

## Research Article

# Evaluating the effect of maternal factors on total and differential leucocyte count of healthy newborns in cord blood

Ashwani Kumar\*, Jaspreet Kaur

Department of Pediatrics, Government Medical College, Patiala, India

**Received:** 06 June 2016

**Accepted:** 02 July 2016

### \*Correspondence:

Dr. Ashwani Kumar,

E-mail: [kumarashwani91@yahoo.com](mailto:kumarashwani91@yahoo.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** To evaluate the effect of maternal factors (parity, age and type of delivery) on total and differential leucocyte count of healthy newborns in cord blood.

**Methods:** The study was conducted on 200 healthy newborns admitted in neonatology section of Department of Paediatrics, Govt. Medical College/Rajindra Hospital, Patiala. Cord blood sample (2ml) was taken at birth by milking the cord into an EDTA containing vial. TLC was done by manual method (haemocytometer method) using improved Neubauer Chamber. DLC was done by Smear made from the EDTA blood stained by Leishman stain (Romanowsky group) in body and tail part of the stained smears by following Z pattern.

**Results:** Mean TLC and DLC was done in cord blood of healthy newborns and it was compared with parity (P1, P1-P3, >P3), age of mother (<25 yrs, 25-30, >30yrs) and type of delivery (NVD/LSCS and mode of presentation).

**Conclusions:** It was seen that maternal factors (parity, age and type of delivery) didn't have effect on Mean TLC of newborns, whereas statistical difference for DLC in relation to maternal parity was significant for neutrophils and Monocytes and highly significant for Monocytes related to mode of presentation. However, statistical difference for Mean DLC in babies was not significant in relation to age of mother and type of delivery.

**Keywords:** TLC, DLC, NVD, LSCS, Parity

## INTRODUCTION

Despite the fact that the infant is dependent on the mother for its nourishment, the striking diversity in the haematological picture of the two has led to a number of studies on cord blood and subsequent changes in the blood picture in the neonatal period. Various authors had studied value of TLC and DLC in new-borns.<sup>1-6</sup>

It has been studied by some that haematological parameters depends on the gestational age, day of life, maternal factors, mode of delivery and site of blood collection.<sup>7</sup> Furthermore, haematological values in new-borns are an index of health and depend to large extent on maternal, social and geographical factors.<sup>8</sup> Studies have been done to relate the maternal factors (differences in mode of delivery, maternal age, and parity etc.) with new-born haematological parameters. Some studies even

have noted the difference in haematological values of neonates delivered by different methods.<sup>9</sup> One author studied total and differential leukocyte counts during the first 5 days of life in relation to the method of delivery.<sup>10</sup> An another study has shown that the number of total leukocytes, neutrophils, band cells and platelets are significantly higher in vaginally born new-borns than the neonates born by caesarean section.<sup>11</sup>

Till now studies have been done to find any relation of maternal parity and delivery factors with total and differential count in healthy new-borns. Thus objective of this study is to determine effect of maternal factors (parity, age and type of delivery) on total and differential leucocyte count values in healthy new-borns using umbilical cord blood.

## METHODS

The study was conducted on 200 healthy new-borns admitted in neonatology section of Department of Paediatrics, Govt. Medical College/Rajindra Hospital, Patiala. Maternal and Neonatal data was recorded. Babies born to mother with Pregnancy induced hypertension (PIH), Gestational diabetes, Fever, Prolonged labour, Premature rupture of membranes, Foul smelling liquor, Dai handling, Multiple vaginal examinations, Instrumentation during delivery were excluded from the study. Similarly, the babies with septicemia, birth asphyxia, respiratory distress syndrome, blood group incompatibility, intraventricular hemorrhage, congenitally malformed babies, small for gestational age and large for gestational age were also excluded. Cord blood sample (2ml) was taken at birth by milking the cord into an EDTA containing vial and was used for determining total and differential leucocyte counts. TLC was done by manual method (haemocytometer method) using improved Neubauer Chamber.<sup>12</sup> Using a WBC pipette, blood was filled up to 0.5 mark. Neubauer's chamber will be charged with WBC pipette. Using low power objective (20x), WBCs were counted in the four larger corner squares. The numbers of WBC's per cumm were calculated as follow:

$$\frac{\text{WBC}}{\text{Cumm}} = \frac{\text{Cells counted} \times \text{Dilution factor} \times \text{Depth factor}}{2 \times \text{Area of chambers counted!}}$$

Where, dilution factor = 20, depth factor = 10, area of chambers = 4.

