IJBPAS, September, 2018, 7(9): 1822-1831

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

HEMATOLOGICAL PROFILE OF PRETERM INFANTS SUFFERING FROM ANEMIA

MALIK A[1], AMIN G[2], ALVI HT[3], PARVEEN G[1], WAQUAR S[1], ZAHID A[1] AND ALI Q[1]

1: Institute of Molecular Biology and Biotechnology (IMBB), The University of Lahore-Pakistan

2: University College of medicine and dentistry (UCMD), The University of Lahore-Pakistan

3: Fatima Jinnah Medical University, Lahore-Pakistan

***Corresponding Author: Arif Malik (PhD): Email: arifuaf@yahoo.com; Cell: 0321-8448196**

Received 20th March. 2018; Revised 7th April 2018; Accepted 12thMay 2018; Available online 1st Sept. 2018

https://doi.org/10.31032/IJBPAS/2018/7.9.4549

ABSTRACT

Preterm labor is one of the major concerned due to high death rate among children less than 5 years of age. According to a survey report from UNICEF in 2016, Pakistan stands on second number amongst the top ten countries where the death rate due to complications in premature birth is two-third. Preterm labor has been linked with various morbidities among which one is anemia. Premature infants suffer from anemia due to increased iron demand, loss of blood because of phlebotomy and physiological drop-off in the level of hemoglobin Assessment of various blood profile and their role in the development of anemia in preterm infants.Hundred premature infants and hundred normal infants were taken as healthy control. For the assessment 5ml blood was taken and serum was separated and stored at -75 degrees for the biochemical analysis. Subjects were determined for the number of biochemical and physiological parameters such as Complete Blood Count (CBC) with the help of automated Coulter by Beckman Coulter, Inc.Mean body weight (Kg) and age (YRS) of preterm anemic infants was 1.36±0.645 and 27.56±4.26 in comparison with full-term infants 2.87±0.913 and 37.59±5.26 respectively. The decreased level of RBCs, Platelets, Hematocrit, Neutrophil Counts, Serum Folate, Hemoglobin and Serum Ferritin were recorded in preterm infants (3.09±0.18/L, 165.99±10.96/L, 31.29±3.42 %, 3.88±0.42/L, 22.88±3.99, 9.26±1.44 g/L, 66.99±0.95 µ/l) respectively. On the other hands,

the levels of WBCs and total bilirubin were significantly elevated in preterm anemic infants (10.26±1.03/L and 2.99±0.095) as compared to full-term healthy infants (7.33±0.88/L and 0.95±0.056kmg/dl) respectively. Hematological demeanor of preterm infants is illustrated by low levels of hemoglobin in the first year of infant's life. Decrease concentrations of iron, serum folate, vitamins and proteins are responsible for the development of anemia. Anemia of prematurity can be distinct as decrease levels of hematological concentrations of hematocrit (Hrt), hemoglobin (Hb), iron, number of erythrocytes and reticulocytes. On the other hand, hyperbilirubinemia has been observed in preterm anemic infants which are due to the result of immaturity of intestinal tract and liver. The anemia of prematurity can be managed by regulating erythrocytes formation and undamaged red blood cells levels.

