among RA patients ($p=0.007$). A significant association was observed between high LDL level and RA cases ($p=0.01$). A significant differences were observed between RA cases and controls regarding VLDL level ($p=0.5$). Low HDL level was significantly higher among RA cases ($p<0.001$). Generally, Dyslipidemia was significantly

higher among RA patients ($p<0.001$). No significant differences were observed between male and female RA cases regarding lipid profile. There was a significant association between dyslipidemia and high DAS 28 score ($p=0.02$). There was a significant association between high ESR of RA patients and dyslipidemia ($p=0.001$). A significant association was observed between high CRP level and RA patients with no dyslipidemia ($p<0.001$).

Table 2: Distribution of RA patients' ESR and CRP according to dyslipidemia of RA patients.

Variables	Dyslipidemia		No Dyslipidemia		X ²	P
	No.	%	No.	%		
ESR					10.4	0.001
Normal	5	10.4	20	38.5		
High	43	89.6	32	61.5		
CRP					39.9	<0.001
Positive	15	47.9	48	77.0		
Negative	33	52.1	4	23.0

Figure 3: Lipid profile of RA patients.

DISCUSSION

Several pieces of evidence indicate that rheumatoid arthritis (RA) is a proatherogenic disease associated with increased cardiovascular (CV) mortality²³ which account for about half of all deaths in these patients²⁴.

Figure 4: DAS 28 scores distribution of RA patients.

Besides genetic and traditional CV risk factors chronic²⁵ inflammation has effect in the development of this process²⁶. Results showed that RA occurs in all age groups between 20-70 years, which showed that 36% of them between 50 to 59 years and 26% were between 40 to 49 years of age; this is in accordance with other study which mentioned that RA affects usually people above 40 years old²⁷ and also matched with the study done by Abdul Qahar ZH *et al.*, in Baghdad, Iraq²⁸. The prevalence of dyslipidemia

among RA patients in present study was 48%. This prevalence is close to results of Haye Salinas MJ *et al.*, in Argentina²⁹ that reported dyslipidemia prevalence in RA patients as 43%, on other hand, Akiyama *et al.*, study in Japan³⁰ showed that 56.5% of RA patients had dyslipidemia³¹.

Figure 5: Lipid profile of RA patients.

Patients with rheumatoid arthritis (RA) have higher rates of morbidity and mortality than the general population, which is highly attributed to an increased risk of cardiovascular disease (CVD) among RA patients³². The increased risk of CVD appears to be linked to coronary atherosclerosis³³ and may be directly caused by chronic inflammation or secondarily caused by physical inactivity and drugs used to treat RA³⁴. In this study we found that patients diagnosed

with RA had significantly reduced levels of HDL-cholesterol in comparison to control groups and this was matched with many other study done in all of Pakistan by Nisar A *et al.*,³⁵ Tunisia by Zrou SH *et al.*,³⁶ Malaysia by Manjunatha Goud BK *et al.*,³⁷ South India by Vinapamula KS *et al.*,³⁸ Saudi Arabia by Bahlas S *et al.*,³⁹ Bagdad, Iraq by Ameer KH *et al.*,⁴⁰ by Georgiadis AN *et al.*,⁴⁰ and United Kingdom⁴¹ which is un favorable profile with regard to cardiovascular risks⁴² and there was no study against it.

Figure 6: Dyslipidemia distribution of RA patients.

Current study revealed a significantly higher cholesterol level of RA patients in comparison to controls ($p=0.001$). This is consistent with Attar study in Saudi Arabia⁴³. In present study, blood levels of triglycerides and LDL cholesterol of RA patients were significantly higher than healthy controls with significantly lower HDL cholesterol level. These findings are similar to results of previous Spanish study done by Gonzalez Gay MA *et al.*,⁴⁴. Regarding HDL-cholesterol, it has been reported that patients with active RA consistently demonstrate reduced levels⁴⁵. Also in current study Serum VLDL level of RA patients was significantly higher than healthy controls. This finding coincides with Al-Kaissi *et al.*, study in Jordan⁴⁶ reported high VLDL prevalence among RA patients but inconsistently with our results, Al-Chetachi and Shaher study⁴⁷ in Iraq reported no significant difference in VLDL and Tg levels between RA and healthy controls.

Figure 7: Dyslipidemia in RA cases and controls.

