

## Study the Relationship Between Hemoglobin (Hb) and Erythrocyte Sedimentation Rate (ESR) in a Group of Iraqi Patients in Baghdad

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### Abstract

The erythrocyte sedimentation rate (ESR) remains a commonly measured indicator of disease, but it is subjected to several non-disease influences. The hemoglobin concentration (Hb) and ESR were measured in 35 consecutive patients (20men; 15 women) from Al Karama Hospital and Yarmouk Hospital.

An inverse correlation was found between Hb and ESR throughout the range of measured Hb, and in particular there was a significant difference in the median ESR of patients in the highest and lowest quartile for non-anemic Hb. These results indicate that correct clinical analysis of an ESR result should take into account the Hb, both in anemic and in non-anemic patients.

**Keywords:** ESR, Hb, Iraqi patients.

### دراسة العلاقة بين معدل ترسيب كريات الدم الحمراء ونسبة الهيموغلوبين في مجموعة من المرضى العراقيين في مدينة بغداد

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#### الخلاصة

يعتبر معدل ترسيب كريات الدم الحمراء (ESR) مؤشرا شائعاً لوجود المرض في الجسم ، لكنه رغم ذلك يعتبر مؤشر لحالات عديدة غير مرضية.

تم تصميم هذا البحث لدراسة العلاقة بين معدل ترسيب كريات الدم الحمراء ومستوى الهيموغلوبين في الدم لدى عدد من المرضى العراقيين حيث تم قياس تركيز الهيموغلوبين (Hb) و ESR في 35 مريضاً على التوالي (20 رجلاً ؛ 15 امرأة) من مستشفى الكرامة ومستشفى اليرموك التعليمي.

اظهرت النتائج وجود علاقة عكسية بين مستوى الهيموغلوبين (Hb) ومعدل ترسيب الكريات الحمر (ESR) في جميع الحالات الخاضعة للدراسة (مجموعة Hb المقاسة) ، وعلى وجه الخصوص كان هناك اختلاف كبير في متوسط ESR للمرضى في المجموعة الأعلى والأدنى المصابة بفقر الدم مقارنة مع مجموعة السيطرة (غير المصابين بفقر الدم) هذه النتائج تشير إلى أن التحليل السريري الصحيح لنتائج ESR ينبغي أن يأخذ في الاعتبار قيمة الهيموغلوبين في الدم (Hb) ، سواء في المرضى الذين يعانون من فقر الدم وغير المرضى الذين يعانون من فقر الدم .

**الكلمات المفتاحية :** معدل ترسيب كريات الدم الحمراء، هيموغلوبين ، مرضى عراقيين .

## Introduction

### Hemoglobin

Abbreviated **Hb** or **Hgb**, is the iron-containing oxygen transport metallo-protein in the red blood cells of all vertebrates[1] as well as the tissues of some invertebrates.

Hemoglobin in the blood carries oxygen from the respiratory organs (lungs or gills) to the rest of the body (i.e. the tissues). There it releases the oxygen to permit aerobic respiration to provide energy to power the functions of the organism in the process called metabolism.

Hemoglobin deficiency can be caused either by a decreased amount of hemoglobin molecules, as in anemia, or by decreased ability of each molecule to bind oxygen at the same partial pressure of oxygen.

In any case, hemoglobin deficiency decreases blood oxygen-carrying capacity. Hemoglobin deficiency is, in general, defined as decreased partial pressure of oxygen in blood,[2-5] . Decrease of hemoglobin, with or without an absolute decrease of red blood cells, leads to symptoms of anemia. Anemia has many different causes, although iron deficiency and its resultant iron deficiency anemia are the most common causes in the Western world. As absence of iron decreases heme synthesis, red blood cells in iron deficiency anemia are *hypochromic* (lacking the red hemoglobin pigment) and *microcytic* (smaller than normal). Other anemias are rarer.

### Erythrocyte sedimentation rate

ESR or sed rate is the rate at which red blood cells sediment in a period of one hour. It is a common hematology test, and is a non-specific measure of inflammation. To perform the test, anti-coagulated blood was traditionally placed in an upright tube, known as a Westergren tube, and the rate at which the red blood cells fall was measured and reported in mm at the end of one hour.

The ESR is increased in inflammation, pregnancy, anemia, autoimmune disorders (such as rheumatoid arthritis and lupus), infections, some kidney diseases and some cancers (such as lymphoma and multiple myeloma). The ESR is decreased in polycythemia, hyper viscosity, sickle cell anemia, leukemia, low plasma protein (due to liver or kidney disease) and congestive heart failure. The basal ESR is slightly higher in females[6].

