World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 6.129

# ASSOCIATION BETWEEN MATERNAL ANEMIA DURING THIRD TRIMESTER WITH ADVERSE FETOMATERNAL HEALTH OUTCOMES

**Eesha Waheed*[1], Shahnai Basharat[2], Syed Amir Gilani[3], Tahira Ashraf[4], Faiz-ul-Hassan Shah[5]**

[1]A20, Bukhari House, Lalazar Colony, Sialkot, Pakistan.
[2]Associate Professor, University Institute of Diet & Nutritional Sciences, The University of Lahore.
[3]Dean, Faculty of Allied Health Sciences, The University of Lahore.
[4]Assistant Professor, University Institute of Diet & Nutritional Sciences, The University of Lahore.
[5]Senior Lecturer Biostatistics, University Institute of Radiological Sciences & Medical Imaging Technology (UIRSMIT), The University of Lahore.

***Corresponding Author: Eesha Waheed**
A20, Bukhari House, Lalazar Colony, Sialkot, Pakistan.

**Article Received on 09/10/2019** **Article Revised on 30/10/2019** **Article Accepted on 20/11/2019**

## ABSTRACT

**Back ground:** Anemia is a major contributor to maternal death in developing countries. Iron deficiency is a disorder in which red cells and hemoglobin levels reduce in the body, resulting in health complications. **Objective:** To determine the association of fetomaternal outcomes with maternal anemia during last trimester of pregnancy. **Study Design**: A Case Control Study. **Materials and Methods:** 130 pregnant women admitted for delivery in their 3rd trimester with anemia were studied and compared with 130 non-anemic women. Both of the groups were well matched. The research was done in Islam Central Hospital, Sialkot. Chi-square test and Odds ratio were applied to determine adverse fetomaternal outcomes that include: low birth weight, low APGAR scores, mode of delivery (SUD, C-section, instrumental), perinatal mortality and fetal birth defects. **Results**: The mean age of pregnant women who were enrolled in the study was ±27.7 years old. All the women were going through their first pregnancy and were in their 3rd trimester of pregnancy. Total 260 pregnant women were studied and were divided into two groups: 130 mothers were anemic and the other 130 mothers were non-anemic. The occurrence of lower birth weight in infants having non-anemic mothers were 27.9% and with anemic mothers were 72.1%, APGAR scores in infants with non-anemic mothers were 28.6% and anemic mothers were 71.4%, mode of delivery in non-anemic mothers was SVD (57%); C-section(21.2%); instrumental (100%), and anemic mothers was SVD(43%); C-section(78.8%); instrumental(0%), perinatal mortality in infants with non-anemic mothers was 33.3% and anemic mothers was 66.7%, fetal birth defects in infants with non-anemic mothers were 0 out of 130 and anemic mothers were 1 out of 130, preterm birth in infants with non-anemic mothers were 36.7% and in anemic mothers were 63.3% respectively. **Conclusion:** The current study suggested a link between maternal anemia with increased adverse health risks of fetomaternal outcomes. The mother anemia was associated with greater risk of negative fetomaternal consequences at childbirth. such as low birth weight, low APGAR scores, mode of delivery (SUD, C-section, instrumental), perinatal mortality and fetal birth defects. Severe anemia in pregnancy causes significant risk to mother and fetus if it is present in the 3rd trimester of pregnancy.

**KEYWORDS:** Maternal Anemia, Perinatal Outcome, Fetomaternal Outcomes, Preterm Birth, APGAR Scores.

## INTRODUCTION

Pregnancy is the duration from conception to fertilization. During this phase, critical nutrients are: iron, protein, folic acid, vitamin b12.[1] "Iron deficiency is a disease arising from too little iron in the body," reports CDC (Centers for Disease Control and Prevention).[2] Maternal anemia is a condition in which Hb level is lower than normal i.e.: according to WHO (world health organization) and CDC (centers for disease control and prevention) Hb level less than 11gm% is considered anemic state.[3] According to (WHO), the prevalence of anemia is 23% in the develop countries and the average pervasiveness in emerging countries is 56%.[4] Its prevalence ranges from 41.8% globally in pregnant females. High incidence of lower birth weight, low APGAR scores (Appearance, Pulse, Grimace, Activity, and Respiration), perinatal mortality and fetomaternal outcomes cases had been informed in infants with anemic mothers.[5] Worldwide maternal anemia has increased tremendously and it affects the overall health status of women. In developing countries this challenge is face more often due to poor nutritional status.[5]

