

# Survey of Food-hygiene Practices at Home and Childhood Diarrhoea in Hanoi, Viet Nam

Kumiko Takanashi<sup>1,2</sup>, Yuko Chonan<sup>1</sup>, Dao To Quyen<sup>3</sup>, Nguyen Cong Khan<sup>3</sup>,  
Krishna C. Poudel<sup>1</sup>, and Masamine Jimba<sup>1</sup>

<sup>1</sup>Department of Community and Global Health, Graduate School of Medicine, University of Tokyo, Japan, <sup>2</sup>International Life Sciences Institute Japan Center for Health Promotion, Japan, and <sup>3</sup>National Institute of Nutrition, Hanoi, Viet Nam

## ABSTRACT

A cross-sectional study was conducted to investigate the potential factors of food-hygiene practices of mothers on the prevalence of diarrhoea among their children. Mothers who had children aged 6 months–5 years were recruited in a hamlet in Viet Nam. The food-hygiene practices included hand-washing, method of washing utensils, separation of utensils for raw and cooked food, and the location where foods were prepared for cooking. A face-to-face interview was conducted, and data on 206 mothers were analyzed. The risk of diarrhoea was significantly higher among children whose mothers prepared food for cooking somewhere other than the table (typically on the ground) compared to children whose mothers prepared food on the table (adjusted odds ratio=2.85, 95% confidence interval 1.11-7.28). The results indicate that food-hygiene practices of mothers, such as avoiding preparing food for cooking on the ground, has a potential impact in preventing diarrhoea among children in Viet Nam.

**Key words:** Cross-sectional studies; Diarrhoea; Diarrhoea, Infantile; Food handling; Hygiene; Knowledge, attitudes, and practice; Viet Nam

## INTRODUCTION

The prevention of diarrhoea remains one of the major public-health problems in developing countries. Approximately 1.5 billion episodes of diarrhoea are reported every year in developing countries, and this figure has remained more or less constant over the last 20 years (1). An estimated 2.5 million people die due to diarrhoea each year, and the majority are children aged less than five years in developing countries (2).

The prevalence of diarrhoea among children aged less than five years is also a concern in Viet Nam. Diarrhoea morbidity among this age-group in Viet Nam was 11.3% in 2000 (3). The estimated annual number of children who died due to diarrhoea was 7,900 (4). Furthermore, diarrhoea can cause mal-

nutrition, leading to impaired physical growth and cognitive development (5,6). Therefore, prevention of diarrhoea is as important as its treatment.

Inadequate food hygiene is considered to be one of the major contributors to diarrhoea. Up to 70% of diarrhoea episodes in developing countries are regarded as food-borne (7-9). Weaning food given to children in West Africa (10-11), Bangladesh (12), and Peru (13) contains substantial amounts of bacteria.

The level of food contamination is related to the storage of foods at high ambient temperature (12), for long periods of time (10,11,14), and in the rainy season (10,15). Unclean utensils were also considered a source of food contamination (9,16,17).

Furthermore, previous studies have shown that several food-hygiene factors are associated with diarrhoea among children. For example, results of a prospective cohort study in Turkey showed that infants whose houses did not have a kitchen were more likely to suffer from diarrhoea (18). Similarly, children in Nigeria who lived in households with a private kitchen had lower incidence rates of diarrhoea than those whose households had no such kitchens (19). Results of a case-control study in Bra-

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Correspondence and reprint requests should be addressed to:

Dr. Masamine Jimba  
Department of Community and Global Health  
Graduate School of Medicine  
University of Tokyo  
7-3-1 Hongo, Bunkyo-ku  
Tokyo 113-0033, Japan  
Tel: 81 3 5841 3698  
Email: mjimba@m.u-tokyo.ac.jp  
Fax: 81 3 5841 3422

zil showed that owners of refrigerators were more likely to have a lower rate of diarrhoea among children (20). The hand-washing practice of mothers before food preparation was also associated with a lower risk of diarrhoea among children (21-23). The prevalence of diarrhoea among children was significantly higher in families where mothers less often washed their hands before feeding children in a case-control study in Viet Nam (24). For children's practices, eating food that had been placed on the floor was significantly associated with persistent diarrhoea in a case-control study in Myanmar (25). The cleanliness of kitchen-floor was significantly associated with the prevalence of diarrhoea among children in Nicaragua (21).