For Differential leucocyte count, smear made from the EDTA blood was stained by Leishman stain (Romanowsky group).<sup>12</sup> DLC was done in body and tail part of the stained smears by following Z pattern.

## RESULTS

Total and differential leucocyte count was done in cord blood of 200 healthy new-borns and relation with maternal delivery factors and parity was evaluated. Results were interpreted and it was found that mean TLC in babies born to mothers with parity less than 1 was  $9275 \pm 1397/\text{cumm}$ , with parity 1 to 3 was  $9012 \pm 1590/\text{cumm}$  and with parity more than 3 was  $9372 \pm 994/\text{cumm}$ . Statistical difference between mean TLC in babies born to mothers with different parities was not significant, whereas Mean DLC in three groups was; Neutrophils (cumm) were  $5115 \pm 1426$  in babies of mothers with parity <1,  $4529 \pm 1419$  in p1-p3 and  $4941 \pm 974$  in p>3; Lymphocytes (cumm) were  $4051 \pm 1001$  in babies of mothers with parity <1,  $4243 \pm 1110$  in p1-p3 and  $4357 \pm 308$  in p>3; Monocytes (cumm) were  $68 \pm 119$  in babies of mothers with parity <1,  $120 \pm 175$  in p1-p3 and  $19 \pm 42$  in p>3; Eosinophils (cumm) were  $45 \pm 85$  in babies of mothers with parity <1,  $69 \pm 108$  in p1-p3 and  $36 \pm 50$  in p>3; Basophils (cumm) were  $18 \pm 53$  in babies of mothers with parity <1,  $24 \pm 57$  in p1-p3 and  $17 \pm 39$  in p>3; Immature cells (cumm) were  $1 \pm 12$  in babies of mothers with parity <1,  $2 \pm 15$  in p1-p3 and  $0$  in p>3; Statistical difference for DLC in three groups was significant for neutrophils and Monocytes (Table 1).

**Table 1: TLC and DLC in relation to parity.**

Group	No. of Cases	TLC Mean $\pm$ SD (Reference range)	Mean $\pm$ SD (Reference range)					
			N	L	M	E	B	I
<P <sub>1</sub>	93	$9275 \pm 1397$ (4500-12800)	$5115 \pm 1426$ (2520-9600)	$4051 \pm 1001$ (1800-6720)	$68 \pm 119$ (0-510)	$45 \pm 85$ (0-392)	$18 \pm 53$ (0-320)	$1 \pm 12$ (0-92)
P <sub>1</sub> – P <sub>3</sub>	102	$9012 \pm 1590$ (4500-13400)	$4529 \pm 1419$ (1032-9360)	$4243 \pm 1110$ (1600-7776)	$120 \pm 175$ (0-960)	$69 \pm 108$ (0-510)	$24 \pm 57$ (0-370)	$2 \pm 15$ (0-100)
>P <sub>3</sub>	5	$9372 \pm 994$ (8400-11000)	$4941 \pm 974$ (4032-6600)	$4357 \pm 308$ (3872-4730)	$19 \pm 42$ (0-95)	$36 \pm 50$ (0-95)	$17 \pm 39$ (0-88)	$0 \pm 0$ (0)
Statistical Analysis		F = 0.816 P = 0.444	F = 4.189 P = 0.017	F = 0.904 P = 0.407	F = 3.586 P = 0.03	F = 1.578 P = 0.209	F = 0.359 P = 0.699	F = 149 P = 0.862

Mean TLC in new-borns with age of mother <25 yrs was  $9191 \pm 1439/\text{cumm}$ , in with 25-30 yrs was  $9101 \pm 1483/\text{cumm}$  and in with >30 yrs was  $9130 \pm 1907/\text{cumm}$ . Statistical difference in mean TLC in different groups was not significant. Mean DLC in three groups was; Neutrophils (cumm) were  $4970 \pm 1435$  in babies with age of mother <25 yrs,  $4753 \pm 1493$  with age of mother 25-30 yrs and  $4237 \pm 866$  with age of mother >30 yrs; Lymphocytes (cumm) were  $4055 \pm 952$  in babies with age of mother <25 yrs,  $4183 \pm 1108$  with age of

mother 25-30 yrs and  $4595 \pm 1159$  with age of mother >30 yrs; Monocytes (cumm) were  $99 \pm 158$  in babies with age of mother <25 yrs,  $84 \pm 146$  with age of mother 25-30 yrs and  $112 \pm 153$  with age of mother >30 yrs.

