

## Role of courtyard counselling meeting in improving household food safety knowledge and practices in Munshiganj district of Bangladesh

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### ABSTRACT

Unsafe food is linked to the deaths of an estimated two million people annually. Food containing harmful agents is responsible for more than 200 diseases ranging from diarrhoea to cancers. A one-sample pilot intervention study was conducted to evaluate the role of courtyard counselling meetings as the means of intervention for improving food safety knowledge and practices among household food handlers in a district of Bangladesh. The study was conducted in three phases: a baseline survey, the intervention and an end-line survey between April and November 2015 where 194 food handlers took part. Data were collected through observations and face-to-face interviews. The mean age of the respondents was 38.8 ( $\pm 12.4$ ) years, all of whom were females. Hand washing before eating, and washing utensils with soap were significantly improved at the end-line in comparison to the baseline (57% vs. 40% and 83% vs. 69%, respectively). Hand washing with soap was increased by 4%. The mean score of food handling practices was significantly increased after the intervention (20.5 vs. 22.1;  $P < 0.001$ ). However, hand washing after use of toilet was unchanged after the intervention (75% vs. 76%). Knowledge about safe food and the necessity of thorough cooking were significantly increased after the intervention (88% from 64% and 34% from 21%, respectively). Mean scores of knowledge and practice on food safety were significantly increased by 1.9 and 1.6, respectively after the one month intervention. Thus this food safety education in rural communities should be scaled up and, indeed, strengthened using the courtyard counselling meetings in Bangladesh.

**Key Words:** food safety knowledge, food safety practices, household food handler, courtyard counselling meeting, Bangladesh

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Received: June 13, 2016; accepted: August 17, 2016

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## INTRODUCTION

Food safety is defined by the Food and Agriculture Organization (FAO)/World Health Organization (WHO) as the assurance that food when consumed in the usual manner does not cause harm to human health and well being. Unsafe food is linked to the deaths of an estimated two million people annually - including many children in the world.<sup>1)</sup> Food containing harmful bacteria, viruses, parasites or chemical substances is responsible for more than 200 diseases ranging from diarrhoea to cancers. Various epidemiological data indicate that a substantial proportion of food-borne disease is attributable to improper food preparation practices in consumers' homes. However, most of the food-borne disease is preventable with proper food handling following the WHO's five keys to safer food: i) keep clean; ii) separate raw and cooked; iii) cook thoroughly; iv) keep food at safe temperatures; and v) use safe water and raw materials.<sup>2)</sup> Key actions based on five keys can be taken into practice within existing programs to reduce household-level food borne illness in developing countries.<sup>3)</sup> So the consumers have an important role to play in preventing food-borne disease through improved knowledge, attitudes and practices.

Food safety and hygiene practices are multi-factorial. Some studies have noted that knowledge of food handling is significantly related with food handling practices,<sup>4,6)</sup> whereas a study in India and Bangladesh indicated that food hygiene practices was related to the educational status of food handlers.<sup>7,8)</sup> Temperature, solid waste storage and disposal, sanitary condition and hand washing facilities of the food and drink establishment were found in some studies to be associated with food handling practices.<sup>1,4)</sup>

Food-borne diseases are common in developing countries, including Bangladesh, because of the prevailing poor food handling and sanitation practices, a lack of knowledge of food safety, traditional beliefs, inadequate food safety laws, weak regulatory mechanisms, and a lack of health education for food handlers. The knowledge of food handlers about food safety practices is important to prevent the outbreaks of food borne infection.<sup>9)</sup> In Bangladesh, unsafe food causes a major threat to public health. Like other developing countries, millions of its citizens suffer from bouts of illness following the consumption of unsafe food. Studies conducted in Bangladesh reported that hand washing can reduce the incidence of diarrhoea in intervention areas.<sup>9,10)</sup> However, no study has been conducted to know the comprehensive picture of knowledge and practices about food safety among household food handlers in Bangladesh.

