RESEARCH ARTICLE

Gestational diabetes and its effect on some biochemical parameters

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ARTICLE INFO

Article History:
Received 18 Jun 2024
Accepted 21 Sep 2024
Published 01 Dec 2024

Keywords:
Amniotic fluid index, Gestational diabetes, Type 2 diabetes in pregnant women, Electrolytes in pregnancy, Protein in pregnant women

ABSTRACT

Some pregnant women are at risk of developing gestational diabetes for many reasons, including being overweight, insulin resistance, women over 35 years old, women with polycystic ovary syndrome, or for other reasons. In this study, we studied the effect of gestational diabetes on some biochemical variables in the blood and amniotic fluid of pregnant women aged (15-45) years who visited the private Batool Teaching Hospital in Nineveh Governorate. The levels of glucose, total proteins, albumin, urea, creatinine, and some electrolytes such as sodium, potassium, chloride, and calcium were estimated in the serum of the pregnant woman and the amniotic fluid, where the results indicated a significant increase in the levels of glucose, total proteins, albumin, urea, creatinine, chloride, potassium, and sodium in the blood serum and amniotic fluid. There was a significant decrease in calcium levels compared to the control group.

How to cite this article
Ali, W.Kh. Gestational diabetes and its effect on some biochemical parameters. Nanomed Res J, 2024; 9(4): 348-355. DOI: 10.22034/nmrj.2024.04.002

INTRODUCTION

Amniotic fluid is the clear fluid that surrounds the baby through pregnancy. This fluid acts as a lining to protect the baby from trauma and provides room for movement, growth, and development during pregnancy. It also protects the umbilical cord from pressure between the wall of the uterus and the fetus [1-3].

When pregnancy occurs, the baby begins to form in the mother's womb, inside a sac. This sac comprises (2)membranes, the amnion, and the placenta. Where the baby begins to grow inside it, and it is surrounded by amniotic fluid. At the beginning of pregnancy, the fluid consists of water that it takes from the mother's body, but when the pregnancy reaches the twentieth week, this fluid becomes entirely composed of fetal urine, because the fetus swallows this fluid and then excretes it as urine. The amniotic fluid contains vital molecules, Such as antibodies, hormones, and nutrients. When the color of the amniotic fluid is green or brown, this indicates that the baby has begun expelling meconium before birth. The term meconium refers to the baby's first bowel movement, and when meconium is present in the amniotic fluid, it can cause a problem for the body of the pregnant mother and the baby, and it can also cause a problem in the baby's breathing process, especially when the meconium enters the lung. This requires the fetus to need treatment after birth [4,5].

The protection of the fetus is responsible for the amniotic fluid, as it protects the fetus from external shocks, reduces the impact of shocks on the child, and also maintains the temperature of the fetus inside the mother's womb, as the fluid insulates the fetus and maintains the warmth of its body in the mother's womb [6,7] On the other hand, the amniotic fluid helps control and reduce infection because it contains some antibodies. It works to develop the fetus' respiratory, lung, and digestive systems through breathing and swallowing amniotic fluid, and the child can exercise and use these muscles during pregnancy and after birth. It also helps in the proper growth of bones and muscles, and the amniotic fluid helps the baby

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with lubrication, as it prevents body parts such as the feet and fingers from growing together without causing adhesion between them, especially when amniotic fluid levels are low. On the other hand, it also helps the umbilical cord move because it prevents fluid pressure in the uterus [8,11]. Food and oxygen are carried from the placenta through the umbilical cord to the fetus inside the uterus to grow properly [9,10].

Generally speaking, the amniotic fluid level reaches its peak during 36 weeks of pregnancy and has a volume of roughly 1 liter. This volume reduces as labor time draws near. The amniotic fluid inside the uterine amniotic sac begins to flow through the cervix and vagina when the amniotic sac ruptures. Only approximately 15% of water is believed to break at the start of labor when the first stage of labor normally starts. When this occurs, it could be quite soon before the baby is born. There may be more or less amniotic fluid than usual during some pregnancies. [12-15].

The fluid contains urea, electrolytes, phospholipids, proteins, and carbohydrates that aid in the fetus' growth. [13,14].