In general, dyslipidemia was significantly Noted in RA patients in present study ($p<0.001$). This is consistent with results of Mahdi *et al.*, study in Iraq and Curtis *et al.*, study in USA^{48,49}. In current study, the RA activity (DAS) was significantly high among RA patients with dyslipidemia ($p=0.02$). This is consistent with results of Georgiadis *et al.*, study in Greece⁵⁰.

Table 3: Distribution of lipid profile according to RA cases and controls.

Variables	RA Cases		Control		χ^2	P
	No.	%	No.	%		
Cholesterol level					9.5	0.001
Normal	73	73	90	90		
High	27	27	10	10		
Tg level					7.1	0.007
Normal	63	63	80	80		
High	37	37	20	20		
LDL level					5.3	0.01
Normal	82	82	93	93		
High	18	18	7	7		
VLDL level					0.2	0.05
Normal	67	62	73	70		
High	33	38	27	30		
HDL level					14.9	<0.001
Normal	62	62	86	86		
Low	38	38	14	14		
Dyslipidemia						<0.001
Yes	48	62	4	4		
No	52	38	96	96		

Current results showed that ESR and CRP levels were significantly higher among RA patients with dyslipidemia. These findings are significant to results of Curtis *et al.*, study in USA⁴⁹. Inflammation is a common denominator in both RA and atherosclerosis. A growing body of evidence supports the involvement of common pro inflammatory cytokines-such as macrophage migration inhibitory factor (MIF), interleukin (IL)-1, IL-6, and tumor necrosis factor- α (TNF- α)-in the development and progression of both RA and atherosclerosis⁵¹.

Figure 8: Dyslipidemia distribution in RA disease activity.

CONCLUSION

The prevalence of dyslipidemia among rheumatoid arthritis patients in Sulaimani is high. The blood levels of total cholesterol, triglycerides and LDL cholesterol were higher among RA patients. HDL cholesterol level was lower among RA patients. Dyslipidemia may be a risk factor for rheumatoid arthritis severity and cardiovascular diseases. Obesity is a risk factor for rheumatoid arthritis incidence.

RECOMMENDATIONS

Dyslipidemia among RA patients are common and this increase risk of cardiovascular disease and mortality among RA patients, lipid management including

greater use of statin therapy may be appropriate to reduce this. Screening programs for RA patients on lipid profile to predict activity and severity of disease, Cardiovascular screening should be recommended every 6 months to once yearly in Sulaimani city. Encouraging the diet restriction programs and physical activities in schools to prevent the obesity. Further national large sized studies on prevalence and effect of hyperlipidemia on RA patients must be supported. Additional prospective, long-term studies are needed to comprehensively determine the role of inflammation and the impact of biologics on lipid levels and cardiovascular outcomes in patients with RA.

ACKNOWLEDGEMENTS

The author extends his thanks and appreciation to the Ministry of Higher education and Scientific researched KRG, Iraq-Kurdistan to provide necessary facilities for this work.

CONFLICT OF INTEREST

No conflict of interest was associated with this work.

