

Food safety knowledge and practices of food handlers of various food service establishments of urban Vadodara, India

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ABSTRACT

Survey was conducted on 260 food handlers of 9 different categories of Food Service Establishments FSEs. Semi-structured, precoded questionnaires were used as a tool for eliciting data. Most food handlers were literate with at least primary or higher secondary education. Almost 58% of them earned Rs. <2000 per month. Only a few of them were trained in the job. Better educated and young food handlers were more willing to take training if provided a chance. Most handlers wore clean and fresh clothes everyday, had trimmed nails. However, only few handlers used hand gloves, headgear and apron while cooking/serving and removed rings/bangles/wrist watches before starting work. Most of the handlers reported of washing hands before starting days' work and after using toilet. Personal hygiene and food handling practices of handlers were found to be poor irrespective of their education and wages. Most of the food handlers could not reply when asked about carriers/sources for spreading various food borne diseases. In conclusion, the lack of knowledge of food handlers in food hygiene and sanitation can pose a high risk for the consumers eating in different FSEs.

Key words : Food safety, Knowledge, Personal hygiene, Food handlers, Food establishments, Food handling practices.

Food borne disease has an enormous public health impact, as well as significant social and economic consequences. As described by Linton *et al.* (1998), there are many food handling errors that can cause food borne illness in food retail establishments including poor personal hygiene and cross contamination. Research has also described failure to avoid unsafe foods, neglect of cleaning and sanitation, improperly trained staff and unaware consumers as other threats to food safety (Herrmann and Warland, 2000, Medeiros *et al.*, 2001, Stivers and Gates, 2000). Several factors are known to cause food borne outbreaks. Most often they are preventable with knowledge and care on part of the food handlers. Of the various etiological factors, the food handlers who may harbor the pathogens play a very important role in transmission of food borne diseases. These pathogens may be introduced into foods during production, processing, distribution and preparation. Food handlers may introduce biological hazards when suffering from specified disease, through organisms on the skin, respiratory tract, their intestine and faeces and by cross contamination after handling raw materials. Wearing jewelry, such as bangles, rings, watches, bandages etc., all introduce physical hazards.

Roday *et al.* (1999) stated that food handlers who are ill informed, poorly trained and who do not practice good personal hygiene can be responsible for food contamination. Another study on the knowledge and

attitude of the food handling personnel showed that they had little knowledge regarding the pathogens that cause food borne diseases and the correct temperature for the storage of hot or cold ready-to-eat foods. Most of the personnel had positive attitudes, but disparity between attitude and practice was noted (Askarian *et al.*, 2004). Undoubtedly, adequate personal hygiene practices are essential in reducing the risk of a food borne illness outbreak. Hand washing is one of the most effective and cheapest measures against infection and food borne diseases. It was reported that 31% of the food borne illness in Washington from 1990 to 1999 was because of inadequate hand washing practices of the food handlers (Washington State, Department of Health, 2000). Therefore, inadequate hand washing by food handler is an important contributing factor to food borne diseases outbreak. A survey of retail food service establishments showed that only 52% of the food handlers could describe the hand washing procedure outlined in Minnesota Food Code (Allwood *et al.*, 2004).

It has been noted that unhygienic practices like coughing, sneezing in food preparation area, wearing dirty clothes and caps, spitting and chewing tobacco, pan, etc. all may introduce a variety of microorganisms in food (Kudu and Mishra, 2003). Food samples collected from cafeterias and restaurants yielded strains of enterogenic Staphylococci (Soriano *et al.*, 2002). Illnesses caused by contaminated food are a leading public health problem

and an important cause of reduced economic productivity, suffering and ultimately death in the developing countries.

Research on knowledge and behaviours of food service workers in institutional settings, restaurants and retail food stores is surprisingly limited, but this is a major area of concern for a number of reasons. These include rapid turnover of employees and the difficulties it poses in terms of training, and the fact that food safety mistakes in large scale feeding operations can have major ramifications. In the present study Food safety knowledge, Attitude and Practice of 260 food handlers of nine different categories of Food Service Establishments (FSEs) were assessed.

