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**ORIGINAL RESEARCH**

# TO STUDY THE ASSOCIATION BETWEEN RISK OF INFANT ANEMIA AND MATERNAL ANEMIA

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**Abstract**

**Aim:** To study the association between risk of infant anemia and maternal anemia.

**Methods:** This research comprised 100 infants aged 3 to 6 months. All of the infants were delivered at the hospital at term, with birth weights more than 2500g. This research included babies who were exclusively breastfed, had no prior history of hospitalisation, and whose moms had an uncomplicated prenatal period. These neonates were weighed using a digital scale, and their weights were placed on a WHO growth chart. The maternal data were used to determine the maternal haemoglobin concentration in the third trimester.

**Results:** 70 (70%) of 100 infants (3-6 months) born at term suitable for gestational age and exclusively breastfed had haemoglobin concentrations of <11g/dl .Out of 70 newborns with low haemoglobin concentrations (<11g/dl), 60 (60%) were delivered to anaemic mothers and 10 (10%) were born to non-anemic mothers (>11g/dl). Twenty (20%) of the infants delivered to anaemic mothers had haemoglobin concentrations more than 11g/dl. Maternal anaemia had a substantial (p value 0.0005) effect on these babies' haemoglobin level. Infant anaemia is 6.0 times more likely among infants delivered to anaemic moms. A linear regression analysis was performed to assess the relationship between maternal haemoglobin and infant weight gain pattern, and it was discovered that maternal haemoglobin concentration during the last trimester influenced 31 percent of the variation in weights of these 3-6 months old term exclusively breast-fed infants. There is a positive connection, R2=0.31, indicating that maternal anaemia accounts for 31% of the variance in the child's current weight.

**Conclusion:** Maternal anaemia in the third trimester is substantially related with low haemoglobin and poor weight growth in term 3-6 month old infants.

**Keywords:** Anemia, Breast fed, Infants, Maternal anemia, Term

## Introduction

Anemia, defined as a volume of packed red blood cells/hematocrit (Hct) or haemoglobin (Hb) concentration higher than two standard deviations (2SD) below the mean for age, may be caused by one of three factors: blood loss, accelerated RBC destruction, or decreased RBC generation. [1] The primary physiologic impact of anaemia is decreased oxygen delivery to

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tissues, which results in both compensatory responses as well as acute or chronic consequences such as poor growth, decreased activity, impaired cognitive performance, behavioural, motor development, and limited cardiovascular reserve. [2, 3]

In underdeveloped nations, anaemia is a serious public health issue and a direct cause of childhood death and morbidity.[4]Globally, 43 percent of preschool-age children are anaemic, with 28.5 percent of these children living in Sub-Saharan Africa (SSA), where the incidence rate is shockingly high at 67 percent. [5]Anemia is caused by a variety of factors, the most common of which is iron deficiency[6], though other factors such as micronutrient deficiencies (i.e., folate, riboflavin, and vitamins A and B12), acute and chronic inflammation (i.e., malaria, tuberculosis, and HIV)[7], and inherited or acquired disorders that affect Hb synthesis, RBC production, or RBC survival (i.e., hemoglobinopathies)[8] can Previous study has shown that, in addition to dietary and pathogenic variables, additional factors such as a child's characteristics[9], mother characteristics, household qualities, and community characteristics all have an influence on childhood anaemia. [10]

According to the World Health Organization (WHO), more than half of all women in underdeveloped nations are anaemic, compared to 18 percent in affluent ones. However, the disease is more prevalent in Asia and Africa, where 60 and 52 percent of women are thought to be anaemic, respectively. [11] Previous research has linked maternal anaemia during pregnancy to an increased risk of low birth weight, premature delivery, perinatal and neonatal death, mother morbidity and mortality, and poor productivity. [11]

**Methods and materials**

This research comprised 100 infants aged 3 to 6 months. All of the infants were delivered at the hospital at term, with birth weights more than 2500g. This research included babies who were exclusively breastfed, had no prior history of hospitalisation, and whose moms had an uncomplicated prenatal period. The research excluded preterm newborns, NICU graduates, and neonates with a history of severe jaundice and bleeding. These neonates were weighed using a digital scale, and their weights were placed on a WHO growth chart. The maternal data were used to determine the maternal haemoglobin concentration in the third trimester. After receiving informed agreement from their parents, a competent employee took 0.5ml of venous blood sample from these newborns under medical supervision. [12-14]The haemoglobin content in blood obtained in sterile vacuum tubes with EDTA was determined using an autoanalyzer.

