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Clinical Profile and Outcome of Infant of Diabetic Mother in Tertiary Care Newborn Care Units

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ABSTRACT
The aim of this study was to assess the clinical profile, metabolic and hematological abnormalities and neonatal outcomes in neonates born to diabetic mothers (IDMs) at a tertiary care neonatal unit. A total of 76 neonates born to mothers with diabetes (either pre-gestational diabetes mellitus [OGDM] or gestational diabetes mellitus [GDM]) were enrolled in this prospective observational study. Maternal and neonatal characteristics, birth weights, presence of macrosomia, clinical abnormalities and complications including hypoglycemia, hyperbilirubinemia, congenital anomalies and respiratory distress were recorded. The outcomes of neonates born to mothers with GDM and OGDM were compared. Among the 76 IDMs, 87% were born to mothers with GDM and 13% to mothers with OGDM. The mean maternal age was 25.6 years and 67.2% of mothers with GDM were multiparous. The neonatal cohort had a significant incidence of metabolic abnormalities: hypoglycemia (46.1%), hyperbilirubinemia (44.7%) and hypocalcemia (34.2%). Macrosomia was observed in 36% of the neonates. Congenital anomalies were identified in 6.6% of the neonates, with cardiac defects and cleft lip and palate being the most common. Respiratory distress affected 38.2% of the neonates. Infants born to mothers with OGDM had more severe outcomes, including higher rates of macrosomia and respiratory distress, compared to those born to mothers with GDM. Infants of diabetic mothers are at increased risk of metabolic abnormalities, macrosomia, congenital anomalies and respiratory complications. Strict maternal glycemic control during pregnancy and early postnatal management of neonates are critical to minimizing these risks. Furthermore, preconceptional counseling for women with diabetes is essential for optimizing maternal and neonatal health outcomes.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder caused by either a relative or absolute lack of insulin or peripheral tissue resistance to the action of insulin. Pre-gestational diabetes (PGDM)-PGDM includes women with type 1 diabetes and type 2 diabetes who have been diagnosed and treated prior to conception. Type 2 pre-gestational diabetes mellitus (PGDM) is now more common than type 1 as obesity prevalence and its associations climb. PDGM complicates 1%-2% of all pregnancies and comprises 13%-21% of diabetes in pregnancy. Gestational diabetes mellitus (GDM)-Any carbohydrate intolerance that is initially diagnosed during pregnancy. GDM currently complicates up to 14% of all pregnancies and accounts for the vast majority of all cases of diabetes in pregnancy[1]. In South East Asia region the prevalence of Gestational Diabetes mellitus was 25.9% in year 2021. In India, the prevalence of Gestational Diabetes mellitus was 29.3% in year 2021 as per International Diabetes Federation Data. In Gujarat, the prevalence of Gestational Diabetes mellitus was 12.7% in year 2022[2]. Pregnant women with diabetes (type 1, type 2 and gestational) are more likely to experience unfavourable pregnancy outcomes., controlling blood sugar levels before and during pregnancy is essential to achieving the best possible results[3]. Infants born to mothers with diabetes have been at significantly greater risk for spontaneous abortion, stillbirth, congenital malformations, perinatal morbidity and mortality. Abnormal fetal metabolism during pregnancy complicated by maternal diabetes mellitus results in multiple neonatal sequelae, including abnormalities of growth, glucose and calcium metabolism, hematologic status, cardiorespiratory function, bilirubin metabolism and congenital anomalies[4]. Compared to mothers without diabetes, the newborn mortality rate among IDMs is five times higher[5]. Some of the adverse effects of diabetes in pregnancy can be prevented by pre-conceptional counseling, careful planning of the mode and time of delivery, better glucose control, early screening for fetal abnormalities and good neonatal care. Data regarding the types of complications and their incidence in the infants of diabetic mothers is sparse from south Gujrat hence, the present study was undertaken to study the complications in the infants of diabetic mothers in our hospital.

