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The Impact of Low Sodium and High Potassium Salt on Hypertension Patients

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Abstract

Present study aimed to analyze the effect of low sodium high potassium salt on hypertension patients. This Between-subjects experimental study was conducted at Outpatient Department of a public hospital of Lahore. To assess the impact of dietary salt, a random sample of 93 hypertensive patients was divided into experimental (n=45) and control group (n=48). At baseline, blood pressure readings and blood tests (to measure the sodium and potassium quantities), were taken. Experimental group was instructed to take dietary salt while control group continued to take regular salt for a month. Patients maintained a record of their blood pressure ratings, checked on daily basis. After intervention, the effect of dietary salt was seen. Outcomes manifested that after taking dietary salt, interventional group got normal levels of sodium (Na=136–145 mmol/L) but control group was having greater level of sodium almost similar to reported at baseline (NaCl=146–153 mmol/L) p<.001. Moreover, the introduction of low sodium salt led to normal levels of potassium in experimental group. Subsequently, results showed a significant decrease in blood pressure levels of experimental group than control group. In short, replacement of low sodium salt with regular salt is effective in normalizing blood pressure.

Keywords: *Hypertension, Dietary Salt, Serum Sodium, Serum Potassium.*

Introduction

Hypertension occurs when blood circulates in arteries at a higher pressure than normal. It refers to persistent elevation of the pressure in blood vessel at an abnormal level, transferring blood into the body. Hypertension has four stages with marked increase in blood pressure threshold value (≥ 140/90 mm HG

and even >160/100 mm HG) (Dale, 2019). It is estimated that one billion individuals have been affected by hypertension worldwide and this ratio is expected to reach 1.5 billion till 2025 (Park, Kario, & Wang, 2015). According to World Health Organization (2018), 18,746 (1.5%) of adults' mortality (> 18 years) caused by hypertension in Pakistan, which led the Pakistan's rank "52" in the world (World Health Organization, 2018). Most recently, Basit et al. (2020) found that 46.2% of Pakistani population is suffering from hypertension where 33.3% of patients found in Punjab, Pakistan. Especially urban population is at higher risk of developing hypertension than rural areas because people living in towns have adopted luxurious lifestyle and usually eat diet rich in salt, sugar, and saturated fatty acid (Shah et al., 2018; Ishtiaq et al., 2017).

Thus, the significant part of the study is that controlling hypertension through changing diet patterns such us using low sodium high potassium salt, is prodigiously important because high blood pressure is known as a "silent killer" which affects adults of different age groups (≥20 years) (Kitt et al., 2019; Sawicka et al., 2011). Hypertension is also an alarming sign of developing life-threatening diseases such as myocardial infarction, stroke, renal failure, vascular diseases etc (Thompson et al., 2017). So, this study suggests the cost effective, better, safe, and natural substitutes to normalize the blood pressure of hypertensive patients. It educates the patients and general population about the role of diet in better management of hypertension and to escape further complications. Also, the present research is helpful for the clinicians and researchers regarding the use and effectiveness of remedy.

Statement of the Problem

Does dietary salt reduce hypertension?

Objective

The current study was carried out with the objective to analyze the impact of low sodium high potassium salt on patients with hypertension.

Materials and Methods

Researchers have adopted between subject, experimental research design to conduct the study. First of all, Medical Superintendent allowed us to carry out the study in the Outpatient Department of a public hospital of Lahore, Pakistan. A random sample of 100 hypertension patients, diagnosed by medical officer, based on mean arterial blood pressure and past history with elevated blood pressure, was taken. G power analysis with significant value (.001), and effect size (.60), helped in determining the sample size. Patients, signing out the consent form were fully informed about the purpose, benefits, and potential risks of the study. They were assured that the entire interventional procedure will be carried out under the supervision of a professional general physician with 20 years of experience, so they can seek medical assistance whenever needed. However, 7 patients refused to be the part of the study due to personal reservations thus the final sample comprised of 93 hypertension patients (men = 42, women = 51), with age range 20-60 years. Patients with mild to severe hypertension, either underweight, healthy weight, or obese, were included but those with Diabetes, Glomerulonephritis, Hyperkalemia, Addison's disease, Congenital Adrenal Hyperplasia, and taking anti-inflammatory mediators; Tacrolimus, were excluded. Also, patients using potassium sparing diuretics and undergone any trauma were not selected.

The whole study comprised of three phases:

Phase 1: In this phase, 93 patients were randomly assigned to both experimental (n = 45) and control group (n = 48). Patients' BMI was assessed; height was calculated by the help of a Stadiometer (measuring rod) while weight measured through a well calibrated movable weighing machine. A baseline was drawn by evaluating the blood pressure levels (systolic and diastolic) of hypertensive patients through an automatic

sphygmomanometer. Also, blood tests were taken at the laboratory of Mayo hospital to gauge the quantity of Serum Electrolytes i.e., sodium and potassium ions in the hypertension patients. The readings were recorded at this point to compare them with the readings obtained after the intervention.

