

## EFFECT OF MATERNAL ANAEMIA ON FETAL PARAMETERS

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**Background:** A cohort study of anaemic pregnant women was carried out at the Department of Obstetrics and Gynecology, Women and Children Hospital, Abbottabad, from November 30, 1992 to March 30, 1993, to determine the effects of antenatal maternal anaemia on the newborn babies. **Methods:** 34 pregnant women with anaemia and 39 non-anaemic pregnant women were included in the study. Parameters studied were Hemoglobin levels, RBC morphology, Foetal birth weights, Foetal gestational ages, and Foetal APGAR score (at birth and after 10 months). **Results:** Out of 34 anaemic women, 6 delivered at 7 or 7+ months, 7 at 8 or 8+ months and 21 at 9 or 9+ months, as compared to 39 non-anaemic, one of whom delivered at 7 or 7+ months, 2 at 8 or 8+ months and 36 at 9 or 9+ months. Fetal mortality rate for anaemic women was 50% at 7 or 7+ months, 28.7% at 8 or 8+ months and 23.80% at 9 or 9+ months. For all non-anaemic women, it was 0%. Mean fetal birth weight in anaemic group was 1.4 + 0.66 kg at 7 or 7+ months, 1.93+ 0.53 kg at 8 or 8+ months and 2.61± 0.3 I kg at 9 or 9+ months. Among non-anaemic group, it was 2.8 kg at 7 + months, 3.75± 0.55 kg at 8 or 8+ months and 3.65 ± 0.66 kg at 9 or 9+ months. **Conclusions:** These findings show that mothers with nutritional or iron deficiency anaemia tend to deliver prematurely with low birth weight babies and a high mortality rate or stillbirths, as compared to non-anaemic mothers.

### INTRODUCTION

Anemia is defined as quantitative deficiency of Haemoglobin and/or erythrocytes or a condition in which there is a reduction in the number of circulating erythrocytes per cubic millimeter, the amount of haemoglobin per deciliter or the volume of packed red cells per deciliter of blood. It results in functional impairment of blood in the form of its reduced ability to carry oxygen, causing tissue and organ hypoxia.

Its major symptoms are pallor of skin, fingernail beds and mucous membranes: weakness; vertigo; headache; sore tongue; drowsiness; general malaise; dyspnoea; tachycardia; palpitations; angina pectoris; gastrointestinal disturbances; amenorrhoea; loss of libido; and slight fever.

Diagnosis is made by measuring the blood haemoglobin level. The normal haemoglobin level for females is 12-16 g/dL and for males 14-18 g/dL.

There are about 29 major types of anaemias. One of these occurring most frequently is nutritional, specifically Iron Deficiency Anaemia (IDA). It is defined as a nutritional anaemia resulting from a greater demand on the stored iron than can be supplied.

It can be caused by inadequate iron intake; malabsorption of iron; chronic loss of blood; pregnancy and lactation; intravascular haemolysis; or any combination of these factors.

In the USA, an estimated 18 million people suffer from IDA. Worldwide it is considered to be the commonest chronic disease of mankind.

Several studies have shown a direct correlation between maternal antenatal health and the health of the foetus and newborn. Other studies have shown a

significant incidence of anaemia in pregnant and lactating mothers which not only affects the outcome of pregnancy, but also the health of the newborn.

In order to assess the absolute or relative effect of maternal health and anaemia on the foetus and newborn, this study was carried out at Women and Children Hospital (WCH) Abbottabad. It was designed to compare three parameters, viz, Birth Weight, Gestational Age, and Mortality rate between Anaemic Pregnant Mothers and Non-Anaemic Pregnant Mothers.

### MATERIALS AND METHODS

A cohort study was carried out at WCH, Abbottabad. All pregnant women admitted to the Obstetrics department for delivery during the period between November 30, 1992 and March 30, 1993 were studied and their records checked for the presence or absence of anaemia. From these patients, two groups of cases were sampled out; one group of 34 with anaemia (study group), and the second group of 39 with no anaemia or other disease (control group). Relevant data was recorded on pre-designed proformas. Inclusion and exclusion criteria for both groups were Inclusion Criteria

The anaemia should be only of the nutritional or iron deficiency type in group one and there should be no anaemia of any type in group two. Anaemia was defined as haemoglobin levels below 12.0 g/dL, but in order to bring out a greater contrast between the two groups, cases with haemoglobin levels below g/dL were included for study in group one. AN cases in group two were at haemoglobin levels of g/dL or above.

Exclusion Criteria Any other causes for anaemia (familial or hereditary anaemias or acute blood loss anaemias, etc.) were excluded in both groups, as these conditions can affect foetal health as well.

1. Cases with any significant maternal disease that could affect maternal or foetal health and haemoglobin levels (diabetes, malaria, tuberculosis, etc.) were excluded from both groups.
2. Mothers using medication (including contraceptive pills) or addictive substances (including cigarette smoking) before or during pregnancy were excluded from both groups. Cases with a history of IUCD (Intrauterine Contraceptive Device) were also excluded.
3. Cases with history of exposure to radiation or ultrasound during pregnancy were excluded from both groups.
4. Mothers with complicated pregnancies were excluded from both groups.
5. Newborns with congenital abnormalities, diseases or defects were excluded from both groups.

