

## Investigation of factors affecting adult erythrocyt sedimentation rate

Jamshid Ayatollahi<sup>1,2</sup>, Forouzan Desin<sup>3,\*</sup>, Mohammad Sharifyazdi<sup>1</sup>, Seyed Alireza Mousavi<sup>1</sup>, Zohre Akhondimeybodi<sup>1,4</sup>, Faezehsadat Heidari<sup>1</sup>, Samaneh Mazidi<sup>3</sup>, Vahid Sharifi<sup>3</sup>, Sadiyah Dehghani<sup>3</sup>, Alireza Etemadieh<sup>3</sup>, Mahdie Hamidfar<sup>1</sup>, Seyed Hossein Shahcheraghi<sup>1,\*</sup>

<sup>1</sup>Infectious Diseases Research Center, Shahid Sadoughi Hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran; <sup>2</sup>Hematology and Oncology Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran; <sup>3</sup>Infectious and tropical diseases, Shahid Sadoughi University of Medical Sciences, Yazd, Iran; <sup>4</sup>Prevention and control of nosocomial infections, Shahid Sadoughi Hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

**\*Corresponding authors:** Seyed Hossein Shahcheraghi. Infectious Diseases Research Center, Shahid Sadoughi Hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. Email: shahcheraghih@gmail.com; Forouzan Desin, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. . Email: foroozandesin@gmail.com

DOI: 10.22034/HBB.2022.03

Received: December 29, 2021; Accepted: February 1, 2022

### ABSTRACT

Various factors are effective in reduction or increase of Erythrocyte Sedimentation Rate (ESR). This study was designed to investigate the effective factors on ESR in adults participating study in Yazd in Iran. In this study, the data in cohort study was used. The variables of age, sex, Body Mass Index (BMI), alcohol consumption, smoking, infection, inflammation, cancer, and blood pressure were collected. There is a significant relationship between age, sex, systolic blood pressure, BMI, physical activity, joint and heart pain, osteoporosis and smoking history with ESR. Cancer history and diastolic blood pressure variables have no significant effect on ESR values. Results showed that ESR levels in an adult population are generally affected by age and sex.

**Keywords:** Erythrocyte sedimentation rate, age, sex, BMI

### INTRODUCTION

ESR is an easy and inexpensive method that helps in early detection of mild inflammation and to follow the response to

treatment [1,2]. The unit of this test is millimeters per hour [3]. This test is also used to identify latent diseases [4]. Sometimes an ESR test can help differentiate a disease or cause a patient to

complain. For example, in a patient with chest pain, the ESR increases in the presence of myocardial infarction but is normal in the presence of angina [5,6]. Some studies have suggested that this test may be useful as an indicator of illness or as a tool for screening about a specific disease [7]. High ESR, defined above 100, is important for important underlying diseases including infections such as tuberculosis and abscesses, collagen vascular disease, and malignancies [8,9]. An ESR above 100 in the first hour indicates a bad prognosis [10]. Diseases associated with elevated proteins such as hyperfibrinogenemia, as well as diseases associated with elevated serum protein levels, cause elevated ESR [11]. In severe anemia (such as iron deficiency or B12 deficiency), the rate of deposition increases with decreasing red blood cell volume [12,13]. Chronic lymphocytic leukemia [14], polycythemia [1], chronic anemia [15] and aspirin [16] treatment reduce ESR. The factors involved in decreasing or increasing ESR are varied [17].

This study was designed to investigate the factors affecting the ESR in adults participating in the YAS study in Yazd.

## **MATERIALS AND METHODS**

The present study was a descriptive cross-sectional study. It was approved in the ethics committee of Shahid Sadoughi University of Medical Sciences of Yazd, Iran with the code of IR.SSU.REC.1399.084, the data contained in the YAS project was used.

The investigated variables in this study that were extracted from the mentioned project included age, sex, Body Mass Index (BMI), alcohol consumption, smoking, physical activity, infection, inflammation, cancer, body temperature and aspirin use. Sampling was by census and cases with incomplete information were excluded from the study.

Finally, statistical analysis was performed using SPSS (version 14). Kolmogorov-Smirnov statistical test was used to evaluate the normality of data distribution and descriptive statistics were used to determine the mean and standard deviation indices.

Chi-square was used to investigate the relationship between qualitative variables with decreasing or increasing ESR. Totally, Chi-square, Pearson correlation coefficient and logistic regression tests were used to analyze the data at a significant level of 5 %.

**RESULTS**

In the present study, 1408 adult persons participated including 528 (37.5 %) men and 880 (62.5 %) women. There was a significant relationship between the ESR and age and gender parameters (p=0.000) (Table 1).

Based on the results of the present study, there was a significant relationship between systolic blood pressure and the ESR mean (p=0.014), but no significant relationship was found with diastolic blood pressure (p=0.845) (Table 2).

