Original Article

Dietary salt consumption in an urban slum of Dhaka city

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Background: Dietary salt is one of the contributors to cardiovascular diseases (CVDs). However, minimal research has been done to estimate salt consumption among Bangladeshi citizens. The objective of this study was to determine the mean dietary salt consumption of adults living in a slum population of Dhaka city.

Methods: A cross-sectional study was conducted among a sample of randomly selected dwellers of the Kalyanpur slum (Pora Basti) in Dhaka city. A total of 135 adults (67 men and 68 women) from 135 households were interviewed, and urine samples were collected. The 24-hour salt intake was estimated from spot urine samples using the equation of Tanaka.

Results: The estimated mean dietary salt intake was 8.9 g/day [95% confidence interval (CI): 8.6–9.3]. Men had a slightly lower salt consumption (8.8 g/day; 95% CI: 8.4–9.2) than women (9.0 g/day; 95% CI: 8.5–9.6). All the participants, irrespective of their age groups, sex, occupations, and education level, had the habit of consuming salt more than the recommended amount, >5 g/day. More than half (53.3%) of them always added salt while taking a meal. However, 11.9% were always consuming processed food rich in salt. A multiple logistic regression analysis observed a statistically significant association [odds ratio (OR) =2.1; 95% CI: 1.0–4.4] of added salt intake with high salt intake (≥9 g/day).

Conclusions: Dietary salt consumption in this urban slum population is high. Control of added salt intake on the table could be one of the important options for reducing the overall reduction of salt intake.

Keywords: Dietary salt; salt intake; spot urine; 24-hour urinary sodium; Bangladesh

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Introduction

Excessive dietary salt is directly linked to cardiovascular diseases (CVDs) (1). Salt consumption behavior in Bangladesh is a neglected topic. The World Health Organization (WHO) STEP-wise Approach to NCD Risk Factor Surveillance (STEPS) Survey in Bangladesh 2018 is the largest study yet in this context, and its estimated average salt consumption is 9.0 g per day (2). Two other studies also had the average salt consumption well over the WHO recommended level (3,4). Several studies using questionnaire and spoon measurement techniques were conducted between 2014 and 2020 to assess salt intake (5-8). Only a few of these studies had ever used spot urine or

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24-hour urine analysis for salt estimation.

A study that focused purely on the salt consumption of a low-income urban slum population and it determined the salt consumption of the slum dwellers as 7.8 g/day based on a spot urine sample (9). Our study gives further insight into this vulnerable population group. This study aimed to estimate the salt intake using spot urine among the dwellers of the Kalyanpur slum (Pora Basti) in Dhaka city. The information will help compare the salt consumption pattern in different socioeconomic groups and better understand the overall salt consumption pattern among the Bangladeshi low socioeconomic group of people. In addition, we present this article in accordance with the STROBE reporting checklist (available at https://jxym.amegroups.com/article/view/10.21037/jxym-23-8/rc).

Methods

Study design and setting

A cross-sectional study was conducted among the adults of Kallyanpur Pora Slum, found near the edge of Dhaka city. It spans an area of 15 acres. The total household and population of the Kalyanpur slum (Pora Basti) are 2,184 and 8,129 (men 4,126, women 3,998, and others 5), respectively (10). People from different regions of Bangladesh live in this slum. The data collection was done in October 2021.

Study populations

Adult people (age between 18–69 years) living in the selected slum were the study populations. The total estimated sample size was 115, calculated by using a formula for a one-sample mean (11) using standard deviation (SD), considering the SD of salt intake of 1 g (2) and degree of precision of 0.25, and 80% response rate. However, 135 (68 women, 67 men) participants were recruited during the actual survey to ensure a reliable result. A systematic random sampling technique was applied. One man or woman was selected from each household alternatively. A random selection of the households was done using a sampling interval for 2,184 households from 10 blocks. Those who were severely ill or had been fasting were excluded.

Highlight box

Key findings

- Amount of salt consumption is almost double as recommended by World Health Organization (WHO) among slum population using spot urine technique.

What is known and what is new?

- We know the amount of salt consumption using the 24-hour urine analysis.
- The present study estimates the salt consumption of slum population base on the spot urine technique.

What is the implication, and what should change now?

- The spot urine technique for the estimation of salt consumption could be the best alternative in terms of convenient and cost effective then 24-hour urine analysis.

Data collection

The data collection instrument was adapted from to the WHO STEPS survey questionnaire (12). The questionnaire consisted of a few personal information (sex, age, education, and occupation), behavioral information (habit of adding extra salt and frequency of salty processed food consumption), physical measurements (height and weight), and biochemical measurement (spot urine analysis for sodium and creatinine). Data were collected through face-to-face interviews using a Bangla version of the questionnaire (13). A briefing was given at the beginning, and show cards were used for further explanation. Height, weight, urinary sodium, and creatinine values were recorded.