Nutritional needs as elevate during pregnancy such as iron, protein, calcium and folic acid intake also increases respectively.[6] Women who are facing the challenge of iron deficiency due to their body's physiological changes during pregnancy, such as genital changes, breast changes, skin changes, weight increase, skeletal changes, urinary changes, gastro intestinal changes, cardiovascular changes, respiratory changes and hematological changes etc.[7] goes through several complications during and after pregnancy. The complications start from the 1st trimester and progresses throughout gestation.[8] Many Complications such as low birth weight, low APGAR scores, mode of delivery (SUD, C-section, instrumental), perinatal mortality and fetal birth defects in the mother and infant are present, which can add value to gestational iron deficiency. Anemia prevalence in third trimester is very high and may have an adverse effect on mother's health during gestation and fetal outcomes.[9] Such opposing reactions are not only present during gestation, infant or neonatal period, but it may also intensify the possibility of other problems during maturity.[10] The negative consequences rely on the intensity and length of iron deficiency and the pregnancy period. Mother's morbidity and mortality rise as anemia becomes more severe. Iron supplementation reduces the chances of low birth weight and preterm birth in anemic pregnant women.[11] Anemia could be prevented during pregnancy as it can be diagnosed and treated even in primary health care.[12]

In Pakistan, a very high ratio of anemic mothers during gravidity was observed in the past research papers. The key determination for this research study was to ensure that how many expecting women in the third trimester were facing iron loss and how iron was one of the major key components in creating risk factors for the mother and her infant. The purpose of this research study was to know the pervasiveness of pregnant women with iron deficiency and its adverse fetomaternal consequences.

## MATERIALS AND METHODS

### Sample collection

The sample size formula was $n = \frac{\left\{Z_{1-o}\sqrt{2\bar{p}(1-\bar{p})}+Z_{1-o}\sqrt{P_1(1-P_1)+P_2(1-P^2)}\right\}^2}{(P_1-P^2)^2}$ .[13]

which was estimated using frequency of preterm birth taken as 7% in non-anemic females and taking the absolute precision as 5%. In this case control study, 260 pregnant women were examined according to inclusion criteria and were divided into two groups. Group 1: Anemic pregnant women (n=130); Group 2: non-anemic pregnant women (n=130). Women who were in their 3rd trimester of pregnancy were examined and followed till their due date in order to note down their fetomaternal outcomes. The research study was completed in the period of 9 months. Taking absolute precision: 5%.

All the females were examined for the study by non-probability purposive sampling method. The pregnant women of 3rd trimester visiting selected hospital with age limit ranging from 20 to 35 and primigravida pregnant women were included in the inclusive criteria. The research study was started by giving consent forms to the pregnant females and then proformas were apprehended to them so that the desired information regarding our research study was collected. Women with non-corporation, previous unavailable history and history of thalassemia and sickle cell anemia were excluded from the research study. Questionnaires helped to note down the significant changes in anemic and non-anemic women during and after pregnancy. Their age, hemoglobin level, BMI (BMI = $kg/m^2$), parity, demographic measures, and fetomaternal possible outcomes were listed in the questionnaire. The data was analyzed using spss 21. The quantitative variables like age, parity and gestational age were presented as mean ±S.D. Chi-square test and Odds ratio were calculated to determine association between the anemic and non-anemic groups and their fetomaternal outcomes.

## RESULTS

Total 260 pregnant women were examined for the current research and the mean age of the pregnant women was ±27.5 years.

