

## Evaluation of Cord Blood biochemical parameters of term newborns in coastal parts of Odisha

Santwana Mantri<sup>1\*</sup>, Prakash Chandra Mohapatra<sup>2</sup>, Pramila Kumari Mishra<sup>3</sup>, Pradeep Kumar Jena<sup>4</sup>

<sup>1</sup>Principal Investigator of Department of Science & Technology, Govt. of India, sponsored Project in Department of Bio-chemistry, S.C.B. Medical College, Cuttack.

<sup>2</sup>Dean & Principal, S.C.B. Medical College, Cuttack.

<sup>3</sup>Professor & Head, Department of Bio-chemistry, S.C.B. Medical College, Cuttack.

<sup>4</sup>Professor, Department of Pediatric Surgery, SVP Post graduate Institute of Pediatrics, S.C.B. Medical College, Cuttack.

### Abstract

**Objective:** Cord Blood parameters can be considered as early predictors of some of the metabolic disorders in future adult life. Based on this concept, our present observational study aims at evaluating the cord blood biochemical parameters & provides a concise view of their current status among the term newborns in coastal parts of Odisha.

**Methods:** 80 study participants were recruited as representative sample from coastal districts of Odisha after the careful sampling of cord blood. Demographic data related Questionnaire were translated into local language and administered to the mother individually. Processing of the blood samples and biochemical analysis of parameters were then carried out.

**Results:** The Range of glucose & total protein level was found to be 39.8-95.92mg/dl, 5.07-7.65mg/dl. The Urea, Uric acid & Creatinine level were found to be in range of 13.21-25.79mg/dl, 3.03-7.45mg/dl, 0.629-1.19mg/dl respectively & compatible with reported level of other study. Total Cholesterol & Triglycerides level exhibited the Range of 27.74-89.66mg/dl, 24.28-81.12mg/dl. The level of High Density Lipoprotein, Low Density Lipoprotein and Very Low Density Lipoprotein was observed in the range of 6.66-23.54 mg/dl, 12.33-53.87 mg/dl, 4.82-16.18mg/dl respectively. The Range of total Alkaline phosphatase activity was observed to be lower to the level suggested by other investigators. But the level electrolytes like Na<sup>+</sup>, K<sup>+</sup> were found to be lower in our study as compared to the level proposed by investigators of other study.

**Conclusion:** We are concluding here that evaluation of cord blood parameters along with Alkaline phosphatase activity, may help in providing a snapshot of health status as well as establishing the future Normal range for term newborns of Odisha.

**Key Words:** Cord blood, Parameters, Coastal Districts, Term newborn

### INTRODUCTION

The wellness of a newborn emanates from the nutritional status of the fetal life, this determines the quality of future adult life. Fetus is known to be the reference source for the establishment of normal concentrations of nutrients in the blood & tissue.<sup>[1]</sup> The carbohydrate, protein and lipid nutritional status to the fetus can be well detected in the cord blood serum. Cord Blood can also act as screening aid for various metabolic diseases. Hawdon & Ward Platt (1993) recommended that cord blood glucose & blood glucose at 4-6 hrs of age (before the second feed) should be measured for the screening of hypoglycemia.<sup>[2]</sup> Anderson et al. (1993) observed that 38% of uncomplicated term infants born in Kathamandu, Nepal showed a blood glucose concentration of <2.6mmol/lit during the first 50 years of life.<sup>[3]</sup> In an Indian follow-up neonatal hypoglycemic study, 107 cases of asymptomatic or symptomatic neonatal hypoglycaemia were studied with neurodevelopmental outcome.<sup>[4]</sup> Low birth weight (LBW) and malnutrition to the fetus are risk factors for the ontogeny of lipid disorder, cardiac ischemia, hypertension, obesity, and diabetes in adult stage.<sup>[5,6]</sup> In one of the investigational studies, the researchers reported that in cord blood, no significant differences were found due to sex while 0.1% significant difference of cholesterol was observed in newborn of 5 days.<sup>[7]</sup> Richard D Bland (1972) demonstrated that

