ORIGINAL ARTICLE

Antenatal Anemia: Predictor of Poor Maternal and Perinatal Outcome

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ABSTRACT

Objective: To assess the impact of antenatal anemia on maternal and perinatal outcome.

Design of the study: Prospective Cohort study

Place of Study: was conducted at antenatal clinic of Creek General Hospital, United Medical and Dental College, Karachi, Pakistan.

Methodology: One hundred and thirty-five singleton anemic pregnant women who satisfied the inclusion criteria were included in the study. Enrolled patients were analyzed in detail, sociodemographic and obstetric characteristics recorded and followed till delivery after their informed consent. Haemoglobin estimation was done at first visit & anaemia was graded according to WHO criteria and statistical analysis were done.

Results: The study population included 135 antenatal anemic women. Mean ± SD of maternal age was 25.8±5.12 years. Mild anemia was found in 31.1%, moderate in 59.2% and 9.6% women were diagnosed with severe anemia. Anemia was diagnosed in 1.5% of antenatal women in 1st trimester, 54.8% in 2nd trimester and 43.7% in 3rd trimester. Majority of patients were booked (87.4%), out of them 25.9% were diagnosed with mild anemia, 55.6% with moderate and 5.9% were severely anemic, while 12.59% were non-booked of those 5.2% were diagnosed with mild, 3.7 % with moderate and severe anemia each (p-value=0.003%). Maternal complications in antenatal and postnatal period included Preterm labour (13.33%), Pregnancy induced hypertension/ Pre-eclampsia (8.88%), Gestational diabetes mellitus (7.40%), oligohydramnios (11.85%) , antepartum hemorrhage (5.92%) and Postpartum hemorrhage (5.18%). 50.37% of pregnant women delivered vaginally while in 49.62 % abdominal delivery was conducted (Emergency-37 %, Elective -12.6%). Regarding Neonatal outcomes, Low Birth weight was found in 80% of cases which was highly significant, 20.7% were delivered by mildly anemic, 52.6% by moderately and 6.7% by severely anemic mothers (p value- 0.009). NICU admission within the first week of birth was needed in 47.40%, Still Birth (0.74%), Low APGAR scores (20.74%) and unfortunately two Neonatal Deaths occurred as well (1.48%).

Conclusion: Antenatal anemia is still a prevalent public health issue in developing countries. Provided that anemia is a straightforward predictor of poor maternal and fetal outcome, intensive prophylactic strategies to be implemented for timely diagnosis and management. The authorities should play their active role in refining policies to remediate the principal risk factors, provision of basic health care, reinforce proper antenatal care, maintain regular availability of iron and supplements for correction of anemia and other nutritional deficiencies.

Keywords: Anemia, Maternal and fetal outcome, Obstetric

INTRODUCTION

Globally antenatal anemia is a public health issue, mostly affecting underdeveloped regions. anemia in pregnancy is associated with poor maternal and perinatal outcome.[1] Anemia in pregnancy is reported around 42% of women across the world as estimated by WHO survey, and underdeveloped countries (52%) harbor almost double burden of disease as compared to developed countries (23%).[2] Antenatal anemia is highly prevalent in women of Sub-Saharan Africa (SSA) (57%), followed by Southeast Asia (48%), and only 24 % pregnant women were diagnosed with anemia in South America.[3]

Pregnancy complicated with anemia is associated with adverse maternal and perinatal outcome. Antenatal anemia is related with maternal morbidity and mortality according to its severity, it may lead to easy fatigability, concentration and memory problem, inability to perform at work properly, increased susceptibility to infections, increase load on cardiovascular system or cardiac decompensation, hypertension in pregnancy, increased susceptibility towards interventional delivery and increased risk of blood loss during and after delivery.[2,4-6] According to literature around one quarter of indirect deaths in low resource countries are contributed by anemia in pregnancy.[3]

maternal anemia is correlated with unfavorable perinatal consequences including, prematurity, low birth weight, intrauterine growth retardation, poor APGAR, death in utero, increased risk of neonatal and infant death.[3-4,6]

Majority of low birth weight infants attain appropriate growth by second year of their life, on contrary 15-20 % of these babies have insufficient growth throughout their early years of life.[7] Low birth weight leads to short height or stunting.

