Consequences on sodium, potassium and body mass index in hypertensive individuals

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ABSTRACT

Objectives: Hypertension is one of mortality causing factor among the non-communicable diseases, therefore, this study aims to determine serum level pattern of Na^+ and K^+ between male and female hypertensive participants. Another objective of this study is to find the association of serum Na^+ or K^+ with BMI in hypertensive people, and association between serum Na^+ and K^+ as well.

Methods: For this study, hypertensive participants with history of no any other diseases were randomly selected from the hospital of Lalitpur, Nepal. Serum sodium, potassium were estimated through their fasting serum samples and BMI of the participants were calculated from their weight and height measurements.

Results: Among 100 hypertensive participants, 58% were male and 42% were female, in which 78% participants are within the normal range of BMI. In this study, both serum Na^+ and K^+ levels were found significantly higher in female than male ($p<0.05$). Furthermore, it was found that serum Na^+ and K^+ had a weak negative noteworthy correlation (r: -0.227, $p<0.05$), no relation between serum Na^+ and BMI (r: 0.045), and serum K^+ and BMI had slightly weak positive relation (r: 0.143).

Conclusion: Female hypertensive participants had noticeably higher serum Na^+ and K^+ compare to male participants. Additionally, there was no association between Na^+ or K^+ with BMI but had a weak negative association between serum Na^+ and K^+.

KEY WORDS: Sodium, Body mass index, Potassium, Hypertension

Introduction

Hypertension (HTN) is common clinical manifestation among elderly age group and is responsible for more deaths than the tobacco smoke (second) and acute respiratory infections (third) leading risk factors combined [1]. The previous study reported that it affects almost one-fourth of the world's population plus is predicted to increase by another 60% by the year 2025 [2]. The relevance of the problem is even greater in view of the fact that childhood and youth obesity shows a strong association with HTN and has identified as an important predictor of a similar condition in adulthood [3-5]. Non-communicable diseases are the contributing reason of death in all of the world's most nations and accounts for almost 40% of all deaths worldwide [6]. While the functional role of genetics remains unclear, but deprived nutrition, physicalism, cigarette smoking and/or tobacco chewing are fundamental threat in most people and populations [1]. Malnourishment and physical inactivity manifest as overweight and obesity, hypertension (HTN), lipid abnormalities, diabetes mellitus (insulin resistance, type-2 diabetes) [7, 8], and the metabolic syndrome [9]. In addition, HTN may also lead to social and psychological problems [8]. To reduce the population burden of illness such as cardio vascular diseases and other HTN-related disorders, prevention and treatment of high blood pressure (BP) are essential factors [1].

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A wide array of dietary factors has been related to high BP, including high sodium (Na^+) and calorie intake and low potassium (K^+) intake [10-12]. But clinical guidelines recommend a low Na^+ and high K^+ diet to reduce BP and potentially modify the risk and severity of complications [13]. There is general acceptance of a strong direct association between both body weight and dietary Na^+ with BP and a strong inverse association between dietary K^+ and BP, with no apparent threshold for any of these relationships. But the

relationship between dietary Na^+ intake and HTN has been the subject of a continuing debate as it is difficult to show a clear relationship between Na^+ and BP in population-based studies [2]. Observational studies can provide only indirect estimates of intervention effect and the potential influence of an intervention effect modifier and some other studies have suggested a greater "effect" of dietary Na^+ on BP at higher compared with lower levels of body weight [14-16].

Similarly, the additional parameter in this study, body mass index (BMI) which is the main indicator of abdominal fat accumulation and frequently associated as parameter for weight classification as normal, overweight and obesity [17]. Thus, this method for the diagnosis of overweight/obesity is used in epidemiological studies and in the clinical practice [18, 19] because it is precise, reproducible, and easy to perform [20]. In both age ranges, obesity is associated with the presence of cardiovascular risk factors such as HTN, dyslipidemia [8]. Approximately 60% of those who present obesity in the first decades will have at least one of these metabolic alterations in adulthood [21]. Hence, the current study was carried to find the association of serum Na^+, K^+, BMI in between known hypertensive people.

Materials and methods

Study population

This study was conducted on randomly selected 100 known hypertensive participants (male and female) from Patan Hospital, Lalitpur who full fills the inclusion criteria (history of no any other diseases except hypertension and weight with minimal cloths). The fasting blood sample collected from standard veni puncture method and serum separated from blood following standard protocol. The research method was quantitative and primary data collected for further analysis.

Methodology

At first, serum was diluted with distilled water 1:50 (*v/v*) and the calibrating standard solution was diluted (1: 50 *v/v*) as given in the protocol (Lot. No: OHO18, Cat/Best Nr.: 478692, Chiron diagnostic limited, Na^+ chloride: 140 mmol/L, K^+: 4 mmol/L, Tris buffer). Then, the absorbance's serum and calibrating standard solution were recorded at 589 nm, 766 nm for Na^+ and K^+ respectively against a blank with a flame photometry (M400, Id no 4506, Corning England). All samples were analyzed in triplicate. Measurement of the weight and height of the participants was taken and the anthropometry measurements of these participants were carried out; weight of the participant was measured with accurately calibrated electronic scales (Health meter BR-9510), height of participant was measured with stadiometer (Prestige) recorded to the nearest 0.5 cm and BMI was calculated.