METHODOLOGY.

The survey was carried out in urban Vadodara (Gujarat). The city was divided into five zones – North, East, West, South and Central – with due consideration of equal distribution of area (sq. km) in each zone. A list of areas falling in each of the five zones was prepared. Random selection technique was followed in which areas falling in each zone were listed down and were randomly selected using lottery system for survey of food handlers of different FSEs (as per the given specifications – 4 vendors, 2 Restaurants (small, medium), 2 Fast Food Joints (FFJs), 2 roadside Dhaba, 2 Railway food Butlets, 2 Bus stand food outlets, 2 Sweet meat Shops (SMS) and 2 Food traders). From each vendor, food retailer and SMS two food handlers were surveyed. Three food handlers were surveyed from each FSEs. Since Bus stand, Railway food outlet and Dhaba were not available in all the zones, they were surveyed from the areas where they were found. A total of 260 food handlers were surveyed. Semi-structured, precoded questionnaires were used as a tool for eliciting data. Pre-testing was done by administering the questionnaire to 10% of the sample size. The responses of those were excluded from the study. Their suggestions were noted and necessary changes were incorporated to form the final questionnaire.

The questionnaires used to elicit data on handlers working in different FSEs contained sections/questions to gather specific information on the following aspects:

- Background information of the food handlers.
- Fringe benefits and training related information about food handlers.
- Personal habits and food handling practices of food handlers.
- Knowledge of food handlers about carrier of diseases.

Data were analyzed using Microsoft Excel, 2000. Descriptive statistics (proportion and means) were

conducted. Chi square test was used to test the differences in proportion (Rao and Richard, 1996). p-values smaller than 0.05 and/or 0.01 were considered statistically significant.

RESULTS AND DISCUSSION

Most of the food handlers (94%) surveyed were below the age of 45 years. Some food handlers (25%) were engaged in various activities such as serving and cleaning and others (39%) were working as cooks and assistant cooks. Most handlers were literate with at least primary (31.5%) or higher secondary education (49.6%). Only a few of them (14.2%) were illiterate and a very few of them (4.2%) were graduates. Food handlers of traders and SMS were found to be better educated as compared to handlers of restaurant (small) and street food vendors but this difference was not found to be statistically significant. Many of the cleaners (31.15%) were illiterate. Cooks, salesman and handlers working at cash counter were better educated than cleaners and waiters (Table 1). Association between educational level of food handlers and different work profile was found to be statistically significant ($p < 0.01$).

About 58% of the food handlers earned Rs. 1000-2000 per month. Some of them (28%) earned Rs. 2000-3000 per month whereas few (10%) even earned Rs. >3000. Type of FSE did not have any association with the wages earned by the food handlers (Table 2). Many food handlers (23.33%) working in restaurants earned as high as Rs. >3000 per month whereas none of the bus stand food handlers and very few of dhaba and railway food handlers earned wages above Rs. 3000.

Wages of food handlers on the basis of work profile can be seen from Table 3. Cooks were found to be earning better than other handlers. Most of the waiters and cleaners earned Rs. 1000-2000 per month. Difference in wages of handlers with different work profile was found to be statistically significant ($p < 0.01$). Also statistically significant difference was found in educational level of food handlers and wages earned by them ($p < 0.05$). Better educated handlers earned higher as compared to illiterates. Most handlers had a work experience of less than 5 years (39.2%) and other had an experience of 5-10 years (26.9%) or 10-20 years (27.7%). Food handlers with more experience were earning better than inexperienced or less experienced handlers ($p < 0.05$). Most handlers (41.18%) with <5 years of experience earned Rs. <1500 per month. Very few handlers with <5 years of experience (6.86%) earned Rs. >3000/month as compared to handlers with an experience of 15-20 years (22.73%) and >20 years (12.50%).

