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Study on Relationship between Foetus, Neonatal & Maternal Haemoglobin Level

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Abstract
Objectives: *Our study was to find out the relationship between foetus, neonatal and maternal haemoglobin level of non-anaemic and anaemic mothers and their new borns.*
Methodology: *A total of 100 full term pregnant women and their full term newborn were enrolled in this study. A detail history, dietary pattern, clinical examination and relevant investigation were performed. Maternal blood and cord blood of newborns were examined. Haemoglobin level was estimated by Sahli's acid haematin method.*
Results: *Data was analyzed by using SPSS software. Mean, standard deviation and t value were observed. P value was taken ≤ 0.05 for significant differences.*
Conclusions: *Our study concluded that if the mother suffers from anemia, i.e. low hemoglobin level, the baby born to will also have low cord hemoglobin. Maternal anemia has a definite bearing on neonatal hemoglobin level.*
Keywords: *Anaemia, Pregnancy, Maternal blood, cord blood, Haemoglobin.*

Introduction

Anaemia is a common medical problem in pregnancy. The extent up to which maternal anaemia affects maternal and neonatal health is still uncertain[1]. India has reported high prevalence of anaemia in pregnancy. In one of the studies conducted on a large population, it was estimated that 87% of the Indian population of the Indian women are anemia[2].

Anemia is defined as the most common hematological disorder during pregnancy having decreased hemoglobin level or circulating red blood cells[3]. The World Health Organization (WHO) has estimated that prevalence of anemia in pregnant women was found 14% in developed, 51% in developing countries and 65-75% in India. Prevalence of anemia in all the groups is higher in India as compared to other developing countries. WHO recommends that hemoglobin ideally should be maintained at or above 11.0 g/dl in the second trimester[4].

Hematology of newborn recently represented as area of study that focusing in study of umbilical cord blood and its elements in general.[5] Umbilical cord blood count at birth shows that there is an increased in hemoglobin, hematocrit, mean corpuscular volume, leukocyte count, reticulocyte count and nucleated red blood cells with presence of occasional immature white blood cells or left-shifted in peripheral blood of healthy infants, with variable degree in immature sick newborns.[6] The mean cord hemoglobin value varies approximately between 16.6 and 17.1 gm/dl of blood.[7] The average hematocrit level approximately 0.55 L/L (55%) at birth.[8] The total white blood cell count at birth generally high in ranges between 9 and 30 x 109 / liter.[9]

Reticulocyte number at birth about 4% to 6% and reflected the activity of the red cell formation in fetal life.[10] Variable number of platelets during neonatal period was reported; figure reported at time of birth ranges from 150 x 109/liter to 350 x 109/liter.[11] Intrauterine fetus is maternal dependent from embryonic stage, fetal hood up to birth; hence anemia during pregnancy play a major role in causes of fatal life threatening to the mother and her fetus, and considered to make serious complications resulting from lower oxygen delivery, elevation of erythropoietin level, reticulocyte counts, and nucleated red blood cells of valuable inspections of neonatal healthy status.[12] Hence Increased erythropoietin level of cord blood at time of birth used as indicator markers for fetal hypoxia.[13]

Maternal and child health is an important problem of public health, influencing the development of the family and the community. Mother and infant protection is a priority in the health field because these population groups are the most exposed to the sickness and death, consequently to their low reactivity to the environmental factors and to their high responsiveness to the disorders[14].

Objectives of our study was to assess and determine the maternal haemoglobin (Hb) level on pregnancy outcome and to find out the association between maternal Hb level and its effect on neonates.

Materials and Methods

The present study was carried out on 100 full term pregnant women and their full term newborn admitted in the department of Obstetrics and Gynaecology, Katihar Medical College & Hospital, Katihar, Bihar, India during a period from January 2016 to December 2017. The attendants of entire subjects signed an inform consent approved by institutional ethical committee of Katihar Medical College, Katihar, Bihar was sought. The relevant investigations were carried out in the department of Physiology and upgraded department of Obstetrics and Gynaecology, Katihar Medical College, Katihar, Bihar.

Pregnant mothers without complications and their single born term normal neonates delivered spontaneously by vaginal route were considered for this study. Detail history of the mothers was noted and complete physical examination of them and their newborns was carried out.

