Original Article

Knowledge and behaviors related to dietary salt and sources of dietary sodium in north India

Prashanth Aparna[1], Harshal Ramesh Salve[1], Krishnan Anand[1], Lakshmy Ramakrishnan[2], Sanjeev Kumar Gupta[1], Baridalyne Nongkynrih[1]

[1]Centre for Community Medicine, [2]Cardio-thoracic Centre, All India Institute of Medical Sciences, New Delhi, India

Abstract

Sodium, an element needed for the normal human physiology is known to be associated with high blood pressure and other consequences if consumed in excess. The assessment of knowledge and behavior related to sodium that is consumed in the form of salt plays an important role in the control of cardiovascular diseases. To control the intake of sodium, dietary sources of sodium need to be identified. To address this, a community-based cross-sectional study was conducted among women aged 20 to 59 years in north India, where knowledge, attitude, and behavior questionnaire given by the World Health Organization and 24-h dietary recall were used. The mean age of the participants was 34.5 years, and the majority of them were homemakers. Approximately, 80% of the participants believed that high salt diet causes serious health problems, and only 5% of the participants were aware of the existence of a recommendation for daily salt intake. Less than 20% of the participants took measures to control their salt intake. Vegetable-based dishes were found to be the major contributors to the daily salt intake followed by pulse-based and cereal-based dishes. This is because of the high quantity in which they are consumed. Food cooked at home contributed to 90% of the daily salt intake. To control the salt intake, we should cut- down the discretionary salt use. Dietary advice should be customized to the individual, and the family physician plays an important role in this. Behavioral change is the need of the hour to control the epidemic of non-communicable diseases.

Keywords: Knowledge, behaviour, salt, intake, source

Introduction

Sodium is an important element needed for normal physiological functioning of the human body. It is involved in maintaining fluid-electrolyte balance, cell integrity, generating nerve impulses, and various other important functions.[1] Metabolic studies have shown, with long-term intake of 0.25 g–0.9 g salt (i.e. 100–375 mg sodium) per day, sodium balance can be maintained.[2] Over the ages, the salt intake has increased, and the global mean salt intake was estimated to be 10.06 (9.88–10.21) g/day in 2010.[3] A systematic review was done in India which included studies from 1986 to 2014 showed overall mean weighted salt intake to be 10.98 g/day (95% confidence interval 8.57– 13.40).[4]

Scientific and medical evidence associates excessive sodium intake to high blood pressure and secondary consequences such as cardiovascular disease and stroke.[5-7] High salt intake is also known to cause osteoporosis, obesity, gastric cancer, and chronic kidney disease.[8] This calls for a reduction of salt in the diet which is supported by strong scientific evidence that shows its beneficial effect in reducing blood pressure, especially among the population who consume salt of more than 5 g/day.[9,10] A reduction of 3 g/day over 30 years is expected to avert nearly 4 lakh cases of hypertension and about 81,000 deaths from myocardial infarction and stroke in India.[11]

Address for correspondence: Dr. Baridalyne Nongkynrih, Centre for Community Medicine, All India Institute of Medical Sciences, Ansari Nagar, New Delhi - 110 029, India.
E-mail: baridalyne@gmail.com

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_49_19

How to cite this article: Aparna P, Salve HR, Anand K, Ramakrishnan L, Gupta SK, Nongkynrih B. Knowledge and behaviors related to dietary salt and sources of dietary sodium in north India. J Family Med Prim Care 2019;8:846-52.

To reduce blood pressure and risk of cardiovascular disease and stroke, the World Health Organization (WHO) recommends a reduction in sodium intake to less than 2 g/day (i.e. 5 g/day salt) in adults (>or = 16 years).[12] Salt reduction at population level forms the keystone to control cardiovascular diseases, and it is one among the top five priority interventions that have been identified to prevent Non Communicable Diseases (NCDs).[13,14]

To be able to bring about a reduction in population salt intake, their knowledge and behavior related to salt intake and the sources of dietary sodium need to be assessed as population knowledge and behaviors, influence salt consumption and are considered the modifiable mediating factors that are flexible to change.[15]

India is a diverse nation with multiple religious, cultural, and dietary practices. The food habits vary from region to region and so do the food items, which contribute to the increased salt intake. There is little-published literature regarding the sources of dietary sodium in north-India. The study of knowledge and behavior related to salt consumption of women becomes important here, as they are mostly involved in cooking meal for the family and indirectly determine the salt consumption of the family. Hence, this study was conducted among women 20 to 59 years of age to assess the knowledge and behaviors related to salt consumption and sources of dietary sodium.

