JURNAL ILMU DAN TEKNOLOGI KESEHATAN
Vol 11, No 1, September 2023,
ISSN: 2338-9095 (Print)
ISSN: 2338-9109 (online)

Determination of Blood Sedimentation Rate (ESR) Referal Value in Us Women 20-50 Years Old

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Article history

Posted, April 8th, 2023
Reviewed, Aug 16th, 2023
Received, Aug 25th, 2023

ABSTRACT
ESR (Erythrocyte Sedimentation Rate) is one of the parameters used for health checks. The ESR value is used to determine the presence of inflammation and infection and monitor disease. The reference value is an examination used to see a normal rather than a laboratory examination of a patient. The problem is that the current ESR reference values refer to lab parameter insert kits and WHO, where reference values may vary between geographic regions, age groups, gender and race. Based on the International Council for Standardization in Hematology (ICSH) and ISO 15189 Clause 5.2.2, the range of reference values must be stated based on the local area minimum of 120 samples. The population used in this research was Periuk sub-district, Tangerang City, is 191 and the sample was 126 people with a random sample. Determining the reference value range in this study used primary data using statistical calculations based on CLSI EP28-A3C guidelines, namely the 2.5 and 97.5 percentiles. The research results obtained a degree of ESR reference values of 0-39 mm/hour. Suggestions for further research are to determine reference values based on gender and racial distance.
Keywords: *ESR, Reference Value, ICSH*

ABSTRAK
LED (Laju Endap Darah) merupakan salah satu parameter yang dilakukan untuk skrining kesehatan. Nilai LED digunakan untuk menentukan adanya inflamasi/peradangan, infeksi, juga untuk monitoring suatu penyakit. Nilai rujukan suatu pemeriksaan digunakan untuk melihat normal tidaknya suatu pemeriksaan laboratorium pada pasien. Permasalahannya adalah nilai rujukan LED saat ini merujuk pada kit insert parameter lab dan juga WHO dimana nilai rujukan mungkin bervariasi antara daerah geografis, kelompok usia, jenis kelamin, dan ras. Berdasarkan *International Council for Standardization in Haematology* (ICSH) dan ISO 15189 Klausul 5.2.2, rentang nilai rujukan tersebut harus dinyatakan berdasarkan wilayah lokal. Populasi yang digunakan pada penelitian ini adalah kecamatan Periuk Kota Tangerang sebanyak 191 dan sampel sebanyak 126 orang. Penentuan rentang nilai rujukan pada penelitian ini menggunakan data primer

DOI: 10.32668/jitek.v11i1.1113

dengan menggunakan perhitungan statistik berdasarkan pedoman CLSI EP28-A3C yaitu persentil 2,5 dan 97,5. Hasil Penelitian didapatkan rentang nilai rujukan LED 0-39 mm/jam. Saran penelitian selanjutnya adalah menentukan rentang nilai rujukan berdasarkan jenis kelamin dan ras.
Kata Kunci: LED, Nilai Rujukan, ICSH

INTRODUCTION

Erythrocyte sedimentation rate (ESR) is the rate at which erythrocytes settle in a tube containing sodium citrate anticoagulant within one hour (Guarner et al., 2015). The results of the ESR examination are used to monitor the inflammatory process and acute disease activity and screening. An increase in the ESR value indicates an inflammatory process in a person's body, either acute or chronic inflammation or tissue damage (Tishkowski & Gupta, 2023). Although the results of the ESR examination cannot be used to support an etiological diagnosis, in practice, they are still routinely used in clinics because apart from being a simple and easy procedure, it is also economical, practical, and can be used as a point-of-care examination (near the patient), and still has important clinical significance. Based on the National Committee for Clinical Laboratory Standards (NCCLS), which is now known as the Clinical Laboratory Standards Institute (Gary L. Horowitz, MD *et al.*, 2010) and the International Council for Standardization in Haematology (ICSH), Westergreen is a standard method that is sensitive and recommended for ESR examination (Tishkowski & Gupta, 2023). In 1977, ICSH accepted modifications to the Westergreen method, such as pipettes made of plastic instead of glass and the use of EDTA anticoagulant blood. In 1988, both NCCLS and ICSH published new guidelines for quality assurance. In 1993, the ICSH group published new recommendations and emphasised that it is crucial to ensure that the measurements are obtained in different laboratories (Kratz et al., 2017).