Preconception assessment and counseling for a planned conception after optimization of health consumption of iron supplements during pregnancy may reduce burden of disease and its adverse effects.[2,8]

Correction of iron deficiency and anemia accompanied by healthy diet intake, proper sanitation facilities, infection control and elevating the quality of life will help in reducing maternal and perinatal morbidity and mortality.[9]

This study was conducted at antenatal clinic of Creek General Hospital mostly serving women with low socioeconomic status, to assess the impact of antenatal anemia on maternal and perinatal outcome.

MATERIAL AND METHOD

This prospective Cohort study was conducted at antenatal clinic of Creek General Hospital, United Medical and dental College, Karachi, Pakistan from November 2019 to October 2020. The study population included 135 as computed the sample size 133 by using WHO sample size calculator, based on following assumptions complication in pregnant women due to anemia was calculated 14.5% from past research,[6] confidence interval 95% and absolute precision of 6%, then the estimated sample size is 133.

One hundred thirty-five patients were selected through non-probability convenience sampling technique. **singleton anemic pregnant** women who visited antenatal clinic at any gestational age and satisfied the inclusion criteria were included in the study after their informed consent. Women with multiple pregnancies, past history of preterm delivery, hemolytic disorder or medical illness except anemia, were excluded from the study. Enrolled patients were analyzed in detail, sociodemographic and obstetric

characteristics recorded and followed till delivery for maternal and perinatal outcome and any adverse consequences. Hemoglobin estimation was done at first visit by Sahli's method.[10] Blood samples were drawn and kept in tubes containing EDTA for complete blood count (CBC) of the blood samples. Anemia defined as hemoglobin concentration of less than 11 gm/dl. Furthermore, hemoglobin level was characterized into mild anemia (10.0-10.9 g/dL), moderate anemia (7 -9.9 g/dL) and severe anemia (<7.00 g/dL) according to WHO criteria.[11]

Pregnant women having hemoglobin > 11g/dl were given oral iron and women with severe anemia in late trimester or those who were non-compliant, not responding or intolerant to oral iron were treated with parenteral iron or blood transfusion per departmental guidelines as a routine antenatal care, no intervention was done for purpose of this undergoing study.

Details regarding maternal and perinatal outcome, including antenatal complications, gestational age at delivery, mode of delivery, post-partum hemorrhage, perinatal outcome noted in terms of still birth, birth weight, APGAR score, NICU admissions within first week of birth and neonatal death were recorded on a predesigned questionnaire.

The study was conducted after approval from the Institutional Ethical Committee. Participation in this study was on voluntary basis; every respondent was given a copy of the consent form. An assurance of privacy and confidentiality of the information was also given to the participants.

After collection of data, details entered and analysis conducted by using Statistical Package for Social Science (SPSS) software, Version 20. Mean and standard deviation were calculated for quantitative variables like age and parity. Frequency and percentages were calculated for qualitative variables including degree of anemia, maternal characteristics, trimester in which anemia diagnosed, mode of delivery, maternal complications in antenatal and postnatal period including Antepartum hemorrhage, Preterm labour, Pregnancy induced hypertension or preeclampsia, Gestational diabetes mellitus, Oligohydramnios and for perinatal outcomes as Still Birth, Low Birth Weight, NICU Admission, Low APGAR Score and Neonatal Death. Post stratification chi square test was applied, considering $P<0.05$ as significant.

RESULTS

The study population included 135 antenatal anemic women. Mean ± SD of maternal age was 25.8±5.12 years, while mean ± SD of parity was calculated to be 1.33±1.44. Mild anemia was found in 31.1%, moderate in 59.2% and 9.6% women were diagnosed with severe anemia. Anemia was diagnosed in 1.5% of antenatal women in 1st trimester, 54.8% in 2nd trimester and 43.7% in 3rd trimester. One hundred and ten women were having parity two or less than two, 26.7% had mild, 48.1% had moderate and 6.7% had severe anemia and twenty-five had more than two parity out of them, 4.4% suffered from mild, 11.1% moderate and 3% from severe anemia. Majority of patients were booked (87.4%), out of them 25.9% were diagnosed with mild anemia, 55.6% with moderate and 5.9% were severely anemic, while 12.59% were non-booked of those 5.2% were diagnosed with mild, 3.7 % with moderate and severe anemia each (p-value=0.003%).