There was also a significant relationship between BMI and physical severe activity

per week (p=0.000) with the ESR average (Table 3).

The results also showed a significant relationship between heart pain (0.020), osteoporosis (p=0.000), joint pain (p=0.000) and smoking (p=0.002) with the ESR mean (Table 4).

Finally, the results showed that there was no a significant relationship between the history of cancer particularly skin (p=0.337), breast (p=0.111) and prostate (p=0.768) cancers with the ESR mean.

**Table 1.** The relationship between the ESR mean with age and gender

Age group	ESR mean	Standard deviation	p value
20-29	12.47	3.204	0.000
30-39	14.24	3.257	
40-49	15.65	3.505	
50-59	17.64	7.079	
60-69	18.65	8.798	
<b>Gender</b>			
Male	13.09	7.153	
Female	19.16	5.014	

**Table 2.** The relationship between systolic and diastolic blood pressure and the ESR mean

<b>Systolic blood pressure</b>	<b>ESR mean</b>	<b>Standard deviation</b>	<b>p value</b>
Below 90	15.55	7.580	0.014
90-119	15.95	6.458	
120-139	16.56	5.274	
140-159	17.11	4.709	
Above 160	18.70	2.241	
<b>Diastolic blood pressure</b>			0.845
Below 90	16.25	4.721	
90-119	16.71	5.954	
120-139	17.09	5.642	
140-159	16.25	5.592	
Above 160	21.05	2.915	

**Table 3.** The relationship between BMI and physical severe activity per week with the ESR average

<b>Body mass index</b>	<b>ESR average</b>	<b>Standard deviation</b>	<b>p value</b>
18.5>	12.81	2.693	0.000
18.5-24.9	14.70	6.998	
25-29.9	15.67	4.489	
30-39.9	16.69	6.637	
Above 40	21.06	6.947	
<b>Severe activity</b>			
Never	17.39	7.474	
once a week	13.31	6.004	
Twice a week	16.43	9.434	
Three to four times per week	14.49	3.417	
Five or more per week	16.16	3.014	

**Table 4.** The relationship between heart pain, osteoporosis, joint pain and smoking with the ESR mean

<b>Heart pain</b>	<b>ESR average</b>	<b>Standard deviation</b>	<b>p value</b>
Yes	20.81	2.756	0.020
No	16.42	5.449	
<b>Osteoporosis</b>			
Yes	22.63	7.204	0.000
No	16.19	5.838	
<b>Joint pain</b>			
Yes	19.95	6.853	0.000
No	15.21	5.517	
<b>Smoking</b>			
Yes	17.25	5.233	0.002
Sometimes	8.95	6.090	
I have left	18.36	5.726	
I have never consumed	19.76	5.082	

## DISCUSSION

The results of the present study showed that ESR mean was higher in women than men.

The results of similar study in accordance with the present study has shown that ESR rate is higher in women than men [18].

In the present study, a significant effect of age on ESR was also proved. Some studies have confirmed this in accordance with the present study [19,20].

In current study, there was also a significant relationship between BMI and the ESR average. In different studies, BMI was significantly associated with ESR [18,21-23].

The current study results also did not demonstrate a significant relationship between the history of cancer and the ESR mean. One study found that increased ESR was associated with metastatic disease and worse survival in patients with malignant skin melanoma [24].

## CONCLUSION

At present study, there was a significant relationship between the ESR mean and

age, gender, systolic blood pressure, BMI, physical severe activity, heart pain, osteoporosis, joint pain and smoking. Thus, ESR is an important test in these subjects that we can use it for investigation.

## ACKNOWLEDGMENT

The authors like acknowledge the staff of Infectious Diseases Research Center of Shahid Sadoughi University of Medical Sciences of Yazd.

## REFERENCES

- [1]. Tishkowski K, Gupta V. Erythrocyte sedimentation rate. In StatPearls. StatPearls Publishing; 2021.
- [2]. Alende-Castro V, Alonso-Sampedro M, Vazquez-Temprano N, Tuñez C, Rey D, García-Iglesias C, *et al.* Factors influencing erythrocyte sedimentation rate in adults: new evidence for an old test. *Medicine*, 2019; 98.
- [3]. Ali A, Abbasi AS, Amjad T, Saleem F. Erythrocyte sedimentation rate and C-reactive protein as marker of acute versus chronic medical conditions. *J Ayub Med Coll Abbottabad*, 2019, 31: 39-45.