Cord blood total protein levels can act as Screening aid for Idiopathic Respiratory Distress Syndrome (IRDS). In 33 infants out of 34 infants with developed IRDS showed cord blood total protein concentration of 4.6gm per100ml or less.<sup>[8]</sup> Creatinine is the most widely used marker of renal function and can be used to estimate glomerular filtration rate (GFR).<sup>[9]</sup> In one of the recent Canadian studies, the investigators established a reference interval for the cord blood total Alkaline phosphatase.<sup>[10]</sup> Cheik investigated the variation in the concentration of electrolytes in normal pregnancy and concluded that the concentration of electrolytes was unchanged in maternal blood but the conceptus was in an osmotic disequilibrium within itself and in respect to maternal tissue.<sup>[11]</sup>

The coastal parts of Odisha have got more than 36% of total population of the State. The people below poverty line or the rural villagers of the coastal belt are the most vulnerable population to be socioeconomically affected by natural calamities. Hence our study is focused mainly on the health status of term newborn of coastal Odisha.

Keeping all of the above lab investigations into consideration, our main objective of this cross-sectional study was to determine the levels of some significant Cord Blood biochemical parameters like Glucose, Total protein, Albumin, Urea, Uric acid, Creatinine, Lipid parameters like Total cholesterol(TC), Triglyceride (TG), High density lipoprotein (HDL), Low density lipoprotein( LDL) & Very low density lipoprotein(VLDL), total Alkaline phosphatase(ALP) activity & Electrolytes of the term newborns. Collection of cord blood without any painful procedure provides a convenient way of sampling the fetal blood.

### Address for correspondence\*

Santwana Mantri

Department of Bio-chemistry,  
S.C.B. Medical College, Cuttack.

Email: santanam\_mantri@rediffmail.com

## METHODS

We were able to avail 80 samples from four coastal districts like Puri, Jagatsinghpur, Kendrapada & Bhadrak, after fulfilling our inclusion & exclusion criteria of this study. Collection of Blood sample was accomplished in the Department of Obstetrics & Gynecology, S.C.B Medical College & Hospital, Cuttack. Informed written consent was obtained from mothers before delivery as approved by the Institutional Ethical Committee. The assessment of health condition of the newborn was evaluated for 8-10 points according to Apgar scale. We included only singleton birth for the current study. Immediately after the infant delivery, the umbilical cord blood of 5ml was collected in a sterile tube and allowed to clot. The sample was processed within 1 hour of collection. It was centrifuged at 1500rpm for 5 minutes at room temperature to obtain serum.

Some of the significant biochemical parameters like Glucose, Urea, Uric acid, Creatinine, Albumin, Total protein, TC, TG, HDL, LDL & VLDL were assessed using Automated Clinical Autoanalyzer Biolis24i Premium (Tokyo Boeki Machinery Ltd.). Electrolytes like Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup> were evaluated using Ecolyte (ISE) Eschweiler, while Total Alkaline phosphatase activity was measured by Automated Dry-chemistry System, Ektachem DT60 II Analyzer, in the Biochemistry Department, S.C.B. Medical College and Hospital, Cuttack. The names of referred Methods (12-23) along with Sources from which reagents and chemicals availed for this quantitative assessment were given in Table-1.

**Exclusion criteria** The eligible pregnant mothers for this study were 20-35 years of age with no indication of Septicemia, any other Hematological infections or complications and negative for VDRL, human immunodeficiency, hepatitis B, hepatitis C viruses. Pregnant women with Diabetes mellitus, hypertension, and chronic diseases were excluded from this study.

**Statistical Analysis** The Demographic data related to this study were carried out by a previously prepared Questionnaire (Structured) in local oriya language and administered to the participants individually. Laboratory data included evaluated value of cord blood serum parameters. The Mean (Standard Deviation), Range & 95% Confidence Interval level were evaluated for each cord blood analyte.

## RESULTS

It took about 8 months (from February to September 2012) for the collection of cord blood sample of term infants from four coastal districts. Demographic data collected through the Structured Questionnaire, were presented in percentage by the number of samples in Table-2. Regarding the demographic characteristics, majority of mothers were belonged to rural region. After the measurement of each blood analyte level from 80 cord samples, the results were presented in Table-3 in the form of Mean  $\pm$  Standard Deviation, Range (mean  $\pm$  1.96SD) with their 95% Confidence Interval level.

