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Original article

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

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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 $\geq$ 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.

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

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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 haemoglobin 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' represents 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 tendency in acquiring developmental deficiencies with Apgar score decreased at 1 and 5 mins (Razaz et al., 2019). Gestational anemia in the first trimester is the leading cause of preterm birth (Silvo, 2018). Gestational anemia in first trimester is leading cause of preterm birth (Rahmati et al., 2020). In low-income countries, severe anaemia along with small for gestational age (SGA) babies are basic reasons for low birth weight outcome (Paudel, 2020). SGA is defined as the weight of the newborn is <10th percentile, or newborn is smaller than the normal of that gestational age (Col Madendag et al., 2019). The requirement for iron is increased in the late pregnancy, and that is the specific time when the fetus grows, inappropriate iron supply due to anemia may lead to SGA, (Means, 2020) the fetal morbidity and mortality is related to low birth weight, is also associated with growth and developmental anomalies (Lake and Fite, 2019). Serum low levels of Hb and ferritin are usually the causative factors which can lead to low birth weight babies (Bondevik et al., 2001). In this study it is intended to observe the effect of gestational anemia on the birth weight, Apgar score, gestational age, SGA babies, and mode of delivery of newborns.

2. Materials and methods

2.1. Study design and participants

This study is a cross-sectional study conducted at the department of the Physiology University of Sindh in collaboration with the department of gynaecology and obstetrics, Liaquat University of medical and health sciences Jamshoro, and with diagnostic and research lab, Hyderabad /Jamshoro, it was conducted from September 2018 to September 2019, after obtaining permission from the institutional review board committee department of physiology, viva letter no: IRB/120/AUG 2018, total 400 pregnant females were selected by convenient random sampling and were distributed into two groups depending on the serum Hb levels, pregnant women with Hb < 11 g/dl is considered as anemic group and females with Hb, values above this range were placed is non-anemic group. Inclusion criteria include pregnant women of 16 years or older with a singleton pregnancy, pregnant women with a previous history of pre-term birth, multiple pregnancy and obstetric complications were excluded from study.

2.2. Biochemical measurements

Hemoglobin of the participants was estimated by CBC haematology analyzer Celltac Alpha MEK-6500(Nihon Kohden Germany), calculation of Apgar was done according to the standard protocol. In APGAR scoring five factors (which APGAR stands for) were used to calculate the baby's condition and each scored on a scale of 0 to 2, with 2 being the best score. A baby who scored 8 or above was considered in good health and a score of <8 was considered low. 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, the 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 0.22, which is no significant, Hb g/dl is 8.45 ± 3.65 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-chromic (mild) anemia	108	52.4%
Normocytic Non-chromic (moderate) anemia	26	12.6%
Normocytic Non-chromic (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%

Table 2
Hematological parameters (mean ± SD and P- value) in study group

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

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. value0.00001) 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 (x^2value = 56.2, P = 0.00001). Severe and moderately depressed Apgar score is observed more in anemic mothers as compared to pregnant 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 (14.5%) 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 is anemic group, similarly 10 (5.15%) 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 (Sunuwar 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 new born. 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 (Biswas 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 no 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 3
Apgar score of babies at 1 and 5 mins in Anemic and Non-Anemic Pregnant Women.

Apgar score	Anemic mothers n = (206)		Non anemic mothers n = (194)		Chi square (X^2)	*P*-Value
	Apgar < 5	Apgar > 5	Apgar < 5	Apgar > 5		
Apgar score at 1 min	77	129	12	182	56.19	0.001
Apgar score at 5 mins	70	136	10	184	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		

Table 5
Infant's outcome of the anemic and non- anemic mothers.

Birth weight	Anemic n (%)	Non- anemic n (%)	x^2	*p*. value
Weight of infant (gm)				
Wt <2500gm=	98 (47.5)	30 (15.4)	47.3	0.0001
Wt>2500 gm=	108 (52.4)	164 (84.5)		
Term Small for gestational age				
T.SGA	30 (14.5)	7(3.6)	14.28	0.0001
T.AGA	176 (85.4)	187(96.3)		
Gestational Age				
G.A <37weeks	36 (17.4)	10(5.15)	14.9	0.0001
G.A >37 Weeks	170 (82.5)	184(94.8)		
Mode of delivery				
C/section	110 (53.3)	60(30.9)	20.64	0.0001
NVD	6 (46.6)	134(69.0)		

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., 2018) 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.

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