Determination of hemoglobin level, P.C.V and total W.B.C count of mothers at the time of onset of labour was carried out. Same investigations were carried out on the cord blood of the newborns of these mothers.

Pregnant women with hemoglobin level of more than 12.0 gm/dl constituted the normal non-anaemic control group or group I. Pregnant women with hemoglobin level of less than 12.0 gm/dl were further divided into three anemic groups or case group (group II, III & IV). Group II: included pregnant women were with hemoglobin level of 9.1 to 12.0 gm/dl. Group III: included pregnant women with hemoglobin level of 6.1 to 9.0 gm/dl. Group IV: included pregnant women with hemoglobin level of less than 6.0 gm/dl. On the same pattern babies were assigned to their respective mother groups. A total of 100 pregnant women were enrolled in this study. Among 100 pregnant women, 25 pregnant non-anaemic women were in group I, 30 pregnant

anaemic women were in group II, 30 pregnant anaemic women were in group III and 15 pregnant anaemic women were in group IV.

Methods

Detail assessment and clinical examination were performed to all case like identification: name, address, age, religion, occupation, gravida, parity, Presenting complaints, menstrual history, obstetrical history, history of past illness, family history, personal history, socioeconomic status.

General examination: Appearance, built, state of nutrition, height and weight, pallor, cyanosis, jaundice, pulse, respiration, temperature, blood pressure, tongue, gums, clubbing, koilonychias, thyroid, lymphodenopathy, any other specific nutrition deficiency sign.

Systemic examination: Abdominal and pelvic examination: size of uterus interms of weeks, uterine contraction, lie and presentation of foetus, foetal heart sound. mothers cardiovascular system, respiratory system, digestive system and central nervous system.

Examination of newborn: Apgar scoring, weight, length, skin, heart, chest, abdomen, cord, rectum and genitilia, reflexes, circumference of head and circumference of chest.

Blood samples: Mothers venous blood and the cord blood of respective newborns were collected. Mother's blood was collected from antecubital vein 2-48 hours before delivery. Newborns blood was collected from umbilical cord just after delivery, when cord pulsation has ceased but before the placental separation.

Investigation done on maternal and cord blood: Estimation of Haemoglobin level, total R.B.C count, P.C.V. estimation, calculation of M.C.H and M.C.H.C.

Estimation of Haemoglobin

Haemoglobin estimation of both maternal and cord blood was done by Sahli's acid haematin method.

Principle: Anticoagulated blood is added to the 0.1 N HCl and kept for 5-7 minutes to form acid haematin. The color of this acid haematin should be matched with the solution, present in the calibration tube. Distilled water is added to the acid haematin until the color matches and the final reading is directly noted from the graduation in the calibration tube. [Please note that 100 percent on the scale corresponds to 14.5gm % to 15gm %].

Requirements: Sahli's haemoglobinometer, Hydrochloric acid, distilled water.

Procedure: Place N/10 HCL in diluting tube up to the mark 20. Take blood in the haemoglobin pipette up to 20-cubic-mm-mark and blow it into diluting tube and rinse well. After 10 minutes add distilled water in drops and mix the tube until it has exactly the same color as the comparison standards. Note the reading, which indicates the percentage of haemoglobin.

Precautions: i. Pipetting of blood should be done cautiously. ii. Mix the blood properly with HCl by using stirrer. iii. Match the color cautiously.

Determination of total R.B.C count:

Principles: A known volume of blood is diluted (200 times) with an isotonic solution containing anticoagulant. R.B.C. in a known volume of blood are counted in special counting chamber and number of R.B.C. per cu mm of blood is calculated there from.

Materials and Instruments

a) Whole blood, using EDTA or heparin as an anticoagulant. Using capillary blood.
b) Hayem's solution:Hgcl2 0.05g, NaSO4 2.5g, NaCl 0.5g and distilled water 100ml.
c) RBC pipette
d) Hemocytometer (Neubauer's counting chamber) with coverslip.
e) Microscope.
f) Lancet.
g) Alcohol 70%.
h) Pipette rotator
i. Aspirator connected to a faucet with running water.