Ascertainment of key variables

Age, height, and weight

Participants were asked about their age. In doubtful cases, national ID cards were checked. Weight was measured using a portable weighing scale, and weight was recorded to the nearest 0.1 kg (13). The height was measured using a metal measuring tape positioned against a flat and vertical surface to the nearest 0.1 cm (13).

Urinary sodium and creatinine

A 15–20 mL sterile labeled container was supplied to the participants to collect their urine for urine specimen after explaining the proper urine preservation technique. Specimens were asked to be stored overnight at normal temperature before collection the next morning. An indirect ion-selective electrode method was used for spot urine sodium levels measurements. The Jaffy method was used to

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estimate the creatinine level (13,14). The 24-hour estimates were then worked out using the Tanaka formula (14). The sodium values were recorded in mmol/day, then converted to 24-hour sodium using the Tanaka formula (14).

24-hour sodium estimation

We used the Tanaka formula (14) for dietary salt estimation since this equation had already been used on the Bangladeshi population in the national STEPS survey 2018 (13) and other studies (4). The Tanaka equation deploys an indirect measurement of 24-hour sodium excretion, which considers the sodium-to-creatinine ratio in spot urine multiplied by predicted 24-hour urinary creatinine (14). After applying the equation, we got 24-hour sodium intake, which was then converted to salt intake by dividing with a conversion factor of 17.1 to attain the estimated salt intake in grams (15).

Statistical analysis

Before analysis the missing data was logically checked. Data were analyzed by using Microsoft Excel version 2020. Descriptive analysis (percentage, mean and SD) was done as proper for categorical and quantitative variables. The Chi-square test (χ^2) or Fisher's Exact Test for categorical variables were performed by the Statistical Package for the Social Sciences (SPSS) version 25.0 for Windows to see the association of excessive salt intake with socio-demographic and behavioral characteristics among participants. In addition to the WHO's recommended daily intake (<5 g/day), we used a cut-off point of 9 g/day based on the national average (13). The multivariate binary logistic regression was used to find the association between high dietary salt intake (≥9 g/day) and other factors, and an odds ratio (OR) with 95% confidence interval (CI) was reported. The statistical significance value was set as $P<0.05$.

Ethical clearance

This study was conducted by postgraduate students under the supervision of the department's teachers at the Bangladesh University of Health Sciences (BUHS) as a requirement for the Master of Public Health (Non-Communicable Diseases) curriculum under the Advanced Research Methodology course. The purpose of the study and confidentiality issues were explained to the participants. The study was conducted following the Declaration of Helsinki (as revised in 2013), and the Ethical Review Committee of BUHS (No. BUHS/ERC/EA/20/279) approved the protocol of this study. Written permission was taken from the local leader of the slum area. Written and thumb impression informed consent was taken from all participants. All the information collected from the participant was kept confidential. There was no risk of physical harm for the study participants. The participants had the right to withdraw them at any part of data collection.

Results

Data were collected from 135 respondents out of 141, response rate was 95.7%.

Socio-demographic & behavioral characteristics

Among 135 individuals, there were 67 men and 68 women. The mean age of the participants was 38.8 (SD, 13.7) years. About 6 in 10 (59.3%) participants were 18–39 years old. About 66.7% had completed any form of education, while one-third (33.3%) had no formal schooling. Majority of the men (79.1%) were manual laborer. In contrast, almost of all of the women (94.1%) were non-manual laborer. When asked about their food habit, 53.3% of all participants reported always adding extra salt to food, while 34.8% claimed to have never been using extra salt in their meals. Regarding the frequency of consuming processed salty food, 11.9% responded as 'Always', 25.1% responded as 'Never', while the remaining 63% admitted having varying degrees of consumption, which reported as others in the table (*Table 1*).

Salt intake behavior

The estimated mean dietary salt intake was 8.9 g/day (95% CI: 8.6–9.3). Men, on average, had slightly lower consumption of salt intake at 8.8 g/day (95% CI: 8.4–9.2) than women, 9.0 g/day (95% CI: 8.5–9.6). However, this difference was not statistically significant. Similarly, there were slight between groups of respondents concerning age, education, occupation, consumption of added salt, and processed food (*Table 2*).