Although the World Health Organization (WHO) outlined basic principles for the preparation of safe food for infants and young children (7), little has been reported on the effect of food-hygiene practices of mothers on diarrhoea among children in community settings (26,27). Therefore, more data should be collected to describe the potential factors of food-hygiene practices of mothers on diarrhoea among children in Viet Nam. The data will be useful to develop guidelines fit for local setting and to encourage mothers to change their practices for preventing diarrhoea among children.

The objective of this study was to investigate the potential factors of food-hygiene practices of mothers in the home on the prevalence of diarrhoea among their children in a community in Hanoi, Viet Nam.

## MATERIALS AND METHODS

### Study site

The study was conducted in Huynh Cung village, Tam Hiep commune, Thanh Tri district, Hanoi city, Viet Nam. Thanh Tri district is categorized as one of five sub-urban districts of 14 districts of Hanoi city and located in the low-lying Red Delta region, with an average elevation of 3-4 metres. Its main products are rice, flowers, and vegetables. The average annual income per household was about US\$ 400 in 2004 (28). This commune consists of three hamlets. One of them—the Huynh Cung hamlet—had a population of about 3,900 in 2006.

### Water supply and sanitation at the study site

The water-treatment facility (WTF) has been distributing water to the Huynh Cung hamlet but it has not succeeded in removing iron, arsenic, and ammonium from the water supply (29). Further-

more, contamination by coliforms and *Clostridium perfringens* was also detected (29). A municipal sewage system does not exist in this hamlet.

### Participants

The study team recruited all mothers with children aged 6 months–5 years in the target area. This criterion was used since children aged less than five years were considered to be more affected by unhygienic water condition. Children younger than six months were excluded as most of them were breastfed and had less exposure to drinking-water. In total, 298 children were selected in the hamlet, using the register of the hamlet. In cases where more than two children in the selected age-group belonged to one household, the youngest child was targeted in this study. The three collaborators (non-salaried, volunteer health workers) of the commune health station took informed consent from the targeted mothers before data collection, and all the 298 mothers agreed to participate in the survey.

During the three-day survey period, however, only 235 mothers came to the commune health station and registered to participate in the survey. The common reasons of absence were: forgetting the survey date, having other work, and waiting too long to register. Furthermore, 14 other caretakers, such as grandmothers and fathers who came to the survey, instead of mothers, were excluded. Of the registered 235 mothers, 213 (90.6%) were interviewed because they had registered with more than two children in one household, or they left without receiving the interview. Seven additional mothers were excluded for minor reasons (e.g. on the interview day, age of their children was found to be more than 5 years). The remaining 206 mothers were included in data analysis.

### Data collection

Data were collected as part of a baseline survey in a project for improving water and nutrition in northern Viet Nam from 2001 to 2008. The project has been implemented by the National Institute of Nutrition (NIN), the International Life Sciences Institute Japan Center for Health Promotion (ILSI Japan CHP), and the Japan International Cooperation Agency (JICA).

A structured questionnaire, used for conducting interviews, consisted of four sections: (a) general information, (b) nutrition and health, (c) food hygiene, and (d) water management in the household, with total 113 items. The questionnaire was

prepared mainly based on a similar survey (30) and the guidelines set by the WHO (7) and the Viet Nam government authority (31). The questionnaire was also developed based on information from staff members of the commune health station, the leader of the hamlet, the leader of the commune, and two group discussions: one with 10 mothers and another with 10 men living in the hamlet.

