Drinking water salinity and associated risk of raised blood pressure in young reproductive-aged women in coastal Bangladesh: a cross-sectional study

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Outline of the Presentation:

- Background of the study
- Methods
- Results Section
- Limitations
- Conclusions
Background of the study
2 in 7 people are living in the coastal Bangladesh

*Water Aid, Regional advocacy meeting on climate change, January 21, 2008*

5 out of 8 people are exposed to drinking water salinity

*Environmental pollution 214 (2016) 248-254*
Saltwater intrusion into surface and ground water is one of the most important blows of climate-induced sea level rise.

A major portion of coastal people, including women, are exposed to a higher level of sodium than recommended by WHO.

There is no data on the population health effects of increasing water salinity on blood pressure in the interior coast of Bangladesh.
Methodology
The study was cross-sectional in design and was conducted among 478 young reproductive-aged women (18-30 years old) in three sub-districts with the highest salinity affected areas in Jessore district of Bangladesh.

Spot urine and drinking water were collected and measured for sodium levels. Blood pressure was measured for each of the individual. A 24-h dietary recall with multiple pass method and multiple source method was conducted.
4.16 thousands hectar

4.93 thousands hectar

5.48 thousands hectar

Source: Soil Resource Development Institute (SRDI), Ministry of Agriculture, Bangladesh, 2010, pp- 32
Sampling process; 2\textsuperscript{nd} Stage

In the case of Keshabppur the three unions were selected for the study namely Sagordari, Trimohoni, and Biddanondokati as these unions are the nearest unions from the Kopotakkho river.
Sampling process; 2\textsuperscript{nd} Stage

In the case of Abhaynagar three unions were selected for the study namely Prembagh, Baghutia, and Siddhipasha as these unions are the nearest union from the Bhairab River.
In the case of Monirampur the three unions will be selected for the study namely Dakuria, Kultia, and Horidaskati as these unions are the nearest union from the Mukulessori river.
In the last stage of sampling, sixty households were randomly selected from each of the selected unions under the sub-districts. We constructed a sampling frame of the households within a unions with the help of local government.

This made a total of 540 households for this study. One woman of reproductive-age was included from each of the 540 households.
**Salinity in drinking water:** From each of the households drinking water sources were collected and measured for salinity in part per thousands using conductivity meter.

1 ppt = 1000 mg/L = 1 g/L

**Urinary sodium:** Spot urine of the participants was collected and measured for urinary sodium in millimoles per liter by the Ion Selective Electrode Method using Automated Chemistry Analyzer.
Results Section
**Figure 1.** Characteristics of the young reproductive-aged women. (A) Age Categories, (B) Religion, (C) Education Level and (D) Occupation
Table 1: Anthropometric, blood pressure, urinary sodium, and sodium intake level of the women

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
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<tbody>
<tr>
<td>Age (in years)</td>
<td>23.4</td>
<td>3.2</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>21.9</td>
<td>2.8</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>73.1</td>
<td>6.2</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>117.1</td>
<td>8.2</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>77.6</td>
<td>5.9</td>
</tr>
<tr>
<td>Na intake from saline water (g/d)</td>
<td>1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Discretionary Na intake (g/d)</td>
<td>2.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Urinary Na Excretion (g/L)</td>
<td>3.8</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Figure 2. Systolic (A) and diastolic (B) blood pressure against the tertiles of daily sodium intake from saline water. \(^1\)All the tertiles contain an equal number of sample (n=159) except the 2\(^{nd}\) tertile (n=160). *Analysis of variance (ANOVA) is performed with Games-Howell post hoc analysis to compare the effects of different sodium intake level on systolic and diastolic blood pressure. Values not sharing the same letters (a-b) denote significant difference among tertiles (P<0.05).
Figure 3. Systolic (A) and diastolic (B) blood pressure against the tertiles of urinary sodium excretion (g/L). All the tertiles contain an equal number of sample (n=159) except the 2nd tertile (n=160). *Analysis of variance (ANOVA) is performed with Games-Howell post hoc analysis to compare the effects of different urinary sodium excretion level on systolic and diastolic blood pressure. Values not sharing the same letters (a-b) denote significant difference among the tertiles (P<0.05).
Figure 3: Odds ratio (OR) with 95% CI for associations of predictor variables and the likelihood of having raised **systolic blood pressure** among the young reproductive-aged women adults. The analysis included 478 women. OR adjusted for BMI, Waist circumference, education, occupation, religion, and discretionary sodium intake in the diets.
**Figure 3:** Odds ratio (OR) with 95% CI for associations of predictor variables and the likelihood of having raised *diastolic blood pressure* among the young reproductive-aged women adults. The analysis included 478 women. OR adjusted for BMI, Waist circumference, education, occupation, religion, and discretionary sodium intake in the diets.
Limitations
We used a single spot urine to assess urinary sodium excretion level of these women instead of 24-h urine collection which is considered as a gold standard for assessing sodium intake.

We assessed water salinity once during the middle of dry season (April to June). Water salinity is usually higher in this season. Seasonal variability and its effect on blood pressure was not observed.
Conclusion
4 in 11 reproductive-aged women had raised blood pressure

Alarmingly, all the women had urinary sodium excretion well above the WHO/FAO recommended level (2g/d)
The mean urinary sodium excretion is equivalent to 2 teaspoon of salt.

The mean daily sodium intake from drinking saline water is equivalent to half teaspoon of salt.
sodium intake from drinking water is associated with raised systolic and diastolic blood pressure in the young reproductive-aged women in the saline affected coastal areas of Bangladesh.

Increased urinary sodium excretion at the level of 3.9-6.7 g/d was also found as a risk factor for raised blood pressure among the coastal young reproductive-aged women