Gestational Anemia and its effects on neonatal outcome, in the population of Hyderabad, Sindh, Pakistan

Tazeen Shah, Muhammad Saleh Khaskhel, Shafaq Ansari, Hazooran Lakhan, Farheen Shaikh, Asad Ali Zardari, Jamshed Warsie, Nadir Ali Rind, Khalid Hussain Rind, Akhtar Hussain Sharg

Department of Physiology, Liaquat University of Medical and Health Sciences, Jamshoro, (LUMHS) Sindh, Pakistan
Department of Anesthesiology, Surgical ICU and Pain Center, Peoples University of Medical and Health Sciences for Women, Shaheed Benazir Abad, Sindh, Pakistan
Department of Physiology, Muhammad Medical College, Mirpurkhas Sindh, Pakistan
Department of Obstetrics and Gynecology, Ghulam Muhammad Mahar Medical College (GMMMC), Sukkur, Sindh, Pakistan
Department of Biochemistry, Peoples University of Medical and Health Sciences for Women, Shaheed Benazir Abad, Sindh, Pakistan
Department of Anatomy, Peoples University of Medical and Health Sciences for Women, Shaheed Benazir Abad, Sindh, Pakistan
Department of Molecular Biology and Genetics, Shaheed Benazir Bhutto University, Shaheed Benazirabad, Sindh, Pakistan

Keywords:
- Anemia
- Low birth weight
- Apgar score
- Small for gestational age babies

Abstract

Background: Anemia in pregnancy is a globally health-related issue, that affects both mothers and their newborn. Anemia during pregnancy across the world involves approximately 38% of the world population. To evaluate the effect of gestational anemia on perinatal outcome in the population. The aim of present study is to evaluate the effect of gestational anemia on perinatal outcome in the population of Hyderabad, Sindh, Pakistan.

Methods: A cross-sectional comparative analysis was conducted among pregnant mothers who were listed to give birth at Liaquat University of medical and health sciences Jamshoro/Hyderabad during the period of September 2018 to September 2019. The study population 400 were selected by convenient random sampling, and grouped into 2 on the basis of their Hb levels, with Hb < 11 gm% they were classified as anemic mothers, Hb ≥ 11 gm% were termed as non-anemic mothers, data was collected on the preformed questionnaire, and was analyzed on SPSS 21.

Results: The prevalence of anemia was 51.5% in in total population out of which, the incidence of normocytic normochromic anemia was highest 52.4 %microcytic hypochromic anemia was found in 19.4%, Overall, extremely low Apgar was found in 53 anemics, and 8 non. anemic mother’s infants, LBW incidence was 47.5 %; in anemic mothers, and 15.4 % in non-anemic group, the term, small for gestational age infants were 14.5% in anemic mothers, and 3.6% in non-anemic mothers, there were 36 preterm births to anemic mothers and 10 in non-anemic mothers. The incidence of caesarian section is 53.3% in anemic mothers compared to 30.9% in non-anemic mothers.

Conclusions: Anemia in pregnancy significantly increases risks of low Apgar, LBW, term SGA, preterm birth, and an increase incidence of caesarian section.