Statistical analysis

BMI calculation and bar-diagrams were drawn from MS Office (Excel) 13. All statistical analyses were completed using the software package Statistical Package for Social Sciences (IMB SPSS Statistics 21). Student's t-test was carried out to see significant serum level of Na^+ in male and female as well as for K^+ in male and female. Data of serum Na^+ and K^+ were presented as median ± standard deviation. Pearson's correlation test with the significance was assumed ($p<0.05$) to find associations among Na^+, K^+ and BMI in hypertensive participants.

Results

Serum Na^+ and K^+ of 100 known hypertensive participants (male=58 and female=42) were estimated and their BMI were calculated. In these participants, median value of serum Na^+ was 142 ± 6.23 (Median 142.11, range 135.88 – 148.34) and K^+ 3.9 ± 0.79 (Median 4.22, range 3.11 – 4.69) respectively. In this study, both serum Na^+ and K^+ levels were found significantly higher in females compare to the male (p=0.001) and shown in figure no 1 and 2 respectively. Among them, 78% participants had BMI within the normal range and the rest were under weight, over weight and obese are 5, 16 and 1% respectively.

From the analysis, no relationship observed between serum Na^+ and BMI (r: 0.045). In addition, serum K^+ and BMI had slightly weak positive relation (r: 0.143), and a weak negative noteworthy relationship (r: -0.227, p=0.012) between serum Na^+ and K^+.

Figure 1. Concentration of sodium (mmol/L) in hypertensive male and female (Median).

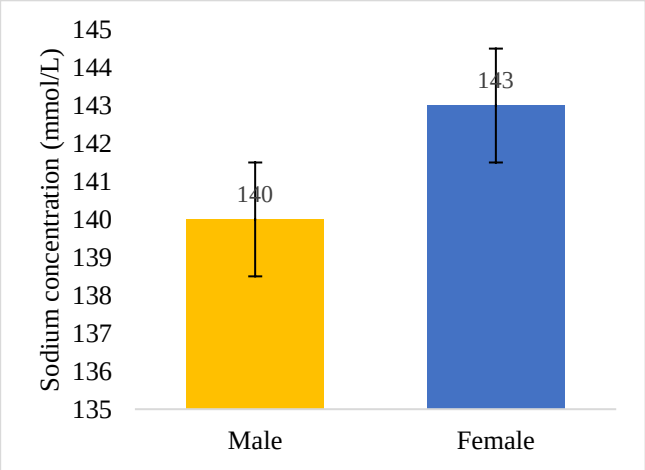
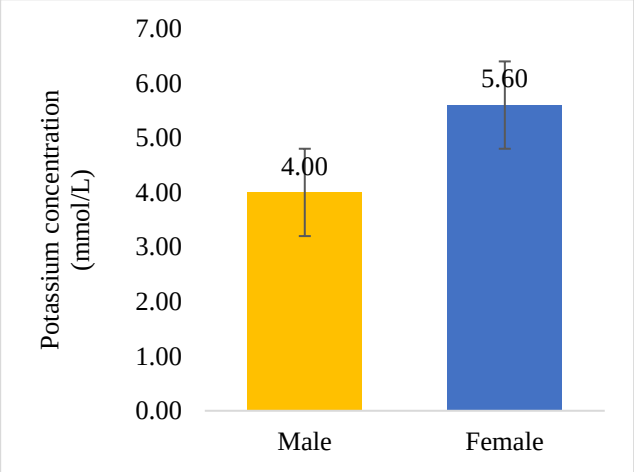


Figure 2. Concentration of potassium (mmol/L) in hypertensive male and female (Median).



Discussion

Here, in the study, to find out any significance of serum Na^+ and K^+ levels in between male and female, Student's t-test was carried out with 95% confidence interval. The study found that both serum Na^+ and K^+ were fairly higher in female than male (p=0.001) which is altered from the reports from other countries [21-22, 26-28] . Furthermore, to understand whether serum Na^+ and K^+, BMI are associated with each other or not in hypertensive participants, Pearson's correlation with 95% confidence interval was performed and shown in table 1. In this study, it was found that serum Na^+ and K^+ had a weak negative noteworthy correlation (r: -0.227, p=0.012). Likewise, the study showed no relation between serum Na^+ and BMI had with each other (r: 0.045), and serum K^+ and BMI had slightly weak positive relation (r: 0.143) with no significant.

Table 1. Relationship with serum Na^+, K^+ and BMI of hypertensive participants

Parameters		Na^+	K^+	BMI
Na^+	Pearson Correlation	1	-.227*	.045
	Sig. (1-tailed)		.012	.327
K^+	Pearson Correlation	-.227*	1	.143
	Sig. (1-tailed)	.012		.078
BMI	Pearson Correlation	.045	.143	1
	Sig. (1-tailed)	.327	.078	

Note: '*'Correlation is significant at the 0.05 level (1-tailed).

This correlation was in agreement with the findings of other authors who also found no evidence that the BMI effect of Na^+ on hypertension [21-25]. Most studies show that high blood pressure is linked to decreased K^+ intakes which may be due to K^+'s ability to decrease Na^+ excretion and the vasoactive effects of K^+ on blood vessels [26-32]. In contrast, to these studies, there is a weak relation between Na^+ and k^+ with high significance.

Conflict of Interest

I declare that we have no conflict of interest.

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