Original Article

Baseline knowledge about hypertension and sociodemographic factors related to salt intake behavior among hypertensive individuals in a rural community of Bangladesh: Substudy of a randomized controlled trial

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Abstract

Background: Excess salt consumption increases blood pressure, and therefore, this substudy was designed among rural hypertensive individuals to assess the baseline knowledge about hypertension (HTN), and dietary salt intake behavior and identify the potential predictors for urinary salt excretion in Bangladesh. **Material and Methods:** A total of 420 participants were enrolled after meeting the eligibility criteria during the 12 months of the study period. The participants received behavior changes related to short message services (SMS) and face-to-face education from community health workers. **Results:** Our study results found that 80% of the participants had positive knowledge of HTN. This study showed that the mean value of overnight urinary sodium excretion was 10.65 ± 3.00 at the 1st-month follow-up and 10.24 ± 3.03 at the endline. We found that mid-upper arm circumference (MUAC), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were significantly related to higher salt intake ($P = 0.009$, $P = 0.011$, and $P = 0.005$, respectively). However, participants had improved their MUAC, SBP, and DBP status in their 1st follow-up period, but still, significant associations were observed between them ($P = 0.033$, $P = 0.011$, and $P = 0.002$, respectively). **Conclusion:** This study's results found that sodium excretion among hypertensive participants was higher, and higher urinary sodium excretion was associated with overweight and BP in adults. Nonetheless, the real salt intake practice among the Bangladeshi population is still unknown, which demands further research.

Keywords: Hypertension, knowledge, salt intake

Introduction

Hypertension (HTN) is one of the most important risk factors for cardiovascular diseases (CVDs).[1] Elevated blood pressure (BP) is a leading preventable cause of global CVD mortality and disease burden.[2] Reducing salt intake is a key strategy for lowering blood pressure, with an estimated 9.5% of deaths from CVD occurring globally.[3] However, there is a major burden of CVD, which is significantly greater in low- and middle-income (LMIC) countries than in high-income countries.[4] About 80% of CVD deaths take place in LMICs, and nearly 40% of these are classified as premature.[4]

Like other LMICs, Bangladesh is experiencing an epidemiological transition[5] and the results of lifestyle changes (changing food habits, reduced physical activity, etc.) have a significant impact on health.[6] Among the changing food habit, processed food indicates a higher salt intake.[6] The World Health Organization (WHO)

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recommended a salt intake of 5 g/day (under one teaspoon per day) for normotensive populations and an intake of less than 1.5 g salt/day in individuals with HTN.[7,8] However, on average, people consume around 10 g of salt per day worldwide,[8] whereas Bangladeshi people consume more than 17 g of salt per day[7] and it's more than double as recommended.

The source of dietary salt intake varies among different population groups. In Bangladesh, individuals have a strong preference for salty flavors and a habit of taking salt during meals.[9] Nevertheless, there is currently no accurate assessment of the salt consumption of the Bangladeshi population. Research suggested that dietary evaluation can only account for a small amount of salt. The most accurate way to determine the overall amount of sodium consumed across all sources is to estimate the 24-hour urine sodium excretion, which is regarded as the gold standard approach.[10]

It is natural to expect that behavior should be influenced by knowledge, and by extension, understanding whether a person's salt intake behavior is related to their knowledge about salt and health. With regard, primary care doctors and nurse practitioners have the ability to influence their patients' attitudes and behaviors as the first line of medical defense.[11] Studies demonstrated in smoking cessation[12] and weight management,[13] physicians play an important role in reinforcing and sustaining behavioral change. Even without extensive counseling, a simple supportive message on the benefits of salt reduction would be helpful. The physician's effectiveness in this role reflects increased knowledge, improved skills, and positive attitudes toward salt reduction and other lifestyle changes.[14] Furthermore, physician–patient encounters provide physicians with a unique opportunity to promote lifestyle changes that should focus on reducing salt intake.

Therefore, it is important to assess prior knowledge and perception regarding salt consumption. So far, very few studies have been conducted on these issues in Bangladesh, particularly in this study area. Therefore, this study was designed among rural hypertensive individuals to assess the baseline knowledge about HTN, and dietary salt intake behavior and to identify the potential predictors for urinary salt excretion in Bangladesh.