Several food-hygiene practices of mothers were measured. Such practices included hand-washing before food preparation, washing-method of utensils, such as cups, bowls, and spoons, separation of utensils, such as cutting boards or knives for raw or cooked food, and the location where food was prepared for cooking. We also recorded the episodes of childhood diarrhoea). Childhood diarrhoea was defined as the percentage of children who experienced watery stool more than three times per day in the past two weeks before the survey (32,33).

A pre-test was conducted with 25 participants in December 2005 in two different hamlets of the Tam Hiep commune. Additional modification was made based on the results of the pre-test. The questionnaire was originally developed in English. A Vietnamese staff member working at the NIN translated the English questionnaire into Vietnamese. Another professional translator did back-translation to confirm the meaning.

Trained eight interviewers from the NIN conducted a face-to-face interview with the mothers at the commune health station from 15 to 17 January 2006. Each interview took 20-30 minutes.

The study received an ethical approval from the Institutional Review Board of the University of Tokyo. The NIN also approved the study and gave ethical clearance.

### Analysis of data

The Epi Info software (version 2000) was used for data input and the SPSS software (version 12.0J) (SPSS, Japan Inc., Tokyo) for data analysis. First, we described the prevalence of childhood diarrhoea and the food-hygiene practices. Then, we performed bivariate analysis to examine the relationships between the food-hygiene practices of mothers and the prevalence of childhood diarrhoea. Finally, multiple logistic regression analysis was performed to adjust for the confounding factors to examine a relationship between the food-hygiene practices and the prevalence of diarrhoea among children. The diarrhoea-prevalence variable was adjusted for confounding factors, such as age of child,

gender, education of mother, hand-washing by the child with soap after toilet, hand-washing by the child with soap before eating, hand-washing by the mother with soap after toilet, and hand-washing by the mother with soap before feeding. We adjusted these variables as they were associated with childhood diarrhoea in previous studies (9,20,22-25,34-38). In this study, possession of a refrigerator was also considered to reflect the economical status of household; therefore, we also included this variable in the model. We reported the odds ratio (OR) of diarrhoea among children and 95% confidence interval (CI).

## RESULTS

### Characteristics of children and their mothers

The mean age of 206 children was 27.7 (standard deviation [SD]=15.0) months: 71.3% were aged 6 months–2 years. In all, 115 (55.8%) were male (Table 1). The number of first-born or second-born children was 199 (96.6%). All children had started receiving some additional food or drink other than breastmilk before the survey period. Overall, 46 (22.7%) children had diarrhoea at least once in the past two weeks before the interview (Table 1). The mean age of the mothers was 30.5 (SD=4.8) years. Regarding the education of mothers, 200 (98.0%) attended at least secondary school (grade 6-9), and 129 (63.2%) attended at least high school (grade 10-12) (Table 1). Overall, 68 (34.5%) mothers worked as farmers. Twenty-nine (14.7%) mothers were housewives. For the question “who takes care of the child most frequently?”, 168 (76.4%) answered ‘mother’, and 38 (17.3%) answered ‘grandmother’. The mean number of family members was  $4.6 \pm SD=1.5$ . 63.1% had refrigerators.

### Status of sanitation, water management, and hand-washing

Table 2 shows the condition of sanitation, water management, hand-washing practices, and food-hygiene practices. In terms of sanitation, nearly all (205 of 206) households had a private toilet, and of these, 159 (77.6%) had a water-flush toilet. The water-flush toilet has an underground tank and is flushed by pouring in a bucket of water. Forty-one (20%) had the sewage-tank of single/double vault latrine, which is located on the ground, and faeces are used as fertilizer for agriculture. Five (2.4%) used biogas vault latrine or septic tank. As for water management, the households in the hamlet used several water sources, such as water from water-treatment facility, private wells, rainwater for drink-

**Table 1.** Characteristics of children and their mothers

Characteristics	No.	%*
<b>Children</b>		
Age (years)		
0	31	15.0
1	67	32.5
2	49	23.8
3	31	15.0
4	28	13.6
Gender		
Male	115	55.8
Female	91	44.2
Diarrhoea experience during 2 weeks before survey†		
Experienced	46	22.7
Not experienced	157	77.3
<b>Mothers</b>		
Education‡		
Primary school/secondary school	75	36.8
High school/college/university	129	63.2
Occupation¶		
Farmer/housework	97	49.2
Others (worker, teacher, etc)	100	50.8
Possession of refrigerator		
No	76	36.9
Yes	130	63.1

