



Determination of haematocrit using Mindray BC-2800Vet[®] automated haematology analyser and microhaematocrit method: A comparative study

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Abstract

A comparative cross sectional study was carried out between September and November 2014 to determine the haematocrit values obtained using automated haematology analyser and the microhaematocrit (manual) methods. A total of 197 cattle were sampled. Three (3) ml of blood was obtained from each animal into an EDTA sample bottle for analysis using both methods. The haematocrit data generated was statistically analysed by student's t-test and linear regression. The result showed a strong positive correlation ($r=0.946$) between the automated haematocrit and microhaematocrit values. The haematocrit values obtained by the automated haematology analyser were significantly higher than the haematocrit values obtained by microhaematocrit method ($p=0.0051$). The strong positive correlation probably implies that results obtained from both methods are comparable and reliable. A correction factor of the haematocrit value obtained by manual method can be obtained from the regression equation $y = 1.043x + 0.5892$. This may be used to extrapolate the corrected haematocrit value for clinical and research purposes.

Keywords: Cattle, Correlation, Haematocrit, Haematology analyser, Microhaematocrit

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Introduction

Haematocrit is a measure of the ratio or percentage the red blood cells occupy in whole blood. It is also referred to as the packed cell volume (PCV) or erythrocyte volume fraction (Bull *et al.*, 2000; Gebretsadkan *et al.*, 2015). It is perhaps the most frequently requested laboratory test in several disease conditions and a good index of patient's health evaluation (Bull *et al.*, 2000). Haematocrit and other haematological indices form part of most research investigations in assessing the level of damage in parasitic infections, monitoring progress of disease, assessing recovery of patients as well as testing the safety of many experimental designs (Bull *et al.*, 2000; Bull & Hay, 2001; Kaznowska-Bystryk, 2011).

Manual (microhaematocrit centrifuge) method (Coles, 1986, Bull *et al.*, 2000) is the common method used to determine haematocrit (spun haematocrit). However, the use of automated haematology analysers have increasingly gained acceptance during the last three decades (Kaznowska-Bystryk, 2011). This had gradually replaced the manual method in modern hospitals and research institutions (Lantis *et al.*, 2003). This may be due to higher possibility of introducing errors in the haematocrit value by the manual method when compared to the automated method (Bull & Hay, 2001; Novis *et al.*, 2006). The automated haematology analyser has better precision than the manual microhaematocrit (Gebretsadkan *et al.*,

2015). The haematocrit values obtained through the manual and automated procedures correlate well (Ike *et al.*, 2010; Kaznowska-Bystryk, 2011; Gebretsadkan *et al.*, 2015). However, despite the strong positive correlation between the two methods, the spun haematocrit is sometimes significantly higher or lower than automated haematocrit (Bull & Hay, 2001; Ike *et al.*, 2010; Gebretsadkan *et al.*, 2015). This is the first report of comparison of manual and automated haematocrit analyser designed for Veterinary use in Nigeria to the best of our knowledge. Previous comparisons were carried out with machines designed for use in human specimens (Ike *et al.*, 2010), where automated haematology analyser gave a better precision as well as save time and labour cost, compared to the manual method. The cost of the auto analyser and consumables makes it unavailable for field use. They are therefore mainly used for indoor laboratories. Contrarily, several designs of microhaematocrit exist, many of which can easily be used for field experiments.

This study was therefore designed to compare the haematocrit obtained using the manual microhaematocrit method and Mindray BC-2800Vet[®] automated haematology analyser in Veterinary practice and to determine a correction factor when using the spun haematocrit for medical and research purposes.

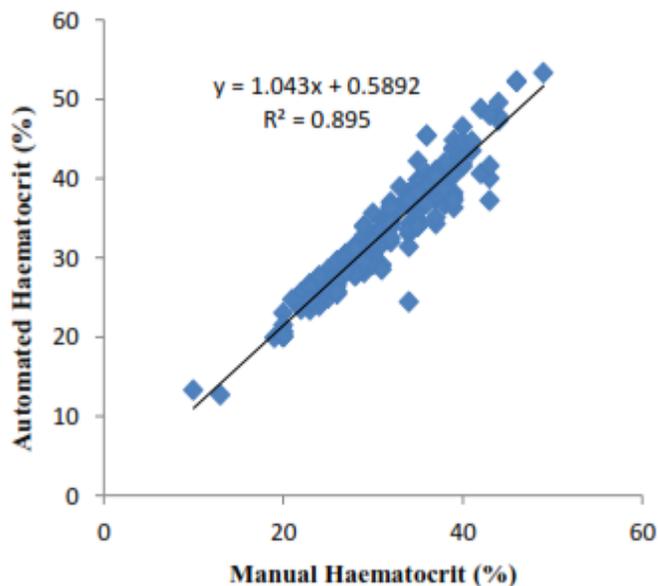


Figure 1: A scatter plot showing the correlation of automated and manual haematocrit values in cattle, with equation of line of best fit and R^2 value

Materials and Methods

Ethical approval

All applicable international, national and/or institutional guidelines for the care and use of animals were followed.