Majority of women belonged to low socioeconomic status (67.40%). Regarding educational status, 46 women were illiterate, 47 were educated till primary level, 33 received secondary education while nine had higher education. (Table 1)

Maternal complications in antenatal and postnatal period included Preterm labour (13.33%), Pregnancy induced hypertension/ Pre-eclampsia (8.88%), Gestational diabetes mellitus (7.40%), Oligohydramnios (11.85%), antepartum hemorrhage (5.92%) and Postpartum hemorrhage (5.18%). 50.37% of pregnant women delivered vaginally while in 49.62 % abdominal delivery was conducted (Emergency-37 %, Elective - 12.6%).

Regarding Neonatal outcomes, Low Birth weight was found in 80% of cases which was highly significant, 20.7% were delivered by mildly anemic, 52.6% by moderately and 6.7% by severely anemic mothers (p value- 0.009).

Table 1:

Description			Frequency	Percentage
Demography	Age	Under 19	10	7.4
		20-30	104	77.0
		> 30	21	15.6
	Parity	0-2	110	81.5
		>2	25	18.5
	Booked	Yes	118	87.4
		No	17	12.6
	Socioeconomic Status	Low	91	67.4
		Middle	44	32.6
	Ethnicity	Balochi	7	5.2
		Bengali	6	4.4
		Gilgit	6	4.4
		Pashto	8	5.9
		Punjabi	19	14.1
		Sindhi	28	20.7
		Urdu	61	45.2
	Educational Status	Illiterate	46	34.1
		Primary	47	34.8
		Secondary	33	24.4
		Higher	9	6.7
Complications	Trimester	1st	2	1.5
		2nd	72	53.3
		3rd	61	45.2
	Mode of Delivery	SVD	68	50.4
		EMLSCS	50	37.0
		ELLSCS	17	12.6

Table 2:

Modifier		Degree of anemia			P-Value
		Mild	Moderate	Severe	
Age	Under 19 (n=10)	6 (4.4%)	4 (3.0%)	0 (0%)	0.118
	20-30 (n=104)	33 (24.4%)	60 (44.4%)	11 (8.1%)	

	> 30 (n=21)	3 (2.2%)	16 (11.9%)	2 (1.5%)	
Parity	0-2 (n=110)	36 (26.7%)	65 (48.1%)	9 (6.7%)	0.408
	>2 (n=25)	6 (4.4%)	15 (11.1%)	4 (3.0%)	
Booked	Yes (n=118)	35 (25.9%)	75 (55.6%)	8 (5.9%)	0.003
	No (n=17)	7 (5.2%)	5 (3.7%)	5 (3.7%)	
Socioeconomic Status	Low (n=91)	26 (19.3%)	54 (40.0%)	11 (8.1%)	0.312
	Middle (n=44)	16 (11.9%)	26 (19.3%)	2 (1.5%)	
Ethnicity	Balochi (n=7)	5 (3.7%)	2 (1.5%)	0 (0%)	0.209
	Bengali (n=6)	2 (1.5%)	3 (2.2%)	1 (0.7%)	
	Gilgit (n=6)	3 (2.2%)	2 (1.5%)	1 (0.7%)	
	Pashto (n=8)	5 (3.7%)	2 (1.5%)	1 (0.7%)	
	Punjabi (n=19)	4 (3.0%)	13 (9.6%)	2 (1.5%)	
	Sindhi (n=28)	5 (3.7%)	21 (15.6%)	2 (1.5%)	
	Urdu (n=61)	18 (13.3%)	37 (27.4%)	6 (4.4%)	
Educational Status	Illiterate (n=46)	13 (9.6%)	28 (20.7%)	5 (3.7%)	0.245
	Primary (n=47)	10 (7.4%)	31 (23.0%)	6 (4.4%)	
	Secondary (n=33)	16 (11.9%)	16 (11.9%)	1 (0.7%)	
	Higher (n=9)	3 (2.2%)	5 (3.7%)	1 (0.7%)	

A study revealed that to reduce maternal and fetal complications, anemia prevention and control of anemia among pregnant women is essential, which will help to have healthy and fruitful forthcoming generation.

