



**Research Article**

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## Total serum cholesterol and selected electrolytes during pregnancy among women residents in Yenagoa metropolis, Bayelsa state Nigeria

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### Abstract

The incidence of high cholesterol, electrolytes imbalance and hypertension are emerging health issues prevalent among pregnant women globally. This study determines total serum cholesterol, selected electrolytes (Na<sup>+</sup> and K<sup>+</sup>) and blood pressure of pregnant women subjects in Yenagoa metropolis. A total sample of two hundred pregnant women subjects aged 18->40years with 80, 70, and 50 in their first, second, and third trimesters were randomly recruited. While total serum cholesterol was measured using oxidative and hydrolysis method the blood pressure and electrolytes were recorded by standard methods using automated electrolytes analyser and Omron digital blood pressure machine. One way ANOVA was used to analysed the data obtained for comparison between groups. Result from the study shows a significant (<0.05) increase in total serum cholesterol and percentage difference from the first, second, and third trimesters of pregnancy. Serum sodium concentration was slightly higher in the second trimester compared with the first and third trimesters while potassium concentration was slightly higher in the first trimester compared with other trimesters. The blood pressure of the participants were higher among subjects with high total serum cholesterol and age 34years and above during pregnancy. Findings from this study have shown slight decrease in serum potassium concentration among pregnant women with raised blood pressure compared to mean values of other subject groups.

**Keywords:** Pregnancy, Cholesterol, Serum, Electrolytes, Subjects, Blood pressure.

### INTRODUCTION

Pregnancy or gravid is the period a rapidly developing embryo or offspring attaches itself to the endometrium from the last menstrual circle in about 40 weeks. The division of pregnancy into three periods include first trimester (1 - 12 weeks), second trimester (13 – 28 weeks), and third trimester (28 weeks to birth). Physiological changes in maternal organ system are expected to occur though most return to normal after delivery but unlike the nulliparous. Cholesterol level is usually determined from dietary intake and its production in the liver. The adverse effect of maternal cholesterol and the unborn fetus have not been fully isolated, though research studies on experimental animals have shown the adverse effect of high cholesterol during pregnancy. The high-density lipoprotein physiological role is to transport cholesterol from peripheral tissues to the liver for its removal and the production of nitric oxide that has a relaxation effect on blood vessels [1].

Normal cholesterol levels are about 120-190mg/dl but can be over 200mg/dl during pregnancy though the level can climb even higher among women with high cholesterol prior to conception which could result in hypertension. However, the mother's placenta and fetus have certain enzymes to produce cholesterol into physiological hormones essential for the baby's growth and in turn increase its level in the mother's blood stream. Cholesterol ranges from 1.4 and 2.2mg/ml in first trimester, 1.8-3mg/ml in second trimester and 2.5-3.5mg/ml during the third trimester but any level above this range in total cholesterol and decrease high density lipoprotein is considered dangerous [2,3].

The stimulation of the angiotensin aldosterone system mechanism increased during pregnancy leading to the retention of sodium ions that is mainly due to the interplay that exists between anti natriuretic stimuli and natriuretic that is present during pregnancy [4]. During normal pregnancy, the blood pressure and

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vascular peripheral resistance decreased toward the end of the first trimester of serum electrolytes with serum chloride remaining almost unchanged and a significant increase in aldosterone level [5].

Though tubular reabsorption of sodium is increased resulting in positive sodium balance needed to allow for fetal requirement and increase maternal blood volume. During the third trimester, more water than sodium is retaining contributing to the dependent oedema [6,7].

Findings from previous study have shown that increase in electrolytes concentration during the first trimester of pregnancy is accompany by increase renal excretion with a network of sodium and potassium which did not occur until the reduction of these ions output. Though sodium osmolality decreased toward term despite sodium retention indicating an increased fetal usage [8,9,10].

According to Cribbs [11], little attention has been paid to obtaining the history of pregnant women cardiovascular parameters and complications ranges from preeclampsia to hypertension which will help to strategized and develop preventive methods towards women

Prone to high risk of cardiovascular diseases. Despite the advancement in the medical field, the etiology of preeclampsia is yet to be fully understood.it is associated with electrolyte imbalance in pregnant women due to alterations in intracellular water concentration. This is related to changes in the cell membrane responsible for most pathological changes in preeclampsia [12].Many factors responsible for total serum cholesterol and lipid profile in different stages of pregnancy include age, genetic factor, dietary pattern of individual,socio-economic, race ,among others [13].This study was design to determine the variation of serum cholesterol and some electrolytes among pregnant women and also between the different trimesters of pregnancy to provide useful information that will serve as reference for both clinicians and other medical researchers in home and abroad.

