# AN OBSERVATIONAL STUDY ON THE IMPACT OF CLINICAL CONDITIONS ON CHILD BIRTH AND ITS MANAGEMENT

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**Abstract:**
*Pregnancy, also known as gestation, is the time during which one or more offspring develops inside a woman. It is evident that a considerable proportion of these are affected by certain clinical conditions which may complicate pregnancy leading to maternal and foetal morbidity and mortality. A prospective observational study was conducted on 130 pregnant women of reproductive age (18-35 years) with clinical conditions (Gestational Diabetes Mellitus, Gestational Hypertension, Abnormal Amniotic Fluid (Oligohydramnios and Polyhydramnios, Epilepsy) for a period of 6 months. The required data is collected from the patient's respective case sheets at study location and the data is evaluated to report the incidence of pregnancy complications in association with clinical conditions on child birth and their management strategies. A total of 130 pregnant women with clinical conditions were observed and complications were identified in foetus.. The complications like preterm birth (54.34%), low birth weight (31.6%), still birth (14.7%), foetal distress (12%), macrosomia (2.3%), pre-eclampsia (3%) were observed in the study. Complications like macrosomia, still birth were associated with gestational diabetes mellitus, pre-eclampsia in gestational diabetes patients with hypertension as a co-existing condition, pre-term births and low birth weight infants in gestational hypertension and oligohydramnios patients and foetal distress in epileptic patients were observed. Foetal Doppler changes were observed in patients particularly with Epilepsy and abnormal Amniotic fluid Index. This study concludes that most of the complications in the study were associated with at least one or more than one clinical condition. In the study population the prevalence of abnormal Amniotic Fluid Index patients co-existing with other conditions were higher when compared to other conditions. About 50% of the reported preterm births fall under low birth weight category. It is evident that altered amniotic fluid index is the major contributing factor for preterm births. 12% new born were admitted to NICU due to foetal distress which implies foetal morbidity rate. The treatment strategies provided, managed the patient health status during the trimesters, parturition period and declined the foetal mortality.*
**Key words:** *Child birth, management, anaemia, complications, epilepsy, amniotic fluid index.*

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## INTRODUCTION:

**P**regnancy, also known as gestation, is the time during which one or more offspring develops inside a woman. Child birth typically occurs around 40 weeks from the Last Menstrual Period (LMP)[1]. This is just over nine months, where each month averages 29½ days. When measured from conception it is about 38 weeks. An embryo is the developing offspring during the first eight weeks following conception, after which, the term fetus is used until birth. Any health condition attributed to and/or aggravated by pregnancy and child birth during second or third trimester has a negative impact on the women's well-being and fetus well-being as well respectively[2]. Despite of increased global focus on maternal and fetal morbidity and mortality as a public health concern there is a limited knowledge available for the causes of maternal and fetal complications[3,4].

### Aim

To assess the incidence of various clinical conditions (gestational hypertension, gestational diabetes, anaemia, epilepsy, thyroid disorders, oligo and polyhydramnios) to identify their impact on foetus health during pregnancy and observe their management strategies.

### Objectives

* To assess the prevalence of clinical conditions arising during pregnancy.
* To identify the chance of foetal complications rose due to any clinical condition.
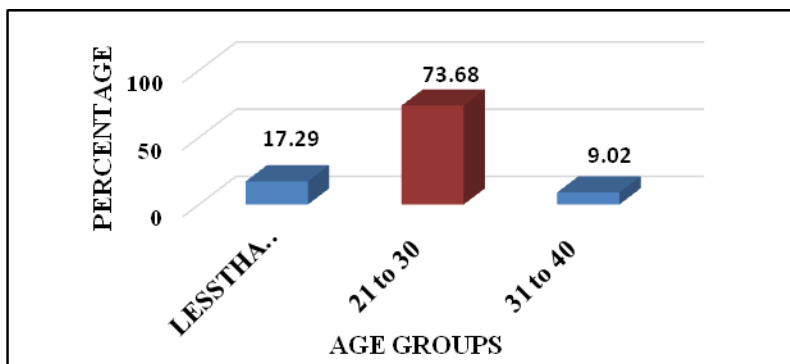* To assess the severity of foetal damage and mother health status.

## RESULTS:

* To assess the effectiveness of management strategies maintaining these conditions.

## METHODOLOGY:

### Study protocol

It is an observational study conducted for the period of four months and patient who met the study criteria were included in the study. The required data were collected from the patient case sheet by using suitable patient profile form and the obtained *d*ata were evaluated.

### Study design

It is a retrospective observational study.

### Study site

The study was conducted at Gandhi Hospital, Hyderabad, Telangana, India.

### Study period

Study was conducted for 4 months.

### Study population

The present study was conducted on 250 patients and it was conducted in pregnant women.

### Study criteria

### Inclusion criteria

* Pregnant women with gestational hypertension, gestational diabetes and, anemia, epilepsy, thyroid disorders, oligo and polyhydramnios.

### Exclusion criteria

* Pregnant women without any clinical manifestations.
* Pregnant women with malignancies.
* Pregnant women carrying twin.



**Figure 1: Age groups**

The above graph depicts majority of the pregnant women (73.68%) fall under the age group between 21 to 30 years.
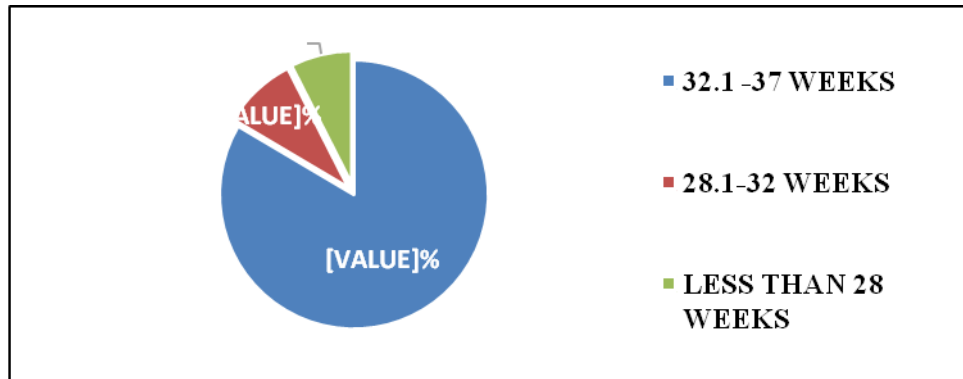
**Figure 2: Gestational age**

The chart illustrates that pregnant women with clinical complications (Epilepsy, anaemia, GHTN, GDM, hypothyroid, AFI) are higher in number of gestational age 32.1-37(83.5%) weeks than women with gestational ages 28.1-32 weeks (9%) and <28 weeks (7.5%).
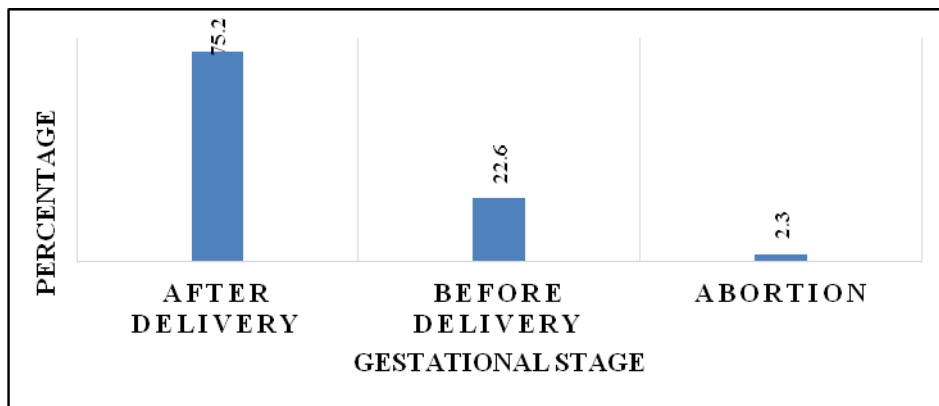


