



CORRELATION OF RA FACTOR WITH DIET AND BIOCHEMICAL PARAMETERS IN RHEUMATOID ARTHRITIS

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ABSTRACT

Rheumatoid arthritis (RA) is an autoimmune disease that affects joints, bones, and cartilage. Genetics and environment play a role in its onset, with diet playing a significant role. Nutrients like polyunsaturated fatty acids can protect against inflammation, while red meat and salt may exacerbate symptoms. The present study was conducted at a government hospital in Kamptee, Nagpur District, in adult subjects aged 30-65. RA subjects were selected from the hospital's OPD over 8 months using purposive sampling. Data collection involved structured questionnaires covering demographics, medical history, diet, and lifestyle. Anthropometric measurements and biochemical parameters were recorded. The study revealed an intricate relationship between various factors and RA development and progression. It identified gender (90% females), family history (67%), medical complications (60% hypertension), and symptoms (pain 100%, morning stiffness 88%, edema 36%) as significant contributors to RA prevalence and severity. Maximum subjects were in Obese grade 1 category (BMI 27). Biochemical analyses indicated high mean LDL (105.6mg/dl), very high RA factor (106.35IU/ml) and high CRP (16.45 mg/l). Results of Pearson's correlation reflected significant relationship between RA factor and protein ($p=0.01$) and fat ($p=0.03$) intake. Similarly a significant correlation was observed between RA factor and FBG ($p=0.03$), total cholesterol ($p=0$), triglycerides ($p=0.01$), LDL-C ($p=0.03$), and Calcium ($p=0.00$). Poor exercise schedules were observed in all subjects. The findings emphasize the importance of holistic management strategies, including dietary modifications and lifestyle changes, in RA treatment. Further research is needed to better understand these relationships and develop personalized interventions for effective RA prevention and management.

KEYWORDS: Rheumatoid arthritis (RA), RA factor, CRP, Diet, Exercise.

INTRODUCTION

Rheumatoid arthritis (RA) is a common autoimmune disease affecting 0.5–1% of the worldwide population. RA is a degenerative disease of the joint and the most common form of arthritis causing pain, mobility limitation, affecting independence and quality of life in millions of people. There is no known cure for RA, but there are several medical, biological and environmental risk factors, modifiable and non-modifiable, that are known to be involved in the development and progression of the disease. As per a 2021 news report, 1.3 crore people in India suffer from rheumatoid arthritis.^{[1][2]}

The US CDC defines rheumatoid arthritis as an autoimmune and inflammatory disease, which means that the immune system attacks healthy cells in the body by mistake, causing inflammation (painful swelling) in the

affected parts of the body. It mainly focuses towards women as compared to men. Arthritis means causing inflammation in the joints. Inflammation causes redness, warmth, swelling, and pain within the joint by reducing the synovial fluid. Initially the arthritis that still not yet identified is called indolent arthritis. Once it is developed it is called Rheumatoid arthritis that affects the whole human body, especially the knees, wrists, and spine. It may also affect the visceral organs like heart, blood, skin, nerves, lungs and eyes. The major symptoms faced by the patients suffering from rheumatoid arthritis are long duration fever, fatigue, and joint pain, swelling between joints and morning stiffness at a time of wakeup. This disease affects the people through many ways like some people may affect faster and for few affects gradually with symptoms over several years.^[2,3,4,5]

Rheumatoid arthritis affects both men and women, but it happens three times more often in women than in men. This can happen at any age, but it happens more often during middle age. The cause of disease is unknown yet, but it's believed that the major cause is a combination of environmental and genetic factors involved. Certain types of food can cause inflammation while others can help reduce inflammation. Foods that can cause inflammation include red meat, salt and eating too many calories. On the contrary foods like oil, fatty fish and fruits can help reduce inflammation.^[2,3,5,6,7]

MATERIALS AND METHODS

Adult subjects diagnosed with Rheumatoid Arthritis, aged 30-65 years were selected by purposive sampling technique from sub district government hospital, Kamptee located in Nagpur district. Maharashtra. Informed consent was obtained from all subjects. An interview cum predesigned questionnaire schedule was used to elicit information on demographic characteristics, symptoms of RA experienced by the subjects, present medical complications, dietary information and lifestyle pattern. Anthropometric measurements viz: height, weight, waist circumference and hip circumference were measured by standard techniques. BMI, WHR and WHtR were calculated. Mean nutrient intake was calculated from dietary records using food values from Indian Food Composition Tables (ICMR 2017). Biochemical parameters taken from hospital records include Hb, FBG, PPBG, HbA1c, KFT, LFT, serum sodium, potassium, calcium, RA factor and CRP. Data of all the variables was compiled; means and standard deviation were calculated. Pearson's correlation coefficient was applied to assess the correlation if any between the RA Factor and nutrient intake and the serum values of all the variables under study. SPSS version 18.0 was used for statistical analysis.