Procedure

a) Wipe finger with cotton soaked with alcohol, with a sterile lancet do small prick

on the finger tip. Use pipette. Aspirate blood to 0.5.

b) Aspirate diluting Hayem's solution to the 101 mark.
c) Hold the pipette horizontally and role it with both hands between finger and thumb.
d) Touch the tip of the pipette on the surface of the counting chamber 45 degree.
e) Place the chamber on the stage of the microscope and allow 2 minutes for the cell to settle.
f) Scan the counting area with 10x objective lens.
g) Use 45x objective, include all cells lying on the upper and left lines of any sequare, omit the cells on the lower and right- hand lines.
h) Count the cells in five groups of 16 small sequares i.e 80 small sequares.

Calculation: The total number of red cells/c.mm=NX 10 000, where N is the number of red cells found in 80 squares.

Determination of packed cell volume

Principle: packed cell volume is determined by centrifuging a sample of blood made uncoagulable by a suitable anticoagulant.

Apparatus and reagent:

1. Wintrobe's haematocrit tube.
2. Anticoagulant mixture (potassium oxalate + ammonium oxalate)

Procedure: 2 ml of blood was added in a test tube containing anticoagulant mixture. This was thoroughly mixed by gently shaping and rotating the test tube. This blood was drawn in the Wintrobe's haematocrit tube up to zero mark. It was centrifused at the speed of 3000 r.p.m for a period of one hour. Then direct reading was taken of the upper limit of packed cells. This used the packed cell volume as percentage, of the original blood.

Calculation of Mean Corpuscular Haemoglobin

Mean Corpuscular Haemoglobin (M.C.H) is the average amount of haemoglobin contained in a single R.B.C. and is expressed in micro-microgram.

M.C.H = Hb in gm/100 ml of blood ÷R.B.C. in million/cu. mm of blood x 10

Normal range of M.C.H IS 24-33 micro-microgram.

Calculation of Mean Corpuscular Haemoglobin Concentration

Mean corpuscular haemoglobin concentration (M.C.H.C) is the percentage saturation of red cell with haemoglobin.

M.C.H.C. = Hb in gm/100 ml of blood ÷ P.C.V. 100/ml of blood x 100.

Normal range of M.C.H.C is 30-36 %.

Statistical Analysis

Date was analyzed by using the SPPSS software. Mean, standard deviation, t value were calculated. P value was taken less than 0.05 for significant differences.

Observation

A total of 100 full term pregnant women and their full term newborn (25: non-anaemic, 30: mild anaemic, 30: moderate anaemic and 15: severe anaemic) were enrolled in this study.

Table.1. Distribution of cases according to maternal haemoglobin level in gm percent

Group		Maternal Hb in gm percent	No. of cases
Non-anaemic	Group I (Control)	12.1 – 14.8	25
Anaemic	Group II	9.1 – 12.0	30
	Group III	6.1 – 9.0	30
	Group IV	3.4 – 6.0	15

Table.2 Showing mean value and standard deviation of maternal Hb in control group and case group mothers.

Mothers	Hb in gm percentage	
Group I (Control)	Mean	Standard deviation
	13.28	0.74
Group II (Anaemic)	9.95	0.91
Group III	7.35	0.85
Group IV	4.85	0.81