**Figure 3: Gestational stage**

The graph represents various percentages of gestational stage during the study period, out of 133 patients, 75.2% of women were at a stage of after delivery, 22.6% were at before delivery and 2.3% got aborted.
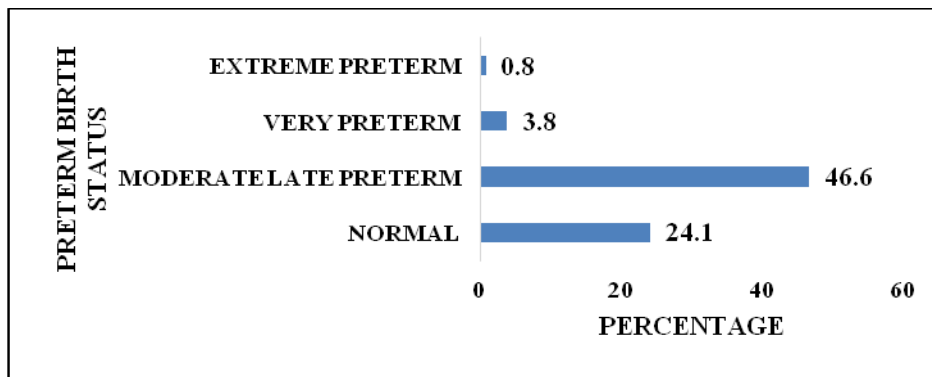


**Figure 4: Preterm birth status**

Based upon the results, preterm birth status was observed that 46.6% births are moderate/late preterm, 3.8% and 0.8% had very preterm and extreme preterm births respectively where as 24.1% are normal births.
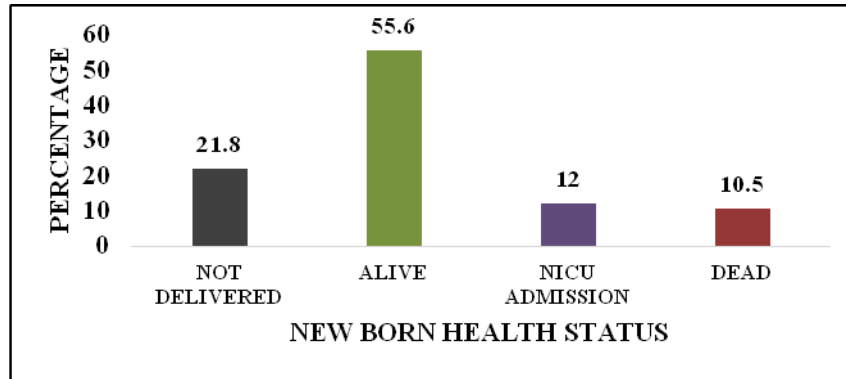
**Figure 5: New born health status**

The graph explains new born health status of which 55.6% babies are alive after delivery, 12% babies got admitted to NICU, 10.5% were stillborn.
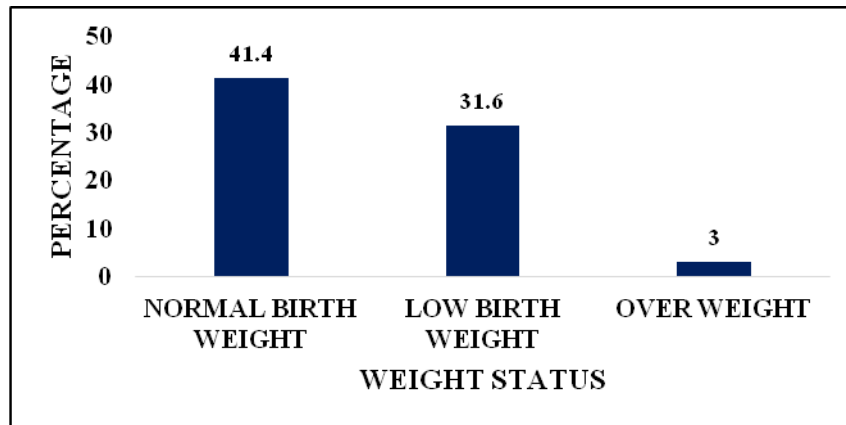


**Figure 6: Weight status**

The graph explains that newborns with normal birth weight are 41.4%,low birth weight are of 31.6% and over weight/large babies stand at a least percent of 3%.
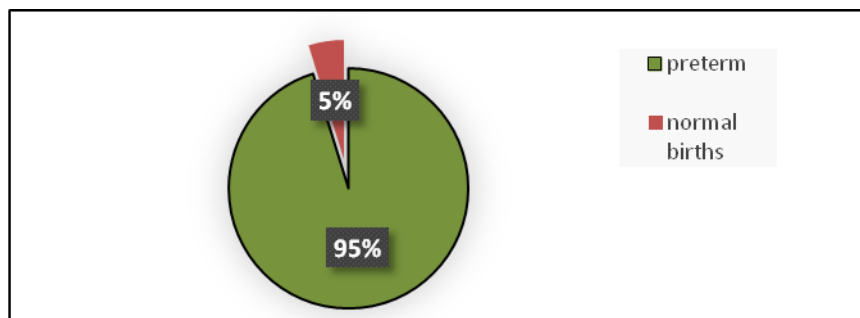


**Figure 7: Percentage of preterm births and normal births in underweight infants**

The above chart illustrates the frequency of under weight newborns is maximum (95%) in pre term labor condition.
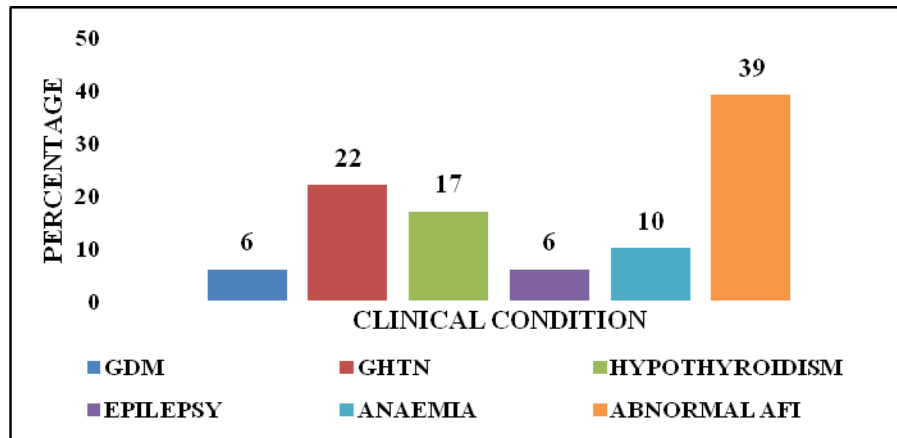
**Figure 8: Distribution of population in each clinical condition**

The graph represents the percentage of population which is about 6% in gestational diabetes mellitus (GDM) patients, 22% in gestational hypertension patients, 17% in hypothyroid affected women, 6% with epilepsy, 10% with anaemia and 39% with abnormal AFI.
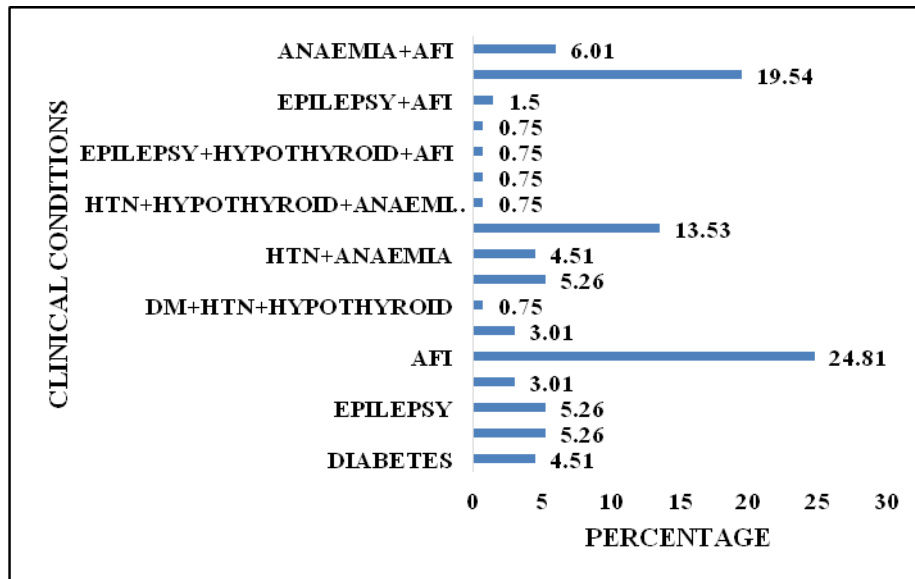