Based on ICSH, the expected value of ESR for adult women is 0-20 mm/hour. This reference range is obtained from various samples in the areas agreed upon by ICSH. Reference ranges for the same method or instrument may differ between laboratories and geographic regions due to different operating conditions of the equipment, different selection criteria for healthy subjects, other patient populations, and geographical areas such as different temperature, altitude, barometric pressure, and humidity and Subject preparation and

DOI: 10.32668/jitek.v11i1.1113

sample collection may vary (Özcürümez et al., 2019) The National Committee for Clinical Laboratory Standards (NCCLS) stated that reference ranges should be set locally because of these differences. The NCCLS recommends testing a sample of at least 120 patients to determine a statistically significant reference interval. Other experts recommend a minimum of 200 pieces to ensure stable lower and upper reference limits (Jones et al., 2019).

Based on research conducted by Tishkowski & Gupta (2023), the reference value for ESR in healthy people aged 41-75 years for men is 14.80 ± 3.52 mm/hour, while the reference value for women is 23.79 ± 5.34 mm/hour O'clock. The application of the current ESR reference value, to the author's knowledge, has never been established in Indonesia. Therefore, researchers are interested in examining the range of ESR reference values for adult women.

METHOD

This research complies with the ethics of the Stikes Prima Health Research Ethics Committee number 52/EC/KEPK/STIKES-PI/VII/2021. The research is analytic, using a cross-sectional design in a group of adult women (aged 20-50 years). Determination of referral value in this study used the direct method where the sample came from patients recruited prospectively in two housing areas in the Periuk area, namely the Global Mansion and Pondok Fortune. The researcher confirmed the health status of the participants/patients using questionnaires and direct interviews and carried out routine haematology laboratory tests (haemoglobin levels, hematocrit values, platelet counts, and leukocyte counts). Determination of reference values based on CLSI EP28-A3C expressed in the range of 2.5 and 97.5 percentile values or the mean ± 2SD.

This research was conducted for approximately six months, namely July - December 2021. The time for this research was calculated from searching for research subjects until the preparation of this research report in stages. The research sample was standard (20-50) adult women. The inclusion criteria were subjects aged 20-50 years living in a house in the Periuk sub-district, Tangerang City, inhabited for at least three years and had no abnormalities/diseases. Exclusion criteria for smoking, currently using drugs, pregnancy, and breastfeeding.

Determination of referral value in this study used the direct method where the sample

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came from patients recruited prospectively in two housing areas in the Periuk area, namely the Global Mansion and Pondok Fortune. Researchers confirmed the health status of participants/patients using questionnaires and direct interviews and carried out routine haematology laboratory examinations.

The sample collection is primary data. One hundred ninety-one people willing to be respondents had their blood taken for examination related to the inclusion criteria. A total of 150 out of 191 were accepted for routine haematology examinations and then routine haematology examinations. A total of 126 out of 150 people had normal routine haematology values, so this number will be used to calculate the reference value. Furthermore, determining the reference value of the ESR on the 126 research subjects (primary data) uses a sampling method that the minimum sample that can be taken according to CLSI is 120. Data processed using Excel and SPSS to determine reference values based on CLSI guidelines EP28-A3C is RI's 2.5 and 97.5 percentile. Determining 2.5 and 97.5 can be done by finding the mean and standard deviation and then calculating the x±2SD value.

RESULT AND DISCUSSION

1. Results achieved

In this study, determining the RI value considered known patient variables such as age (adults aged 20-50 years), female sex and several other laboratory variables that could affect ESR, such as haemoglobin, hematocrit, leukocyte count, and platelet count. The characteristics of the research subjects are given in Table 1.