## DISCUSSION

**Glucose** In the present study the mean cord blood glucose level with SD was found to be 67.5  $\pm$  14.5 mg/dl (3.75 mmol/L) with the normal range of 39.08-95.92 mg/dl. This mean value was similar to that of blood glucose (3.9  $\pm$  0.5 mmol/L) of cord blood, as observed in one of the study by Onyesom et al.<sup>[24]</sup>

**Total Protein & Albumin** As the protein is the most important nutrient of developing fetus, hence the total protein evaluation of cord blood will provide the health status of the

newborn. Total protein and albumin level in one of the observational study in Kerala, India, were in the range of 4.4-7.4 gm/dl, 1.7-3.4 gm/dl respectively,<sup>[25]</sup> which was less than the calculated range of our study, while our mean albumin value was similar to that of the suggested value (40.1  $\pm$  6.2 gm/dl) of another study.<sup>[24]</sup>

**Urea, Uric Acid & Creatinine** Serum uric acid levels showed no significant change in full term & preterm in both maternal & cord blood.<sup>[26]</sup> The levels of Urea, Uric acid, Creatinine in maternal and umbilical cord serum showed no or slight differences in one of the investigational study.<sup>[27]</sup> The evaluated mean values of these parameters in the above study, were observed to be 18.94  $\pm$  6.00 mg/100 ml, 5.63  $\pm$  1.39 mg/100 ml, 0.83  $\pm$  0.22 mg/100 ml, which was in consistent with that of our study.

**Lipid Parameter** Fredrickson and Breslow,<sup>[28]</sup> stated that differences in ethnic or socioeconomic background, including dissimilar diets, were associated with great differences in maternal lipid levels, yet differences in fetal levels were indistinguishable, which was opposed by Stein et al.<sup>[29]</sup> Glueck and co-workers,<sup>[30]</sup> suggested that measurement of umbilical cord blood cholesterol levels in consecutively studied healthy babies could be used as a population screening test for the diagnosis of one genetic lipid disorder, familial hypercholesterolemia. In Indian follow up studies, the mean value of TC, TG & HDL (69.79  $\pm$  19.81 mg/dl, 66.66  $\pm$  20.30 mg/dl & 36.08  $\pm$  2.86 mg/dl) as advised by Elizabeth et al.<sup>[25]</sup> was different from that of value (73.64  $\pm$  21.61 mg/dl, 33.75  $\pm$  16.39 mg/dl & 23.25  $\pm$  7.66 mg/dl) suggested by Kharb et al.<sup>[31]</sup> The range value of above parameters of our study was lower than that of TC, TG & HDL value (29-128 mg/dl, 29-140 mg/dl, 31-41 mg/dl) of one of the above observational study,<sup>[25]</sup> while the mean value of LDL & VLDL (41.81  $\pm$  17.88 mg/dl, 12.81  $\pm$  11.08 mg/dl) as suggested in one of Indian study,<sup>[31]</sup> was higher to that of our assessed value.

**Alkaline phosphatase** In case of neonates, increase in total Alkaline phosphatase has been attributed to the raised level of its bone isoenzyme. The range the total Alkaline phosphatase activity of cord serum of term infants as evaluated (62 -256 U/L) [10], was observed to be higher than that of our lab investigation.

**Electrolytes** In one of the lab investigation [32] on the cord blood level of electrolytes (Na<sup>+</sup>, K<sup>+</sup>) of term newborns appeared in the range of 126-166 mEq/L, 5.6-12.0 mEq/L respectively, which was found to be higher to the level evaluated in our study.

Calcium plays a vital role in bone and teeth formation, neuromuscular function and hemostasis. Our study provided the range value of Ca<sup>2+</sup> in cord blood was 1.00-2.29 mmol/L, compatible to the range (1.35-2.65 mmol/L) suggested by one of the recent Indian study by Elizabeth et al.<sup>[25]</sup> while in one of the western studies, the calcium level of cord blood was found to be in the range of 2.5 -3.0 mmol/L of term infants.<sup>[10]</sup> The large variation (standard deviation) in some analytes as observed in (Table-3) in cord blood of term newborn suggesting future larger multicentric studies on these parameters.

