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Comparative Study of Westergren Method and Automated ESR Analyser (Microsed-10)

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Abstract
Background & Objectives: *The erythrocyte sedimentation rate (ESR) is still widely used in clinical practice as an indicator of inflammation, infection, trauma, or malignant disease and several billion tests are being performed in clinical laboratories throughout the world. Present study is to compare the ESR done by MicroSED 10, an automated ESR analyser and by the Westergren method in, Individual with normal range ESR, Individual with anaemia, Individual with tuberculosis, Paediatric patients, Orthopaedic patients, Individual with metastasis, Male individual and Female individual.*
Method: *Total 500 Blood samples are taken in sodium citrate vacutee. First ESR is measured by westergren method. Then same sample is run in the Automated ESR analyser Microsed-10.*
Results: *R value of this study is 0.44. So the present study is significant for using automated ESR method instead of gold standard westergren method in patient with individual with normal range(0.43), anaemia(0.49), paediatric patients(0.45), individual with metastasis(0.97), individual with tuberculosis (0.37), male individual (0.44) and female individual(0.44) have significant R value so in these cases automated ESR Analyser can be used for gold standard westergren method. Orthopaedic patient (0.24) have low R value, so automated ESR cannot be used for gold standard westergren method.*
Keywords: *Erythrocyte sedimentation rate, Westergren method, Microsed -10.*

INTRODUCTION

The erythrocyte sedimentation rate (ESR) is still widely used in clinical practice as an indicator of inflammation, infection, trauma, or malignant disease.[1,2,3]. The most satisfactory method of performing the test was introduced by westergren in 1921. Although the method lacks specificity, it can be effective in determining prognosis, as in Hodgkin's disease or prostatic cancer, and for monitoring disease activity as in rheumatoid arthritis. [1]

Despite its advantages, the risk to the medical staff regarding contact with blood specimens leading to blood borne infection is very high.[2]

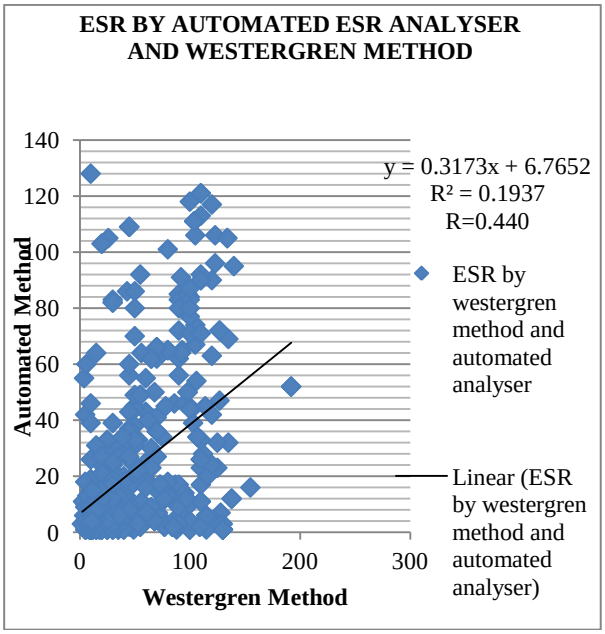
MicroSED -10 is an automated technique for measuring ESR. The greatest advantage with this method is that it can give the ESR readings in 30 minutes of 10 patients with all the temperature corrections at 18°C using infrared barriers which are not seen with the usual standardized methods for ESR.[1]

MATERIALS AND METHODS

- The study are conducted from March 2015 to March 2016. 500 cases were collected of all types of patients in both gender.
- We divide the patients in six groups: Patients with normal range ESR, Tuberculosis patients, Patients with metastasis , Paediatric patients, Orthopaedic patients, Anaemic patients, male individual, female individual.
- Blood is collected in black sodium citrate (3.8%) vacutee under aseptic precausion. Then it is measured in westergren tube (mm per hour) and then same sample is runningin the Automated ESR analyserMicrosed-10 in which reading is available in 30 mins.
- **Statistical test:** Results are expressed as mean, median and Standard Deviation. R value by the linear regression test was used for multiple group comparisons.

