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Relation Ship of Maternal Haemoglobin Concentration Measured in Labour with Neonatal Outcome among Sudanese Women

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Abstract

Objective: Data showed that maternal anaemia during pregnancy negatively affects maternal/fetal outcomes. We here attempted to re-confirm this in this specific region of Sudan, with special reference to fetal/neonatal outcome. **Methodology:** This cross-sectional observational study was carried out at Omdurman Maternity and Khartoum North Teaching Hospitals-Sudan from March 2018 to March 2019, with 246 pregnant women presented in labour enrolled. Maternal characteristics, haemoglobin (Hb) measured after labour initiation and fetal/neonatal outcomes were analyzed. **Results:** When maternal anemia was defined as Hb less than 10.0 g/dL, 80 (32.5%) had anemia and 166 had not. Anemic women (Hb; 8.3 ± 0.31), compared with non-anemic women (Hb; 11.4 ± 0.61), were significantly more likely to have low birth weight (LBW) infants (40% vs. 15.7%) and still birth (12.5% vs. 4.8%). There was a correlation between hemoglobin concentration and the followings: LBW, respiratory distress syndrome, neonatal nursery admission, still birth, early neonatal death, and low Apgar score. **Conclusions:** Maternal anaemia negatively affected fetal/neonatal outcomes. This data may be useful to make health policy in this area.

Keywords

Maternal Hemoglobin, Pregnancy, Neonatal Outcome, Birth Weight, Apgar Score, Sudanese Women

1. Introduction

Iron deficiency anemia is a globally important public health problem, particularly for low- and middle-income countries, such as Sudan. Pregnant women and young children are especially vulnerable [1]. According to WHO estimates, up to 50% of all women living in developing countries are anaemic. However, the population group with the greatest number of individuals affected is pregnant women [2] [3] [4]. During pregnancy, the fetal demand for iron increases maternal daily iron requirements from 1 to 2.5 mg/d in early pregnancy and 6.5 mg/d in the third trimester. Anemia during pregnancy was defined as hemoglobin concentration, 10 g/dl [5]. Anemia that complicates pregnancy threatens the life of both the mother and the fetus and has long been considered a risk factor for LBW and low APGAR score [6]. With increased maternal morbidity and mortality, higher rates of preterm birth and low birth weight, and reduced infant survival, with potential long-term consequences for child growth and development [7] [8].

Thus the risk of low birth weight newborns was approximately doubled in pregnant women with moderate-to-severe anemia during the first and second trimesters, while this relationship was reversed during the third trimester [9]. Low birth weight (LBW) is a significant risk factor for adverse health outcomes including many childhood diseases [10]. Since anemia is considered to be one of the most common medical disorders during pregnancy, this association is of main importance. Data showed that maternal anaemia during pregnancy negatively affects maternal/fetal outcomes. We here attempted to re-confirm this in this specific region of Sudan, with special reference to fetal/neonatal outcome.

2. Material and Methods

It was observational cross-sectional and hospital based study carried out at Omdurman Maternity and Khartoum North Teaching Hospitals-Sudan from March 2018 to March 2019. Two hundred and forty sixty (246) pregnant women presented in labour were enrolled in the study. The Open Source Epidemiologic Statistics for Public Health (https://www.openepi.com/SampleSize/SSPropor.htm) was used to calculate the sample size. With reference to the prevalence of anemia among Sudanese pregnant women (20% to 76.0%). Blood sample from the mother was collected for haemoglobin estimation. Participants completed a questionnaire on personal data and clinical history. The neonatal outcome includes the data whether the newborn alive or not. Among the alive and healthy newborn, other data was collected, including preterm birth, low birth weight, and APGAR score. In this study, low birth weight defined as the infant birth weight which less than 2500 gram and preterm birth was considered as gestational age under 37 weeks. The BMI was determined by using World Health Organization (WHO) classification for obesity.

Statistical analysis was performed via SPSS software (SPSS, Chicago, IL, USA). Continuous variables were compared using student's t test (for paired data) or

Mann-Whitney U test for non-parametric data. For categorical data, comparison was done using Chi-square test (X^2) or Fisher's exact test when appropriate. A P value of <0.05 was considered statistically significant.

Ethical clearance and approval for conducting this research was obtained from the general manager of the hospitals and informed written consent was obtained from every respondent who agreed to participate in the study. The respondents informed that the study is not associated with experimental or therapeutic intervention while information was collected from them.