## CONCLUSION

Certain biochemical analytes of Cord Blood change appreciably as a function of gestational age and others do not. Damardy et al. claimed that umbilical cord blood could not be used as a reliable index of familial hypercholesterolemia, which was supported by Goldstein et al. But in one of the study by Kwiterovich et al. measured both LDL-cholesterol & Total

**Table: 1 Name of Methods (12-23) , Units and Sources used for the quantitative assay of the following parameters.**

Parameters	Methods with Units	Sources
Glucose	Glucose Oxidase- mg/dl	Accurex Kit
Urea	GLDH method- mg/dl	Accurex Kit
Uric acid	Uricase/POD- mg/dl	AGGAPE Kit
Creatinine	Modified Jaffe's method- mg/dl	Dialab Kit
Total protein	Biuret- gm/dl	ERBA Kit
Albumin	Bromocresol green- gm/dl	ERBA Kit
Cholesterol	CHOD-PAP- mg/dl	Diagnova Kit
Triglycerides	Glycerol phosphate oxidase/PAP- mg/dl	Accurex Kit
HDL cholesterol	Turbidometric immunoassay - mg/dl	ERBA Kit
LDL cholesterol	Friedwald's Formula- mg/dl	
VLDL cholesterol	Calculated- mg/dl	
Total Alkaline Phosphatase	p-nitrophenyl phosphate- U/L	AGGAPE Kit
<b>Electrolytes</b>		
Na <sup>+</sup> , K <sup>+</sup>	Ions selective Electrodes- mEq/L	
Ca <sup>2+</sup>	Ions selective Electrodes- mmol/L	

**Table-3: Laboratory Evaluation of Mean(SD) and Range values for Glucose(mg/dl), Urea(mg/dl), Uric acid(mg/dl), Creatinine(mg/dl), Total protein(gm/dl), TC(mg/dl), TG(mg/dl), HDL(mg/dl), LDL(mg/dl),VLDL(mg/dl), total ALP(U/L),Na+ (mEq/L),K+(mEq/L) &Ca2+(mEq/L) .**

Cor d B loo d S e r u m An a lyt e s	M e a n ± S D *	R a n g e o f 95 % o f s a m p l e s	95 % C I †
Gl u c o s e ( m g / d l )	67 . 5 ± 14 . 5	39.08 - 95.92	64 . 79 - 70 . 22
U r e a ( m g / d l )	19 . 5 ± 3.2 1	13.21 - 25.79	18 . 96 - 20 . 02
U r i c a c i d ( m g / d l )	5 . 24 ± 1.1 3	3.03 - 7.45	4 . 71 - 5 . 77
C r e a t i n i n e ( m g / d l )	0 . 9 11 ± 0 . 144	0.629 - 1.19	0 . 8 06 - 1.0 17
T o t a l P r o t e i n ( g m / d l )	6 . 3 6 ± 0.6 59	5.07 - 7.65	6 . 25 - 6 . 46
A l b u m i n ( g m / d l )	4 . 0 5 ± 0.2 53	3.55 - 4.54	1 . 5 86 - 6.5 23
T C ( m g / d l )	58 . 7 ± 15 . 8	27.74 - 89.66	56 . 20 - 61 . 14
T G ( m g / d l )	52 . 7 ± 14 . 5	24.28 - 81.12	50 . 34 - 55 . 06
H D L ( m g / d l )	15 . 1 ± 4.3 1	6.66 - 23.54	12 . 96 - 17 . 42
L D L ( m g / d l )	33 . 1 ± 10 . 6	12.33 - 53.87	31 . 35 - 34 . 77
V L D L ( m g / d l )	10 . 5 ± 2.9 0	4.82 - 16.18	8 . 82 - 1 2 . 25
A L P ( U / L )	16 2 ± 44 . 7	74.39 ± 249 . 61	15 4 . 9 - 16 8 . 9
N a <sup>+</sup> ( m E q / L )	14 3 ± 9.53	124 . 33 - 1 61 . 67	14 0 . 6 - 14 6 . 0
K <sup>+</sup> ( m E q / L )	5.2 7 ± 1 . 1 5	3 . 02 - 7 . 52	5 . 0 88 - 5 . 4 61
C a <sup>2+</sup> ( m m o l / L )	1 . 6 5 ± 0.3 29	1.006 - 2.294	1 . 4 64 - 1 . 8 37