Keywords: Iron, Hemoglobin, RBCs, Hematocrit, Total Bilirubin

INTRODUCTION

The hematological demeanor of preterm infants is characterized through two phases of decreased hemoglobin concentration throughout the 1st year of life. Anemia of prematurity known as 'too soon' or 'physiological' is among one of them that occurs on the primary fifty to sixty days of life. At the age of two months, lower level of hemoglobin were decreased, which is compiled through gradual arise in the concentration of hemoglobin. During fourth-month, no hypochromic anemia or microcytosis of red blood cells is shown [1]. The temporary hypoactivity of bone marrow results in the early anemia of preterm infants [2]. Analyzing bone marrow along with other tissues it has been proved that at the first two months iron is stored and disappears after two months [3]. Generally it has been thought that if iron is administered on this time, excess iron does not alter anemia of prematurity [4].After 4th or 5th month the concentration of hemoglobin were decreased and also hypochromasia and/ or microcytosis develops gradually during the second phase of 1st year of life. Iron helps to recover anemia of prematurity and also therapeutic iron prevents early anemia of prematurity [2, 5]. Anemia of prematurity is believed to be the outcome of variant within the rapid blood volume increase referable to growth plus iron availability for the formation of hemoglobin. Iron deficiency anemia in preterm infants is not different from full-term babies; only the difference is that in preterm infants it occurs too soon, more often and is more critical [6]. Not necessary that iron deficiency anemia develops in all babies but few cases can

become critically anemic. To explain such differing flows; various variables have been concerned; such as maternal anemia is present or absent, sufficiency of maternal iron storage, at birth the concentration of hemoglobin and iron storage as determined through birth weight and rate of development, iron availability from exogenic source and blood loss [7, 8].

Preterm labor is one of the major concerned due to high death rate among children less than 5 years of age [9]. According to a survey report from UNICEF in 2016, Pakistan stands on second number amongst the top ten countries where the death rate due to complications in premature birth is two-third [10]. Preterm labor has been linked with various morbidities among which one is anemia. Premature infants suffer from anemia due to increased iron demand, loss of blood because of phlebotomy and physiological drop-off in the level of hemoglobin[11, 12]. Lower iron storage in the body of premature infants possibly linked with birth weight, time of cord clamping, status of iron in mother, gestational age at the time of birth, supplementation of iron and gender [13]. The prevalence of iron deficiency anemia alters among various studies as it may depend on preterm age difference, iron supply and also support of nutrition. While studying the prevalence of iron deficiency anemia it was analyzed that population of Brazil based on 12 months of age had 26.5%, population in Turkey of aged 4 months had 42.8% and in Sweden 6 months aged infants had 9.9% [14, 15]. Iron deficiency anemia might affect irreversibly on the motor neuron growth, also cognitive, function of hearing and behavior, along myelin development [16]. While to prevent the manifestations of iron deficiency anemia clinically, complete profile of iron in premature infants ought to be obtained.

MATERIALS AND METHODS

Present study about hundred premature infants and hundred normal infantswere taken as healthy controls. All of the subjects were taken after the informed consent and the work was according to the Research Ethical Committee of Institute of Molecular Biology and Biotechnology (IMBB), The University of Lahore-Pakistan. For the valuation5ml blood was taken and serum was separated and stored at -75 degrees for the biochemical analysis.Infants those were born before 37 week of gestation were considered appropriate for the following study. Infants those with any disease or abnormality were excluded out of the study. Subjects were determined for number of

biochemical and physiological parameters such as Complete Blood Count (CBC) with the help of automated Coulter by Beckman Coulter, Inc.

RESULTS

The data presented in figure 01 revealed the hematological and demographic profile in preterm infants suffering from anemia. The mean body weight (Kg) and age (YRS) of preterm infants was 1.36±0.645 and 27.56±4.26 as compared to full-term infants 2.87±0.913 and 37.59±5.26 respectively. Significantly low levels of RBCs, Platelets, Hematocrit, Neutrophil Counts, Serum Folate, Hemoglobin and Serum Ferritin were recorded in preterm infants (3.09±0.18/L, 165.99±10.96/L, 31.29±3.42 %, 3.88±0.42/L, 22.88±3.99, 9.26±1.44 g/L and 66.99±0.95 µ/l) as compared to full-term healthy infants (4.26±0.27/L, 314.58±14.16/L, 39.35±3.16%, 5.26±0.58/L, 35.26±5.66, 14.19±1.05/Lm and 103±0.55 µ/l) respectively. On the other hands, the levels of WBCs and total bilirubin were significantly increased in preterm anemic infants (10.26±1.03/L and 2.99±0.095 mg/dl) in comparison with full-term healthy infants (7.33±0.88/L and 0.95±0.056 mg/dl) respectively.

