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Association between behavioural, metabolic risk factors of non-communicable diseases and socio-demographic factors among Bihari population in Bangladesh

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ABSTRACT

Background: The Bihari community is an underprivileged group of people, immigrants from Pakistan during 1971 independence war, now living in Bangladesh. This community is considered as vulnerable for not having adequate health care facilities and access to health services. The current study is aimed to determine the association between behavioural, metabolic risk factors of non-communicable diseases (NCD) and socio-demographic factors among Bihari community in Bangladesh.

Methods: It was a community based cross-sectional study. Total 183 Bihari living in Geneva camp in Dhaka city have been included in the study by purposive sampling. An adopted WHO STEPS questionnaire was used for data collection. A semi structured questionnaire and standardized procedures were used to measure behavioural risk factors and physical characteristics. Data were analysed by using SPSS version 21.

Results: Among the respondents the mean age was 44.4 ± 13.2 years with 60.1% men. One-third (32.2%) were current tobacco user, almost all (99.5%) didn't take sufficient fruit and vegetables, 52.5% were added salt user, 76.0% didn't perform adequate physical activity but alcohol consumers were negligible (3.3%). More than half (54.6%) were overweight or obese, 33.9% had hypertension, 23.0% had hyperglycaemia and 50.3% had hyperlipidaemia. Sex, age, education, occupation and family income were significantly associated with these NCD risk factors.

Conclusions: To our best knowledge this is the first ever study that describes the NCD risk factors and its sociodemographic determinants among the Bihari population in Bangladesh.

Keywords: Non-communicable diseases, Risk factors, Bihari population, Bangladesh

INTRODUCTION

Non-communicable diseases (NCDs) are the most leading public health threat for the current world. The major NCDs are cardiovascular diseases, cancers, chronic respiratory diseases and diabetes. NCD is responsible for 71% of all global deaths every year and the low- and middle-income countries are suffering most which accounts over 85% of total premature deaths.¹

According to World Health Organization (WHO), Western Pacific Region, South-East Asia Region and European Region are the most vulnerable for NCD deaths.²

Among the identified risk factors of NCDs, the major behavioural risk factors are- tobacco use, harmful use of alcohol, unhealthy diet (insufficient fruit and vegetable intake), excessive dietary salt intake and inadequate

physical activity (PA) whereas the metabolic risk factors are overweight and obesity, hypertension (HTN), hyperglycaemia and hyperlipidaemia.¹ Vulnerable and socially disadvantaged people are at higher risk of getting sick and dying sooner from NCDs, especially due to greater risk of being exposed to harmful products (like tobacco), unhealthy dietary practices and limited access to health care services.¹ War, violence situations and prosecutions induced refugees or migrants, or most of the immigrant people are one of the vulnerable groups that usually belong to underprivileged social backgrounds and have higher rates of both mortality and morbidity from NCDs.^{3,4} Available studies conducted in United States (US), Europe and Arabian Gulf among the migrant Indians reported higher prevalence of NCDs and their risk factors than the native population.⁴⁻⁸ One literature's analysis has identified eight crucial health issues and lifestyle and diet-related health problems are one of them, however, prospective studies are a mandate to observe migrant health in a better way and also to develop intervention for immigrants' health maintenance.⁹

The targeted population of this study was Bihari, the Urdu speaking non-native Muslim community living in Bangladesh for more than four decades. 'Bihari', originally a Hindi word, literary means a person from Bihar state of India. In 1947, during the independence of Indian subcontinent from British colonial, the countries India and Pakistan (East Pakistan and West Pakistan) were created based on religious issue. Majority of Bihari Muslims migrated from India to East and West Pakistan. Later on, in 1971, during the independence war of Bangladesh (former East Pakistan) from Pakistan ruling, a large proportion of Binaries' could not get back to Pakistan therefore, became stranded. Now, this community is comprised of over 250,000 and have been living in 66 squalid camps with poor facilities scattered in several areas of Bangladesh. Although they are residing in 'refugee camps', the united nations high commissioner for refugees (UNHCR) does not recognize them as refugees. Therefore, they are deprived of the benefits and opportunities extended to the refugees by the UNCHR. As a consequence, the stranded binaries' in Bangladesh face multiple problems especially underprivileged socio-economic backgrounds.¹⁰

This community is considered as vulnerable for not having adequate health care facilities, access to health services and other fundamental rights. Studying on this population is important to know about the health-related situations that can be comparable to the general population as well as other minorities of the country. This step is essential to aware the policy planners and other health work force to pay attention on the health of immigrants and ethnic communities.