Eosinophils (cumm) were  $54 \pm 94$  in babies with age of mother <25 yrs,  $60 \pm 105$  with age of mother 25-30 yrs and  $56 \pm 66$  with age of mother >30 yrs; Basophils (cumm) were  $23 \pm 62$  in babies with age of mother <25 yrs,  $20 \pm 49$  with age of mother 25-30 yrs and  $19 \pm 39$  with

age of mother >30 yrs; Immature cells (cumm) were  $0.94 \pm 8$  in babies with age of mother <25 yrs,  $2 \pm 16$  with age of mother 25-30 yrs and  $6 \pm 25$  with age of mother

>30 yrs; Statistical difference for DLC in three groups was not significant (Table 2).

**Table 2: TLC and DLC in relation to age of mother (years).**

Group	No. of Cases	TLC Mean $\pm$ SD (Reference range)	Mean $\pm$ SD (Reference range)					
			N	L	M	E	B	I
<25 years	90	9191 $\pm$ 1439 (4500-12200)	4970 $\pm$ 1435 (2600-9600)	4055 $\pm$ 952 (1890-7130)	99 $\pm$ 158 (0-960)	54 $\pm$ 94 (0-436)	23 $\pm$ 62 (0-370)	0.94 $\pm$ 8 (0-85)
25-30 years	95	9101 $\pm$ 1483 (4500-13100)	4753 $\pm$ 1493 (1032-9360)	4183 $\pm$ 1108 (1600-7776)	84 $\pm$ 146 (0-720)	60 $\pm$ 105 (0-510)	20 $\pm$ 49 (0-264)	2 $\pm$ 16 (0-100)
>30 years	15	9130 $\pm$ 1907 (6000-13400)	4237 $\pm$ 866 (2730-5880)	4595 $\pm$ 1159 (3000-7504)	112 $\pm$ 153 (0-564)	56 $\pm$ 66 (0-188)	19 $\pm$ 39 (0-98)	6 $\pm$ 25 (0-98)
Statistical analysis ANOVA		F = 0.085 P = 0.919	F = 1.843 P = 0.161	F = 1.776 P = 0.172	F = 0.346 P = 0.708	F = 0.087 P = 0.917	F = 0.119 P = 0.887	F = 1.133 P = 0.324

**Table 3: TLC and DLC in relation to type of delivery.**

Group	No. of Cases	TLC Mean $\pm$ SD (Reference range)	Mean $\pm$ SD (Reference range)					
			N	L	M	E	B	I
NVD	130	9194 $\pm$ 1531 (4500-13100)	4926 $\pm$ 1511 (1643-9600)	4116 $\pm$ 993 (1600-7776)	87 $\pm$ 139 (0-612)	53 $\pm$ 96 (0-510)	16 $\pm$ 41 (0-192)	2 $\pm$ 13 (0-100)
LSCS	70	9049 $\pm$ 1419 (6400-13400)	4601 $\pm$ 1272 (1032-7992)	4231 $\pm$ 1149 (1936-7568)	104 $\pm$ 173 (0-960)	65 $\pm$ 100 (0-436)	31 $\pm$ 73 (0-370)	2 $\pm$ 15 (0-98)
Statistical analysis		t = 0.653 P = 0.514	t = 1.527 p = 0.128	t = -0.742 p = 0.459	t = -0.723 p = 0.470	t = -0.799 p = 0.425	t = -1.967 p = 0.051	t = -0.213 p = 0.832

**Table 4: TLC and DLC in relation to type of presentation.**

Group	No. of Cases	TLC Mean $\pm$ SD (Reference range)	Mean $\pm$ SD (Reference range)					
			N	L	M	E	B	I
Vertex	183	9174 $\pm$ 1476 (4500-13400)	4858 $\pm$ 1454 (1032-9600)	4152 $\pm$ 1060 (1600-7776)	90 $\pm$ 140 (0-720)	54 $\pm$ 93 (0-510)	21 $\pm$ 55 (0-370)	2 $\pm$ 13 (0-100)
Breech	16	8616 $\pm$ 1488 (6000-10900)	4858 $\pm$ 1454 (2730-6479)	4183 $\pm$ 976 (2080-6104)	74 $\pm$ 120 (0-418)	80 $\pm$ 132 (0-436)	18 $\pm$ 40 (0-109)	5 $\pm$ 20 (0-83)
Others	1	12000 $\pm$ 0 (12000)	6240	4560	960	240	120	0
Statistical Analysis ANOVA		F = 2.929 P = 0.056	F = 2.095 P = 0.126	F = 0.080 P = 0.923	F = 19.488 P = <0.001	F = 2.311 P = 0.102	F = 1.642 P = 0.196	F = 0.361 P = 0.697