**Table:2 Demographic Characteristics of the study participants (n=sample size in percentage)**

Characteristics	n in percentage(%)
<b>Sex</b>	
Male	36(45%)
Female	44(55%)
<b>Gestational Age*</b>	
36 weeks	0
37-38 weeks	54(67.5%)
39-40 weeks	26(32.5%)
<b>Birth weight in grams</b>	
2500	24(30%)
2500-3000	38(47.5%)
3000-3500	18(22.5%)
<b>Maternal age</b>	
20-25 years	26(32.5%)
25-30 years	44(55%)
30-35years	10(12.5%)
<b>Mode of Delivery</b>	
Caesarian section	30(37.5%)
Normal Vaginal Delivery	50(62.5%)
<b>Parity</b>	
Primi	29(36.25%)
Multi	51(63.75%)
<b>Social Economic status</b>	
Urban	11(13.75%)
Rural	61(76.25%)
Slum	8(10%)
<b>Coastal Districts</b>	
Puri	20(25%)
Jagatsinghpur	20(25%)
Kendrapada	20(25%)
Bhadrak	20(25%)

cholesterol& concluded that heterozygotes could be accurately detected by cord blood cholesterol measurement. Postnatal umbilical cord blood samples are routinely available but cannot be assumed to reflect fetal values, even at term. Colossal changes in the fetal physiology and anatomy occur during the transition from the in utero to the postnatal environment; for example, massive fluid shifts take place in the first hours of postnatal life, altering the distribution of body water.

With the above citations of controversies on cord blood parameters as early predictor of future wellbeing, we measured these parameters to know their current nutritional status indicating health condition of term newborn. In one of Indian studies on cord blood nutrients, the investigators observed that some normal weight babies from the non affluent sections were born with low nutrients especially albumin, calcium and iron and suggested that these nutrients could be more likely to be further lowered by recurrent infections and inappropriate feeding habits. Nutritional supplements should be provided even to the normal weight term newborn of non affluent section.

The study participants of our investigation were taken invariably from four major coastal districts (Puri, Jagatsinghpur, Kendrapada & Bhadrak) of Odisha, as they were carefully chosen during sampling. This is a single center study & the outcome of this study may be affected by certain local factors, so these parameters may need to be further investigated by large multiple health centers in the State. Our observational cross sectional study suggests that the 95% CI values of each parameter obtained from cord blood may further help in setting up the Reference range for term healthy newborn of Odisha.

#### ACKNOWLEDGMENTS

This study was supported and funded by the grants from Department of Science & Technology (DST), Govt. of India.

#### REFERENCES

1. American Academy Pediatrics Committee on Nutrition-Nutritional needs of Preterm Infants. In: Kleinman RE, ed. Pediatric Nutrition Handbook. 6th edition. Elk Grove Village,IL: American Academy Pediatrics;2009:79-112.
2. Hawdon JM, Ward Platt MP. Metabolic adaptation in small for gestational age infants. Arch. Dis. Childh. 1993; 68: 262-268.
3. Anderson S, Shakya KN, Shrestha LN, de L Costello AM. Hypoglycaemia: A common problem among uncomplicated newborn infants in Nepal. Journal Tropical Pediatr. 1993; 39: 273-277.
4. Singh M, Singhal PK, Paul VK, Deorari AK, Sundaram KR, Ghorpade MD, et al. Neurodevelopmental outcome of asymptomatic and symptomatic babies with neonatal hypoglycaemia. Indian J Med Res.[B]. 1991;94: 6-10.
5. Gale CR, Ashurst HE, Hall NF, MacCallum PK, Martyn CN. Size at birth and carotid atherosclerosis in later life. Atherosclerosis. 2002; 1:141-147.
6. Godfrey KM, Barker DJ: Fetal nutrition and adult disease. Am J Clin Nutr. 2000; Suppl. 5: 1344S-1352S.
7. Vobecky JS, Vobecky J, Shapcott D, Demers P-P, Cloutier D, Blanchardand R, et al. Biochemical indices of nutritional status in maternal, cord, and early neonatal blood. Am J Cli Nutr. 1982;36:630-642.
8. Bland RD. Cord-Blood Total Protein Level as a Screening