Material and Methods

Study design and setting

This retrospective chart analysis used data from a randomized control trial that was conducted in a rural community in Bangladesh involving people with HTN. The detailed study design has been previously reported.[15]

Study participants

A total of 420 hypertensive participants were enrolled after meeting the eligibility criteria during the 12 months of study periods where the intervention periods were 5 months.

Participants (either sex) enrolled in this study who were diagnosed with HTN were aged 35 years or older, had 1-5 years of schooling, resided within a radius of 3 miles from the tertiary hospital, decided to stay in the community for at least five months, had a personal cell phone or access to a shared phone, could exchange views freely, and were willing to participate in the study. Individuals with mental illnesses or serious comorbidities such as malignancy or tuberculosis were excluded from this study.

During enrollment, trained community health workers (CHWs) visited the participant's household in the morning to conduct an interview. At the same time, they performed physical examinations (height, weight, SBPsystolic BP (SBP) / Diastolic BP (DBP), waist circumference, hip circumference, and mid-upper arm circumference (MUAC)) and blood tests (random blood sugar) of the study participants. The intervention (n = 209) group received 5-month health education along with an education booklet and text messaging for developing awareness and enhancing knowledge about salt intake related to HTN. On the other hand, the control group (n = 211) received only the same health education booklet with the same duration. Furthermore, the CHWs checked urinary salinity from spot morning urine (only at baseline) and overnight urine. The details of the study procedures were described in our previous paper.[16] However, for this study, we allocated our study population to <11 g and ≥11 g based on their salt intake.

Measurements

The sociodemographics (i.e., age, gender, marital status, education level, occupation, monthly income, and wealth index) and knowledge related to HTN data were collected through a structured questionnaire. A total of nine knowledge-related questions were considered for this study and described three questions as yes/no, 5 questions as 5-point Likert scale (Strongly agree/Very unlikely to Strongly disagree/Don't know) and another one was BP level.

Furthermore, physical examinations (described above) were performed at the participant's household in the morning. We collected subjective salt intake data through a questionnaire, and for urinary salt excretion measurement, we used a urinary salinity checker (KME-03, KOUNO ME Institute, Japan) from overnight urine[17] (for urine, we did not include the baseline data during analysis as it was measured from spot urine). In this substudy, we measured overnight urinary salt excretion among hypertensive individuals,[16] and we excluded subjective data for analysis.

Data analysis

Baseline characteristics are presented as the mean (± standard deviation), medians of continuous variables, and counts (percentages) of categorical variables. The differences between the sociodemographic categorical variables and urinary salt excretion groups were examined by a Chi-square (X^2) test, and a *t*-test was used for continuous variables. In the case of

urinary salt excretion, we categorized it from their median values as low excretion (average <11 g/day) = 0 and high excretion (average ≥11 g) = 1 and took those as a dependent variable. We further considered sociodemographic variables as independent variables. Data were analyzed using the statistical software package SPSS for Windows version 25.0, and statistical significance was considered *P* value <0.05.

Ethics approval and consent to participate

Ethical approval was taken from Bangladesh Medical Research Council (BMRC), Registration # 06025072017. The study was registered at the Clinical Trial Registration # NCT03614104 and UMIN Registration # R000033736. Written informed consent was obtained from all participants before enrolment, and their confidentiality was assured throughout the study.

Result

Demographic status of the participants

A total of 420 participants were enrolled between August 2018 and July 2019. During the study periods, five participants from the intervention group and three from the control group refused to continue the study. Baseline characteristics and physical measurements of the randomized population are shown in Table 1.

Baseline knowledge related to HTN

Most of the participants had positive knowledge of HTN. Eighty percent (n = 337) of the participants strongly agreed that HTN can be harmful to health. About 70% (n = 285) and 77.9% (n = 327) of the participants strongly agreed that lifestyle change and lowering high BP can improve health. One-third of the participants (79.3%) disagreed that HTN is an elderly disease, and more than half of the participants somewhat likely think that they had a chance of developing HTN in the future.