In 4% of all pregnancies and roughly 12% of pregnancies that go past the due date, low amounts of amniotic fluid can occur [15–16]. This could happen when the amniotic membranes break and fluid leaks, or it could happen to moms who have had one of the following medical conditions: Problems with placental abruption, high blood pressure, multiple pregnancies such as twins or triplets, as well as diabetes, and birth defects such as kidney abnormalities and premature birth. There are other unknown reasons. It can cause a decrease in the volume of amniotic fluid at any time during pregnancy. However, the first six months of pregnancy are when this issue is most pressing. Considering that it may result in birth deformities, pregnancy loss, an early delivery, or the infant's death at birth. The hazards of low fluid levels in the latter three months of pregnancy include delayed baby growth and labor difficulties. also the requirement for a cesarean section [17- 19].

Polyhydramnios is the term for an increase in amniotic fluid volume. The American Pregnancy Association estimates that it happens in 1% of all pregnancies. When the uterine amniotic fluid index exceeds 24 cm, polyhydramnios develops; the maximum value is 8 cm[20,-23,37-38].

The study aimed to determine the relationship between gestational diabetes and some biochemical variables in amniotic fluid and blood.

MATERIALS AND METHODS

Thirty-nine blood and amniotic fluid samples were taken from pregnant patients at Al-Khansa and Al-Batoul Hospital in Mosul who suffered from gestational diabetes. Their ages ranged between (15-45) years. Five mL of blood samples and amniotic fluid were collected from each pregnant woman. The blood and fluid were separated by centrifugation, and the serum was frozen at a temperature of (-20 degrees Celsius) for later use. The samples were divided into two groups [Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes]. Some biochemical variables such as glucose, total proteins, albumin, urea, creatinine, calcium, chloride, potassium, and sodium were measured to determine the effect of gestational diabetes on them. Ready-made analysis kits from the French company VEDALAB and the American company BIOMERIEUX were used to calculate the mentioned variables, respectively. Statistical analysis of the results was performed using SPSS version 25 software. For all samples, a t-test was run, and a probability level of p00.5 was used.

Table 1. Biochemical variables measured for the Pregnant groups and the control group in blood samples.

parameters		Control group(n=22) Mean± S.D.	Pregnant groups (n=39) Mean± S.D.		p-value
			A (15-45) year N=20	B (15-45) year N=19	
Total protein	g/dl	6.36±0.13	7.18±0.19	6.94±0.32	p≤0.01
Serum albumin	g/dl	3.19±0.09	4.14±0.73	5.04±0.12	p≤0.001
Blood urea	mg/dl	14.34±0.23	45.63±3.11	50.54±2.76	p≤0.001
Serum creatinine	mg/dl	1.15±0.7	2.76±0.49	2.46±0.83	p≤0.005
Blood sugar	mg/dl	102±0.93	220.87±.95	281.32±1.53	p≤0.001
Calcium	mmol/L	1.19±0.82	0.92±0.17	0.81±0.33	p≤0.05
Chloride	mmol/L	89.2±2.71	95.44±7.17	102.43±4.83	p≤0.001
Sodium	mmol/L	113.9±5.13	122.96±4.1	125.93±4.11	p≤0.05
Potassium	mmol/L	4.06±0.79	4.63±0.6	5.4±0.87	p≤0.05

S. creatinine: serum creatinine

Table 2. Biochemical variables measured for the Pregnant groups and the control group in amniotic fluid.

parameters		Control group(n=22) Mean± S.D.	Pregnant groups (n=39) Mean± S.D.		p-value
			A (15-45) year N=20	B (15-45) year N=19	
Total protein	g/dl	0.56±0.13	0.78±0.19	0.74±0.32	p≤0.01
Albumin	g/dl	0.17±0.09	0.34±0.73	0.24±0.12	p≤0.001
Blood urea	mg/dl	18.54±0.23	43.61±3.11	40.5±2.76	p≤0.001
Creatinine	mg/dl	0.95±0.7	1.76±0.49	1.46±0.83	p≤0.05
Blood sugar	mg/dl	62±0.93	120.87±.95	108.32±1.53	p≤0.001
Calcium	mmol/L	0.92±0.82	0.72±0.17	0.81±0.33	p≤0.05
Chloride	mmol/L	67.2±2.71	85.44±7.17	92.43±4.83	p≤0.001
Sodium	mmol/L	93.9±5.13	108.96±4.1	106.93±4.11	p≤0.05
Potassium	mmol/L	3.06±0.79	4.13±0.6	4.24±0.87	p≤0.05