MATERIALS AND METHODS

Study Design: Observational Cross-sectional study.

Study Duration: 18 months.

Study Place: Neonatal ICU, Department of pediatrics at tertiary care center.

Study Population: Infants of diabetic mothers born during the study period which were admitted to the neonatal care unit of tertiary care Hospital included according to inclusion criteria.

Sample Size: 76 cases. Sample size calculated considering proportion of neonates born to diabetic mother admitted at NICU is 5.2%.

$$n= \frac{Z2PQ}{L2}$$

P=5.2%

Q=1-P

L= Allowable Error=5%

Z=Level of Confidence=95%

Sampling Method: Purposive Sampling.

Inclusion Criteria: All newborn [intramural (admitted at any time) and extramural (admitted within 120 hours)] babies admitted in NICU who born to mother known to have pre-gestational diabetes mellitus or gestational diabetes mellitus.

Exclusion Criteria:

- Newborns whose parents were not willing to give consent for the study.
- Extramural newborn admitted after 120 hours of life.

Ethical Consideration: This study was approved by the Institutional Ethical Committee of this institute. Written informed consent was taken prior to the study of each participant.

Method of Collection of Data: Neonates admitted in NICU, whose mothers have gestational diabetes mellitus (GM) or pre-gestational diabetes mellitus (PDGM) who fulfilled the mentioned inclusion criteria were included in the study. After obtaining the informed written consent from the parent or guardian, the relevant information from the history, physical examination and investigation findings were recorded in a predesigned proforma. Maternal characteristics recorded included mother's age, mother's weight, History of consanguinity, LMP, EDD, gravida, parity, h/o previous abortions, stillbirths, other significant ANC USG findings, any maternal illness, Drug history, Gestational age at delivery time, mode of delivery, amniotic fluid details. Diabetic status, HBA1C value, and treatment abstracted from the antenatal records and classified according to WHO guidelines. Diabetic mothers who had blood glucose levels in the range of 70 to 110 mg/dL throughout the day are considered to have good glycemic control and above this are considered to have poor glycemic control. After the baby is born, any complications during labor are

recorded. APGAR scores were assessed and recorded. Routine care was done. For those that required resuscitation, the mode of resuscitation was noted. The baby was weighed and the gestation was assessed according to modified Ballard's score. The newborn was subjected through a thorough clinical examination for detection of any structural anomalies, systemic defects. General physical examination was done and vitals-heart rate, respiratory rate and SpO2 were checked. Head-to-toe examination done. Birth injuries-cephalhematoma, brachial plexus injury (erb's palsy), fractures or bruises looked for. Anthropometric measurements were performed and babies were classified as large for gestational age (LGA), appropriate for gestational age (AGA), or small for gestational age (SGA) according to centile charts. Babies with weight of >4000g were labeled as macrosomic and babies <2500g as low birth weight.

Systemic examination:
Cardiovascular system-to look for any murmur on auscultation, peripheral pulses, cyanosis. Respiratory system-to look for signs of respiratory distress. Central nervous system-to look for any lethargy, poor feeding, poor cry, activity, or convulsions. Per abdomen system-to look for organomegaly and abdominal distention. Musculoskeletal system-to look for spinal deformities like spina bifida and sacral agenesis. Blood glucose levels were checked at 0, 2,4, 6, 12, 24, and 48 hours by glucostix. Serum calcium levels were measured routinely at admission of newborn and later if there was hypocalcemia or symptoms present of hypocalcemia. A complete hemogram was done at admission and 24 hours later. Blood samples were collected in each time taking aseptic precautions, results were measured by autoanalyzer. Among other investigations: chest x-ray posterior-anterior view (CXR PA), plain X-ray of lumbosacral spine, USG-Abdomen, and 2D Echo were done as indicated by clinical parameters. Newborns were treated according to their clinical problems like respiratory distress, hypoglycemia, hypocalcemia, hyperbilirubinemia, sepsis, polycythemia, feeding difficulties or intolerance, apnea. The duration of stay was noted.

