



VARIATION IN ERYTHROCYTE SEDIMENTATION RATE AMONG DIFFERENT AGE GROUPS

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ABSTRACT

Erythrocyte Sedimentation Rate (ESR) is a hematological test that is also a non-specific index of inflammation and is frequently used in clinical practice in screening and monitoring of different types of pathological conditions. The current research article entitled Variation in Erythrocyte Sedimentation rate among various age groups set out to determine the spread of ESR in the various age groups, as well as to obtain the age-wise trend of ESR dispersion. A cross-sectional descriptive study design was employed and a sample of 100 respondents was used, divided into four age categories; 0-15 years, 16-30 years, 31-50 years and above 50 years. ESR values were categorized as normal, borderline, and elevated values, and their analysis was done using frequency and percent distribution. The findings revealed that 55% of the participants were found to have normal ESR, 20% had borderline ESR and 25% had high ESR. Analysis by age showed that there is a gradual increase in elevated ESR with increasing age where the above 50 years group represented the highest proportion of elevated ESR (44%) and lowest normal ESR (32%) and the 0-15 years group represented highest normal ESR (75%) and lowest elevated ESR (10%). The results verify that ESR is more likely to increase with age and insist on the age-specificity of ESR in clinical diagnosis and monitoring.

Keywords- *Erythrocyte Sedimentation Rate (ESR), Age Groups, Inflammation, Hematological Parameters, Elevated ESR, Clinical Interpretation, Frequency and Percentage Analysis*



1. INTRODUCTION

One of the most common and economical hematological investigations in the clinical practice is the Erythrocyte Sedimentation Rate (ESR). It is the speed of settling of red blood cells (erythrocytes) in the bottom of a vertical tube during a given time (usually, one hour). ESR is a non-specific predictor but very significant in recognizing and treating inflammatory and infectious diseases, autoimmune diseases, malignancies and chronic systemic diseases.

ESR is affected by an increase or decrease in plasma proteins that induce rouleaux formation and consequently induce faster sedimentation like fibrinogen and immunoglobulins. Nevertheless, the values of ESR depend not only on the state of a disease but also on various physiological and demographic factors such as age, sex, pregnancy, anemia, and nutritional status.

Among these factors, age is a significant influence of ESR variation. It is a common fact that ESR usually rises with advancing age because of physiological changes like changes in the plasma proteins, diminished RBC count or activity, and also, low-grade inflammation in the older people. Consequently, the diagnosis of ESR should not be performed without taking into account the age-related reference ranges to avoid diagnostic errors, unnecessary labor, or quagmire of inflammatory status.

Therefore, the given research is concerned with the change in ESR among various age groups, trying to determine a more accurate picture of ESR trends in various age categories and to emphasize the fact that age-specific interpretation needs to be taken into consideration in clinical and laboratory practice.

1.1. Age-Related Factors Influencing ESR Values

The physiological alterations which accompany age contribute to a great extent to the value of erythrocyte sedimentation rate (ESR), and thus age is a crucial factor when interpreting the hematological parameter in question. As one ages, some plasma proteins, specifically fibrinogen, globulins, and other acute-phase reactants, gradually rise, and these proteins allow rouleaux to develop (red blood cells stacking on top of each other). This boosts aggregation



thereby raising the weight of erythrocyte clusters thus settling faster therefore raising ESR values.

Other hematological changes associated with old age include mild anemia, decrease in the number of red blood cells or variations in red blood cell size and shape in addition to the alteration in plasma proteins. These changes enhance the sediment resistance of the erythrocytes, which adds to an increase in the ESR levels. Besides, as an age-related disease, low-grade chronic inflammation is generally attributed to aging, although the disease itself may not be pronounced enough to increase ESR levels.

All these physiological and biochemical modifications are the reasons why ESR is higher in older age groups than it is in younger people. Therefore, the use of ESR values without age differences can cause an overestimation of the inflammatory or pathological states among elderly patients. This is why, it is necessary to use the age-adjusted reference ranges and closely correlate with the clinical information to make an accurate diagnosis, proper monitoring, and prevent unnecessary investigations in older patients.

1.2.Objectives Of the Study

1. To determine ESR values among different age groups in the study population.
2. To compare the mean ESR levels across various age categories.
3. To analyse the trend/pattern of ESR variation with increasing age.
4. To emphasize the clinical significance of using age-related ESR reference values for accurate diagnosis and monitoring.