A recent study, conducted among Bihari population of Mirpur camp in Dhaka city, reported the prevalence of type-2 diabetes mellitus (DM), impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) were

estimated as 10.11%, 8.74% and 4.55% respectively along with 41% of smoker and 5% of alcohol consumers.¹¹ However, overall distribution of the NCD risk factors among this group and the knowledge about any association between behavioural, metabolic risk factors of non-communicable diseases and socio-demographic factors among the selected community in Bangladesh is still unknown.

It is important to generate the evidence to see how different their lifestyle is from the general population of Bangladesh and the risk factors that might leads to premature NCDs among this vulnerable people. Therefore, current study was conducted to explore all of the behavioural and metabolic risk factors of NCDs among the Bihari population living in Geneva Camp in Dhaka city in Bangladesh.

METHODS

It was a community based cross-sectional study conducted from December 2015 to December 2016. A purposive sampling of 183 Bihari people living in Geneva camp have been included in the study after taking voluntary written consent from each participant. We conducted data collection in a camp setting with in the selected population. We enrolled both men and women aged 30 years and above.

A semi-structured questionnaire was adopted from WHO STEPS Instruments (developed for assessing non-communicable disease risk factors) and that was pretested before final use. The questionnaire comprised of socio-demographic factors (sex, age, education, occupation and monthly family income), behavioural risk factors (tobacco use, alcohol consumption, insufficient fruit and vegetables intake, inadequate physical activity and added salt intake during meal) and metabolic risk factors (overweight and obesity, hypertension, hyperglycaemia and hyperlipidaemia).

Data were collected by face-to-face interview by well-trained research personnel. The respondents were asked about their socio-demographic factors and behavioural risk factors. Fruit and vegetables intake were assessed in serving size (1 standard serving = 80 grams of fruit and vegetable) using serving size show-card of WHO STEPS Instruments. Level of physical activity was assessed in total minutes for both moderate and vigorous types. Physical measurements (height, weight and blood pressure) were taken appropriately maintaining standard procedures. Blood (venous) samples were collected by trained phlebotomist for biochemical measurements (fasting blood glucose and fasting total cholesterol). Blood samples were collected and then transported to laboratory of Bangladesh Institute of Health Science (BIHS) by maintaining the cold chain following standard protocol. Blood pressure was measured two times in sitting position with Omron digital blood pressure machine by maintaining standard procedure. A 10-minute

of rest was maintained between two measurements. The average of two readings was taken as the final blood pressure following the NICE guidance for diagnosis of hypertension.¹²

Presences of risk factors among the respondents were defined following the guideline of WHO STEPS manual.¹³ Fruit and vegetables (FAVs) intake were defined as insufficient when it was <5 servings/day. Level of physical activity (PA) was defined as inadequate when it was <150 minutes of moderate-to-vigorous physical activity per week. Overweight and obesity was defined when body mass index (BMI) was ≥ 25.0 (measured as- dividing the weight in kg by height in meter²). Hypertension (HTN) was defined when systolic blood pressure (SBP) was ≥ 140 mm. of Hg. or diastolic blood pressure (DBP) was ≥ 90 mm. of Hg. or history of previously diagnosed HTN. Hyperglycaemia was defined when fasting blood glucose (FBG) was 100–125 mg/dl (5.6–6.9 mmol/l) and 2-h PG 140–199 mg/dl (7.8–11.0 mmol/l) according to American Diabetes Association. Hyperlipidaemia was defined when fasting total cholesterol (FTC) was ≥ 190 mg/dl or on medication for hyperlipidaemia.

The collected data were checked for competences, coded and cleaned and finally exported to Statistical package for social science (SPSS) software version-21 for analysis. Descriptive statistics was done to illustrate socio-demographic factors and risk factors among the respondents. Comparative statistics (Chi-square test) was done to illustrate the association between socio-demographic factors and risk factors. When there were p values <0.05 in Chi-square tests, these analyses were considered for further multivariate analyses (adjusted binary logistic regression). Determinants of risk factors among this population were considered when there were significant associations ($p<0.05$ at 95% confidence interval) in multivariate analyses.