Data Collection and Analysis: Data was collected by case record form and entered into MS Excel 2016. Data analysis was done in SPSS Software version 26.

Statistical Methods:
- Descriptive statistical analysis has been carried out in the present study.
- Results on continuous measurements are presented on Mean±SD (Min-Max) Results on categorical measurements are presented in Number (%). Categorical data was represented in the form of Frequencies.
- Significance is assessed at a 5% level of significance.
- The Chi-square/ Fisher Exact test has been used to find the significance of study parameters on a categorical scale between two or more groups. Paired t testis the test of significance for paired quantitative data.
- **Graphical Representation of Data:** MS Excel and MS Word were used to obtain various types of graphs, such as bar and Pie diagrams.
- p-value<0.05 is considered as statistically significant.

RESULTS AND DISCUSSIONS

The present study is a hospital-based prospective study to know the occurrence of metabolic and hematological abnormalities and congenital anomalies in infants of diabetic mothers and to compare the outcome in GDM and overt DM mothers. There were 7120 babies born during the period between March-2023 to February-2024. During these periods 76 newborns born to Mother's having a history of gestational or pre-gestational diabetes mellites meeting the inclusion criteria were studied.

Table 1: Baseline Maternal Characteristics

Variables		Frequency	Percentages %
Mean Age of Mother (in years)		25.6 + 4.7 years	
Diabetic Status			
Gestational DM		66	87
Overt DM		10	13
Gravida			
Primigravida		11	14.4
2nd-3rd Gravida		51	67.2
>3 Gravida		14	18.4
Diabetic control			
GDM	Good	59	89.4
	Poor	7	10.6
Overt gdm	good	7	70
	poor	3	30
Delivery method			
Gdm	vaginal	29	43.9
	lscs	37	56.06
Overt gdm	vaginal	5	50
	lscs	5	50

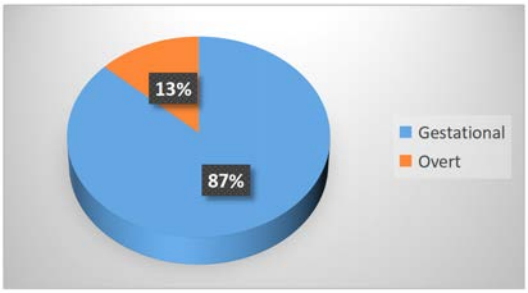

Fig. 1: Distribution of Cases According to Type of Diabetes

The mean age of mother's was 25.6+4.7 years. As per table 1 and (Fig. 3), Among the study participants the incidence of GDM was 87% and the incidence of Overt

DM was 13%. Out of total, 11 (14.4%) cases were primipara, 51 (67.2%) cases had 2nd or 3rd gravida and remaining 14 (18.4%) cases had >3 gravida.

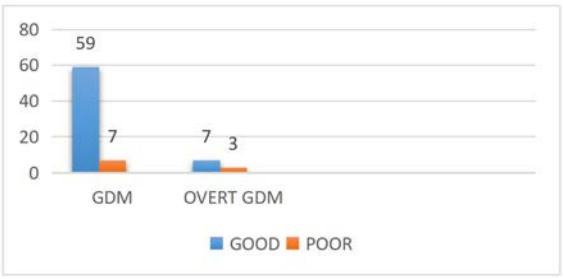

Fig. 2: Distribution of Cases According to Glycemic Control Among GDM and OVERT GDM Cases

On assessing the diabetic control, among GDM patients 59 (89.4%) cases had good control and 7 (10.6%) cases had poor control. While among overt DM patients 7 (70%) cases had good control and 3 (30%) cases had poor control. So as per (Fig. 4). Total 87% mothers having good glycemic control while 7% had poor glycemic control.