2. REVIEW OF LITERATURE

Fest et al. (2019) performed a prospective population-based cohort study, to investigate the prognostic importance of erythrocyte sedimentation rate (ESR) when compared to mortality. The authors document that ESR had been a predictor of all-cause mortality independently even after the other clinical and demographic factors were taken into consideration. The researchers highlighted that high levels of ESR had already reflected some underlying state of

inflammation and could be reported as a significant indicator of health risks in the long term. The results showed ESR to be a useful parameter capable not only of determining the presence of inflammation but also forecasting the outcomes in the population level.

Ramsay and Lerman (2015) examined the clinical utility of ESR in the practice of paediatrics and described the use the test had been made in the identification of the inflammatory and infectious diseases in children. The authors noted that ESR had continued to be a valuable investigation in those instances where there was uncertainty in clinical presentation, but also, ESR was not specific and may be influenced by various physiological and pathological states. The research postulated that a close clinical adjustment of ESR interpretation in children had not been done and it should not have been employed as a diagnostic measure. Their efforts came with recommendations to the clinicians on how and where ESR is used and restricted in paediatrics.

Harrison (2015) explored the importance of ESR and C-reactive protein (CRP) as key parameters of inflammation applied in medical diagnosis and in disease surveillance. The author elaborated that ESR had been affected by plasma proteins, red cell properties among other physiological factors and it was a non-specific yet a widely used tool. The paper also explained the fact that CRP had responded faster to inflammation than ESR, and hence CRP was a superior biomarker of acute inflammation, but ESR had continued to be valuable in long-term inflammatory diseases. The review has distinctly separated the clinical utility of ESR and CRP, as well as the two of them when combined have been shown to be useful in assessing inflammatory disorders.

Shaikh et al. (2020) conducted a systematic review and meta-analysis aimed at assessing the diagnostic value of procalcitonin, CRP and ESR in the diagnosis of acute pyelonephritis among children. The authors indicated that even though ESR had been used in diagnostic decision making, it had lower accuracy in compared to procalcitonin and CRP. The research arrived at the conclusion that inflammatory markers had demonstrated inconsistent diagnostic utility and that alone the ESR was not adequate to allow consistent diagnosis. Their results pointed at the relevance of ESR supplemented with other biomarkers to enhance the diagnostic results in paediatric infections.



3. RESEARCH METHODOLOGY

The chapter explains the logical process undertaken when carrying out the current research whose title is Variation in Erythrocyte Sedimentation Rate among Different Age Groups. The methodology describes the study design, population, sample size, age group, ESR, and statistical methods employed to analyse it. The study will mainly focus on determining age differences in ESR values through descriptive analysis with frequency and percentage distribution, and thus will assist in a clinical interpretation of ESR in different age groups.

3.1. Study Design

The current research design was descriptive and analytical cross-sectional study which aimed at investigating the difference in erythrocyte sedimentation rate (ESR) across age groups. The design was deemed fit to determine age-wise distribution and comparison trends of ESR values at a given point of time.

3.2. Study Population

The target population was 100 participants ($N = 100$) who were different in age groups. The participants were chosen in such a way that childhood, young adult, middle age, and old populations of children were represented so that the important ESR variation could be compared.

3.3. Sample Size

The sample was 100, a number deemed sufficient to discuss the patterns of age-wise distribution and frequency of ESR values by percentage analysis.

3.4. Data Source and Collection

The study utilized secondary clinical data that concerned erythrocyte sedimentation rate (ESR). Routine hematological records provided the values of ESR. This study did not use any questionnaire or survey technique.

4. DATA ANALYSIS

To analyze them, the participants of the study were segmented into four age groups. The ESR values were categorized into three groups, which included: Normal, Borderline, and Elevated. Frequency and Percentage tables are used to represent the data.

Table 1: Distribution of Participants by Age Group

Age Group (Years)	Frequency (n)	Percentage (%)
0 – 15	20	20.0
16 – 30	30	30.0
31 – 50	25	25.0
Above 50	25	25.0
Total	100	100.0