\*Sum of individual proportions may not add up to 100% due to rounding; †Participants who did not answer this question (n=3) were excluded from the analysis; ‡Participants who did not answer this question (n=2) were excluded from the analysis; ¶Participants who did not answer this question (n=9) were excluded from the analysis

ing purpose but 204 (99.0%) boiled water before drinking.

Finally, analysis of hand-washing practice of children revealed that 36.8% of the 182 mothers reported that hands of children were always washed with soap after using the toilet, and 29.7% of the 192 mothers reported that hands of children were always washed with soap before eating. Two hundred six mothers (59.2%) always washed their hands with soap after using the toilet, and 206 (43.2%) mothers always washed their hands with

soap before feeding.

### Status of food-hygiene practices

Table 2 shows that 206 (30.1%) mothers always washed their hands with soap before preparation of foods. For washing utensils, 205 (86.8%) mothers always washed utensils by water with soap. Eighty-seven (42.4%) of the 205 mothers did not separate utensils for raw or cooked food, and 58 (28.2%) mothers did not always prepare foods for cooking on the table. Of the 58 mothers, 52 (89.7%) prepared foods for cooking always on the ground, and five (8.6%) prepared foods for cooking sometimes on the ground.

### Association of diarrhoea with age of children

The prevalence of diarrhoea was 32.3% (n=31) among children aged less than one year, and it was 31.3% (n=67) among children aged one year. On the other hand, the prevalence of diarrhoea was 16.7% (n=48) among children aged two years. It was 13.8% (n=29) among children aged three years and 10.7% (n=28) among children aged four years. Its prevalence was significantly higher among children aged less than two years than among children aged 2-4 years (odds ratio [OR]=2.78, 95% (confidence interval [CI] 1.39-5.55) (Table 3).

### Association between diarrhoea and food-hygiene practices

Table 3 shows that the two variables, which showed significant associations with the prevalence of diarrhoea and food-hygiene practices, were: separation of utensils for raw and cooked food and the place of preparing foods for cooking in a bivariate analysis. The risk of diarrhoea was significantly higher among children whose mothers did not separate utensils for raw and cooked food compared to children whose mothers did separate the utensils (OR=2.03, 95% CI 1.04-3.94). The risk of diarrhoea was also significantly higher among children whose mothers did not prepare foods for cooking on the table compared to children whose mothers did prepare foods for cooking on the table (OR=2.50, 95% CI 1.25-4.97). For only the place of preparing foods for cooking, the odds ratios were even higher after adjustment for confounders (OR=2.85, 95% CI 1.11-7.28) (Table 4).

Washing of utensils and the hand-washing practice before preparation of foods did not show any significant association with the prevalence of diarrhoea among children.

**Table 2.** Conditions of sanitation, water, hand-washing, and food-hygiene behaviour

Onsite condition	No.	%
<b>Sanitation</b>		
Private toilet/latrine ownership		
No	1	0.5
Yes	205	99.5
Type of toilet (among owners of a private toilet)		
Water-flush toilet	159	77.6
Single/double vault latrine	41	20.0
Others (biogas vault latrine, septic tank)	5	2.4
<b>Water</b>		
Water boiled before drinking		
Not always	2	1.0
Always	204	99.0
<b>Hand-washing</b>		
Hand-washing with soap after toilet (children's hands)*		
Not always water with soap	115	63.2
Always water with soap	67	36.8
Hand-washing with soap before eating (children's hands)†		
Not always water with soap	135	70.3
Always water with soap	57	29.7
Hand-washing with soap after toilet (mothers)		
Not always water with soap	84	40.8
Always water with soap	122	59.2
Hand-washing with soap before feeding (mothers)		
Not always water with soap	117	56.8
Always water with soap	89	43.2
<b>Food-hygiene behaviour</b>		
Hand-washing with soap before food preparation		
Not always water with soap	144	69.9
Always water with soap	62	30.1
Washing utensils‡		
Not always water with soap	27	13.2
Always water with soap	178	86.8
Separating utensils for raw and cooked food‡		
No	87	42.4
Yes	118	57.6
Place of preparing foods for cooking		
Not always on the table	58	28.2
Always on the table	148	71.8

