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SERUM CALCIUM LEVEL IN NORMAL AND HYPERTENSIVE PREGNANT WOMEN AT WOMEN AND CHILDREN HOSPITAL ABBOTTABAD

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SUMMARY:

We have studied ionized serum calcium, total calcium, phosphorus, total protein and albumin in 20 normal pregnant women, 37 moderate and severe pregnancy induced hypertensive women and 9 pregnant women with chronic hypertension. The total serum calcium was significantly reduced in moderate and severe pregnancy induced hypertension and chronic hypertension ($P<0.05$ and 0.0001 respectively) while ionized calcium was also significantly reduced in pregnancy induced hypertension and chronic hypertension patients as compared to the normotensive pregnant women. ($P<0.001$ and $P<0.0001$ respectively). Total protein and albumin was less in hypertensive group as compared to normotensive. Serum phosphate was increased in hypertensive group.

It was observed that total calcium and ionized calcium among these hypertensive groups were decreased which support conclusion of other epidemiologic studies of hypertension in non-pregnant patients and pregnant patients that abnormal calcium metabolism contributes to the genesis of hypertensions.[1-2]

INTRODUCTION

The normal plasma calcium concentration is between 2.2-2.55 mmol/1.[3] In the serum the calcium is distributed into three forms, a non-diffusible, protein-bound calcium, diffusible calcium complexes, and diffusible ionic calcium (Ca^{+2}). It circulates in plasma in two main forms. The albumin bound fraction is little less than half of the total which is inactive while remaining plasma calcium is free ionized (Ca^{+2}) and is the physiologically important fractions.

An increase in the level of free ionized calcium is required for the contraction of cardiac and vascular smooth muscle cells: In addition to this calcium is needed for the formation and conduction of the impulse in the sinoatrial and atrioventricular nodes of heart. In this way calcium is important in the pathogenesis of hypertension by affecting membrane fluxes and intracellular concentration.[4]

The relationship of serum calcium and hypertension is controversial. Many studies have been done in this regard. Experimental support for this hypothesis is the reported increase in blood pressure in pregnant female rate fed a calcium deprived diet compared with a group of rats fed a normal calcium diet.[5] Recently, serum ionized calcium concentration have been demonstrated to be reduced in non-pregnant hypertensive patients but similar data in pregnant hypertensive patients were lacking. [6] The present study was designed to identify potential differences in calcium levels among women with normal pregnancies, women with pregnancy induced hypertension and pregnant women with

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chronic hypertension.

MATERIAL AND METHODS:

66 pregnant women from DHQ Hospital Abbottabad were selected from April, 1987 to November, 1988 for this study. All the information such as age, height, weight, gestational period, blood pressure, personal history, laboratory investigations were recorded on prescribed proforma. Body mass index (BMI), was used as an index of obesity which is defined as an index of obesity which is defined as $\frac{\text{weight (Kg)}}{\text{Height (m)}^2}$

BMI-0 when values are 20-24.9
BMI-1 when values are 25-29.5
BMI-II when values are 30-40
BMI-III when values are 40+

Blood pressure was measured in the supine position with mercury sphygmomanometer. Three reading were taken at interval of 10 minutes. Total serum calcium and phosphorus were determined by using Boehringer Mannheim Kit. [7,8] total serum protein was measured by Biuret reaction and albumin by Bromocresol-green method.[10] Ionized calcium was calculated by using following formula:

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$$\text{Percentage of calcium in ionized form} = \frac{100xf6\text{-}fP/3C)]}{P + 6}$$

P stand for total protein. C stand for total calcium.

Statistical significance was evaluated by student's T test with a value <0.05 considered significant.

RESULTS

The mean age of all pregnant women was 26.9 years. Forty-one percent belonged to rural area. Forty-five percent women belonged to low socio-economic group, their family income was less than Rs. 1500/- per month. All cases had a habit of light activity. All the normotensive and hypertensive group pregnant women were in 3rd trimester.

Of the total 66 selected pregnant women 20 were normotensive. 39 were suffering from moderate to severe pregnancy-induce hypertension while 9 patient had chronic hypertension. Their mean ae, and body mass index is shown in Table – I.

