International Journal of Research in Medical Sciences
Thaseen N et al. Int J Res Med Sci. 2021 Jun;9(6):1662-1666
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20212233

Original Research Article

Leukocyte profile in cord blood of newborns to diabetic and non-diabetic mothers

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Received: 17 March 2021
Revised: 18 May 2021
Accepted: 19 May 2021

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ABSTRACT

Background: Increasing incidence of diabetes due to strees inducing life-style, involves dearrangement of carbohydrate, fat, protein metabolism characterized by hyperglycemia, hyperlipidimia and negative nitrogen balance respectively. Causing morbidity and mortality, effects gestational diabetes. Pregnancy, capacity to secrete insulin increases with gestational age, has effect in last trimester of pregnancy. Maternal glycemic-status influences neonates leucocyte profile.
Methods: Fully automated haematology analyzer ABXMICROsot used to analyze cord blood of neonates born to 40 diabetic (known to be diabetic at pregnancy) and 40 non-diabetic mothers, collected in EDTA tubes. Diabetic group was sub divided into D1 and D2. D1 as 100-150 mg/dcl, D2 as above 150 mg/dcl. Statistical treatment of Levene's test of equality of variances applied to the data.
Results: WBC count, granulocyte percent and monocyte percent were significantly lower, lymphocyte percent was higher in neonates to diabetic mothers. Significantly higher in D2 then D1group. The prognosis for the child of a pregnant diabetic is related to the degree of control of mother's glycemic status, reflected higher indices in D2 then D1.
Conclusions: Neonates immune system depends on the mother's immune system i.e.; immunological properties are practically under control of interleukin-1 and interleukin-6. Interleukin-6 potentiates action of interleukin-1 synergistically, such action of interleukin converts non-committed stem cells to committed stem cells. Immunosuppressant status in diabetic mother (i.e.; non-priming of neonatal interleukin-6 by immunosuppressant diabetic mother's interleukin-6, main cause for altered counts) modulating neonatal interleukin-6 it decreases haematopoietic potential in the neonates, ECF in infants of diabetic mother is reduced leading to haemo-concentration, increasing cell count. Pictures as increase cell count at birth in neonates of diabetic mother.

Keywords: Gestational diabetes, Cord blood, Interlukin, Immunity, Neonates, Haematological indices

INTRODUCTION

In normal pregnancy the capacity to secrete Insulin increases with gestational age and is most striking during the last trimester of pregnancy Rising levels of progesterone, estrogen, cortisol and human placental lactogen are held responsible for the marked increase in insulin resistance. Gestational diabetes mellitus is defined as diabetic mellitus appearing for the first time in pregnancy or could be associated with potential diabetes. In diabetes maternal hyperglycemia leads to fetal hyperglycemia which in turn stimulates the fetal beta cells to increase insulin production. Fetal insulin has central role in fetal growth and development during approximately the last 10 weeks of gestation. The grouping of diabetic mothers according to blood sugar levels gave more information of prognostic importance.[1]

All the immunological properties are particularly under the control of IL-1 and IL-6 consequently the defense capability of neonates in the new hostile environment is influenced by immunomodulatory status of IL-1and IL-6 of diabetic mothers.

The aim of the study was to document data regarding leucocyte profile in cord blood sample of neonates to diabetic and non-diabetic mothers. In this local cross section of population, we also observed influence of maternal hyperglycemia on leucocyte profile of new born.

METHODS

Study type

The study type was prospective case-control study.

Study place

The study was carried out at Vanivilas hospital at Bengaluru, India

Study period

The study period was from January 2000 to 2002

Selection criteria of patient

Pregnant women's visiting obstetric department of Vanivilas hospital for pre-natal checkup were screened for blood glucose level, mean blood glucose level during the last weeks of pregnancy was calculated for each woman and used as index of glycemic status of pregnant women.[2] The diabetic group was subdivided into D1 i.e., mother's sugar level before the birth of neonates 100-150 mg/dl and D2 i.e.; sugar level above 150 mg/dl

Diabetic mother's with vascular complications like benign retionopathy, proliferative retinopathy and nephropathy were excluded. Control group consisted of uncomplicated pregnant women.