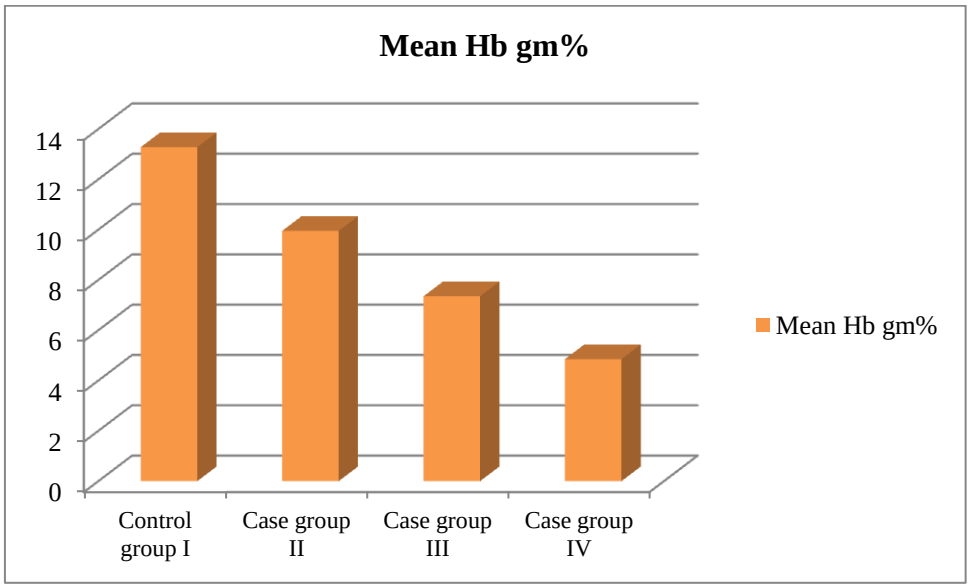

Figure.1. Mean value of maternal Hb of non-anaemic (control group) and anaemic (case group) mothers.

Table.3 Comparison of mothers Hb level of control group (non-anaemic) with case group(anaemic).

Group	t-value	Df	P value	Conclusion
Group I with Group II	11.17	53	< 0.001	Significant
Group I with Group III	21.81	47	< 0.001	Significant
Group I with Group IV	24.97	27	< 0.001	Significant

When group I was compared with group II, group III and group IV, p value was found to be less than 0.05. That was highly significant.

Table.4. Showing maternal R.B.C. count in millions/cu.mm, mean value and standard deviation of control and case group.

Group	R.B.C. in million/cu.mm.		
	Range	Mean	S.D
Group I	3.4 - 4.5	3.98	0.27
Group II	3.1 - 4.2	3.75	0.29
Group III	2.8 – 4.2	3.51	0.35
Group IV	2.0 – 3.4	2.72	0.34

Table.5 Comparison of R.B.C. count of group I with group II, group III and group IV

Group	t-value	df	P-value	Conclusion
R.B.C. count of group I with group II	2.47	56	< 0.01	Significant
R.B.C. count of group I with group III	4.31	47	< 0.001	Highly significant
R.B.C. count of group I with group IV	7.17	23	< 0.001	Highly significant

Above table shows statistically significant fall in R.B.C. count in different groups of anemic mothers as compared with those of control group.

Table.6. Mean value and standard deviation of maternal P.C.V of mothers of control group and case group.

Mothers	Packed cell volume in ml. percent		
	Range	Mean	S.D
Group I	38-48	42.76	2.47
Group II	30-43	35.40	3.71
Group III	24-42	33.26	4.43
Group IV	17-29	23.92	3.67

Table.7 Comparison of P.C.V. of normal mothers of group I with anemic mothers of case group II, III and IV

Mothers	t-value	df	p-value	Conclusion
Group I with Group II	7.59	61	< 0.001	Highly significant
Group I with Group III	23.76	49	< 0.001	Highly significant
Group I with Group IV	32.91	31	< 0.001	Highly significant

Above table shows that there was statistically significant fall in P.C.V. values in different groups of anemic mothers as compared with those of control group.

Table. 8. Mean value and standard deviation of maternal M.C.H in micro micrograms of mothers of control and case group.

Mothers	Mean Corpuscular Hb in micro micrograms		
	Range	Mean	S.D
Control group I	31.70 – 35.52	33.46	1.05
Case group II	23.33 – 29.37	26.66	0.17
Case group III	18.00 – 25.31	21.60	1.62
Case group IV	15.65 – 22.30	17.69	1.00

Above table shows significant fall in M.C.H. values in different group of anemic mothers as compared with those of control group non-anemic mother.

Table. 9. Ranges, mean values and standard deviation of maternal M.C.H.C. values of mothers of control group and case group.

Mothers	M.C.H.C, in percent		
	Range	Mean	S.D.
Control group I	29.54 – 33.09	31.11	0.80
Case group II	25.55 – 32.33	28.32	1.88
Case group III	19.41 – 27.34	22.98	2.06
Case group IV	17.30 – 22.50	20.35	1.49

Above table shows that there was significant fall in M.C.H.C. values in different groups anemic mothers (case group) as compared with those of mothers of control group.

Table. 10. Range, mean and standard deviation of cord blood haemoglobin level of newborns of mother of control group (non-anemic mothers) and case group (anemic mothers).