Materials and Methods

Ethical clearance was obtained from the All India Institute of Medical Sciences, New Delhi, ethics committee. The participant information sheet was read out to each participant, and written consent was taken.

This community-based cross-sectional study was conducted in Dakshinpuri extension, an urban resettlement colony in south-east Delhi. The study included women of the age 20 to 59 years residing in the colony for at least 6 months. The sample size was estimated to be 434 from an estimation of 52% women reporting lowering of salt in their diet was important,[16] and relative precision of 10%.

The list of eligible participants was obtained from the computerized population database of 6 blocks of Dakshinpuri extension. Simple random sampling was done using Microsoft Excel, and a list of 450 participants was made. The participants with the known history of heart or kidney failure, stroke and liver disease, pregnant or lactating women, those recently started on diuretics (<2 weeks), and any disease that alters their dietary habits were excluded.

Data were collected from October 2017 to December 2017. House to house visit was made, and of the 450 participants approached, 426 agreed to participate. They were interviewed with a pre-tested, semi-structured questionnaire, which covered the following domains of basic socio-demographic details, lifestyle behaviors, and questions on the knowledge, attitude, and behaviors adapted from the WHO/Pan American Health Organization (PAHO) protocol for population-level sodium determination and salt module of the WHO STEPS questionnaire were included.[17,18]

A 24-h dietary recall was taken in detail by the investigator. Standard measures were used to quantify the food items. Data were entered in the DietCal software, which is a tool for dietary assessment that gives the nutritive value of most of the food items from the Indian Food Composition Tables 2017. It also contains standard food recipes for some of the south and north Indian food items and gives the nutritive value of the same. For the recipes that were missing in the DietCal software, nutritive values were obtained from the "Nutrify India Now" app, developed by the National Institute of Nutrition, Hyderabad. The quantity of each food item consumed by the participant was entered in the software or the app. The sodium content of the packed food items was noted from the nutritive information given on the packet and entered in the software. The software calculated the sodium content of each of the food item from the quantity consumed. It gave the inherent sodium content of the raw food item and also the sodium from the salt that is added while cooking. After data of all the participants were entered and sodium content calculated, the results were exported to Microsoft Excel for further analysis.

Three different types of classification of food items were made. First was depending on the basic ingredient of the recipe, second from the place of preparation of food, and the third was from whether the food was high fat, salt or sugar (HFSS) or non-HFSS. Under each classification, the sodium content of each food group of all participants and their contribution to the total daily salt intake of all the participants was calculated. The contribution of each food group to the daily sodium intake was expressed in percentages in each of the three types of classification.

Data were entered in Microsoft Excel, Windows version 2007. The statistical analysis was performed using STATA 12.1. Results about knowledge and behavior were expressed in proportions. To compare it among the less and more educated participants, the Chi-squared test and Fisher's exact test were used. The *P* value was calculated to express statistical significance, and a value of less than 0.05 was considered statistically significant.

Results

Out of the 450 participants in the list, five had moved out and three were ineligible (pregnant and lactating). Of the 442 remaining participants, 11 were not available during the three visits made and five refused to take part, giving a response rate of 96.4%.

The mean age of the participants in our study was 34.5 years (SD = 9.4), and more than two-third were between 20 and 39 years. The majority of the participants (78%) were currently married. Approximately, half of the participants (53%) lived in

nuclear families. The majority of them were educated up to high school certificate. More than two-third of the participants were home-makers only. Approximately, 42% of the participants belonged to the lower middle class, followed by 33% in the upper lower class and the rest belonging to the upper middle class according to the updated Kuppuswamy's socio-economic classification.[19] None of the participants reported to either smoke or consume alcohol. Participants' demographics are summarized in Table 1.

Two-third of the participants were predominantly on mixed diet, and one-fourth were on vegetarian diet only. Rest of them were vegetarians who consumed egg. Among the total 426 participants, 44 claimed to have restrictions in the diet where 20 claimed to have low-sugar and low-rice diet, low-salt diet was claimed to be consumed by 20 participants, and low-fat diet by 28 participants. All the participants consumed food cooked at home daily. Over three-fourth of the working participants claimed to have never consumed food from the canteen in their workplace in the past 2 months. Food from the canteen was reported to be consumed daily by 15%, and street food or food from the restaurant was consumed almost weekly by 18% of the participants. Nearly, half of the participants rarely had such food.