Moreover, less than 50% of the participants (n = 151) had knowledge of normal B*P* values and more than 80% of participants (n = 357) knew that excess salt intake could cause high BP. Only 31.9% (n = 134) knew that high BP affects daily activity. Near 30% (n = 111) of the participants took either/both smokeless tobacco (betel leaf/*paan* with tobacco leaf) [Table 2].

Association between sociodemographic and physical measurements, and overnight urinary salt excretion level at 1st follow-up and endline

No significant association was observed between the group's sociodemographic variables and overnight urinary salt excretion level during 1st follow-up periods. On the other hand, the participants who were overweight and obese tended to excrete more salt in their urine (had more salt intake) (*P* value = 0.074) in the 1st follow-up period. Larger waist circumference (*P* value = 0.061) and hip circumference (*P* value = 0.090) were related to more salt intake, and wider MUAC was significantly related to higher salt intake (*P* value = 0.009). For SBP and DBP, we found significant

Table 1: Participants' baseline characteristics

Variables	Number [N (%)] Mean±SD
No. of participants	420
Age	47.1±8.5
Min-Max	35-71
Female sex	361 (86.0)
People live in your household	4.7±2.8
Min-Max	1-20
Height	152.5±7.2
Weight	62.7±11.2
Waist circumference	91.3±10.0
Hip circumference	96.7±8.4
Mid-upper arm circumference	30.0±3.2
Systolic blood pressure	136.9±19.2
Diastolic blood pressure	90.0±10.2

Note: Data are expressed as mean±standard deviation and number (percentage)

Table 2: Participants' baseline knowledge related to hypertension

Variables	Number (N)	%
No. of participants	*n*=420	
Do you think hypertension can be harmful to your health?		
Strongly agree	337	80.2
Agree	83	19.8
Can lifestyle change help to reduce high blood pressure?		
Strongly agree	285	67.9
Agree	129	30.7
Neither agree nor Disagree	3	0.7
Disagree	3	0.7
What should be the normal blood pressure level?		
<140/90 mmHg	151	36.0
140/90 mmHg	40	9.5
Don't know	229	54.5
Can lowering high blood pressure improve your health?		
Strongly agree	327	77.9
Agree	92	21.9
Disagree	1	0.2
Extra salt intake can cause hypertension		
Yes	357	85.0
High blood pressure affects daily activity		
Yes	134	31.9
What type of smokeless tobacco products do you use at least once a month? *Paan* with tobacco leaf		
Yes	111	26.4
Do you think hypertension is an elderly disease?		
Strongly agree	30	7.1
Agree	31	7.4
Neither agree nor Disagree	26	6.2
Disagree	317	75.5
Strongly Disagree	16	3.8
How likely are you to have health problems as a result of hypertension in the future?		
Very unlikely	8	1.9
Unlikely	25	6
Somewhat likely	220	52.4
Very likely	136	32.4
Don't know	31	7.4

Note: Data are expressed as numbers and percentages

associations between the overnight urinary salt excretion level at 1st follow-up period. We considered MUAC cutoffs range between ≤23.0 cm and ≤25.5 cm, which served as appropriate indicators for low BMI.[18] Hence, the mean cutoff points of MUAC (30.5 ± 3.17) indicated that the participants who had high Body Mass Index (BMI) were more likely to excrete more urinary salt during the 1st follow-up period and it was statistically significant (*P* value = 0.009). For SBP (133.6 ± 16.5) and DBP (88.6 ± 9.6), the participants who had higher values of BP were more likely to excrete more urinary salt in the 1st follow-up period, and statistically significant differences were observed (*P* value = 0.011 and *P* value = 0.005) between them.

From the 1st follow-up period to the endline, the number of participants with urinary salt excretion ≥11 g/day decreased from 44.5% to 39.8%. However, we did not find any significant associations with participants' gender, age category, marital status, educational status, occupation, and monthly income with the overnight urinary salt excretion level.

With regard to physical measurements, participants had improved their MUAC, SBP, and DBP status in their 1st follow-up period, but still, significant associations were observed between them. In the case of waist and hip circumferences, the waist–hip ratio was 0.94 which indicated high health risk for the participants and both of the circumferences were statistically significant at the endline (*P* value = 0.020, *P* value = 0.010) [Table 3].