## MATERIALS AND METHODS

Research design: This was a retrospective cross sectional clinical study carried out in health centers and hospitals within Yenagoa metropolis in Bayelsa state. The data of two hundred normotensive pregnant women during their antenatal care visit were collected after obtaining an informed consent from each participant and analysed using spss version 23.0 Chicago USA.

**Table 1:** Total serum cholesterol and electrolytes in different trimesters of pregnancy

Parameters	Trimesters of pregnancy					
	1 <sup>st</sup>	2 <sup>nd</sup>	%	3 <sup>rd</sup>	%	P value Sig <0.05
	(n=80)	(n=70)	Diff.	(n=50)	Diff.	
Chol. (mmol/L)	5.10±1.02	5.70±1.33	11.11	6.80±1.07	28.57	0.00 #
Na+(mEq/L)	142.01±3.90	146.03±6.12	2.79	145.60±8.26	2.49	0.01 #
K+ (mEq/l)	3.51±0.17	3.24±0.6	-8	3.26±0.81	-7.38	0.04 #

NB: Results are given as mean ± standard deviation, green= (+ve) increase %diff, red= (-ve) decrease %diff. # = Significant

**Study Location:** The participants for the study were randomly selected from Igbogene, Yenegwe, Akenfa, Yenezuegene and Polaku all in Yenagoa local government area of Bayelsa state.

This research was approved by the University of Port Harcourt research ethical committee with approval number UPH/R&D/REC/04.

**Inclusion criteria:** pregnant subject within the ages of eighteen to forty years in Yenagoa local government area, pregnant women willing to give consent.

**Exclusion criteria:** Subjects with family history of hypertension, below eighteen years, diabetes, not willing to give consent and with obvious medical condition were excluded from the study.

**Determination of total serum cholesterol:** A multicheck machine manufacture by Kernel international cooperation (Taiwan) was used to determine the total serum cholesterol of the participants.puncturizer adjusted to suit the depth of each participant skin, sterile lancet, swab, gloves and cholesterol test strip were used for the determination.

**Method:** Oxidative and hydrolysis.

**Determination of blood pressure:** The blood pressure and pulse rate of the subjects were measured in a sitting position from the left arm using Omron digital blood pressure monitor after resting for ten minutes.

**Gestational age:** The gestational age was calculated from their last normal menstrual period and the palpation of the fundal height.

**Electrolyte determination:** Three mL of blood samples was centrifuge at 3500resolution per minute for serum potassium and sodium separation and the readings taking using a semi-automated electrolyte analyser (accure enlite).

## RESULTS

The total serum cholesterol, electrolytes and cardiovascular status of the pregnant women subjects studied are presented in tables below. Two hundred pregnant women subjects with mean age of 28.36±3.86, 29.51±8.91 and 30.12±1.15 years giving a percentage of (40%), (35%) and (25%) during the first, second, and third trimesters of pregnancy were recruited for this study. They were categorized into desirable (<5.1mmol/L), borderline high (>5.1mmol/L) and high (>6.1mmol/L) levels of serum cholesterol while their age were grouped into 18-25, 26-33, and 34-40 respectively.

**Table 2:** Relationship between serum cholesterol and blood pressure during pregnancy

Parameters (mmHg)	Normal	Moderate high	High			
	<5.1 (mmol/l)	>5.1 (mmol/l)	>6.1 (mmol/l)			
	(n=19)	(n=90)	% Diff	(n=91)	% Diff.	P- value
<b>SBP</b>	116.56±12.15	124.16±13.52	6.31	134.24±14.40	14.07	0.01#
<b>DBP</b>	78.12±10.21	80.52±8.96	3.02	86.33±11.52	9.98	0.00 #
<b>MAP</b>	90.73±8.21	94.52±6.63	4.09	102.13±5.33	11.82	0.00 #
<b>Pulse (bpm)</b>	86.11±13.00	84.30±16.21	-2.24	80.24±11.12	-7.17	0.03 #
<b>Na+(mEq/l)</b>	141.72±5.01	142.62±4.20	0.63	144.08±3.24	1.64	0.02#
<b>K+(mEq/l)</b>	2.96±1.25	3.35±0.12	12.36	3.00±0.07	1.34	0.00#

NB: Results are given as mean ± standard deviation, green= (+ve) increase %diff, red= (-ve) decrease %diff. # = Significant

Table 2 shows the classification of serum cholesterol into desirable level, borderline high and high level by the (NILBI 2007).