**Figure 9: Distribution of population based on co-existence of one or more clinical conditions**

The graph represents that pregnant women in our study exhibited various clinical conditions, among them majority i.e. 24.81% had abnormal AFI, 19.54% had hypothyroidism with abnormal AFI, 13.53 had gestational hypertension with abnormal AFI.
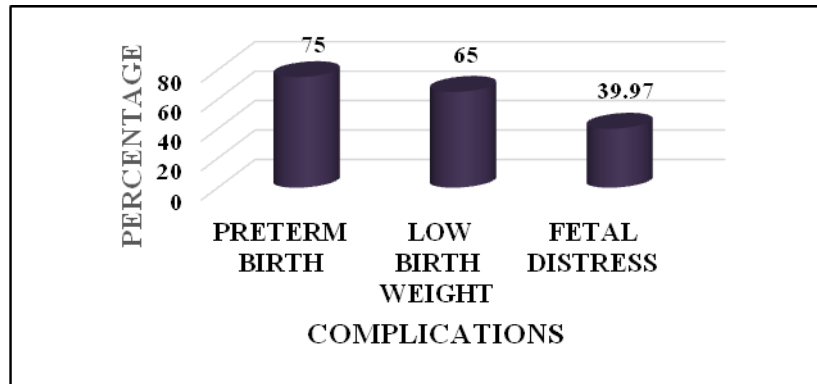
**Figure 10: Various complications due to abnormal AFI condition**

The above graph represents complications due to abnormal AFI levels in which majority were reported with preterm births (75%) followed by low birth weight infants (65%).
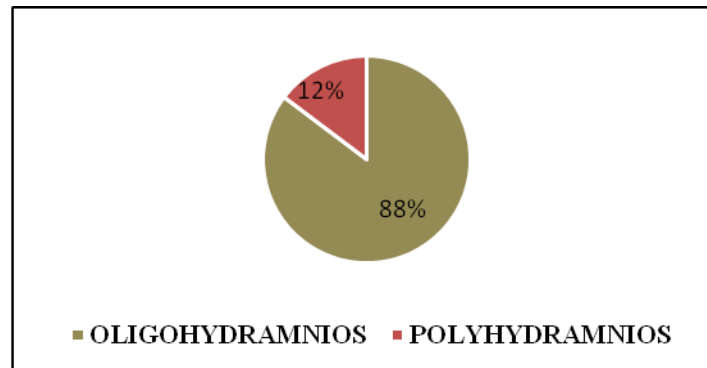


**Figure 11: Distribution of population according to AFI levels**

The chart explains, out of the total study population oligohydramnios affected pregnancies are 88%, polyhydramnios pregnancies are 12%.
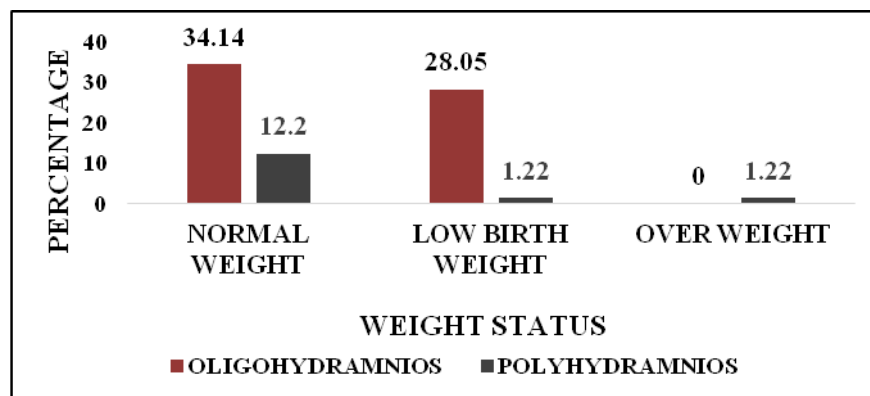


**Figure 12: Weight status in abnormal AFI patients**

The above graph represents that in oligohydramnios affected pregnancies the percentage of newborns having normal weight is 34.14% and low birth weight is 28.05%, and in polyhydramnios pregnancies,the percentage of newborns having normal weight, low birth weight and overweight are 12.2%, 1.22% and 1.22% respectively.
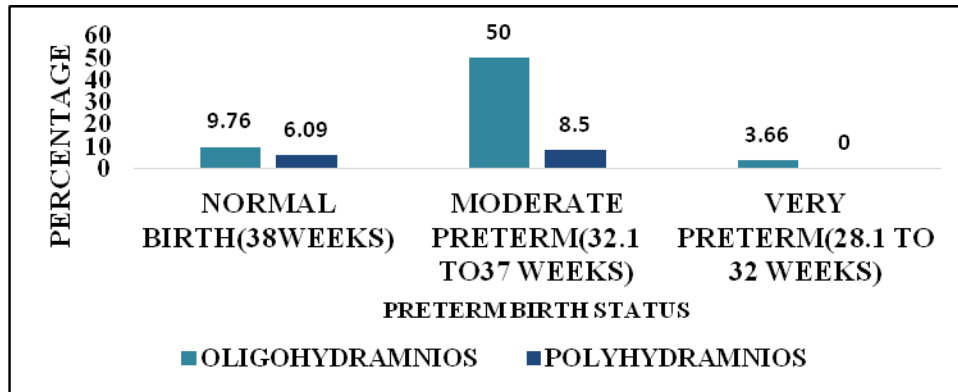
**Figure 13: Preterm birth status in abnormal AFI pregnant patients**

The graph represents birth status, pregnant women affected with oligohydramnios is 50% with moderate preterm, 3.66% with very preterm and 3.66% had normal births; birth status in women with polyhydramnios have moderate preterm with 8.5% and normal births with 6.09%.
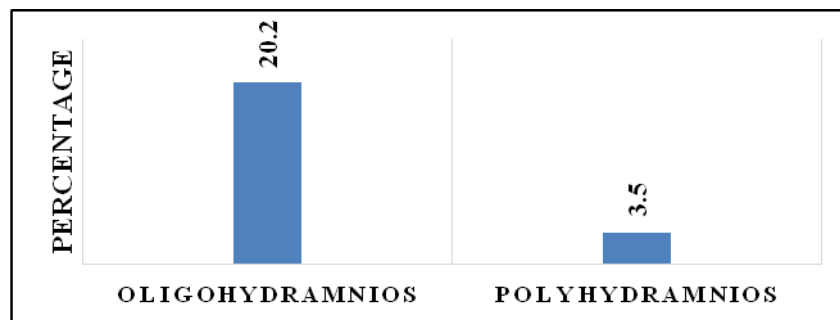


**Figure 14: Doppler changes in pregnant women with abnormal AFI levels**

Based on the observations, the doppler changes in pregnant women with oligohydramnios is 20.2 % and women with polyhydramnios condition is about 3.5%.



**Figure 15: Various complications in GDM condition**

The graph illustrates that still births were reported in higher percent (27%) than other complications such as preterm births (8.72%), low birth weights (10%), macrosomia (2.3%) and pre-eclampsia (3%).