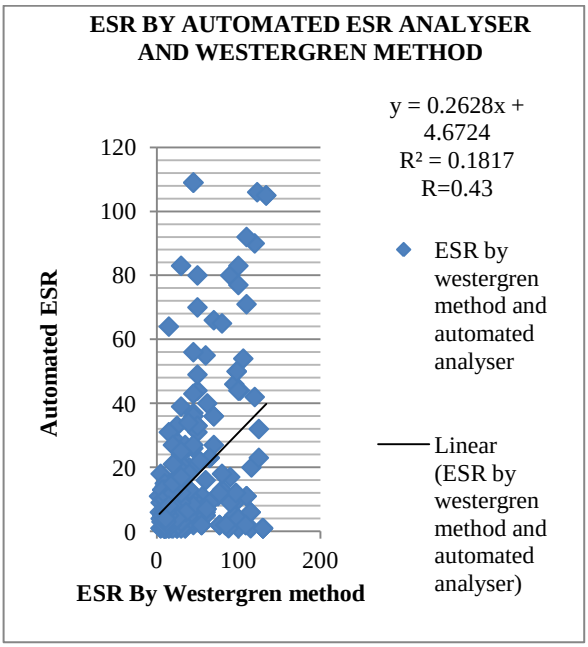
RESULTS

All 500 samples were analyzed for ESR by the Westergren and automated methods. The data from this study were summarized in Graph I to IX. The comparison of methods plotted automated method (Y) VS Westergren method (X). Graph I gave the least square linear regression equation of y = 0.3173x + 6.7652.

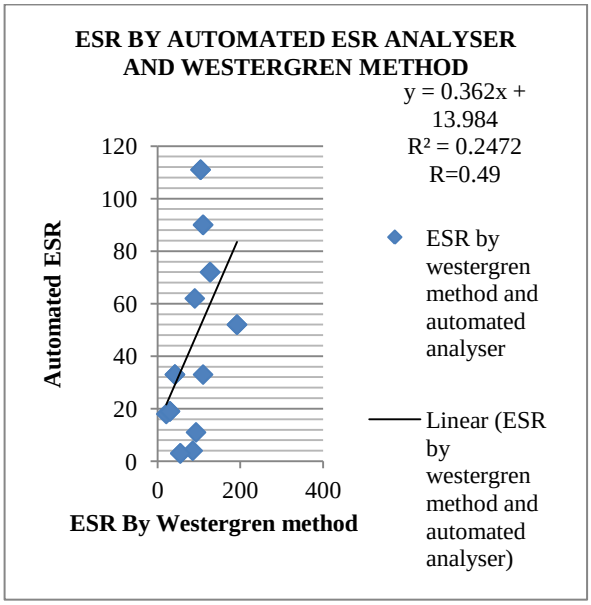


Graph: I. Total cases are included. (Sample size: 500)

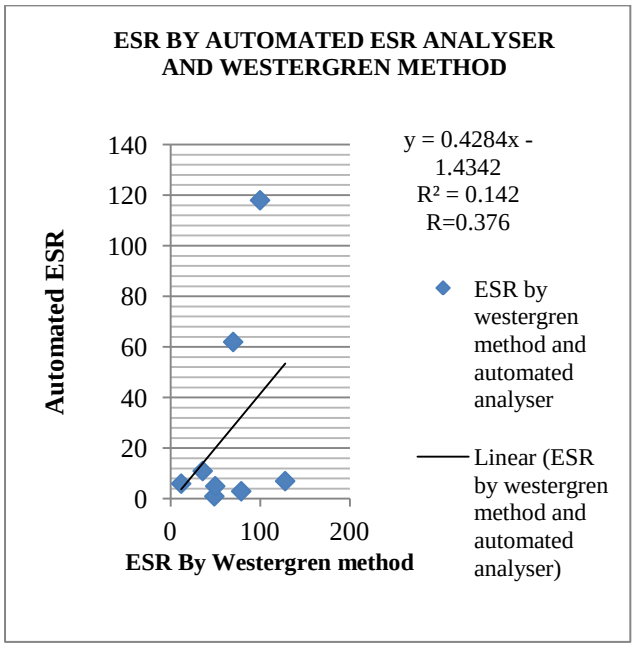
R value of this study was 0.440. So the study was significant for using automated ESR method for the gold standard westergren method.