Table 2: Baseline Characteristics of IDM

Variables (n=76)	Frequency	Percentages
Gender		
Male	42	55.3
Female	34	44.7
Gestational age		
Preterm	10	13
Term	66	87
Mean Birth weight	2.74+1.6 kg	
Birth weight		
>4 kg	27	36
2.5-3.999 kg	33	43
1.5-2.499kg	14	18
1-1.499kg	2	3
Gestational age and birth weight group		
AGA	46	60.5
LGA	20	26.3
SGA	10	13.2

Among the study participants, 42 (55.3%) cases were males and 34 (44.7%) cases were females.

Table 3: Birth Related Variables Distribution

Variables	Frequency	Percentages
Respiratory Distress	29	38.2
Gross anomaly		
CHD	2	2.6
Cleft lip palate	1	1.3
Cleft palate	1	1.3
Meningomyelocele	1	1.3
Absent right ear	1	1.3
Birth injury		
Erb's palsy	2	2.6
Shoulder dislocation	1	1.3

Table 4: Distribution of Cases According to Metabolic and Hematological Abnormalities

Variables	Frequency	Percentages
Polycythemia	11	14.5
Hypocalcemia	26	34.2
Hypoglycemia	35	46.1
Hyperbilirubinemia	34	44.7

Most common abnormality Hypoglycemia 35 (46.1%) followed by Hyperbilirubinemia 34 (44.7%), Hypocalcemia 26 (34.2%), Polycythemia 11 (14.5%).

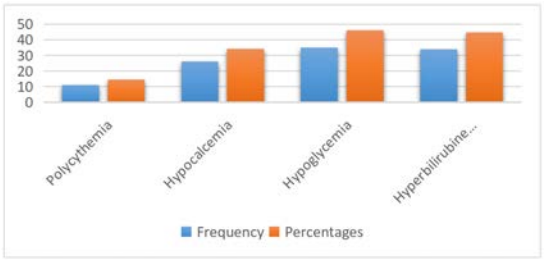

Fig. 3: Distribution of Cases According to Metabolic and Hematological Abnormality

Table 5: Comparison of Various Parameters Between Infant Born to Mothers with Diabetes Mellitus and Overt Gestational Diabetes among study Participants

Variables		Type of DM GDM(n=66)	Overt(n=10)	P-value
Glycemic control	Good	60	6	0.007
	Poor	6	4	
Birth weight (in kg)	<1.5	1	1	0.552
	1.5-2.5	8	6	
	2.5-4	31	2	
	>4	26	1	
Gestational age	Preterm	6	4	0.007
	Term	60	6	
Gestational age and birth weight group	AGA	40	6	0.021
	LGA	17	3	
	SGA	9	1	
Birth asphyxia	Yes	10	1	0.666
	No	56	9	
Delivery Method	LSCS	37	5	0.24
	Vaginal	29	5	
Respiratory distress	Yes	22	7	0.026
	No	44	3	
Gross anomaly	Yes	3	3	0.547
	No	63	7	
Birth Injury	Yes	2	1	0.321
	No	64	9	
Polycythemia	Yes	6	5	0.01
	No	60	5	
Hypocalcemia	Yes	22	4	0.219
	No	44	6	
Hyperbilirubinemia	Yes	30	4	0.547
	No	36		

Table 6: Comparison of Parameters affecting Hypoglycemia

Variables	Hypoglycemia Present	Hypoglycemia Not present	P-value
Type of DM			
0.074			
GDM	28	38	
Overt	7	3	
Glycemic control			
Good	31	35	0.680
Poor	4	6	
Gestational age with Birth weight			
SGA	5	4	0.002
AGA	15	25	
LGA	15	2	