According to WHO recommendations, maternal anaemia was defined as haemoglobin levels of <11g/dl in the third trimester.[15] There is no defined cut limit for haemoglobin concentration in babies aged 6 months to diagnose anaemia. [16] As a result, the WHO definition of anaemia for infants older than 6 months as haemoglobin concentration <11g/dl was used as the cut off in this research for newborns aged 3-6 months. [15]

The study population's prevalence of low haemoglobin (<11g/dl) was calculated. A univariate analysis was performed to determine the relationship between maternal anaemia in the third trimester (<11g/dl) and low haemoglobin levels. In these words, exclusively breastfed 3-6 month old babies (<11 g/dl). Linear correlation analysis was performed using SPSS 25.0 software on maternal haemoglobin concentrations recorded in their final trimester and child

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weight to investigate the impact of maternal anaemia on the weight increase pattern of these term exclusively breastfed 3-6 months old babies.

Maternal anaemia was considered if their haemoglobin concentration in the final trimester went below <11g/dl according to WHO guidelines, and for newborns aged 3 to 6 months, <11g/dl was deemed low haemoglobin.[15] When displayed on the WHO growth chart, weight for age -2 SD was deemed low weight for age.

**Results**

In our research, 80 (80 percent) of the moms had a final trimester haemoglobin content of <11g/dl. 40 (40%) of the mothers had haemoglobin concentrations between 9 and 10.9 g/dl, 33 (33%) had haemoglobin concentrations between 7-9g/dl, 7 (7%) had haemoglobin concentrations between <4 and 7g/dl, and none had extremely severe anaemia (4g/dl). The majority of the infants were between the ages of 4-5 months. (Table 1)

**Table 1: Age of the infant**

| Age of the infant | Number | Percentage |
|---|---|---|
| 3-4 | 22 | 22 |
| 4-5 | 44 | 44 |
| 5-6 | 34 | 34 |

70 (70%) of 100 infants (3-6 months) born at term suitable for gestational age and exclusively breastfed had haemoglobin concentrations of <11g/dl (Table 2).

**Table 2: Prevalence of Anemia In 3-6 Months old infants**

| | Number | Percentage |
|---|---|---|
| Non anemic infants | 30 | 30 |
| Anemic infants | 70 | 70 |

Among these infants with haemoglobin concentrations less than 11g/dl, 1 baby (1%) had a concentration less than 7g/dl, 59 babies (59%) had a concentration between 7-9g/dl, and 10 babies (10%) had a concentration between 9-10.9 g/dl. In the study group, the average haemoglobin concentration was 9.8g/dl. Out of 70 newborns with low haemoglobin concentrations (<11g/dl), 60 (60%) were delivered to anaemic mothers and 10 (10%) were born to non-anemic mothers (>11g/dl). Twenty (20%) of the infants delivered to anaemic moms had haemoglobin concentrations more than 11g/dl. On univariate analysis, it was discovered that maternal haemoglobin concentration had a significant connection with newborn haemoglobin concentration, with an odds ratio of 6.77 (95 percent confidence range 2.17-15.71 and p value 0.005). (Table 3).

**Table 3: Univariate analysis between maternal Hb and baby Hb**

| | Maternal Hb <11g/dl | Maternal Hb >11g/dl |
|---|---|---|
| Baby Hb <11.0g/dl | 60 | 10 |
| >11.0g/dl | 20 | 10 |

Maternal anaemia had a substantial (p value 0.0005) effect on these babies' haemoglobin level. Infant anaemia is 6.0 times more likely among infants delivered to anaemic moms. The

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weights of these infants (3 to 6 months old) delivered at term with acceptable birth weight were measured and documented. When these measures were plotted on WHO growth charts, it was shown that 31 (31 percent) of these neonates had low weight for age (-2SD) according to the WHO growth chart. All 31 infants (31%) were delivered to anaemic women with haemoglobin concentrations less than 11g/dl in the third trimester, and none were born to moms with haemoglobin concentrations more than 11gm/dl (table 3).

**Table 4: Prevalence of low weight for age of the babies among anemic and non-anemic mothers**

| | Maternal Hb<11g/dl | Maternal Hb>11g/dl |
|---|---|---|
| low weight for age | 31 | 0 |

A linear regression analysis was performed to assess the relationship between maternal haemoglobin and infant weight gain pattern, and it was discovered that maternal haemoglobin concentration during the last trimester influenced 31 percent of the variation in weights of these 3-6 months old term exclusively breast-fed infants. There is a positive connection, R2=0.31, indicating that maternal anaemia accounts for 31% of the variance in the child's current weight. (p0.001 significant, r = 0.533).