RESULTS

Men respondents dominated women by 60.1%. The mean age of the respondents was 44.4 ± 13.2 years, and majority of them were below 50. Half of them (50.3%) were illiterate. Two in every five (40.4%) were involved in any job. Four in every nine (44.8%) had monthly family income less than 5,000 BDT (Table 1).

Current study explored that the behavioural and metabolic risk factors of NCDs are very common among the Bihari population. One-third of them (32.2%) was habituated to practice tobacco in any form, among which three-quarter were used to practice smokeless tobacco. Almost all (99.5%) were used to intake insufficient fruit and vegetables. Half (52.5%) were used to take added salt during their meal. Three-quarter (76.0%) didn't perform adequate level of physical activity. More than half (54.6%) were overweight or obese. One-third (33.9%) had hypertension. One-fourth (23.0%) had

hyperglycaemia. And, half of them (50.3%) had hyperlipidaemia. However, alcohol consumers were negligible (Table 2).

Table 1: Socio-demographic factors of Bihari community in Bangladesh (n=183).

Variables	Number	%
Sex		
Men	110	60.1
Women	73	39.9
Age (in years)		
Mean \pm SD=47.2 \pm 13.0		
Below 50	120	65.6
50 and above	63	34.4
Educational status		
Literate	91	49.7
Illiterate	92	50.3
Occupational status		
Employed	74	40.4
Unemployed (including housewives)	109	59.6
Monthly income (in BDT=Bangladesh taka), Median=6,000		
Up to 5,000	82	44.8
Above 5,000	101	55.2

Chi-square test found significant association ($p<0.05$) of behavioural and metabolic risk factors with the considered socio-demographic factors of the respondents in this study as shown below in Table 3. We tried to stratify the data according to sex (male, female), age groups (below 50 and 50 above), educational status (literate and illiterate), occupational status (employed and unemployed) and monthly income (less and above 5,000TK). Any kind of tobacco using is more among male than female but the difference is not significant ($p=0.143$), similarly there is no statistical difference regarding alcohol consumption, insufficient fruits and vegetable intake, inadequate physical activity, added salt intake, obesity, hypertension and hyperlipidaemia between male and female. However, in terms of hyperglycaemia women are having more hyperglycaemia (32.9%) and the difference is significant ($p=0.009$). In terms of age groups alcohol consumption, hypertension and hyperglycaemia is significantly different (p values 0.019, <0.001 and 0.002 respectively). In terms of literacy, salt intake, hypertension and hyperglycaemia are different among the groups (p values 0.046, 0.033 and 0.006) and risk factors are mostly higher among illiterate group. Similarly, in terms of occupational status use of tobacco and inadequate physical activity differs among employed and unemployed groups (p value 0.048, 0.004) respectively.

Binary logistic regression analysis (not shown in any table) found tobacco use was almost 2 times higher among the employed participants ($p=0.049$, OR 1.9, 95% CI 1.0-3.5); respondents having higher age (50 years and

above) were showing 10 times increased alcohol consumption ($p=0.035$, OR 10.3, 95% CI 1.2-89.9); illiteracy and low monthly family income (up to 5,000 BDT) reported 2-3 times higher extra salt uses during meal ($p=0.047$, OR 1.8, 95% CI 1.0-3.3; and $p=0.001$, OR 2.7, 95% CI 1.5-5.0 respectively); unemployed individual showed almost 3 time inadequate physical activity than employed group ($p=0.005$, OR 2.7, 95% CI 1.4-5.5); higher age (50 years and above) and hypertension was 3 times more among illiterate

respondents ($p=0.001$, OR 3.1, 95% CI 1.6-5.9; and $p=0.034$, OR 2.0, 95% CI 1.1-3.7 respectively); hyperglycaemia was more among women sex, higher age (50 years and above) and illiterate ($p=0.010$, OR 2.5, 95% CI 1.2-5.1; $p=0.002$, OR 3.1, 95% CI 1.5-6.2; and $p=0.007$, OR 2.8, 95% CI 1.3-5.8 respectively) respondents and hyperlipidaemia was found to be almost 3 times higher among comparatively higher monthly income families ($p=0.001$, OR 2.8, 95% CI 1.6-5.0).

Table 2: Behavioural and metabolic risk factors of non-communicable diseases among stranded Pakistani Bihari community in Bangladesh (n=183).