### **Relation between hemoglobin concentration and erythrocyte sedimentation rate**

The erythrocyte sedimentation rate (ESR) remains a commonly measured indicator of disease, but is subject to several non-disease influences. An inverse correlation was found between Hb and ESR throughout the range of measured Hb, and in particular there was a significant difference in the median ESR of patients in the highest and lowest quartile for non-anemic Hb. These results indicate that correct clinical analysis of an ESR result should take into account the Hb, both in anemic and in non-anemic patients.

### **Diagnosis of ESR**

It can sometimes be useful in the diagnosing of some diseases, such as multiple myeloma, temporal arthritis, polymyalgia, rheumatica, various auto-immune diseases, systemic lupus erythematosus, rheumatoid arthritis, inflammatory bowel disease[7] and chronic kidney diseases. In many of these cases, the ESR may exceed 100 mm/hour.[8]

It is commonly used for a differential diagnosis for Kawasaki's disease (from Takayasu's arteritis; which would have a markedly elevated ESR) and it may be increased in some chronic infective.

### **Methodology**

#### **Sampling**

Numberpatients aged between 15 – 70 years were included in this study along the period from September2017– January 2018 attendingAl Karama Hospital and Yarmouk Hospital complaining from different degrees of anemia of both males and females.

### **A-REQUIREMENTS**

- Anti-coagulated blood (EDTA) double oxalate
- Pasteur pipette
- Timer
- Westergren's tube
- Westergren's stand

### **B-METHOD OF ESR DETERMINATION**

- Westergren's method

### Westergren's Method

It is the best method for estimating the ESR than other methods. The reading obtain is magnified as the column is lengthier. The Westregren tube is open at both ends. It is 30 cm in length and 2.5 mm in diameter. The lower 20 cm are marked with 0 at the top and 200 at the bottom. It contains about 2 ml of blood.

### Requirements

- Anti-coagulated blood (0.4 ml of 3.13% trisodium citrate solution + 1.6 ml blood)
- Westergren tube
- Westergren stand
- Rubber bulb (sucker)

### Procedure

- 1- Mix the anti-coagulated blood thoroughly.
- 2- Draw the blood into the tube up to 0 mark with the help of rubber bulb.
- 3- Wipe out blood from bottom of the tube with cotton.
- 4- Set the tube upright in stand. Make sure the pipette fits snugly to eliminate possible leakage and that the pipette is in vertical position.
- 5- Leave the tube undisturbed for 1 hour.
- 6- At the end of 1 hour, read the result.

### Normal Value

For males: 0-10 mm/hr

For females: 0-15 mm/hr

### Hemoglobinmeasurement procedure

The Hb concentration can be measured through measuring the PCV first.

The packed cell volume (PCV) can be determined by centrifuging heparinized blood in a capillary tube (also known as a micro-hematocrit tube) at 10,000 RPM for five minutes. [9] This separates the blood into layers. The volume of packed red blood cells divided by the total volume of the blood sample gives the PCV. Since a tube is used, this can be calculated by measuring the lengths of the layers.

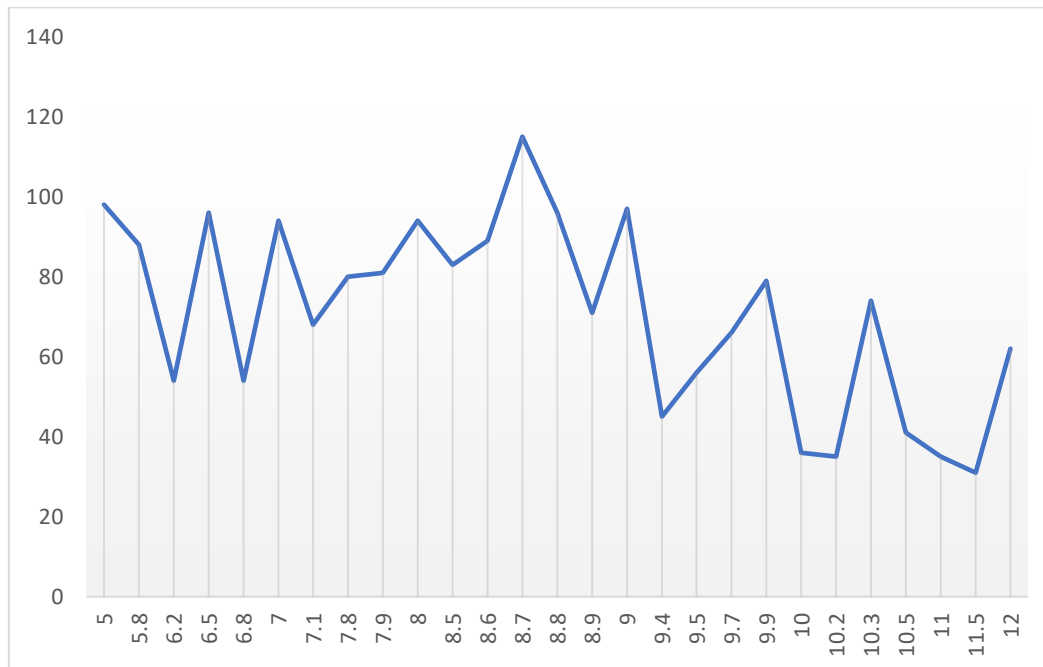
The HB value can then be calculated through the following equation: -