**Discussion**

Iron deficiency anaemia is the most frequent cause of anaemia in underdeveloped nations, affecting mostly women and children.[17,18]Iron deficiency anaemia affects 65-75 percent of pregnant women in rural India, and 70 percent of children aged 6-59 months. [19,20]The current research found an increasing incidence of maternal anaemia (80%) in our area of the state. There is less data on the prevalence of anaemia in infants under 6 months old because it is generally assumed that these infants born at term with an appropriate weight for gestational age have adequate iron stores, but several evidences suggest that even when born at term with an adequate birth weight, these infants have low iron stores when born to anaemic mothers. In our research, 70 newborns (70 percent) had haemoglobin concentrations of <11g/dl among 100 babies delivered at term with appropriate birth weight. Infants may anticipate a post-natal drop in haemoglobin owing to reduction of erythropoietin production in the comparatively hazardous extrauterine environment, with a nadir between 6 and 12 weeks of age. [21] Despite the fact that term newborns experience a reduction in haemoglobin for 6 - 12 weeks owing to physiological anaemia of infancy, they have enough iron reserves for the first 6 months of life. Mild maternal iron deficiency anaemia, on the other hand, has few meaningful effects on the iron status of the newborn, but severe anaemia has a major affect. Fetuses from iron-deficient moms have lower iron stores and haemoglobin mass than their normal counterparts. After roughly 4 months of age, there is a progressive change from an excess of iron stores to minimal iron reserves, which provides to a time of ongoing fast development. Low haemoglobin levels during pregnancy, according to available research, lead to decreased iron storage, resulting in infantile anaemia even before the age of 6 months. The risk of anaemia in 3- 6 month old children born to anaemic moms is 6.0 times larger than those born to non-anemic mothers, according to the current research. Similarly, Zhang Y and Jin L et al found that maternal haemoglobin concentrations measured during 24-28 weeks of gestation, but not during the first trimester, were correlated with infant haemoglobin concentration and

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increased the risk of infant having low haemoglobin at 5-7 months (AOR: 1.95, 95 percent CI: 1.59 - 2.40) and 11 - 13 months (AOR: 1.72, 95 percent CI: 1.59 - 2.40). [22] Similarly, Maria de lourds et al concluded in their study on the influence of breast feeding type and maternal anaemia on haemoglobin concentration in 6 months old infants that maternal anaemia had an influence on the haemoglobin level of 6 months old infants even when only children on exclusive and predominant breast feeding were analysed and that there is an urgent need to prevent maternal anaemia before conception, during pregnancy, and throughout lactation. [23] In addition, Jareen K et al reported in a study on infant anaemia and its relationship with maternal anaemia that maternal anaemia was independently associated with a threefold increased risk of infant anaemia (p value 0.03), and that those associations were not explained by confounding with other maternal or infant factors. [24] In a prospective cohort research, Colomeret colleagues examined 156 neonates and investigated the relationship between pregnant women's haemoglobin concentration and the risk of anaemia in their newborns at twelve months of age. [25] Teltar B et al found a statistically significant difference in height, weight, and chest circumference of newborns of severe and mild anaemic mothers in their study on the effect of maternal anaemia on anthropometric measurements of newborns, which included 3688 mothers, 1588 (43 percent) of whom were found to be anaemic (p 0.017, 0.008 and 0.02 respectively). [26] According to their findings, severe anaemia had a considerable unfavourable influence on infant anthropometric measures. It was discovered in this research that there is a linear relationship between mother haemoglobin and the weight of these exclusively breast-fed newborns. The infants weighing -2SD were all delivered to anaemic moms. In a similar research, AlokBhargavaet colleagues included 100 babies under the age of 6 months in Kenya and investigated the relationship between maternal anaemia and the weight increase pattern of these newborns. [27] The research concluded that maternal haemoglobin concentration and weight of these babies under 6 months old were positively linked with a p value of 0.05. In their study of 990 babies aged 3 to 5 months, Saskia de Pee et al hypothesise that the haemoglobin concentration of many infants is too low below the age of 6 months due to iron deficiency anaemia, particularly by increased risk of low haemoglobin concentration among infants of anaemic mothers.[16] According to univariate analysis, four parameters impacting the incidence of low haemoglobin in babies less than 6 months were substantially correlated: maternal haemoglobin concentration, birth weight, child age, and breast feeding status. In this research, however, the sample population was homogenised by enrolling term infants with birth weights (>2500g) who were exclusively breastfed. In keeping with our findings, several research have shown a link between maternal anaemia and foetalhaemoglobin, suggesting that placental iron transport systems may not function at higher levels of maternal anaemia, resulting in a drop in haemoglobin levels in these children. [28]

## Conclusion

Maternal anaemia in the third trimester is substantially related with low haemoglobin and poor weight growth in term 3-6 month old infants.

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