Variables	Number	%
Tobacco use (current)		
Yes	59	32.2
No	124	67.8
Types of tobacco use (n=59)		
Smoking tobacco	9	15.3
Smokeless tobacco	44	74.6
Both types	6	10.2
Alcohol intake (current)		
Yes	6	3.3
No	177	96.7
Insufficient FAVs intake (<5 servings/day)		
Mean\pmSD=1.8\pm0.9 servings		
Yes	182	99.5
No	1	0.5
Added salt use		
Yes	96	52.5
No	87	47.5
Inadequate PA (<150 minutes moderate-to-high intensity PA/week)		
Median=60 minutes		
Yes	139	76.0
No	44	24.0
Overweight and obesity (BMI\geq25.0)		
Mean\pm SD=27.5\pm19.3 BMI		
Yes	100	54.6
No	83	45.4
HTN (SBP \geq140 or DBP \geq90 mmHg or previously diagnosed HTN)		
Mean\pmSD=SBP 119\pm17 and DBP 75\pm10		
Yes	62	33.9
No	121	66.1
Hyperglycemia (FBG \geq6.1 mmol/l)		
Mean \pmSD= 5.8\pm2.8 FBG		
Yes	42	23.0
No	141	77.0
Hyperlipidemia (FTC \geq190 mg/dl or on medication for hyperlipidemia)		
Mean\pm SD= 194\pm44 mg/dl		
Yes	92	50.3
No	91	49.7

FAVs=Fruit and vegetables; SD=Standard deviation; PA=Physical activity; BMI=Body mass index; HTN=Hypertension; SBP=Systolic blood pressure; DBP= Diastolic blood pressure; FBG= Fasting blood glucose; FTC= Fasting total cholesterol.

Table 3: Relationship of behavioural and metabolic risk factors of noncommunicable diseases with socio-demographic factors among Bihari community in Bangladesh (n=183).

Socio-demographic variables	Tobacco use		Alcohol consumption		Insufficient FAVsI		Added salt intake		Inadequate PA		Overweight/obesity		Hypertension		Hyper-glycaemia		Hyper-lipidaemia	
	Yes N (%)	P value	Yes N (%)	P value	Yes N (%)	P value	Yes N (%)	P value	Yes N (%)	P value	Yes N (%)	P value	Yes N (%)	P value	Yes N (%)	P value	Yes N (%)	P value
Sex																		
Men	40 (36.4)	0.143	3 (2.7)	0.684	109 (99.1)	1	61 (55.5)	0.319	79 (71.8)	0.108	54 (49.1)	0.064	36 (32.7)	0.686	18 (16.4)	0.009*	54 (49.1)	0.695
Women	19 (26.0)		3 (4.1)		73 (100)		35 (47.9)		60 (82.2)		46 (63.0)		26 (35.6)		24 (32.9)		38 (52.1)	
Age (in years)																		
Below 50	33 (27.5)	0.058	1 (0.8)	0.019	120 (100)	0.344	68 (56.7)	0.116	92 (76.7)	0.756	62 (51.7)	0.264	30 (25.0)	<0.001*	19 (15.8)	0.002*	60 (50.0)	0.919
50 and above	26 (41.3)		5 (7.9)	*	62 (98.4)		28 (44.4)		47 (74.6)		38 (60.3)		32 (50.8)		23 (36.5)		32 (50.8)	
Educational status																		
Literate	25 (27.5)	0.17	1 (1.1)	0.211	91 (100)	1	41 (45.1)	0.046*	69 (75.8)	0.967	46 (50.5)	0.268	24 (26.4)	0.033*	13 (14.3)	0.006*	47 (51.6)	0.711
Illiterate	34 (37.0)		5 (5.4)		91 (98.9)		55 (59.8)		70 (76.1)		54 (58.7)		38 (41.3)		29 (31.5)		45 (48.9)	
Occupational status																		
Employed	30 (40.5)	0.048*	1 (1.4)	0.404	73 (98.6)	0.404	43 (58.1)	0.207	48 (64.9)	0.004*	36 (48.6)	0.179	21 (28.4)	0.195	15 (20.3)	0.477	36 (48.6)	0.717
Unemployed	29 (26.6)		5 (4.6)		109 (100)		53 (48.6)		91 (83.5)		64 (58.7)		41 (37.6)		27 (24.8)		56 (51.4)	
Monthly income (BDT)																		
Up to 5,000	24 (29.3)	0.438	2 (2.4)	0.693	81 (98.8)	1	54 (65.9)	0.001*	58 (70.7)	0.136	45 (54.9)	0.954	29 (35.4)	0.702	23 (28.0)	0.139	30 (36.6)	0.001*
Above 5,000	35 (34.7)		4 (4.0)		101 (100)		42 (41.6)		81 (80.2)		55 (54.5)		33 (32.7)		19 (18.8)		62 (61.4)	

Chi-square test and Fisher's Exact test were done when appropriate. FAVsI= Fruit and vegetables intake; PA= Physical activity; BDT= Bangladeshi Taka. Star (*) mark represents significant association.