Table 1: Educational level of food handlers of different FSEs and work profile

	Education			Chi square
	Illiterate n (%)	Upto Primary n (%)	Higher secondary and above n (%)	
FSEs				
Street food vendors	7 (17.50)	17 (42.50)	16 (40.00)	18.6 ^{NS}
Restaurant (small)	7 (23.33)	11 (36.67)	12 (40.00)	
Restaurant (medium)	4 (13.33)	9 (30.00)	17 (56.67)	
Fast Food Joints	4 (13.33)	9 (30.00)	17 (56.67)	
Dhaba	5 (16.67)	6 (20.00)	19 (63.33)	
Railway food outlet	3 (10.00)	12 (40.00)	15 (50.00)	
Bus stand food outlet	6 (20.00)	8 (26.67)	16 (53.33)	
Food trader and SMS	1 (2.50)	9 (22.50)	30 (75.00)	
Work profile				
Cook	2 (4.26)	15 (31.91)	30 (63.83)	34.93 ^{**}
Assistant Cook	6 (11.76)	20 (39.22)	25 (49.02)	
Waiter	8 (12.12)	15 (22.73)	43 (65.15)	
Cleaner	19 (31.15)	24 (39.34)	18 (29.51)	
Salesman and Cash counter	2 (5.71)	7 (20.00)	26 (74.29)	

N.S. – Non-significant ** indicate significance of value at P<0.01

Table 2 : Food handlers of different FSEs on the basis of their wages

FSEs	Monthly income (Rs.)					Chi square
	<1500 n (%)	1500-2000 n (%)	2000-2500n (%)	2500-3000n (%)	>3000n (%)	
Street food vendors	12 (30.00)	14 (35.00)	3 (7.50)	6 (15.00)	5 (12.50)	37.78 ^{NS}
Restaurant (small)	13 (43.33)	8 (26.67)	1 (3.33)	5 (16.67)	3 (10.00)	
Restaurant (medium)	8 (26.67)	7 (23.33)	6 (20.00)	2 (6.67)	7 (23.33)	
Fast Food Joints	5 (16.67)	10 (33.33)	6 (20.00)	6 (20.00)	3 (10.00)	
Dhaba	13 (43.33)	11 (36.67)	2 (6.67)	3 (10.00)	1 (3.33)	
Railway/bus stand food outlet	17 (28.33)	23 (38.33)	14 (23.33)	5 (8.33)	1 (1.67)	
Food trader	6 (30.00)	7 (35.00)	1 (5.00)	3 (15.00)	3 (15.00)	
SMS	4 (20.00)	5 (25.00)	4 (20.00)	5 (25.00)	2 (10.00)	

N.S. = Non-significant

Most food handlers (80%) were getting fringe benefits such as food at their place of work. Many of them (61.5%) had worked at other FSE before joining the present job. When training related questions were asked, many handlers (82.3%) reported that none of them received any formal training but some of them were trained in the job (17.7%). Some food handlers (27.3%) wanted to go for training if provided a chance as around 25% of them thought that they can do better job after training and will get better wages. The duration of training preferred by them was between 1-6 months and most of them preferred to take training in culinary aspects (20%) and some of them were willing to learn restaurant management (6.20%), stewardship (2.60%), customer service (4.60%) and cleaning (1.90%). Poor handling practices are influenced by a large number of demographic factors including age, gender, race, education and income (Beletshachew *et al.*, 2000, Klontz *et al.*,

1995).

Young cooks are receiving less training in food preparation than previous generations. This has grave implications for the future of food safety. In present study, none of the food handlers had received any formal training. Very few of them were willing to undergo training and major reason given for unwillingness was lack of interest, as they believed that training is not required for the work they were doing. This can be attributed to their lack of knowledge on carriers of various food and water borne diseases. Survey of cafeteria staff in Girls hostel by Sheth and Sukul (2005) showed that 83% had poor knowledge on safe food preparation and all had fair personal hygiene and health care practices. Food safety education imparted showed significant improvement in their knowledge regarding “what are micro organisms”, causes of food spoilage and knowledge about importance of wearing appropriate uniforms

Table 3 : Food handlers with different wages on the basis of their work profile, educational level and work experience