**Table 1: Paired T-test distribution for gestational diabetes**

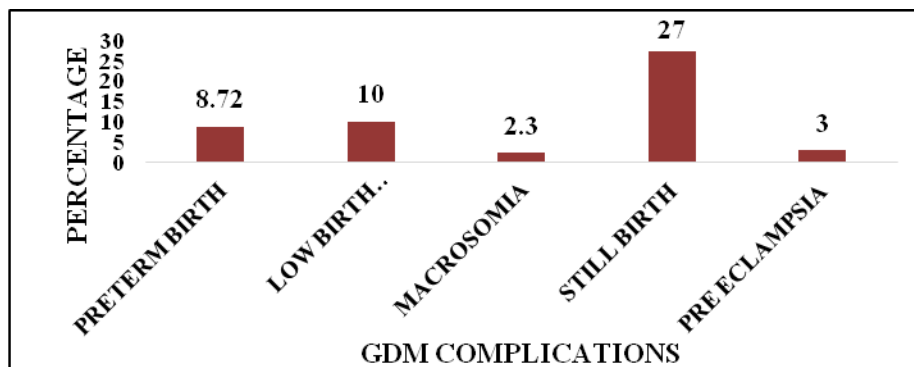| Sugar levels | Paired Differences | | | | | T | Differential factor | Significance (2-tailed) |
| | Mean | Standard Deviation | Standard Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | Lower | Upper | | | |
|---|---|---|---|---|---|---|---|---|
| D1FBS - D2FBS | -6.5455 | 31.9448 | 9.6317 | -28.0063 | 14.9154 | -0.68 | 10 | 0.512 |
| D1RBS - D2RBS | -6.1818 | 29.161 | 8.7924 | -25.7724 | 13.4088 | -0.703 | 10 | 0.498 |
| D1PLRBS - D2PLRBS | -4 | 31.209 | 9.4099 | -24.9665 | 16.9665 | -0.425 | 10 | 0.68 |
| D2FBS - D3FBS | 6.9091 | 24.7364 | 7.4583 | -9.7091 | 23.5272 | 0.926 | 10 | 0.376 |
| D2RBS - D3RBS | -19.4545 | 44.3111 | 13.3603 | -49.2231 | 10.3141 | -1.456 | 10 | 0.176 |
| D2PLRBS - D3PLRBS | -3.9091 | 25.7 | 7.7488 | -21.1746 | 13.3564 | -0.504 | 10 | 0.625 |
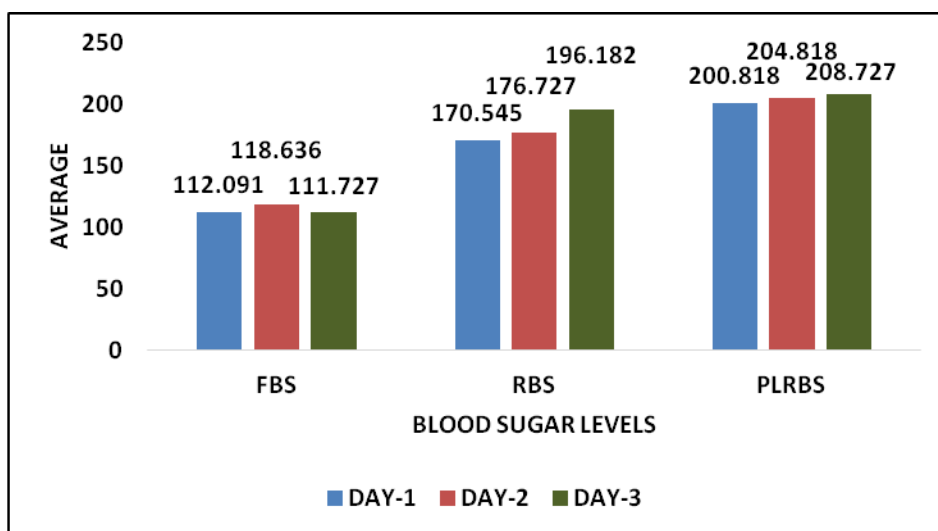


**Figure 16: Mean distribution of blood sugar levels day by day**

The above Table 1 represents that there is no significant difference in blood sugar levels from day-1 to day-3. This
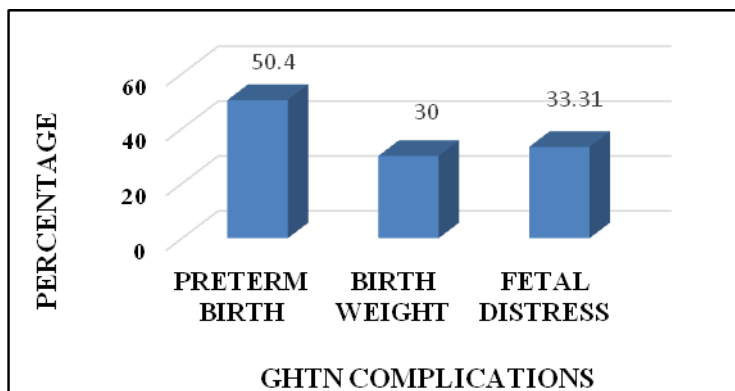
can be observed in the above graph.



**Figure 17: Various complications in GHTN condition**

From the above graph it was observed that preterm births (50.4%), low birth weight infants (30%) and foetal distress (33.31%) were reported in GHTN condition.

**Table 2: Paired T-test for blood pressure**

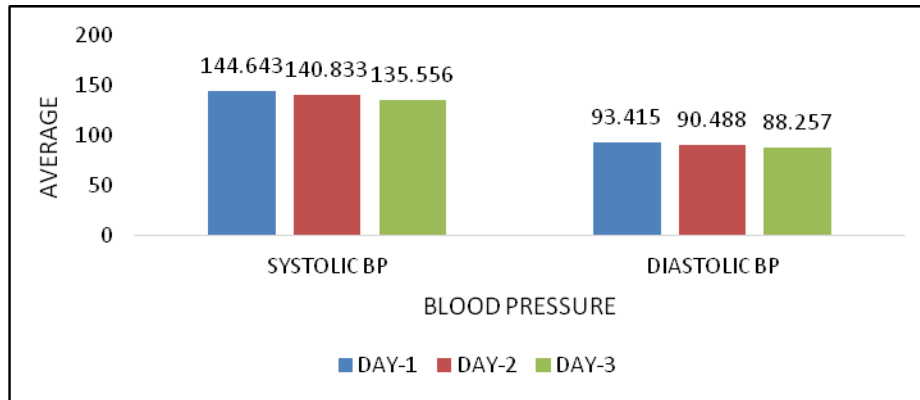| Blood pressure | Paired Differences | | | | | T | Different ial Factor | significanc e (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Standar d Deviati on | Standar d Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | Lower | Upper | | | |
| D1 & D2 SYSTOLICBP | 3.4524 | 19.333 | 2.9832 | -2.5722 | 9.477 | 1.157 | 41 | 0.254 |
| D1 & D2 DIASTOLICBP | 2.9268 | 9.2854 | 1.4501 | -0.004 | 5.8577 | 2.018 | 40 | 0.051 |
| D2 & D3 SYSTOLICBP | 5.2778 | 18.8961 | 3.1494 | -1.1158 | 11.6713 | 1.676 | 35 | 0.103 |
| D2 & D3 DIASTOLICBP | 2.6 | 8.8524 | 1.4963 | -0.4409 | 5.6409 | 1.738 | 34 | 0.091 |