$$HB = \frac{PCV-1}{3}$$

The normal range for hemoglobin is:

**For men,** 13.5 to 17.5 grams per deciliter

**For women,** 12.0 to 15.5 grams per decilitre



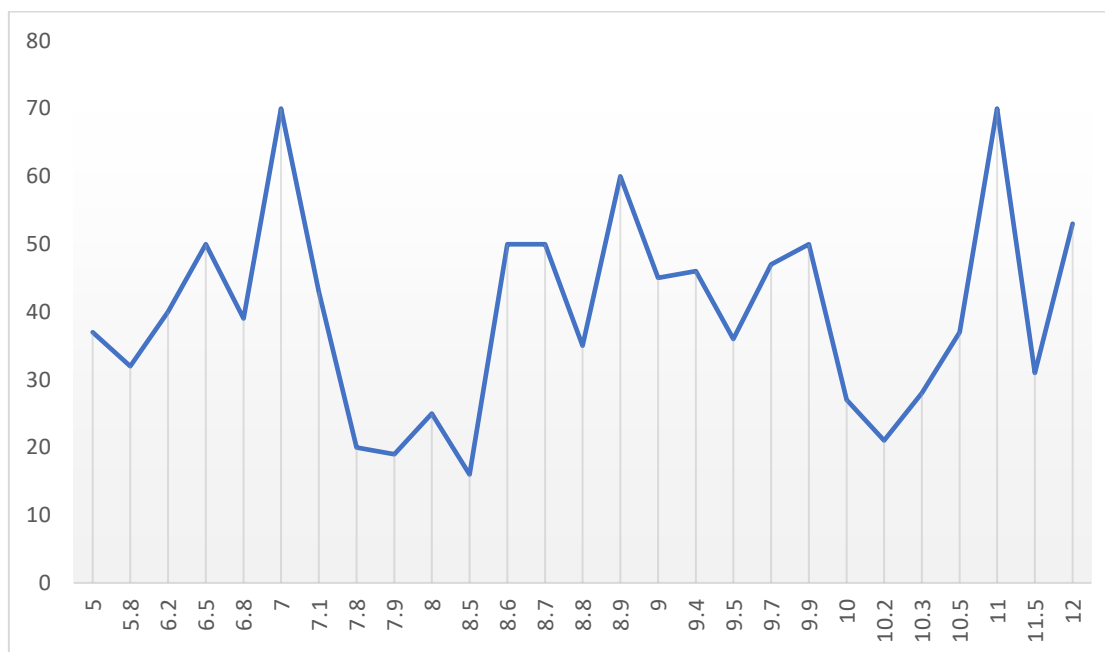
**Figure (1):** a diagram showing the relationship between Hb& ESR

## Results & Discussion



**Figure (2):** showing the relation between ESR procedures

The low rate of Hbis due to a lack of red blood cells and in this case will precipitate faster, leading to a high percentage of ESR



**Figure (3):** a diagram showing between Hb & age where x axis represents age factor & y axis's represents Hb value

The age group which is mostly exposed to infection was (10-20) year (28%), this result seems to be acceptable because of the hormonal disturbances & changes of children at this age, plus the shortage in many hygienic habits that most teenagers are not aware enough about cleaning their skin properly and being unable to protect the skin against microorganism.

The lowest infections rate was among the age group (30-40) years (6.38%) this result seems to be logic since the adults are more aware than teenagers in their hygienic habits besides the immune system is completed in this age gives a further support to protect the body against various infections

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