DISCUSSION

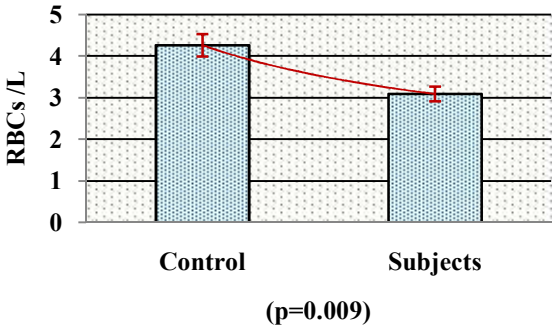
Preterm birth that is also known as premature birth, in which the birth of newborn baby has, begins before the 37 weeks of gestation. It is one of the most frequent reasons of death of infants in worldwide [17]. The main cause of preterm birth is still unidentified but various risk factors such as poor nutrition, diabetes during pregnancy, preeclampsia, vaginal infections, multiple pregnancies, psychological stress, hormonal imbalances and placental abruption are responsible for preterm delivery [18]. However, preterm infants have been linked with various morbidities such as hearing problems, sight problems, cerebral palsy, delays body growth and anemia. These infants were suffering from anemia because of increased demand of iron and loss of blood due to phlebotomy as well as drop-off in hemoglobin levels physiologically [12]. Decrease levels of iron storage in preterm infants have been associated with status of mother iron, time of cord clamping, birth weight, supplementation of iron and gestational age [13]. The occurrence of iron deficiency anemia is different between various studies because it depends on iron supply, nutritional support and preterm age difference. Iron deficiency anemia has major

effect on behavior, cognition, function of hearing, motor and myelin growth and development [16]. The attempt of present study was made to assess certain factors that may have influence on anemia of prematurity.

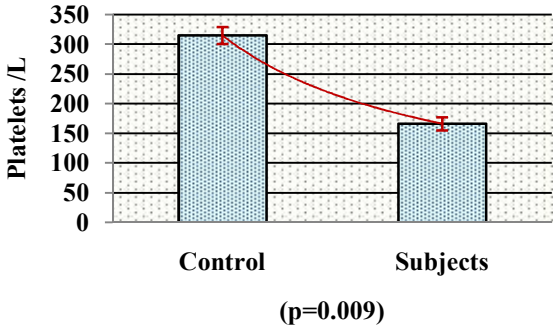
The hematological behavior of preterm infants is characterized by low levels of hemoglobin in the first year of life. Anemia in preterm infants is multifaceted anemia which is distinguished by premature birth take place before placental iron transport, decrease level of erythropoietin due to declined formation and increased catabolism, low blood volume, increase blood loss and deficient in erythropoiesis [19]. This type of problem is associated with high incidence rate and symptoms as well as high blood transfusion condition. The research carried out by William *et al*., 2005, reported the low level of hemoglobin in preterm infants as compared to full-term infants. This study is similar to the current research work which is linked with decreased physical activity, tachycardia and failure in body growth due to low concentrations of hemoglobin. It has also been measured that low levels of iron, vitamins, proteins and folic acid are accountable for the development of anemia. In current research work, decreasedlevel of serum folatein preterm infant was responsible for the development of anemia. Iron deficiency in premature infants influences maturation, perinatal growth and activity of body organ systems such as skeletal muscle, heart, brain and gastrointestinal tract (GIT) [20]. Furthermore, anemia of preterm infants can be defined as decreased hematological concentrations of hematocrit (Ht), hemoglobin (Hb), number of reticulocytes, erythrocytes and serum iron [21]. According to the study of Nelida [22], the significantly low level of hemoglobin (Hb) is present in preterm infants in comparison with full-term infants. This finding is similar to the current study in which the concentration of hemoglobin is diminished. Management of premature anemia is to maintain undamaged red blood cells levels and regulate the formation of erythrocytes [23].

