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Original Article

Comparative Study of Serum Triglyceride Level in Normal Pregnancy and in Pregnancy with Hypertensive Disorder and its Maternal and Fetal Outcome

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Abstract

Background and Objectives: At present most popular theory is an oxidative stress. Abnormal lipid profiles and reactive oxygen species may have a role in the promotion of oxidative stress and vascular dysfunction seen in pre-eclampsia. To compare and correlate serum triglyceride levels among normotensive and hypertensive disorder in pregnancy.

Methods: This is a prospective comparative study, where data was collected from pregnant women, who were more than 28 weeks of gestation and met the inclusion criteria. Comparison was done on blood pressure, triglyceride level, body mass index (BMI), mode of delivery, maternal and fetal outcome among two groups, i.e., hypertensive and normotensive.

Results: The mean triglyceride level in the hypertensive patient were 183.36 mg/dl with standard deviation (SD) of 53.85 whereas in normotensive serum triglyceride levels were 129.47 mg/dl with SD of 28.08 (*P*-value = 0.00). The mean BMI in hypertensive and normotensive was 24.03 kg/m^2 and 22.94 kg/m^2, respectively.

Conclusion: Levels of serum triglyceride are significantly increased in hypertensive patients. The mean serum triglyceride levels also significantly increased with increase in the severity of hypertension. Hence, it is important to identify the serum triglyceride levels among hypertensive patients, so as to initiate a therapy as soon as possible and curtail the burden of diseases.

Key words: Triglyceride levels, Normal pregnancy, Hypertensive pregnancy

INTRODUCTION

Hypertensive disorders are a long-standing threat that endangers the lives of both mother and child. It can manifest in four forms during pregnancy, i.e., gestational hypertension, chronic hypertension, preeclampsia, and eclampsia. 50–98% of the maternal deaths that occur in India are due to direct obstetric complications which also include hypertensive disorders.[1,2]

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The prevalence of preeclampsia is around 8–10% in India.[2,3] Hypertensive disorders are amongst the top three causes for maternal deaths in India. Being a multisystem disorder, if not identified early, it not only impairs the functions of the kidney and liver but also causes intense vasospasm, HELLP syndrome, postpartum vascular collapse, impaired electrolyte balance, blindness, PRES, etc., effecting almost every organ of the body.[4] Women with pre-eclampsia are also more likely to suffer neonatal death or stillbirth. It might also effect the fetus by causing intrauterine death, intrauterine growth retardation, and prematurity.[5]

Pregnancy is a physiological process that is accompanied by various anatomical, physiological, and biochemical changes of the entire body. During pregnancy total lipid levels increases by 50%. High-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglyceride levels also increase by 15%,

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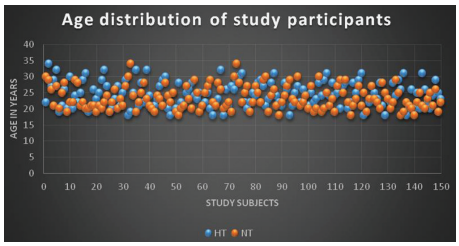
40%, and 50%, respectively. The etiology of pre-eclampsia is still unknown.[2,4,6] Since the etiology and pathogenesis of hypertensive disorders in pregnancy still remains controversial, many markers of endothelial dysfunction have been identified in preeclampsia women. Due to insulin resistance and increased estrogen during pregnancy, there is alteration of circulating triglycerides, fatty acids cholesterol, and phospholipids due to metabolic changes in both the liver and adipose tissue.[7,8] Altered lipid synthesis leads to decrease in PGI2: TxA2 ratio which is also supposed to be an important way of pathogenesis in pregnancy-induced hypertension. As pregnancy continues, this causes hyperlipidemia consisting principally of increased triglycerides.[9,10] Hypertriglyceridemia is one of the potent risk factor for metabolic syndrome. Hence, altered lipid profiles such as increased total cholesterol, LDL cholesterol, triglycerides and decreased HDL cholesterol concentrations are associated with an increased risk of preeclampsia.[11] Hence the current study was undertaken with an aim to show the co-relation between triglyceride levels and the maternal and fetal outcome.