Ethical approval was obtained from OBG department and pediatric department of Vanivilas hospital.

Sample size was calculated as per the guidelines of sample size requirements for case control study designed.[3] Statistical treatment was given useing SPSS software After resection of the umbilical cord, the cord stem remaining on the placenta was cleared off the maternal blood, 2 ml of cord blood was collected with EDTA as anti-coagulant the sample was transferred to the laboratory in a cold container and analyzed using ABXMICROsot, a fully automated hematological analyzer was used for in vitro diagnostic testing of whole blood specimen the following parameters were recorded by using 12 micro liters of whole blood mixed with ethylenediamine tetraacetic acid (EDTA).[4] The parameters are WBC count, granulocyte percent, monocyte percent and lymphocyte percent. The data obtained from cord blood sample of new born to 40 diabetics and 40 non-diabetics was documented. Statistical treatment of Levene's test of equality of variances was applied to the data using SPSS software.

It was found that WBC count, granulocyte percent and monocyte percent were significantly higher in non-diabetic than in diabetic group. It was evident that lymphocyte percent was increased in diabetic group than in non-diabetic group. The significantly altered counts in D2 more than D1. As the prognosis for the child of a pregnant diabetic is related to the degree of control of mother's glycemic status which is reflected by higher indices in D2 than D1.

RESULTS

The mean of the neonates to 40 diabetic and 40 non-diabetic pregnant women is documented in Table 1-2. The diabetic group was further subdivided into D1 i.e.; mother`s sugar level before the birth of neonates 100-150 mg/dl and D2 i.e.; sugar level above 150 mg/dl. The mean of D1 and D2 is documented in Table 3. The data so obtained relating to leucocytes was statistically treated by Levene's test of equality of variances and was applied to the data. The t values and its significance are shown in Table 4. The mean, SD, t value and its significance of D1 and D2 are shown in Table 5. The graphs were developed to portray relationship between parameters and corresponding groups and are documented in Figure 1-2.

It was found that total WBC count, granulocyte percent and monocyte percent are higher in non-diabetic than in diabetic group. Lymphocyte percent was increased in diabetic group than in non-diabetic group. These altered counts are significantly prominent in D2 than D1 group. The prognosis for the child of a pregnant diabetic is related to the degree of control of mother's glycemic status which is reflected by higher indices in D2 than D1.

Table 1: Mean of cord blood values in neonates of non-diabetic mothers (N=40).

Parameters	Mean
WBC count (10^3/mm^3)	14.7150
Monocyte percent (%)	13.6875
Granulocyte percent (%)	51.7600
Lymphocyte percent (%)	34.5675

Table 2: Mean of cord blood values in neonates of diabetic mothers (N=40).

Parameters	Mean
WBC count (10^3/mm^3)	12.0125
Monocyte percent (%)	10.7125
Granulocyte percent (%)	43.0650
Lymphocyte percent (%)	45.5075

Table 3: Mean of cord blood values in neonates of D1 and D2 groups.

Parameters	Mean	
	D1	D2
WBC count (10^3/mm^3)	13.0526	11.9762
Monocyte percent (%)	11.7421	9.7810
Granulocyte percent (%)	46.3095	39.4789
Lymphocyte percent (%)	42.5476	48.7789
Glucose level (mg/dl)	Cases	
100-150	19	
150 and above	21	

Table 4: Mean, SD and level of significance of cord blood leukocyte profile in neonates of non-diabetic and diabetic mothers.