© 2021 The Author(s). Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Anemia is a global issue, that affects both developed and underdeveloped countries (Shah et al., 2020a). Anemia usually presents in all age groups and both genders, males and females, infant or adults (Didzun et al., 2019). In females of reproductive age, factors that may contribute to causing anemia include dietary deficiencies, poor socioeconomic status, multiparity or any other disease conditions (Pathan et al., 2021; Shah et al., 2020b). About 50% of cases gestational anemia occurs as a consequence of inadequate iron intake or depleted body stores (Bano et al., 2018). The requirement of iron in menstruating females is 1.5 mg/day
whereas in pregnant females it is 45 mg/day far greater than the non-pregnant requirement (Penney and Miller, 2008). There is an expansion in the volume of plasma during pregnancy which will lead to physiological, anemia, hence the WHO has set the Hb levels of 11 g/dl in pregnant women and 12 g/dl in normal women as a cut off for anemia (Sun et al., 2017). Anemia during pregnancy across the world involves around 32 million individuals, approximately 38% of the world population (Tan et al., 2020). According to recent researches 2/3rd of the pregnant population is affected by anemia (Ali et al., 2020). During pregnancy, anemia of mothers could lead to detrimental effects on the newborn (Sarah et al., 2018; Shah et al., 2020c). Anemia is not the only risk to mothers but low hemoglobin levels may lead to unfortunate consequences including low Apgar score, compromised birth weight, small for gestational age (SGA) babies, preterm labor, intrauterine growth retardation or intrauterine death (Shah et al., 2020c). Low Apgar scores can lead to neonatal morbidity (Rüdiger and Rozycki, 2020). There is a growing tendency in acquiring developmental deficiencies with Apgar score decreased at 1 and 5 mins (Razaz et al., 2019). Gestational age (SGA) babies, preterm labor, intrauterine growth retardation or intrauterine death (Shah et al., 2020c). Anemia is not the only risk to mothers but low hemoglobin levels may lead to unfortunate consequences including low Apgar score, compromised birth weight, small for gestational age (SGA) babies, preterm labor, intrauterine growth retardation or intrauterine death (Shah et al., 2020c). To assess the vitality of a newborn in the first min of life, we perform APGAR scoring (Saha and Saha, 2020). The fetal to neonatal transition can be recorded with Apgar score (Bovbjerg et al., 2019). Apgar is the assessment of the fetal well-being, where ‘A’ shows the appearance of a newborn, ‘P’ signifies pulse of the baby, ‘G’ stands for grimace, ‘A’ shows the activity of the baby, and ‘R’ is the respiratory rate of the newborn (Anwar et al., 2019a). Low Apgar scores can lead to neonatal morbidity (Rüdiger and Rozycki, 2020). There is a growing trend in acquiring developmental deficiencies with Apgar score decreased at 1 and 5 mins (Razaz et al., 2019). Gestational age (SGA) babies, preterm labor, intrauterine growth retardation or intrauterine death (Shah et al., 2020c). Apgar is the assessment of the fetal well-being, where ‘A’ shows the appearance of a newborn, ‘P’ signifies pulse of the baby, ‘G’ stands for grimace, ‘A’ shows the activity of the baby, and ‘R’ is the respiratory rate of the newborn (Anwar et al., 2019a). Low Apgar scores can lead to neonatal morbidity (Rüdiger and Rozycki, 2020).

2.2. Biochemical measurements

Hemoglobin of the participants was estimated by CBC haematology analyzer Celltac Alpha MEK-6500 (Nihon Kohden Germany). The fetal weight of the infant was measured on a weighing scale, newborn weight of <2500gms is considered as LBW, Ultrasound was used to assess SGA babies, mode of delivery was noted of the participants. Gestational age was calculated with LMP (last menstrual period) and confirmed with ultrasound.

2.3. Statistical analysis

Data was analyzed on SPSS 21.0. Students t-test and chi-square test was applied on the variables, p-value < 0.05 was considered as statistically significant.

2.4. Ethical consideration

The study was performed after the approval from Ethical Review Committee (ERC) of Physiology Department of University of Sindh, Jamshoro

3. Results

3.1. Morphological types of anemia in pregnant women

The results of this study show 206 (51.5%) anemic mothers and 194 (48.5%) non-anemic mothers, according to morphological types of anemia, the Mild normocytic normochromic anemia was reported in 108 (52.4%) Moderate normocytic normochromic in 26 (12.6%) and severe normocytic normochromic was found in 3 (1.46%). Similarly, it was 40 (19.4%) of mild microcytic hypochromic, 24 (11.6%) of moderate, and 5 (2.4%) of severe microcytic hypochromic cases respectively as shown in Table 1.