RESULTS AND DISCUSSION

Sociodemographic Information: The age group of the subjects ranged between 30-65 years. Maximum percentage of subjects (38%) was in the age range of 41-50 years. The sexwise presentation of RA was higher in females (90%) as compared to males (10%). Earlier studies have indicated a higher prevalence of RA in women suggesting that female hormones play a role in susceptibility.^[5,8]

Family history of RA was observed in 67% of the subjects. Earlier investigations have indicated a genetic predisposition for rheumatoid arthritis.^[9,10] Severe RA is found at approximately four times the expected rate in first degree relatives of individuals with disease associated with the presence of rheumatoid factor and 10% of patients with RA have an affected first degree relative.^[11]

Severe pain in joints was experienced by 100% subjects, morning stiffness by 88% and oedema on wrist by 36%.

A major percentage of the study subjects (60%) had hypertension. Type -2 Diabetes Mellitus was observed in 14%, CAD 4% and problem of thyroid in 8%. Obesity is well described as an important contributor to the burden of chronic pain and disability. Obesity is also strongly associated with co morbidities including diabetes, hypertension, cardiovascular disease, fatty liver disease and a number of types of cancer.^[12]

Nutrient intake: The type and quality of food eaten and the lifestyle pattern have a direct impact on health. The relationship between lifestyle, environmental conditions and health status is becoming increasingly evident in auto immune diseases. Observations of the present study show a wide range in the macronutrient intake of the subjects. The energy intake varied between 1200 - 1600kcal with 137-295g of carbohydrates, 29 -72g protein and 20 - 65g. of fat. The dietary fiber intake ranged between 23-39g and the calcium intake 199 -697g. Severe pain causing discomfort was observed to be one of the main reasons for frequently missing meals by the subjects.

Lifestyle pattern: Most of the subjects had a sedentary lifestyle. Only 14% subjects followed a regular exercise schedule. Santos indicated from his study that 89% of the subjects did not practice physical activity.^[2] Nohair also reported a high prevalence of poor exercise habits in 95.3% of subjects.^[5] According to Sandberg physically active individuals seem to present with milder rheumatoid arthritis, which adds to the beneficial effects of physical activity on inflammatory diseases.^[13]

Anthropometric indices: The mean BMI of subjects was 27 indicating Obesity Grade I category but nevertheless showing a wide range of BMI ranging between 16-34 (underweight to obesity grade II category). The subjects were classified based on their BMI category as shown in **table 1**.

Table 1: Mean Anthropometric Measurements of RA Subjects Based on BMI Category.

Anthropometric Variables		Underweight (<18)	Healthy Weight (18.5 - 22.9)	Over Weight (23 - 24.9)	Obesity I (25 - 29.9)	Obesity II (≥30)
(n=50)	%	8%	18%	14%	52%	8%
Height (cm)	M	147.7	158	156.7	157.4	155.2
	SD	±17.4	±7.9	±6.9	±9.7	±11.9
	R	122 - 160	152 - 175	152 - 170	122 - 173	141 - 170
Weight (kg)	M	44	53.1	60.1	65.8	71.2
	SD	±2.7	±4.3	±5.7	±10.5	±4.7
	R	40 - 46	48 - 63	54 - 70	40 - 85	67 - 78
BMI (kg/m ²)	M	17.2	21.1	23.5	27.1	31.2
	SD	±0.9	±1.0	±0.5	±1.2	±1.8
	R	16 - 18	19 - 22	23 - 24	25 - 29	30 - 34
WC	M	80.7	85.1	91.4	97.7	91.7
	SD	±11.3	±12.3	±4.9	±8.3	±17.0
	R	66 - 93	58 - 105	88 - 102	82 - 110	67 - 104
WHR	M	0.55	0.53	0.54	0.57	0.55
	SD	±0.11	±0.06	±0.05	±0.05	±0.05
	R	0.43 - 0.69	0.38 - 0.39	0.5 - 0.6	0.4 - 0.7	0.5 - 0.6
Hip (cm)	M	102.5	100	109	114.5	114.7
	SD	±15.19	±16.1	±4.4	±14.1	±8.7
	R	89 - 112	66 - 120	100 - 114	61 - 132	105 - 124
WHR	M	0.78	0.77	0.83	0.82	0.76
	SD	±0.04	±0.13	±0.03	±0.07	±0.15
	R	0.7 - 0.8	0.5 - 0.9	0.8 - 0.9	0.4 - 0.9	0.5 - 0.8