METHODS

A prospective comparative study was done where data was collected from pregnant women, who were more than 28 weeks of gestation and met the inclusion criteria ate and approaching hospital for delivery. Preliminary information regarding the participants was collected after obtaining informed consent by using a questionnaire and the blood samples were collected for the estimation of triglyceride levels. The participant was contacted personally in hospital after delivery to know the outcome of pregnancy.

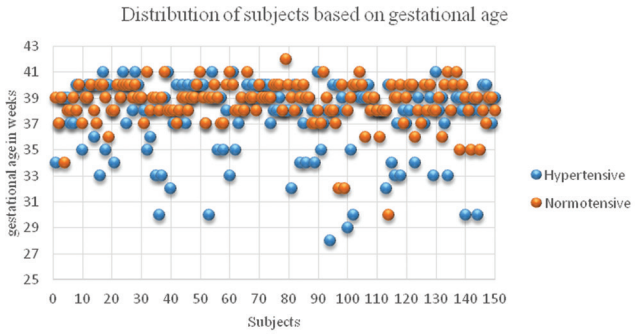
RESULTS

Age distribution among hypertensive subjects varied from 18 years to 34 years. Most of the participants in this group were of 25 years. The mean age was 24.5 years with a standard deviation (SD) of 3.89 years. Age distribution among normotensive subjects varied from 18 years to 34 years. Most of the participants in this group were of 22 years. The mean age was 23.3 years with a SD of 3.59 years. There was no significant difference in the mean age of both the groups, hence both the groups were comparable in terms of age.

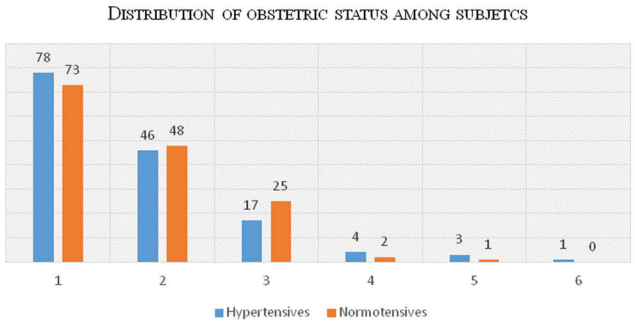


The gestational age among hypertensive patients varied from 28 weeks to 41 weeks. Most of the participants were of 40 weeks of gestation. The mean gestational age in the group was 37.53 weeks with a SD of 2.9 weeks.

The gestational age among normotensives varied from 30 weeks to 42 weeks. Most of the participants were of 39 weeks of gestation. The mean gestational age in the group was 38.56 weeks with a SD of 1.7 weeks. The two groups differed with respect to the gestational age and the difference was statistically significant.

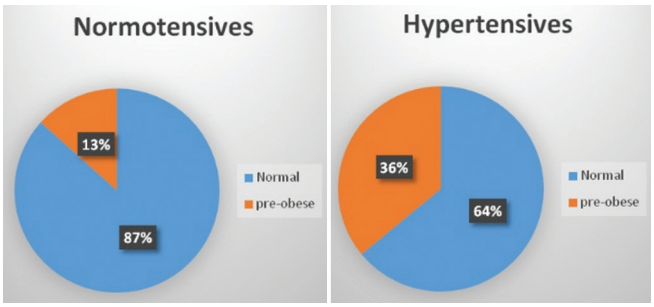


Around 78 participants and 72 participants in the hypertensive group were primigravida and multigravida, respectively. Participants varied from gravida 1 to gravida 6 in this group. The mean of obstetric status with respect to gravida was 1.73 and a SD of 0.982. Around 73 participants and 77 participants in the normotensive group were primigravida and multigravida, respectively. Participants varied from gravida 1 to gravida 5 in this group. The mean of obstetric status with respect to gravida was 1.72 and a SD of 0.836. There was no statistically significant difference between both the groups with respect gravida status, therefore the two groups were similar in terms of their obstetric status.