**Table 1. Frequency distribution of Anthropometric measurements and hemoglobin levels of anemic or non-anemic groups.**

| Non anemic or anemic | | Age | Hemoglobin Level | BMI |
|---|---|---|---|---|
| **Non anemic** | Mean | 26 | 11.6 | 25.5 |
| **Anemic** | Mean | 24.9 | 9.38 | 26.3 |

According to Table-1, the mean hemoglobin levels were 11.4±.68 among anemic women. The mean HB level was 12 % among non-anemic women. The mean Body mass index of anemic and non-anemic women were 12.5% and 24 % respectively.

**Table.2: Frequency distribution of Mode of Delivery in anemic and non-anemic pregnant women.**

| | | Mode of Delivery | | |
|---|---|---|---|---|
| | | **SVD** | **C-section** | **instrumental** |
| **Nonanemic** | Count | 118 | 11 | 1 |
| | % within Mode of Delivery | 57.0% | 21.2% | 100.0% |
| **Anemic** | Count | 89 | 41 | 0 |
| | % within Mode of Delivery | 43.0% | 78.8% | 0% |

The result showed that 130 non-anemic pregnant women had Spontaneous vaginal delivery 118(57 percent); C-section 11(21.2 percent); instrumental 1(100 percent) mode of delivery. While the anemic mothers had Spontaneous vaginal delivery 89(43 percent); C-section 41(78.8 percent); instrumental 0(0 percent) mode of delivery, The results clearly showed that frequency for Spontaneous vaginal delivery is more in the non-anemic pregnant women, whereas the frequency of C-section was more in the anemic pregnant women while showing a slight change of frequency in instrumental mode of delivery as shown in the Table 2.

**Table 3: Low-birth-weight range of anemic or non-anemic pregnant women's infants.**

| | | Low Birth Weight | | Total |
|---|---|---|---|---|
| | | **NO** | **YES** | |
| **Nonanemic** | Count | 118 | 12 | 130 |
| | % within Low Birth Weight | 54.4% | 27.9% | 50.0% |
| **Anemic** | Count | 99 | 31 | 130 |
| | % within Low Birth Weight | 45.6% | 72.1% | 50.0% |

The results from the Table 3 showed that, 130 pregnant women who were non-anemic gave birth to 12(27.9 percent) infants with low birth weight and the other 130 anemic pregnant women gave birth to 31(72.1 percent) infants with low birth weight.

**Table 4: Frequency distribution of Low Apgar score in Infants with Anemic and Non-Anemic Pregnant Women.**

| | | Low APGAR score | |
|---|---|---|---|
| | | **NO** | **YES** |
| **Nonanemic** | Count | 126 | 4 |
| | % within Low APGAR score | 51.2% | 28.6% |
| **Anemic** | Count | 120 | 10 |
| | % within Low APGAR score | 48.8% | 71.4% |

The result showed from the Table 4, that 130 non-anemic pregnant women gave birth to 4(28.6 percent) infants with lower APGAR scores as compared to anemic pregnant women who gave birth to 10(71.4 percent) infants with lower APGAR scores.

**Table 5: Frequency distribution of Perinatal Mortality in Infants.**

| | | Perinatal Mortality | |
|---|---|---|---|
| | | **No** | **Yes** |
| **Nonanemic** | Count | 129 | 1 |
| | % within Perinatal Mortality | 50.2% | 33.3% |
| **Anemic** | Count | 128 | 2 |
| | % within Perinatal Mortality | 49.8% | 66.7% |

The result from the above table 5 showed that out of 260 in total, non-anemic pregnant women gave birth to 1 out of 130(33.3 percent) infants with perinatal mortality and non-anemic pregnant women gave birth to 2 out of 130(66.7 percent) infants with perinatal mortality.

## DISCUSSION

Anemia is one of the complications during pregnancy. It is a very significant contributor in mother and infant mortality and morbidity as an indirect or direct cause.[14] Its prevalence ranges from 41.8% globally in pregnant females. The prevalence of anemic mothers in Pakistan is reported to be quite high according to previous studies. In a research done in Karachi the incidence rate observed was 50%. Many similar researches have been conducted in several Asian countries regarding the anemic states of pregnant women.[15]

Our study indicates that iron deficiency is extremely common among Pakistan's pregnant women. Several

aspects have contributed to the high incidence of maternal anemia, among which iron deficiency might have been the major factor. Our study validates that women with severe anemia have adverse fetal and neonatal outcomes. The mean age of pregnant women in our research study was ±27.5 years. All the women were going through their first-time pregnancy and were in their 3rd trimester.