There is statically significant difference in poor glycemic control, respiratory distress, gestational age and birth weight group and polycythemia between infants born to mothers with GDM and those with overt GDM, with these conditions being more common in infants born to mothers with overt GDM. Among GDM group, 26 Cases had birth weight more than 4 kg,

while in overt DM group, only 1 case had birth weight >4 kg. There was no association found between type of DM and birth weight, birth Asphyxia, Gross anomaly as well as birth injury (p value->0.05). On assessing haematological and metabolic parameters, there was no association found between type of DM and Hypocalcemia, Hyperbilirubinemia. (P value->0.05). On assessing the comparison between Hypoglycemia status and type of DM there was no significant association found (p value->0.05). Total 31 study participants who had good glycemic control, had presence of hypoglycemia. There was no association found between type of glycemic control and presence of hypoglycemia (p value->0.05). Among the patients of Hypoglycemia category, 5 cases were SGA, 15 cases were AGA and another 15 cases were LGA. There was an association found between presence of hypoglycemia and Gestational age with birth weight.

Table 7: Comparison of Outcome and Type of GDM

Outcome	GDM	OVERT	P-value
Discharged	62	9	0.125
Death	2	0	
DAMA	1	1	
Referred	1	0	

Out of total among GDM patients, 62 cases were discharged, 1 case was DAMA, another one case was Referred to other hospital and 2 deaths were noted. Among Overt DM patients, 9 cases were discharged and 1 case was DAMA. There was no association found between outcome and type of GDM among study participants. Among the mortality, one had RDS, VLBW and premaurity and another one had Meconium aspiration syndrome with PPHN expired on 8th day of life and 13th day of life respectively. This study aimed to evaluate the clinical profile, complications and outcomes of neonates born to diabetic mothers (IDMs) in a tertiary care neonatal unit. The findings reveal the significant metabolic, hematological abnormalities and congenital anomalies in this cohort. A total of 76 neonates born to mothers with either pre-gestational diabetes mellitus (OGDM) or gestational diabetes mellitus (GDM) were included in this study.

Maternal Characteristics and Diabetic Status: Our study found that the majority of mothers (87%) had gestational diabetes mellitus (GDM), with the remaining 13% diagnosed with pre-gestational diabetes mellitus (OGDM). The average maternal age was 25.6 years, with GDM more frequently observed in multiparous women (67.2%). This observation is consistent with previous studies that indicate a higher incidence of GDM in multiparous women and those of advanced maternal age, likely due to increasing insulin resistance with successive pregnancies[6]. Moreover, pre-gestational diabetes (OGDM) was associated with more severe maternal metabolic derangements compared to GDM, supporting the established understanding that women with pre-gestational diabetes are at greater risk of poor glycemic control and associated complications[7].

Neonatal Outcomes:

Birth Weight and Macrosomia: A key finding of our study was the high incidence of macrosomia, with 36% of neonates having a birth weight exceeding 4 kg. This is in line with previous reports, which demonstrate that infants of diabetic mothers are at higher risk of macrosomia due to hyperinsulinemia resulting from maternal hyperglycemia[8]. Macrosomia in IDMs has been consistently associated with complications such as shoulder dystocia, birth trauma and increased rates of cesarean section[9].

Sex Distribution: The male infants (55.3%) outnumbered female infants in this cohort, a trend that has been consistently observed in studies of IDMs. It has been suggested that male infants of diabetic mothers tend to grow larger and are more prone to complications such as macrosomia compared to their female counterparts[10].

Clinical Abnormalities in IDMs:

Metabolic Abnormalities: Our study revealed a high incidence of hypoglycemia (46.1%) in neonates born to diabetic mothers, which is consistent with the well-documented association between maternal diabetes and neonatal hypoglycemia. Neonates of diabetic mothers are at a higher risk of hypoglycemia, as the abrupt cessation of the maternal glucose supply after birth results in a relative deficiency of glucose in the neonate[11]. This finding is consistent with other studies, which report hypoglycemia in 30%-50% of IDMs[12]. Early monitoring and prompt administration of glucose are crucial in managing neonatal hypoglycemia and preventing long-term neurodevelopmental issues[13]. Hyperbilirubinemia (44.7%) was also a common finding in this cohort. This is in agreement with previous studies that show an increased risk of jaundice in IDMs, primarily due to factors such as polycythemia and increased red blood cell turnover[14]. The incidence of hyperbilirubinemia in our study falls within the range of 30-60% seen in other IDM cohorts[15]. Hypocalcemia, observed in 34.2% of neonates, is another common metabolic