Knowledge and behavior related to dietary salt

Approximately, 80% of the participants reported that high salt consumption causes serious health problem and the most common health problem being high blood pressure (45%). Only 5% of the participants were aware of the existence of recommendation for daily salt intake. Out of this 5%, only nine participants knew the exact recommended daily salt intake (i.e. <5 g). Nearly, 80% of the participants reported to consume just the right amount of salt.

Table 1: Distribution of participants by socio-demographic factors (*n*=426)

Variable	Sub-group	Frequency	Percentage
Age groups (years)	20-29	149	35.0
	30-39	148	34.7
	40-49	82	19.3
	50-59	47	11.0
Marital status	Married	330	77.5
	Never married	67	15.7
	Widow/divorced	29	6.8
Number of family members	<=5	244	57.3
	>5	182	42.7
Type of family	Nuclear family	227	53.3
	Extended family	199	46.7
Educational qualification	Illiterate	63	14.8
	Upto middle school certificate	28	6.6
	High school certificate	177	41.5
	Above high school certificate	158	37.1
Occupation	Homemaker only	304	71.4
	Working outside	122	28.6
Socio-economic status (*n*=386)*	Upper middle class	97	25.1
	Lower mddle class	163	42.2
	Upper lower class	126	32.7

*Income not reported by 40 participants

Less than half (43%) of the participants reported that lowering salt in diet is somewhat important, and 33% reported that it is very important. Approximately, 82% of the participants do not restrict their salt intake and only 18% do. The most common method of restriction being not adding salt at the table followed by avoiding or minimizing consumption of pickle or papad.

Forty-four percent of the participants often or always add salt while kneading dough and almost 50% of the participants add salt while cooking rice. Over 30% of the participants often add salt to the salad. Among the total 426 participants, 23 claimed to never add salt while cooking rice, kneading dough, to the food at the table, and to the salad. There were many statistically significant differences in the knowledge and behaviors related to dietary salt among the more-educated compared to the less-educated participants. The knowledge and behavior related to dietary salt is summarized in Table 2.

Sources of dietary sodium

The maximum contribution to the daily salt consumption of the participants was by the vegetable-based dishes such as cooked vegetables including tubers (31%). Twenty-six percent of daily salt intake was contributed by pulse-based dishes such as dal or curries. Cereal-based food such as roti, paratha, or rice contributes to 23% of the daily salt intake of the participants. Non-vegetarian food items such as meat, egg, and their curries contribute to 9% of the daily salt intake. Snacks that include samosa, biscuits, rusk, puff, pizza, sauces, etc., contributed to 7% of the daily salt intake. Beverages such as milk and milk products, coffee, and tea were found to contribute to 3%, and pickle or chutney contributed to 1% of the daily salt intake of all the participants. Fruits contributed to 0.018% of daily salt intake. The sources of dietary sodium are summarized in Table 3.

It was noted that 95% of the total sodium intake was contributed by the salt added while cooking the food item, and the rest 5% was present inherently in the raw products.

Maximum contribution to daily salt intake was by the food prepared at home (90%), followed by packed food i.e. food items bought from stores such as biscuits, chips, puff, maagi, pickles, sauces, ready to eat food items, etc., (7%) and food prepared outside the home (food items consumed in restaurant, canteen, street food, at weddings or other gatherings, and home-delivered food) contributed to 3% of daily salt intake. High fat, salt, or sugar food items such as chips, fried food, sugar-sweetened carbonated beverages, sugar-sweetened non-carbonated beverage, ready-to-eat noodles, pizzas, burgers, potato fries, and confectionery items contributed to 4% of daily salt intake.