Study area

The study was carried out in two Local Government Areas (Makurdi and Gboko) of Benue state, Nigeria from September to November, 2014. Benue state is located within $6^{\circ}25'N$ and $8^{\circ}8'N$ and $7^{\circ}47'E$ and $10^{\circ}E$ (Anon, 2013).

Study design

A comparative cross sectional study was carried out using 3 ml of blood obtained from 197 apparently healthy cattle into EDTA coated sample bottles. This was labelled serially and immediately conveyed in ice pack box to the Clinical Pathology and Parasitology Laboratory of the Veterinary Teaching Hospital, University of Agriculture Makurdi for analysis. For each sample, Mindray BC-2800Vet[®] automated haematology analyser was used to obtain the haematocrit following the manufacturer's instructions. Similarly, heparinised capillary tubes were $\frac{3}{4}$ filled with the blood sample and sealed at one end with plasticine. The capillary tubes were centrifuged using SH120 high speed microhaematocrit centrifuge (Medifield Equipment & Scientific Ltd, England) at 12,000 g for five minutes and then read using microhaematocrit reader (Hawksley, England) (Coles, 1986).

Statistical analysis

Data generated were expressed as mean \pm SD and were statistically analysed using GraphPad Prism 5.0. Student's t-test and regression were used to analyse the haematocrit at 95% confidence interval. Values of $p \leq 0.05$ were considered significant.

Results and Discussion

The average value of haematocrit obtained from the automated haematology analyser was $34.11 \pm 7.20\%$ while the value obtained from microhaematocrit centrifuge method was $32.14 \pm 6.53\%$. There was a significant difference between the mean haematocrit (1.97%) from the two methods ($p=0.0051$), and a strong positive correlation ($r = 0.9460$, $CI = 0.9291$ to 0.9590). The equation for the best-fit value (Figure 1) was:

$$y = 1.043x + 0.5892$$

Where y represents the automated haematocrit and x represents the spun haematocrit. The R^2 value obtained from the scatter plot in Figure 1 was 0.895. The mean spun haematocrit values obtained in this study was significantly lower ($p=0.0051$) than the value obtained for automated haematocrit with a mean difference of 1.97%. Earlier studies (Prihirunkit *et al.*, 2008; Ike *et al.*, 2010; Gebretsadkan *et al.*, 2015) have reported a significant difference in the mean haematocrit values obtained using the two methods. In these studies the value obtained for spun haematocrit was higher than the automated haematocrit value, this was contrary to the results in the present study where the spun haematocrit values obtained was significantly lower than the haematocrit obtained from automated haematology analyser. Kakel (2013) also reported a lower spun haematocrit than the automated value, although there was no significant difference observed. The differences obtained from previous studies mentioned above and in this study show no consistency in the results, hence the haematocrit obtained manually cannot be replaced by automated haematocrit. In lower haematocrit values (30% and below), the spun haematocrit value is higher by 1 – 3% than the normal, this is possibly due to leucocytes and plasma being trapped among the packed red cells as suggested by Bull & Hay (2001). This could be as much as 6% in disorders such as polycythaemia, macrocytosis, spherocytosis, hypochromic anaemia, sickle cell anaemia and burns (Pearson & Guthrie, 1982; Gotch *et al.*, 1991; Salem *et al.*, 1991). In this study, the automated haematocrit values was significantly higher than the

manual haematocrit for values less than 30%, between 31 and 40% and above 40%. The mean difference in the haematocrit values was least in haematocrit values below 30%. This agrees with the report of Bull & Hay (2001).

Due to the disparities in haematocrit values obtained using the two methods, Gebretsadkan *et al.* (2015) suggested that the mean difference (1.5%) between the values of the two methods should be added to the automated haematocrit value. This study proposes that the corrected haematocrit for spun haematocrit should be extrapolated from the regression equation outlined earlier.

A strong positive correlation exist between the two methods of haematocrit determination ($r=0.946$). This agrees with the report of Prihirunkit *et al.* (2008) in cats and dogs as well as the report of Ike *et al.* (2010), Threeswaran *et al.*, 2012 (0.8651) and Gebretsadkan *et al.* (2015) ($r=0.95$) where strong positive correlations were observed between the two methods.

In conclusion, the haematocrit obtained with Mindray BC-2800Vet[®] automated haematology analyser have a strong positive correlation with the microhaematocrit method, although one cannot be a substitute for the other.

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