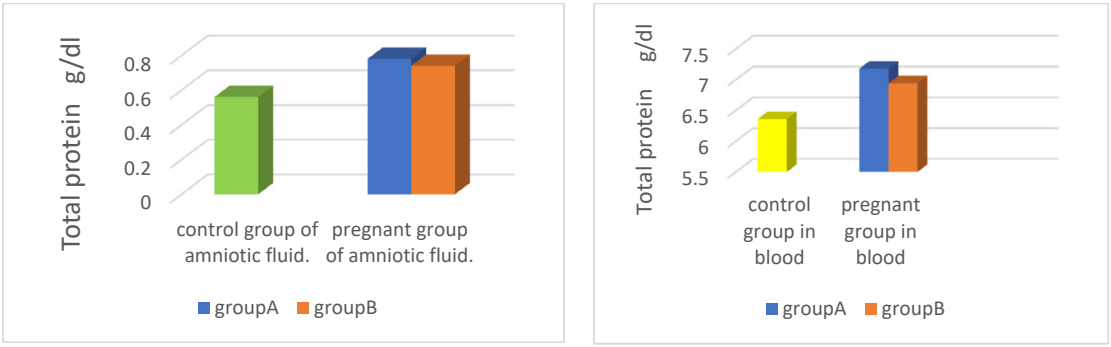

Fig. 1. Level of Total protein in the group [A, B]and control groups in blood and amniotic fluid. According to the findings [Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

RESULTS AND DISCUSSION

The table below represents the obtained results. The results showed that there is a significant difference between the Pregnant groups [which include group A (15-45) years gestational diabetes, group B (15-45) year diabetes type 2,] and the control groups (Pregnant without diabetes).at the probability level $P < 0.05$.

In Figure (1), Based on the data, it can be concluded that group [A, B] has a significantly higher level of total protein than the control group in blood and amniotic fluid. perhaps as a result of gestational diabetes, which causes high levels of glucose and insulin. Gestational diabetes increases the risk of high blood pressure, preeclampsia, and other conditions that can threaten the life of the pregnant woman and the baby. this concurs with [21-26,31-36].

in Figure (2), the albumin levels in groups [A, B] were significantly higher than those in the control group in blood and amniotic fluid. An increase in blood sugar levels can cause a rise in total protein and albumin levels in a pregnant woman's blood serum. Perhaps because of the effect of gestational diabetes on kidney function. Diabetes in pregnant women can cause side effects on kidney function, as it damages the glomerulus cells and prevents them from filtering urine and harmful substances properly. and this agrees with [11-14, 20- 25, 27-35].

In addition, the results shown in Figures 3 and 4 showed that the levels of urea and creatinine in the pregnant group [A, B] were significantly increased compared with the blood and amniotic fluid control group. The side effects of gestational diabetes can affect the kidneys, leading to high urea and creatinine during pregnancy. The placenta provides nutrients and oxygen to the growing fetus. The placenta also produces some hormones. In late pregnancy, the hormones cortisol, estrogen, and human placental lactogen can prevent insulin from doing its job. This is called insulin resistance. In this case, glucose cannot enter the body's cells and glucose remains in the blood and raises blood sugar levels. This is consistent with [9-17,24-33].

The results shown in Figure (5) reveal that the

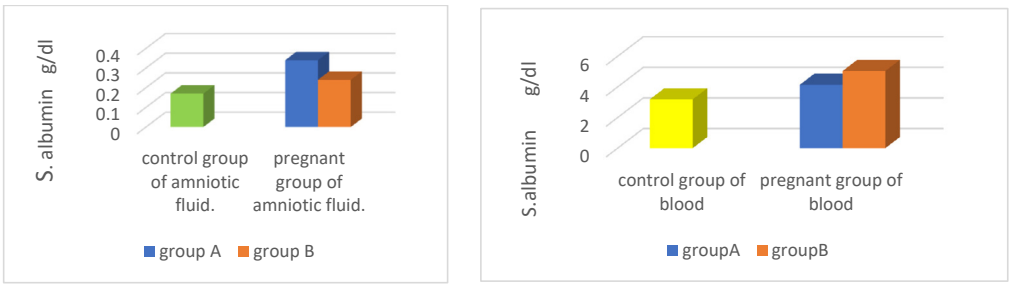

Fig. 2. level of Albumin in the group [A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