Mothers			
	Range	Mean	S.D.
Control group I	13.5 – 19.3	15.96	1.79
Case group II	11.5 – 17.3	13.9	1.63
Case group III	11.5 – 16.1	13.44	1.25
Case group IV	13.4 – 18.3	14.28	0.57

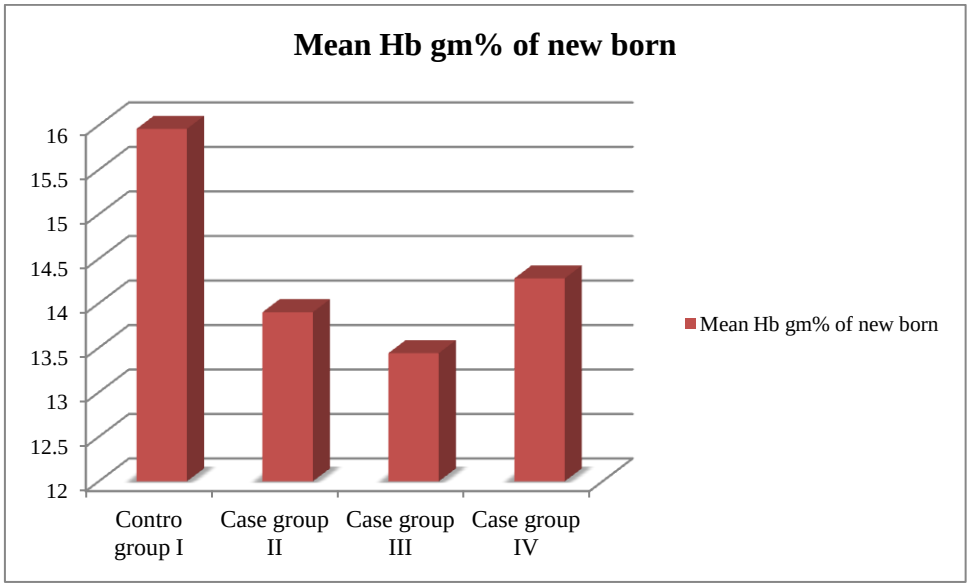

Figure.2. Cord Hb level of newborn of mothers of control group and case group

Table.11. Comparison of cord blood Hb of newborns of control group with case group.

Group	t-value	df	P value	Conclusion
Group I with Group II	4.08	59	< 0.001	Highly significant
Group I with Group III	4.13	43	< 0.001	Highly significant
Group I with Group IV	3.94	27	< 0.001	Highly significant
Group II with Group III	0.47	71	> 0.05	No significant
Group II with Group IV	0.91	49	> 0.05	No significant
Group III with Group IV	0.73	39	> 0.05	No significant

Above table shows that when cord blood Hb of control group was compared with case group, it was highly significant. But, when intra group analysis was done in case group (group II), it was not significant differences.

Table.12. Range, mean and standard deviation of cord blood R.B.C. count in millions/cu.mm of newborns of mother of control group and case group.

Newborns	R.B.C. count in million/cu.mm.		
	Range	Mean	S.D
Control group I	4.0 – 6.2	5.1	0.63
Case group II	3.6 – 5.3	4.52	0.48
Case group III	3.4 – 4.6	4.03	0.29
Case group IV	3.8 – 4.7	4.15	0.29

Table.13 Comparison of cord blood R.B.C. count of newborn of control group with case group.

Group	t- value	df	p- value	Conclusion
Group I with Group II	2.71	59	< 0.01	Significant
Group I with Group III	3.57	47	< 0.001	Highly significant
Group I with Group IV	3.93	26	< 0.001	Highly significant
Group II with Group III	1.02	71	> 0.05	Not significant
Group II with Group IV	2.29	49	> 0.05	Not significant
Group III with Group IV	0.51	39	> 0.05	Not significant

Above table shows that when cord blood R.B.C. of newborn of control group was compared with case group, it was found to be highly significant. But when intra group comparison of cord blood R.B.C. of newborn of mothers of case group, it was not significant differences.

Table. 14. Range, mean and standard deviation of cord blood P.C.V. value of newborn of mothers of control group and case group.

Group	Packed cell volume in ml. percent		
	Range	Mean	S.D.
Control group I	43 - 61	51.28	4.99
Case group II	38 - 56	46.76	4.98
Case group III	39 - 48	43.33	2.67
Case group IV	39 - 49	43.66	3.33

Table.15. Comparison of P.C.V. of newborn of mothers of Control group with Case group.