REFERENCES

- Gabriel SE, Crowson CS, Maradit Kremers H, Doran MF, Tureson CO, Fallon WM survival in rheumatoid arthritis: a population based analysis of trends over 40 years. *Arthritis Rheum* 2003; 48:54-8. <https://doi.org/10.1002/art.10705>
- Ward MM. Recent improvement in survival in patients with rheumatoid arthritis; better outcomes or different study designs *Arthritis Rheum* 2001; 44:1467-9. [https://doi.org/10.1002/1529-0131\(200106\)44:6<1467::AID-ART243>3.0.CO;2-6](https://doi.org/10.1002/1529-0131(200106)44:6<1467::AID-ART243>3.0.CO;2-6)
- Taysi S, Polat F, Gul M, Sari RA, Bakan E. Lipid peroxidation, some extracellular antioxidants and antioxidant enzymes in serum of patients with rheumatoid arthritis. *Rheumatol Int* 2002; 21:200-4. <https://doi.org/10.1007/s00296-001-0163-x>
- Heimick CG, Felson DT, Lawrence RC. National Arthritis Data, work group. Estimate of the prevalence of arthritis and other rheumatic conditions in the US. part I. Arthritis and rheumatism 2008; 58(1):15-25. <https://doi.org/10.1002/art.23176>
- Dorsos A. Epidemiology of rheumatoid arthritis *Autoimmun REV* 2004; 3(sup11):S20-S22.
- Majithia V, Geraci SA. Rheumatoid arthritis: diagnosis and management. *Am J Med* 2007; 120(11): 936-936. <https://doi.org/10.1001/jama.2018.13103>
- Ralston S.H., Doherty M. Rheumatoid arthritis, chapter 25. In: Colledge NR; Walker BR; Ralston S.H. (editors). *Davidson's principles and practice of medicine*, 21th edition. Churchill Livingstone. 2010; 1088-1092. <https://doi.org/10.3329/bjmb.v7i2.22415>
- Spellman CW. Strategies for optimizing lipid treatment outcomes. *J Am Osteopath Assoc* 2003; 103:S12-5. <https://doi.org/10.2337/dc16-S004>
- Abou-Raya A, Abou-Raya S. Inflammation: a pivotal link between autoimmune diseases and atherosclerosis. *Autoimmun Epub* 2006; 5:331-7. <https://doi.org/10.1016/j.autrev.2005.12.006>
- Frostegard J. Atherosclerosis in patients with autoimmune Diseases. *Arterioscler Thromb Vasc Biol* 2005; 25:1776-85. <https://doi.org/10.1161/01.atv.0000174800.78362.ec>
- Toms TE, Panoulas VF, Kitas GD. Dyslipidemia in rheumatological autoimmune diseases. *Open Cardiovasc Med J* 2011; 5:64-75. <https://doi.org/10.2174%2F1874192401105010064>
- Shoenfeld Y, Gerli R, Doria A, Matsuura E, Cerinic MM, Ronda N, et al. Accelerated atherosclerosis in autoimmune rheumatic diseases. *Circulation* 2005; 112:3337-47. <https://doi.org/10.1161/circulationaha.104.507996>
- Tureson C, Jacobsson LT, Matteson EL. Cardiovascular comorbidity in rheumatic diseases. *Vasc Health Risk Manag* 2008; 4:605-14. <https://doi.org/10.2147%2Fvhrm.s2453>
- Yoo HW. Dyslipoproteinemia in patients with active rheumatoid arthritis: Effects of disease activity, sex, and menopausal status on lipid profiles. *J Rheumatol* 2004; 31: 1746-53. *PMID: 15338494*
- Kelly CA. Extra-articular features of rheumatoid arthritis. *Medicine* 2002; 30: 48-9.