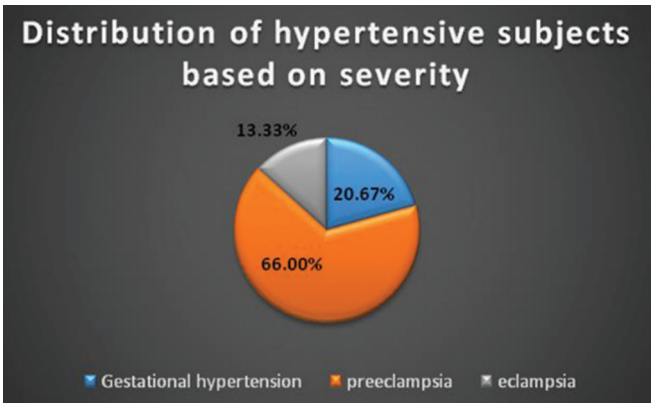
The body mass index (BMI) of the women in hypertensive group varied from 19.20 to 29.3. the mean BMI in the group was 24.03 with a SD of 2.24. About 64% of the women had normal BMI whereas rest 36% were pre-obese. The BMI of the women in normotensive group varied from

19.40 to 26.90. The mean BMI in the group was 22.94 with a SD of 1.65. About 87% of the women had normal BMI, whereas rest 13% were pre-obese. There was significant difference in the BMI of both the groups



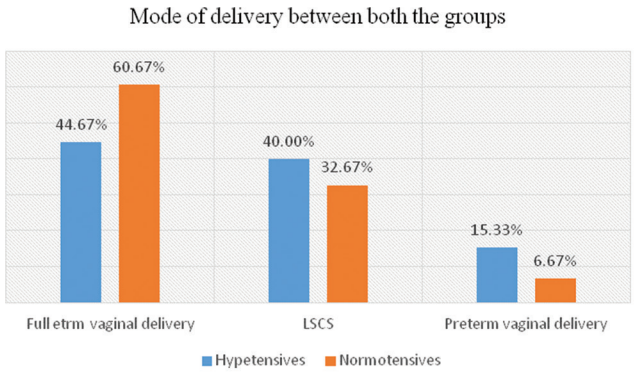
Pre-pregnancy BMI among hypertensive and normotensives

Among the hypertensive group, the mean systolic blood pressure (SBP) was 153.7 with a SD of 10.3. The mean diastolic blood pressure (DBP) in the group was 100.07 with a SD of 8.78. 66% of the subjects had gestational hypertension, 22% had preeclampsia and 13% of them had eclampsia. Among the normotensive group, the mean SBP was 111.6 with a SD of 10.4. The mean DBP in the group was 73.39 with a SD of 8.07. The difference in both systolic and diastolic pressure was statistically significant between both the groups.

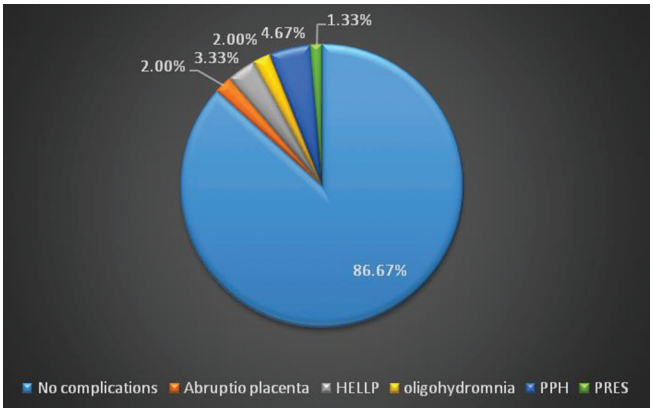


The levels of serum triglyceride varied from 100 to 394 in hypertensive subjects. The mean serum triglyceride levels were 183.36 with a SD of 53.85 in the group. The levels of serum triglyceride varied from 74 to 375 in normotensive subjects. The mean serum triglyceride levels were 129.47 with a SD of 28.08 in the group. The mean serum triglyceride level was significantly higher in hypertensive subjects as compared to normotensive group.

In the hypertensive group out of 150, 67 (45%) of them underwent full-term normal vaginal delivery, 23 (15%) preterm normal vaginal delivery, and the rest 60 (40%) delivered through cesarean section. In the normotensive group out of 150, 91 (61%) of them underwent full-term normal vaginal delivery, 10 (6%) preterm normal vaginal delivery, and the rest 49 (33%) delivered through cesarean section. In both the groups' majority of them underwent normal delivery which were predominantly full term. When compared the frequency of normal delivery was higher in normotensive subjects whereas the frequency of lower segment Cesarian section (LSCS) was higher in hypertensive subjects. The difference in the mode of delivery was statistically significant between both the groups.