Discussion

The study involved women 20 to 59 years of age, who were mostly housewives residing in a resettlement colony. The study found the participants to be fairly knowledgeable about salt with nearly 80% aware of the harmful effects of high salt intake, a

Table 2: Knowledge and perception related to salt consumption by education

KAB questions	Percentage			
	Overall	Below high school certificate	High school certificate or more	*P*
Believe that a high salt diet could cause a serious health problem				
Yes	79.3	75.8	85.4	0.02
No	20.7	24.3	14.6	
Knowledge about the diseases caused by high salt diet				
High blood pressure	44.6	42.9	47.5	0.5
Bone problem	11.7	10.8	13.3	
Others (itching and iodine problem)	1.2	1.1	1.2	
Do not know	42.5	45.2	40.0	
Know about the existence of recommendation for daily maximum salt intake				
Yes	5.4	2.6	10.1	0.001
No	94.6	97.4	89.9	
Perception about their salt consumption				
Too little	14.1	17.5	8.2	0.005
Just the right amount	78.6	77.3	81.0	
Too much	7.3	5.2	10.8	
Importance of lowering the salt/sodium in diet				
Very important	32.6	32.1	33.6	0.7
Somewhat important	43.4	43.7	43.0	
Not at all important	6.8	6.0	8.2	
Do not know	17.2	18.2	15.2	
Addition of salt while kneading dough				
Never/rarely	44.4	40.3	51.3	0.002
Sometimes	11.5	9.3	15.2	
Often/always	44.1	50.4	33.5	
Addition of salt while cooking rice				
Never/rarely	51.7	46.6	58.9	0.03
Sometimes	10.3	12.3	7.0	
Often/always	38.5	41.1	34.1	
Addition of salt to food at the table				
Never/rarely	70.2	73.9	63.9	0.09
Sometimes	23.0	20.1	27.9	
Often/always	6.8	6.0	8.2	
Addition of salt to salad at the table				
Never/rarely	32.2	34.7	27.9	0.02
Sometimes	29.8	32.5	25.3	
Often/always	38.0	32.8	46.8	
Practice on a regular basis to control salt or sodium intake				
Yes	17.8	19.0	15.8	0.4
No	82.2	81.0	84.2	
Method practiced to control salt or sodium intake				
Do not add salt at the table				
Yes	16.2	18.3	12.7	0.1
No	83.8	81.7	87.3	
Avoid/minimize consumption of pickle/papad				
Yes	4.9	5.6	3.8	0.4
No	95.1	94.4	96.2	
Look at the salt labels on food				
Yes	0.9	0.4	1.9	0.1
No	99.1	99.6	98.1	
Avoid/minimize consumption of processed foods				
Yes	0.7	0.0	1.9	0.05
No	99.3	100.0	98.1	

Contd...

Table 2: Contd...

KAB questions	Percentage			
	Overall	Below high school certificate	High school certificate or more	*P*
Buy low salt alternatives				
Yes	0.2	0.4	0.0	0.6
No	99.8	99.6	100.0	
Use spices other than salt when cooking				
Yes	0.2	0.0	0.6	0.4
No	99.8	10.0	99.4	

Table 3: Proportion of dietary sodium by sources in total salt consumed by all the participants (On the basis of the basic ingredient of the recipe)

Food groups*	Percentage
Vegetable-based dishes	31
Pulse-based dishes	26
Cereal-based dishes	23
Non-vegetarian dishes	9
Snacks	7
Drinks and beverages	3
Pickle/chutney	1

*Food groups are listed in descending order of their contribution to the total dietary sodium

little less compared to the Johnson *et al.* study (90%), and almost double the Garg *et al.* study finding (48%).[16,20] Similar to other studies, hypertension was the single largest problem reported to be caused by high salt diet, but the proportion of participants reporting it were less in our study compared to studies by Grimes *et al.*, Land *et al.,* and other studies.[21-25] Most participants were not aware of the other harmful effects of high salt intake such as, stomach cancer, kidney disease, etc., which was also seen in the above-mentioned studies.

In this study, only 5% of the participants were aware of the existence of a recommendation for daily salt intake, and only nine participants knew the exact amount. This is in contrast with the Johnson *et al.* study, where 70% of the participants identified the recommended intake.[16] In that study, all the participants were asked about the recommended daily salt intake, and the resulting high number can be owing to chance alone. However, in our study, this question was asked to the participants who were aware of the existence of recommendation for daily maximum salt intake. In the by Garg *et al.* study done in urban Delhi, 21% of the participants knew that a maximum daily salt consumption limit should be there, and 18% knew the correct amount of daily salt consumption.[20] All these figures show that there is poor awareness among the general population about the recommendation. A study conducted by Fathima *et al.* among the health care providers in Mangalore, Karnataka reported that less than half of the participants were aware of the upper limit of the daily salt intake, which shows that the people who are supposed to advice the patients are themselves unaware.[26]

In our study, nearly 80% of the participants reported to consume "just the right amount" of salt. Almost similar finding was seen in the Johnson *et al.* (73%) and Garg *et al.* (67%) studies.[16,20]

About three-fourth of the participants believed that reducing salt in diet is important, which is an appreciable proportion, for any intervention to work. As seen in the Johnson *et al.* study, there were significant differences in the knowledge and behavior related to dietary salt among the more-educated compared to the less-educated. Therefore, education was found to be a determinant of knowledge and behavior related to dietary salt.