DISCUSSION

Since stranded Bihari community in Bangladesh is underprivileged and not focused, the health-related data is extremely insufficient among them. Current study emphasized on NCD risk and explored the behavioural and metabolic risk factors of NCDs among Bihari community which wasn't covered adequately. The study revealed NCD risk factors were remarkable among the population. In this section, we tried to discuss the study findings regarding the evidence on NCD risk factors among general population and underprivileged population of Bangladesh for establishing a clear comparison among these groups and also with similar communities in South Asia context with available evidences.

Prevalence of overall tobacco use was found less among the Bihari population of this study than the available relevant studies in Bangladesh including two national surveys.^{11,13-15} Previous study among the Bihari's in Mirpur camp of Dhaka city reported noticeably higher proportion of smoking tobacco use alone.¹¹ The recent Global Adult Tobacco Survey reported almost constant finding for tobacco use with our study whereas data from WHO STEPS Survey and another study conducted to identify NCD risk factors among an underprivileged population in Dhaka reported noticeably higher prevalence of tobacco users.¹⁴⁻¹⁶ Moreover, another relevant study conducted among rural population of Bihar state of India using similar WHO Step wise approach reported higher prevalence of tobacco use than the current study.¹⁷ The possible reason of less prevalence of tobacco use in this study could be due to the under reporting about tobacco uses by the respondents. The alcohol consumption rate was negligible among this study population which is similar with the Bihari's of Mirpur and underprivileged population of Shanty town.^{11,15} We found the alcohol consumption rate is even noticeably less than the native Indian Bihari population.¹⁷ Low alcohol consumption scenario in Bangladesh is actually the reflection of the successful restriction on alcohol production, business and consumption whereas Bangladeshi society, culture, religion and law are playing a favourable role. Although insufficient fruit and vegetables intake behaviour is remarkably higher in previous studies in Bangladesh, however, it was found extremely higher in our study even compared to Indian Bihari population also.¹⁵⁻¹⁷ Added salt intake behaviour in meal among the current study population wasn't noticeably varied than the Bangladeshi general population as well as the underprivileged population.^{16,18}²⁰ Inadequate level of PA was noticeably higher among the selected population in contrast to the general population of this country reported in national survey report and underprivileged population of Bangladesh, and also the Indian Bihari population.¹⁵⁻¹⁷ The residents of the selected community lack adequate open space and also playground for physical exerting recreational activities. Along with the behavioural risk factors, all of the

metabolic risk factors have also been found a bit higher among the Bihari's in Bangladesh. Remarkably higher proportion of overweight (including obesity) and hypertension have been found among them compared to the population of national survey and underprivileged population of Bangladesh and as well as the Indian Bihari population.¹⁷ Moreover, the proportions of raised blood glucose as well as hyperlipidaemia have also been found noticeably higher among the selected Bihari population in contrast of underprivileged population of the country.¹⁶ However, all of the socio-demographic factors of the Bihari population played the key role to determine the risk factors.

It was a pilot study and the study weren't beyond few potential limitations. The study place was selected purposively, the sample size was low and the men-women ratio was disproportionate. Due to the cross-sectional design it could not describe the causal interference. There is a chance of missing some potential confounders while analysis, however, the potential strengths of the study were the assessment of all of the behavioural and metabolic risk factors of the population and biochemical measurements for assessing blood glucose by using gold standard marker (OGTT) and fasting total cholesterol.

To our best knowledge this is the first ever study to describe the NCD risk factors among the selected population. The findings of this study will be helpful to describe the vulnerability of developing NCDs in future among the selected Bihari population as well as other minorities in Bangladesh. We also recommend for conducting future studies in a large scale among this population for finding other gaps and supporting our study evidences where possible.