Our data showed negative effects of maternal anemia on neonatal outcomes such as low birth weight, lower APGAR results, delivery method (SUD, C-section, instrumental), perinatal mortality, and infant birth defects Gestational duration gradually decreased as mother's anemia became more severe. The shorter gestational length also appears to interfere with the studied association among both iron and LBW. Past research support the negative effect of higher iron rates on birth weight.[16] Due to plasma expansion, high Hb in the anemic community was partially responsible for hemodilution. This plasma expansion is expected to have positive effects on the flow of the development of placenta and fetus.[17] Future studies were needed to confirm our findings and explain the conflicting results. The strongest effect on birth weight regardless of gestational age was seen only with severe maternal anemia (Hb 570g / L), which was consistent with previous studies.[18] In comparison to gestational age and birth weight, maternal anemia had much less impact on neonatal performance, probably because very few mothers are severely anemic. It does not disprove the possibility of long-term health effects in these babies.[19] Preterm and LBW babies were vulnerable to a vast variety of physical growth, cardiovascular and metabolic performance, and fetal development long-term issues.[20] Anemic maternal babies also had an increased risk of developing anemia during infancy. Severe maternal anemia adversely affected cord blood concentration and breast milk iron concentration. Iron deficiency is associated with long-term behavioral deficits throughout early childhood, which occur following the introduction of iron.[21]

The present study suggests, the ratio of SVD was higher in non-anemic patients and ratio of c- section was higher in anemic respectively (Table 1). A similar study was conducted in 2013 to assess the effects of IDA on cesarean cases and adverse maternal and neonatal outcomes at admission for delivery.[22] Anemia during delivery was associated with an increased risk in healthy women for cesarean section and adverse maternal and neonatal outcomes. Hemoglobin level was significantly lower in women who delivered by cesarean compared with women who delivered vaginally.[23]

The current study showed that the birth weight of infants was low than the ideal birth weight in anemic pregnant women as compare to non-anemic pregnant women (Table-2). The Israeli study revealed anemia and the incidence of negative birth outcomes, the odds of both LBW and premature delivery increased to 60%.[24] A U-shaped association between gestation Hb concentration and bad outcome has been documented in several findingsA British report established a U-shaped association between maternal Hb concentrations and LBW incidence and premature birth.[25] Low maternal expansion of plasma results in high production of Hb associated with negative delivery outcomes. In another study conducted in India, a U-shaped relation between Hb concentration and LBW risk was determined.[26] A recent meta-analysis has established an association of early pregnancy anemia with increased risk of LBW and premature birth as well as an inverse correlation of late pregnancy anemia with LBW and premature birth.[27] A research found a link between low hematocrit in early pregnancy and a higher rate of premature birth, and if hematocrit levels were high in later pregnancy, higher rates of premature birth were identified.[28]

The current study results were compatible with the previous study as our study suggested that APGAR scores in infants with non-anemic mothers were higher in anemic pregnant women as compared to non-anemic pregnant women shown in table 3, whereas in 2014 similar previously done research showed that the frequency of Low birth weight (62.68 percent) and APGAR score < 7 (60 percent) in anemic patients.[29] Severe anemia during pregnancy significantly increases the chance of adverse perinatal and maternal outcomes such as low birth weight and APGAR score.[30]

In our study perinatal mortality in infants with non-anemic mothers was lesser as compared to anemic pregnant women as shown in table 4, Prematurity was the leading cause of perinatal mortality in Pakistan in a similar study published in 2016. Severe anemia (< 8 g / dl) was correlated with levels of birth weight that were 200–400 g less than those of people with normal hemoglobin values (> 10 g / dl).[31] Even though numerous literature studies had analyzed the connection between maternal iron deficiency and adverse perinatal outcomes, particularly low birth weights, there was no consensus that during the trimester maternal anemia had a greater impact on birth weight.[32] Another recent study recorded a correlation between high Hb values in the third trimester and low birth weight.[33] The present study is designed to achieve more accurate outcomes with the findings of the two participant groups reported in the third trimester and then contrasted. Several studies showed a link between elevated hematocrits and poor outcomes in childbirth. Excessive red cell mass may cause high levels of hematocrit, but it was more likely to be correlated with failure to achieve expansion of the plasma volume usually seen during normal pregnancy.[34]

