ISSN 1991- 8690 الترقيم الدولي ٨٦٩٠ - ١٩٩١
website: http://jsci.utq.edu.iq Email: utjsci@utq.edu.iq

Effect of Pregnancy Duration on the Levels of Some Biochemical Parameters in Pregnant Women

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Abstract

The study investigated the effect of pregnancy case on the level of some biochemical components in the blood sera, which accompany fetus growth of. It was conducted on (45) blood serum of pregnant women and compared with (52) blood serum of non-pregnant women which were considered as control group. The measured parameters in sera were included the electrolyte (sodium and potassium) and some trace element (selenium) as well as the antioxidant vitamins (A, C, E).

The results showed non-significant decrease in (sodium and potassium) concentrations of pregnant women compared with control group, while a significant decrease in level of selenium was noticed in serum of pregnant women compared with control group. The results also showed a significant decrease in the levels of vitamins (A , C , E) in serum of pregnant women compared with control group. An inverse relationship between the concentration of determined vitamins E and C during pregnancy period .It was noted that vitamin E concentration decreased, and that of vitamin C increased during pregnancy period.

Introduction

Pregnancy defined as a state of physiological stress accompanied by profound serial hormonal, biochemical, metabolic and even psychological changes (Cruikshank and Hays, 1986).The normal duration of pregnancy is about 40 weeks. These weeks are divided into three (3-month) periods called trimesters. A trimester is a time frame grouping that is used to assess the normal development of the fetus, and each trimester is based on a period of between 12 to 14 weeks (Rosenblatt, 2007). In general the stages of pregnancy can be divided in to **three** stages**,** first, second and third trimester(Gottfried, 1994).

After menstruating for the first time, a girl has her period once every month.

The first day of the period is counted as the first day of the menstrual cycle. After the bleeding stops, one egg starts to grow in the ovary. Also, the lining of the uterus starts to build up, in order to receive a fertilized egg. Between the eleventh and fourteenth day, the egg is released from the ovary and starts to move through the fallopian tubes to the uterus (Singh, 2007).

A woman's egg can survive for approximately 24 hours and a sperm can live in the reproductive tract for several days. Once fertilized, the egg (zygote) continues to travel through the fallopian tube until it reaches the uterus two to four days later. It then implants itself into the wall of the uterus (womb) and begins to develop (Melanine and Hallam, 2003).

In some cases, a fertilized egg may implant itself outside the uterus;a case known as an ectopic pregnancy. It is also possible for more than one egg to be fertilized, or for the fertilized egg to divide into identical but separate zygotes .These potential events result in a multiple pregnancy (Tomasulo and Lubetkin, 2008).

Nausea and vomiting of the pregnancy, commonly known as a morning sickness, affect approximately 80% of pregnant women. Many women also develop craving or aversion of certain foods in addition to Dehydration, Ketosis, Abdominal enlargement and Electrolyte disturbances. (Hill and Quinlan, 2003).

There are an important relation between pregnancy and some biochemical parameters like falling in the hemoglobin concentration, is usually due to iron deficiency anemia rather than the heam dilution of pregnancy and iron deficiency anemia of pregnancy and iron requirements increase, because large amounts of iron may not be available from body stores and may not be in the diet supplementation is recommended to prevent iron deficiency anemia at term, also serum alkaline phosphates levels may be elevated three to four folds due to placental production and ceruloplasmin activity and transferrin concentration will be increased but the uric acid, total protein and Albumin decreased (Baker, 2000; Richter, 2002).

Materials and methods

The study was applied on forty five blood sample of pregnant women, collected from health center of Duhok (Sharia Center) and from health center in Mosul (Risalah Health Center).compared with (52) blood samples of non pregnant women as control group. Regarding the pregnant women, many factors were considered such as, smoking ,geographical location, chronic diseases and pregnancy duration .Venous blood sample (10 ml) were drown from pregnant and control groups . Samples, then transferred immediately to a clean dry plain tube. After removing the needle , the blood was allowed to clot for at least (10-15 mins) at room temperature , centrifuged for (10 mins) at (4000 xg) . Serum was removed for the following biochemical parameters measurements as shown in table (1) (Tietz , 1999).