Discussion

This study aimed to identify the baseline knowledge about HTN, and dietary salt intake behavior and identify the potential predictors for salt excretion among hypertensive individuals in a rural community in Bangladesh. This study found that more than half of hypertensive patients had satisfactory knowledge of HTN at baseline,[19] which is similar to the other study findings in South India (52.4%)[20] and Tanzania (66.8%).[21] On the other hand, it is higher than other studies conducted in Nepal (14%)[22] and Ethiopia (43.6%).[23] Previous studies revealed that knowledge, attitude, and behavior toward HTN and salt intake play a remarkable role in controlling BP and as a preventive measure for HTN.[24,25] In this study, the majority of the participants considered that salt intake is an important factor for elevated BP, which is similar to other studies.[26,27] This study showed that self-reported mean salt intake was 11.56 ± 5.16 g/day at baseline and this was far from recommended.[16] In addition, the estimated urinary salt excretion from overnight urine samples showed the usual salt intake of the previous day. In this study, the mean value of overnight urinary sodium excretion was 10.65 ± 3.00 at the 1st-month follow-up and 10.24 ± 3.03 at the endline. However, till now there are no nationwide surveys for the evaluation of population-based dietary salt excretion in Bangladesh. A study by Zhang *et al.*, 2017,[28] suggested that the best way to control HTN is by increasing awareness and promoting healthy salt intake behavior. Regards, general primary care providers and family physicians can play a crucial role in the "first-line" effort to treat HTN by counseling patients on pharmaceutical and lifestyle modifications that will help them reach their target BP. Furthermore, the Dietary Approaches to Stop Hypertension (DASH) diet is specifically recommended by primary care providers and family physicians since it is thoroughly explained, reproducible, and is an effective strategy to reduce salt consumption.[29]

However, no significant associations were found in this study among sociodemographic factors such as gender, age, education, and so on with urinary salt excretion among hypertensive participants. Studies suggested that socioeconomic status was positively related to sodium intake, as well as the urinary excretion of sodium.[30,31]

However, a person with high BP and central obesity has a frequent chance of developing metabolic syndrome. Researchers observed that in rural Bangladesh around 20% of older persons (21% women, and 18% men) had metabolic syndrome and the prevalence is higher in women.[18] Furthermore, the incidence of metabolic syndrome is higher in hypertensive individuals (31.2%) than in the general population.[32]

In the present study, higher urinary sodium excretion levels were associated with overweight and central obesity measured by both BMI and waist circumference and this study's results are consistent with previous studies.[18,33] Studies directly examined the association between urinary sodium excretion levels and overweight and obesity among adults.[18,33] Though the exact mechanism for sodium intake and weight gain is still ambiguous, several biological mechanisms are recommended. Biologically a high concentration of sodium in the body can lead to being overweight by increasing cortisol levels and its metabolites,[34] decreasing adiponectin, and producing abnormal metabolic profiles, such as high BP, diabetes, and increased triglyceride levels.[34,35] Another possible mechanism could be high sodium intake increased the volume of extracellular water that caused increased weight gain.[35] More studies are needed to confirm these findings.

Furthermore, this study found the association between urinary sodium excretion and BP (SBP and DBP) at the 1st-month follow-up and at the endline. This finding suggested that the effect of sodium on BP is dependent on the diet.[36] Previous studies have shown that increasing sodium intake, SBP, and DBP also significantly increased. Contrarily, a reduction in dietary sodium intake lowered SBP and DBP levels.[37]

Strengths and limitations

This is the first-ever study among hypertensive individuals in the rural Bangladeshi population to determine the dietary salt intake from overnight urinary salt excretion. Urinary sodium excretion provided more accurate information regarding the daily dietary salt intake habit of individuals.