The present study suggests that preterm birth in infants with non-anemic mothers were 36.7 percent and in anemic mothers were 63.3 percent as shown in table 5. Where as in 2013 a similar study showed the association between hemoglobin concentration and adverse outcome,

conducted between 2014-2016, showed that maternal anemia during early pregnancy is associated with slightly increased preterm delivery but not with significantly increased low birth weight or with fetal growth restriction.[35]

There were some shortcomings in our study. During admission for delivery, Maternal Hb was determined. In the absence of retrospective analysis during pregnancy, it was not possible to know the impact of maternal anemia on our tests. External limitations were the lack of evidence on the source of anemia, maternal nutritional intake, and newborn baby hematological indices. The report, however, established the highest-risk demographic to establish preventive approaches to improve maternal-child health. Through additional data on the source and progression of anemia, multiple treatment strategies could be developed relevant to this community. Another such technique, which is proven to enhance neonatal results, is parenteral iron administration for serious maternal anemia. The anemic pregnant women gave birth to children who had to go through multiple problems including low birth weight, poor APGAR levels, premature birth, perinatal mortality, and prenatal birth defects.[36]

## CONCLUSION

The study concluded that iron deficiency in females can cause serious adverse effects in terms of fetomaternal outcomes during pregnancy and after pregnancy such as low birth weight, low APGAR scores, mode of delivery (SUD, C-section, instrumental), perinatal mortality and fetal birth defects. Our research also demonstrates that pregnancy anemia is a very common health issue which needs to be taken serious care. Higher incidence of motherly iron deficiency in gestation and its negative infant outcomes, maternal anemia prevention and treatment is of great significance. Our analysis showed that most adverse effects arise when mother's hemoglobin was less than < 11g / dL. Therefore, greater attention should be provided during the third trimester to achieve and maintain maternal > 11g / dL. Mandatory screening for iron deficiency by health care providers in community can benefit. A well-planned, potential study was needed to address the long-term effects of maternal anemia on maternal and newborn health and develop approaches beyond routine iron supplementation.