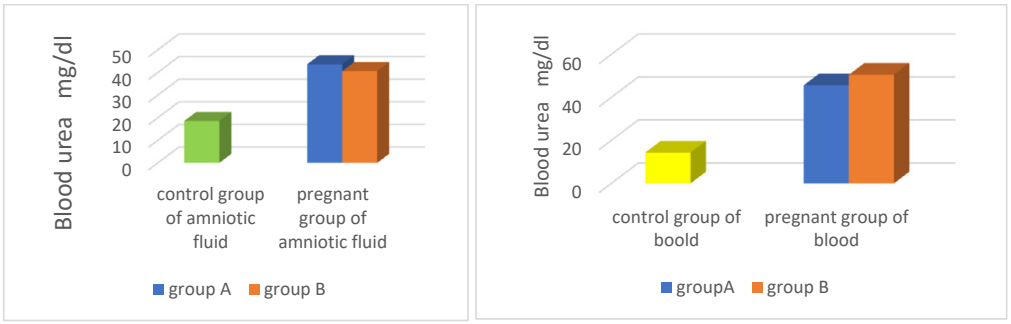

Fig. 3. level of urea in the group [A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

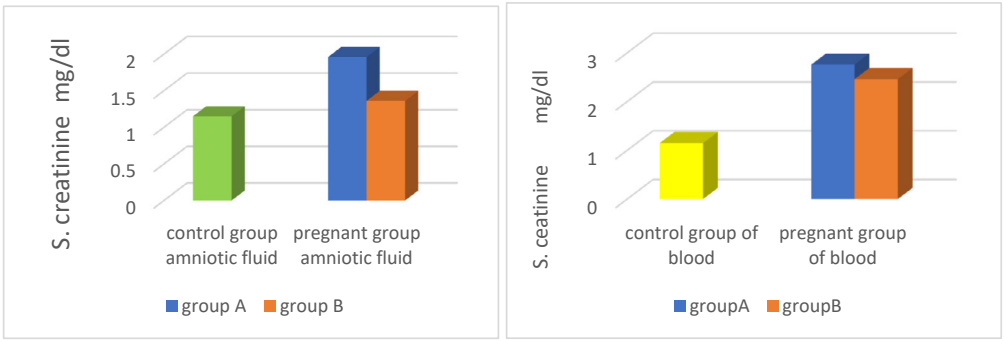

Fig. 4. level of serum creatinine in the group [A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

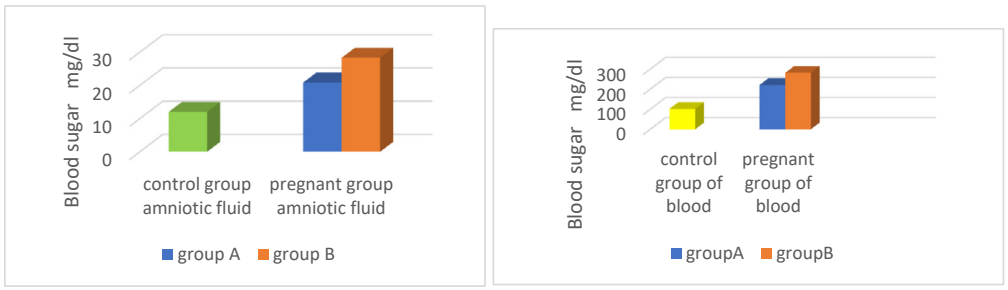

Fig. 5. Level of blood sugar in the group [A, B]and control groups in blood and amniotic fluid.A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