3.2. Hematological parameters in pregnancy

The mean ± SD age of the pregnant anemic mothers is 37.42 ± 6.32, and that of non-anemic mothers is 36.59 ± 7.23 with a p-value of 0.22, which is no significant. Hb g/dl was found to be 8.45 ± 7.65 in anemic mothers 12.1 ± 4.48 mean ± SD in non-anemic, with a p-value of 0.001, that is statistically significant. Serum iron μg/dl was found to be significant p = 0.001, with 62.9 ± 29.84, mean ± SD in anemic mothers vs 106.1 ± 14.8 mean ± SD in non-anemic mothers. Serum ferritin ng/dl in anemic mothers was 31.9 ± 10.98 mean ± SD, and 49.2 ± 17.97 mean ± SD in non-anemic mothers with a p = 0.034, as shown in Table 2.

Table 1

Anemia and its Morphological types in pregnant women.

| Gestational anemia | Number (n) | (%) |
|--------------------|------------|-----|
| Absent             | 194        | 48.5% |
| Present            | 206        | 51.5% |
| Normocytic Non-chronic (mild) anemia | 108 | 52.4% |
| Normocytic Non-chronic (moderate) anemia | 26 | 12.6% |
| Normocytic Non-chronic (severe) anemia | 3 | 1.46% |
| Microcytic Hypochromic (mild) anemia | 40 | 19.4% |
| Microcytic Hypochromic (moderate) anemia | 24 | 11.6% |
| Microcytic Hypochromic (severe) anemia | 5 | 2.4% |
3.3. Apgar score of babies in anemic and non-anemic pregnant women

The Apgar score of babies of anemic and non-anemic mothers, out of 206 anemic mothers the Apgar of 77 was low as compared to 129 normal Apgar scores. Similarly, in the non-anemic group, 12 out of 194 have low Apgar in comparison to 182 babies with normal Apgar score. Apgar score at 5 mins in both anemic and non-anemic groups also revealed statistically significant results, (P value 0.00001) as 70 out of 206 in the anemic group and 10 out 194 in non-anemic group showed low Apgar at 5 min, show statistically significant results with p- 0.00001) as shown in Table 3.

3.4. Infants Apgar score of anemic and non-anemic mothers

In this study Apgar score of extremely low (0–3), in Pregnant Anemic and non – anemic is found to be 53 (25.7%) vs. 8(4.1%), moderately low (4–6) in 24 (11.6%) vs.4(2.0%), and excellent condition (7–10) in 129 (62.6%) vs.182(93.8%) respectively (χ²value = 56.2, P = 0.00001). Severe and moderately depressed Apgar score is observed more in anemic mothers as compared to non-anemic mothers. Excellent condition of Apgar is observed more in non-anemic compared to anemic mothers. (182 vs. 129). As shown in Table 4.

3.5. Infant’s outcome of anemic and non-anemic mothers

The infant’s outcome is given, which shows that 98 (47.5%) of newborn of the anemic mothers are low birth weight as compared to 30(15.4%) in non-anemic group with a significant p-value of 0.0001, the incidence of small gestational age (SGA) babies is 30 (15.4%) in anemic population whereas 7 (3.6%) in non-anemic population, 36 (17.4%) babies were born before 37 weeks of pregnancy, and 170 (82.5%) were term babies in anemic group, similarly 10 (5.1%) were preterm and 184(94.8%) were term babies in non-anemic group, which is significant with a p-value 0.001, the mode of delivery is c/section 110 (53.3%) with 96 (46.6%) normal vaginal deliveries in anemic mothers, in non-anemic group there are 60 (30.9%) caesarian section, and 134 (69%) normal vaginal deliveries in non-anemic group which is statistically significant as shown in Table 5.