Graph II: Normal individual cases (sample size:293) R value was 0.43, so the study was significant for using automated ESR method for the gold standard westergren method.

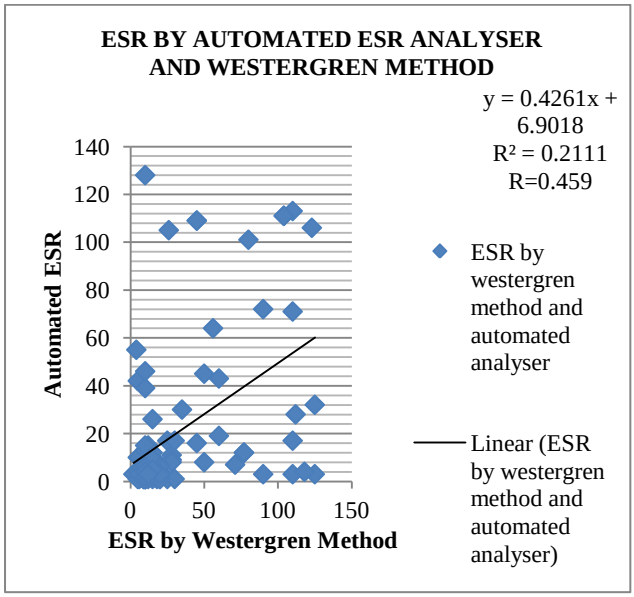


Graph III: Anaemic individual(sample size:19) R value was 0.49, so the study in anaemic patient group was significant for using automated ESR method for the gold standard westergren method.



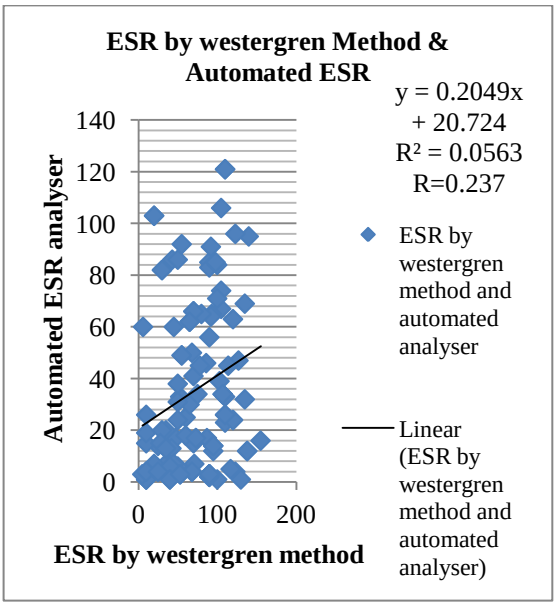
Graph: IV Individual with Tuberculosis(sample size:08)

R value was 0.376, so the study in individual diagnosed as tuberculosis was significant for using automated ESR method for the gold standard westergren method.