Table (1): Determination of biochemical parameters in blood serum

Biochemical parameters	Method of determination	Technique	References
1 -Sodium	flam	Flam photometry	Annino & Giese,1976, Bishop *et al.*,2005
2-Potassium	flam	Flam photometry	Annino & Giese,1976, Bishop *et al.*,2005
3-Selenium	Colorimetric	Spectrophotometer	Cummins *et al.*, 1965
4-Vitamin A	Colorimetric	Spectrophotometer	Wootton , 1947
5-Vitamin C	Colorimetric	Spectrophotometer	Colowick & Kaplan,1979, Tiets , 1999
6-Viatmin E	Colorimetric	Spectrophotometer	Varley *et al.*, 1976

Statistical analysis

Statistical analysis was performed using SAS statically software (SAS, 1996). The results were expressed as mean ± SD. Duncan's test was used to differentiate between the means values for blood biochemical parameters. The comparison included pregnant women and non-pregnant as a control group. The means were distinguished among statistical group at P≤ 0.05, has been taken as a statistically significant. To find the relationship between biochemical parameters which measured in the serum of pregnant women correlation coefficient (r) was found.

Results and Discussion

1- Effect of pregnancy on the levels of biochemical parameters in the pregnant and non-pregnant women.

The results of the measured biochemical parameters are summarized in table (2). The trace mineral selenium and vitamins (A, C, E) concentrations were significantly decreased (P ≤ 0.05) in serum of pregnant women compared with control group. Electrolyte (sodium, potassium) concentrations showed non significant decrease in serum of pregnant women compared with control group.

1.1-Sodium:

Sodium is the major cation of the extracellular fluids and is largely associated with chloride and bicarbonate in the regulation of acid base equilibrium .Sodium is thus has a protection role against excessive fluid loss (Martin *et al*., 2003). The function of sodium is the regulation of acid base equilibrium, it helps to maintain osmotic pressure of body, it helps to preserve irritability of muscles and permeability of cells. The deficiency of sodium results in muscular cramps of the extremities and abdomen, headaches, nausea and diarrhea (Singh, 2007).

The results in table (2) showed that there was non significant decrease in

sodium concentration in serum of pregnant women compared with control group. The decrease in plasma sodium concentration might be due to low sodium intake during pregnancy (Callahan *et al.,* 2004*).* The normal increase in blood volume in pregnancy may be associated with a sodium deficiency due to low sodium intake, while a decrease in blood volume had been demonstrated in sodium deficiency state (Wardlaw and Pike, 2008; Hautvast *et al*., 1997). The study by (Gottfried, 1994) mentioned that the pregnant women can feel hot and sweaty because of increased cardiac output and peripheral vasodilatation and this may be lead to decrease of sodium concentration.

1.2- Potassium:

Potassium is one of the main blood minerals called electrolytes (the others are sodium and chloride). Potassium is well absorbed from the small intestine and most excess potassium is eliminated in the urine and sweat, this mineral is also lost with vomiting and diarrhea (Hass, 2008). The result in table (2) showed non significant decrease in potassium concentration in serum of pregnant group compared with control group.

Estimations of plasma sodium, potassium and chloride concentrations, with plasma and serum osmolality, had been made during pregnancy and the early puerperium. Both sodium and potassium concentrations decrease until 28 weeks, after which both rise, potassium significantly so. (Anastasiadis and Rimpler, 1984; Macdonald and Good, 2005).

1.3 -Selenium:

Selenium is an essential dietary nutrient for most animals and humans, helps in defend the organism against oxidative stress and enhance the antioxidant effect of vitamin E and activates glutathione (Saleem, 2002).

The result in table (2) showed a significant decrease ($P \leq 0.05$) in serum selenium concentration of pregnant group compared with control group. During pregnancy, the whole blood and plasma concentration and selenium in red cells decline in a linear fashion from the first trimester to parturition, with the lost levels at delivery. This demonstrates that the requirement of selenium is increased during pregnancy as a result of transport to the growing fetus (Mahajan *et al*., 2006).