4. Discussion

In this study 51.5% of female population is suffering from anemia, in southeast countries it is reported to be 52% that is consistent to our study (Sunuw et al., 2020) another study concludes gestational anemia at 65% (Ibrahim et al., 2021) which is greater than our findings, the average age of the pregnant women in this study is 18 to 40 years, which is consistent to a study of china (Wu et al., 2020) which suggest anemia is common in pregnancy irrespective of age, young and old both age groups can be affected during gestation. Another study concludes that gestational anemia is common in young mothers with does not comply with our findings (Opitasari and Andayasari, 2015), In present study the anemia is predominantly normocytic normochromic variety with an incidence of 108(52.4%), similar results were reported by Melku (Melku et al., 2014) showing significant normocytic normochromic anemia, study from the mount Cameroon area shows anemia with 32.6% hypochromia, and 32.6% microcytosis which is greater than our findings. In our study it is found that 77 of the babies has low Apgar at 1 min, who are born to anemic mothers As compared to only 12 babies with low Apgar score in non-anemic mothers, this is consistent with study of Farah et al, which suggest there is 2.1 times increase incidence of low Apgar score in anemic mothers than non-anemic (Lone et al., 2004), another study also favors our findings that different ranges of Hb, will affect the maternal outcome in weight, Apgar and anthropometric indices of newborn (Afifi et al., 2013) whereas according to Cinzia (Orlandini et al., 2017) there is no effect of anemia on the Apgar of the newborn. Apgar at 5 mins also has 70 babies with depressed Apgar in anemic as compared to 10 in non-anemic mothers, similarly study conducted at Rawalpindi shows linear relationship between Apgar score at 1 and 5 mins of babies born to anemic and non-anemic mothers Ahmad and Kalsoom, 2015). In this study the birth low weight of the babies born to anemic mothers is found out be 47.5% which is consistent to study by Shweta (Kumari et al., 2015) according to which anemia leads to 32.9% of low birth weight babies. Biswas (Biswa et al., 2019) also agrees that the maternal anemia is high risk for low birth weight babies. The incidence of SGA in this study is 14.5% in anemic mothers and 3.6% in non-anemic population, which is less than another study conducted in Nepal, (Chaudhary et al., 2021) showing SGA prevalence of 20.3%.Another study shows there is no association of anemia with SGA babies (Badfar et al., 2019). In this study the number of infants

Table 2

| Hematological parameters | Anemic Hb < 11 g/dl N = 206 | Nonanemic Hb < 11 g/dl N = 194 | P-value |
|-------------------------|---------------------------|-------------------------------|--------|
| Age                     | 37.42 ± 6.23              | 36.59 ± 7.23                 | 0.22   |
| Hemoglobin(g/dl)        | 8.45 ± 3.65               | 12.1 ± 4.48                  | 0.0001 |
| Serum iron(µg/dl)       | 62.9 ± 29.84              | 106.1 ± 14.8                 | 0.0001 |
| Serum ferritin(ng/dl)   | 31.9 ± 10.98              | 49.2 ± 17.97                 | 0.034  |

Table 3

| Apgar score at 1 min | Anemic mothers n = (206) | Non anemic mothers n = (194) | Chi square (X²) | P-Value |
|----------------------|--------------------------|-------------------------------|----------------|---------|
| Apgar < 5            | 77                       | 12                           | 12             | 56.19   | 0.001  |
| Apgar > 5            | 129                      | 182                          | 10             | 51.88   | 0.001  |
| Apgar score at 5 mins| 70                       | 136                          | 10             | 51.88   | 0.001  |

Table 4

| Infants Apgar score of anemic and non-anemic mothers. |
|-----------------------------------------------|--------------------------|------------------------|----------------|
| Apgar Score of new born | Anemic mothers | Non -Anemic mothers | Chi-square | p. value |
|--------------------------|-----------------|----------------------|------------|---------|
| Extremely low (0-3)      | 53              | 8                    | 56.2       | 0.001   |
| Moderately low (4-6)     | 24              | 4                    |            |         |
| Excellent Condition (7-10)| 129            | 182                  |            |         |
| Total                    | 206             | 194                  |            |         |
born < 37 weeks is 36(17.4%) in anemic group, in comparison to 10(5.15%) pre-term births in non-anemic group. study by Srour et al. (Srour et al., 2019) also documented close association of low serum ferritin with low birth weight, and preterm birth. Another study from Rawalpindi (Anwar et al., 2019b) also shows higher 69% of preterm births in anemic population. In this study the immediate caesarian section in anemic population is 53.3% as compared to non-anemic population which is 30.9% similar results were noted in another study, 45% in anemic and 29% in non-anemic population (Mahmood et al., 2019) study from Jerusalem (Drukker et al., 2015) also confirm our findings that anemia will lead to elective caesarian section and placental problems.