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REFERENCES

1. WHO NEWS. 2019. Available at: <http://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Accessed on 22 January 2019.
2. WHO. Global Status Report on non-communicable diseases 2014.
3. Pavli A, Maltezou H. Health problems of newly arrived migrants and refugees in Europe. *J Travel Med.* 2017;24:1-8.

4. Enas EA, Garg A, Davidson MA, Nair VM, Huet BA, Yusuf S. Coronary. Heart disease and its risk factors in first-generation immigrant Asian Indians to the United States of America. *Indian Heart J.* 1996;48:343-53.
5. Begam NS, Mini GK. Impact of migration on non-communicable disease risk factors: comparison of Gulf migrants and their non-migrant contemporaries in the district of origin in Kerala, India. *Austin J Public Health Epidemiol.* 2016;3:1038.
6. Patel JV, Vyas A, Cruickshank JK, Prabhakaran D, Hughes E, Reddy KS, et al. Impact of migration on coronary heart disease risk factors: comparison of Gujaratis in Britain and their contemporaries in villages of origin in India. *Atherosclerosis.* 2006;185:297-306.
7. Bhatnagar D, Anand IS, Durrington PN, Patel DJ, Wander GS, Mackness MI, et al. Coronary risk factors in people from the Indian subcontinent living in west London and their siblings in India. *Lancet.* 1995;345:405-9.
8. Keil JE, Britt RP, Weinrich MC, Hollis Y, Keil BW. Hypertension in Punjabi females: comparison between migrants to London and natives in India. *Hum Biol.* 1980;52:423-33.
9. Attanapola CT. Migration and Health: A literature review of the health of immigrant populations in Norway. Norwegian University of Science and Technology (NTNU). 2013.
10. World Directory of Minorities : South Asia. (Biharis of Bangladesh). Available at: <http://www.faqs.org/minorities/South-Asia/Biharis-of-Bangladesh.html>. Accessed on 22 January 2019.
11. Asaduzzaman M, Chowdhury S, Shahed JH, Kafi MAH, Uzzaman MN, Flown MT, et al. Prevalence of type 2 diabetes mellitus among urban Bihari communities in Dhaka, Bangladesh: a cross-sectional study in a minor ethnic group. *Cureus.* 2018;10(1):e2116.
12. Hypertension in adults: diagnosis and management. Available at: <https://www.nice.org.uk/guidance/cg127>. Accessed on 22 January 2019.
13. World Health Organization. Non-communicable diseases and their risk factors. WHO STEPS Surveillance Manual; 2017.
14. WHO. Global Adult Tobacco Survey: Fact sheet. Bangladesh, 2017. Available at: <http://www.who.int/tobacco/surveillance/survey/gats/fact-sheet-gats-bangladesh-2017.pdf>. Accessed on 22 January 2019.
15. Zaman MM, Bhuiyan MR, Karim MN, Moniruzzaman, Rahman MM, Akanda AW, et al. Clustering of non-communicable diseases risk factors in Bangladeshi adults: An analysis of STEPS survey 2013. *BMC Public Health.* 2015;15:659.
16. Khalequzzaman M, Chiang C, Choudhury SR, Yatsuya H, Al-Mamun MA, Al-Shoabi AAA, et al. Prevalence of non-communicable disease risk factors among poor shantytown residents in Dhaka, Bangladesh: a community-based cross-sectional survey. *BMJ Open.* 2017;7:e014710.
17. Kumar P, Singh CM, Agarwal N, Pandey S, Ranjan A, Singh GK. Prevalence of risk factors for noncommunicable disease in a rural area of Patna, Bihar- a WHO STEP wise approach. *Indian J Prev Soc Med.* 2013;44:46-53.
18. Mondal R, Sarker RC, Banik PC, Acharya NP, Sultana S, Madumita M, et al. Knowledge attitude and behavior towards dietary salt intake among Bangladeshi population. *SMU Med J.* 2017;4:170-8.
19. Zaman MM, Choudhury SR, Ahmed J, Khandaker RK, Rouf MA, Malik A. Salt intake in an adult population of Bangladesh. *Glob Heart.* 2017;12:265-6.
20. Sarker R, Mondal R, Roy DC, Acharya NP. Knowledge attitude and behaviours towards dietary salt in a selected slum population in Bangladesh. *Int J Perception in Public Health.* 2018;2(4):178-83.

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