Group	t-value	df	p-value	Conclusion
Group I with Group II	6.317	59	< 0.001	Highly significant
Group I with Group III	9.326	50	< 0.001	Highly significant
Group I with Group IV	8.416	31	< 0.001	Highly significant
Group II with Group III	3.81	69	< 0.01	Significant
Group II with Group IV	4.03	47	< 0.01	Significant
Group III with Group IV	1.61	29	> 0.801	Not significant

Above table shows that when cord blood P.C.V. value in newborn of control group was compared with case group, differences was highly significant. When intra group comparison of case group II with case group III and case group IV, difference was significant. But intra group comparison of case group III with case group IV, there was found to be not significant differences.

Table.16. Range, mean and standard deviation of M.C.H. value of cord blood of newborn of mothers of control group and case group

Group	M.C.H. in micro micrograms		
	Range	Mean	S.D.
Control group I	27.73 – 34.28	31.73	1.53
Case group II	28.77 – 33.80	30.71	1.36
Case group III	27.04 – 37.56	34.07	2.14
Case group IV	31.86 – 39.23	34.31	2.13

Above table shows that M.C.H. values of cord blood of newborns of control group and different group of case group do not fall in spite of fall in maternal hemoglobin level.

Table.17. Range, mean and standard deviation of M.C.H.C. values of cord blood of newborns of control group and case group

Group	M.C.H.C. in percent		
	Range	Mean	S.D.
Control group I	28.43 – 32.79	30.98	1.005
Case group II	26.72 – 33.00	29.73	1.09
Case group III	29.31 – 35.34	31.58	1.4
Case group IV	30.68 – 36.41	32.72	1.09

Above table shows that M.C.H.C. level in cord blood of newborns of case group was not fall in spite of fall in maternal hemoglobin level.

Discussion

There is a significant association between maternal Hb level and pregnancy outcome like type of delivery, birth weight. Study conducted on risk for preterm delivery and low birth weights are independently increased severity of maternal anaemia.

This study compromised of 100 pregnant women from different socioeconomic strata with varying nutrition status. Out of 100 pregnant women 25 served as normal non-anemic control group. This group having hemoglobin level above 12.0 gm/dl with a mean value of 14.03 gm/dl was labeled as non-anemic control group I.

Remaining 75 pregnant women with hemoglobin level bellow 12.0 gm/dl were designated as anemic case group. This case group was further divided into three groups. Group II: Included 30 pregnant women with hemoglobin ranges from 9.1 gm/dl to 12.0 gm/dl. Group III: included 30 pregnant women with hemoglobin ranges from 6.1 gm/dl to 9.0 gm/dl. Group IV: included 15 pregnant women with hemoglobin level of 6.0 gm/dl and bellow (table 1).

This arbitrary grouping of the degree of maternal anemic on the basis of their hemoglobin content was done in accordance with the line adopted Goswami et al (2014).[15]

The anemic pregnant mothers (case group) with hemoglobin bellow 12 gm/dl were suffering from iron deficiency anemia by the presence of low hemoglobin level, low R.B.C. count, decreased P.C.V., M.C.H. and M.C.H.C. values.

The mean hemoglobin level of Group I mothers serving as control was 13.28 gm/dl, with a range of 12.1-14.0 gm/dl, standard deviation ± 0.74. The mean hemoglobin level of group II mothers was 9.96 gm/dl with a range of 9.1-12.0 gm/dl, standard deviation being ± 0.91. This value for group III and group IV mothers was 7.35 gm/dl (ranges 6.1-9.0 gm/dl, S.D. ± 0.85) and 4.85 gm/dl (range 3.4-6.0 gm/dl, S.D. ± 0.81) respectively.

The R.B.C. count of control group I mothers ranges from 3.4 - 4.5 millions/cu.mm. with a mean value of 3.98 millions/cu.mm., S.D.± 0.27. in case group II mothers R.B.C. count was ranging from 3.1 - 4.2 million/cu.mm with a mean value of 3.75 million/cu.mm., S.D. ± 0.29. In group III mothers the R.B.C. count ranges from 2.8 – 4.2 million/cu.mm with a mean value of 3.5 million/cu.mm., S.D. ± 0.35. The R.B.C. count of case group IV mothers ranged from 2.1 – 3.4 million/cu.mm with a mean value of 2.72 millions/cu.mm., S.D. ± 0.34.