1.4 -Vitamin A:

Vitamin A is a fat soluble vitamin stored in the liver and deficiency of the vitamin occurs only after prolonged lack of dietary intake (King, 2004). The main consequence of a poor vitamin A supply during pregnancy is a low vitamin A status at birth and in the next few months (Jain *et al*., 2000). Low vitamin A status does not seem to be related to a higher incidence of intrauterine growth retardation; the fetus starts to accumulate vitamin A during the third trimester of pregnancy(Pascal *et al*., 2000).Statistical analysis (table2) showed a significant decreased ($P \leq 0.05$) in vitamin A concentration in serum of pregnant group compared with control group.

1.5-Vitamin C:

Ascorbic acid is more commonly known as vitamin C. Ascorbic acid is derived from glucose via the glucoronic acid pathway. The main function of ascorbic acid is as a reducing agent in a number of different reactions (King, 2004). During pregnancy plasma level of vitamin C normally fall 10 % to 15 %.

This decline is attributed to plasma volume expansion rather than increase demands of maternal or fetal tissue (Kamlesh, 2002).

Results in table (2) showed a significant decrease ($p \leq 0.05$) in vitamin C levels in serum of pregnant group compared to control group. The reduction of vitamin C concentration might be due to heam dilution as well as active transfer to the fetus. Therefore in order to transfer adequate vitamin C to the fetus additional vitamin C needed during pregnancy is absence of data on near maximal neutrophil saturation during pregnancy (Ramsey *et al*., 2000)

1.6-Vitamin E:

Vitamin E is a mixture of several related compounds known as tocopherols. Vitamin E is absorbed from the intestines packaged in chylomicrons. Vitamin E acts as a natural antioxidant scavenging free radicals and molecular oxygen (Saleem, 2002). In contrast to the case for most nutrients, the blood concentration of α-tocopherol increases during pregnancy, in parallel with an increase in total lipid. Placental transfer of vitamin E from mother to fetus appears to be relatively constant as pregnancy progresses. Although vitamin E deficiency can occur in premature newborn precipitating a hemolytic anemia, there are no reports of vitamin E deficiency during pregnancy and no evidence that maternal supplementation with vitamin E would prevent deficiency symptoms in premature (Ramsey *et al.*, 2000).

Results in table (2) showed a significant decrease in vitamin E concentration in serum of pregnant group compared with control group. This might be due to that pregnant women have low vitamin E intake (National Research Council, 2003). Data in (table3) showed in inverse correlation (table 3) between vitamin E and vitamin C levels in serum of pregnant women ($p \leq 0.05$, $r = -0.297$).

Table (2): values of biochemical parameters in pregnant and non-pregnant groups ± SD

Biochemical parameters	Mean ± SD		P - value
	Pregnant sample no. (45)	Control sample no. (52)	
Sodium (mmol/L)	135.514 ± 12.498	137.912 ± 5.546	0.215
Potassium (mmol/L)	3.681 ± 0.558	3.761 ± 0.526	0.470
Selenium (µmol/L)	0.653 ± 0.113	0.814 ± 0.197	0.000 *
Vitamin A (µmol/L)	0.666 ± 0.125	1.770 ± 0.328	0.000 *
Vitamin C (µmol/L)	19.453 ± 3.180	34.363 ± 3.063	0.000 *
Vitamin E (µmol/L)	9.707 ± 1.318	16.819 ± 1.766	0.000 *

* Significant difference existed between pregnant and non-pregnant groups at levels of significance (P≤ 0.05).

Table (3): Correlation coefficient "r" for biochemical parameter in pregnant women sera

Parameter		Sodium	Potassium	Selenium	Vitamin A	Vitamin C
Potassium	correlation	-0.202				
Selenium	correlation	0.033	-0.088			
Vitamin A	correlation	0.134	-0.193	-0.048		
Vitamin C	correlation	-0.079	0.256	0.226	-0.133	
Vitamin E	correlation	-0.101	0.041	-0.002	-0.020	-0.297 *

*Correlation is significant at level (p≤ 0.05).