The iron deficiency and the manifestations caused by its deficiency can be easily reduced by supplementation in the pre-natal period, which will help to reduce the risk for maternal and fetal morbidity and mortality.

5. Conclusion

Gestational anemia is a probable cause of low Apgar, low birth weight, and small for gestational age (SGA) babies.

6. Recommendations

It is recommended that large sample size should be used with the same pattern to generate more promising results.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

The researcher is thankful to the medical staff of the gynaec/obstetrics department of Liaquat university of medical and health sciences, for providing all the assistance and facilitation throughout the study.

References

Affi, Abdel-Raouf Abdel-Aziz. Rasha, Ali, Dina Kamal, Talkhan, Hamdy M., 2013. Pregnancy outcome and the effect of maternal nutritional status. J. Egypt. Soc. Parasitol. 43 (1), 125–132. https://doi.org/10.12818/00063722.
Ahmad, Muhammad Owais, Kalsoom, Umay, 2015. Effect of maternal anaemia on APGAR score of newborn. J. Rawalpindi Med. College (JRMC) 19.
Ali, Sameera Aziz, Abbaai, Zahed, Jabar, Ghazal Moin, K, Hambidge, Michael, Krebs, Nancy F., Westcott, Jamie E., McClure, Elizabeth M., Goldenberg, Robert L., Saleem, Sarah, 2020. Prevalence and determinants of anemia among women of reproductive age in Thatta Pakistan: findings from a cross-sectional study.
Means, Robert T., 2020. Iron Deficiency and Iron Deficiency Anemia: Implications and Impact in Pregnancy, Fetal Development, and Early Childhood Parameters. Nutrients. MDPI AG. https://doi.org/10.3390/nu12030447.

Melku, Mulugeta, Addis, Zelalem, Alem, Meseret, Eneawgaw, Bamlak, 2014. Prevalence and Predictors of Maternal Anemia during Pregnancy in Gondar, Northwest Ethiopia: An Institutional Based Cross-Sectional Study. Anemia 2014. https://doi.org/10.1155/2014/108593.

Opitasari, Cicih, Andayasari, Lelly, 2015. Young Mothers, Parity and the Risks of Anemia in the Third Trimester of Pregnancy. Health Sci. J. Indonesia 6.

Orlandini, Cinzia, Torricelli, Michela, Spirito, Nicoletta, Alaimo, Lucia, Di Tommaso, Mariarosaria, Severi, Filiberto Maria, Ragusa, Antonio, Petraglia, Felice, 2017. Maternal Anemia Effects during Pregnancy on Male and Female Fetuses: Are There Any Differences? J. Maternal-Fetal Neonatal Med. 30 (14), 1704–1708. https://doi.org/10.1080/14767058.2016.1222607.

Pathan, Nusrat Foiza, Unar, Foiza, Noor, Bushra, Aun, FarheenShahik Qurat ul, Shahik, Rehnaz, Ahnner, Arslan, 2021. Assessment of the Patterns of Exercise and Diet Intake among the Pregnant and Pre-Pregnant Women Reported at Gynae OPD Civil Hospital Khairpur, Sindh, Pakistan. J. Pharmaceut. Res. Int. 33 (12), 51–58. https://doi.org/10.5734/jpri-2021/v33i1231254.

Paudel, Gautam, 2020. Prevalence, Risk Factors and Consequences of Newborns Born Small for Gestational Age: A Multisite Study in Nepal. BMJ Paediatrics Open 4, 607. https://doi.org/10.1136/bmjpo-2019-000607.

Penney, Debra S., Miller, Kathleen C., 2008. Nutritional Counseling for Vegetarians During Pregnancy and Lactation. J. Midwifery Women’s Health 53 (1), 37–44. https://doi.org/10.1016/j.jmwh.2007.07.003.

