



## Levels of Hemoglobin, ESR, Iron & TIBC in Rheumatoid Arthritis Patients Compared with Normal Individuals

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### Abstract

*Rheumatoid Arthritis is a chronic multisystem disease of unknown etiology. One of the most common extra-articular features of rheumatoid arthritis is anemia. Iron plays a potential role in oxidative stress mediated injuries and pathologies eg. Rheumatoid arthritis (RA). In the present study, we investigated Hb%, Iron & Total iron binding capacity in RA patients. This study has been carried out 200 subjects, of which 100 subjects were control. The study found a significant decreased Hb% and significantly lower levels of serum iron & TIBC in RA patients as compared to control. The result suggested that routine dietary supplementation with multivitamins and a trace element is appropriate in rheumatoid arthritis patients.*

**Keywords:** Rheumatoid arthritis, Anemia, Iron, TIBC

### Introduction

Rheumatoid arthritis (RA) is a progressive, relapsing and chronic inflammatory disease. Although it affects about 1% of the adult population, its etiopathogenesis has not been fully revealed yet <sup>(1)</sup>. Anemia is a frequent comorbidity in patients with RA <sup>(2)</sup>.

The main types of anemia occurred in RA are iron deficiency anemia and anemia of chronic disease (Majhi and Srivastava, 2010) <sup>(3)</sup>. Iron deficiency anemia is usually microcytic hypochromic while anemia of chronic disease is normocytic normochromic (Hove *et al.*, 2000) <sup>(4)</sup>. Iron is a vital mineral to the human being required for

erythropoiesis, oxygen transport, DNA synthesis and electron transport (Goodnough, 2011) <sup>(5)</sup>.

A recent prospective trial involving over 2000 patients with RA found that anemia (World Health Organization [WHO] Classification: hemoglobin (Hb) <12 g/dl in women and <13 g/dl in men) was present in 31.5% of patients, while the lifetime prevalence of anemia was estimated to be 57% <sup>(6)</sup>. In patients with RA, anemia develops as a result of long standing disease (anemia of chronic disease [ACD]) although other conditions such as iron deficiency may also be contributing factors <sup>(7, 8)</sup>. Although the pathogenesis of ACD is not fully understood, several mechanisms have been

proposed, including abnormalities of iron absorption<sup>(9)</sup> and release from macrophages<sup>(10)</sup> as well as malfunction of the cytokine network<sup>(11-16)</sup>, all of which can result in inadequate erythropoiesis. There is conclusive evidence to show that the presence of anemia in patients with chronic illnesses such as CKD, cancer, and HIV is associated with a substantial negative impact on morbidity, mortality, and quality-of-life (QOL) outcomes<sup>(17, 18)</sup>. While a few studies have also found similar associations between anemia and poor outcomes in patients with RA<sup>(6, 19)</sup>.

Iron plays an important role in oxygen delivery, electron transport for energy procurement, the production of RNA by ribonucleotide reductase and cell division. However, iron is insoluble at physiological pH and can be toxic to living cells and tissues through a generation of oxygen-based radicals (i.e. oxidants). As a result of its absolute dependence on the metal and the potential for the introduction of an oxidative stress, the body has developed several mechanisms that allow the body adequate iron for critical cell processes while avoiding toxicity associated with its employment<sup>(20)</sup>.

Iron plays a potential role in oxidative stress mediated injuries and pathologies eg. rheumatoid arthritis (RA). Four decades ago it was suggested that iron may have a crucial role in the progression of inflammation in RA. Indeed, free radicals generated by iron can cause damage to lipids, proteins, carbohydrates and DNA. It is this believed to occur in rheumatoid joint<sup>(21)</sup>.

The objective of this study to estimate the levels of ESR, Hemoglobin, Iron & Total iron binding

capacity in patients with rheumatoid arthritis as compared to control.

### Material & Methods

This study was undertaken in the Department of Biochemistry, Moti Lal Nehru Medical College, Allahabad. The study was performed in 200 individuals of different age (20-70 years). In this study we take 100 normal individual and 100 rheumatoid arthritis patient.

For the biochemical parameter to be analyzed, blood samples were drawn from the antecubital vein avoiding venostasis. In all subjects a blood sample was collected after an overnight fast. Plain & double oxalate vials were used for the estimation of ESR, Hb, Iron and TIBC respectively. ESR, Hb percentage, Iron and TIBC were measured by Wintrobe Method<sup>(22)</sup>, Cyanide Method<sup>(23)</sup> and Ferrozine Method<sup>(24)</sup>.

### Statistical Analysis

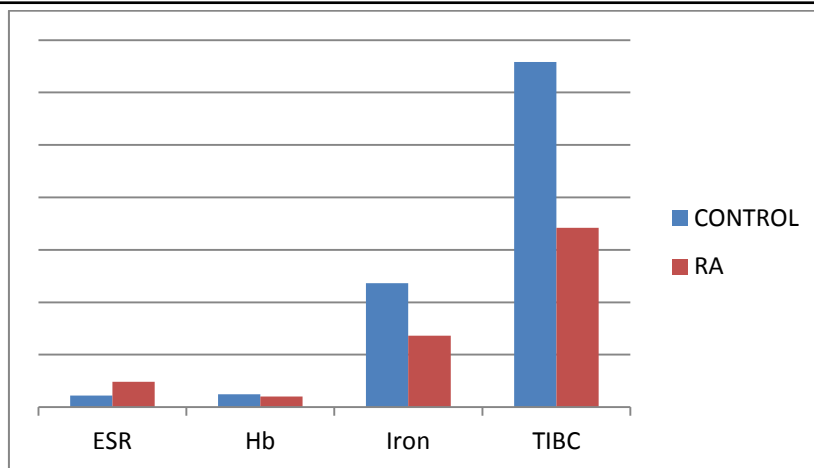
The data are expressed as mean± sd. Statistical comparisons were performed by student t test.