Premature anemic infants develop yellow color to their skin, due to increased production of bilirubin protein. It has formed in the body by the breakdown of red blood cells and the process is called as hemolysis. Than bilirubin travels into the bloodstream through the liver, in which it is processed by various enzymes and then enters into the intestine. It is excreted from the body when the preterm infant's passes

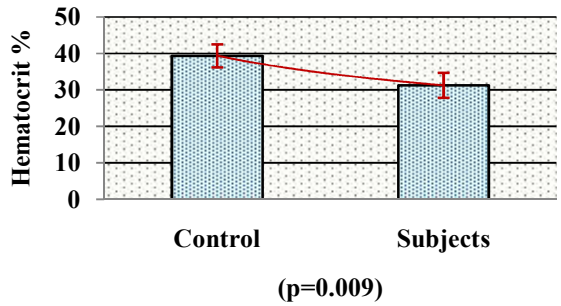
stool [24]. The study Barbara and Kliegman, 2004, observed that 80% hyperbilirubinemia in preterm anemic infants in the first week of life as compared to full-term infants. Increased concentration of bilirubin in the bloodstream of preterm infants is due to the result of inadequate ability to secrete out from the body and immaturity of intestinal tract and liver. Infants, especially premature infants have elevated levels bilirubin as compared to full-term infants and adults due to shorter lifespan of red blood cells and high rate of turnover [25]. IHD (Isoimmune hemolytic disease) is the frequent cause of hyper-bilirubinemia in premature infants. This pathological condition is due to the result of immune destruction of red blood cells in the infants and fetus and ultimately leads toward anemia [26, 27]. At the time of birth, most of the premature babies show anemia and swelling of the spleen and liver. These body organs regularly enhance in size by increasing the severity of anemia and hemolysis. In the current research work, there is increased level of bilirubin is present in preterm infants suffering from anemia as compared to full-term infants. Due to the occurrence of anemia, the premature infants develop various complications such as hepatosplenomegaly, pleural effusion ascities and cardiac failure.