Table 3:

| Complication			Degree of anemia			P-Value
			Mild	Moderate	Severe	
Maternal	Trimester	1st (n=2)	0 (0%)	1 (0.7%)	1 (0.7%)	0.001
		2nd (n=72)	12 (8.9%)	54 (40.0%)	6 (4.4%)	
		3rd (n=61)	30 (22.2%)	25 (18.5%)	6 (4.4%)	
	Mode of Delivery	SVD (n=68)	17 (12.6%)	40 (29.6%)	11 (8.1%)	0.089
		EMLSCS (n=50)	19 (14.1%)	29 (21.5%)	2 (1.5%)	
		ELLSCS (n=17)	6 (4.4%)	11 (8.1%)	0 (0%)	
	APH	Yes (n=8)	0 (0%)	7 (5.2%)	1 (0.7%)	0.145
		No (n=127)	42 (31.1%)	73 (54.1%)	12 (8.9%)	
	PPH	Yes (n=7)	1 (0.7%)	4 (3.0%)	2 (1.5%)	0.180
		No (n=128)	41 (30.4%)	76 (56.3%)	11 (8.1%)	
	PTL	Yes (n=18)	4 (3.0%)	12 (8.9%)	2 (1.5%)	0.681
		No (n=117)	38 (28.1%)	68 (50.4%)	11 (8.1%)	
	PIH/PE	Yes (n=12)	2 (1.5%)	9 (6.7%)	1 (0.7%)	0.483
		No (n=123)	40 (29.6%)	71 (52.6%)	12 (8.9%)	
	GDM	Yes (n=10)	3 (2.2%)	7 (5.2%)	0 (0%)	0.534
		No (n=125)	39 (28.9%)	73 (54.1%)	13 (9.6%)	
	OLIGO	Yes (n=16)	7 (5.2%)	7 (5.2%)	2 (1.5%)	0.402
		No (n=119)	35 (25.9%)	73 (54.1%)	11 (8.1%)	
Neonatal	Low Birth Weight	Yes (n=108)	28 (20.7%)	71 (52.6%)	9 (6.7%)	0.009
		No (n=27)	14 (10.4%)	9 (6.7%)	4 (3.0%)	
	NICU Admission	Yes (n=64)	16 (11.9%)	39 (28.9%)	9 (6.7%)	0.135
		No (n=71)	26 (19.3%)	41 (30.3%)	4 (3.0%)	
	Still Birth	Yes (n=1)	1 (0.7%)	0 (0%)	0 (0%)	0.328
		No (n=134)	41 (30.4%)	80 (59.3%)	13 (9.6%)	
	Low APGAR Score	Yes (n=28)	10 (7.4%)	15 (11.1%)	3 (2.2%)	0.788
		No (n=107)	32 (23.7%)	65 (48.1%)	10 (7.4%)	
	Neonatal Death	Yes (n=2)	0 (0%)	1 (0.7%)	1 (0.7%)	0.129
		No (n=133)	42 (31.1%)	79 (58.5%)	12 (8.9%)	
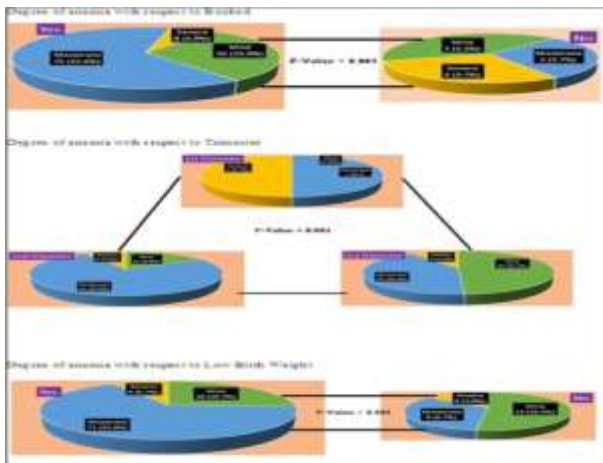
Figure 1:

Figure 2:

ICU admission within the first week of birth was needed in 47.40%, Still Birth (0.74%), Low APGAR scores (20.74%) and unfortunately two Neonatal Deaths occurred as well (1.48%). Maternal and neonatal complications were stratified for degree of anemia and p values calculated. (Table 2)

DISCUSSION

Anemia in pregnancy is a global public health problem, leading to maternal and fetal morbidity and mortality.