All cases and controls were followed up to one day after delivery. Neonatal data recorded included APGAR score at delivery and at 10 minutes after delivery, foetal birth weights (in kgs), and foetal gestational age (in months).

**Statistical Analysis**

Data were collected by proformas and historical records of both cases and controls. Routine data analyses were performed by manual means and use of calculators. Relative Risk was calculated by the use of Contingency (2 x 2) Tables.

**RESULTS**

A total of 34 anaemic (group one) and 39 non- anaemic (group two) pregnant women were studied between November 30, 1992 and March 30, 1993. All the women in group one had no history of even a single visit to an antenatal clinic, whereas the majority of women in group two had been visiting antenatal clinics during pregnancy. Distribution of data is shown in Tables 1 - 5.

All group one women fulfilled selection criteria of being (nutritionally, including iron deficiency) anaemic. 21 out of these 34 delivered at 9 or 9+ months, 7 at 8 or 8+ months, and a 6 at 7 or 7+ months.

AH group two women fulfilled the criteria of being perfectly normal, healthy and non-anaemic mothers. 36 out of these 39 delivered at 9 or 9+ months, 2 at 8 or 8+ months and only one at 7 months.

Total women delivering at a gestational age less than 9 months were 16, 81.25% of them were anaemic and 18.75% non-anaemic. Exposure rate for cases was 81.25% whereas that for controls was 36.84%. Relative risk or risk ratio was 4.97.

A further sub-study in the same respect for women delivering at 7 or 7+ months, but less than 8 months, showed them to be 7.85. 71% of them were anaemic and 14.28% non-anaemic. Exposure rate for cases was 85.71% and that for controls 42.42%. Relative risk or risk ratio was 6.88.

Among the babies delivered at 9 or 9+ months, 5 were dead, all (100%) belonging to anaemic mothers. In the 9 or 9+ months groups, there were 21 anaemic mothers (Tables 2, 3); thus among the anaemic group the mortality percentage was 23.80%, whereas among the 35 non-anaemic mothers, all the 36 babies (one mother delivered twins) were alive and thus in this group mortality rate was zero. Exposure rate for cases was 100% and controls 30.18%. Relative risk or risk ratio was ~ (infinite).

The mean foetal birth weight among anaemic women was 1.33 kg ± 0.6 in the 7 or 7+ (but < 8) months group, 2.09 + 0.5% in the 8 or 8+ (but < 9) months group and 2.62 + 0.3 in the 9 or 9+ months group.

In the non-anaemic women it was 2.8 kg in 7 or 7+ (but <8) months group, 3.75kg + 0.55 in the 8 or 8+ (but < 9) months group and 3.65kg + 0.66 in 9 or 9+ month group.

Among all the women delivering at a gestational age of 9 or 9+ months, 20 babies with birth weight below 3 kg were born. 18 of them (90%) were born to 18 anaemic mothers while 2 twins (90%, and the only twins of this study) were born to a non- anaemic mother. Among the 21 anaemic mothers. 85.71% (18 mothers) delivered babies with birth weight below 3 kg, while among 35 non-anaemic mothers this percentage was 0.03% (i.e. one mother) (Tables 4, 5).

The exposure rate for cases was 90% and for control 7.89%. The relative risk was 15.87.

**Table 1: Number of cases according to gestational age**

Gestation	Non Anaemic	Anaemic
7 - 7+Months	1	6
8- 8+Months	2	7
9- 9+Months	36	21
Total	39	34

**Table 2: - Fetal Mortality in non-anaemic mothers**

Status	7-7 + Months	8 - 8 + Months	9-9 + Months
Alive	1	2	36
Dead	0	0	0
% Mortality	0	0	0

**Table 3: - Fetal mortality in anaemic mothers**

Status	7-7 + Months	8-8 + Months	9-9 + Months
Alive	3	3	16
Dead	3	2	5

Percentage Mortality	50	28.57	23.80
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**Table 4: - Fetal birth weight in non-anaemic mothers**

Gestation (Months)	Mean Hb (G/Dl) ± S.D.	Mean Birth Weight (Kg) ± S.D.
7—7+ Months	12	2.8
8- 8+ Months	13 ± 0.3	3.75 ± 0.55
9—9+ Months	13.2 ± 1.8	3.65 ± 0.66

**Table 5: -Fetal Birth Weight in Anaemic Mothers**

Gestation (Months)	Mean Hb (G/Dl) ± S.D.	Mean Birth Weight (Kg) ± S.D.
7—7+ Months	8.35 ± 0.95	1.4 ± 0.66
8- 8+Months	8.09 ± 1.55	1.93 ± 0.53
9 - 9+Months	7.49 ± 1.79	2.61 ± 0.31

## DISCUSSION

The results of study have shown that pregnant women who suffer from (nutritional and/or iron deficiency) anaemia tend to deliver babies with a low birth weight, babies who are premature and babies who are not alive at birth, more often as compared to non- anaemic pregnant women.