Observations from the table reveal that a major percentage of the subjects were in obese grade I (52 %) category. Only 18% of the subjects had a healthy weight while 8% were underweight. Lombard reported that 45.9% of the population with RA was obese.^[14] Santos also reported that 45.8% of the subjects were overweight and 26.4% were obese.^[2] Recent findings suggest that obesity is common in patients with RA and can have a substantial impact on patient's symptoms and outcomes. Obesity is associated with higher rates of chronic pain and elevated inflammatory markers.^[12]

A similar trend as in BMI was observed in waist circumference (WC), hip circumference (HC), and waist hip ratio (WHR). These indices did not vary with change in BMI status.

Biochemical indices: The biochemical parameters of the subjects have been presented based on **their** BMI category in Table 2.

Table 2: Mean Biochemical Parameters of Subjects Based on BMI Classification.

Biochemical Parameters		Underweight (<18)	Healthy Weight (18.5 - 22.9)	Over Weight (23 - 24.9)	Obesity I (25 - 29.9)	Obesity II (≥30)
(n=50)	%	8	18	14	52	8
Hb g/dl	M	11.3	11.7	11.9	11.9	12.5
	SD	±1.60	±1.44	±2.10	±1.38	±1.17
HbA1C %	M	4.3	4.34	5.87	4.36	5.27
	SD	±1.02	±0.52	±3.56	±0.79	±0.92
FBG g/dl	M	80.97	84.66	101.35	85.37	93.25
	SD	±9.52	±6.08	±36.92	±8.30	±4.71
PPBG g/dl	M	109	113.44	148.8	118.8	134.6
	SD	±2.74	±9.69	±87.69	13.6	±2.88
Serum Urea mg/dl	M	18.16	16.45	19.42	18.76	21.25
	SD	±9.02	±8.36	±6.55	±8.16	±3.40
Serum Creatinine mg/dl	M	0.79	0.86	0.91	0.85	0.63
	SD	±0.07	±0.20	±0.11	±0.17	±0.31
Total Cholesterol mg/dl	M	146	144.33	139.28	153.61	152
	SD	±15.3	±31.73	±25.07	±44.64	±49.9
Triglyceride mg/dl	M	133.6	107.55	103.1	115.61	114.7
	SD	±33.3	±32.50	±38.38	±45.67	±74.5
HDL-C mg/dl	M	42.35	43.66	46.57	44.65	42
	SD	±6.53	±6.70	±13.26	±7.05	±6.73
LDL-C mg/dl	M	113.7	108.22	108.42	104.61	94.97
	SD	±8.5	±7.10	±36.42	±21.58	±19.3
RA Factor IU/ml	M	110.5	96.27	109.28	101.76	147.5
	SD	±61.9	±14.52	±45.10	±51.16	±35.8
CRP mg/L	M	15.7	18.55	14.28	15.73	14.75
	SD	±5.32	±5.68	±4.88	±6.35	±2.5
Serum Calcium mg/dl	M	8.62	8.62	8.68	8.66	9.02
	SD	±0.62	±0.50	±0.41	±0.52	±0.53
Serum Uric Acid mg/dl	M	3.4	4.92	4.85	4.36	5.25
	SD	±0.49	±0.96	±1.35	±1.00	±1.66

Observations from **table 2** show that irrespective of the BMI status the mean biochemical parameters of subjects did not show a particular increasing trend or reflect wide differences. However the RA Factor was observed to be very high in all categories of subjects indicating that, being obese can increase the risk of RA. Mean CRP values were found to be high in all subjects irrespective of BMI category.

Rheumatoid Arthritis is an autoimmune and inflammatory disease. The immune system attacks the

healthy cells in the body by mistake, causing inflammation (painful swelling) in affected parts of the body. Minor elevation has been reported in obesity and moderate elevation in RA or other autoimmune diseases.^[15]

Statistical interpretation of data: Pearson's correlation coefficient has been applied to statistically assess the association between RA and nutrient intake and biochemical parameters of subjects. The results are presented in **table 3&4** respectively.

Table 3: Correlation Coefficient of RA Factor with Macronutrient and Calcium Intake (n-50).