Phase 2: In this phase, the low sodium salt was distributed to the patients in experimental group and were advised to take dietary salt while patients in control group were recommended to take regular salt. One month was counted as washout period. So, all patients were instructed to measure blood pressure once a day, between 9 AM to 11 AM, on daily basis for one month. They were asked to keep the record of their blood pressure levels on a tracking chart. The impacts of both salts were studied by repeating and evaluating the biochemical tests and blood pressure tracking chart after one-month duration. Patients in both groups were also given dietary advice for the management of hypertension.

Phase 3: At this phase, both groups were compared to examine the effect of intervention. Blood tests to assess sodium and potassium levels, were again taken. An average of blood pressure levels of all patients in both groups to equate them with the baseline values, was obtained.

Data Analysis

Statistical Package for Social Sciences (SPSS IBM V 24.0) was used to evaluate the descriptive characteristics of patients. Further, ANOVA was applied to make a comparison of electrolytes (sodium and potassium) and blood pressures levels between experimental and control group, before and after intervention.

Results

The current study comprised of 93 hypertensive subjects (men = 42, women = 51) with age range 20-60 years (Mage = 45.32 $\pm$10.4). All subjects belonged to middle class and were married. The clinical characteristics of subjects given below.

Table-1: Clinical Characteristics of Patients

Characteristic	Frequencies	Percentages
Severity of Disease		
Prehypertension (mild)	29	31.18
Hypertension (Stage 1, Moderate)	43	46.23
Hypertensive Emergency (Stage 2, severe)	21	22.58
Disease Duration		
One year	39	41.93
Two years	33	35.48
Three years	22	22.58
BMI		
Under weight	3	4.30
Healthy weight	47	50.53
Over weight	38	40.86
Obese (grade 1)	5	4.30

Table-1 displays that in the current study, 31.18% (n = 29) patients were suffering from mild hypertension, while 46.23% (n = 43) were stage 1 and 22.58% (n = 21) were having severe hypertension. The time period to be diagnosed with hypertension was 1 to 3 years. It was seen that majority of the patients were having

healthy BMI 50.53% (n = 47) but 40.86% (n = 38) were overweight whereas 4.30% (n = 3) underweight and 5 were obese (grade 1).

Table-2: Regular vs Dietary Salt

Regular Salt		Dietary Salt	
Nutrition	**Values**	**Nutrition**	**Values**
Sodium (Na)	99.2%	Sodium (Na)	33%
Calcium (Ca^{+2})	0.06%	Calcium (Ca^{+} 2)	0.06%
Magnesium (Mg^{+2})	0.05%	Magnesium (Mg^{+2})	0.05%
Potassium iodine (KIO_3)	50ppm*	Potassium ($K^{+)}$	66%
Moisture	0.20%	Moisture	0.22%
Water insoluble matter	0.20%	Water insoluble matter	0.20%
Sulphate (SO_4^{-2})	0.29%	Sulphate (SO_4^{-2})	0.29%

*ppm = parts per million

Table-2 manifests that regular or table salt usually contains high quantity of sodium (99.2%) with minimum level of potassium (50 ppm) and other electrolytes which people normally use. But the dietary salt, used in the current study for experimental group, contained just 33% of sodium while the rest contained 66% of potassium along other electrolytes.

Table 3: Comparison of Sodium and Potassium Levels Between Experimental (n = 45) and Control Groups (n = 48) Before and After Intervention

	Electrolytes			
	Sodium		**Potassium**	
Group	**Pre†**	**Post**	**Pre**	**Post**
Experimental	148.13(3.70)‡	139.00(2.36)	3.29(.20)	4.28(.37)
Control	148.50(3.10)	147.50(2.06)	3.30(.25)	3.28(.24)
F	.19	220.16	.01	148.35
P	.66	.00*	.91	.00*
η_p^2	.00	.79	.00	.72

Note. †Intervention, ‡ Mean (Standard Deviation), *significant, F = ANOVA, η_p^2 = partial eta squared