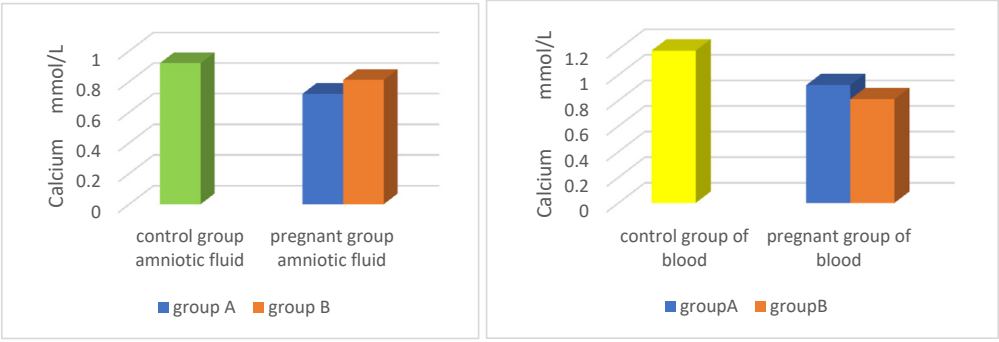

Fig. 6. level of serum calcium in the group [A, B]and control groups in blood and amniotic fluid.A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

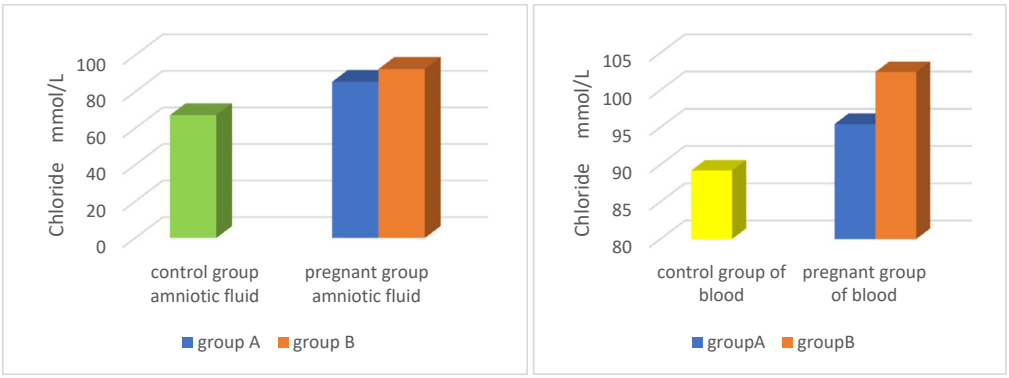

Fig. 7. Level of serum chloride in the group [A, B]and control groups in blood and amniotic fluid.A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

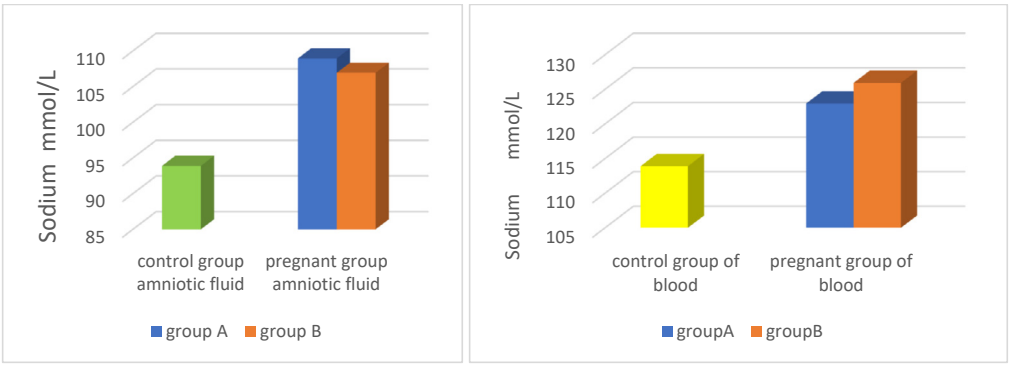

Fig. 8. Level of serum sodium in the group [A, B]and control groups in blood and amniotic fluid.A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

blood sugar level in the pregnant group [A, B] increased significantly compared to the control group in the blood and amniotic fluid. According to research, gestational diabetes may be caused by insulin resistance or lack of insulin production by the body, which controls blood sugar levels. High blood sugar levels in pregnant women may lead to weight gain in babies, which may lead to excessive growth of babies. Another complication of gestational diabetes is low blood sugar (hypoglycemia) in the baby immediately after birth, as babies suffer from low blood sugar (hypoglycemia) shortly after birth. Severe hypoglycemic episodes may cause seizures in the baby. These cases can be treated with rapid feeding and intravenous glucose to restore the baby's blood sugar level to normal [3,15-23,34].