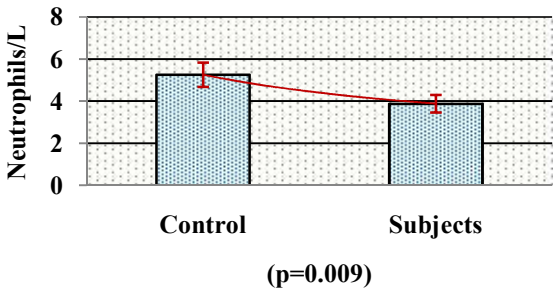


A

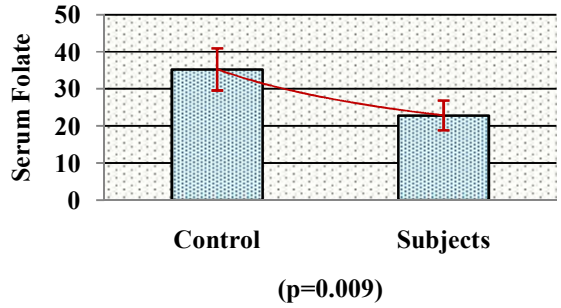


B

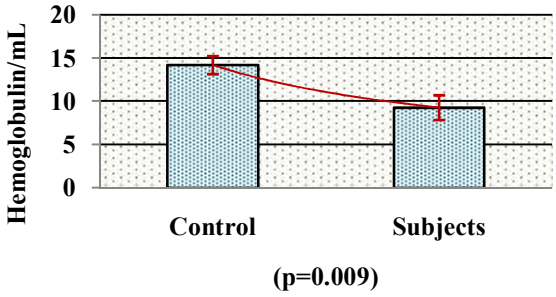




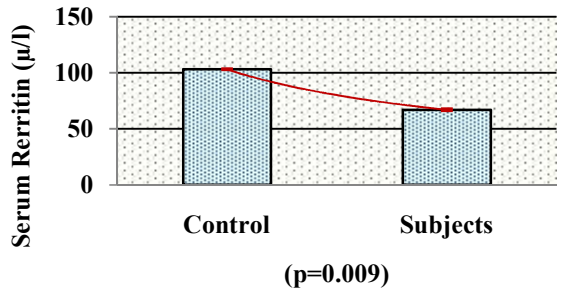
C



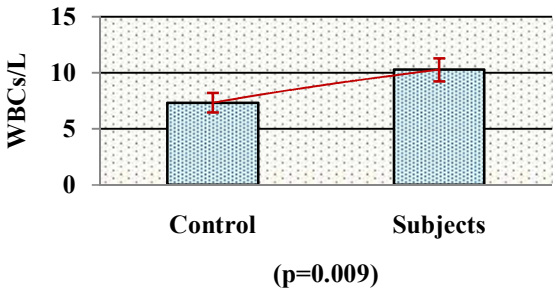
D



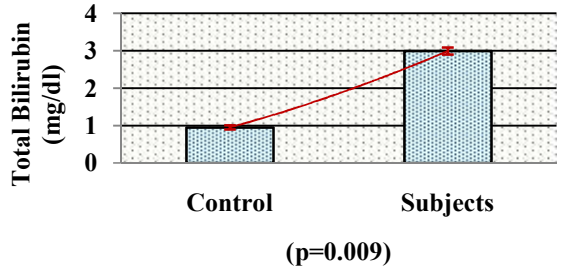
E



F



G



H

I

Figure 1: Hematological profile of preterm infants suffering from anemia

CONCLUSION

Hematological behavior of preterm infants was distinguished by decreased concentration of hemoglobin in the first year of life. In premature infants, anemia is a complicated anemia which has characterized by untimely birth take place before placental iron transport, low level of erythropoietin formation and increase catabolism, low blood volume, incomplete erythropoiesis and increase blood loss. According to the study, it has also observed that low levels of iron, proteins, vitamins and folic acid are responsible for the development of anemia. Moreover, anemia of premature infants can be defined as low levels of hematological concentrations of hemoglobin (Hb), hematocrit (Hrt), serum iron, number of erythrocytes and reticulocytes. On the other hand, 80% of hyperbilirubinemia has observed in preterm anemic infants of the current study. Isoimmune hemolytic disease is the common cause of hyperbilirubinemia in preterm infants. Various research works have concluded that premature anemia can be managed by maintaining undamaged red blood cells levels and regulate the formation of erythrocyte.

ACKNOWLEDGEMENTS

The authors are highly thankful for the valuable contribution of Prof. Dr. M. ArslanDirector Institute of Molecular Biology and Biotechnology (IMBB)/ Center for Research in Molecular Medicine (CRiMM), The University of Lahore-Pakistan regarding financial support and critical review of the manuscript.

CONFLICT OF INTEREST

Authors declares no conflict of interest

REFERENCES

[1] Hadley CG and Chinnock RF A study of hemograms in premature inDownloaded from by guest on July 7, 2017 ARTICLES 373 fants. J. Pediat, (1954); 45:413.

[2] Gaisford W and Jennison RF. Intramuscular iron in infancy. Brit. M. J, (1955); 2:700.

[3] Seip I and Halvorsen S. Erythrocyte I)ro(llction and iron stores in premature infants during the first months of life. The anemia of prematurity-etiology, pathogenesis, iron requirement. Actapaediat,(1956); 45:600.

[4] Volff, JA and Coodfellow AM.Hernatopoiesis in Premature infants with speciil consideration of the effect of iron and animal protein factor. PEDI-ATRICS, (1955); 16:753.

[5] Recedy ME, Schwartz S and Plattncr EB. Anemia of the premature infant. A two year study of the response to iron medication. J. Pediat, (1952); 41:25.

[6] Etteldorf JN and Tuttle AH. Anemia in premature infants. Pediat. Clin. North America,(1954); 593.

