

Association of Hypertensive Disorders of Pregnancy with variations in Serum Sodium and Potassium Concentration

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ABSTRACT

Objective: To study the variation in Serum Sodium and Potassium concentration in Pre-eclampsia and Normotensive pregnant ladies.

Study Design: Cross-sectional study.

Place and Duration of the Study: Combined Military Hospital, Kharian District Gujrat Pakistan, from Jun 2020 to Jan 2021.

Methodology: The study population Comprposed of 80 pre-eclamptic and 80 normotensive pregnant women recruited consecutively at their first, third trimester, and prenatal visits. Serum Sodium and Potassium were analysed using Ericson Photometer.

Results: When the two Groups were compared, in the Normotensive Group, the mean Sodium concentration of 132 ± 4.490 mEq/dl was significantly less than the Pre-eclampsia Group of 139.1 ± 3.909 mEq/dl. On the contrary, mean Serum Potassium concentration was significantly less in Pre-eclampsia 3.54 ± 0.511 mmol/L compared to the Normotensive Group to 4.0 ± 0.513 mmol/L.

Conclusion: High levels of Sodium and low level of Potassium were observed in the Pre-eclampsia Group. There may be a causal relationship between electrolyte fluctuations and Pre-eclampsia.

Keywords: Electrolytes, Hypertension, Potassium, Pre-eclampsia, Sodium.

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INTRODUCTION

Hypertensive disorders of pregnancy, especially Pre-eclampsia, are prevalent disorders leading to several significant foetal and maternal morbidities and mortality.¹ It involves many systems and occurs worldwide, with incidence ranging from 5-10%.² It is the commonest, yet, least understood disorder of pregnancy.³ The incidence is more common in less developed nations like ours. Around 10% of pregnancy-related mortality is believed to be directly related to pre-eclampsia.⁴

In developing countries, dietary deficiency of various mineral ions has been established to have a role in blood pressure regulation in pregnant women with consequent development of pre-eclampsia.⁵ Studies have mentioned that serum calcium and magnesium levels have a vasomotor activity on various blood vessels in pregnancy, whilst others have reported a contradictory conclusion on the effects of serum sodium and potassium levels on vasomotor activity during pregnancy.^{6,7} In a few odd studies, serum

sodium levels have been observed to reduce in both pre-eclampsia and pregnancy-induced hypertension when compared to normotensive pregnant and non-pregnant women.⁸ This has created confusion in the minds of clinicians regarding electrolyte interpretation in these disorders. These electrolytes are pivotal in vasomotor activity during pregnancy and can be causative in the pathophysiology of pre-eclampsia.⁹ Literature, however, is yet to reach a concrete consensus on the role of these electrolytes in the aetiology of Pre-eclampsia. Reviewing the above-mentioned literature, the serum sodium and potassium profile in Pre-eclampsia compared with a normal pregnancy is inconclusive.¹⁰ This study sought to compare the serum sodium and potassium levels between preclamptic and normotensive pregnant women in a tertiary hospital in Kharian, District Gujrat. Therefore, it may help better understand the long-standing controversy regarding concentrations of various electrolytes in pregnancy and their role in pre-eclampsia.

METHODOLOGY

The cross-sectional study was conducted at the Obstetrics and Gynaecology Department, Combined Military Hospital Kharian Pakistan, from June 2020 to

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January 2021 after IERB approval. CMH Kharian is a tertiary care hospital providing emergency and routine ante-natal and post-natal care to a broad population of three Districts of Punjab. The Gynaecology department has more than 250 beds, and more than 20,000 delivery cases occur annually in our setup. The sample size for this study was calculated using the WHO sample size calculator, based on a two-sided significance a minimum detectable difference of 2.5 mEq/dL for serum Sodium and 0.5 mmol/L for serum Potassium between the pre-eclamptic and normotensive Groups.¹¹

Inclusion Criteria: The study included all normotensive pregnant women and pre-eclamptic women attending the obstetrics and gynaecology outdoor clinic during the study duration.

Exclusion Criteria: All pregnant ladies with the history of kidney disease, diabetes mellitus, cardiac diseases, and neuromuscular disorders were excluded. Pregnant and pre-eclamptic females on any medical treatment other than haematinics were excluded from the study. Similarly, pregnant and pre-eclamptic with chronic hypertension were excluded from the study population.

The international society for the study of hypertension in pregnancy criteria was used to diagnose pre-eclampsia.¹² the sample size was 80 participants in each Group, for a total of 160 participants in the study. After obtaining informed consent, participants' age, parity, height, and weight were recorded on a data collection form. Blood pressure measurements were obtained at the first and third-trimester prenatal visits using a sphygmomanometer and a stethoscope by manual measurement. Measurements were done on the right arm with the patient sitting. At least two measurements were done per patient at 15 min intervals and averaged.

Aseptic conditions were strictly adhered. Five millilitres of blood was drawn from the cubital veins using a sterile 19G hypodermic needle fixed on a 10 ml syringe after cleansing the site to be punctured with methylated spirit. No Tourniquets were applied to avoid haemolysis leading to erratic electrolyte values.

The blood sample was transferred into a plain test tube, immediately sent to the laboratory, and then spun at a speed of 4,000 rpm for 10 mins to separate serum from cells. serum sodium and potassium were analysed using Ericson Photometer (Model 420 by Sherwood Scientific Ltd, UK), and values were recorded on data collection forms.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Independent sample t-test was applied to explore the inferential statistics. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

A total of 160 patients were recruited in our study. Group-I consisted of 80 normotensive patients, and Group-II comprised 80 patients from the Pre-eclampsia group. The mean Sodium (132.30±4.490 mEq/dl) was significantly less in the Normotensive group and the pre-eclampsia group (139.10±3.909 mEq/dl). On the contrary, mean Serum Potassium concentration was significantly less in Pre-eclampsia, (3.54±0.511mmol/L), compared to 4.01mmol/L±0.513 in the Normotensive Group (Table).