Factors associated with high salt intake

All but one had >5 g/day salt intake (results not given in tables). About 43% of the participants had salt intake higher than the national average of 9 g/day (*Table 3*). The variations in salt intake between groups were not statistically significant except for added salt intake, as shown by the

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Table 1 Socio-demographic and behavioral characteristics of Kallyanpur slum study population, Dhaka, Bangladesh, 2021

Variables	Overall (n=135)	Men (n=67)	Women (n=68)
Age, years, mean (SD)	38.8 (13.7)	39.7 (14.0)	37.9 (13.4)
Age group (years), n (%)			
18–39	80 (59.3)	41 (61.2)	39 (57.4)
40–69	55 (40.7)	26 (38.8)	29 (42.7)
Educational level, n (%)			
No education	45 (33.3)	21 (31.3)	24 (35.3)
Any education	90 (66.7)	46 (68.7)	44 (64.7)
Occupation, n (%)			
Manual worker[†]	57 (42.2)	53 (79.1)	4 (5.9)
Non-manual worker	78 (57.8)	14 (20.9)	64 (94.1)
Frequency of added salt intake, n (%)			
Always	72 (53.3)	37 (55.2)	35 (51.5)
Others[†]	63 (46.7)	30 (44.8)	33 (48.5)
Frequency of salty processed food consumption, n (%)			
Always	16 (11.9)	10 (14.9)	6 (8.8)
Others[‡]	119 (88.1)	57 (85.1)	62 (91.2)

[†], manual worker consists of rickshaw/van-puller, garments worker, transport worker, construction worker, restaurant worker, cottage industry, street worker, and day labourer; [‡], others include often, sometimes, rarely, and never. SD, standard deviation.

number and percent. We used a multivariate binary logistic regression model for the factors associated with high salt intake (≥9 g/day), taking age, gender, education, occupation, added salt intake, and processed food intake as independent variables. This analysis also showed that added salt intake was associated with increased daily dietary salt consumption of ≥9 g/day (OR =2.14; 95% CI: 1.04–4.41) (*Table 3*).

Discussion

Our study revealed a high dietary salt consumption among residents of the Kallayanpur slum based on spot urine samples. All except one of the 135 participants had salt consumption almost double than WHO recommended value. Forty-three percent had above the national average (>8.9 g/day) salt consumption. This result was not unexpected. An earlier 2014 study suggested that the urban population had higher salt consumption than rural communities (16). This, coupled with the low literacy and, probably, low awareness level of people living in the slum, makes them highly vulnerable to non-communicable diseases.

The result of our study is consistent with most other studies done on the topic in Bangladesh (5-8). Our result closely matches the finding of the national STEPS 2018 survey in Bangladesh (13) and another urban slum study (9). The fact that most sociodemographic groups in Bangladesh show similar tendencies in salt consumption suggests that altering the salt intake behavior will not be an easy task. The study done by Khan *et al.* (9) indicated that both Tanaka and Kawasaki formulas can be applied reliably for estimating salt consumption in the Bangladeshi slum community. This study (9) also highlighted that 54% of the respondents took added salt to their diet while 46% often ate salty processed food (chips, salty biscuits, chanachur, salted nuts, salted beans, salted fishes, jhalmuri) (13). These findings are also like ours, suggesting a common trend in salt consumption behavior among the people living in the slums.

An earlier study published in 2020 studied salt consumption behavior among students at a private university in Bangladesh (6). This group is likely fall into the middle-income category. When asked about their

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Table 2 Estimated 24-hour (g/day) salt intake among Kallyanpur slum study population according to demographic and dietary practice, Dhaka, Bangladesh, 2021

Variables	Overall (n=135)		Men (n=67)		Women (n=68)	
	Mean	95% CI	Mean	95% CI	Mean	95% CI
All	8.9	8.6–9.3	8.8	8.4–9.2	9.0	8.5–9.6
Age (years)						
18–39	9.1	8.6–9.6	9.1	8.4–9.7	9.1	9.2–9.8
40–69	8.7	8.2–9.2	8.3	8.0–8.9	9.0	7.8–9.8
Education						
No education	8.7	8.6–9.4	8.4	7.7–9.2	9.0	8.0–9.8
Any education	9.0	8.1–9.3	9.0	8.5–9.5	9.1	8.3–9.8
Occupation						
Manual worker[†]	8.9	8.4–9.4	8.9	8.4–9.3	9.0	3.2–14.7
Non-manual worker	8.9	8.5–9.4	8.5	7.6–9.5	9.0	8.5–9.6
Frequency of added salt intake						
Always	9.2	8.7–9.6	9.0	8.6–9.7	9.3	8.5–10.1
Others[‡]	8.6	8.1–9.1	8.5	7.9–9.2	8.7	7.9–9.5
Frequency of salty processed food consumption						
Always	8.5	7.6–9.5	8.4	7.1–9.6	8.8	6.6–11.0
Others[‡]	9.0	8.6–9.3	8.9	8.5–9.3	9.0	8.5–9.6

[†], manual worker consists of rickshaw/van-puller, garments worker, transport worker, construction worker, restaurant worker, cottage industry, street worker, and day labourer; [‡], others include often, sometimes, rarely, and never. CI, confidence interval.

tendency to take added salt, the majority claimed to have avoided added salt. In contrast, only 11% of our study subjects avoid taking added salt. On the other hand, most university students claimed avoiding salty processed food. In contrast, only 15% of our study subjects try to do the same. Other research also highlights that people from higher socioeconomic status in Bangladesh at least claim to be cutting down on added salt and salty processed food (7).