- Choi HK, Seeger JD. Lipid profiles among US elderly with untreated rheumatoid arthritis—the Third National Health and Nutrition Examination Survey. *J Rheumatol* 2005; 32: 2311-6.
- Toms TE, Symmons PM, Kitas GD. Dyslipidaemia in rheumatoid arthritis: the role of inflammation, drugs, lifestyle and genetic factors. *Curr Vasc Pharm* 2010; 8(3): 301-26. <https://doi.org/10.1136/ard.2008.104497>
- Dessein PH, Joffe BI, Stanwix A, Botha AS, Moomal Z. The acute phase response does not fully predict the presence of insulin resistance and dyslipidaemia in inflammatory arthritis. *J Rheumatol* 2002; 29: 462-6.
- Kavanaugh A. Dyslipoproteinaemia in a subset of patients with rheumatoid arthritis. *Ann Rheum Dis* 1994; 53: 551-2. <https://doi.org/10.1136%2Fard.53.8.551>
- Park YB, Lee SK, Lee WK, et al. Lipid profiles in untreated patients with rheumatoid arthritis. *J Rheumatol* 1999; 26: 1701-4. *PMID: 10451065*
- Peters MJ, Vis M, van Halm VP, et al. Changes in lipid profile during infliximab and corticosteroid treatment in rheumatoid arthritis. *Ann Rheum Dis* 2007; 66: 958-61. <https://doi.org/10.1136%2Fard.2006.059691>
- Tishler M, Caspi D, Yaron MC. Reactive protein level in patients with rheumatoid arthritis, the impact of therapy. *Clinical rheumatology* 1985; 4(3):321-4. <https://doi.org/10.1007/bf02031616>
- Avia-Zubieta JA, Choi HK, Sadatsafavi M. Risk of cardiovascular mortality in patients with rheumatoid arthritis: a meta-analysis of observational studies. *Arthritis Rheum* 2008; 59:1690–1697. <https://doi.org/10.1002/art.24092>
- Maradit-Kremers H, Crowson CS, Nicola PJ, Ballman KV, Roger VL, Jacobsen SJ. Increased unrecognized coronary heart disease and sudden deaths in rheumatoid arthritis: A population-based cohort study. *Arth and Rheum* 2005; 52(2): 402-411. <https://doi.org/10.1002/art.20853>
- Lpez-Mejias R, Garca-Bermdez M, Gonzalez-Juanatey C. NFKB1-94ATTG ins/del polymorphism (rs28362491) is associated with cardiovascular disease in patients with rheumatoid arthritis. *Atherosclerosis* 2012; 224:426–429. <https://doi.org/10.1016/j.atherosclerosis.2012.06.008>
- Gonzalez-Gay MA, Gonzalez-Juanatey C, Lopez Diaz MJ. HLA-DRB1 and persistent chronic inflammation contribute to cardiovascular events and cardiovascular mortality in patients with rheumatoid arthritis. *Arthritis Rheum* 2007; 57:125–132. <https://doi.org/10.1002/art.22482>
- Alamanos Y, Voulgari PV, and Doros AA: Incidence and prevalence of rheumatoid arthritis based on 1987 American College of Rheumatology criteria: A systematic review. *Semin Arthritis Rheum* 2006; 36(3): 182-88. <https://doi.org/10.1016/j.semarthrit.2006.08.006>
- Abdul-Qahar ZH, Al-Osami MH, Al-Asady: Prevalence of Metabolic Syndrome in Iraqi Patients with Rheumatoid Arthritis. *IOSR J Dent Medi Sci* 2013; 11(1): 69-72.
- Haye Salinas MJ, Bertoli AM, Lema L, Saucedo C, Rosa J, Quintana R, et al. Prevalence of dyslipidemia and elevated cardiovascular risk in patients with rheumatoid arthritis. *Medicina (B Aires)* 2013; 73(1):26-30. <https://doi.org/10.1177%2F1759720X16643340>

