COMPARISON OF PHOTOMETRIC CYANMETHEMOGLOBIN AND AUTOMATED METHODS FOR HEMOGLOBIN ESTIMATION

Waqar Azim, *Shahida Parveen, Saadat Parveen
Department of Pathology, Combined Military Hospital, Multan and *CPC Research Projects DG Khan, Pakistan.

Background: Hemoglobin estimation is the most frequent laboratory investigation requested. Different methods include acid haematin, photometric cyanmethemoglobin estimation and automated estimation with the help of counters. Aims and objectives of the current study were to compare photometric cyanmethemoglobin method with hemoglobin estimation by Medonic automated counter. **Methods:** One hundred and ten adult cases were included through convenience sampling. Samples with hemolysis were excluded from the study. Blood was drawn in CP bottles. Sample was thoroughly mixed and hemoglobin estimation was done by Medonic counter as well by photometer 4010. Commercial controls were run with each batch. **Results:** By manual methods, results revealed mean 0.85% increase compared to automated counter. Commercial control results showed 2.3% and 2.7% coefficient of variation by Medonic counter and photometer 4010 respectively. **Conclusions:** It was concluded that both methods are accurate and precise, with reference range 2.61% more in manual method. It is recommended that with small samples and with parameters like hemoglobin or hemoglobin with erythrocyte sedimentation rate, manual method is cost effective and feasible. However with multiple parameters like absolute values and with very large batches, like in tertiary laboratory, automated method is time effective and feasible, provided the laboratory can bear the cost.
Key Words: Hemoglobin estimation, Cell counter, Cyanmethemoglobin.

INTRODUCTION

Hemoglobin (Hb) is a porphyrin iron protein compound that transports oxygen from the lungs to the body tissues where it is utilized for energy metabolism[1]. Hemoglobin estimation is of prime importance in medical investigations. It is advised in every admitted case and in all the females undergoing antenatal check up.

Hemoglobin being initial and most commonly advised test in laboratory diagnostic analysis, needs a most suitable and economical method of estimation. Different methods are in use like acid hematin method, cyanmethemoglobin method by photometer and automated methods by cell counters[2]. Different laboratories need different methods depending upon number of patients, technical skill of staff and availability of funds. Cost effective method which is accurate and precise is required by the all the laboratories[3].

Aims and objectives of the study were to evaluate the precision, accuracy, suitability, cost effectiveness and feasibility of photometric versus automated method of Hb estimation.

MATERIALS AND METHODS

110 adult patients recommended for Hb estimation by out patient clinics and wards of CMH Multan were included in the study. Ten patients were selected on alternate day and a total of 11 batches were made. Samples with hemolysis were excluded from the study. Samples were divided into batches of 10 samples per batch. Blood samples were drawn in CP bottles, having K_3 EDTA anticoagulants. After proper mixing hemoglobin was estimated by automated Medonic cell counter. Parallel estimation for Hb content was done manually by spectrophotometer 4010. Ten µL of well mixed blood sample was taken in 2 ml of Drabkin's reagent and incubated at 37 °C for 10 minutes. Absorbance was taken at 540 nm [4]. PARA-12 commercial control was also run with each batch. Accuracy, precision and cost of both the methods were compared on SPSS computer software.

Automated method on Medonic CA 530 is based on electronic impedance principle for cell counting while lysing and colorimetry for Hb estimation. In manual method, Hb in the sample reacts with Drabkin's reagent to from cyanmethemoglobin, which is estimated photometrically at 540 nm with the help of standard Hb solution[5].

RESULTS

A total of 110 samples were estimated for hemoglobin estimation. Out of these 62 were males and 36 females. Mean hemoglobin concentration on Medonic automated analyzer was 11.7 mg/dL $\pm$ 2.59, while mean hemoglobin concentration by cyanmethemoglobin method on photometer on 4010 was 11.8 mg/dL $\pm$ 2.39. This showed 0.85% increase in results by manual method. Commercial control results were within the control range by both the methods. Comparison of different variables by both methods is given in table 1.

Cost of automated analysis was Rs. 50/test, while manual method costed Rs. 3.5/test. It takes 5 minutes by Medonic counter compared to 25 minutes by manual method. Maintenance of automated analyzer caused frequent problems, while photometer 4010 required negligible maintenance.

Table-1: Comparison of Medonic counter and photometer 4010.

Variable	Medonic counter	Photometer 4010
Number	110	110
Mean Hb	11.7	11.8
Lowest Hb	5.8	5.6
Highest Hb	16.2	16.64
SD	2.59	2.39
Analyzer cost	Rs. 0.65 million	Rs. 0.22 million
Coefficient of variation of controls	2.3%	2.7%
Reagent stability	Stable	Stable
Technical skill	Not required	Required

DISCUSSION

A tertiary care medical unit of public as well as private sector needs an economically suitable methodology. Automated cell counter costs Rs. 50/sample for hemoglobin estimation while cyanmethemoglobin method performed manually costs a few rupees only. Cost of Medonic Cell Counter is about Rs. 0.65 million while cost of photometer 4010 is about Rs. 0.22 million. As photometer 4010 has the capability to do all the chemistry analytes, so separate photometer for Hb is not required in small laboratories. So it is recommended that for single test advice, manual estimation being accurate and cost effective should be preferred. Automated estimation, no doubt, is feasible, but should be carried out when the whole blood picture and red cell indices are required. Before the advent of automation, salicylic acid haematin method used to be compared with colorimetric cyanmethemoglobin method[6]. Now with increasing automation and increased requests for Hb estimation, comparison was required for suitability of different labs, according to their workload, staff and available equipment available in the lab[7]. US Lab accreditation programmes have set up quality goals for both the methods and set up standards to follow, which should be followed[8]. Both methods can be monitored by proper quality control and can be adopted with accuracy and precision[9]. A periodic scheme for evaluation of methods being run by the labs should be followed for continued improvement[10].

CONCLUSIONS

It is concluded that proper feasibility and evaluation should be done before adopting a method and within approved feasibility, both methods can prove to be accurate and precise. A tertiary laboratory should have both methods while small laboratory may give equally good results with photometer 4010.

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Address for Correspondence and Reprints:

Lt. Col Dr Waqar Azim, 88, St-29, Sector I-9/1, Islamabad. Pakistan.

Email: waqarazim65@hotmail.com