So recognizing the factor of anemia is an input to take evidence based interventions.[12]In current study moderate anemia was found to be most prevalent 59.2%, followed by mild anemia 31.1%, and severe anemia 9.6%. These results are close to the study done by chintanUpadhyay et al, which found the prevalence of moderate anemia as 53% followed by mild (29.5%) and severe (17.5%) respectively.[6,13]

Almost similar results were calculated by other studies, while Jufar AH and Zewde T found that, 80.95% had mild, 17.86% moderate and 1.19% had severe anemia.[4,14-16]

Mean ± SD of maternal age was 25.8±5.12 years in present study. Similarly, in a study conducted by gajendra et al, mean age of the subjects was 23.44 + 3.35 years.[13,14] Anemic women mainly belonged to age group of 20-30 years (77%), followed by above 30 years' group (15.6%) and under 19 group (7.4%) respectively.[16]While in a study by Prakash et al, age distribution was found to be highest among 25-30 years of age 74 (37%) followed by less than 25 years of age 70 (35%).[4]

In present study mean ± SD of parity was calculated to be 1.33±1.44. Among women having parity two or less, 26.7% had mild, 48.1% had moderate and 6.7% had severe anemia, while women who had more than two parities, 4.4% suffered from mild, 11.1% moderate and 3% from severe anemia in our study.

Prevalence of anemia was seen to increase with increase in parity and advancing gestational age in study conducted by Jin L et al,[17] nothing such observed in current study. Although statistically not significant, Majority of women belonged to low socioeconomic status (67.40%) and low educational level (illiterate- 34.1% and up to primary 34.8%) in current study.

As in many previous studies, anemia was directly proportional to low educational status and socio-economic status.[4,14] Low socioeconomic status leads to anemia due to lack of adequate nutrition. In study conducted by Shradha S Makka et al,[15] 82% belonged to low socioeconomic group while in survey by Rangnekar et al 67% of women belonged to low socioeconomic group.[15,18]

Education of women have direct impact on her socioeconomic status through better job and income. well educated and economically stable women are not at risk of nutritional anemia compared to her non educated counterparts due to the lack of information about sufficient nutrition during pregnancy, economic factors and the inaccessibility of health care centers.[19]

Empowerment of women and education are essential to combat maternal anemia and other health problems, and to ensure this multispectral collaboration is needed. In the present study 87%were booked out of which 26% has mild anemia, 55% has moderate and 6% has severe anemia, this was comparable with Awasthi A et al (83.5%).[15,20]

As observed in current study prevalence of anemia was mainly observed in second trimester (53.3%) followed by third trimester (45.2%). High number of cases of anemia in second trimester may be observed due to physiological changes of pregnancy contributing to anemia, as most of women book themselves late in third trimester that might be the reason of a smaller number of anemic women because of antenatal care and iron supplementation. In study conducted by Gajendra et al anemia prevalence increased with advancing gestational age.[14]

Antepartum hemorrhage is among one of frequent outcomes related to maternal anemia, but this study did not found any significant statistical association of antenatal anemia with APH and

the p-value is to be 0.145, this is line with Makrides M, et al and Ziaei S et al studies.[21,22] But in disagreement with study conducted by RuramayiRukuni et al.[23]In present study postpartum hemorrhage was observed in 5.18 % of cases which was comparable to study conducted by Maka SS et al. (4%).[14,24]

Significant association between maternal anemia and PPH was not observed in current study as p-value is to be 0.180, similar results were observed in RuramayiRukuni et al. but in contrast, it has been found in previous studies that severe anemia is associated with an increased risk of PPH.[8,10,23]