We realized that salt consumption habits have been passed along the generations. The tightly knitted family structure of Bangladesh strongly influences the children to acquire the food taste of their parents. They get used to the taste of highly seasoned food which later becomes their benchmark for salty foods. Most individuals don't realize that the level of salt that they consume to be normal is already much higher than the recommended level (17).

Constraints in food affordability may account for the reluctance to cut the salt. Blunt tasting food like plain rice and boiled vegetables, are made more appetizing by adding salt to the meal. This is especially true for people with socioeconomic deprivation. Salty processed foods are often fried and rich in fat which quickly brings a feeling of satiety. They are also relatively cheap and easily available. Salty processed food offers an affordable quick-fix solution to their hunger for busy blue-collar workers.

Another interesting phenomenon was highlighted during our survey. Bangladesh has a long history of iodine deficiency. Health promotion campaigns since the 1980s tried to promote the use of iodized salt among people. However, as an unintended consequence of these promotions, many people believed that extra salt would make people healthier. Advertisement agencies fueled this delusion further by associating the consumption of extra iodized salt with a higher intelligence quotient in children. Another intended promotional campaign gone wrong is the advertisement of oral rehydration salts. Oral rehydration salts are a valuable tool to combat dehydration and, therefore, fatigue in people, mainly manual laborers.

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Table 3 Percentage and factor associated with salt consumption above the national average (>8.9 g/day) among the Kallyanpur slum study population (overall, n=135), Dhaka, Bangladesh, 2021

Variable	Salt consumption		OR (95% CI)
	<9 g/day (n=77)	≥9 g/day (n=58)	
Age (years), n (%)			
18–39	42 (52.5)	38 (47.5)	1
40–69	35 (63.6)	20 (36.4)	0.58 (0.26–1.28)
Sex, n (%)			
Male	41 (61.2)	26 (38.8)	1
Female	36 (52.9)	32 (47.1)	1.63 (0.55–4.80)
Education, n (%)			
No education	28 (62.2)	17 (37.8)	1
Any education	49 (54.4)	41 (45.6)	1.23 (0.55–2.80)
Occupation, n (%)			
Non-manual worker	43 (55.1)	35 (44.9)	1
Manual worker[†]	34 (59.6)	23 (40.4)	1.15 (0.39–3.45)
Practice regular added salt intake, n (%)			
Others[‡]	41 (65.1)	22 (34.9)	1
Always	36 (50.0)	36 (50.0)	2.14 (1.04–4.41)*
Practice regular salty processed food intake, n (%)			
Others[‡]	66 (55.5)	53 (44.5)	1
Always	11 (68.8)	5 (31.3)	0.49 (0.15–1.56)

[†], manual worker consists of rickshaw/van-puller, worker, day laborer, others, garments worker, transport worker, construction worker, restaurant worker, cottage industry, and street worker; [‡], others include often, sometimes, rarely, and never; *, P=0.04, all others are not statistically significant. OR, odds ratio; CI, confidence interval.

However, to promote sales, advertising agencies in recent years have been highlighting certain brands of oral rehydration salts as solutions that can immediately boost energy. Such unregulated advertisement and promoting salt-containing food might have created misperceptions among consumers and might contribute to people's salt intake behavior. However, further in-depth studies should be conducted before coming to any conclusion.

Although our study adds valuable knowledge for the slum population, it had a weakness of a small sample size for sub-group analysis. We used an estimate based on spot urine analysis to determine the salt consumption based on a formula proposed for the Japanese population. It would be good to have a population-specific formula for Bangladeshi people.

In conclusion, the study findings revealed high dietary salt consumption among the urban slum population and a bad salt consumption behavior. Added salt intake while taking a meal could be targeted for the slum population in addition to the robust awareness campaigns discouraging people from consuming too much salt.

Conclusions

Salt consumption among urban slum populations is too high, primarily due to added salt while taking a meal, which warrants interventions to reduce unhealthy dietary practices.

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Footnote

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Ethical Statement: The authors are 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. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Ethical Review Committee of Bangladesh University of Health Sciences (No. BUHS/ERC/EA/20/279) and informed consent was taken from all the participants.

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