Sr.no	Nutrients			Correlation coefficient with RA Factor	
				Pearson Correlation	Sig. (2-tailed)
1	Carbohydrate g	M	181.56	0.111	0.443
		SD	±31.58		
2	Protein g	M	43.42	0.360*	0.01
		SD	±9.50		
3	Fat g	M	36.4	0.307*	0.03
		SD	±8.40		
4	SFA g	M	11.76	0.26	0.065
		SD	±2.89		
5	MUFA g	M	13.12	0.21	0.132
		SD	±3.11		
6	PUFA g	M	11.01	0.295*	0.038
		SD	±4.06		
7	Calcium mg	M	333.48	0.058	0.691
		SD	±121.68		
8	Fibre g	M	33.14	-0.03	0.836
		SD	±4.22		

All the subjects in the study group were non vegetarians and regular red meat consumers. Fish was consumed frequently. Protein adequacy was noted in the diets. Daily consumption of red meat by the subjects was observed. A +ve (**0.360**) and significant correlation (**p=0.010**) of protein to RA factor is noted. Fat intake of the subjects also shows a +ve (**0.360**) and significant (**p=0.03**) correlation to RA factor. A +ve (**0.295**) and significant (**p=0.03**) correlation was observed between PUFA in the diet with RA factor.

Certain types of foods have been indicated to cause inflammation, while others can actually help reduce inflammation. Examples of foods that can cause inflammation include red meat, salt and eating too many calories. On the contrary foods like oils, fatty fish and fruits can help reduce inflammation.^[3,16,17,18,19]

The statistical data on Pearson's correlation between RA factor and biochemical parameters measured in subjects, classified according to BMI status is presented in **table 4**.

Table 4: Pearson Correlation Coefficient of RA factor and Biochemical Indices (n-50)

Sr.no	Biochemical Parameter			Correlation coefficient with RA Factor	
				Pearson Correlation	Sig. (2-tailed)
1	Hb g/dl	M	11.93	0.031	0.833
		SD	±1.47		
2	HbA1C %	M	4.64	0.247	0.084
		SD	±1.53		
3	FBG g/dl	M	87.78	0.306*	0.031
		SD	±15.80		
4	PPBG g/dl	M	122.42	0.261	0.067
		SD	±34.71		
5	Serum Urea mg/dl	M	18.76	-0.129	0.372
		SD	±7.68		
6	Serum Creatinine mg/dl	M	0.84	-0.206	0.15
		SD	±0.18		
7	Total Cholesterol mg/dl	M	149.71	0.481**	0
		SD	±37.87		
8	Triglycerides mg/dl	M	114.36	0.344*	0.014
		SD	±43.62		
9	HDL-C mg/dl	M	44.63	0.109	0.451
		SD	±7.91		
10	LDL-C mg/dl	M	106.76	0.300*	0.034
		SD	±31.27		
11	CRP mg/l	M	16.4222	0.213	0.137
		SD	±5.71		
12	Serum Calcium mg/dl	M	8.6832	0.417**	0.003
		SD	±0.60		
13	Serum Uric Acid mg/dl	M	4.5468	0.263	0.065
		SD	±1.12		

Statistical association between FBG & RA show a low +ve (**0.306**) but significant relationship (**p = 0.031**). However insignificant association was observed between RA factor and PPBG and HBA1c values.

A moderately + ve(**0.481**) and highly significant (**p = 0**) association was observed between total cholesterol & RA factor. Choi in their study on total cholesterol (TC) and rheumatoid arthritis (RA) risk, found a significant relationship between elevated cholesterol levels and RA in women but not in men. Specifically, women with higher cholesterol levels were at increased risk of developing RA.^[1]

Observations further reflected a low +ve (**0.300**) and significant (**p = 0.03**) relationship of LDL-C and a +ve (**0.344**) and significant relationship (**p=0.01**) of triglycerides with RA factor. The "lipid paradox" has been reported in rheumatoid arthritis RA, where the patients may have lower lipid levels but still experience higher cardiovascular disease (CVD) risk due to systemic inflammation.^[20]

Results of the present study reflected moderately +ve (**0.417**) but highly significant (**p=0.00**) association with serum calcium and RA factor. A longitudinal study on serum calcium levels in patients with rheumatoid arthritis reported considerable temporal variation in total and corrected calcium levels. Transient hypocalcaemia and hypocalcaemia occurred occasionally, but for most of the time calcium levels were normal. Changes in calcium levels were reported not related to changes in clinical, haematological, or immunological parameters of disease activity. Mean serum calcium levels are lower in disease than health; this occurs in RA as well as other diseases.^[21]

CONCLUSION

The study underscores the interplay between genetics, diet and lifestyle in the development and progression of RA. Family history and obesity were noted to be significant factors in RA subjects. Understanding the main causes of RA is crucial in managing and preventing this condition. There is an urgent need for adopting a comprehensive approach to dietary modifications; lifestyle care to promote overall well-being and reduce the impact of RA on daily life.

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