Table 1. Characteristics of Research Subjects

Characteristic	Total	Percentage (%)
Age:		
20-30	12	10
31-40	32	25
41-50	82	65
BMI (Body Mass Index):		
17.0-18.4	9	7
18.5-25.0	106	84
25.1-27.0	11	9
Concentration of Hemoglobin (g/dL), X±2SD	9.4 – 18.6	
Erythrocyte Sedimentation Rate (%), X±2SD	0-39	
Leucocyte count (sel/uL), X±2SD	5.1 – 10. 78 x 10^3	
Thrombocyte count (cell/uL), X±2SD	287,06 – 307, 58 x 10^3	

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CLSI Guideline EP28-A3c recommends that laboratories use statistical methods in RI studies, namely parametric statistical methods limited to analytes showing a Gaussian probability distribution. Statistical method for determining the 2.5 and 97.5 percentile of RI. (Gary L. Horowitz, MD *et al.*, 2010) Based on statistical tests by looking at the extreme values of several laboratory parameters that can affect the value of the ESR, the 2.5 and 97.5 percentiles of RI or the Tablemean ± 2SD where when calculating, the average obtained is 18.00, and the SD is 10. 5 so that the reference value range obtained is 0-39 mm/hour. Compared with the ESR reference value from WHO (0-20 mm/hour), there is a difference between the ESR reference value from WHO and the local ESR reference value (table 2).

Table 2. Calculation of ESR Reference Value

Reference Interval (WHO)	Reference Interval Local (Research)
0-20 mm/hour	Average = 18.00 Standard of Deviation (SD)=10.5 Average ± 2SD= 0-39 mm/hour

Determining the ESR in the general population is vital for interpreting reference values. Guidelines for choosing the reference interval indicate that partitioning should be considered when significant differences between subgroups are determined by age, sex, and general exposure (Coşkun et al., 2021). ESR increases with age in adults, and ESR values are higher in women than men. Common metabolic abnormalities, such as obesity and the associated metabolic syndrome, are proinflammatory states that can be related to increased ESR. Previous studies have shown that smoking increases ESR values in women and specific samples of patients with arthritis (Alende-Castro et al., 2019). The potential effects of additional lifestyle factors, such as alcohol consumption, on ESR have not been fully explored. ESR can be affected by the number, volume, and shape of erythrocytes and tends to be higher in patients with anaemia or increased red blood cell volume.

The reference value of the ESR in this study was higher than the reference value determined by WHO. This is because in the study, there were more research subjects aged

DOI: 10.32668/jitek.v11i1.1113

41-50 (65%) than those aged 20-40 (35%). This is related to the increase in ESR with age in adults and higher ESR values in women than men. The median ESR for women is two times higher than for men, and the median ESR for individuals aged >65 years is two times higher than individuals in the youngest category (age 18-35 years). ESR varies significantly according to age and sex, lifestyle, general metabolic disease, and geographical location, so it is proposed to determine the appropriate reference value.

Laboratory conditions when measuring ESR can also affect the specified reference value, for example, at the pre-analytical stage, such as the use of anticoagulants. For the Westergreen ESR method, you can use EDTA blood added with citric acid as much as 1:4. If too much diluent is added, it will cause high ESR value (Tishkowski & Gupta, 2023). Likewise, with the tube material, several studies have stated that plastic materials can cause an increase in the value of the ESR. In the analytical stage, using westergreen tubes that are not perpendicular can generate high LEDs (Alende-Castro et al., 2019)

Based on research conducted by (Tishkowski & Gupta, 2023), the reference value for ESR in healthy people aged 41-75 years for men is 14.80 ± 3.52 mm/hour, while the reference value for women is 23.79 ± 5.34 mm/hour hours, whereas, in our study, the ESR reference value in women aged 20-50 years was 0-39 mm/hour. The ESR reference value in this study is greater than the ESR reference value in that study, and this is different due to different samples and different geographical locations in the Miao study, the models used came from high altitudes, while in our study, the lowlands (Tangerang City). Another difference is that China's lifestyle differs from Indonesia's, especially in Tangerang City. Lifestyle factors (physical activity, smoking, and alcohol consumption) and common metabolic abnormalities (obesity and related metabolic syndrome) may also influence ESR values. To the best of our knowledge, this is the first study to examine the reference value of ESR in women aged 20–50 years in an adult population sample.

CONCLUSION

Based on research, the ESR reference value in women aged 20-50 years is 0-39 mm/hour, which is different from the reference value often used in laboratories (WHO), which is 0-20 mm/hour. Apart from being influenced by geographic location and lifestyle, this

DOI: 10.32668/jitek.v11i1.1113

difference is also influenced by conditions and laboratory examination stages.

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