In the second objective of the national nutrition policy 2015, the Government of Bangladesh prioritized the availability of adequate, diversified and quality safe food and the promotion of healthy feeding practices. A food safety program of FAO is being implemented in Bangladesh with the aim of contributing to an efficient and well functioning food safety control system that leads to improved public health. A key output of this program is enhanced public awareness and education on food safety and consumers' health. FAO selected Munshiganj district as a pilot area for a comprehensive package of food safety information, education and motivation/promotion of safe food practices. To carry out these activities, an information, education and communication (IEC) material package (2 leaflets, 1 flip chart and 2 posters) was developed in Bengali and to be used to create consumer awareness in general, and women in particular. These materials are mainly based on the WHO's 5-keys to safer food, which are globally accepted and promoted.

Many health-related messages, for instance on family planning and the expanded program on immunization in Bangladesh have been disseminated successfully among community people through courtyard counselling meetings (CCMs). In Bangladesh, the CCM model was begun in 1978 by the family planning program.<sup>11)</sup> A CCM is a small gathering of rural people, especially women, at a designated place, usually taking place in someone's house in a village. Generally 6-8 CCMs in a month are conducted jointly by a health assistant (HA) and a family welfare

assistant (FWA) in their catchment area to pass on important messages about health and family planning to bring about positive changes, particularly among rural women. Food safety issues should also be integrated into community level counselling to reduce food borne diseases. To improve the food safety related knowledge and practice of household food handlers, use of the CCM model was thought to be an ideal platform for interventions.

Therefore, we aimed to assess the significance of CCMs as a method of intervention in improving food safety related knowledge and practice among household food handlers in the FAO pilot district Munshiganj, Bangladesh.

## MATERIALS AND METHODS

A one-sample pilot intervention study was conducted in Louhajong sub-district (upazila) of Munshiganj district between April and November of 2015. The study was undertaken in three phases: a baseline survey, the intervention through CCMs and an end-line survey. Two hundred households were randomly selected from the lists of government holding numbers of Louhajong upazila for the study. But six household heads did not allow data collectors to stay inside their house for 5 hours observation. Finally, 194 household food handlers participated in all three phases of the study.

Before collecting baseline data, a semi-structured questionnaire, an observation checklist and a CCM monitoring checklist were developed through a 4-day long workshop consisting of the investigators, FAO officials and experts on food safety from other organizations. All these research instruments were derived from WHO's 5-keys to safer food and its ten golden rules for safe food preparation.<sup>2)</sup> These were edited, translated into Bengali and finalized for adoption in our study. The questionnaire was used to assess food safety knowledge and the observation checklists were used to investigate the status of food safety practices and contained information about hand washing practice, kitchen cleanliness, food preparation methods, cooking and reheating techniques, food storage, household water, fuel and food supplies, and garbage disposal, amongst other practices. The research instruments were pre-tested before the commencement of data collection.

Before the baseline survey, 8 qualified data collectors and 2 supervisors from the residents of the study area were appointed. A 2-day hands-on training course on the use of the questionnaire and checklists, the household observation process, monitoring of data collection and the etiquette to be followed with respondents was conducted for the data collectors and supervisors. A further 2-day training course was also conducted for the data collection team before the end-line survey.

### *Baseline data collection*

Baseline data were collected through physical observation and face-to-face interviews with the household food handlers, using the observation checklists and questionnaire, respectively. Each data collector visited 25 selected households on 25 separate days with the help of government field workers. Data collectors physically observed and recorded data about household food preparation, food handling and personal hygiene practices, cooking processes and food storage practices. The duration of observation period was five hours from 9.00 am to 2.00 pm. These are culturally acceptable times for visitors and the usual time for preparing and cooking family meals. Following the observation, food handlers were interviewed to check their food safety knowledge. Field supervisors supervised the whole data collection process regularly. Quality control of data was ensured by the investigators through unannounced field visits, and re-checking and cross-interviewing 4% of selected households within 24 hours of data collection.

### *Interventions and monitoring*

To improve the food safety related knowledge and practice of the selected household food handlers CCM was applied as the means of intervention. Before conducting CCM two orientation workshops of 1-day were arranged at study area. The study team along with FAO personnel conducted the workshops in collaboration with district and upazila level health and family planning authorities. All the government frontline workers in the upazila participated in the workshops, especially the HAs and FWAs who are usually responsible for conducting CCMs at village level to talk on different health issues. The monitoring team, consisting of 10 members who were different to data collectors, also attended the workshops.