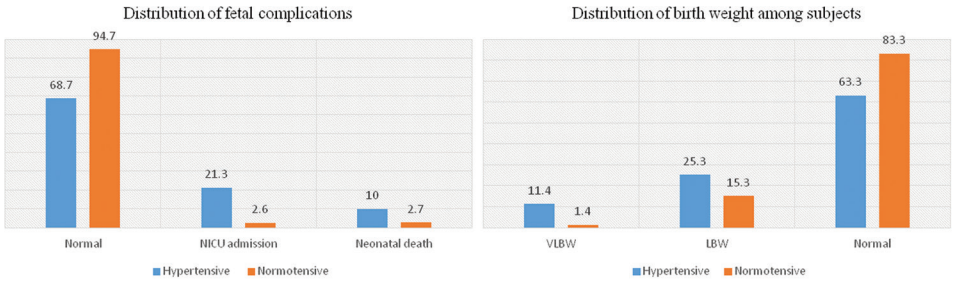


Although 86.67% of the hypertensive subjects did not show any complications, some of the life-threatening complications such as abruptio placenta, HELLP, Oligohydromnia, PPH, and PRES were seen amongst others. Whereas none of the normotensive subjects exhibited any such complications.



The birth weight among normotensive subjects varied from 1 kg to 3.9 kg. The mean birth weight was 2.47 in the group with a SD of 0.66 kg. 83.3% of the babies were of normal weight, whereas 15.3% were low birth weight weighing <2.5 kg but more than 1.5 kg and 1.4% were very low birth weight that is <1.5 kg.

The mean birth weight of the newborns of hypertensive subjects was higher as compared to normotensive and the difference was statistically significant.



In the hypertensive group, 68.7% of the newborns had no complications. 31.3% of the babies were admitted to newborn intensive care unit (NICU) as a result of various complications amongst which 10% died within the first 2 weeks of the postnatal period. In the normotensive group, 94.7% of the newborns had no complications. 5.3% of the babies were admitted to NICU as a result of various complications amongst which 2.7% died within the first 2 weeks of the postnatal period.

The frequency of complications was higher among newborns of hypertensive subjects and the difference of distribution among both groups was statistically significant.

DISCUSSION

Hypertensive disorders are a long-standing threat that endanger the lives of both mother and child. 50–98% of these maternal deaths, that occur in India are due to direct obstetric complications which also include hypertensive disorders.

Age at Pregnancy

In the current study, none of the participants belonged to teenage pregnancy. According to WHO, each year around 21 million girls aged 15–19 years and 2 million girls aged under 15 years become pregnant in developing regions. On the other hand pregnancy over 35 years old, is also associated with increased risks. Older pregnant women demand more information and have anxiety related to the outcome of their pregnancy, the serum triglyceride levels depend on age of the women. It generally increases as the women ages. In the current study, there was no significant difference in the mean age among hypertensive and normotensive women. Hence, both the groups were comparable in terms of age.

Obstetric Status of the Women

Gaillard *et al.*[12] in his study tested the associations between parity and the growth and risk factors in the child. They conducted a population-based prospective cohort study in which fetal and childhood growth were measured on various occassions. Parameters such as body fat distribution, left ventricular mass, blood pressure (BP), blood lipids, and insulin levels at the age of 6 years were also measured. The study found that nulliparous mothers had children with lower risks of preterm birth and small-size-for-gestational-age at birth but a higher risk of large-size-for-gestational-age at birth as compared to multiparous women. Whereas, the multiparous mothers had lower rates of total fat mass percentage, accelerated infant growth, and lower levels of childhood BMI LDL cholesterol than children of nulliparous mothers. Apart from this the children also had clustering of cardiometabolic risk factors. Multiparous women also had a lower risk of childhood overweight and lower cholesterol levels with increasing parity. Therefore, the study stated offspring from nulliparous mothers have lower fetal but higher infant growth rates and higher risks of childhood overweight and adverse metabolic profile.

In the current study, there was no difference in the obstetric status among both the groups. Hence both the groups were comparable in terms of their obstetric status. In both the groups, the number of primigravida and multigravida were almost equal. The obstetric index varied from gravida 1 to gravida 6 in hypertensive subjects and gravida 1 to gravida 5 in normotensive subjects.