In this study preterm labor was observed in 13.33% of cases and association with degree of anemia was not significant, variant results were reported by previous studies for example 0.5% by Stephen G eta al and 9.5 % by Awasthi A et al.[22] while 20% of the women had preterm delivery as observed by Maka SS et al.[15,24]

It has been suggested that anaemia in pregnancy is associated with an increased risk of adverse pregnancy outcomes, such as hypertensive disorders.[19,21] In the present study, 8.8 % women had pregnancy induced hypertension/ pre-eclampsia. In comparison with it Awasthi A et al observed in 24.5% and ChintanUpadhyay et al in 22.5%. [13,20] Regarding Neonatal outcomes in our study, Low Birth weight was found in 80% of cases which was highly significant, 20.7% were delivered by mildly anemic, 52.6% by moderately and 6.7% by severely anemic mothers (p value- 0.009). NICU admission within the first week of birth was needed in 47.40%, Still Birth (0.74%), Low APGAR scores (20.74%) and unfortunately two Neonatal Deaths occurred as well (1.48%).

Low birth weight has been reported to be suboptimal pregnancy outcomes of anemia in previous studies. These results were in accordance with our findings. [8,21,25] Study conducted earlier by Levy A et al which revealed that there was higher rate of low birth weight among babies born to mothers who has anemia during pregnancy as compared to the babies born to non-anemic mothers.[1,24] Bakhtiar UJ et al conducted a study about association between maternal hemoglobin and perinatal outcome in 2007.[26] In present study the risk of giving birth to low birth weight babies among severe anemic women was 2.25 times more than non-anemic women and significant association was found between neonatal anemia and low birth weight. In Contrast, study conducted by Grace Stephen et al, there was low occurrence of negative pregnancy outcomes: LBW (3.6%), preterm births (0.5%), and stillbirth (2.3%).[3]

CONCLUSION

Antenatal anemia is still a prevalent public health issue in developing countries. Provided that anemia is a straightforward predictor of poor maternal and fetal outcome, intensive prophylactic strategies to be implemented for timely diagnosis and management. The authorities should play their active role in refining policies to remediate the principal risk factors, provision of basic health care, reinforce proper antenatal care, maintain regular availability of iron and supplements for correction of anemia and other nutritional deficiencies.

REFERENCES

1. Nair M, Gireesh S, Yakoob R, Cherian NC. Effect of maternal anaemia on birth weight of term babies. Int. J. Contemp. Pediatr. 2018 May;5(3):1019-22.
2. Harvey T, Zkik A, Auges M, Clavel T. Assessment of iron deficiency and anemia in pregnant women: an observational French study. Women's Health. 2016 Jan;12(1):95-102.
3. Stephen G, Mgongo M, Hussein Hashim T, Katanga J, Stray-Pedersen B, Msuya SE. Anaemia in pregnancy: prevalence, risk factors, and adverse perinatal outcomes in Northern Tanzania. Anemia. 2018 Oct;2018.
4. Prakash S, Yadav K, Bhardwaj B, Chaudhary S. Incidence of Anemia and its socio-demographic determinants among pregnant women attending for antenatal care: a cross sectional study. International Journal of Medical and Health Research. 2015 Oct;1(3):12-7.

