

# HemoCue photometer: a better alternative of hemoglobin estimation in blood donors?

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## Abstract

**Purpose of study** To find out the prevalence of anemia in potential blood donors and to compare the direct cynmethemoglobin and HemoCue methods for assessing hemoglobin concentration.

**Material and methods** The study group included 540 potential blood donors; who were tested for their hemoglobin concentration in capillary blood samples by direct cynmethemoglobin and HemoCue methods.

**Results** Average age of the potential donors was 39.2 year, with 505 males and 35 females. Mean hemoglobin concentration using the HemoCue was  $13.2 \pm 2.4$  g/dl and  $12.8 \pm 2.3$  g/dl with the direct cynmethemoglobin method (Table 1). The prevalence of anemia was slightly higher when using the direct cynmethemoglobin method (14.1%) as compared to HemoCue method (13.6%). The sensitivity and specificity for the HemoCue assessment was 94.1% and 95.2% respectively as compared to 90.1% and 94.2% respectively for the direct cynmethemoglobin method.

**Conclusion** Photometric hemoglobin determination (HemoCue) combines the convenience of onsite testing with

sufficient accuracy and rapidity. We feel this is a better method for evaluating potential blood donors.

**Keywords** Anemia · Blood donors · Cynmethemoglobin method · HemoCue

## Introduction

Anemia, defined as a reduced hemoglobin concentration, is associated with increased perinatal mortality, increased child morbidity and mortality, impaired mental development, impaired immune competence and decreased performance at work [1].

In the developing countries of South-East Asia, the prevalence of anemia among pregnant women is as high as 60–70% [2]. Whereas the estimated Indian prevalence of anemia amongst pregnant women and young children is 49.7% and 74% respectively [3].

Estimates of the prevalence of anemia depend on the methods used for assessing hemoglobin concentration and on the cut-off point applied: the cut-off point is different for different groups in a population [4, 5]

The gold standard for assessing hemoglobin concentration is the direct cynmethemoglobin method. Another method uses a new generation of hemoglobin photometer, the HemoCue. The HemoCue method is used to analyse blood collected in a microcuvette and is based on the principle of oxidation of hemoglobin to hemiglobin by sodium nitrite and the subsequent conversion of hemiglobin to hemiglobinazide by sodium azide [6].

The aim of the present study was to determine which of these two alternative methods for determining hemoglobin concentration is more useful in blood donor screening for anemia.

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**Table 1** Comparison of HemoCue and Direct cynmethaemoglobin methods for assessing haemoglobin (Hb) concentration in blood samples of donors (n = 540)

Parameters	Direct cynmethaemoglobin	HemoCue
Mean Hb concentration (g/dl)	12.8	13.2
Standard deviation	2.3	2.4
<b>Percentage of participants with Hb concentration</b>		
<11.0 g/dl	6.1	4.8
11–12.5 g/dl	9.9	9.2
>12.5 g/dl	84.0	86.0

## Material and methods

The present study was carried out on a total of 540 replacement and voluntary blood donors. Donors fingertip was warmed, cleaned with alcohol and punctured with a needle using an autoclix apparatus. The first drop of blood was discarded; blood was then collected for the two methods; direct cynmethemoglobin and HemoCue. For the direct cynmethemoglobin method, 20 µl of blood were mixed with 5 ml Drabkin's solution and the hemoglobin concentration was determined using a spectrophotometer. In the HemoCue method, blood is collected in a microcuvette by capillary action. It gets mixed with the reagents and absorbance and reading in the HemoCue photometer calculates the hemoglobin concentration in g/dl and displays the results as a digital reading in 15–45 seconds.

## Results

The average age of the 540 participants was 39.2 years. There were 505 male donors and 35 female donors in our study.

Mean hemoglobin concentration using the HemoCue was  $13.2 \pm 2.4$  g/dl and  $12.8 \pm 2.3$  g/dl with the direct cynmethemoglobin method (Table 1).

The prevalence of anemia was slightly higher when using the direct cynmethemoglobin method (14.1%) as compared to HemoCue method (13.6%).

The sensitivity and specificity for the HemoCue assessment was 94.1% and 95.2% respectively as compared to 90.1% and 94.2% respectively for the direct cynmethemoglobin method.

## Discussion

The measurement of hemoglobin constitutes the first step in the investigation of anemia. In clinical laboratories, the cynmethemoglobin method remains one of the most widely used for its determination [7]. But in modern day blood

banking, due to medical and surgical emergencies and exceptionally heavy clinic load, where immediate and appropriate management of fluid replacement is critical to the survival of any patient who has lost large volumes of blood; the HemoCue system has replaced time consuming methods of hemoglobin estimation; as HemoCue is easy to use and provides rapid and accurate on the spot results and donation decisions can be made and acted on without delay [8].

The direct cynmethemoglobin method is prone to certain errors because of the required dilution with reagent and the potential of interference by turbidity caused by, for example, plasma proteins or cell stromata and lipid particles [9]. Therefore the possibility of measuring hemoglobin in undiluted blood with simultaneous correction for background turbidity has become increasingly attractive with the advent of HemoCue, as it uses a light source which makes readings at 565 nm and 880 nm, the latter reading for blanking purposes to compensate for any turbidity caused by lipaemia or leukocytosis [10]. Also a higher sensitivity and specificity of the HemoCue method of hemoglobin estimation, could help retrieve blood donors deferred by the direct cynmethemoglobin method.

We conclude that photometric hemoglobin determination (HemoCue) combines the convenience of on-site testing with sufficient accuracy and rapidity. We feel this is a better method for evaluating potential blood donors.

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