Parameters	Non-diabetic		Diabetic		t value	Significance
	Mean	SD	Mean	SD		
WBC count (10^3/mm^3)	14.7150	4.6138	12.0125	3.5473	2.937	S
Monocyte percent (%)	13.6875	7.6125	10.7125	5.5715	2.995	S
Granulocyte percent (%)	51.7600	10.1020	43.0650	16.3229	2.865	S
Lymphocyte percent (%)	34.5675	10.2798	45.5075	12.4608	4.283	S

Table 5: Mean, SD and level of significance of cord blood leucocyte profile in neonates of diabetic- D1 and D2 group mothers.

Parameters	D1		D2		t value	Significance
	Mean	SD	Mean	SD		
WBC count (10^3/mm^3)	13.0526	3.9884	11.9762	3.1965	2.067	S
Monocyte percent (%)	11.7421	5.3804	9.7810	5.7061	2.150	S
Granulocyte percent (%)	46.3095	17.1982	39.4789	14.9259	2.650	S
Lymphocyte percent (%)	42.5476	13.0449	48.7789	11.2172	2.260	S

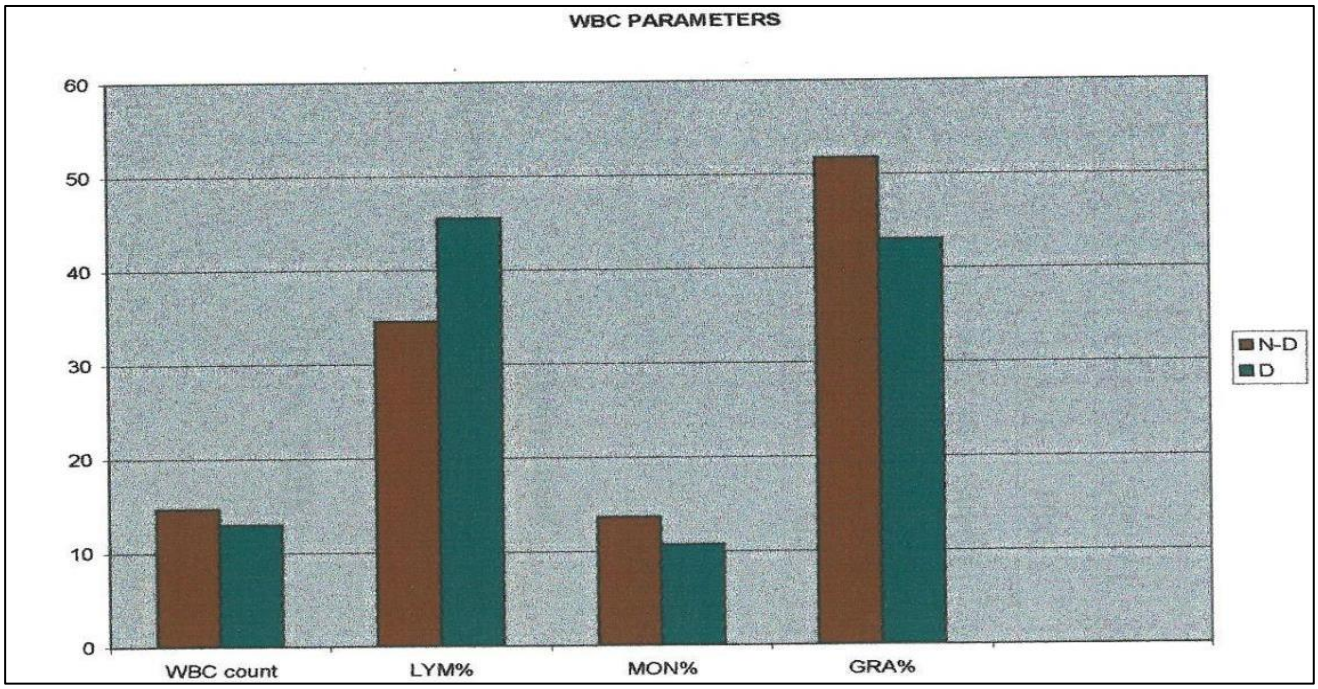

Figure 1: Cord blood leucocytic profile in neonates of diabetic and non-diabetic mothers.