30. Akiyama M, Mawatari T, Nakashima Y, Miyahara H, Yamada H, Okazaki K. Prevalence of dyslipidemia in Japanese patients with rheumatoid arthritis and effects of atorvastatin treatment. *Clin Rheumatol* 2015; 34(11):1867-1875. <https://doi.org/10.1007/s10067-015-3049-0>
31. Scott IC, Ibrahim F, Johnson D, Scott DL, Kingsley GH. Current limitations in the management of cardiovascular risk in rheumatoid arthritis. *Clin Exp Rheumatol* 2012; 30: 228-232. <https://doi.org/10.1177%2F1759720X16643340>
32. Nicola PJ, Maradit-Kremers H, Roger VL, Jacobsen SJ, Crowson CS, Ballman KV, Gabriel SE. The risk of congestive heart failure in rheumatoid arthritis: a population-based study over 46 years. *Arthritis Rheum* 2005; 52(2):412-420. <https://doi.org/10.1002/art.20855>
33. Gabriel SE. Heart disease and rheumatoid arthritis: understanding the risks. *Ann Rheum Dis* 2010; 69(1):i61-64. <https://doi.org/10.1136%2Fard.2009.119404>
34. Turesson C, Jacobsson LT, Matteson EL. Cardiovascular co-morbidity in rheumatic diseases. *Vasc Health Risk Manag* 2008; 4(3):605-614. <https://doi.org/10.2147%2Fvhrm.s2453>
35. Nisar A, Rasheed U, Aziz W, Farooqi AZ. Prevalence of Dyslipidemia in Autoimmune Rheumatic Diseases. *J College Phys Surg Pakistan* 2012; 22 (4):235-239. PMID: 22482380
36. Zrour SH, Neffeti F H, Sakly N, et al. Lipid profile in Tunisian patients with Rheumatoid Arthritis. *Clin Rheum* 2011; 30(10): 1325-1331. <https://doi.org/10.1007/s10067-011-1755-9>
37. Manjunatha Goud BK, Sarsina Devi O, Bhavana N, Devaki RN, Deepa K, Niveditha S. Nutritional antioxidants and lipid profile in newly diagnosed rheumatoid arthritis patients. *The Int Med J Malaysia* 2012; 11 (1):5-8.
38. Vinapamula KS, Manohar SM, Bitla AR, Kanduri R, Bhattaram SK and Pemmaraju SR. Evaluation of dyslipidaemia in patients with rheumatoid arthritis in South Indian population. *Indian J Rheumatol* 2013; 8 (4):155-60. <https://doi.org/10.1016/j.injr.2013.06.006>
39. Bahlas S, Ahmed MM: Lipid levels and association with disease activity in RA and SLE in Saudi Arabia 2013; 11 (7):1-6. <https://doi.org/10.15537%2Fsmj.2015.6.10557>
40. Ameerkh A, Alosami MH, Salih ES. Comparative study of predicting the risk of cardiovascular diseases in active RA Iraqi patients by traditional and nontraditional methods; *Global J Bio Sci Biotech* 2013; 2(4):522-526.
41. Georgiadis AN, Papavasiliou EC, Lourida ES, Alamanos Y, Kostara C, Tselepis AD. Atherogenic lipid profile is a feature characteristic of patients with early rheumatoid arthritis: effect of early treatment: a prospective, controlled study. *Arthritis Res Ther* 2006; 8(R82). <https://doi.org/10.1186%2Far1952>
42. Dursunoglu D, Evrengul H, Polat B, Tanriverdi H, Cobankara V, Kaftan A. Kilic, M Lp(a) lipoprotein and lipids in patients with rheumatoid arthritis: serum levels and relationship to inflammation. *Rheumatol Int* 2005; 25: 241-5. <https://doi.org/10.1007/s00296-004-0438-0>
43. Attar SM. Hyperlipidemia in rheumatoid arthritis patients in Saudi Arabia: Correlation with C-reactive protein levels and disease activity. *Saudi Medical J* 2015; 36(6):685-691. <https://doi.org/10.15537%2Fsmj.2015.6.10557>
44. Gonzalez-Gay MA, Gonzalez-Juanatey C. Inflammation and lipid profile in rheumatoid arthritis: bridging an apparent paradox. *Ann Rheum Dis* 2014; 73(7):1281-1283. <https://doi.org/10.1136/annrheumdis-2013-204715>
45. Dursunoglu D, Evrengül H, Polat B, Tanriverdi H, Cobankara V, Kaftan A, et al. Lp (a) lipoprotein and lipids in patients with rheumatoid arthritis: serum levels and relationship to inflammation. *Rheumatol Int* 2005; 25: 241-245. <https://doi.org/10.1007/s00296-004-0438-0>
46. Al-kaissi EN, Al-muhtaseb NI, Al-muhtaseb N. The influence of adding antibiotic in treatment of rheumatoid arthritis patients on streptococcus pyogenes carrier rate and on the lipid profile. *Int J Pharm Pharmaceutical Sci* 2015; 7 (2): 245-251.
47. AL-Chetachi MF, Shaher YA. Lipid Status in Rheumatoid Arthritis. 11th Scientific Conference of Medical College-Mosul University 2013; 119-124. <https://doi.org/10.1007%2Fs12291-008-0010-x>
48. Mahdi EA, Mohamed LA, Hadi MA. The Relationship between Lipid Profile and Inflammatory Markers in Patients with Early Rheumatoid Arthritis. *Iraqi National J Chem* 2012; 47: 391-400. <https://doi.org/10.1016/j.aller.2013.11.003>
49. Curtis JR, John A, Baser O. Dyslipidemia and Changes in lipid profiles associated with rheumatoid arthritis and initiation of anti-tnf therapy. *Arthritis Care Res* 2012; 64(9):1282-1291. <https://doi.org/10.1002%2Facr.21693>
50. Georgiadis AN, Papavasiliou EC, Lourida ES. Atherogenic lipid profile is a feature characteristic of patients with early rheumatoid arthritis: effect of early treatment—a prospective, controlled study. *Arthritis Res Therap* 2006; 8(3):R82. <https://doi.org/10.1186%2Far1952>
51. Di Micco P, Ferrazzi P, Libre L, Mendolicchio L, Quaglia I, De Marco M. Intima-media thickness evolution after treatment with infliximab in patients with rheumatoid arthritis. *Int J Gen Med* 2009; 2:141-144. <https://doi.org/10.2147%2Fijgm.s5178>