Mean TLC in new-borns delivered by NVD was  $9194 \pm 1531$ /cumm and in those delivered by LSCS was  $9049 \pm 1419$ /cumm. Statistical difference in mean TLC in two groups was not significant. Mean DLC in two groups was; Neutrophils (cumm) were  $4926 \pm 1511$  in babies born by NVD and  $4601 \pm 1272$  in babies born by LSCS;

Lymphocytes (cumm) were  $4116 \pm 993$  in babies born by NVD and  $4231 \pm 1149$  in babies born by LSCS; Monocytes (cumm) were  $87 \pm 139$  in babies born by NVD and  $104 \pm 173$  in babies born by LSCS; Eosinophils (cumm) were  $53 \pm 96$  in babies born by NVD and  $65 \pm 100$  in babies born by LSCS; Basophils (cumm) were  $16 \pm 41$

in babies born by NVD and  $31 \pm 73$  in babies born by LSCS; Immature cells (cumm) were  $2 \pm 13$  in babies born by NVD and  $2 \pm 15$  in babies born by LSCS. Statistical difference for DLC in two groups was not significant (Table 3).

Mean TLC in new-borns delivered by vertex presentation was  $9174 \pm 1476$ /cumm, in delivered by breech presentation was  $8616 \pm 1488$ /cumm and in delivered by other presentations was  $12000$ /cumm. Statistical difference in mean TLC in different groups was not significant. Mean DLC in three groups was; Neutrophils (cumm) were  $4858 \pm 1454$  in babies born with vertex presentation,  $4858 \pm 1454$  in babies born with breech presentation and  $6240$  in babies born with other presentation; Lymphocytes (cumm) were  $4152 \pm 1060$  in babies born with vertex presentation,  $4183 \pm 976$  in babies born with breech presentation and  $4560$  in babies born with other presentation; Monocytes (cumm) were  $90 \pm 140$  in babies born with vertex presentation,  $74 \pm 120$  in babies born with breech presentation and  $960$  in babies born with other presentation; Eosinophils (cumm) were  $54 \pm 93$  in babies born with vertex presentation,  $80 \pm 132$  in babies born with breech presentation and  $240$  in babies born with other presentation; Basophils (cumm) were  $21 \pm 55$  in babies born with vertex presentation,  $18 \pm 40$  in babies born with breech presentation and  $120$  in babies born with other presentation; Immature cells (cumm) were  $2 \pm 13$  in babies born with vertex presentation,  $5 \pm 20$  in babies born with breech presentation and  $0$  in babies born with other presentation; Statistical difference for DLC in two groups was highly significant for Monocytes (Table 4).

## DISCUSSION

The present study included 200 healthy new-borns admitted to neonatology section of department of paediatrics Govt. medical college /Rajindra Hospital Patiala. Cord blood sample was collected and TLC, DLC were measured at birth.

In present study mean TLC in babies born to mothers with parity less than 1, parity 1 to 3 and parity more than 3 was  $9275 \pm 1397$ ,  $9012 \pm 1590$  and  $9372 \pm 994$ /cumm respectively. Statistical difference in mean TLC between babies born to mothers with different parities was not significant whereas Statistical difference for DLC in three groups was significant for neutrophils and Monocytes. Neutrophils (cumm) were  $5115 \pm 1426$  in babies of mothers with parity  $<1$ ,  $4529 \pm 1419$  in p1-p3 and  $4941 \pm 974$  in p>3 and Monocytes (cumm) were  $68 \pm 119$  in babies of mothers with parity  $<1$ ,  $120 \pm 175$  in p1-p3 and  $19 \pm 42$  in p>3. A similar study showed low TLC in babies born to multiparous than primiparous. It also witnessed monocytes were high in primipara and eosinophils were high in mutipara group.<sup>13</sup> Our study showed comparable result regarding monocytes but instead of eosinophils neutrophils showed statistically significant value high in primi compared to multipara. Similarly another study

showed low TLC and other hematological values except lymphocyte count with increasing parity.<sup>14</sup>

In present study it was found that maternal age has no relation with mean TLC and DLC of new-born. Similar results were shown by others except one study that showed high neutrophils in young mothers and high lymphocytes in old age mothers.<sup>13</sup>

The value of mean TLC in new-borns delivered by NVD and LSCS was studied by various authors.<sup>15,16</sup> Nikischin W et al studied that the mean TLC after spontaneous birth ( $14600 \pm 4000$ /cumm) were significantly higher than after cesarean section ( $12100 \pm 4400$ /cumm;  $p < 0.05$ ). Sparrow et al studied that the mean TLC in new-borns delivered by NVD had a significantly higher TLC concentration compared with that from cesarean section (medians-17100 and 13600/cumm, respectively;  $p < 0.0001$ ). However, in our study mean TLC and DLC in new-borns delivered by NVD and LSCS was studied and statistical difference between two groups was not significant.