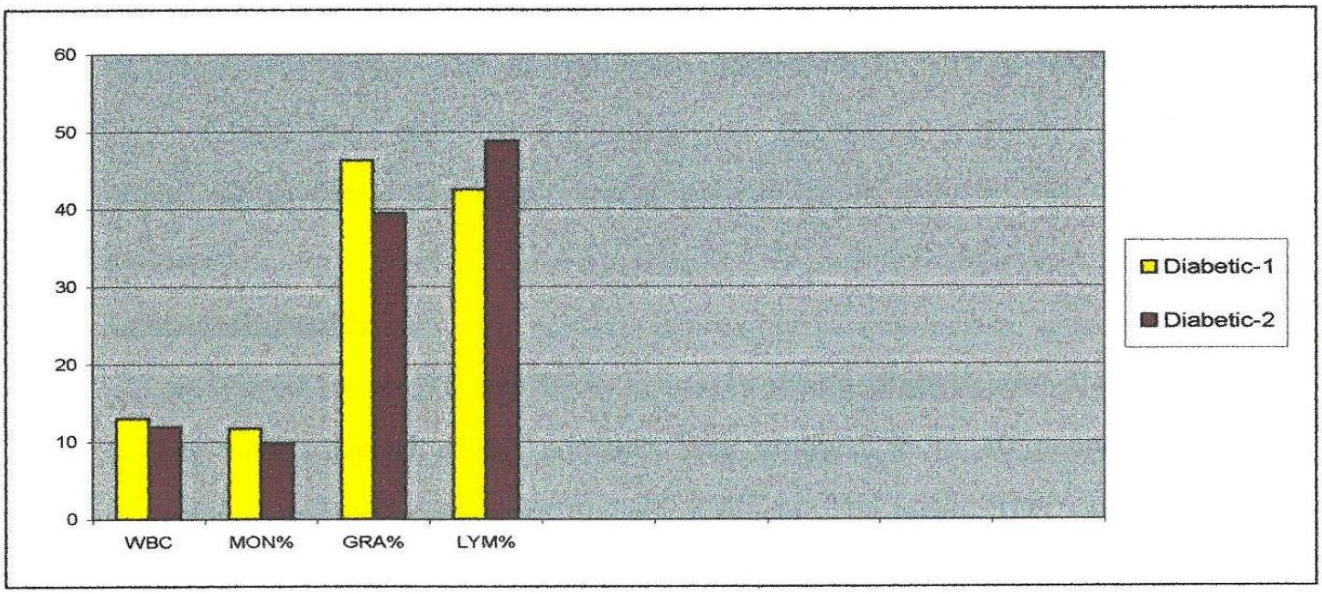

Figure 2: Cord blood leucocytic profile in neonates of diabetic- D1 and D2 group mothers.

DISCUSSION

An attempt is made to discuss impact of glycemic level on various parameters.

Leucocyte profile

This is explained by the following ways, progenitor cells are more sensitive to appropriate stimuli like IL-6.[5] IL-6 potentiates the action of IL-1 synergistically such action of interleukin converts uncommitted stem cells to committed stem cells which enhances proliferation of granulocyte and monocytes leading to increased WBC count in non-diabetic group.[6] The immune suppressant status in diabetic mother by modulating neonatal IL-6 decreases haeomopoitic potential in neonates leading to decreased enhancement in WBC count, granulocyte percent and monocyte percent. In the last trimester, ECF in infants of diabetic mother is reduced leading to haemo-concentration and increasing cell count.[7-9]