3. Results

Total number of 246 pregnant ladies presented in labour was enrolled. **Table 1** shows the maternal characteristics of two groups. The mean of age was 32 ± 2 Std among anemic mothers, and it was 26 ± 2 Std among non anemic mothers. The mean haemoglobin in anaemic mothers was found to be 8.3 ± 0.31 gm/dl and that in non-anaemic mothers was 11.4 ± 0.613 gm/dl. The mean of BMI was 22 ± 21 Std among anemic mothers, and it was 25 ± 41 Std among non anemic mothers. More than half of anaemic mothers (53.8%) were primgravidous, while (33.1%) of non anaemic mothers were primgravidous. About third of anaemic mothers (32.5%) were booked, where it was (68.7%) among non anaemic mothers. The percentage of preterm labour (30% vs 15.1%; P value = 0.00) was significantly higher in anaemic mothers compared with non anaemic mothers. Anemic mothers had an increased percentages of VD (80.0% versus 70.6%; compared with non-anaemic mothers ($P < 0.05$)).

Among anaemic mothers, 40% of new born were low birth weight, where it was 15.7% among neonates of non anaemic mothers and was found significant ($P < 0.05$). Among anaemic mothers, 12.5% of new born were still birth, where it was 4.8% among neonates of non anaemic mothers and was found significant ($P < 0.05$). Among anaemic mothers, 27.5% of new born were low apgar score < 7, where it was 9.6% among neonates of non anaemic mothers and was found significant ($P < 0.05$). The study showed significant correlation between hemoglobin concentration and the following measures; low birth weight (LBW), respiratory distress syndrome (RDS), neonatal nursery admission, still birth, early neonatal death, and low apgar score ($P < 0.05$) respectively (**Table 2**).

4. Discussion

This study discussed important area in obstetric practice; birth weight, neonatal outcome and haemoglobin concentration among Sudanese women presented in labour. The importance of this research based on the results which cleared that birth weight plays an important role in infant mortality and morbidity, development, and future health of the child [11].

Anaemia during pregnancy is a big problem because it can contribute morbidity and mortality, either in mother or newborn. Low birth weight (LBW) is a significant risk factor for adverse health outcomes including many childhood diseases [12].

Table 1. Shows the nonparametric correlation between the two groups regarding demographic data and clinical characteristics.

	Anaemic mothers 80		Non anaemic mothers 166		P value
	Count	%	Count	%	
Age in years					
<20	09	11.2%	22	13.2%	
20 - 30	27	33.8%	65	39.2%	
31 - 35	36	45.0%	51	30.7%	0.124
>35	08	10.0%	28	16.9%	
Total	80	100.0%	166	100.00%	
BMI (kg/m^2)					
<20	05	06.2%	18	10.8%	
20 - 25	41	51.3%	54	32.6%	
26 - 30	24	30.0%	58	34.9%	0.01*
>30	10	12.5%	36	21.7%	
Total	80	100.0%	166	100.0%	
GA					
Preterm	24	30.0%	25	15.1%	
Term	56	70.0%	141	84.9%	0.00*
Total	80	100.0%	166	00.00%	
Party					
PG	43	53.8%	55	33.1%	
Multipara	20	25.0%	59	35.5%	
Grandmultipara	17	21.2%	52	31.4%	0.134
Total	80	100.0%	166	100.00%	
Status of booking					
Booked	26	32.5%	114	68.7%	
Un booked	54	67.5%	52	31.3%	0.04*
Total	80	100.0%	166	100.0%	
Mode of delivery					
SVD	60	75.0%	111	66.9%	
IVD	04	05.0%	06	03.6%	
C/S	16	20.0%	49	29.5%	0.215
Total	80	100.0%	166	100.0%	

*Statistically significant at 0.05 level.

Table 2. Shows the nonparametric correlation between the two groups regarding neonatal outcome.

Neonatal outcome	Anaemic mothers 80		Non anaemic mothers 166		P value
	Count	%	Count	%	
Neonatal weight					
<2500 kg	32	40.0%	26	15.7%	
>2500kg	48	60.0%	140	84.3%	0.001*
Total	80	100.0%	166	100.0%	
Neonatal outcome					
Alive	64	80.0%	154	92.8%	
Still birth	10	12.5%	08	04.8%	0.000*
END	06	07.5%	04	02.4%	
Total	80	100.0%	166	100.0%	
RDS					
Yes	37	46. 2%	19	11.4%	
No	43	53. 8%	147	88.6%	0.00*
Total	80	100.0%	166	00.0%	
Apgar score					
<7	22	27.5%	16	09.6%	
>7	58	72.5%	150	90.4%	0.01*
Total	80	100.0%	166	100.00%	
Nursery admission					
Yes	49	61.2%	37	22.3%	
No	31	38.8%	129	77.7%	0.00*
Total	80	100.0%	166	100.00%	
Prolong hospitliation					
Yes	23	28.8%	21	12.7%	
No	57	71.2%	145	87.3%	0.13
Total	80	100.0%	166	100.0%	

*Statistically significant at 0.05 level.

This observational study showed that neonates born to anaemic mothers had a poorer neonatal outcome when prenatal maternal haemoglobin concentration was low.