\*Participants who did not answer this question (n=24) were excluded from analysis; †Participants who did not answer this question (n=14) were excluded from analysis; ‡One participant who did not answer this question was excluded from analysis

## DISCUSSION

The results of this study suggest that food-hygiene practices of mothers might have an important impact on the prevalence of diarrhoea among children. The risk of diarrhoea was higher among chil-

dren whose mothers did not separate utensils for raw and cooked food and whose mothers prepared food on the ground rather than on the table. Children aged less than two years were more vulnerable to suffer from diarrhoea than children aged 2-4 years. The association with the prevalence of



**Table 3.** Association of the prevalence of diarrhoea among children with characteristics of participants, hand-washing, and food-hygiene behaviour

Associated factor	Total (n=203)*	Diarrhoea			
		Cases		OR	95% CI
		No.	%		
<b>Characteristics of children</b>					
Age (months)					
6-23	98	31	31.6	2.78	1.39-5.55
24-59	105	15	14.3	1.00	
Gender					
Male	113	31	27.4	1.89	0.95-3.77
Female	90	15	16.7	1.00	
<b>Characteristics of mothers</b>					
Education <sup>†</sup>					
Primary school/secondary school	74	21	28.4	1.62	0.83-3.15
High school/college/university	127	25	19.7	1.00	
Possession of refrigerator					
No	75	20	26.7	1.43	0.73-2.79
Yes	128	26	20.3	1.00	
<b>Hand-washing</b>					
Hand-washing with soap after toilet (children's hands) <sup>‡</sup>					
Not always water with soap	112	25	22.3	1.19	0.56-2.53
Always water with soap	67	13	19.4	1.00	
Hand-washing with soap before eating (children's hands) <sup>¶</sup>					
Not always water with soap	133	27	20.3	0.70	0.34-1.44
Always water with soap	56	15	26.8	1.00	
Hand-washing with soap after toilet (mothers)					
Not always water with soap	82	16	19.5	0.74	0.37-1.46
Always water with soap	121	30	24.8	1.00	
Hand-washing with soap before feeding (mothers)					
Not always water with soap	115	24	20.9	0.79	0.41-1.53
Always water with soap	88	22	25.0	1.00	
<b>Food-hygiene behaviours</b>					
Hand-washing with soap before food preparation					
Not always water with soap	142	31	21.8	0.86	0.42-1.74
Always water with soap	61	15	24.6	1.00	
Washing utensils <sup>§</sup>					
Not always water with soap	23	8	34.8	2.05	0.81-5.19
Always water with soap	179	37	20.7	1.00	
Separating utensils for raw and cooked food <sup>§</sup>					
No	87	26	29.9	2.03	1.04-3.94
Yes	115	20	17.4	1.00	
Place of preparing foods for cooking					
Not always on table	57	20	35.1	2.50	1.25-4.97
Always on table	146	26	17.8	1.00	

\*Participants who did not answer the question about diarrhoea (n=3) were excluded from analysis; <sup>†</sup>Participants who did not answer this question (n=2) were excluded from analysis; <sup>‡</sup>Participants who did not answer this question (n=24) were excluded from analysis; <sup>¶</sup>Participants who did not answer this question (n=14) were excluded from analysis; <sup>§</sup>One participant who did not answer this question was excluded from analysis; CI=Confidence Interval; OR=Odds ratio