Participants were taught, in detail, about food safety and good practices using the WHO's 5-keys to safer food and the 10 golden rules for safer food preparation. The benefits of food safety and good hygiene practices and the consequences of not following such practices were also discussed in detail at the workshop. The IEC materials were subsequently distributed among the participants. The workshop then focused on the use of the IEC materials and how to teach the community household members effectively about food safety and hygiene practices.

After the workshops, the HAs and FWAs were instructed to include the food safety messages in their regular teaching activities targeting the community women in the CCMs. The study team ensured that these new messages reached the selected food handlers in the sample households, so that the results of the invention could be evaluated by the end-line survey. The HAs and FWAs conducted CCMs at the household level. Louhajong upazila has 10 unions and in each union, 6 CCMs were conducted by the field workers. Therefore, a total of 60 CCMs were performed in the one month of the intervention in the whole upazila. Members of the monitoring team attended all 60 CCMs to ensure that the HAs and FWAs actually had discussions with the community women about food handling and hygiene practices and the risk of food-borne illness. Dissemination of five keys to safer food messages using the IEC materials was ensured by the monitoring team. The presence of the selected household food handlers in the CCMs was also confirmed. IEC materials were distributed among the participants at each CCM.

The study investigators regularly monitored the CCMs to ensure that the health workers disseminated the information and IEC materials regarding food safety and hygiene practices according to the proper procedures, as instructed during the training workshops.

### *End-line survey*

Following the one month intervention through the CCMs, the household food handlers were allowed one further month to adopt the correct food safety and hygiene practices. Then a repeat survey was undertaken to assess the household food safety practices and knowledge. This followed the same procedure as for the baseline survey, and visited the same households. The data collectors attended a refresher 2 day training course before collecting the end-line data.

### *Data management*

Data cleaning and entry were done by the professional data management team and re-checked by the researchers. Statistical Package for Social Science (SPSS) v. 21 was used to analyze the data. Descriptive statistics were used for presentation of data. The McNemar test was used to see the differences between baseline and end-line distributions. Paired t-tests were used to compare mean scores of knowledge and practice before and after the intervention. Knowledge scores and practice scores were calculated by giving "1" for a correct answer and "0" for incorrect answer to each item. The total knowledge score and total practice score were computed for each participant. Adequate knowledge and good practices were defined as correctly answering  $\geq 60\%$  of knowledge items (24 out of 40 points) and practice items (23 out of 37 points), respectively.

A two tailed *P*-value of less than 0.05 was considered as statistically significant.

### *Ethical consideration*

The study was approved by FAO-Bangladesh and ethical clearance was taken from the Ethical Review Committee, of the National Institute of Preventive and Social Medicine. Permission was taken from Munshiganj district and Louhajong upazila health and family planning authorities to conduct this study in their locality. All respondents gave their written consent before providing information, both in baseline and end-line surveys. They were assured that the information provided by them would be kept confidential and used only for research purposes.

## RESULTS

### *Socio-economic characteristics*

A total of 194 household food handlers responded during the baseline and end-line surveys. All food handlers were females and housewives. Their mean age was 38.8 ( $\pm 12.4$ ) years and a quarter of food handlers had no education. The stated professions of the majority of household heads (40%) were business and for more than one-third (38%) of households, the monthly family income ranged from Bangladeshi Taka (BDT) 5,000 – 10,000. The socio-economic characteristics are shown in Table 1.

### *Food safety practices*

Table 2 describes the food safety practices by the respondents. Regarding WHO's first key to safer food, it was observed that after the intervention hand washing practice was significantly improved before eating, after handling meat/fish/vegetable, and after cooking (57% vs. 40%, 67% vs. 49%, and 73% vs. 62%, respectively). However, no change was observed after the intervention in hand washing practice after using the toilet (75% vs. 76%). Although the practice of drying hands after washing by using clean cloths significantly improved after the intervention (43% vs. 35%,  $p = 0.014$ ), some bad practices, for instance drying hands using dirty cloths was also increased significantly (8% from 4%,  $p = 0.039$ ). Washing utensils with soap was significantly improved at the end-line assessment in comparison to the baseline (83% from 69%,  $p < 0.001$ ). There were significant improvements after the intervention in the practices of 'kitchen cleanliness', 'keeping kitchen waste in a dust box' and 'discarding waste from yard' by 11%, 16% and 9%, respectively. Fig. 1 shows that hand washing with soap was increased by 4% in end-line (66% from 62%).