Table – I: **Mean ae and Body mass index in Normal, and Hypertensive pregnancy**

Group	Nos	Mean Age	Mean Body Mass Index
Normal	20	27.4 ± 4.48	18.59 ±.20
Pregnancy – Induced Hypertension	37	27.20 ± 1.41	21.8 ± 3.8
Chronic Hypertension	09	26.12 ± 1.41	21.8 ± 3.8

In normotensive, no family history of hypertension was found while in pregnancy-induced hypertension 23% had positive family history of hypertension. In chronic hypertension 30% had positive family history. Various variable such as blood pressure and body mass index were higher in hypertensive as compared to normotensive. Table – II

Table – II: **COMPARISON OF VARIOUS VARIABLE IN NORMOTENSIVE AND HYPERTENSIVE PREGNANCY WOMEN**

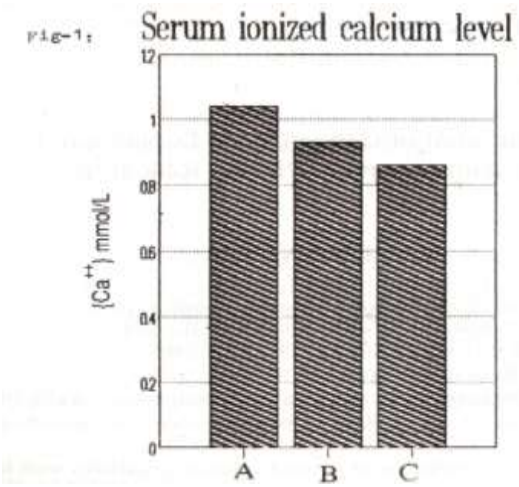
Variable	Normotensive	Pregnancy Induced Hypertension	Chronic Hypertension
No	20	39	09
Age	27.41 ± 4.5	27.20 ± 4.0	26.12 ± 1.2
Blood Pressure			
Systolic	111.2 ± 9.5	149.37 ± 15.26	176.66 ± 5.8
Diastolic	73.3 ± 8.16	101.87 ± 9.1	126.6 ± 10.4
Body Mass Index	18.59 ± 2.0	23.84 ± 5.2	21.8 ± 3.8

Total protein, albumin, total calcium and ionized calcium was significantly reduced in hypertension groups while phosphorus was increased in hypertensive group. Total calcium and ionized calcium in normotensive pregnant women was significantly reduced as compared to hypertensive group ($P<0.05$, $P<0.001$ and $P<0.001$, 0.0001 respectively). Table – III

Table III: Comparison of Total Proteins, Albumins, Total Calcium, IONIZED Calcium and Phosphorus in Normal and Hypertensive Groups.

Group	Total Protein (g/dl)	Albumin (g/dl)	Total Calcium (mmol/l)	Ionized Calcium (mmol/l)	Phosphorus (mmol/l)
Normotensive	6.5 ± 0.83	3.2 ± 0.37	2.20 ± 0.15	1.04 ± 0.08	1.04 ± 0.26
Hypertensive					
Pregnancy - Induced	5.6 ± 1.1	3.2 ± 0.37	1.84 ± 0.24 (P<0.05)	0.86 ± 0.04 (P<0.001)	1.20 ± 0.27
Severe	5.35 ± 1.4	1.9 ± 0.44	1.84 ± 0.24 (P<0.0001)	0.86 ± 0.04 (P<.0001)	1.56 ± 0.04

Serum ionized calcium levels are graphically shown in Fig. I:



A = Normotensive Pregnant Women

B = Pregnancy induced Hypertensive Women

C = Chronic Hypertensive Pregnant Women

DISCUSSION:

This study has positive relation between serum calcium, ionized calcium and total protein, albumin concentration among normotensive and hypertensive groups. Our observations compare favorably with a study carried out by Mc Carron and Low,[6] showing reduction in the level of above mentioned parameters especially ionized calcium. It further supports the idea that free intra cellular calcium leads to decrease in the force of concentration and the tone of vascular smooth muscle, thereby reducing peripheral resistance and lowering the blood pressure. On this hypothesis calcium channel blocker have been increasingly used in the treatment of hypertension which are very successfully.[11] However, in another study, no difference was reported in concentration of serum ionized calcium among normotensive and hypertensive group. [12]

In our study there was no significant difference in ae but mean body mass index was increased in hypertensive group. This is another supporting factor of hypertension because obese people are likely to have higher blood pressure than lean people. Serum protein was in lower normal

limit in all the group but decreased in hypertensive group. Albumin was decreased in chronic hypertensive group. This alteration of serum protein in pregnancy occurred during 12 weeks of pregnancy are remained low until delivery[13] but it is much decreased in hypertensive group which displayed an increased urinary concentration of protein.

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