The anaemic women included in this study were suffering from nutritional and/or iron deficiency anaemia (as other anaemias were ruled out), and had no nutrient supplement in the form of medication or food. Their food quality was very poor (especially in iron) and more than half belonged to a poor socio-economic group. However, this was not confirmed for all the cases, as most of them were reluctant to talk about it.

Mortality rate was staggeringly high among them as compared to non-anaemic women. This suggests that iron deficiency anaemia somehow directly or indirectly causes foetal death. Although this fact has not been proved up till now, but one direct connection could be made in the form of hypoxia due to anaemia, as intrauterine hypoxia has been suggested as a causative factor for foetal death. It seems that some fetuses cope with the chronic hypoxic conditions in anaemic mothers (which might be compensated by physiological methods such as a raise in blood pressure), while some fail to do so.

Interestingly this failure may occur at any stage up to 9 months or more (full term) gestation. More interestingly, no direct relationship between the haemoglobin level and foetal mortality was found, indicating some other secondary factors which may be compensating or enhancing the effects of maternal anaemia. However, this fact is clear from the study that the vast difference in mortality rates of anaemic and

non-anaemic women was due to one major factor, i.e. anaemia.

Coming to gestational age of the babies, it is again seen that there is a vast difference between the results of anaemic and non-anaemic women. Anaemic women showed a much higher tendency for delivering at a lower gestational age <sup>12</sup>. This again shows that anaemia seems to be hindering with a full term pregnancy. As before no direct correlation with the haemoglobin level, i.e. degree of anaemia, and the low gestational age is seen, again indicating that simple anaemia is not the sole factor and probably some cofactors such as general health, endurance or physiological makeup of the patient may play an important role in enhancing the effects of anaemia. However, the study did show a direct relationship of gestational age and mortality rate in anaemic women, which was not seen in non-anaemic women, i.e. with decreasing gestational age the mortality rate increase. Thus anaemia seems to be resulting in a dual risk, that is an increased mortality rate in all three gestational age groups and an increased tendency for premature births, which further enhances the chances of foetal mortality. These findings correlated with the work of Bhargava et al<sup>2</sup>, Dalman, and Scholl et al<sup>3</sup>.

The third parameter studied was low birth weight. The results showed that Anaemic women were delivering babies with lower birth weight as compared to non-anaemic women in all three gestational age groups. This indicates that anaemia hinders with the development of the foetus, especially weight gains <sup>4,5</sup>. It would be interesting to note that the maximum weight gain occurs in the third trimester of pregnancy (which this study was limited to) and during this trimester we also see an increased tendency of premature deliveries and high mortality. Again the haemoglobin levels (i.e. degree of anemia) and low birth weight show no correlation, however the mean birth weight does sharply decline with decreasing gestational age (as is the trend with non- anaemic women). However, in individual cases, this significance is also Similarly the foetal mortality

did not seem to be depending on foetal birth weight. This again indicates some secondary or cofactors at play along with anaemia.

In this study the non-anaemic women were free from all diseases and with normal haemoglobin levels. The babies born were all free from any congenital abnormalities. Even in cases of dead babies there was no underlying pathology or trauma, e.g. strangulation by umbilical cord. So the only culprit could be maternal anaemia.

As far as the anaemic women were considered, they were also free from all pathological conditions (even hypertension) except anaemia. Furthermore, it was made sure that the anaemia was not due to any congenital reason or due to trauma (blood loss

anaemia). Because of lack of proper facilities, serum iron levels could not be determined, but indirect indicators such as poor diet, low socioeconomic group and absence of other pathological feature indicated that the anaemia was of nutritional origin. It should also be noted that iron deficiency anaemia, especially in women, is a common occurrence due to food that is low in iron content, especially among poor families of Pakistan.

During the study it was also seen that anaemia did not appear to be the sole reason for the disastrous outcomes and the circumstances strongly suggested the role of some secondary or cofactors. As we have already excluded all apparent pathological factors except anaemia, these cofactors could probably be physiological factors and their variations among different individuals.

### SUGGESTIONS

1. It is necessary for pregnant women to have regular checkups, which include haemoglobin level measurements<sup>6</sup>.
2. If any decrease in haemoglobin level is detected, the women should promptly be treated by medicines, multivitamins or blood transfusions, if necessary.
3. Pregnant women should have a proper iron rich diet.
4. As a precautionary measure, it is advisable to add iron supplements and multivitamins to the diet of every pregnant woman.
5. Special attention should be paid to anaemic women in hospitals as they have an increased

risk of foetal death and foetal prematurity by weight and age<sup>6</sup>.

6. The general public and people associated with the medical profession should be made aware of the hazards of anaemia in pregnant women.
7. A campaign against anaemia in the form of health education and preventive measures should be started.

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