**Table 4.** Odds ratios for diarrhoea adjusted for confounding factors

Potential risk factor	Diarrhoea	
	AOR*	95% CI
Characteristics of children		
Age (months)		
6-23	1.87	0.78-4.48
24-59	1.00	
Gender		
Male	2.40	0.95-6.07
Female	1.00	
Characteristics of mothers		
Education		
Primary school/secondary school	2.10	0.91-4.88
High school/college/university	1.00	
Possession of refrigerator		
No	1.49	0.63-3.54
Yes	1.00	
Hand-washing		
Hand-washing with soap after toilet (children's hands)		
Not always water with soap	2.42	0.69-8.52
Always water with soap	1.00	
Hand-washing with soap before eating (children's hands)		
Not always water with soap	0.50	0.13-1.88
Always water with soap	1.00	
Hand-washing with soap after toilet (mothers)		
Not always water with soap	0.33	0.11-1.04
Always water with soap	1.00	
Hand-washing with soap before feeding (mothers)		
Not always water with soap	1.38	0.34-5.61
Always water with soap	1.00	
Food-hygiene behaviours		
Hand-washing with soap before food preparation		
Not always water with soap	0.56	0.14-2.21
Always water with soap	1.00	
Washing utensils		
Not always water with soap	2.69	0.79-9.20
Always water with soap	1.00	
Separating utensils for raw and cooked food		
No	2.33	0.95-5.71
Yes	1.00	
Place of preparing foods for cooking		
Not always on table	2.85	1.11-7.28
Always on table	1.00	

\*Age of children, gender, education of mothers, possession of refrigerator, hand-washing of children with soap after toilet, hand-washing by children before eating, hand-washing by mothers with soap after toilet, and hand-washing by mothers with soap before feeding; AOR=Adjusted odds ratios; CI=Confidence interval

diarrhoea could indicate that the food prepared on the ground was contaminated, and the grounds or the floors are the important routes of transmission of diarrhoea pathogens (39).

Conversely, it could suggest the importance of creating barriers to preventing the spread of pathogens from the ground or floors to food. Besides, we have to note that the preparation of food on the ground may per se not be the primary risk factor of diarrhoea among children. However, the findings of the study will be useful for mothers to guide what kind of measures they can take to minimize the risk of potential contamination of food in relation to diarrhoea. The practice of preparing foods on the ground is a common and traditional custom in Viet Nam. However, this custom may increase the possibility of food contamination and could cause diarrhoea in children in Vietnamese households. Our study introduced that cooking on the table is one of the preventive factors in controlling diarrhoea in Viet Nam. Similar practices may be common in many developing countries; therefore, the effort should be made together with thorough cooking and immediate feeding in clean conditions.

The hand-washing practices of the mothers or children were not statistically associated with the prevalence of childhood diarrhoea. In this study, grandmothers most frequently cared about 17% of the children, and it is possible that the hand-washing practice of grandmothers was different from the practice of our participants. Moreover, we relied on self-report; it is possible that social desirability bias might have influenced the response of our participants on their hand-washing practices.

This study has some limitations. First, although measures were piloted, self-report of hygiene practices are potentially subject to inaccuracy in recall or social desirability bias (40). Therefore, we need further detailed investigation, including household observation. Second, food-hygiene practices include more practices than this study defined. This study missed some important food-hygiene practices, such as food storage and assuring that food is cooked thoroughly at adequately high temperature (41). Further studies are needed to more comprehensively examine the effects of food-hygiene practices on diarrhoea. Third, at the study site, nearly everyone had a toilet, and we found adequate water management (e.g. high rate of boiling water-use). This characteristic may not be typical of other developing countries with high prevalence of diarrhoea among children. However, boiling water was not clearly defined in terms of the time and the temperature.

In conclusion, the results of this study suggest that food-hygiene practices of mothers in the home had a potential impact on the prevention of diarrhoea. The improvement of food-hygiene practices of mothers could be an effective strategy to prevent diarrhoea among children. Further investigation and evaluation studies are needed to document other means of improving food hygiene to prevent diarrhoea in different cultural settings.

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