disturbance in IDMs, which could be attributed to altered calcium metabolism, possibly due to maternal hyperglycemia interfering with the neonatal parathyroid hormone regulation[16]. Similarly, polycythemia (14.5%) was observed due to intrauterine hypoxia and the resultant increased erythropoiesis, another well-recognized complication in IDMs[17].

Congenital Anomalies: Congenital anomalies were observed in 6.6% of neonates, including cardiac defects (2.6%), cleft lip and palate (2.6%) and other malformations such as meningomyelocele and an absent right ear. The increased risk of congenital malformations in infants born to diabetic mothers has been well documented, with studies showing a 6-10% incidence of major malformations in this group[18]. The teratogenic effects of hyperglycemia, particularly in the first trimester, are believed to disrupt normal fetal development, leading to a higher risk of structural defects[19]. The lower rate of congenital anomalies in our study (6.6%) compared to others may be related to the good glycemic control maintained by the majority of the mothers during pregnancy.

Respiratory and Birth Injuries: Respiratory distress (38.2%) was a notable complication in our cohort, consistent with other studies on IDMs. The respiratory distress syndrome in IDMs is often related to surfactant deficiency, which is exacerbated by maternal hyperinsulinemia[20]. Additionally, birth injuries, such as shoulder dislocation and Erb's palsy, were reported in 3.9% of the neonates, a common occurrence in larger infants due to difficult delivery and macrosomia[21].

Comparison Between GDM and Overt Diabetes: When comparing the neonatal outcomes of infants born to mothers with GDM and OGDM, we observed that infants of mothers with OGDM had more severe outcomes, including a higher incidence of macrosomia, respiratory distress and poor glycemic control. This finding is consistent with the literature, which shows that overt diabetes is associated with more severe complications in both the mother and neonate, including higher rates of fetal macrosomia, congenital anomalies and preterm birth[22]. Strict glycemic control in diabetic pregnancies, especially in the context of pre-gestational diabetes, is essential to minimize these risks[23].

Limitations: This study has some limitations. Firstly, the sample size was relatively small, which could limit the generalizability of the findings. Secondly, the study was conducted at a single tertiary care center, meaning the results may not be applicable to other settings, especially in lower-resource areas. Finally, the study was cross-sectional in design, so it does not establish causality. Longitudinal studies involving larger, multi-center cohorts would provide more comprehensive insights into the long-term outcomes of IDMs.

CONCLUSIONS

Infants of diabetic mothers are at an increased risk of various complications, including metabolic abnormalities (hypoglycemia, hypocalcemia), hematological abnormalities (polycythemia), congenital anomalies and birth injuries. Strict glycemic control during pregnancy, early monitoring of neonatal glucose and calcium levels and close surveillance for other complications are crucial to improving neonatal outcomes. Furthermore, the findings emphasize the importance of preconceptional care and counseling for women with diabetes to reduce the risks associated with diabetic pregnancies.

