What Is The Optimum Maternal Haemoglobin Concentration Level For A Normal Birth Weight In Lagos?

Bosede B. Afolabi[1]; and Oluwarotimi I Akinola[2]

[1]Department of Obstetrics and Gynaecology, Lagos University Teaching Hospital, Idi-Araba, Lagos, Nigeria

[2]Ayinke House, Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria.

Abstract

Context: The level of maternal haemoglobin concentration necessary for normal birth weight may differ from that used to define anaemia.
Objective: To estimate the optimum haemoglobin concentration in labour in relation to birth weight.
Design: A cross-sectional study.
Setting: The labour ward of Ayinke House, Ikeja General Hospital, Lagos, Nigeria.
Subjects: One hundred consecutive booked patients presenting in established labour.
Intervention: Estimation of haemoglobin concentration from venous blood samples of each patient.
Main Outcome Measures: Relationship between haemoglobin concentration, mean birth weight and incidence of low birth weight.
Results: The mean haemoglobin concentration was 122. 18g/L. The lowest incidence of low birth weight was found in the haemoglobin less than 100 g/L group. Mean birth weight fell when the haemoglobin concentration rose above 140 g/L. The incidence of low birth weight (birth weight lower than 2500g) also increased in the haemoglobin greater than 140g/L group.
Conclusion: This study shows the possibility that the levels of haemoglobin concentration at which we diagnose anaemia in pregnancy in our environment may be higher than what is needed for normal neonatal birth weight, and that levels of maternal haemoglobin concentration above 140 g/L may be undesirable in our environment as far as birth weight is concerned. A larger study will be done to determine the optimal levels of maternal haemoglobin concentration.

Introduction

The haemoglobin concentration of a woman is related to the outcome of her pregnancy. Anaemia is the most common pregnancy complication worldwide[1] and has a profound effect on both maternal and fetal health, resulting in increased maternal and perinatal morbidity and mortality. Severe anaemia is associated with low birth weight babies as a result of preterm labour and intrauterine growth restriction[1,2,3].

The World Health Organisation (WHO) criterion for the diagnosis of anaemia in pregnancy is a haemoglobin concentration of under 110g/L[4] although it is thought that 100g/L may be more appropriate in Africa[1]. Haemoglobin concentration cannot be taken as the sole measure of iron status in pregnancy, as it is affected by the expansion of plasma volume in pregnancy to a large extent[3]. This is particularly important in Nigerian women as Abudu and Sofola found that the low packed cell volume in normal pregnant primigravidae was probably due to the excessive haemodilution in these patients[5]. The offspring of these women were of normal birth weight.

On the other hand, failure of plasma volume expansion in pregnancy can lead to restricted fetal growth [3,6,7] and preterm labour[3]. In such cases, the haemoglobin concentration and haematocrit are elevated and Steer et al found that levels greater than 145 g/L were associated with the highest proportion of low birth weight and the lowest mean birth weight[8]. They also found that the highest mean birth weight occurred in association with a haemoglobin concentration of 85-95 g/L and that the minimum incidence of low birth weight occurred in association with a haemoglobin concentration of 95-105 g/L[8]. Harrison found that the proportion of low birth weight and perinatal mortality begins to increase with maternal haematocrit levels below 30% in Northern Nigerian women[1]. Therefore although haemoglobin concentration and haematocrit are related to birth weight, the critical levels at which birth weight begins to fall may not be constant.

Haemoglobin estimation after twenty weeks gestation is representative of the fall induced by pregnancy as the fall is steepest up to 20 weeks, remains constant till about 30 weeks, and rises slightly thereafter[8]. Although the degree of pre-pregnancy anaemia matters, it is known that the growth restriction that ensues may be reversed if the anaemia is corrected before term[9]. Birth weight is the single biggest determinant of mortality in the first year of life[8] and is thus an important variable to use to determine what the optimum haemoglobin concentration levels in pregnancy should be. A preliminary prospective study of women admitted in labour was therefore done to estimate the optimum haemoglobin concentration and to examine the relationships between haemoglobin concentration and birth weight.

Correspondence: *Dr B.B. Afolabi, Consultant, Department of Obstetrics and Gynaecology, Lagos University Teaching Hospital, Idi-Araba, Lagos, Nigeria.*
Email: bosedeafolabi2003@yahoo.com

Methods

Patients presenting in established labour to the labour ward at term (37-42 weeks) were included in this study. The hospital is a government owned general hospital based in Ikeja, which is the capital of Lagos State, in turn the economic capital of Nigeria. Unbooked patients were excluded as the quality of their antenatal care was unknown. Informed consent was obtained prior to recruitment.