Table 3: Association between sociodemographic, physical measurements, and overnight urinary salt excretion at 1st follow-up and end line

Variables	1st follow-up urinary salt			End-line urinary salt		
	P for Chi-square N (%)		*P**	*P* for Chi-square N (%)		*P**
	<11 g	≥11 g		<11 g	≥11 g	
No. of participants	232	186		248	164	
Gender						
Female	198 (55.2)	161 (44.8)	0.723	208 (58.8)	146 (41.2)	0.141
Age groups						
35-44 years	81 (52.9)	72 (47.1)	0.519	93 (61.2)	59 (38.8)	0.922
45-54 years	96 (55.2)	78 (44.8)		101 (59.1)	70 (40.9)	
55 years and more	55 (60.4)	36 (39.6)		54 (60.7)	35 (39.3)	
Education status						
Secondary complete or higher	45 (56.3)	35 (43.8)	0.945	49 (61.3)	31 (38.7)	0.069
Secondary incomplete	75 (54.3)	63 (45.7)		91 (67.4)	44 (32.6)	
Primary complete	112 (56.0)	88 (44.0)		108 (54.8)	89 (45.2)	
Marital status						
Married	207 (54.9)	170 (45.1)	0.458	226 (60.8)	146 (39.2)	0.480
Occupation						
Housewife	188 (54.7)	156 (45.3)	0.450	202 (59.8)	136 (40.2)	0.703
Wealth index						
Poor	112 (53.3)	98 (46.7)	0.370	121 (58.2)	87 (41.8)	0.397
Monthly income (BDT)						
<20000	74 (54.4)	62 (45.6)		87 (65.4)	46 (34.6)	
21000-40000	100 (55.9)	79 (44.1)	0.950	98 (55.4)	79 (44.6)	0.118
>40000	58 (56.3)	45 (43.7)		63 (61.8)	39 (38.2)	
BMI category						
Normal (18.5–24.9)	91 (63.2)	53 (36.8)		92 (63.0)	54 (37.0)	
Overweight (25.0–29.9)	102 (52.3)	93 (47.7)	0.074	117 (62.2)	71 (37.8)	0.123
Obese (≥30.0)	39 (50.0)	39 (50.0)		39 (50.0)	39 (50.0)	
Waist circumference (cm)	90.5±10.2	92.4±9.7	0.061	90.3±9.9	92.6±10.0	0.020
Hip circumference (cm)	96.1±8.2	97.5±8.7	0.090	95.8±8.6	98.0±8.1	0.010
Mid upper arm circumference (cm)	29.7±3.3	30.5±3.2	0.009	29.8±3.1	30.5±3.4	0.033
Systolic blood pressure (mmHg)	129.4±16.4	133.6±16.5	0.011	125.5±15.4	129.5±16.3	0.011
Diastolic blood pressure (mmHg)	86.0±9.3	88.6±9.6	0.005	84.2±8.5	87.0±8.9	0.002

Note: Data are expressed as numbers and percentages and mean±standard deviation. *P for the t-test. Level of significance $P<0.05$

Like other studies, this study also has some limitations. Due to cultural, traditional, and economic constrictions, it was not feasible to collect 24-h urine samples to assess sodium excretion. In addition, as our survey sample was minor hypertensive people, therefore, it may not be representative of entire Bangladeshi communities.

Conclusion

Most of our study participants had satisfactory knowledge related to HTN and salt intake. But it is possible that a poor attitude toward the importance of lowering salt intake may be due to a lack of awareness. In addition, our study results found that sodium excretion among hypertensive participants was higher, and higher urinary sodium excretion was associated with overweight and BP in adults. Excessive dietary sodium salt intake raises BP and increases the likelihood of obesity, heart disease, and stroke. Therefore, it is crucial to continuous monitoring and increases the public's awareness of low-salt diets and promotes individual dietary behavior changes. Regarding this, family doctors and general primary care providers can inform patients about this and assist in changing behavior by educating them to minimize their dietary salt intake. Furthermore, they can suggest to their patient some take-home messages and the messages could be: 1) The flavor of foods will not be impacted if salt is reduced by 5% to 10%; 2) use measuring spoons to control the amount of salt; 3) at every meal, eat more fresh fruits and vegetables and eat less salt containing foods; and 4) reduce the salt intake gradually.

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Conflicts of interest

There are no conflicts of interest.

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