**Acknowledgments:** NA
**Conflict of interest:** No conflict of interest.

## REFERENCES

1. Breymann C. InSeminars in hematology 2015 Oct 1 (Vol. 52, No. 4, pp. 339-347). WB Saunders.
2. Chang S, Zeng L, Brouwer ID, Kok FJ, Yan H. Pediatrics. 2013 Mar 1; 131(3): e755-63.
3. Horowitz KM, Ingardia CJ, Borgida AF. Clinics in laboratory medicine. 2013 Jun 1; 33(2): 281-91.
4. Melku M, Addis Z, Alem M, Enawgaw B. Anemia. 2014; 2014.
5. Kochhar PK, Kaundal A, Ghosh P. Journal of Obstetrics and Gynaecology Research. 2013 Feb; 39(2): 504-10.
6. Lelic M, Bogdanovic G, Ramic S, Brkicevic E. Medical Archives. 2014 Jun; 68(3): 184.
7. de Sá SA, Willner E, Pereira TA, de Souza VR, Boaventura GT, de Azeredo VB. Nutricion hospitalaria. 2015; 32(5): 2071-9.
8. Rahmati S, Delpishe A, Azami M, Ahmadi MR, Sayehmiri K. Maternal Anemia during pregnancy and infant low birth weight. International Journal of Reproductive BioMedicine. 2017 Mar; 15(3): 125.
9. Yi SW, Han YJ, Ohrr H. European journal of clinical nutrition. 2013 Apr; 67(4): 337.
10. McClure EM, Meshnick SR, Mungai P, Malhotra I, King CL, Goldenberg RL, Hudgens MG, Siega-Riz AM, Dent AE. PLoS neglected tropical diseases. 2014 Feb 27; 8(2): e2724.
11. Chowdhury S, Rahman M, Moniruddin AB. Medicine Today. 2014 Dec 25; 26(1): 49-52.
12. Ouédraogo S, Koura GK, Bodeau-Livinec F, Accrombessi MM, Massougbodji A, Cot M. The American journal of tropical medicine and hygiene. 2013 Feb 6; 88(2): 292-300.
13. Wong L, Smith S, Gilstrop M, Derman R, Auerbach S, London N, Lenowitz S, Bahrain H, McClintock J, Auerbach M. American journal of hematology. 2016 Jun; 91(6): 590-3.
14. Townsley DM.. InSeminars in hematology 2013 Jul 1 (Vol. 50, No. 3, pp. 222-231). WB Saunders.
15. Sabina S, Iftequar S, Zaheer Z, Khan MM, Khan S. J Innov Pharm Biol Sci. 2015; 2(2): 144-51.
16. Ikeanyi EM, Ibrahim AI. Nigerian journal of clinical practice. 2015; 18(3): 323-7.
17. Tariq N, Ayub R, Khan WU, Ijaz S, Alam AY. J Coll Physicians Surg Pak. 2015 Mar 1; 25(3): 193.
18. Singh P, Khan S, Mittal R. Bali Medical Journal. 2013; 2(1): 14-6.
19. Ivan EA, Mangaiarkkarasi A. JCDR. 2013 Nov; 7(11): 2487.
20. Chang S, Zeng L, Brouwer ID, Kok FJ, Yan H. 2013 Mar 1; 131(3): e755-63.
21. Yılmaz E, Yılmaz Z, Çakmak B, Gültekin İB, Çekmez Y, Mahmutoğlu S, Küçüközkan T. The Journal of Maternal-Fetal & Neonatal Medicine. 2017 Apr 18; 30(8): 977-82.
22. Gedefaw L, Ayele A, Asres Y, Mossie A. Ethiopian journal of health sciences. 2015; 25(2): 155-64.
23. Breymann C. InSeminars in hematology 2015 Oct 1 (Vol. 52, No. 4, pp. 339-347). WB Saunders.
24. Cheema HK, Bajwa BS, Kaur K, Joshi H. Int J Contemporary Med Res. 2016; 3(4): 1194-7.
25. Siteti MC, Namasaka SD, Ariya OP, Injete SD, Wanyonyi WA.. Sci J Public Health. 2014; 2(3): 216.
26. Menon KC, Ferguson EL, Thomson CD, Gray AR, Zodpey S, Saraf A, Das PK, Skeaff SA. Nutrition. 2016 Jan 1; 32(1): 61-5.

27. Singh R, Singh AK, Gupta SC, Singh HK. Indian journal of community health. 2015 Sep 30; 27(3): 351-5.
28. Melku M, Agmas A. Appl Med Res. 2015; 1: 2-7.
29. Khan H, Shah F, Khan K.. Pakistan Journal of Public Health. 2017; 7(2): 79-81.
30. Khan H, Khan K, Raziq F, Naseem A. The Professional Medical Journal. 2014; 21(01): 100-5.
31. Opitasari C, Andayasari L. Young Mothers, Health Science Journal of Indonesia. 2015; 6(1): 7-11.
32. Kalem P, Benli AR, Koroglu M, Benli NC, Koyuncu M, Cesur O, Dane PB.. Int J Clin Exp Med. 2016 Jan 1; 9(11): 22413-147.
33. Goswami TM, Patel VN, Pandya NH, Mevada AK, Desai KS, Solanki KB. Int J Biomed Adv Res. 2014; 5(2): 99-102.
34. Lelic M, Bogdanovic G, Ramic S, Brkicevic E. Medical Archives. 2014 Jun; 68(3): 184.
35. Kumar KJ, Asha N, Murthy DS, Sujatha MS, Manjunath VG. International journal of preventive medicine. 2013 Feb; 4(2): 193.
36. Yildiz Y, Özgü E, Unlu SB, Salman B, Eyi EG. The Journal of Maternal-Fetal & Neonatal Medicine. 2014 May 1; 27(7): 729-32.