

**ORIGINAL ARTICLE****SIGNIFICANCE OF VACUETTE SRS METHOD FOR THE DETERMINATION OF ERYTHROCYTE SEDIMENTATION RATE (ESR) WITH CONVENTIONAL METHOD AS GOLD STANDARD**

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**ABSTRACT**

**Objective:** To compare Vacuette (SRS 20/11) ESR values to Conventional/ Standard stergren method with objective of validating the automated and alternative methods.

**Patients and Methods:** This was a cross-sectional analysis, performed at Department of Pathology, Indus Medical College Hospital Tando Muhammad Khan. Manual Westergren process and Vacuette (SRS) methods subjected a total of 120 blood samples to ESR estimations. Results were evaluated on version 21.0 of SPSS. The results were evaluated, and their association was calculated by using the coefficient of Pearson correlation in SPSS.

**Results:** Powerful significant association exists between the Westergren process Vacuette SRS methods with Pearson coefficient 0.96 and highly significant p value <0.001.

**Conclusion:** Vacuette SRS is well associated with the Westergren manual process and is effective and remarkably suitable for employment in clinical laboratories with heavy workload.

**Keywords:** Erythrocyte sedimentation rate, Westergren method, conventional ESR, Vacuette ESR.

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## INTRODUCTION

Erythrocyte Sedimentation Rate (ESR) is one of the most commonly performed investigation in clinical practice. It is increased in plasma (as acute phase proteins) and has cellular characteristics (concentration of RBC, surface change of RBC and aggregation) in different infectious diseases, malignancies, inflammations, and autoimmune diseases. <sup>(1-4)</sup> They coalesce and induce a disparity in the specific gravity between plasma and red cells, to a greater or lesser degree, and determine the extent to which Rouleaux is formed by the red cells. ESR is a highly responsive measure for chronic as well as silent inflammation which underlies many disease processes. <sup>(5-6)</sup> Therefore, it is still used as frequent and common investigation even though the accessibility of substitute parameters of inflammation i.e. C-Reactive Protein level and WBC count. Dr R Fahraeus and Dr A Westergren first portrayed the scheme for the ESR in 1921. <sup>(7-8)</sup> Later, it became popular screening investigation for acute phase proteins as well as chronic illnesses worldwide. To evaluate the ESR there are several different methods, though the traditional Westergren method is at a standstill known as the reference technique. This technique establishes the sedimentation of erythrocytes in a vertically scale tube with specified measurement lengthwise and bore dimension after 1 hour. Although, it is not an automated technique, and also has a hazard of infection, requires somewhat bulky blood volume, and is time consuming with a testing time of 60 minutes (1 hour). <sup>(9)</sup>

Amplified understanding of biohazards danger to the laboratory personnel has resulted in safer techniques for conducting the ESR, i.e. vacuum operated sample aspiration and automated mixing of sample with sodium citrate (anticoagulant) available in tube.

Several techniques were developed for addressing the functional disadvantages of the original Westergren ESR system. These methods calculate the ESR by means of whole blood mixed with citrate or EDTA in dedicated tubes. The erythrocyte sedimentation is measured and re-calculated to Westergren unit (millimetre/hour) afterwards. Benefit of these techniques above Westergren-oriented manual process is that they supply a more readily accessible, fully closed system with automation with performance. This indicates a strong connection with the traditional Westergren process with the Vacuette SRS system. <sup>(10-11)</sup> After 30 minutes, the Vacuette (SRS 20/11) technique evaluates the results. These methods show strong association with Westergren's traditional reference system. This study was conceived to compare Vacuette SRS 20/11's ESR values with traditional Westergren process, with the goal of validating Vacuette SRS method.

## PATIENTS AND METHODS

The Department of Pathology, Indus Medical College Hospital, Tando Muhammad Khan, conducted a cross-sectional analysis from February 2019 to May 2019. Westergren subjected a total of 120 samples to ESR estimation, and 20/11 methods of Vacuette SRS. Blood was treated with citrate solution for both of the two processes. The SRS 20/11 vacuette works by measuring 30-minute time. The Westergren ESR was performed using sodium citrate as an anticoagulant using the International Council for Standardisation for Hematology (ICSH) selected procedure. Results for the study were entered on SPSS version 21.0. Based on the ESR values obtained by Westergren process, we divided our patients into three groups: Group 1: ESR 0-20 (mm/h); Group 2: ESR 21-50 (mm/h); Group 3: ESR 51-100 (mm/h). Means of results extracted from automated and manual techniques were

evaluated in all samples. The p values were determined in three groups; p Value of <0.05 was considered significant statistically. For both methods variation coefficient has been determined. The Pearson correlation for the Vacuette SRS System was determined.