**Figure 18: Mean distribution of blood pressure values day to day**

The Table 2 shows that there is no significant difference in systolic and diastolic pressures from day-1 to day-3. This can be observed in the above graph.
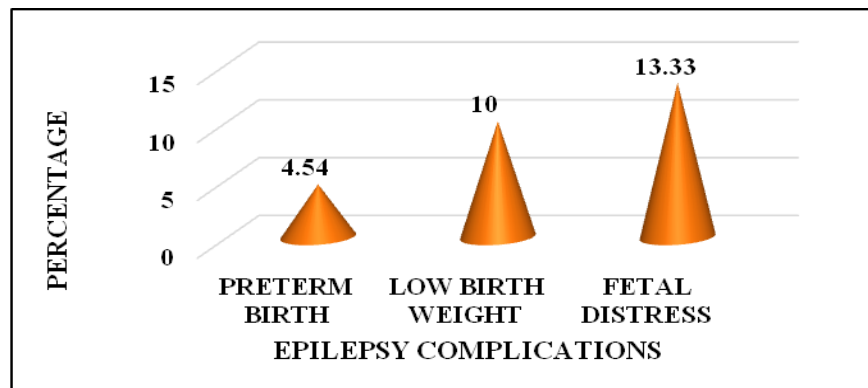


**Figure 19: Complications in epileptic patients**

The graph shows complications in epileptic patients where fetal distress were 13.33%, low birth weights were 10% and preterm births were 4.54%.
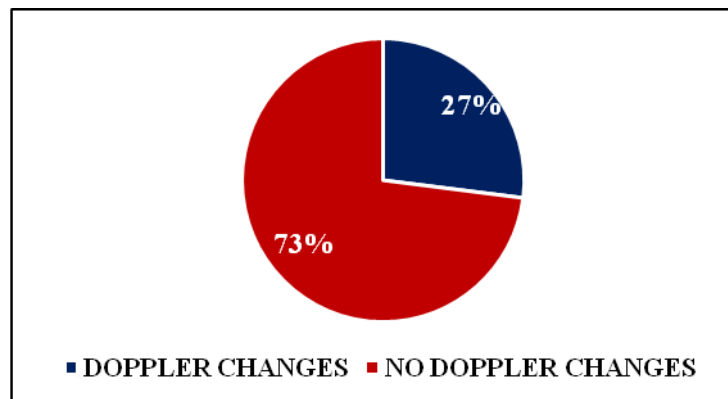


**Figure 20: Percentage of doppler changes in epilepsy patients**

The above pie chart depicts that 27% of total epilepsy affected patients showed doppler changes (like IUGR, maternal morbidity).
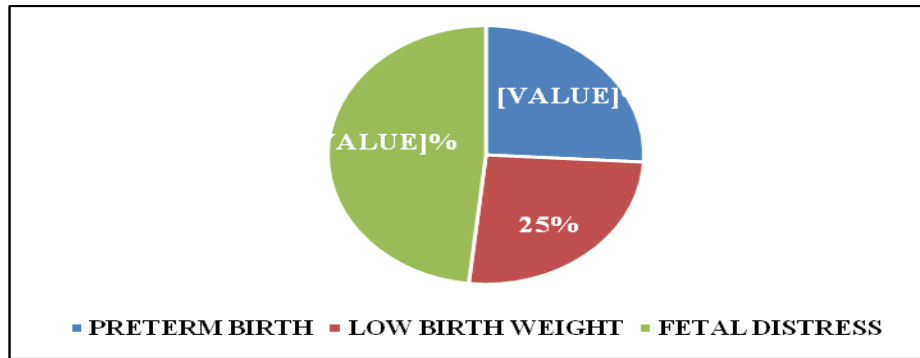
**Figure 21: Various complications in hypothyroid patients**

The chart provides with the information that majority of the patients were reported with foetal distress (46.64%) followed by low birth weights (25%) and preterm births (25.02%).
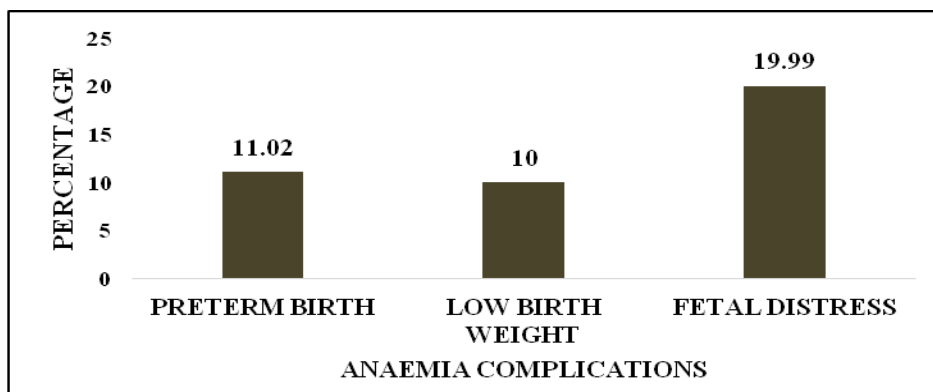


**Figure 22: Complications in anaemic patients**

From the graph it was observed that preterm births (11.02%), low birth weights (10%) and fetal distress (19.99%) were reported in anaemic patients.
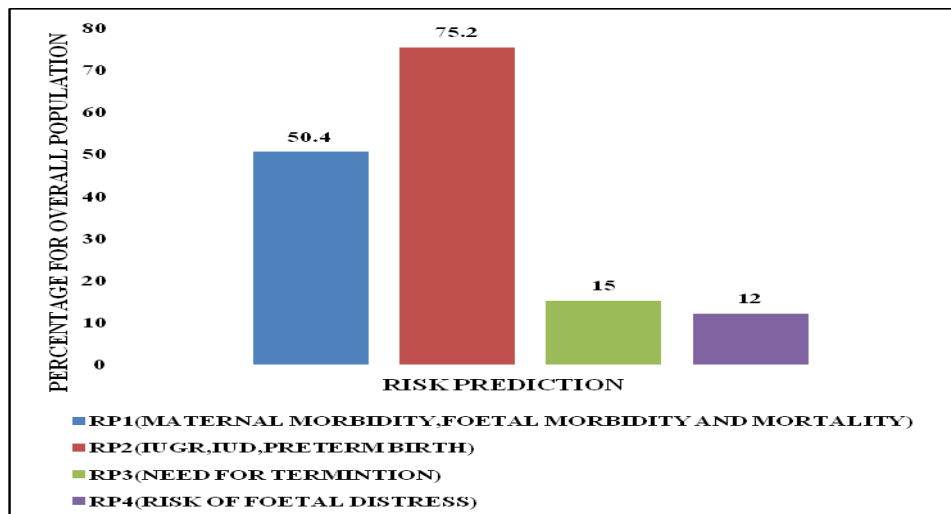


**Figure 23: Risk prediction status**

Majority of the patients fall into the category of RP2 (75.2%) followed by RP1 (50.4%).
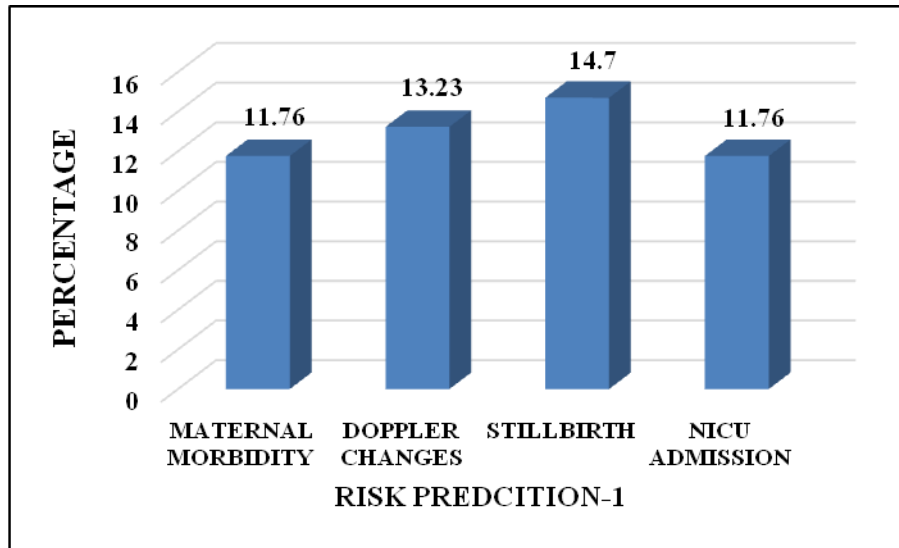