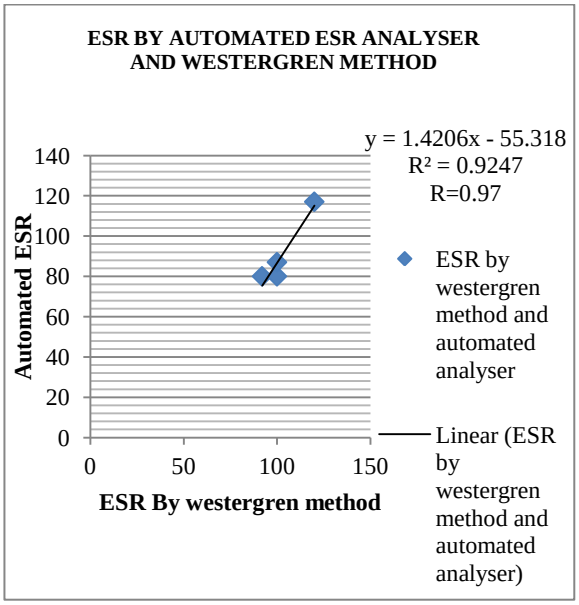
Graph: V Individual with paediatric age group (sample size: 96)

R value was 0.459, so in the present study , patients in paediatric age group had significance for using automated ESR method for the gold standard westergren method.



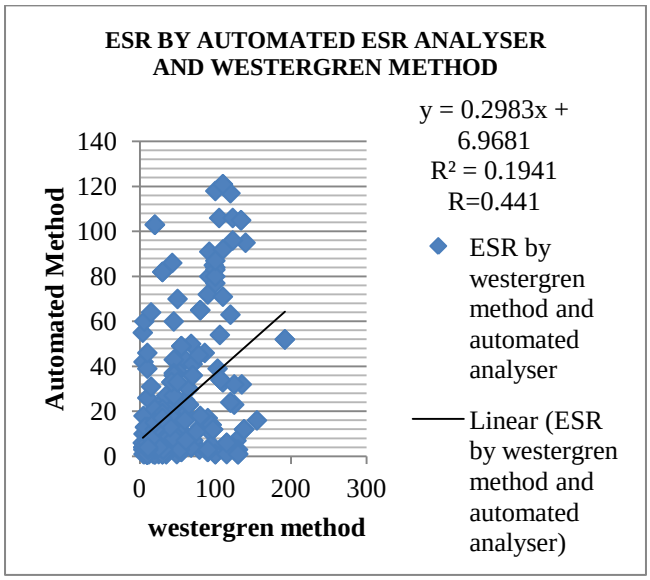
Graph: VI Individual with orthopaedic patient (sample size:114)

R value was 0.24, so individual with orthopaedic problem had no significance for using automated ESR method for the gold standard westergren method.

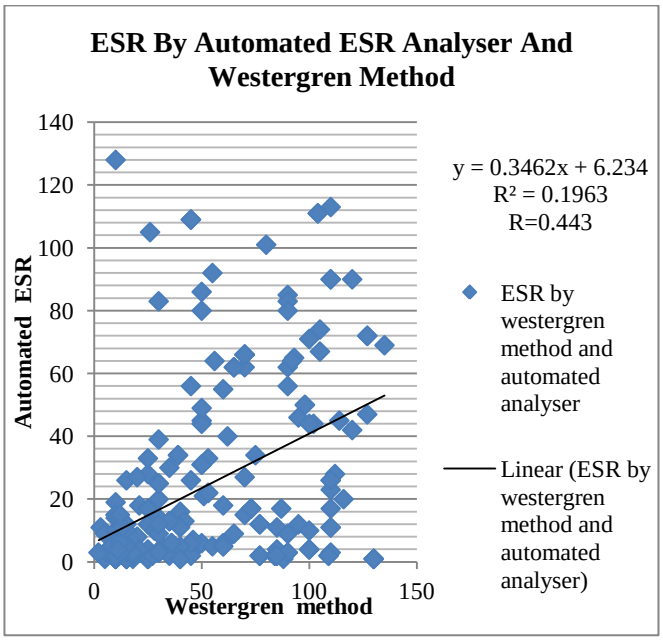


Graph: VII. Individual with Metastasis (sample size: 04)

R value was 0.97, so individual diagnosed as malignancy with metastasis had significance for using automated ESR method for the gold standard westergren method.



Graph: VIII : Male individual(sample size:271)
R value was 0.441, so the study was significant for using automated ESR method for the gold standard westergren method.