In most of the other studies, women had favorable behavior with regard to salt use. We observed in our study that half the participants always add salt while cooking rice and kneading dough. This result is in accordance with the fact that discretionary salt is the main source of salt in developing countries and avoiding addition of salt in these that form the staple food would decrease the salt intake substantially.

Only 18% of the participants reported restricting salt in their diet, which is a small proportion compared to the nearly 75% of participants who believed that salt reduction is important. This proves the mere belief that "salt reduction is important" is not motivating enough for the participants to practice it. The most common method to be practiced to reduce salt intake in our study was by not adding salt at the table followed by avoiding papad and pickle. In the study in Delhi, 10% of the participants reported taking regular action to control their salt intake and the most common methods were by looking at salt labels on food or buying low salt alternatives and avoiding eating out. In the Johnson *et al.* study, the main method of restricting salt in diet was by using spices other than salt followed by avoiding eating out and avoiding processed food. This difference may be because of the study region being a resettlement colony that consists of poor people who were relocated here from slums. In the Marakis *et al.* and Land *et al.* studies, the main approach taken to reduce salt intake was by avoiding processed food, which is the main source of sodium in their diet.[21,24] The restriction of salt while cooking food that is consumed in a larger proportion plays an important role in controlling their salt intake.

Indian cuisine varies from state to state. This study was done in Delhi, which is in north-India and the results reflect the same considering the staple diet here. In this study, we observed the major contribution to daily salt intake to be through the vegetable-based dishes (31%), pulse-based dishes (26%), and cereal-based dishes (23%). One study conducted in south-India by Ravi *et al.*, had major contribution by pulse-based dishes (30%)

followed by rice-based dishes (27%) and vegetable-based dishes (17%).[27] Similar to our study, pickles were not major contributors because of their consumption in small quantity. Hence, although diet pattern varies across India, major contribution to salt intake is through the salt added during preparation of food. It was also observed in our study that 95% of the sodium intake was through the salt added while cooking food at home. This reiterates the fact that discretionary salt is the primary source of salt in diet in this part of the world.[28]

A study by Nair *et al.*, conducted in west-India reported that significant contribution to sodium intake in men was from processed ready to eat foods, and among women was from cooking and table salt,[29] as seen in our study that had women, and the majority of them being homemakers.

The diet of our study population mainly consisted of home-cooked food. Food prepared at home contributed to major proportion (90%) of daily salt intake, whereas packed food (7%) and food prepared outside (3%) contributed to very small proportions. This is in congruence with the observation that women consume less fast food as compared with men.[30] These proportions make us understand that discretionary salt is the sole contributor to the excess salt intake in this population. Hence, any measure to reduce salt intake should focus on changing the discretionary salt use behavior in addition to avoiding food prepared outside or packed food in this population. Avoiding packaged food is important as most of the processed packaged food in India do not have higher potassium to sodium ratio, which is desirable for good health.[31] It is easier to control salt intake in this population considering that major contribution is from the discretionary salt use unlike in Australia and other countries where major contributors are processed food, which makes it challenging for them to control.[23]

HFSS foods were seen to contribute to only 4% of the daily salt intake. Although papads and pickle are rich in salt, because of the small quantity in which they are consumed their contribution to daily salt intake is minimal. Hence, pulse-, cereal-, and vegetable-based dishes are the major contributors. This finding is because of the large quantity in which they are consumed. Similarly, in the study by Fischer *et al.* in Canada, breads were found to be the major contributors of sodium, which was because of the large quantity consumed rather than a high concentration of sodium.[32] To reduce the salt intake of this population, we should focus on decreasing the discretionary salt use in addition to avoid the sodium-rich food items that are rarely consumed.

Health care providers need to keep themselves aware of the recommendations regarding salt intake and the availability of low-sodium salt substitutes and create awareness among the general population about the same. The consumption of traditional food should be promoted, however, the use of salt in them needs to be restricted. Dieticians should consider these findings while planning a diet at the individual level. Educating people about sodium labeling is also important as it is reported to cause a small reduction in daily salt intake.[33] There is a strong need to bring about behavioral change regarding salt use to control the salt or sodium intake.