Gestational Age

Gestational age at birth is associated with both fetal and neonatal deaths, postnatal death, and morbidities such as the respiratory distress syndrome and necrotizing enterocolitis. Some of the long-term morbidities such as deafness, blindness, hydrocephaly, mental retardation, and cerebral palsy are also manifested.

Though the rate of preterm births decreased, in 2018 preterm birth affected 1 of every 10 infants born in the United States.[13] A developing baby goes through important growth throughout pregnancy - including in the final months and weeks. Pre-term babies have higher rates of death and disability. In 2017, pre-term birth and low birth weight accounted for about 17% of infant deaths. Babies who survive may have[14]

- Breathing problems
- Feeding difficulties
- Cerebral palsy

- Developmental delay
- Vision problems
- Hearing problems.

Pre-term are at an increased risk of cardiovascular disease later in life, including increased mean arterial pressure, abnormally shaped and sub-optimally performing hearts and changes in the vasculature.[14]

In the current study, there were preterm births in both normotensive and hypertensive subjects. The difference in the gestational age group significantly varied in both groups. The mean gestational age among hypertensive subjects was significantly lesser as compared to normotensive subjects.[5,6]

Obesity

The cardio-vascular changes that occur in pregnancy are mainly to attain adequate foeto-placental circulation for the well-being of fetal growth and development. There is vasodilatation of systemic vasculature and the maternal kidneys. Cardiac output increases up to 45%, DBP and SBP decreases.[10] On the contrary some studies also proved increase in BP throughout pregnancy.[11] whereas another population-based study showed an increased BP during pregnancy among obese women.[12]

In short, the cardiovascular system of a pregnant women undergoes significant structural and hemodynamic changes. Apart from increase in cardiac output and a decrease in maternal systemic vascular resistance; it also effects the renin-angiotensin-aldosterone system and the heart and vasculature undergo remodeling. Any maladaptation of these factors has been associated with fetal morbidity. Therefore, understanding the normal cardiovascular changes in pregnancy is essential for the better outcome of pregnancy.

Studies suggest cardiovascular diseases and preeclampsia have certain risk factors which can be identified early.[15] Certain characteristics such as obesity, smoking, psychological stress, and polycystic ovarian disease are consistently associated with preeclampsia. Apart from these certain genetic factors also play a role in enhancing the risk. Certain hormonal disorders, such as polycystic ovarian disease and premature ovarian failure have increased risk for preeclampsia by the fact that these disorders confer increased cardiovascular risk outside pregnancy.[14]

A study done by Gaillard *et al*.,[13] showed that compared to mothers with a normal weight, maternal obesity (BMI 30–34.9 kg/m) and morbid obesity (BMI ≥35 kg/m) were associated with higher first trimester SBP and DBP. The study also showed that these differences were observed during the second and third trimesters also. The risks of pregnancy-induced hypertension and preeclampsia were increased among obese mothers and morbidly obese mothers. Maternal weight gain was associated with the risk of pregnancy-induced hypertension. Maternal obesity was strongly associated with BP in each trimester and increased risks of gestational hypertensive disorders among obese women.[14]

In the current study also there was a significant difference in the BMI of both the normotensive and hypertensive subjects. Although none of the women in either of the groups was obese around one-third of the participants in the hypertensive group were pre-obese.

Pregnancy Induced Hypertension

The prevalence of hypertension was 10% of all pregnancies. Around 7–8% of those who had elevated BP, it was pregnancy-induced ("gestational") without other associated problems. Study found that hypertensive disorders occur in up to 1 in 10 pregnant women.[12] In all the countries, 10% of pregnancies in each of the four countries were identified as hypertensive. The incidence was lowest in Pakistan and highest in Mozambique. Few pregnancies were hypertensive based only on isolated systolic hypertension and some had isolated diastolic hypertension later followed by systolic hypertension. In India, women were diagnosed earlier and had significantly more BP measurements. More than 3/4th of the cases who were hypertensive was non-severe. In India particularly hypertension was diagnosed antenatally and in the mid-late third trimester. Around 40% were diagnosed postpartum. In India, the incidence of postpartum hypertension was lowest, and the timing of diagnosis was median 10 days postpartum, whereas in other countries it was 7 days postpartum.