Regarding the second key to safer food, it was noted in both baseline and end-line surveys that most of the food handlers kept raw fish/meat separate from vegetables and raw food from cooked and no significant change was observed after the intervention. Only 17% of food handlers used a separate knife for cutting raw meat/fish and vegetables before the intervention, however the percentage more than doubled (35%) after the intervention, and this change was statistically significant ( $p < 0.001$ ).

Regarding the third key, nearly all of the respondents used appropriate heat for cooking during both baseline and end-line surveys (97% and 99%, respectively). But the practice of 'proper reheating of food before re-serve' did not show an expected increase after the intervention (49% from 45%). From the point of the fourth key, most of the households preserved food in refrigerators at appropriate temperatures before and after intervention with some minor improvement noted in the end-line survey (98% from 94%).

Regarding the fifth key, it was observed from the baseline survey that 74% used tube-well

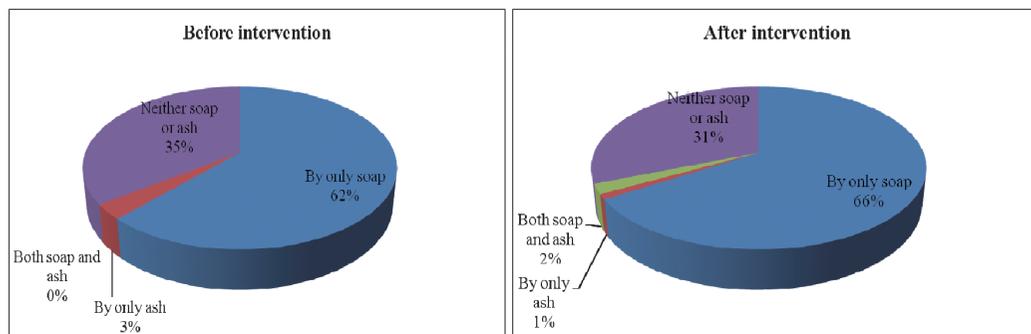
**Table 1** Socio-economic characteristics of food handlers and head of households

Variable	Frequency (n)	Percent (%)	Mean ( $\pm$ SD)
Age (years) of food handlers			38.8 ( $\pm$ 12.4)
< 30	48	25	
30–39	53	27	
40–49	51	26	
$\geq$ 50	42	22	
Education of food handlers (education in year)			5.0 ( $\pm$ 4.1)
No education (0 yr education)	48	25	
Primary (1–5 yrs education)	61	31	
Secondary (6–10 yrs education)	73	38	
Higher Sec. & above (>10 yrs education)	12	6	
Age of household head (in years)			47.9 ( $\pm$ 14.4)
< 30	17	9	
30–39	33	17	
40–49	53	27	
$\geq$ 50	91	46	
Education of household head (education in year)			5.3 ( $\pm$ 4.4)
No education (0 yr education)	53	27	
Primary (1–5 yrs education)	62	32	
Secondary (6–10 yrs education)	59	30	
Higher Sec. & above (>10 yrs education)	20	10	
Profession of household head			
Farmer	35	18	
Service Holder	34	18	
Business	77	40	
Others	46	24	
Monthly family income (BDT)			
< 5000	30	16	
5000–10000	74	38	
10001–15000	41	21	
15001–20000	18	9	
> 20000	31	16	
Number of family members			5.5 ( $\pm$ 2.1)

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**Table 2** Food safety practices by the household cook