2- Effect of smoking on biochemical parameters in pregnant women

Tobacco smoking is associated with multiple types of cancer and with chronic cardiovascular and pulmonary disease. Despite this, 26% of reproductive women smoke and 19 to 30 % of pregnant women continue to smoke (Frank *et al*., 2000). In this study, the obtained result (table 4) indicate that there is no significant difference between smokers and non-smokers pregnant women because most of pregnant women were non-smokers.

Table (4): Value s of biochemical parameters in smoking pregnant women and non-smoking pregnant women ± SD

Biochemical parameters	Mean ± SD		P - value
	Smoking pregnant group no. (4)	Non-smoking pregnant group no. (41)	
1- Sodium (mmol/L)	136.625 ± 1.050	135.409 ± 13.099	0.855
2- Potassium (mmol/L)	4.000 ± 0.548	3.650 ± 0.555	0.235
3- Selenium (µmol/L)	0.675 ± 0.070	0.651 ± 0.117	0.688
4- Vitamin A (µmol/L)	0.670 ± 0.067	0.662 ± 0.132	0.901
5- Vitamin C (µmol/L)	20.975 ± 1.794	19.305 ± 3.260	0.322
6- Vitamin E (µmol/L)	9.598 ± 1.366	9.717 ± 1.330	0.865

3- Effect of the geographical location on biochemical parameters in pregnant women.

Blood sample were distributed according to the residence of two regions: urban and rural. The results in table (5) showed significant increase ($p \leq 0.05$) in potassium and vitamin A concentration in serum of rural pregnant women compared with urban pregnant women. These results might be due to the difference of diet habbits and there source between rural and urban pregnant women. No significant difference has been noted in concern to the other measured parameters.

Table (5): Values of biochemical parameters in rural pregnant women and urban pregnant women ± SD

Biochemical parameters	Mean ± SD		P - value
	Rural pregnant group no. (24)	Urban pregnant group no. (21)	
1- Sodium (mmol/L)	136.054 ± 12.677	134.898 ± 12.572	0.761
2- Potassium (mmol/L)	3.858 ± 0.552	3.479 ± 0.504	0.021 *
3- Selenium (µmol/L)	0.662 ± 0.135	0.642 ± 0.084	0.567
4- Vitamin A (µmol/L)	0.704 ± 0.133	0.615 ± 0.098	0.015 *
5- Vitamin C (µmol/L)	19.928 ± 3.537	18.911 ± 2.697	0.290
6- Vitamin E (µmol/L)	9.457 ± 0.0975	9.995 ± 1.603	0.177

* Significant difference existed at level of significance ($p \leq 0.05$).

4-Effect of chronic diseases on biochemical parameters in pregnant women.

Results in table (6) showed a significant decrease in sodium concentration in pregnant women having chronic disease. Two cases were noticed; the first case included two patients with hypertension, the second one represented one diabetic patient compared with pregnant women without chronic disease. This result might be reasoned to the disorder in carbohydrates metabolism of diabetic patient due to the lake of insulin which lead to osmotic diuresis which consequently lead to polyurea and water-salt (sodium) depletion. While in the other patients of hypertension, there kidneys increased their water and salt (sodium) excretion from the body to stabilize the blood pressure.(Davidson *et al*.,2006). No significant difference had been noted in concern to other measured parameters.

Table (6):Values of biochemical parameters depending on chronic disease in pregnant women ± SD

Biochemical parameters	Mean ± SD		P - value
	Pregnant women with chronic disease no. (3)	Pregnant women without chronic disease no. (42)	
1- Sodium (mmol/L)	116.400 ± 29.435	136.880 ± 9.834	0.005 *
2- Potassium (mmol/L)	3.933 ± 0.208	3.663 ± 0.088	0.424
3- Selenium (µmol/L)	0.650 ± 0.053	0.653 ± 0.117	0.964
4- Vitamin A (µmol/L)	0.543 ± 0.081	0.671 ± 0.124	0.088
5- Vitamin C (µmol/L)	22.103 ± 1.693	19.264 ± 0.492	0.137
6- Vitamin E (µmol/L)	9.613 ± 0.649	9.713 ± 1.358	0.981

* Significant difference existed at level of significance ($p \leq 0.05$).