Table: Comparison of Serum Sodium and Potassium Between the Study Groups (n=160)

Parameters	Normotensive Group Group-I n=80	Eclampsia Group-II n=80	<i>p</i> -value
	Mean±SD	Mean±SD	
Serum Sodium (mEq/L)	132.30±4.492	139.1000±3.90	<0.001
Serum Potassium (mmol/L)	4.095±0.51	3.547±0.5114	<0.001

Compared to the normotensive pregnant women, a significantly low blood pressure was observed with the mean systolic Blood pressure of 122.70±6.55) mm/Hg in the normotensive group (*p*<0.001). It was 172.30±11.932mmHG in the pre-eclampsia group. Similarly, low blood pressure was observed in the normotensive Group with a mean diastolic pressure of 103.55mm/Hg (Pre-eclampsia Group vs 76.60±5.4 mm/Hg with (*p*<0.001) in Normo-the tensive Group) (Figure).

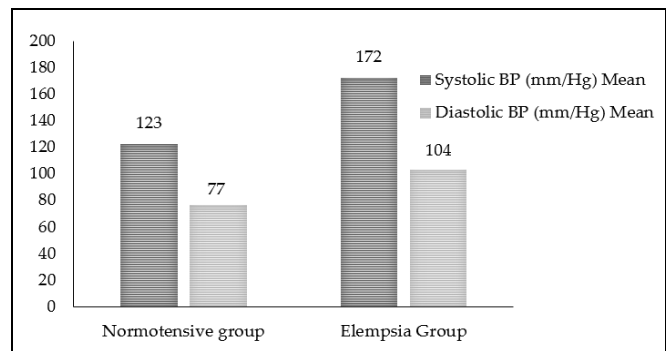


Figure: Comparison of Blood Pressure Between two Groups (n=160)

DISCUSSION

Our study results were aligned with most of the international literature,^{12,13} as no statistically significant difference was noted between the maternal age of the normotensive and pre-eclampsia group ($p=0.358$). Our results were also in keeping with local studies. One such study was carried out by Shamsi *et al.* in Pakistan, who reported similar conclusion.³

Regarding elevated mean systolic blood pressure and mean diastolic blood pressure, findings were in keeping with most of the old and latest literature.¹⁴ The mean systolic blood pressure in our study was 172 mmHg which was significantly higher than normotensive pregnant women (122mm/Hg). Similar elevated readings were obtained with mean diastolic blood pressure which was 103mm/hg compared to the normotensive group (76mm/Hg). These findings were expected because of our inclusion and exclusion criteria parameters. Though, literature is conflicting on observed serum sodium levels in pre-eclamptic compared to normotensive pregnant women, with some showing no significant difference.¹⁵

Our study was in agreement with the findings of other studies as the Mean Sodium concentration of the pre-eclampsia group in our study, was 140 ± 3.9 mEq/dl, which was significantly higher than those of the normotensive group 132 ± 4.4 mEq/dl, p -value (<0.01).¹⁶ Few studies have similarly reported low sodium levels in pre-eclampsia patients.^{17,18} Low sodium is commonly believed to result from the interplay between sodium intake, the Renin-Angiotensin system and Natriuretic peptides. However, our study did not focus on pathophysiological processes, and we did not measure Natriuretic peptide levels or renin levels, as in a few studies.¹⁸

The mean Potassium level in our study was 4 ± 0.5135 mmol/l in Normotensive Group compared to the Pre-eclampsia Group 3.50 ± 0.511 mmol/l. There was a significant difference with p -value (<0.05). Similar findings were recorded by in another study.¹⁹ They tried to draw a correlation between Potassium level and blood pressure. However, any such endeavour was beyond the scope of our study. Our findings were similar to the significant bulk of world literature that reported lower potassium levels in Pre-eclampsia patients.²⁰

Interestingly, some world literature has reported elevated Potassium levels in hypertensive disorders of pregnancy.¹¹ This observation was contradictory to our study and most of the world literature. However, their

inclusion and exclusion criteria were different, and they included complicated patients with AKI, Neuro-muscular disorders and Gitelman syndrome, who were excluded from our study. This different population with different comorbidity profiles may have been the cause for different results (raised potassium) in the fore mentioned studies.

LIMITATIONS OF STUDY

We have a multi-ethnic society with different eating habits and various climatic conditions. People from KPK mostly take low salt and less oily foods, while the Punjabi and Sindhi populations prefer spicy foods with a lot of added salt. These cultural and social values may impact serum Sodium and Potassium levels. These confounders were not catered for in our study. Education level should have been addressed in our study. The education level of the study population may have been responsible for different blood pressure control and antenatal visits leading to variable Blood pressure and electrolytes results. Most of the less educated people don't stick to dietary advice.

RECOMMENDATIONS

In future, a more extensive study with a greater population size should be carried out with more emphasis on Education, ethnicity, socioeconomic class, and dietary habits, which may contribute, at least partially, to hypertension and various electrolyte values in various pregnant females.

CONCLUSION

In the Pakistani population, hypertensive disorders of pregnancy are associated with significant electrolyte abnormalities such as hypernatremia and hypokalaemia. These electrolyte observations may be evaluated for diagnostic utility in future research projects.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

UY & IK: Study design, drafting the manuscript, data interpretation, approval of the final version to be published.

SN & AI: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

KK & AN: Data acquisition, Conception, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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