The incidence of chronic hypertension at <20 weeks gestation was lower in India and Pakistan compared with Mozambique and Nigeria. Most hypertension cases were diagnosed during the antenatal period in India and Mozambique, whereas about half was so diagnosed in Pakistan and Nigeria. The incidence of Pre-eclampsia was same in each of the four countries. Very few women presented with eclampsia as their hypertensive disorder. Overall, chronic hypertension was the rarest (<1.0%), gestational hypertension being the most common (6–12%), and pre-eclampsia intermediate in incidence (3–6%).[14]

Hypertensive disorders in pregnancy are one of the major causes of maternal and prenatal morbidity and mortality.[16-18] Another study done by has found that the prevalence of HDP, gestational hypertension, and preeclampsia are 5.2–8.2%, 1.8–4.4%, and 0.2–9.2%, respectively.[19] The factors that increase the risk of gestational hypertension can be genetic or non-genetic.[20] Some of the factors

such as BMI, anemia, and illiteracy are the important modifiable risk factors. Whereas some other factors like maternal age, primiparous, multiple pregnancies, HDP in previous pregnancy, gestational diabetes mellitus, pre-existing hypertension, pre-existing type 2 diabetes mellitus, pre-existing urinary tract infection, and a family hypertension and some had isolated diastolic hypertension later followed by systolic hypertension.[21,22] In India, women were diagnosed earlier and had significantly more BP measurements. More than 3/4th of the cases who were hypertensive was non-severe. In India particularly hypertension was diagnosed antenatally and in the mid-late third trimester. Around 40% were diagnosed postpartum. In India, the incidence of postpartum hypertension was lowest, and the timing of diagnosis was median 10 days postpartum, whereas in other countries it was 7 days postpartum.[13]

Serum Triglyceride

Study done by Grimes and Wild[23] studied the levels of total cholesterol, triglycerides, LDL cholesterol, and HDL cholesterol in women from pre-conception period to postpartum. In the first trimester, there was a decrease in levels of all parameters during the first 6 weeks. As the pregnancy progressed by the 3rd month levels increased and then there was a steady increase throughout pregnancy in the major lipoprotein lipids. By the third trimester, plasma cholesterol levels are 50% higher than routinely seen pre-pregnancy and while triglyceride levels are doubled.[14]

In the current study, the levels of serum triglyceride varied from 100 to 394 in hypertensive subjects. The mean serum triglyceride levels were 183.36 with a SD of 53.85 in the group. The levels of serum triglyceride varied from 74 to 375 in hypertensive subjects. The mean serum triglyceride levels were 129.47 with a SD of 28.08 in the group. The mean serum triglyceride level was significantly higher in hypertensive subjects as compared to normotensive group.

Among the hypertensive subjects, the mean serum triglyceride levels were 157.90 in those who had gestational hypertension, 184.66 in those who had preeclampsia, and 216.40 in those who had ecclampsia. The mean serum triglyceride levels increased with increase in severity of hypertension and this mean serum triglyceride levels varied significantly.

Serum Triglyceride and Maternal Outcome

In the current study both the groups' majority of them underwent normal delivery which was predominantly full term. When compared the frequency of normal delivery was higher in normotensive subjects whereas the frequency of LSCS was higher in hypertensive subjects. The difference in mode of delivery was statistically significant between both the groups. The 86.67% of the hypertensive subjects did not show any complications, some of the life-threatening complications such as abruption placenta, HELLP, Oligohydromnia, PPH, and PRES were seen amongst others. Whereas none of the normotensive subjects exhibited any such complications.

Author conclude that there is elevation of serum lipids among preeclamptic when compared to normal pregnancy. A simple screening test acquired, helps to recognize dyslipidemia in the early second trimester of patients who are at risk of preeclampsia. Due to early detection of altered lipid profile in preeclamptic, the incidence of complications can be decreased, which in turn reduces the materno-fetal morbidity and mortality.

CONCLUSION

The serum triglyceride levels are one of the important indicators of maternal and fetal health status of a pregnant women. The levels of serum triglyceride are significantly increased in hypertensive patients. The mean serum triglyceride levels also significantly increased with increase in the severity of hypertension. Hypertension in pregnancy per se is associated with varied maternal and fetal complications. Hence, it is important to identify the serum triglyceride levels among hypertensive patients, so as to initiate a therapy as soon as possible and curtail the burden of diseases.

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