Two 5ml samples of venous blood were drawn from each patient on admission to the labour ward for estimation of haemoglobin concentration. Labour was allowed to progress and monitored as usual. After delivery, the babies were carefully weighed by the attending midwife. The haemoglobin concentration estimation was done in two laboratories - the hospital laboratory and a reputable private laboratory in Ikeja. Both used the Coulter counter method. Samples obtained during the day were estimated within 2 hours of collection while nighttime samples were refrigerated overnight and tested within 2 hours of being retrieved from the refrigerator. The average of the 2 samples was recorded as the haemoglobin concentration of each patient.

The data was analysed by computer using the SPSS package. Haemoglobin values were classified into groups based on the mean and standard deviation values. Simple proportions were used to show the relationships between variables.

Results

Eighty-three patients were studied. Sixty-one of them were between 25 and 34 years old with the most common age group being between 25 and 29. Most of them were nulliparous (-57%), 21% were Para 1, 15% Para 2 and the remaining 7% ranged from Para 3-5.

The mean haemoglobin concentration was 122. 18 g/L. 11%, 19% and 24% of the patients had haemoglobin concentration levels less than 100, 107 and 110 g/L respectively.

There was an increase in mean birth weight as haemoglobin concentration increased up to the 120 - 139 g/L group. Mean birth weight then fell sharply after the haemoglobin concentration rose above 140 g/L. (Table 1). Similarly, the incidence of low birth weight (birth weight lower than 2500g) was 0 when the haemoglobin concentration was less than 100g/L group and highest in the group with haemoglobin equal to or greater than 140g/L group (Table 1). When the haemoglobin groups were divided into 8, the incidence of low birth weight was low up to the 96-105 g/L group and highest when over 145g/L (Table 2).

Table 1. Mean (SD) birth weight and incidences of low birth weight (<2500g) and preterm births (<37 completed weeks) by haemoglobin concentration.

	Mean (SD) birth weight(g)	Proportion < 2.5 kg at birth (%)
Haemoglobin concentration(g/L)		
<100	3020 (480)	0
100-119	3060 (650)	14.3
120-139	3280 (480)	2.8
⩾140	3040 (500)	23.1

Table 2. Number of low birth weight babies per group with haemoglobin concentration levels stratified according to Steer et al

	Proportion (%)of low birth weight babies (<2500g)
Haemoglobin concentration in g/L (n)	
< or = 85	0
86-95	0
96-105	0
106-115	22
116-125	5
126-135	5
136-145	8
>145	25

Discussion

This study shows that the incidence of anaemia in the population studied is lower than expected, whether using the WHO definition of haemoglobin concentration less than 110g/L[4] or the Harrison suggestion of 100g/L[1]. A study done in Lagos to define anaemia in pregnancy, found the minimum haemoglobin level acceptable in pregnancy to be 107 g/L[10]. Using this definition, the incidence of anaemia was still lower than expected. The WHO estimates the incidence rate of anaemia in pregnancy to be 37%-56% for Africa[11]. However, exact population figures are usually not available for developing countries and the published rates often pertain to selected urban groups of women[2]. As this was a hospital-based study with an urban, though low-income population, the lower incidence could reflect the fact that a lot of these urban-based women now ingest several multivitamins and haematinics in pregnancy, together with those actually prescribed at the hospital.

The study also shows that the incidence of low birth weight increases as haemoglobin concentration increases past 140 g/L. This finding is similar to Steer et al who found that levels greater than 145 g/L were associated with the highest proportion of low birth weight[8]. Other studies have shown that high maternal haemoglobin concentrations are associated with a poor fetal outcome[12,13,14]. This is thought to be due to failure of plasma volume expansion and the development of pre-eclampsia. Increased blood viscosity has also been postulated as a possible cause of the poor pregnancy

Steer et al also found that the highest mean birth weight occurred in association with a haemoglobin concentration of 86-95 g/L and that the minimum incidence of low birth weight occurred in association with a haemoglobin concentration of 95-105 g/L[8]. The latter was also found in this study when we stratified the haemoglobin levels into groups of 10 g/L (Table 2). However, the numbers in this study are much smaller and these findings need to be corroborated by a larger study.

Conclusion

This study shows the possibility that the levels of haemoglobin concentration at which we diagnose anaemia in pregnancy in our environment may be inappropriate as far as birth weight is concerned. It also draws our attention to the fact that levels of maternal haemoglobin concentration above 140 g/L may be undesirable in our environment and that the incidence of anaemia in pregnancy in our environment may be lower than previously thought. A larger study is needed to put these hypotheses to the test and also to determine the optimal levels of maternal haemoglobin concentration, as far as birth weight is concerned.

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