Rahmati, Shaboo, Azami, Milad, Badjar, Ghoolamreza, Parizad, Naser, Sayehmiri, Kourosh, 2020. The Relationship between Maternal Anemia during Pregnancy with Preterm Birth: A Systematic Review and Meta-Analysis. J. Maternal-Fetal Neonatal Med. https://doi.org/10.1080/14767058.2018.1555811.

Razaz, Neda, Cartingtonius, Sven, Persson, Martina, Tedros, Kristina, Lisonkova, Sarka, Joseph, K.S., 2019. One-Minute and Five-Minute Apgar Scores and Child Developmental Health at 5 Years of Age: A Population-Based Cohort Study in British Columbia, Canada. BMJ Open 9 (5), 27655. https://doi.org/10.1136/bmjopen-2018-027655.

Rüdiger, Mario, Rozycki, Henry J., 2020. It’s Time to Reevaluate the Apgar Score. JAMA Pediatrics. doi:10.1001/jamapediatrics.2019.6016.

Saha, Sumanta, Saha, Sujata, 2020. A Comparison of Apgar Scores and Changes in the Neonates of Gestational Diabetes Mellitus Patients Treated with Metformin versus Glyburide: A Systematic Review. Dubai Diabetes Endocrinol. J. 26 (1), 21–26. https://doi.org/10.1159/000507244.

Sarah, Bibi, Sheikh, Khalida, Shah, Tazeen, 2018. Red Cell Distribution Width Is Early Marker for Detection of Iron Deficiency Anemia during Pregnancy. J. Liaquat Univ. Med. Sci 17 (3), 165–169. https://doi.org/10.22422/jlumsh.181730571.

Shah, Tazeen, Warsi, Jamshed, Laghari, Zulfiqar, 2020a. Effect of Maternal Anemia on the Anthropometric Indices of Newborn. JUMHS 19 (3), 191–194. https://doi.org/10.29309/jumhs.2020.27.05.3959.

Shah, Tazeen, Warsi, Jamshed, Laghari, Zulfiqar, 2020b. Anemia and Its Association with Parity. Profess. Med. J. 27 (05), 968–972. https://doi.org/10.9734/jpri/2021/v33i1231254.

Sun, Dongmei, McLeod, Anne, Gandhi, Shiital, Malinowski, Ann Kinga, Shehata, Nadine, 2017. Anemia in Pregnancy. Obstet. Gynecol. Surv. 72 (12), 730–737. https://doi.org/10.1097/OCG.0000000000000510.

Sunuwar, Dev Ram, Singh, Devendra Rai, Chaudhary, Narendra Kumar, Pradhan, Pranil Man Singh, Rai, Pushpa, Tiwari, Kalpana, 2020. Prevalence and Factors Associated with Anemia among Women of Reproductive Age in Seven South and Southeast Asian Countries: Evidence from Nationally Representative Surveys. PLoS ONE 15 (8 August). https://doi.org/10.1371/journal.pone.0236449.

Tan, Jing, He, Guolin, Qi, Yiquan, Liu, Xuehua, Wang, Wen, Zou, Kang, Lee, Andy H., Sun, Xin, Liu, Xinghui, 2020. Prevalence of Anemia and Iron Deficiency Anemia among Pregnant Women in China: A National Cross-Sectional Survey. BMC Pregnancy Childbirth 20 (1). https://doi.org/10.1186/s12884-020-03359-z.

Wu, Yu, Ye, Hanfeng, Liu, Jihong, Ma, Quyue, Yuan, Yanling, Pong, Qian, Liu, Jue, Kong, Cai, Liu, Min, 2020. Prevalence of Anemia and Sociodemographic Characteristics among Pregnant and Non-Pregnant Women in Southwest China: A Longitudinal Observational Study. BMC Pregnancy Childbirth 20 (1), 535. https://doi.org/10.1186/s12884-020-03222-1.