**Figure 24: Risk prediction-1**

The graph shows risk prediction for maternal morbidity is 11.76%, doppler changes is 13.23%, still birth is 14.7%, NICU admissions is 11.76%.
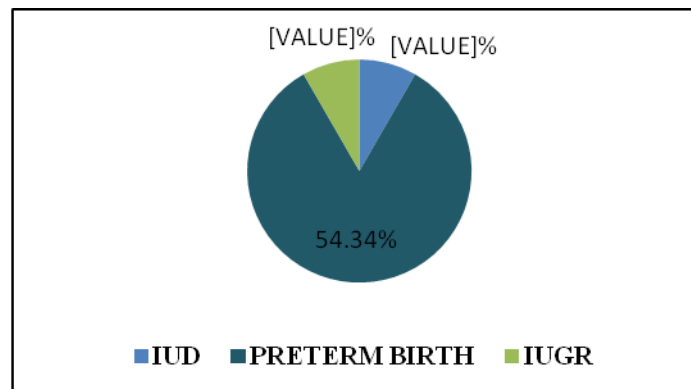


**Figure 25: Risk prediction-2**

The graph shows risk prediction for intra-uterine death is 5.43%, intra-uteriene growth retardation is 5.43%, preterm birth is 54.34%.
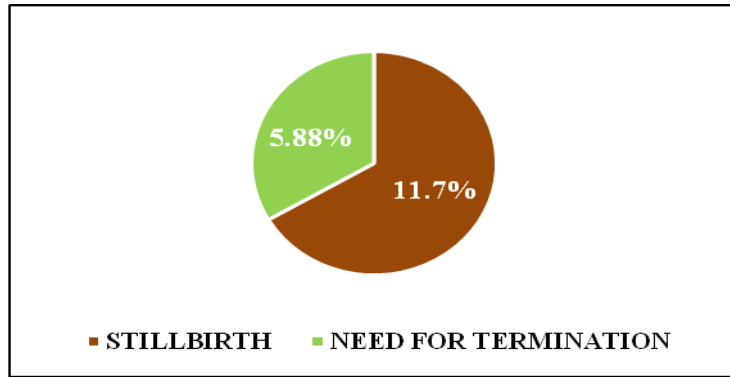
**Figure 26: Risk prediction-3**

The graph shows that risk prediction for still birth is 11.7%, Need for termination is 5.88%.
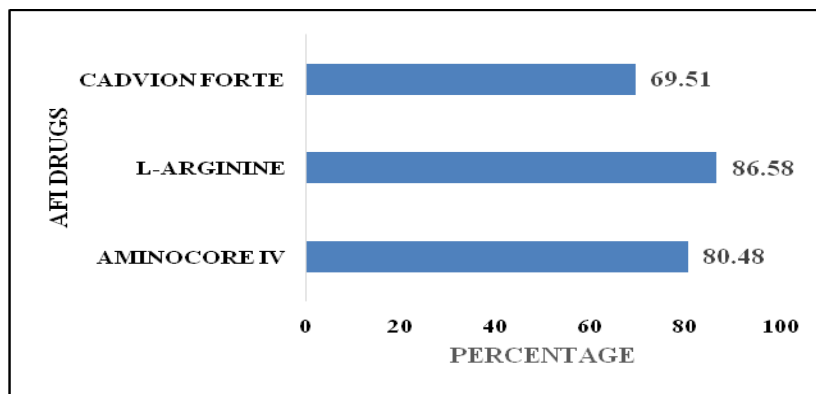


**Figure 27: Treatment for abnormal AFI**

The above chart explains about the medications prescribed for abnormal AFI condition, it was observed that L-arginine (86.58%), aminocore (80.48%) and Cadvion forte(69.51%) were prescribed.
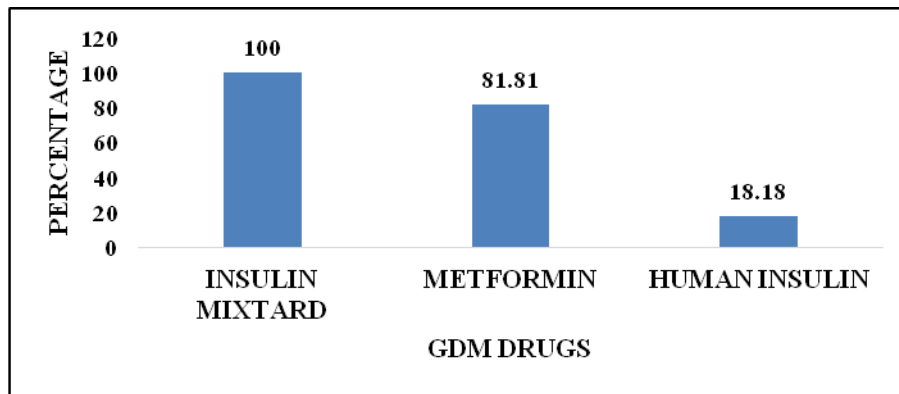


**Figure 28: Treatment for GDM**

In the above graph it is observed that insulin mixtard (100%) was given to majority of the population followed by metformin (81.81%).
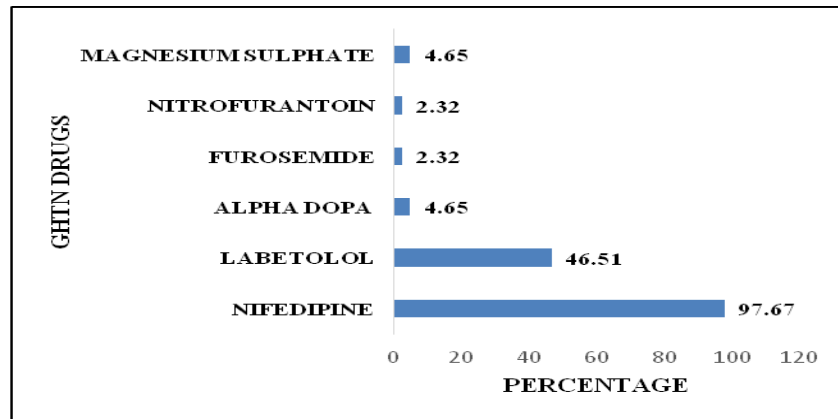
**Figure 29: Treatment for GHTN**

The graph explains that nifedipine (97.67%) and labetalol (46.51%) were given to most of the patients.
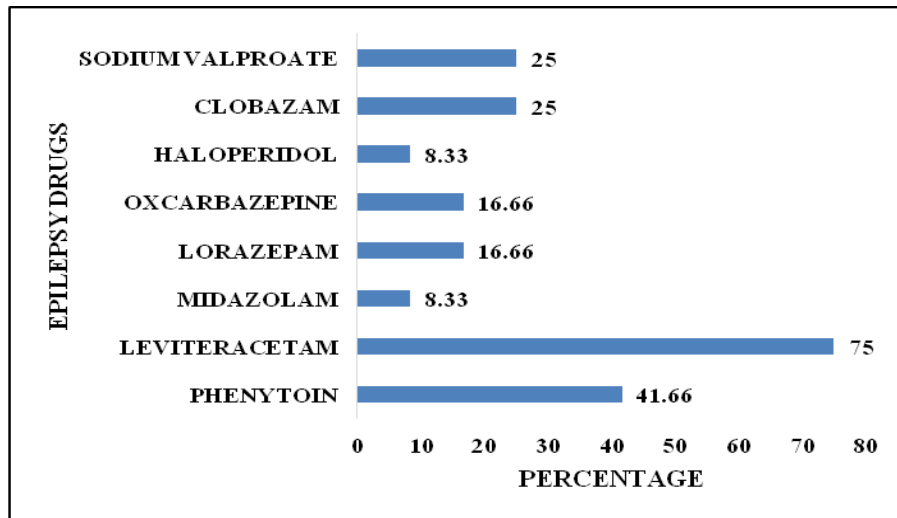