### Result

in this study the level of hemoglobin is significantly decreased ( $p<0.001$ ) in rheumatoid arthritis as compared to control. ESR is significantly increased in study group as compared to control. The Iron levels were significantly decreased in study group as compared to control. Decreased levels of total iron binding capacity found in study group as compared to control.

### Observation Table:

S.N.	Particulars	Control	Rheumatoid Arthritis(RA)
1	ESR(mm/hg)	11.04±1.81	24.33±3.21( $p<0.001$ )
2	Hb(gm/dl)	12.29± 0.79	10.02± 1.86 ( $p<0.001$ )
3	Iron( $\mu$ /dl)	118.37±20.79	68.22± 47.11( $p<0.001$ )
4	TIBC( $\mu$ /dl)	329.29±36.01	170.94± 90.74( $p<0.001$ )



**Figure: 1** Levels of ESR, Hb, Iron and TIBC in RA patient compared to Control

### Discussion

RA anemia is more likely to have more severe joint disease, and anemia correction may rates of disease response to treatment <sup>(25)</sup>. The causes of anemia in RA are not entirely clear although more than 60% of cases are anemia of chronic disease. Most common inflammatory rheumatic diseases are complicated by hematological abnormalities, including anemia, disorders of leukocytes, platelets, and the coagulation system, and hematological malignancy <sup>(26)</sup>. Patients with rheumatoid arthritis (RA) may suffer from a variety of hematologic disorders, particularly anemia, leucopenia and thrombocytes.

In the present we found significantly decreased level of hemoglobin in study group as compared to control. Al Arfaj et al <sup>(27)</sup> also reported increased percent hemolysis and decreased Hb level in their study. Hemolysis can occur due to their oxidative effect on the lipids of RBC membranes.

Kamanli et al <sup>(28)</sup> reported, significantly decreased hemoglobin levels in Rheumatoid arthritis patients as compared to control. This result is inconcordance with our findings.

According to Ravindra et al <sup>(29)</sup> the hemoglobin, Iron and TIBC levels are significantly low in Rheumatoid arthritis patients as compared to healthy subject. These results are in concordance with our finding. Anemia of chronic disease frequently present in RA. Decreased iron absorption was shown to be the result of active

RA rather than a cause of ACD or iron deficiency. It has been hypothesized that bone marrow iron availability decrease due to decreased iron release by the mononuclear phagocyte system or that the anemia in ACD is due to ineffective erythropoiesis; these remain controversial theories <sup>(30)</sup>.

Ayhan et al <sup>(31)</sup> and his colleagues reported low levels of hemoglobin in rheumatoid arthritis as compared to control. Nielson et al <sup>(32)</sup> found a significant inverse correlation between the Hb concentration and ESR in the patients with rheumatoid arthritis.

Karatas et al <sup>(33)</sup> and Thabrew et al <sup>(34)</sup>, found decreased mean hemoglobin concentration in rheumatoid arthritis patients as compared to control. Akyol et al <sup>(35)</sup> found no difference between Hb values of rheumatic patients and healthy individuals.

ESR showed an increase in patient group compared to the control group. Circulating human red blood cells possess the ability to scavenge ROS generated extracellularly by activated neutrophil. Hence, the RBC with decreased antioxidant levels is easily destroyed. The significantly decreased values of RBC and Hb in the blood of RA patients observed in our study are supported by other workers who reported that increased ROS production is inactive of RBC destruction in patients with RA. <sup>(36)</sup>

Agrawal et al <sup>(37)</sup> and his colleagues reported anemia in Rheumatoid arthritis patients as

compared to control. In which they present low Hb levels, low serum iron levels and low serum ferritin levels in their study. Anemia is a frequent extra-articular manifestation in RA significantly Iron Deficiency Anemia (IDA) nearly half the patients. Partial response to iron replacement suggests a component of Anemia of Chronic diseases (ACD) had more active disease as compared with non-anemic patients or those with IDA.

Obtained results regarding the prevalence of anemia in RA were in accordance with those obtained by (Bear *et al.*, 1987, Hochberg *et al.*, 1988, Peeters *et al.*, 1996, Tanaka *et al.*, 1999, Wilson *et al.*, 04 and van Santen *et al.*, 2011)<sup>(38-43)</sup>

The degree of anemia in RA is related to disease activity and inflammation. Treatment of disease activity and erythropoietin therapy usually improve the anemia. The anemia of chronic disease (ACD) will not respond to iron. It is usually normochromic and normocytic (Porter *et al.*, 1994 and Weiss *et al.*, 2005)<sup>(44,45)</sup>.

### Conclusion

On the basis of present findings we can concluded that arthritis patients have lower level of hemoglobin, higher levels of hemolysis and ESR as compared to control. Lower level of Hb, Iron and increased levels of TIBC is a marker of IDA and ACD which plays a significant role in the etiopathogenesis in Anemia in Rheumatoid arthritis. An increased level of ESR and percent hemolysis is a marker of inflammation which plays a significant role in the etiopathogenesis of RA. Thus the assessment of blood hemoglobin may be helpful in prevention of anemia in the study group.

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