In our study mean TLC in new-borns delivered by vertex presentation, breech presentation and by other presentations was  $9174 \pm 1476$ ,  $8616 \pm 1488$  and  $12000$ /cumm respectively. Statistical difference in mean TLC between three groups was not significant. Statistical difference for DLC in two groups was highly significant for Monocytes. Monocytes (cumm) were  $90 \pm 140$  in babies born with vertex presentation,  $74 \pm 120$  in babies born with breech presentation and  $960$  in babies born with other presentation No author had studied correlation of type of presentation at time of delivery with TLC and DLC in new-born.

## CONCLUSION

Effect of maternal factors (parity, age and type of delivery) on Mean TLC of newborns was statistically not significant. Statistical difference for DLC in relation to maternal parity was significant for neutrophils and Monocytes while highly significant for Monocytes related to mode of presentation. However, statistical difference for Mean DLC in babies was not significant in relation to age of mother and type of delivery.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

- Lucas WP, Deaning BF, Hoobler HR, Cox A, Jones NR, Smith FS. Blood studies in the newborn (morphological, chemical, Coagulation, urobilin, and bilirubin). *Am J Dis Child.* 1921;22:525.
- Lippman HS. A morphologic and quantitative study of the blood corpuscles in the newborn period. *Am. J. Dis. Child.* 1924;27:473.

3. Washburn AH. Blood cells in healthy young infants. *Am J Dis. Child*. 1935;50:413.
4. Manroe BL, Weinberg AG, Rosenfeld CR, Browne R. The neonatal blood count in health and disease. Reference values for neutrophilic cells. *J Pediatr*. 1979;95:89-98.
5. Weinberg AG, Rosenfeld CR, Manroe BL, Browne R. Neonatal blood cell count in health and disease II values for lymphocytes, monocytes and neutrophils. *J Pediatr*. 1985;106:462-6.
6. Coulombel L, Dehan M, Tchernia G, Vial M. The number of polymorphonuclear leucocytes in relation to gestational age in the newborn. *Acta Pediatr Scand*. 1979;68:709-11.
7. Stancheva VP, Sherman GG, Avent M, Cory BJ, Dned RN, Ballot DE. Hematological reference ranges in black very low birth weight infants. *Pediatr Hematol Oncol*. 2002;19:91-4.
8. Siddiqui MAR, Saxena H, Srivastava JR. Indian *Pediatr*. A study of hematological values in newborns. 1972;9(2):90-4.
9. Noguera NI, Detarsio G, Perez SM, Bragos IM, Lanza O, Rodriguez JH. Hematological study of newborn umbilical cord blood. *Medicina*. 1999;59:446-8.
10. Chirico G, Gasparoni A, Ciardelli L, Martinotti L, Rondini G. Leukocyte Counts in Relation to the Method of Delivery during the First Five Days of Life. *Biol Neonate*. 1999;75:294-9.
11. Marwaha N, Marwaha RK, Narang A, Thusu K, Garewal G, Bhakoo ON. Routine hematological values in term newborns. *Indian Pediatr*. 1992;29:1095-99.
12. Sood R. Examination of Peripheral Blood Film. *Medical Laboratory Technology*, Fourth edition. 1994:188-194.
13. Qaiser DH, Sandila MP, Ahmed ST, Kazmi T. Influence of maternal factors on hematological parameters of healthy newborns of Karachi. *J Pak Med Assoc*. 2009;59:618-22.
14. Borna H, Borna S, Rafati SH, Haji Ebrahim Terari F. Umbilical cord hematological variables in different modes of delivery. *Tehran University Medical Journal*. 2006;64(8):49-56.
15. Nikischin W, Peter M, Oldigs HD. The influence of mode of delivery on hematological values in the umbilical vein. *Gyneco Obstet Invest*. 1997;43(2):104-71.
16. Sparrow RL, Cauchi JA, Ramadi LT, Waugh CM, Kirkland MA. Influence of mode of birth and collection on WBC yields of umbilical cord blood units. *Transfusion*. 2002;42(2):210-5.

**Cite this article as:** Kumar A, Kaur J. Evaluating the effect of maternal factors on total and differential leucocyte count of healthy newborns in cord blood. *Int J Contemp Pediatr* 2016;3:1050-4.