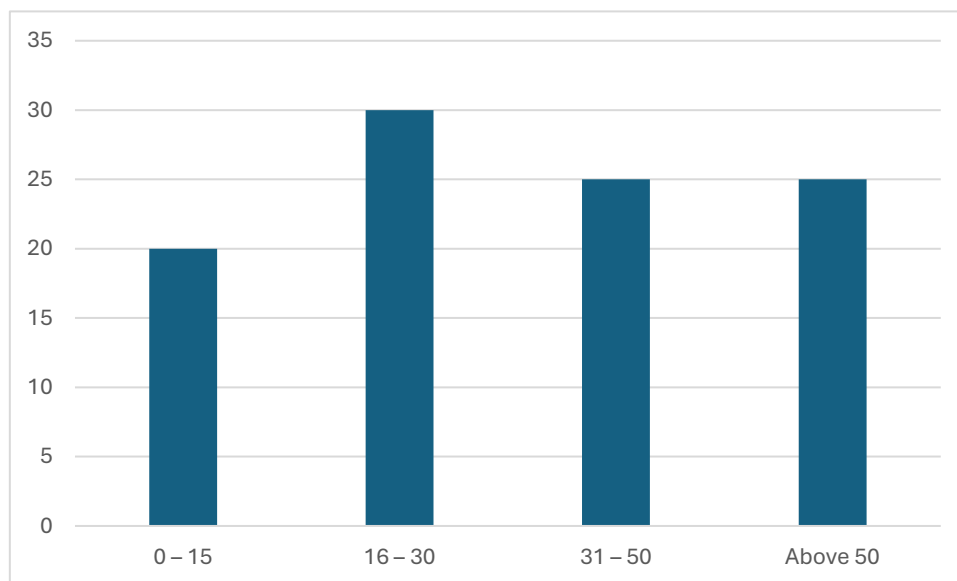


Figure 1: Graphical presentation of Distribution of Participants by Age Group

The distribution of the study participants concerning their age is shown in Table 1 (N = 100). The results indicate that the greatest percentage number of participants were in the 16 years to 30 years age range (30%), so the sample was more representative of the young adults. There was an equal contribution of the 31- 50 years group and the above 50 years group (25 and 25

respectively) and the 0-15 years group constituted 20% of the participants. The general sample size was representative enough to offer the age-based sample to compare ESR analysis.

Table 2: ESR Category Distribution of Total Participants

ESR Category (mm/hr)	Frequency (n)	Percentage (%)
Normal	55	55.0
Borderline	20	20.0
Elevated	25	25.0
Total	100	100.0

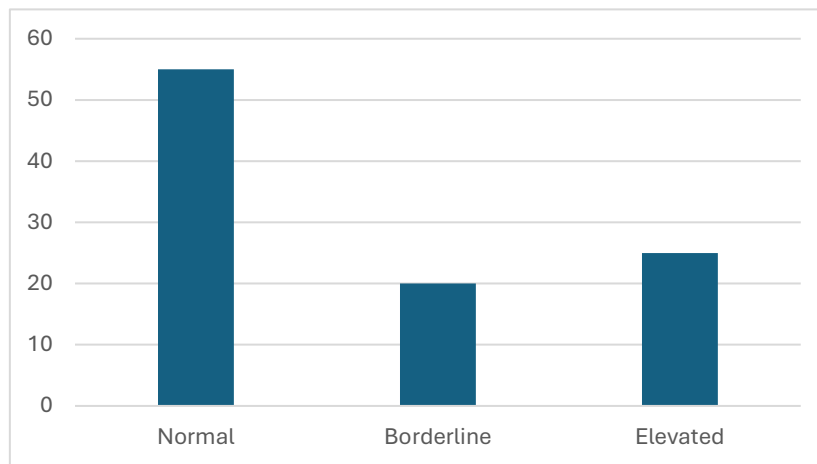


Figure 2: Graphical Presentation ESR Category Distribution of Total Participants

Table 2 provides a general distribution of ESR values of all the participants. It shows that, 55% of the participants had normal values of ESR, which means that over half of the population was within its allowed range. In the meantime, 20% of the respondents were in the borderline category of the ESR, showing mild or moderate elevation. It is worth noting that 25% of the participants recorded high ESR that might indicate high levels of inflammatory processes or underlying diseases. Consequently, as it is reflected in the table, a significant percentage of the sample participants showed abnormal ESR patterns.

Table 3: Age Group-wise Distribution of ESR Categories

Age Group (Years)	Normal n (%)	Borderline n (%)	Elevated n (%)	Total n (%)
0 – 15	15 (75.0)	3 (15.0)	2 (10.0)	20 (100)
16 – 30	20 (66.7)	6 (20.0)	4 (13.3)	30 (100)
31 – 50	12 (48.0)	5 (20.0)	8 (32.0)	25 (100)
Above 50	8 (32.0)	6 (24.0)	11 (44.0)	25 (100)
Total	55	20	25	100

Table 3 provides a comparison between ESR categories between various ages. This is a clear indication that the normal values of ESR were the highest in the smallest age range (0-15 years) with the proportion of normal ESR being 75% or children/adolescents are more likely to have good inflammatory condition or have constant values of ESR. Under the 16-30 years bracket, a normal ESR was found in 66.7%, which indicated that most young adults were also in the normal level. Nevertheless, normal ESR declined to 48% in the 31-50 years group whereas elevated ESR rose to 32% demonstrating that there was a significant change to higher age levels of ESR. The biggest finding is observed in the above 50 years group where only 32% of the group had normal ESR, and 44% were having increased ESR, the highest of all groups. Therefore, Table 3 goes a long way in affirming that the rise of ESR is gradual as one advance in age, which validates the study purpose on ESR variation with age.