5. Sabina S, Iftequar S, Zaheer Z, Khan MM, Khan S. An overview of anemia in pregnancy. J Innov Pharm Biol Sci. 2015;2(2):144-51.
6. Upadhyay C, Upadhyay N. Effect of anemia on pregnancy outcome: a prospective study at tertiary care hospital. Int J ReprodContraceptObstet Gynecol. 2017;6(12):5379-83.
7. Cutland CL, Lackritz EM, Mallett-Moore T, Bardají A, Chandrasekaran R, Lahariya C, Nisar MI, Tapia MD, Pathirana J, Kochhar S, Muñoz FM. Low birth weight: Case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine. 2017 Dec 4;35(48Part A):6492.
8. Farhana Y, Gulfareen H, Raheela Bilal S, Ambreen H, Nasirudin M. Impact of maternal anemia on perinatal outcome. PAFM. 2011; 61 (4): 610-3
9. Nusrat U, Karim SA, Nasim A. Comparison of fetal birth weight between anaemic and non anaemic pregnant women. DepObstetGynaecol Unit AbbasiShaheedHosp Karachi Med Dent Coll. 2014 Jul 1;19(2):85-90.
10. Balasubramaniam P, Malathi A. Comparative study of hemoglobin estimated by Drabkin's and Sahli's methods. Journal of postgraduate medicine. 1992 Jan 1;38(1):8.
11. Kessani L, Kumar R, Rathore A, Khalid R. Associated factors and compliance with iron-folic acid therapy among pregnant women of Karachi, Pakistan. Rawal Medical Journal. 2018 Apr 1;43(2):319-23.
12. Tadesse SE, Seid O, G/Mariam Y, Fekadu A, Wasihun Y, Endris K, Bitew A. Determinants of anemia among pregnant mothers attending antenatal care in Dessie town health facilities, northern central Ethiopia, unmatched case-control study. PloS one. 2017 Mar 13;12(3):e0173173.
13. Upadhyay C, Upadhyay N. Effect of anemia on pregnancy outcome: a prospective study at tertiary care hospital. Int J ReprodContraceptObstet Gynecol. 2017;6(12):5379-83.
14. Tomar GS, Singhal S, Shulka A. Anemia in pregnancy: Epidemiology and it's determinants. International Journal of Medical and Health Research. 2017;3(1):9-13.
15. Maka SS, Tondare SB, Tondare MB. Study of impact of anemia on pregnancy. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017 Nov 1;6(11):4847-51.
16. Rawat K, Rawat N, Mathur N, Mathur M, Chauhan N, Kakkar R, Tinna R. Prevalence and pattern of anemia in the second and third trimester pregnancy in Western Rajasthan. Int J Res Med Sci. 2016 Nov;4(11):4797-9.
17. Xu SZ, Jin L, Ye RW, Zheng JC, Yang RL, Tang JF, Cai LJ, Hu XH, Chen H, Sun XM, Li Z. Study on anemia among premarital women in 6 counties from 1993 to 2003. Zhonghualiu Xing Bing xuezazhi= ZhonghuaLiuxingbingxueZazhi. 2008 Jan 1;29(1):34-7.
18. Rangnekar AG, Rashmi D. Fetal outcome in pregnancy anemia. J ObstetGynecol India. 1993 Apr;43(2):172-6.
19. Lin L, Wei Y, Zhu W, Wang C, Su R, Feng H, Yang H. Prevalence, risk factors and associated adverse pregnancy outcomes of anaemia in Chinese pregnant women: a multicentre retrospective study. BMC pregnancy and childbirth. 2018 Dec;18(1):1-8.
20. Awasthi A, Thakur R, Dave A, Goyal V. Maternal and perinatal outcome in cases of Moderate and Severe anemia. J ObstetGynecol India. 2001 Dec;51(6):62-5.
21. Makrides M, Crowther CA, Gibson RA, Gibson RS, Skeaff CM. Efficacy and tolerability of low-dose iron supplements during pregnancy: a randomized controlled trial. The American journal of clinical nutrition. 2003 Jul 1;78(1):145-53.
22. Ziaei S, Norrozi M, Faghihzadeh S, Jafarbegloo E. A randomised placebo-controlled trial to determine the effect of iron supplementation on pregnancy outcome in pregnant women with haemoglobin≥ 13.2 g/dl. BJOG: An International Journal of Obstetrics &Gynaecology. 2007 Jun;114(6):684-8.
23. Rukuni R, Bhattacharya S, Murphy MF, Roberts D, Stanworth SJ, Knight M. Maternal and neonatal outcomes of antenatal anemia in a Scottish population: a retrospective cohort study. ActaobstetriciaetgynecologicaScandinavica. 2016 May;95(5):555-64.
24. Maka SS, Tondare SB, Tondare MB. Study of impact of anemia on pregnancy. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017 Nov 1;6(11):4847-51.
25. Tandon R, Jain A, Malhotra P. Management of iron deficiency anemia in pregnancy in India. Indian Journal of Hematology and Blood Transfusion. 2018 Apr;34(2):204-15.
26. Bakhtiar UJ, Khan Y, Nasar R. Relationship between maternal hemoglobin and perinatal outcome. Age. 2007; 25:24.