Table 3 illustrates that before taking intervention, at baseline, the sodium level of experimental (M = 148.13, SD = 3.70) and control groups (M = 148.50, SD = 3.10) was almost the same (higher than normal, Na = 147 – 154 mmol/L), indicating insignificant differences [F (1,91) = .19, p > .001, η_p^2 = .00]. Further, the potassium level of both experimental (M = 3.29, SD = .20) and control group (M = 3.30, SD = .25) was lower than the normal level (K = 2.9 – 3.4 mmol/L), demonstrating non-significant group differences [F (1, 91) = .01, p > .001, η_p^2 = .00]. Further investigation revealed the significant effect of intervention, suggesting that subjects in interventional group had normal levels of sodium (Na = 136 – 145 mmol/L) but control group was having almost same level of sodium reported at baseline [F (1, 91) = 220.16, p < .001, η_p^2 = .79]. Moreover, the introduction of low sodium salt led to normal levels of potassium electrolyte in experimental group (M =1.872, SD =.346) whereas the control group (M =1.170, SD =.377) had low

amount of potassium in body as reported earlier at baseline (K = 2.8 – 3.4 mmol/L), [F (1, 91) = 148.35, p < .001, η_p^2 = .72].

Table 4: Comparison of Systolic and Diastolic Blood Pressures Between Experimental (n = 45) and Control Groups (n = 48) Before and After Intervention

	Blood Pressure			
	Systolic		Diastolic	
Group	**Pre†**	**Post**	**Pre**	**Post**
Experimental	141.09(10.66) ‡	124.07(9.66)	85.63(10.03)	74.93(5.45)
Control	137.23(11.83)	136.00(10.64)	85.27(11.12)	84.67(9.96)
F	1.75	20.66	.02	22.03
P	.19	.00*	.89	.00*
η_p^2	.02	.26	.00	.30

Note. †Intervention, ‡ Mean (Standard Deviation), *significant, F = ANOVA, ηp^2 = partial eta squared

Table 4 represents the outcomes of Analysis of Variance by indicating that before introducing intervention, both experimental and control groups were having equal levels of systolic and diastolic blood pressures, judged insignificant p values and 0 effect sizes but after taking intervention, the systolic blood pressure of experimental group (M = 124.07, SD = 9.66) got significantly lowered than control group (M = 136.00, SD = 10.64) [F (1, 91) = 20.66, p < .001, η_p^2 = .26]. Similarly, the subjects in experimental group (M = 74.93, SD = 5.45) reported lower levels of diastolic blood pressure than those in control group (M = 84.67, SD = 9.96), indicating significant p value with stronger effect size [F (1, 91) = 22.03, p < .001, η_p^2 = .30].

Discussion

The current randomized controlled trial study revealed that the reasonable use of low sodium high potassium salt normalizes the quantities of serum electrolytes i.e., sodium and potassium in the body of hypertensive subjects that should be between 135-145 mmol/L and 3.6-5.2 mmol/L respectively. Therefore, the intake of 2.3 g salt on daily basis for a month stabilized the systolic and diastolic blood pressure of patients in interventional group while in control group, no significant differences were observed, at pre and post level of experiment due to the intake of regular salt. The regular salt also deemed had no effect in normalizing the high quantities of sodium while lower levels of potassium in the blood samples of hypertensive subjects. So, we conclude that low sodium high potassium salt was a realistic way to control and maintain the blood pressure of hypertension patients. We also found that low sodium salt proved to be effective in treating and curing mild to severe types of hypertension patients as all subjects in experimental group (stage 1 = 6, stage 2 = 25, stage 3 = 14) had normal readings of serum electrolytes and blood pressure after one month of manipulation. Our results are aligned with a meta-analysis study conducted in Italy by Grillo et al. (2019) in which an extensive review of articles resulted in drawing conclusions that dietary salt not only reduces the hypertension but also decreases the chances of developing hypertension prone illnesses and mortalities, for instance, myocardial infarction, chronic renal diseases, diabetes, endothelial dysfunction etc (Edwards, & Farquhar, 2015; Castiglioni et al., 2016; Safar et al., 2009; Laffer et al., 2016). Kurtz et al. (2017), Elijovich et al. (2016), and Marketou et al. (2019) stated that excessive salt intake leads to hypertension and heart diseases, so, reducing slat in food or taking dietary salt can be helpful in developing such a life-threatening disease. However, a few researches also elaborated that excessive and prolonged use of low sodium high potassium salt can be hazardous to health (Guild et al., 2012; Farquhar et al., 2015) or even a few studies could not find out it fruitful in healing hypertension in salt sensitive patients (Schmidlin et al., 2007; Choi et al., 2015). So, patients should keep in touch with their consultants to inquire about whether they can continue or quit its use. Thereby, in our study, patients were suggested to use it for one month because this time period is usually considered sufficient to notice

the effect of remedy and no doubt, results supported that dietary salt makes a different in blood pressure levels, but its continuation depend on medical advice.

Conclusions

Dietary salt normalizes the sodium and potassium levels more rapidly and efficiently in the body thus, suggesting a prolific natural source for hypertension patients. It is also recommended that nutritionists and clinicians should focus on dietary regimens to increase the quality of life of such patients.

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