5-Effect of pregnancy duration on biochemical parameters in pregnant women.

The results in table (7) showed a significant effect of pregnancy duration on concentration of vitamin A .The value recorded in the first trimester was (0.624 µmol/L) which increased to (0.691 µmol/L) in the second trimester and to (0.773µmol/L) in the third trimester. These difference might be due to that in the third trimester the requirement of the fetus to vitamin A increase due to the growing mechanism of the fetus so the stored of the vitamin A in the maternal liver excreted to the blood making its concentration high according to first and second trimester (Jain *et al*., 2000). No significant difference had been noted in concern to the other measured parameter.

Table (7): values of biochemical parameters depending on duration of pregnancy (gestational age) ± SD

Biochemical parameters	Mean ± SD			P-value
	First Trimester N0. (24)	Second Trimester No. (17)	Third Trimester No. (4)	
1- Sodium (mmol/L)	A 138.036 ± 4.281	A 131.394 ± 19.194	A 137.898 ± 5.552	0.230
2- Potassium (mmol/L)	A 3.669 ± 0.626	A 3.724 ± 0.514	A 3.576 ± 0.350	0.885
3- Selenium (µmol/L)	A 0.625 ± 0.109	A 0.692 ± 0.117	A 0.650 ± 0.093	0.178
4- Vitamin A (µmol/L)	AB 0.624 ± 0.124	A 0.691 ± 0.109	B 0.773 ± 0.118	0.039*
5- Vitamin C (µmol/L)	A 18.956 ± 3.025	A 20.021 ± 3.618	A 20.020 ± 2.026	0.544
6- Vitamin E (µmol/L)	A 9.741 ± 1.271	A 9.684 ± 1.535	A 9.598 ± 0.716	0.977

* Numbers with different letters were statistically significant at level of significant ($P \leq 0.05$).

Conclusion:

From the foregoing results, one can conclude that the pregnancy is one of the most important and embarrassment period in woman life, in which there is an increase in nutrients requirement like vitamins and several minerals which needed by the fetus for growing since it can be noted a significant decrease in selenium and anti oxidant vitamins (A,C,E) concentration in blood serum of pregnant women group compared with the control group. For this reason the requirement of mother for foods supplementations should be increased including proteins, carbohydrate, fats, minerals and vitamins to prevent their deficiency.

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الخلاصة

تضمنت الدراسة الحالية دراسة تأثير الحمل على مستوى بعض المكونات الحيوية في الدم والتي ترافق عملية نمو الجنين . أجريت الدراسة على (٤٥) نموذجا من مصل دم لنساء حوامل و قورنت مع (٥٢) نموذجا من مصل الدم لنساء غير حوامل كمجموعة سيطرة .

تضمنت المتغيرات الكيموحيوية المقاسة في مصل الدم كلا من الشوارد (صوديوم , بوتاسيوم) وبعض المعادن النادرة (السيلينيوم) وبعض الفيتامينات المضادة للاكسده (C,EA,) . أشارت النتائج أن هناك انخفاض غير معنوي في مستوى الصوديوم والبوتاسيوم في مصل دم النساء الحوامل مقارنة مع النساء غير الحوامل , بينما لوحظ انخفاضا معنويا في مستوى السيلينيوم في مصل دم النساء الحوامل مقارنة مع مجموعة السيطرة , وأشارت النتائج أيضا إلى انخفاض معنوي في مستولى الفيتامينات (C,EA,) في مصل دم الحوامل مقارنة مع مجموعة السيطرة .

أخيرا أشارت النتائج إلى وجود علاقة عكسية بين مستوى كل من فيتامين (E و C) خلال فترة الحمل. إذ لوحظ انخفاض في مستوى فيتامين E , بينما مستوى فيتامين C ارتفع خلال فترة الحمل