The relationship between dietary sodium and hypertension is well-established. A family physician is the first, and many times, the only doctor who the patient consults during the course of her/his illness. Patients with hypertension need regular follow-up with their family physicians. Awareness regarding dietary sodium among hypertensives shall aid the family physician in tendering advice. Patients, who have already put into practice their knowledge in this regard, shall require less convincing from their doctor, who can put this time to better use. However, hypertensive patients who are unaware of this would need more persuasion from the family physician. Information on sources of sodium in the diet of the hypertensives shall aid the doctor in providing appropriate advice on nutrition. This would also apply if the family physician is following-up a patient with chronic kidney disease.

Strengths and limitations

It was a community-based study with a high response rate. As the study had only women participants of a certain age group, the results can not be generalized. Standard tool was used to assess the knowledge and behavior related to dietary salt. One 24-h dietary recall was taken, and hence, the day to day variability could not be captured. However, this study was done to assess dietary sources of sodium in the population. Hence, this result will be closer to the actual contribution by various food items. Standard recipes were used for dietary assessment.

Conclusion

Educating the population of all the harmful effects of high salt intake substituted with appropriate behavioral actions to be followed to achieve a reduction in salt intake is the need of the hour. These long-term interventions should be tailor-made for the population of interest. The restriction of salt use in the food items consumed in large proportion is the suitable method to reduce daily salt intake. To be able to achieve 25% reduction in premature mortality from cardiovascular diseases by 2025, 30% reduction in salt intake has to be achieved.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Patel S. Sodium balance-an integrated physiological model and novel approach. Saudi J Kidney Dis Transpl 2009;20:560.
2. Dahl LK. Possible role of salt intake in the development of essential hypertension. Int J Epidemiol 2005;34:967-72.
3. Powles J, Fahimi S, Micha R, Khatibzadeh S, Shi P, Ezzati M,

et al. Global, regional and national sodium intakes in 1990 and 2010: Asystematic analysis of 24 h urinary sodium excretion and dietary surveys worldwide. BMJ Open 2013;3:e003733.