**Figure 30: Treatment for epilepsy**

The above graph represents that levetiracetam (75%) and phenytoin (41.66%) were mostly preferred in epileptic conditions.
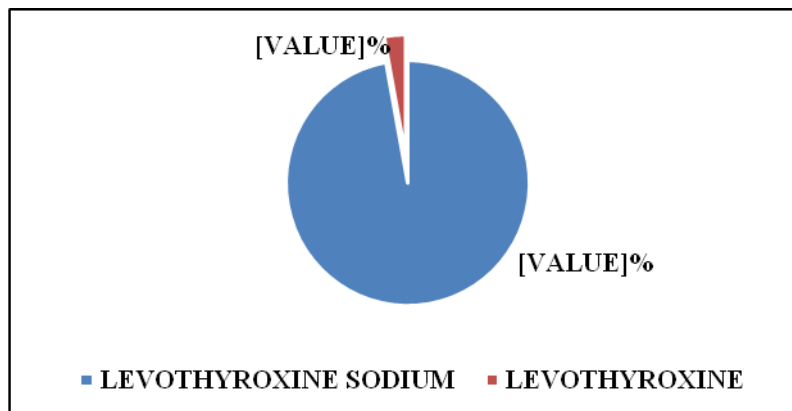
**Figure 31: Treatment for hypothyroid**

The chart illustrates that majority of the patients were prescribed with levothyroxine sodium (97.14%).

**Figure 32: Treatment for anaemia**

The above graph illustrates that iron and calcium supplements (100%) and blood transfusions (85%) were given to anaemic patients.

**DISCUSSION:**

Study population accounted for total 133 pregnant women with various clinical conditions were assessed to evaluate the impact of conditions on child birth. In our study, majority of the subjects (73.68%) fall under the age group 21-30 years and 83.5% of pregnant women with various clinical conditions belong to gestational ag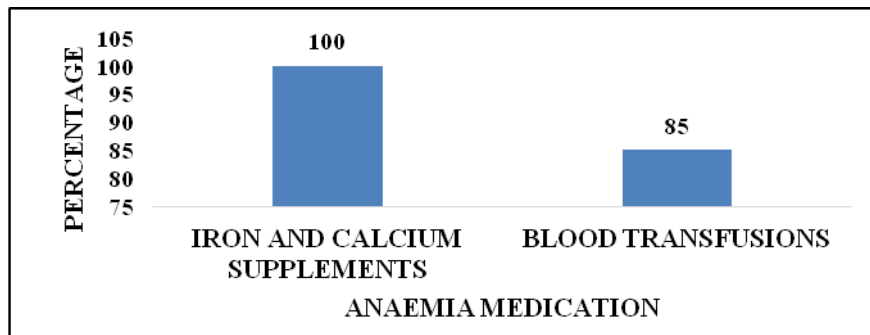e of 32.1-37 weeks. During the study period 75.2% women gave birth to child in whom 24.1% had normal delivery and 51.2% had preterm delivery, explained in the Figure 4. Among the patients who underwent normal delivery, the babies were born alive and healthy. In patients who underwent preterm delivery, 31.5% of babies were alive, 12% were admitted to NICU and 2.3% were stillborn. Out of the total new born neonates 41.1% born with normal weight, 31.6% are underweight and 3% are overweight (large babies) for gestational age. In our study it was observed that majority of the underweight neonates were preterm births (95%). Previous studies also provide evidence that preterm delivery leads to underweight births.

Several foetal and maternal medical conditions are associated with an increased risk of preterm birth, pre-eclampsia, stillbirth and macrosomia. Acute maternal medical conditions lead preterm birth which in turn increases the risk of above complications. This risk was predicted and categorised has explained in Figure 23. The study included 2 pre-existing maternal conditions i.e. epilepsy and hypothyroidism, four conditions were observed during pregnancy such as abnormal AFI, GDM, GHTN and anaemia. Among these maternal/foetal conditions, abnormal AFI (39%) was more prevalent than other conditions

which are shown in the Figure 8. Patients with co-existence of two or more clinical conditions have a huge impact on childbirth during pregnancy. Among those conditions most of the patients had abnormal AFI with Hypothyroidism followed by GHTN with abnormal AFI, anaemia with abnormal AFI. AFI was more incident among all these conditions, shown in the Figure 9. It was observed that out of 133 patients 82 were reported with abnormal AFI condition in which majority (88%) of them had oligohydramnios. Based on AFI values 40.6% had moderate to severe oligohydramnios condition and 9% of patients had severe polyhydramnios condition.

Abnormal AFI is usually associated with maternal and foetal complications. As a part of these complications 77.23% reported with preterm births in which 54% subjects were of oligohydramnios. The previous studies also gave evidence that preterm births are more prevalent in decreased AFI condition due to elevated cytokines and prostaglandins. From the study, 29% of oligohydramnios patients gave birth to under-weight babies where as 35% gave birth to new born with normal weight. It is evident that low birth weight is very common in oligohydramnios condition.

Pathologically foetal anomalies lead to altered AFI levels. These developmental changes are seen through Doppler study. Out of 82 abnormal AFI patients, 20.1% oligohydramnios conditioned foetuses reported Doppler changes has shown in Figure 14. To maintain the amniotic fluid volume in all the reported oligohydramnios patients, L-arginine sachets, aminocore injection have been prescribed for most of the patients and others are managed by

maternal rehydration. In the total study population, only 11 patients are affected with GDM. Among these 11 patients, four patients reported pre-eclampsia complication in which three patients had hypertension as a coexisting condition (this is due to insulin resistance developed during gestational diabetes leading to onset of pre-eclampsia), three are subjected to still birth, three gave birth to macrosomic babies (large for gestational age). Several studies provide evidence that increased amount of blood glucose flows into foetal circulation; this extra glucose is stored as body fat leading to macrosomia. The severity of GDM was estimated by recording blood glucose levels. There is no significant difference in blood glucose levels from day-1 to day-3. To overcome the insulin resistance, pregnant women were prescribed with intravenous administration of human insulin and metformin orally.

Epilepsy is a pre-existing health condition that influence foetal development. From the reported 12 cases of epilepsy, foetal distress was observed more when compared to other complications shown in the Figure 19. This might be due to interruption of breathing during seizure attack. Congenital anomalies occurred during a seizure attack were observed through Doppler changes, shown in the Figure 20. In epileptic patients 5 were treated with phenytoin (100-500mg), levetiracetam was prescribed to all patients by adjusting the doses based on the episodes of seizures (maximum dose of 1500mg, twice a day). Along with phenytoin and levetiracetam, sodium valproate was given in some patients. Adjunctive medication like midazolam, lorazepam and clobazam were administered to calm down the patients. In the study pool, 43 women were reported GHTN condition. Among them half of the subjects (50.4%) had preterm delivery followed by low birth weight complication. Gestational hypertension leads to IUGR, maternal morbidity and need for termination. It was observed that 2 cases reported with intra-uterine growth retardation (IUGR), one gave birth to baby with left ventricular sinus malformations and one was advised for termination of pregnancy due to high blood pressure recordings. The blood pressure levels in patients with GHTN were identical from day to day.

GHTN in pregnant women is managed with nifedipine 10mg in 38, with labetalol 50mg in 21, 16 members were treated with combination of both nifedipine and labetalol. In serious situations alphadopa was administered and magnesium sulphate 1gm was administered to avoid fits caused due to increased blood pressure. Foetal distress was observed more in both the conditions anaemia and hypothyroidism shown in the Figure 21 and 22. Levothyroxine (25-100mcg) was only standard pharmacological approach for hypothyroidism during pregnancy. The dosage range varies based on their T3, T4, TSH levels. Anaemic patients were managed with iron and calcium supplements. In severe anaemic conditions blood transfusions were administered.