Variable	Before intervention n (%)	After intervention n (%)	P-value
Washing hands (n=194)			
Hand wash before eating	77 (40)	110 (57)	<0.001
After toilet use	147 (76)	145 (75)	0.868
After handling meat/fish/vegetable	96 (49)	131 (67)	<0.001
After cooking food	120 (62)	141 (73)	0.008
After sneezing	4 (2)	5 (3)	1.000
Drying hands after wash (n=194)			
By body clothes	91 (47)	85 (44)	0.488
By clean clothes	68 (35)	83 (43)	0.014
By unclean clothes	7 (4)	15 (8)	0.039
By dried air	21 (11)	19 (10)	0.791
Cleaning utensils (n=194)			
By soap and water	134 (69)	160 (83)	<0.001
By flowing water	86 (44)	93 (48)	0.167
By stored water	34 (18)	25 (13)	0.093
By pond/river water	48 (25)	36 (19)	0.017
Utensils dried by clean clothes	47 (24)	32 (17)	0.014
Cleanliness of kitchen and waste disposal			
Clean kitchen	122/193 (63)	142/193 (74)	0.002
Kitchen waste kept in a dust box	94/194 (49)	126/194 (65)	<0.001
Waste discarded from yard	139/192 (72)	156/192 (81)	0.001
Presence of insect on food /in kitchen	78/194 (40)	84/194 (43)	0.461
Keeping raw and cooked food separate			
Raw food and cooked food kept separate	159/162 (98)	160/162 (99)	1.000
Raw meat/fish and vegetables kept separate	153/155 (99)	152/155 (98)	1.000
Use separate knife for cutting raw meat/ fish and vegetables	27/164 (17)	58/164 (35)	<0.001
Wash knife after cutting raw fish/meat/ vegetables	155/161 (96)	158/161 (98)	0.453
Use of refrigerator			
Keep fish/meat and vegetables separate in the refrigerator	124/128 (97)	127/128 (99)	0.250
Keep raw food and cooked food in separate box	126/127 (99)	127/127 (100)	-
Maintain appropriate freezing temperature (in freezer compartment)	120/128 (94)	125/128 (98)	0.125
Set temperature <50c (in refrigerator compartment)	111/127 (87)	119/127 (94)	0.057
Heating and reheating of food			
Proper heating of food	189/194 (97)	193/194 (99)	0.219
Eating within 2 hours of preparing food	132/184 (72)	160/184 (87)	<0.001
Proper reheating of food before re-serve	36/80 (45)	39/80 (49)	0.629
Food serving and taking (n=194)			
Cleaning of spoon and dishes before meal	183 (94)	186 (96)	0.508
Covering food to protect from insect/ flies	181 (93)	187 (96)	0.070
Wash hands by soap before meal (each family members)	62 (32)	101 (52)	<0.001
Serving food by hands	43 (22)	33 (17)	0.108
Presence of animals at the place of eating	51 (26)	71 (37)	0.002
Washing raw fruits and vegetables			
Washing raw fruits and vegetables before eating	129/161 (80)	109/161 (68)	<0.001
Cleaning vegetables and fruits before cooking	152/188 (81)	166/188 (88)	<0.001
Washing onion/garlic/chili before cutting	177/193 (92)	192/193 (99)	<0.001
Washing vegetables and fruits by safe water	160/192 (83)	169/192 (88)	0.049



**Fig. 1** Mode of hand washing before and after intervention

water, 24% used pond water and 2% used supply water for cooking and for washing fish, meat and vegetables. Whereas, 80% used tube-well water, 18% used pond water and 2% used supply water for the same purpose after the intervention.

#### *Food safety knowledge*

Table 3 depicts the knowledge of the respondents on food safety. Most of the respondents during baseline and end-line surveys (94% and 97%, respectively) thought that polluted/unsafe food led to diarrhoea. There was a 9% increase from the baseline to the end-line surveys (77% vs. 86%) in the perception that chemically contaminated food caused damage to health. In the baseline survey, 33% respondents thought that the reasons for washing hands with soap before preparing and eating food were to eliminate pathogens and prevent diarrhea. This rate showed a significant rise to 46% after the intervention. Before the intervention, 45% thought raw food spoils cooked food, and 25% thought raw food spread pathogens to cooked food, however after the intervention there was a significant improvement in this knowledge (60% and 43%, respectively). A significant rise was also found in the necessity of cooking food thoroughly. After the intervention more than one-third (34%) of respondents thought that cooking food thoroughly made food safer, while it was only 21% before the intervention. Our baseline data also showed that among the respondents, 78% thought washing raw vegetables and fruits with safe water cleaned raw vegetables and fruits, 22% thought it disinfects, 20% thought it dispelled chemicals whereas, in the end-line it was 77%, 30%, and 22%, respectively.