Graph IX : Female individual(sample size:229)
R value was 0.443, so the study was significant for using automated ESR method for the gold standard westergren method.

DISCUSSION

Table No: 1. Total 500 cases

	ESR By Westergren Method	ESR by Automated Method	Subramanian et al Monitor 100®[3]	Dhruva et al Monitor 10 [1]
Number of Cases	500	500	200	209
Mean	48.38	22.12	11.2	2.37
SD error of Mean	1.774	1.279	-	0.57
Median	35.0	9.0	-	-
SD	39.662	28.594	35.1	8.31

The ESR is an important laboratory investigation in medicine. Although it is a non-specific parameter, it can help physicians to diagnose and follow-up many diseases. Therefore, a number of methods for ESR determination have been performed.

The Westergren method is accepted currently as standard, but there are some limitations to this technique. Firstly, it is an open method, therefore, practitioners have to make direct contact with blood specimens. At present, there are a number of blood-borne pathogens, they cause diseases, especially hepatitis and HIV infection.

Furthermore, the classical Westergren erythrocyte sedimentation tube is made of glass and must be washed each time before use. Hazards are not only possible from damaged glassware, but contaminated blood can also be expected. Therefore, the Westergren method seems inappropriate as blood borne infection carries a high risk and this technique does not match the concept of laboratory safety.

In view of this a number of methods have been developed to overcome these problems. The automated method is new and based on the measurement of change in blood impedance after the red cell aggregation - sedimentation phenomenon occurs. To determine the ESR, Automated method used the infrared (IR) sensor.

From this study, it was revealed that the usage of this new technique could provide a good correlation (r=0.44). Applying cut off value, the correlation coefficients are also good for both high and low levels.

Therefore it could used as a potential tool in performing ESR determination, especially in a

setting where the rate of blood –borne infectious diseases are more.

Table No. 1 shows Number of samples, Mean, Standard error of mean, Standard deviation and last two column show comparison with the other studies. But there is gross difference between the sample size so mean are not comparable. In this study total 500 sample are taken. Mean of the study by westergren method is 48.38 and by automated ESR analyser is 22.12. Major difference between this is 26.26 because there are lower, normal and higher values of ESR. Due to this outliers this much difference is present. So Median is considered for this study. Median of ESR done by westergren method is 35.0 and by Automated Method is 9.0. Other studies Subramanian et al Monitor 100® [3] and Dhruva et al Monitor 10 [1] exclude the samples which are outlier so mean of these studies are not comparable to present study. . This is unacceptable for clinical interpretation since there is a marked discrepancy between the gold standard westergren method and automated method.

In this study cases which were divided: individual with normal range ESR, anaemia, paediatric patients, individual with metastasis, individual with tuberculosis, male individual and female individual have significant R value so in this cases automated ESR can be used for the gold standard westergren method.

Table No: 2

Groups	R value in linear regression chart	Outcome
Individual with normal range ESR	0.43	Acceptable
Anaemia	0.49	Acceptable
Tuberculosis	0.37	Acceptable
Paediatric patients	0.45	Acceptable
Orthopaedic patients	0.24	Not Acceptable
Individual with metastasis	0.97	Acceptable
Male individual	0.44	Acceptable
Female individual	0.44	Acceptable

Orthopaedic patient have low R value, so automated ESR cannot be used for gold standard westergren method. Orthopaedic patient have higher ESR value, so using Automated ESR Method is not significant.

CONCLUSION

Though automation helped a lot in measurement of ESR values, on comparing the manual and automated methods, marked discrepancy in the ESR results was noted for orthopaedic patient (high ESR) values. However, this was not evident for anaemic patient, paediatric patient, normal range ESR, patient with metastasis, individual with tuberculosis & gender wise evaluation. Thus the automated system tended to underestimate the manual readings for ESR values on the higher range which is clinically unacceptable. Hence it is recommended that a correction factor be applied for the range of ESR values while using this equipment.

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