The haematological effect of IL-1 is to decrease circulating lymphocyte.[10] The loss of synergizing effect of IL-6 on IL-1 in diabetic group neonates due to immune suppressant effect in diabetic mother, has decreased activity of IL-1 precipitating increase in circulating lymphocyte, this as well as relative lymphocytosis due to decreasing granulocyte and Monocyte has given to significant lymphocyte percent in diabetic group. Decreased activity of IL-1 precipitates increased circulating lymphocytes as the immune suppressant effect depends on the mother's blood glucose level there is more significance of lymphocyte percent in D2 than in D1. ECF in diabetic mother is reduced, leading to heamo-concentration and increase in cell count.[8,9]

The body composition of new born to diabetic mother's shows that the total body water in infants of diabetic mother was found to be considerably reduced. It constitutes on the average of 70.2% of the body weight compared to 78.2% of the body weight in normal infants. The reduced total hydration implies that infants of diabetic mother's must possess a surplus of fat tissue with low water content[11.]

The extra cellular water in infants of diabetic mother is reduced. Whereas the intra cellular water is not reduced in absolute amount, which shows that these infants in addition to their obesity possess a source of increased intracellular water bound to carbohydrates stores in the cells.[8,12]

Placental origin hormones, human placental lactogen, progesterone, estrogen and prolactin, enhances insulin resistance while stimulating lipolysis. Pituitary prolactin is also known to decrease insulin binding with in adipose tissue sites and estrogen has been shown to impair glucose tolerance and to antagonize the effect of insulin.[13]

The constellation of abnormalities caused by insulin deficiency is called diabetes mellitus. There are widespread biochemical abnormalities, but the fundamental defects to which most of the abnormalities can be traced to are decreased entry of glucose into various peripheral tissues.[14]

Increased liberation of glucose into circulation from liver. There is therefore an extracellular glucose excess and, in many cells, an intracellular deficiency, a situation that has been called "starvation in the midst of plenty". There is also a decrease in entry of aminoacids into muscle and an increase in lipolysis. It is now clear that there is an absolute or relative hyper secretion of glucogon in diabetes. In

diabetes mellitus and low birth weight infants the residual placental blood volume is smaller when respiration occurs before the cord is clamped in contradiction to normal infants. This finding might be due to shallow respiration in premature and diabetic mother's infants at and just after onset of respiration.[15]

The active management of the pregnant diabetic subject with the goal to reduce the mean blood glucose value below 100 mg/100 ml and the active management of the new born infants with early supply of fluid and calories have good result.[2]

All this has impact on neonates of diabetic mother's.

In this study the values fall with in normal limit. The mean glycemic levels of still higher order would have further spaced out values making them to fall outside the normal limit in diabetic group. Maintaining high glycemic levels intentionally in diabetic pregnant women is deleterious to mother and fetus thus undoubtedly unethical.

CONCLUSION

The incidence of diabetes is increasing among urban population at an alarming rate due to stress inducing life style. It involves dearrangement of carbohydrate, fat and protein metabolism characterized by hyperglycemia, hyperlipidaemia and negative nitrogen balance respectively. The consequence of endocrinal and biochemical profile of diabetic mother on fetal haematological profile is to be considered besides cardiovascular, renal and other complications.

The non-priming of neonatal IL-6 by immune suppress diabetic maternal IL-6 is offered as the main cause of altered counts .since the prognosis of the child in pregnant diabetes is related to the degree of control of mother's glycemic level. Haematological profile of neonates to diabetic groups tend to increase viscosity of blood, this in turn predisposes to cardio respiratory distress neurological symptom and renal vein thrombosis that requires treatment apart from developmental abnormalities.

Fetal hyperinsulinimia has also been implicated in the delay of fetal lung maturation by impartment of pulmonary surfactant production. Thrombosis in newborn infants of diabetic mother's is comparatively high than non-diabetic group.

Thus, it becomes point of paramount importance to manage gestational diabetes by maintaining normal glycemic levels in pregnant women so as to minimize complications which take a great toll of morbidity and mortality.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Thaseen N, Veeraiah S. Leukocyte profile in cord blood of newborns to diabetic and non-diabetic mothers. Int J Res Med Sci 2021;9:1662-6.