The P.C.V. of control group I ranged from 38 – 48% with a mean value of 42.76, S.D. ± 2.47. While that of group II mothers ranged from 30-43 % with a mean value of 35.40 %, S.D. ± 3.71. In group III mothers the ranged of P.C.V. values was 24 – 42 % with a mean value of 33.26%, S.D. ± 4.43 and in group IV mothers this values was ranging 17 – 29% with a mean value of 23.92%, S.D. ± 3.67.

The maternal M.C.H. value for control group I was 31.7 – 35.52 micro microgram with a mean of 33.46 micro microgram, S.D. ±1.05. The M.C.H. level of group II mothers ranged from 23.33 – 29.37 micro microgram with a mean value of 26.66 micro microgram, S.D. ± 0.71. In group III mothers the M.C.H. value was 18.00 – 25.31 micro microgram with a mean value of 21.60 micro microgram, S.D. ± 1.62. In group IV mothers the M.C.H. values was 15.65 – 22.30 micro microgram with a mean value of 17.69 micro microgram, S.D. ± 1.80.

The M.C.H.C. of control group I mothers was in the range of 29.54 – 33.09 % with a mean value of 31.11 %, S.D. ± 0.8. In group II mothers M.C.H.C ranged from 25.55 – 32.33% with a mean value of 28.32%, S.D. ± 1.88. The M.C.H.C. of group III mothers ranged from 19.41 – 27.24 % with a mean value of 22.98%, S.D. ± 2.86. In group IV mothers the M.C.H.C. value ranged from 17.30 – 22.50 % with a mean value 0f 20.35%, S.D. ± 1.49.

On subjecting the above data to statistical analysis in differences in the mean hemoglobin, R.B.C. count and P.C.V. of control group I and anemic group II, III and IV were found to statistically significant, p value < 0.001. Similarly, M.C.H. and M.C.H.C. values also showed statistically significant.

The cord hemoglobin level of newborns to control group I was in the range of 13.5 – 19.3 gm/dl with a mean value of 15.96 gm/dl, S.D. ± 1.79. The newborns to group II mothers had cord hemoglobin level ranging from 11.5 – 17.3 gm/dl, with a mean value of 13.9 gm/dl, S.D. ± 1.63. the babies born to group III mothers had cord hemoglobin level ranging from 11.5 – 16.1 gm/dl with a mean value of 13.44 gm/dl, S.D. ± 1.25. The cord hemoglobin level of babies born to group IV mothers ranged from 13.4 – 15.3 gm/dl with a mean value of 14.28 gm/dl, S.D. ± 0.57. On

subjecting these data to statistical analysis the cord hemoglobin of newborn to non-anemic control group I was found to be significantly higher than those belonging to anemic case group II, III and IV. On the other hand it was also observed that the difference between cord hemoglobin of neonates delivered to group II, III and IV mothers were not statistically significant with the p value being more than 0.05.

A drop in maternal hemoglobin level from a mean value of 13.28 gm/dl to 9.95 gm/dl resulted in a significant fall of cord blood hemoglobin level with p value being less than 0.001. However, further fall in maternal hemoglobin to 7.35 gm/dl and 4.85 gm/dl did not result in any significant decline in hemoglobin level of the cord blood of babies born to those mothers.

The mean value of total R.B.C. count in control group I mothers was 5.1 millions/cu.mm, S.D. ± 0.63 with a range of 4.0 – 6.2 millions/cu.mm. In case group II mothers the means total R.B.C. count was 4.52 millions/cu.mm, S.D. ± 0.48 with a range of 3.6 – 5.3 millions/cu.mm. The mean total R.B.C. count of the cord blood of newborns of group III was 4.03 millions/cu.mm, S.D. ± 0.29 with a range of 3.4 – 4.6 millions/cu.mm. In group IV newborns the total R.B.C. count in cord blood ranged from 3.8 – 4.7 millions/cu.mm with a mean value of 4.13 millions/cu.mm, S.D. ± 0.29. On statistical analysis a significant differences was observed between total R.B.C. count of cord blood of babies born to case group(anemic) and control group (non-anemic) mothers. It was further observed that a fall in maternal hemoglobin level from 13.20 to 9.95 gm/dl resulted in a significant fall in cord blood total R.B.C. count of the babies. However, further lowering of maternal hemoglobin level failed to produce any significant lowering of R.B.C. count in respective cord blood.