- [4]. Naim N. Result analysis of Erythrocyte Sedimentation Rate (ESR) for Tuberculosis (TB) patient with anti-tuberculosis Drug. *Int J Sci Healthcare Res*, 2019, 4 (2): 143-48.
- [5]. Suliman ZAAA. Assessment of erythrocyte sedimentation rate, C-reactive protein and red cell distribution width among myocardial infarction patients in Khartoum State. Sudan University of Science and Technology, 2019.
- [6]. Fitria RN, Suryono S, Riyanti R. The erythrocyte sedimentation rate analysis in acute coronary syndrome and stable angina patients at Dr. Soebandi general hospital. *Pustaka Kesehatan*, 2017, 5: 297-301.
- [7]. Kizilova N, Batyuk L, Baranets V. Human red blood cell properties and sedimentation rate: a biomechanical study. In the international conference of the Polish society of biomechanics. *Springer*; 2018: 3-22.
- [8]. Mitchell P, Viswanath A, Obi N, Littlewood A, Latimer M. A prospective study of screening for musculoskeletal pathology in the child with a limp or

- pseudoparalysis using erythrocyte sedimentation rate, C-reactive protein and MRI. *J Child Orthop*, 2018, 12: 398-405.
- [9]. Kiliç M, Kiliç DK, Topaloğlu US, Eser B. Investigation of diagnosis in patients with higher than 100 mm/hour erythrocyte sedimentation rate and differences of genders, age groups, comorbidities and mortality rates. *Türkiye Klinikleri Tıp Bilimleri Dergisi*, 2020, 40: 168-74.
- [10]. Hale AJ, Ricotta DN, Freed JA. Evaluating the erythrocyte sedimentation rate. *JAMA*, 2019, 321: 1404-1405.
- [11]. Turcanu AM, Turcu DV, Dobrin I, Cristofor AC, Poroch V, Enache AI. Erythrocyte sedimentation rate and total serum protein as biochemical markers of anxiety in chronic obstructive pulmonary disease. *Inflammation*, 2019, 19: 20.
- [12]. Beydoun MA, Hossain S, MacIver PH, Srinivasan D, Beydoun HA, Maldonado AI, et al. Red cell distribution width, anemia, and brain volumetric outcomes among middle-aged adults. *J Alzheimers Dis*, 2021: 1-17.



- [13]. Melku M, Asefa W, Mohamednur A, Getachew T, Bazezew B, Workineh M, *et al.* Magnitude of anemia in geriatric population visiting outpatient department at the university of Gondar Referral hospital, northwest ethiopia: implication for community-based screening. *Curr Gerontol Geriatr Res*, 2018.
- [14]. Morozova E, Teplyuk N, Grabovskaya O, Kayumova L, Smirnova L. A case of polymorphic dermal angiitis in a B-cell chronic lymphocytic leukemia patient during rituximab therapy. *Anticancer Drugs*, 2022, 33: 776-80.
- [15]. Aytekin M. The current use and the evolution of erythrocyte sedimentation rate measurement. *Mid Black Sea J Health Sci*, 2018, 4: 17-23.
- [16]. Nurikhwan PW, Noor Z, Al Audhah N. Description of effectiveness of cilostazol and aspirin as adjuvant of diabetic foot Wagner Grade Ii And Iii. *Berkala Kedokteran*, 2014, 10: 85-94.
- [17]. Etim EA. Effect of maintenance hemodialysis on red cell indices and erythrocyte sedimentation rate

- in northeast Nigeria. *ARC J Hematol*, 2018, 3 (1): 17-22.
- [18]. Shearn M, Kang I. Effect of age and sex on the erythrocyte sedimentation rate. *J Rheumatol*, 1986, 13: 297-98.
- [19]. Piva E, Sanzari MC, Servidio G, Plebani M. Length of sedimentation reaction in undiluted blood (erythrocyte sedimentation rate): variations with sex and age and reference limits. *Clin Chem Lab Med*, 2001, 39 (5): 451-54.
- [20]. Hilder F, Gunz F. The effect of age on normal values of the Westergren sedimentation rate. *J Clin Pathol*, 1964, 17: 292-93.
- [21]. Vallianou NG, Evangelopoulos AA, Panagiotakos DB, Georgiou AT, Zacharias GA, Vogiatzakis ED, *et al.* Associations of acute-phase reactants with metabolic syndrome in middle-aged overweight or obese people. *Med Sci Monit*, 2010, 16: 56-60.
- [22]. De Silva DA, Woon F-P, Chen C, Chang H-M, Wong M-C. Serum erythrocyte sedimentation rate is higher among ethnic South Asian compared to ethnic Chinese ischemic stroke patients. Is this attributable to metabolic syndrome

***Shahcheraghi et al.***

or central obesity? *J Neurol Sci*, 2009, 276: 126-29.

- [23]. Narang V, Grover S, Kang AK, Garg A, Sood N. Comparative analysis of erythrocyte sedimentation rate measured by automated and manual methods in anaemic patients. *J Lab Physicians*, 2020, 12: 239-43.

***Adult erythrocyt sedimentation rate***

- [24]. Tas F, Erturk K. Elevated erythrocyte sedimentation rate is associated with metastatic disease and worse survival in patients with cutaneous malignant melanoma. *Mol Clin Oncol*, 2017, 7:1142-46.