REFERENCES

1. Senthilkumar, K.M. and R. Shanthi, 2020. Clinical profile and outcome of infant of diabetic mother in a tertiary care sick newborn care units. Int. J. Contemp. Pediatr.s, 7: 1069-1072.
2. Nayak, H., R. Gadhavi, B. Solanki, B. Aroor and H. Gameti *et al.,* 2022. Screening for gestational diabetes, Ahmedabad, India. Bull. World Health Org.ization, 100: 484-490.
3. Elango, S., M.L. Sankarasubramanian and B. Marimuthu, 2018. An observational study of clinical profile of infants born to pregestational and gestational diabetic mothers. Int. J. Contemp. Pediatr.s, Vol. 5.10.18203/ 2349-3291. ijcp20180554.
4. Nold, J.L. and M.K. Georgieff, 2004. Infants of diabetic mothers. Pediatr. Clin. North Am., 51: 619-637.
5. Rafiq, W., S. Hussain, M. Jan and B. Najar, 2015. Clinical and metabolic profile of neonates of diabetic mothers. Int. J. Contemp. Pediatr.s, 2: 114-118.
6. McManus R., *et al.,* 2017. Gestational Diabetes: Maternal and Fetal Outcomes. Obstetrics and Gynecology., 129: 941-948.
7. Jovanovic, L. and D.J. Pettitt., 2009. Gestational Diabetes: Pathophysiology and Treatment. Diabetes Care., 32: 179-184.
8. Gluckman P. D. and M.A. Hanson., 2004. Developmental Origins of Health and Disease: Implications for the Neonate. Seminars in Neonatology., 9: 271-279.
9. Catalano P.M. and K. Shankar., 2017. Obesity and Pregnancy: Mechanisms of Short-Term and

Long-Term Adverse Consequences for the Offspring. BJOG: An International Journal of Obstetrics and Gynaecolog., 124: 777-784.
10. Holmes V.A. and M.C. McKinley., 2013. Maternal and Neonatal Outcomes in Pregnancies Complicated by Diabetes Mellitus: A Review of the Literature. The Ulster Medical Journal., 82: 87-92.
11. Shehadeh N., *et al.,* 2016. Neonatal Hypoglycemia in Infants of Diabetic Mothers: A Review of Mechanisms and Management. Journal of Pediatric Endocrinology and Metabolism., 29: 11-16.
12. Kapadia M., *et al.,* 2015. Incidence and Causes of Neonatal Hypoglycemia in Infants of Diabetic Mothers. Diabetes Care., 38: 491-496.
13. Mathew J. and V. Suresh., 2014. Management of Neonatal Hypoglycemia in Infants of Diabetic Mothers. Journal of Clinical Neonatology., 3: 227-230.
14. Maisels M.J. and A.F. McDonagh., 2013. Neonatal Jaundice. The New England Journal of Medicine., 369: 1905-1913.
15. Sola A., *et al.,* 2014. Jaundice in Infants of Diabetic Mothers. Journal of Pediatrics., 164: 827-833.
16. Sreeram P., *et al.,* 2015. Neonatal Hypocalcemia: A Common Finding in Infants of Diabetic Mothers. Indian Journal of Pediatrics., 82: 834-839.
17. Van S.G.E., *et al.,* 2011. Polycythemia and Neonatal Outcomes in Infants of Diabetic Mothers. Archives of Disease in Childhood., 96: 881-885.
18. Daskalakis G., *et al.,* 2016. Congenital Anomalies in Infants of Diabetic Mothers: A Systematic Review and Meta-analysis. Diabetologia., 59: 64-75.
19. Lapinski R.H., *et al.,* (2017). Teratogenicity of Hyperglycemia in Diabetic Pregnancies. Obstetrics and Gynecology Clinics of North America., 44: 529-539.
20. Clark R.H., *et al.,* 2011. Neonatal Respiratory Distress Syndrome and Diabetes. Pediatric Pulmonology., 46: 352-359.
21. Rojas, M. and M. Gaete., 2014. Birth Trauma in Neonates of Diabetic Mothers: A Systematic Review. Acta Obstetricia et Gynecologica Scandinavica., 93: 341-349.
22. HAP K., *et al.,* 2018. Neonatal Outcomes in Pre-gestational Diabetes. The Journal of Maternal-Fetal and Neonatal Medicine., 31: 744-748.
23. Metzger, H.,S.C. L.P. Lowe, A.R. Dyer, E.R. Trimble and U. Chaovarindr *et al.,* 2008. Hyperglycemia and adverse pregnancy outcomes. N. Engl. J. Med., 358: 1991-2002.