Mean scores of both knowledge and practice on food safety were increased significantly by 1.9 and 1.6, respectively after the intervention (Table 4).

About 55% of the respondents had adequate knowledge about safe food, according to the baseline survey, while after the intervention the percentage increased to 70%, which was statistically significant. The study also showed a significant increase in good practice regarding food safety from 30% at baseline to 47% after intervention (Table 5).

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**Table 3** Knowledge regarding food safety

Variables	Before intervention n (%)	After intervention n (%)	P-value
Know about following matters			
Diarrhea caused by unhygienic food	183/194 (94)	189/194 (97)	0.031
Unhealthy food sold at roadside hotel or Footpath	173/193 (90)	183/193 (95)	0.002
Low quality food sold at market	154/194 (79)	174/194 (90)	<0.001
Arsenic contaminated water	160/194 (83)	171/194 (88)	0.001
Food adulteration by sellers	153/194 (79)	176/194 (91)	<0.001
Chemicals mixed with food	149/194 (77)	166/194 (86)	0.001
Formalin mixed with food	137/192 (72)	155/192 (81)	<0.001
Spraying insecticides on food	132/193 (68)	140/193 (73)	0.185
Bird/avian flu	107/194 (55)	130/194 (67)	<0.001
Anthrax	83/193 (43)	97/193 (50)	0.007
Reasons of hand wash with soap before preparing and eating food (n=194)			
Clean hands	144 (74)	147 (76)	0.711
Eliminate pathogens and prevent diarrhea	65 (33)	90 (46)	<0.001
Only remove dirt	43 (22)	34 (18)	0.122
Purpose of separating cooked food from uncooked raw food (n=194)			
Raw food spoils cooked food if kept together	88 (45)	116 (60)	<0.001
Pathogen spreads from uncooked to cooked food	48 (25)	83 (43)	<0.001
Why food should be cooked properly			
Becomes tasty and delicious	121/194 (62)	117/194 (60)	0.618
Becomes safe	40/194 (21)	65/189 (34)	0.002
Kills pathogens and prevent diarrhea	26/194 (13)	52/194 (27)	<0.001
Family likes to eat warm food	19/194 (10)	15/194 (8)	0.523
Why fruits/vegetables should be washed with safe water before cutting/eating (n=194)			
Remove dirt and becomes clean	152 (78)	150 (77)	0.851
Kills pathogen	42 (22)	58 (30)	0.011
Can help to remove chemicals	38 (20)	42 (22)	0.503
Symptoms for waterborne diseases (n=194)			
Diarrhea	129 (67)	129 (67)	1.000
Abdominal pain	88 (44)	71 (37)	0.019
Burning	22 (11)	42 (22)	0.001
Vomiting	39 (20)	44 (23)	0.405
Anorexia	30 (16)	19 (10)	0.035
Headache/fever	7 (4)	8 (4)	1.000

**Table 4** Mean of knowledge and practices on food safety

Mean knowledge and practice	Before intervention Mean ( $\pm$ SD)	After intervention Mean ( $\pm$ SD)	Mean difference	P-value
Mean knowledge	23.7 (5.7)	25.6 (5.3)	1.9	<0.001
Mean practice	20.5 (3.4)	22.1 (3.9)	1.6	<0.001

**Table 5** Distribution of knowledge and practice among food handlers on food safety

Variables	Before intervention n (%)	After intervention n (%)	P-value
Knowledge			
Adequate knowledge	107 (55)	135 (70)	<0.001
Inadequate knowledge	87 (45)	59 (30)	
Practice			
Good practice	59 (30)	91 (47)	<0.001
Poor practice	135 (70)	103 (53)	

Adequate knowledge and good practices were defined as correctly answering  $\geq 60\%$  of knowledge items (scoring 24 out of 40 points) and practice items (scoring 23 out of 37 points), respectively.

## DISCUSSION

Many health programs in Bangladesh, for instance the expanded program on immunization, have been running successfully with the use of CCMs as the means of intervention. The current study has justified the use of CCMs as the modality for educating rural household food handlers on food safety practices and knowledge by the existing government health and family planning field workers. In Louhajang upazila, both food safety knowledge and practices among household food handlers showed statistically significant improvements after the intervention.