[7] Sisson TRC and Whalen LE. Meat in the diet of premature infants. II. Influence on red cell volume and heinoglobin mass. A.M.A. J. Dis. Child, (1958); 95: 626.

[8] Sturgeon P. Studies of iron requirements in infants. III. Influence of supplemental iron during normal pregnancy on mother and infant. B. The infant. Brit. J. Haematol, (1959); 5:45.

[9] Damanik S. Klasifikasibayimenurutberatlahirdanmasa gestasi. In: BukuAjarNeonatologi. Jakarta: Badan Penerbit Ikatan Dokter Anak Indonesia, (2010); 11–3.

[10] UNICEF Pakistan- Media centre- Reduction in preterm births and child deaths imperative to achieve global goal for health and well being. 2016.

[11] Armony-Sivan R, Eidelman AI, Lanir A, Sredni D, Yehuda S. Iron status and neurobehavioral development of premature infants. J Perinatol, (2004); 24:757–62.

[12] JA W. Pathophysiology of anemia during the neonatal period, including anemia of prematurity. Neoreviews. 2008); 9:520-5.

[13] Chaparro CM. Setting the stage for child health and development: prevention of iron deficiency in early infancy. J Nutr,(2008);138:2529-33.

[14] Ferri C, Procianoy RS, Silveira RC. Prevalence and risk factors for iron-deficiency anemia in very-low-birth-weight preterm infants at 1 year of corrected age. J Trop Pediatr. (2014);60:53–60.

[15] Özdemir H, Akman I, Demirel U, Coşkun Ş, Bilgen H, Özek E. Iron deficiency anemia in late-preterm infants. Turk J Pediatr,(2013); 55:500-5.

[16] Sekartini R, Soedjatmiko, Wawolumaya C, Yuniar I, Dewi R, Nycane, et al. Prevalensi Anemia Defisiensi Besipada BayiUsia 4 – 12 Bulan di Kecamatan Matramandan Sekitarnya, Jakarta Timur. Sari Pediatr, (2005); 1:2-8.

[17] Martin JA, Hamilton BE, Sutton PD. Births: final data for 2007. National vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, (2010); 58:1-85.

[18] Lockwood CJ. The diagnosis of preterm labor and the prediction of preterm delivery. ClinObstetGynecol,(1995);38:675-87.

[19] De Pedro A. De Alarcon, Eric J Werner, Anemia of prematurity, Neonatal Hematology,(2005); 58-59.

[20] Deugnier Y, Brissot P, Loreal O: Iron and the liver: *Update 2008*.

[21] Cloherty, John P.; Eichenwald, Eric C.; Stark, Ann R. Manual of Neonatal Care, 6th Edition,2008.

[22] Nelida IN, German D, Susana MP, Iram MB, Olga L, Jose HR, Irma A, Ruben D, Angela CM. Hematologic study of newborn umbilical cord blood. MEDICINA, (1999); 59:446-448.

[23] Tamura T, Goldenberg RL, Hou J, Johnston KE, Cliver SP, Ramey SL, et al.: Cord serumferritin concentrations and mental and psychomotor development of children at five years ofage. J Pediatr,*(*2002); 140:165-70.

[24] Brodsky D, Quinn M. A Parent's Guide to the late Preterm Infant. Lulu. 2014.

[25] Brouillard R. Measurement of red blood cell life-span. J Am Med Assoc(1974); 230:1304-5.

[26] Alwar V, Shanthala DA, Sitalakshmi S, Karuna RK. Clinical patterns and hematological spectrum in autoimmune hemolytic anemia. J Lab Physicians,(2010); 2:17-20.

[27] Nadeem, T., Khan, M.A., Ijaz, B., Ahmed, N., urRahman, Z., Latif, M.S., Ali, Q. and Rana, M.A., 2018. Glycosylation of Recombinant Anticancer Therapeutics in Different Expression Systems with Emerging Technologies. *Cancer research*. 78(11): 2787-2798.