**Table 3:** Relationship between total cholesterol and age during pregnancy with blood pressure

Parameters	18-25 (yrs)	26-33 (yrs)	% diff.	34-40 (yrs)	% diff.	P value, 0.05 sig.
SBP	112.32±13.15	121.89±16.52	8.17	128.94±18.22	13.33	0.03
DBP	68.24±12.11	79.26±6.72	14.94	81.20±13.22	17.34	0.00
MAP	81.92±3.33	93.45±7.74	13.14	97.44±6.46	17.30	
Pulse rate	85.02±13.21	86.30±6.79	1.49	81.00±5.60	-4.84	0.07Ns
Chol(mmol)	5.10±2.55	5.60±0.59	9.34	5.90±0.02	14.54	0.01
Na+(MEq/l)	140.20±4.22	143.52±6.55	2.34	146.6.20±6.79	4.16	0.02
K+(MEq/l)	3.21±0.50	3.19±0.61	-0.06	3.18±0.27	-0.93	0.06Ns

NB: Results are given as mean ± standard deviation, green= (+ve) increase %diff, red= (-ve) decrease %diff. # = Significant

## DISCUSSION

Total serum cholesterol increases during pregnancy but ranges do vary among studies and maternal Physiology is usually influenced by the maternal placenta during the last trimester of pregnancy which could affect lipid metabolism. Result from this study shows a significant increase in total serum cholesterol during the second and third trimesters (5.7 and 6.80mmol/L) of pregnancy. The serum sodium was significantly (<0.05) increased within normal range during the second and third trimesters (146 and 145mEq/L). However, the serum potassium concentration was slightly lower in the second and third trimesters (3.24 and 3.26 mEq/L) compared with first trimester.

There was an increased positive percentage difference of total serum cholesterol and sodium in the first, second and third trimesters of pregnancy while a negative decrease percentage difference was observed in serum potassium in all the trimesters of pregnancy. Result from this study is congruent with the findings of Bartels [14] who observed an elevated cholesterol level in all trimesters of pregnancy with median value from the first trimester. Raghuram et al [15] observe an increase in total cholesterol in the third trimester from his research study. Due to increase in the metabolic rate during pregnancy the maternal body switch over to fat utilization from carbohydrate. Result from this study is not in agreement with the result from study conducted by Pushpa and Som [16] that indicate a decrease in serum sodium during pregnancy. Participants with serum cholesterol level of (<5.1mmol/L) had lower systolic and diastolic blood pressures (116 and 78 mmHg) compared with subjects above (>5.1 and 6.1 mmol/L) whose blood pressures ranges from (124,134mmHg and 80, 86 mmHg) into prehypertension stage.

The pulse rate was observed to be lower among participants with significant increase in cholesterol in comparison with subjects having

lower (<5.1mmol/L) serum cholesterol. There was a significant (p value <0.05) increase in the mean arterial blood pressure (102mmHg) of subjects with high cholesterol level above (>6.1mmol/L) followed by participants above (>5.1 to 6.1 mmol/L). A higher positive percentage difference (11.82%) in the mean arterial blood pressure among pregnant subjects with high total serum cholesterol (>6.1mmol/L) was also observed in the study. This similar increase in blood pressure among pregnant women living in gas flaring communities was also observed from previous studies in Bayelsa state [17]. Pregnant subjects within the age category of (34-40years) had significant (<0.05) increase in systolic, diastolic and mean arterial blood pressures (128,81 and,97mmHg) compared with age (18-25years) of (112,68, and 81mmHg).

The influence of age on the intima of blood vessels with subsequent increase in blood pressure have also been observed by [18, 19] among pregnant and non-pregnant women residents in gas flaring communities in the Niger Delta region of Nigeria. Participants pulse rate of aged above (34-40years) significantly decreases when compared to the younger adults. Persistent increase heart rate due to inhalation of toxic gases can result in myocardial hypertrophy and reduction in heart rate [20,21]. Aging process decreases the SA nodal pathway of the heart electrical system resulting in some behavioural changes of ion channels in older cells [22]. Further findings from this study have shown increase cholesterol level and sodium ion concentration among aging pregnant women subjects compared with the younger adults in Bayelsa state. There was also an increase in potassium concentration (3.21meq/L) among younger adult with lower blood pressure compared with older adults.

## CONCLUSION

This study enhanced the understanding of baseline total serum cholesterol and selected electrolytes during first, second and third trimesters of pregnancy in Bayelsa state and the global world.

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## Conflicts of interest

The authors declare no conflict of interest.

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