## RESULTS

The mean and standard deviation values mean difference and CV determined for the Westergren and Vacuette SRS methods are shown in Table 1 in total samples and in

three classes. In the Vacuette SRS system, the disparity was important with the group 2 (ESR 21-50 mm/hr) Vacuette SRS process. The Pearson correlation between distinct methods is expressed in Table 2. There is a clear positive association between the Westergren method and the Vacuette SRS method with a Pearson coefficient of 0.96 and a highly significant p value of <0.001, as shown in the table 2.

**Table 1: Results of Various Groups (n=120)**

Method	Mean $\pm$ SD (mm/time)	Difference of Means	P value	CV (%)
<b>All cases (n=120)</b>				
Westergren	24.93 $\pm$ 20.81	3.12	<0.03	93.32
Vacuette SRS	21.81 $\pm$ 19.22			96.11
<b>Group 1 (n=75)</b>				
Westergren	9.67 $\pm$ 4.23	0.75	0.12	60.03
Vacuette SRS	8.92 $\pm$ 4.98			59.16
<b>Group 2 (n=34)</b>				
Westergren	34.55 $\pm$ 8.32	7.43	0.003	23.12
Vacuette SRS	27.12 $\pm$ 7.56			33.05
<b>Group 3 (n=11)</b>				
Westergren	76.32 $\pm$ 12.65	3.2	0.11	16.41
Vacuette SRS	73.12 $\pm$ 13.43			24.55

**Table 2: Correlation between Both Methods (n=120)**

Method	Correlation	P value
Westergren method	r = 0.96	<0.001
Vacuette SRS Method		

## DISCUSSION

Erythrocyte sedimentation rate (ESR) is a reasonably easy and economical investigation performed to evaluate patients with acute and chronic inflammatory processes. <sup>(12-13)</sup>

ESR has been revealed to link with an adverse prognosis in malignant conditions and cardiac malfunction as a helpful support in the identification of a variety of clinical situations. <sup>(14-17)</sup> In consideration of the need for standardisation of the ESR calculation, ICSH introduced a code of behaviour for evaluating substitute techniques alongside the reference technique: the new methods must be evaluated on spectrum of 2–120 mm ESR level. 95% of the variations in this contrast must be  $\leq 5$  mm, with greater variations correlated with elevated ESR levels. The statistical modes suggested for the ESR assessments are correlation coefficient, Passing-Bablok regression and statistical approach BlandAltman. <sup>(18)</sup> We conducted the analysis to come across for similarities between Vacuette SRS and Westergren process. With very considerable p-value of  $<0.001$ , we observed clear positive association of Vacuette SRS method with Westergren rule. We have measured Variance Coefficient for various methods. The excellent association between Automated and Westergren was also verified by other researches. <sup>(19-20)</sup>

Several other automated techniques are used currently. Horsti J conducted a research and confirmed that Starr-sed had benefits because it provides reserves in consumables, protection and smooth workflow. The Starr-sed has numerous outstanding practical characteristics, and analysis showed reasonably strong association between the two techniques ( $R2 = 0.72$ ) and revealed that the Westergren approach is improved suited to StaRRsed. They stated that the variations found in their analysis between StaRRsed and the classic Westergren

approaches were appropriate and significant clinically. <sup>(21)</sup> The Fiorucci also evaluated the Westergren method to the Test 1 framework, but the findings revealed a lower level of conformity between the two techniques. Although results acquired with the Test 1 system are surrounded by rational limits, they indicated that the Ves-Matic instrument revealed a stronger association with Westergren process, thereby reducing the probability of false negative and positive results. <sup>(22)</sup> Although, Curvers et al stated less association with the Westergren technique of Ves-Matic, while a strong association with the traditional method of the SEDI system and StaRRsed methods. <sup>(23)</sup>

Our analysis showed the subordinate levels and mean difference between three techniques in three groups, especially at higher ESR values, by the Vacuette SRS method compared to the Westergren method. It was proposed by Subramanian et al to add a correction factor to the spectrum of the ESR levels with such divergences. <sup>(24)</sup> 14 samples in group 3 and 29 in group 2 were reported only. Because these 2 classes are generally significant as they include the diseases with pathological basis suggesting ESR levels. Our suggestion is to perform more studies in each group with a minimum of 50 samples, and the third group should also include more than 100 ESR samples according to the Westergren process. However, both of the methods show strong association with the Westergren method with current available data.

## CONCLUSION

In conclusion, the Vacuette SRS method shows a strong correlation (as shown by the Pearson correlation coefficient) with the Westergren process. These findings show that for a high workload clinical laboratory, Vacuette SRS method is efficient and suitable systems.

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