- Aid for the Idiopathic Respiratory-Distress Syndrome. *N Engl J Med.* 1972; 287:9-13.
9. Wilkins BH. Renal function in sick very low birthweight infants: urea and creatinine excretion. *Arch Dis Child.* 1992; 67:1146-53.
  10. Fenton TR, Lyon AW, Rose MS .Cord blood calcium, phosphate, magnesium, and alkaline phosphatase gestational age-specific reference intervals for preterm infants. *BMC Pediatrics* 2011; 11:76-83.
  11. Cheik JS. Hypertensive disorder in pregnancy. *Am J Obstet Gynecol* 2000;100: 200.
  12. Barham D, Trinder P. Quantitative determination of glucose using GOD-PAP method. *Analyst* 1972; 97:143-146.
  13. Tiffany TO, Jansen J, Burtis CA, Overton JB ,Scott CD. Blood urea estimation by GLDH-Urease method. *Clin Chem.* 1972; 18: 829.
  14. Trivedi RC, Rebar L, Berka E, Strong L. Enzymatic calorimetric method of uric acid determination. *Clin. Chem.* 1978;24:1908.
  15. Bartel SH. Serum creatinine estimation by Jaffe Kinetic method. *Clin Chem.*1972; 37: 193.
  16. Mazzachi BC, Peake MJ, Ehrhardt V. Reference Range and Method Comparison Studies for Enzymatic and Jaffé Creatinine Assays in Plasma and Serum and Early Morning Urine. *Clin. Lab.* 2000; 46: 53-55.
  17. Tietz NW, (Ed.), *Textbook of Clinical Chemistry*, W.B Saunders 1986; p579.
  18. Doumas BT, Watson WA, Briggs AG. Albumin standard and the measurement of serum albumin with bromocresol green. *Clin Chem Acta.* 1971; 31:87-91.
  19. Allain CC, Poon LS, Chan CS. Enzymatic determination of total serum cholesterol. *Clin Chem* 1974;20: 470-5.
  20. McGowan MW, Artiss JD, Strandbergh DR. A peroxidase coupled method for the colorimetric determination of serum triglycerides. *Clin Chem* 1983;29: 538-40.
  21. Gordel T, Castelli WP, Hjortland MC. High density lipoprotein as a protective factor against coronary heart disease. The Framingham Study. *Am J Med* 1977; 62: 707-14.
  22. Friedwald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low density lipoprotein cholesterol without the use of the preparative ultracentrifuge. *Clin Chem* 1972; 18: 499-504.
  23. Tietz NW, Rinker AD, Shaw LM. IFCC methods for the measurement of catalytic concentration of enzymes, part 5: IFCC method for alkaline phosphatase. *J Clin Chem Clin Biochem* 1983;21(11):731-48.
  24. Onyesom I, Opajobi AO, Uzuegbu UE, Oriero D, Mordi J, Awhin PE, et al. Relationship between placental alkaline phosphatase activity and cord blood glucose, albumin and neonatal birth weight at term. *Invest Clin.* 2009;50(4): 491 - 495.
  25. Elizabeth KE, Krishnan V, Vijayakumar T. Umbilical cord blood nutrients in low birth weight babies in relation to birth weight & gestational age. *Indian J Med Res.* 2008;128:128-133.
  26. Chakravarthy S, Sontakke AN. A correlation of antioxidants and lipid peroxidation between maternal and cord blood in full term and preterm deliveries. *Curr Pediatr Res.* 2012;16(2):167-174.
  27. Anderer M, Schindler AE , Liebich HM. Creatinine, Urea and Uric Acid in Amniotic Fluid, Maternal and Umbilical Cord Blood at Delivery. *Arch. Gynak.*1975;220: 65-72.
  28. Fredrickson DS, Breslow JL. Primary hyperlipoproteinemia in infants. *Annu Rev Med.* 1973; 24: 315.
  29. Stein EA, Mendelsohn D, Bersohn I. Early detection of familial hyperlipoproteinaemia by cord blood screening. Presented at the Third International Symposium on Atherosclerosis, abstract no. 69, 1973, Oct 25-28, Berlin, Wrangelstrasse, Germany.
  30. Glueck CJ, Heckman F, Schoenfield M, Steiner P, Pearce W. Neonatal familial type II hyperlipoproteinemia: cord blood cholesterol in 1800 births. *Metabolism* 1971;20:597-608.
  31. Kharb S, Kaur R, Singh V, Sangwan K. Birth Weight, Cord Blood Lipoprotein and Apolipoprotein Levels in Indian Newborns. *Int J Prev Med* 2010, 1(1): 29-33
  32. Acharya PT, Payne WW. Blood Chemistry of normal full-term infants in the first 48 hours of life. *Arch. Dis. Childh.* 1965; 40: 430-435.