The P.C.V. value of babies born to non-anemic control group I mothers was in the range of 43 – 61% with a mean value of 51.28%, S.D. ± 4.99. In the cord blood of babies born to group II, III and IV mothers, the P.C.V. values ranged from 38 to 51%, 39 to 48% and 39 to 49% with the mean value of 46.76 ± 4.98, 43.33 ± 2.67 and 43.66 ± 3.33 respectively. The P.C.V. values also showed similar pattern on statistical analysis, i.e. significant difference was noted in P.C.V, values of babies born to anemic and non-anemic mothers.

The M.C.H. value of babies born to non-anemic control group I ranged from 27.73 – 34.28 micro microgram with a mean value of 31.73, S.D. ± 1.53. This value in cord blood of babies born to case group II, III and IV mothers were in the range of 28.77 – 33.80 micro micrograms, 27.04 - 37.56 micro micrograms and 31.86 – 39.23 micro micrograms with the mean value of 30.71 ± 1.36, 34.07 ± 2.14 and 34.31 ± 2.13 respectively. On statistical analysis it was seen that fall in maternal hemoglobin level does not produce any significant decline in M.C.H. value of cord blood of babies born to such mothers.

Elgari and Waggiallah et al (2013) was studied on anaemic and anaemic mothers and their neonates, their findings supported the findings of our study.[16]

Summary & Conclusion

Investigations were conducted on one hundred full term pregnant women with uneventful gestation and their single born full term normal babies to elucidate the effect of maternal low hemoglobin level on the hemoglobin level of the newborns. All the babies were born spontaneously through vaginal route.

A series of haematological investigations namely haemoglobin estimation, R.B.C. count, P.C.V. estimation and calculation of M.C.H. and M.C.H.C. were done 2 – 48 hours before delivery on maternal blood with a purpose of establishing the presence or otherwise of iron deficiency anemia and to determine its severity.

The normal non-anemic controls designated as group I compromised of 25 pregnant women having a hemoglobin level of more than 12.0 gm/dl. The remaining 75 pregnant women having hemoglobin level below 12.0 gm/dl were regarded as anemic case group and were further devided

into three groups (group II: Hb range 9.1 – 12.0 gm/dl, group III: Hb range 6.1 – 9.0 gm/dl and group IV: Hb range 6.0 gm/dl or less).

After delivery, the newborns were assigned to their mothers group. These newborns were subjected to the same set of investigations which were carried out on their mothers prior to delivery. The results of these investigations were analyzed statistically and the level of their significance was determined.

For group I, II, III and IV newborns, the mean hemoglobin value was 15.96 gm/dl, 13.9 gm/dl, 13.44 gm/dl and 14.26 gm/dl respectively.

When maternal hemoglobin falls from the level above 12.0 gm/dl to a range between 9.1 to 12.0 gm/dl, there occurs a significant fall ($p<0.001$) in cord blood hemoglobin level. However, a further fall in maternal hemoglobin does not result in any significant fall ($p<0.05$) in cord blood hemoglobin level of the respective newborn.

Values of R.B.C. count, P.C.V., M.C.H., and M.C.H.C., of mothers belonging to various groups and their newborns cord blood, more or less similar results were obtained.

Thus, it could be propounded that interrelationship between maternal and neonatal hemoglobin level is more complex than ordinarily conceived. However, it can be concluded from this study that maternal anemia has a definite bearing on neonatal hemoglobin level.

Hence we concluded that, if the mother suffers from anemia, i.e. low hemoglobin level, the baby born to will also have low cord hemoglobin level and it may also be the cause of anemia in further stages of his growth as an individual.

Relevance to Cinical Practice

In our country, anemia associated with malnutrition is very common, especially among poor socio-economic groups. Furthermore, in our country, anemia antedates pregnancy and gets aggravated during pregnancy and labour. It is further propounded by successive pregnancies and lactation. Therefore, it is essential to improve the nutritional status of women by combating faulty dietary habits arising from poverty, ignorance of food values, illiteracy and superstitions.

We can be safely recommended that public health programs should give top priorities to program to ensuring adequate hemoglobin level by proper screening program and nourishment to expectant mothers.

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