## CONCLUSION:
Patients with co-existence of two or more clinical conditions have a greater impact on childbirth than those with specific condition during pregnancy. In the study population, the prevalence of abnormal AFI is higher (40%) when compared to other clinical conditions. In abnormal AFI there is an increased risk of maternal and foetal morbidity. About 50% of reported preterm births fall under low birth weight category. From the study, it is evident that altered AFI is the major contributing factor for preterm births. The clinical complications like macrosomia, preeclampsia is associated with Gestational Diabetes Mellitus condition. In the study, 12% of the new-born were admitted to NICU due to foetal distress which implies foetal morbidity rate. Along with foetal morbidity, doppler changes were reported mostly in abnormal AFI and epilepsy conditions. The treatment strategies provided, managed the patient health status during the trimesters, parturition period and declined the foetal mortality.

## CONFLICT OF INTEREST
Author declares that there is no conflict of interest to disclose.

## REFERENCES:
1. Dinesh Kumar Dhanwal, Saritha Bajaj, Rajesh Rajput. Prevalence of Hypothyroidism in Pregnancy:An epidemiological study from 11 cities in 9 states of India. Indian J Endocrinol Metab 2016; 20(3):387-90.
2. Stevens GA, Finucane MM, De- Regil LM et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: a systematic analysis of population-

repesentative data. The Lancet Global Health 2013; 1(1):e16-e25.

3. Najah M Saleh, Abdulla Al-Hamaq. Prevalence of gestational diabetes and associated maternal and neonatal complications in a fast-developing community: global comparisons. Int J Womens Health 2011; 3:367–73.

4. Ben-Haroush A , Yogev Y. Epidemiology of gestational diabetes mellitus and its association with Type 2 diabetes. Hod M. Diabet Med 2004; 21(2):103-13.

5. Langer O, Yogev Y, Most O, Xenakis EM. Gestational diabetes: the consequences of not treating. Am J Obstet Gynecol 2005; 192(4):989-97.

6. Ferrara A. Increasing prevalence of gestational diabetes mellitus: a public health perspective. Diabetes Care 2007; 30:S141-6.

7. Annunziata Lapolla, Maria Grazia Dalfrà, and Domenico Fedele. Management of gestational diabetes mellitus. Diabetes Metab Syndr Obes 2009; 2:73–82.

8. Gabbe, SG, Niebyl JR., Simpson JL. Diabetes Mellitus complicating pregnancy. In Obstetrics, normal and problem pregnancies. 2007, 976-1005.5th ed. Philadelphia: Churchill Livingstone.

9. Tobias DK, Hu FB, Forman JP, Chavarro J Zhan. Increased risk of Hypertension after Gestational Diabetes Mellitus: Findings from a large prospective cohort study, Diabetes Care 2011; 34:1582-4.

10. Pettitt DJ, Knowler WC, Baird HR, Bennett PH. Gestational diabetes: infant and maternal complications of pregnancy in relation to third-trimester glucose tolerance in the Pima Indians. Diabetes Care 1980; 3(3):458-64.

11. Bartha JL, Martinez-Del-Fresno P, Comino-Delgado R. Gestational diabetes mellitus diagnosed during early pregnancy. Am J Obstet Gynecol 2000; 182(2):346-50.

12. Cox NJ. Maternal component in NIDDM transmission. How large an effect? Diabetes 1994; 43(1):166-8.

13. Boney CM, Verma A, Tucker R. Metabolic syndrome in childhood: association with birth weight, maternal obesity, and gestational diabetes mellitus. Vohr BRPediatrics 2005; 115(3):e290-6.

14. Lee H, Jang HC, Park HK, Metzger BE. Prevalence of type 2 diabetes among women with a previous history of gestational diabetes mellitus. Cho NHDiabetes Res Clin Pract 2008; 81(1):124-9.

15. Kumar A; Bhat BV. Respiratory distress in newborn. Indian journal of maternal and child health 1996; 7(1):8-10.

16. Lucas MJ. Diabetes complicating pregnancy. Obstet Gynecol Clin North Am 2001; 28(3):513-6.

17. Janet A. Rowan, M.B., Ch.B., William M. Hague, M.D., Wanzhen Gao, Ph.D., Malcolm R. Battin, M.B., Ch.B., M. Peter Moore, M.B., Ch.B. Metformin versus Insulin for the Treatment of Gestational Diabetes. MiG Trial Investigators. N Engl J Med 2008; 358:2003-15.

18. Leeman L, Fontaine P. Hypertensive disorders of pregnancy. Am Fam Physician 2008; 78(1):93-100.

19. Vest AR, Cho LS. Hypertension in pregnancy. Cardiol Clin 2012; 30(3):407-23.

20. Buchbinder A, Sibai BM, Caritis S, Macpherson C, Hauth J, Lindheimer MD, Klebanoff M, Vandorsten P, Landon M, Paul R, Miodovnik M, Meis P, Thurnau G. Adverse perinatal outcomes are significantly higher in severe gestational hypertension than in mild preeclampsia. National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. Am J Obstet Gynecol 2002; 186(1):66-71.

21. Xu J, Barinas-Mitchell E, Kuller LH, Youk AO, CatovJM. Maternal hypertension after a low-birth-weight delivery differs by race/ethnicity: evidence from the National Health and Nutrition Examination Survey (NHANES) 1999-2006. Plos One 2014; 9(8):e104149.

22. Kintiraki E, Papakatsika S, Kotronis G, Goulis DG, Kotsis V. Pregnancy-Induced hypertension. Hormones (Athens) 2015; 14(2):211-23.

23. Wender-Ozegowska E, Zawiejska A, Iciek R, Brązert J. Concentrations of eNOS, VEGF, ACE and PlGF in maternal blood as predictors of impaired fetal growth in pregnancy complicated by gestational hypertension/preeclampsia. Hypertens Pregnancy 2015; 34(1):17-23.

24. Armstrong DW, Tse MY, Wong PG, Ventura NM, Meens JA, Johri AM, Matangi MF, Pang SC. Gestational hypertension and the developmental origins of cardiac hypertrophy and diastolic dysfunction. Mol Cell Biochem 2014; 391(1-2):201-9.

25. Sibai BM. Diagnosis and management of gestational hypertension and preeclampsia. Obstet Gynecol 2003; 102(1):181-92.

26. Williams K . Amniotic fluid assessment. Obstet Gynecol Surv 1993; 48(12):795-800.

27. Kehl S, Schelkle A, Thomas A, Puhl A, Meqdad K, Tuschy B, Berlit S, Weiss C, Bayer C, Heimrich J, Dammer U, Raabe E, Winkler M, Faschingbauer F, Beckmann MW, Sütterlin M . Single deepest vertical pocket or amniotic fluid index as evaluation test for predicting

adverse pregnancy outcome (SAFE trial): a multicenter, open-label, randomized controlled trial. Ultrasound Obstet Gynecol 2016; 47(6):674-9.

28. Umber A, Chohan MA. Intravenous maternal hydration in third trimester oligohydramnios: effect on amniotic fluid volume. J Coll Physicians Surg Pak 2007 June, 17(6):336-9.

29. Shahnazi M, Sayyah Meli M, Harmony F, Sadrimehr F, GhatrehSamani F, Koshagar H.

The effects of intravenous hydration on amniotic fluid volume and pregnancy outcomes in women with term pregnancy and oligohydramnios: a randomized clinical trial. Caring Sci 2012; 1(3):123-8.

30. Anita Soni, Seeru Garg, Khushboo Patel, Zarna Patel. Role of L-Arginine in Oligohydramnios. The Journal of Obstetrics and Gynecology of India 2016; 66(1):279–83.