The mean knowledge and practice scores among studied food handlers on food safety were found to increase significantly after the intervention by 1.9 and 1.6, respectively. The number of respondents with adequate knowledge showed a significant increase of 15% after the intervention and respondents demonstrating good practices also increased significantly by 17%. This finding is similar to the studies in Malaysia,<sup>6,12,13</sup> where health education and training on food safety were used as the intervention. We found improved food safety practices after intervention through CCM. It was shown that 41% food handlers had good practices after the intervention as against 30% before the intervention and that this increment was statistically significant, which was congruent with a quasi experimental study conducted in Nigeria where good practices were found 98.5% after two training sessions consisting of lectures and practical demonstrations on proper food safety practices based on WHO's five keys to safer food against 51.5% before training.<sup>15</sup> It was also demonstrated same findings in Malaysian studies,<sup>6,12,13</sup> Iran<sup>15</sup> and Turkey.<sup>16</sup> The mean practice score increased from  $20.5 \pm 3.4$  to  $22.1 \pm 3.9$ , which was similar to the trend found in the studies conducted in Nigeria ( $32.7 \pm 3.2$  to  $44.5 \pm 3.8$ ) and Iran ( $43.9 \pm 7.6$  to  $46.1 \pm 8.0$ ).<sup>14,15</sup> This increase might be due to clear, concise and pictorial messages about food safety in the IEC materials, which were used in the CCMs. However, a study conducted in Korea<sup>17</sup> could not find significant improvement after interventions on food safety through training. It was postulated that the training provided was too short (30 minutes) and not goal oriented.

It is well established that hands can transmit diseases.<sup>18</sup> Our study documented that hand washing with soap increased only by 4% after the intervention using the CCM. This small improvement was most probably because of a single exposure to a CCM. Our monitoring team reported that some CCMs were not organized according to micro-planning of health workers. This might be due to increase in their field of works and inadequate supervision.

Hand washing before preparing food and before eating, and washing utensils with soap were significantly improved at end-line in comparison to baseline (57% vs. 40%, 52% vs. 32% and 83% vs. 69%, respectively), which is consistent with the trend found in Nigeria<sup>14</sup> where hand

washing in different situation was improved at post intervention.

With food safety knowledge after intervention, we found that the mean knowledge score on food safety was significantly improved by 1.9 than that of before intervention, which is in line with the Iranian study where the mean knowledge increased by 3.2 scores after intervention.<sup>15)</sup> Although the similar trend with us the study conducted in Korea showed a significant increase with a high score (17.3) in the knowledge of the intervention group.<sup>17)</sup> Several other studies<sup>19,20)</sup> reported the considerable increase of knowledge after training on food safety. On the other hand, other studies observed that there was no or insignificant change in knowledge score after training on food safety.<sup>21-23)</sup>

Health education through CCMs played an important role in improving knowledge. Although the intervention time was only one month and each food preparer only received the intervention once, the overall improvement in food safety knowledge and practices found statistically significant. There are several other studies that have justified the need for educating consumers on proper food handling.<sup>17,24)</sup>

Our study should be read with some limitations. It was a one-sample intervention study without a homogenous control group. In addition, some food safety practices, such as hand washing with soap after using toilet, after blowing nose were not always possible to verify physically or those events happened before or after the specific time period that the data collectors observed. However, the strength of our study included use of separate teams for data collection and for monitoring CCM, which might help avert information bias.

In conclusion, improvements were observed in food safety knowledge and practices among the food handlers. The role of CCM was found positive in improving household food safety knowledge and practices. Therefore it is strongly recommended that this food safety education in rural communities should be continued through CCM. Alternatively, the government could appoint new health workers under the Ministry of Health and Family Welfare to conduct this education.

## ACKNOWLEDGEMENTS

We express our heartiest gratitude to Louhajong upazila health and family planning authorities for their kind cooperation. We are also thankful to Food Safety Programme of FAO-UN for financial support to this project.

## COMPETING INTERESTS

The authors declare that they have no competing interests.

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