4. Johnson C, Praveen D, Pope A, Raj TS, Pillai RN, Land MA, *et al.* Mean population salt consumption in India: A systematic review. J Hypertens 2017;35:3-9.
5. Aburto NJ, Ziolkovska A, Hooper L, Elliott P, Cappuccio FP, Meerpohl JJ. Effect of lower sodium intake on health: Systematic review and meta-analyses. BMJ 2013;346:f1326.
6. Malta D, Petersen KS, Johnson C, Trieu K, Rae S, Jefferson K, *et al.* High sodium intake increases blood pressure and risk of kidney disease. From the Science of Salt: A regularly updated systematic review of salt and health outcomes (August 2016 to March 2017). J Clin Hypertens (Greenwich) 2018;20:1654-65.
7. Saxena T, Ali AO, Saxena M. Pathophysiology of essential hypertension: An update. Expert Rev Cardiovasc Ther 2018;16:879-87.
8. Antonios, Tarek, and Graham A. MacGregor. Deleterious effects of salt intake other than effects on blood pressure. Clin Exp Pharmacol Physiol 1995;22:180-4.
9. He, MacGregor G. Effect of modest salt reduction on blood pressure: Ameta-analysis of randomized trials. Implications for public health. J Hum Hypertens 2002;16:761-70.
10. Mente A, O'Donnell M, Rangarajan S, McQueen M, Dagenais G, Wielgosz A, *et al.* Urinary sodium excretion, blood pressure, cardiovascular disease, and mortality: A community-level prospective epidemiological cohort study. Lancet 2018;392:496-506.
11. Basu S, Stuckler D, Vellakkal S, Ebrahim S. Dietary salt reduction and cardiovascular disease rates in India: A mathematical model. PLoSOne 2012;7:e44037.
12. WHO. Guideline: Sodium intake for adults and children. [cited 2018 Dec 03]. Available from: http://apps.who.int/iris/bitstream/10665/77985/1/9789241504836_eng.pdf?ua=1.
13. Beaglehole R, Bonita R, Horton R, Adams C, Alleyne G, Asaria P, *et al.* Priority actions for the non-communicable disease crisis. Lancet 2011;377:1438-47.
14. Bhargava M. Salt reduction strategy at population level. J Family Med Prim Care 2017;6:19-20.
15. Sarmugam R, Worsley A, Wang W. An examination of the mediating role of salt knowledge and beliefs on the relationship between socio-demographic factors and discretionary salt use: A cross-sectional study. Int J Behav Nutr Phys Act 2013;10:25.
16. Johnson C, Mohan S, Rogers K, Shivashankar R, Thout SR, Gupta P, *et al.* The association of knowledge and behaviours related to salt with 24-h urinary salt excretion in a population from North and South India. Nutrients 2017;9:144.
17. World Health Organization/Pan American Health Organization Regional Expert Group for Cardiovascular Disease Prevention through Population-wide Dietary Salt Reduction. Protocol for population level sodium determination in 24-hour urine samples; 2010 [cited 2018 Dec 03]. Available from: http://new.paho.org/hq/dmdocuments/2010/pahosaltprotocol.pdf.
18. World Health Organization. WHO STEPS Surveillance Manual: The WHO STEPwise Approach to Chronic Disease Risk Factor Surveillance. Geneva: WHO; 2005 [cited 2018 Dec 04]. Available from: http://www.who.int/chp/steps/instrument/STEPS_Instrument_V3.1.pdf?ua=1.
19. Tabassum DN, Lakshman DRL. An updated Kuppuswamy'ssocio-economic classification For 2017. Int J Health Sci 2017;5:3.
20. Garg V, Shivashankar R, Kondal D, Ghosh S, Khandelwal S, Gupta R, *et al.* Knowledge, attitudes and practices related to dietary salt intake among adults in North India. Public Health Nutr 2018:1-9.doi: 10.1017/S1368980018003518.
21. Land M-A, Webster J, Christoforou A, Johnson C, Trevena H, Hodgins F, *et al.* The association of knowledge, attitudes and behaviours related to salt with 24-hour urinary sodium excretion. Int J Behav Nutr Phys Act 2014;11:47.
22. Claro RM, Linders H, Ricardo CZ, Legetic B, Campbell NR. Consumer attitudes, knowledge, and behavior related to salt consumption in sentinel countries of the Americas. Rev Panam Salud Publica 2012;32:265-73.
23. Webster JL, Li N, Dunford EK, Nowson CA, Neal BC. Consumer awareness and self-reported behaviours related to salt consumption in Australia. Asia Pac J Clin Nutr 2010;19:550-4.
24. Marakis G, Tsigarida E, Mila S, Panagiotakos DB. Knowledge, attitudes and behaviour of Greek adults towards salt consumption: AHellenic Food Authority project. Public Health Nutr 2014;17:1877-93.
25. Grimes CA, Kelley S-J, Stanley S, Bolam B, Webster J, Khokhar D, *et al.* Knowledge, attitudes and behaviours related to dietary salt among adults in the state of Victoria, Australia 2015. BMC Public Health 2017;17:532.
26. Fathima KA, Bhargava M. Salt reduction and low-sodium salt substitutes: Awareness among health-care providers in Mangalore, Karnataka. Indian J Community Med 2018;43:266-9.
27. Ravi S, Bermudez OI, Harivanzan V, Kenneth Chui KH, Vasudevan P, Must A, *et al.* Sodium intake, blood pressure, and dietary sources of sodium in an adult south Indian population. Ann Glob Health 2016;82:234-42.
28. Brown IJ, Tzoulaki I, Candeias V, Elliott P. Salt intakes around the world: Implications for public health. Int J Epidemiol2009;38:791-813.
29. Nair S, Bandyopadhyay S. "Sodium intake pattern in West Indian population." Indian J Community Med 2018;43:67-71.
30. Su D, Zhou J, Jackson HL, Soliman GA, Huang TT-K, Yaroch AL. A sex-specific analysis of nutrition label use and health, Douglas county, Nebraska, 2013. Prev Chronic Dis 2015;12:150167.
31. Singh M, Chandorkar S. Is sodium and potassium content of commonly consumed processed packaged foods a cause of concern? Food Chem 2018;238:117-24.
32. Fischer PWF, Vigneault M, Huang R, Arvaniti K, Roach P. Sodium food sources in the Canadian diet. Appl Physiol Nutr Metab 2009;34:884-92.
33. Zhang D, Li Y, Wang G, Moran AE, Pagán JA. Nutrition label use and sodium intake in the U.S. Am J Prev Med 2017;53 (6 Suppl 2) S220-7.