Table 4: Elevated ESR Cases across Different Age Groups

Age Group (Years)	Elevated ESR Frequency (n)	Percentage (%)
0 – 15	2	8.0
16 – 30	4	16.0
31 – 50	8	32.0
Above 50	11	44.0
Total	25	100.0

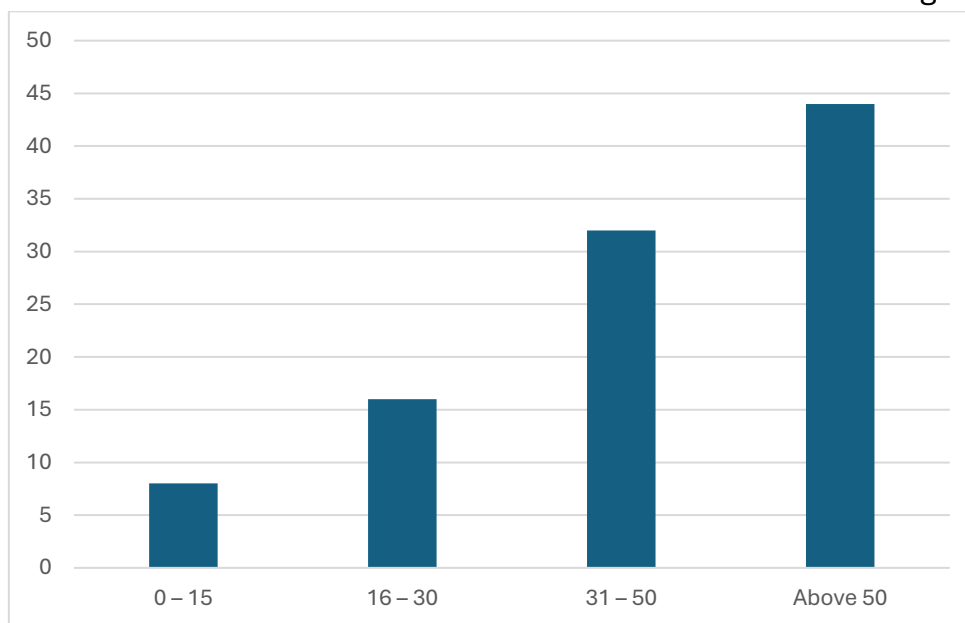


Figure 3: Graphical presentation Elevated ESR Cases across Different Age Groups

Table 4 is dedicated to the distribution of higher cases of ESR ($n = 25$) per age groups. As it can be seen in the table, the greatest percentage of elevated ESR cases was found in the above 50 years age group (44%), which means that elderly participants are the biggest contributors to abnormal ESR results. The 31-50 years group was the most important contributor to the higher tendency of ESR (32%), which proves that middle aged people also have a greater propensity towards elevation of ESR. Comparatively, 16-30 years group contributed lowly to 16% with the lowest being 0- 15 years old with only 8%. Therefore, this table supports the fact that high cases of ESR are mainly clustered in the older age group highlighting the close association between the rise in age and escalation in ESR.

5. CONCLUSION

The current research article titled as Variation in the Erythrocyte Sedimentation Rate among the Different Age Groups concludes that the ESR values depict a steady age-related difference, where there is a gradual increase in the level of ESR with the growth in age. Out of 100 participants, 55% had normal ESR, 20% exhibited borderline ESR, and 25% had elevated ESR, which means that a significant number of the people proved to be more inflammatory. An age-wise analysis showed that the 0 to 15 years group had the most normal ESR (75%) and least elevated ESR (10%) and the above 50 years group had the least normal ESR (32%) and highest

elevated ESR (44%) supporting the fact that it is older people who have the highest chances of having ESR elevation. Furthermore, out of all of the cases that had elevated ESR, the highest proportion (44%) was of those that were above 50 years of age, which supports the high correlation between age and ESR that were elevated. Thus, the study illustrates the need to interpret ESR with age specificity to effectively perform the clinical examination and prevent the misdiagnosis, especially in the middle and older age groups.

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