The results in Figure (6) also show that the calcium level in the pregnant group decreased

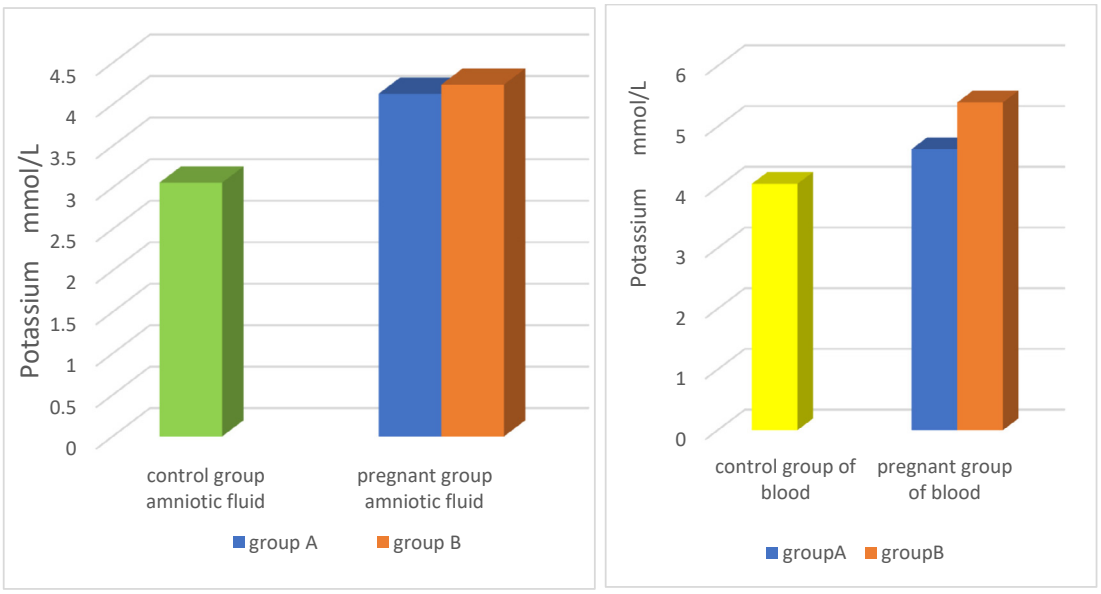

Fig. 9. Level of serum potassium in the group [A, B]and control groups in blood and amniotic fluid.A, B]and control groups in blood and amniotic fluid.[Group A (15-45 years) includes gestational diabetes, and Group B (15-45 years) includes type 2 diabetes].

significantly [a, b] when compared to the control group in the blood and amniotic fluid. The calcium level may decrease due to the fetus's need for growth, due to its low intake by the pregnant mother, or for other reasons related to its absorption and also to the side effects of gestational diabetes that affect kidney function. This is consistent with [17-23,29-31,39].

The results shown in Figure (7,8,9) indicated that there was a significant increase in the level of chloride, sodium, and potassium in the pregnant group [A, B] when compared with the control group in blood and amniotic fluid, The occurrence of any defect in the work of the kidneys, which leads as a result to an increase in the level of electrolytes, and this imbalance may be a result of gestational diabetes and an increase in the level of glucose in the blood. and this agrees with [9,17-24,36].

CONCLUSION

Gestational diabetes has many complications, including what happens to the pregnant woman during and after pregnancy and what happens to the fetus during and after childbirth. These complications may increase if blood glucose levels are not controlled during pregnancy. Complications of gestational diabetes include premature birth, hypocalcemia, high blood pressure, an increased risk of the mother developing type 2 diabetes after about 5-10 years of pregnancy, and preeclampsia. In this study, we noticed many side effects of gestational diabetes on the mother and the fetus. The high glucose level due to the mother having gestational diabetes led to an increase in the level of glucose in the blood and the amniotic fluid, as well as an increase in the level of total proteins, albumin, urea, and creatinine as a result of damage and destruction of kidney cells and their failure to perform their function in maintaining the level of electrolytes in the body, which led to an increase in the level of chloride, sodium, and potassium in the blood of the pregnant mother and the amniotic fluid and a decrease in the level of calcium in the blood and amniotic fluid.

ACKNOWLEDGMENT

The researcher thanks the Deanship of the College of Science, the Department of Chemistry, and all the pregnant women and medical staff who helped in the completion of this research.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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