Out of 246 pregnant women in this study, more than third (32.5%) of them were suffering from anaemia. It is comparable to the previous study which stated that from 35% to 75% (56% on average) of pregnant women in developing

countries, and 18% of women from industrialized countries are anemic [13]. The minimum prevalence of anemia among pregnant women in Sudan was 23.46% observed in a study conducted in Khartoum and the highest, 76.0% was observed in a study conducted in Eastern Sudan.

It is not surprising to notice that, finding of the current study revealed that anaemic mothers are at risk for some adverse neonatal outcomes such as low birth weight, RDS, still birth, preterm labour and nursery admission. Our result was comparable to other studies which obtained same finding [6] [7]. This is also supported by the findings from Murphy JF [8].

The current study revealed that 40.0% of low birth weight babies were born to anaemic mothers whereas 15.7% of those born to non anaemic mothers. Rasmussen KM *et al.* reported that strong evidence exists for an association between maternal hemoglobin concentration and birth weight as well as between maternal hemoglobin concentration and preterm birth [14]. Lone FW *et al.* showed "Maternal hemoglobin values during pregnancy are associated with birth weight and preterm birth in a U-shaped relationship with high rates of babies who are small at low and high concentrations of maternal hemoglobin" [15].

In contrast, some studies reported that anemia is an independent risk factor for the development of adverse outcome of pregnancy or LBW [14] [15] [16] [17].

Neonatal intensive care unit admission was more among anaemic mothers versus Non anaemic mothers ones, (24% versus 10%) It may be due to higher rates of LBW, RDS, and preterm delivery in this group. However, this finding supports by other studies [6] [7].

In the current study, anaemic mothers showed higher still birth and early neonatal death versus non anaemic mothers (12.5% stillbirth against 4.8% and 7.5% early neonatal death against 2.4% with P value 0.000). Most large studies worldwide have reported similar findings and concluded that, the association between maternal haemoglobin and neonatal outcomes has already been studied in the general population of neonates and seems to follow a U-shaped distribution with adverse outcomes at both ends of the haemoglobin range largely mediated through preterm birth and low birth weight [7] [8] [15].

The results of this study demonstrate that anemia among women during labour, is associated with increased risk for a wide range of adverse neonatal outcomes, including, LBW, preterm baby, RDS, SB, END and increase neonatal admission to the nursery. These findings are of particular interest to both the women themselves and healthcare professionals because of the rising trend to future counseling about the effectiveness of iron/folic acid supplementation. Because of the persistently high burden of disease, the World Health Organization has long recommended the prenatal use of iron supplements in low and middle income countries, and this is also recommended in many high income countries [9]. Affected babies should be following because of potential long-term consequences for child growth and development.

Anaemic women, compared with non-anaemic women, are considered to be more handicapped in all aspects (including nutritional, health, social, financial, etc). Thus, the present poorer fetal/neonatal outcomes in anaemic women cannot be ascribed solely to the presence of anaemia.

5. Conclusion

Maternal anaemia negatively affected fetal/neonatal outcomes. Low maternal haemoglobin was associated with increased poor birth outcomes including LBW, preterm birth, stillbirth, perinatal mortality, and neonatal mortality. This data may be useful to make health policy in this area.

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Declaration

This article is our original work. The Submitted manuscripts contain original and authentic results, data and their ideas, which were not published elsewhere. No material from other publications is reproduced in our article. All my co-authors should not submit the same manuscript, in the same language simultaneously to more than one journal. The author of this paper has read and approved the final version submitted.

Ethical Clearance

Ethics approval was obtained from the Research and Ethics Committee of the hospitals (Omdurman Maternity and Khartoum North Hospitals). Ethical clearance and approval for conducting this research were obtained from the general manager of the Ministry of health (Khartoum State). Ethical principles of autonomy, beneficence, non-maleficence and justice, as stipulated in the ethical guidelines of the Sudan Medical Specialization board (SMSB), Medical Research Council, were upheld throughout the study. Informed written consent was obtained from every respondent who agreed to participate in the study. The respondents were informed that the study is not associated with experimental or therapeutic intervention while information was collected from them.

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Authors' Contribution

All my authors play a major role and real contribution to achieve this project.

Nada and Nahla participated in data collection and analysis, Hassbo and Yasir participated in manuscript plan, editing and writing of the article.

Competing Interest

The authors declare that they have no financial or personal relationships which may have inappropriately influenced them in writing this paper. No direct or indirect financial interests or conflicts exist and all authors agree with the content of the manuscript and there are no conflicts of interests between or among them.

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Abbreviation

BMI	Body mass index
C/S	Caesarean section
END	Early Neonatal death
IVD	Instrumental vaginal delivery
GA	Gestational Age
Hb	haemoglobin
LBW	Low Birth weight
PG	Primgravidae
RDS	Respiratory Distress syndrome
SVD	Spontaneous Vaginal delivery
SPSS	Statistical package for social sciences
SB	Still Birth
X^2	Chi-square test
WHO	World Health Organization