	Monthly wages						Chi square
	<1000 n (%)	1000-1500 n (%)	1500-2000 n (%)	2000-2500 n(%)	2500-3000 n(%)	>3000n(%)	
Work profile							
Cook	1 (2.13)	1 (2.13)	5 (10.64)	9 (19.15)	16 (34.04)	15 (31.91)	95.93**
Assistant cook	1 (1.96)	9 (17.65)	24 (47.06)	8 (15.69)	6 (11.76)	3 (5.88)	
Waiter	4 (6.06)	22 (33.33)	28 (42.42)	8 (12.12)	3 (4.55)	1 (1.52)	
Cleaner	3 (4.92)	27 (44.26)	21 (34.43)	4 (6.56)	4 (6.56)	2 (3.28)	
Salesman and Cash counter	2 (5.71)	8 (22.86)	7 (20.00)	8 (22.86)	6 (17.14)	4 (11.43)	
Education							
Illiterate	3 (8.11)	16 (43.24)	12 (32.43)	3 (8.11)	2 (5.41)	1 (2.70)	25.85*
Upto Primary	4 (4.94)	28 (34.57)	26 (32.10)	10 (12.35)	9 (11.11)	4 (4.94)	
Higher Secondary and above	4 (2.82)	23 (16.20)	47 (33.10)	24 (16.90)	24 (16.90)	20 (14.08)	
Experience (years)							
<5		42 (41.18)	36 (35.29)	5 (4.90)	12 (11.76)	7 (6.86)	29.84*
5-10		19 (27.14)	21 (30.00)	14 (20.00)	9 (12.86)	7 (10.00)	
10-15		12 (24.00)	18 (36.00)	8 (16.00)	8 (16.00)	4 (8.00)	
15-20		3 (13.64)	6 (27.27)	4 (18.18)	4 (18.18)	5 (22.73)	
>20		2 (12.50)	4 (25.00)	6 (37.50)	2 (12.50)	2 (12.50)	

* and ** indicates significance of value at P <0.05 and P<0.01, respectively

Most of them did not want to take training because they were not interested and they did not consider training essential for the jobs that they were doing. Other reasons specified were no salary, no incentive, no facility and affordability. The willingness to take training was found to be significantly ($p < 0.05$) associated with age, education and experience whereas wages did not had any effect on willingness for training (Table 4). It was found that, better educated handlers were more willing to take training compared to illiterates and primary educated food handlers. Also young food handlers were more willing to receive training as compared to food handlers of older age. Most food handlers were not willing to take training irrespective of the wages earned, but food handlers with lesser experience (<10 years) were more willing than food handlers with more experience.

The food handlers were observed for their personal habits and food handling practices (Table 5). It was found that 48.8% of them refrained from smoking/gutka/tobacco chewing while cooking or serving meals. Some of them (13.4%) removed rings/bangles/wrist watches before starting work. Most of them wore clean and fresh clothes everyday (59.46%) and had trimmed nails (65.8%). Very few of them used hand gloves (2.7%), headgear (3.1%) and apron (5.41%) while cooking/serving. Food handlers are most important sources for the transfer of microorganisms to the food from their skin, nose, bowel and also from the contaminated food prepared and served by them. While the role of human handling in food borne

Table 4 : Willingness for training among different food handlers

	Willingness for training		Chi square
	No n (%)	Yes n (%)	
Education			
- Illiterate	28 (75.68)	9 (24.32)	8.79*
- Upto Primary	65 (80.25)	16 (19.75)	
- Higher Secondary	91 (70.00)	39 (30.00)	
- Above Higher Secondary	5 (41.67)	7 (58.33)	
Age (years)			
- <15	1 (25.00)	3 (75)	11.48**
- 15-30	98 (67.12)	48 (32.88)	
- 30-45	77 (81.91)	17 (18.09)	
- >45	13 (81.25)	3 (18.75)	
Wages			
- <1000	9 (81.82)	2 (18.18)	2.37 ^{NS}
- 1000-1500	46 (68.66)	21 (31.34)	
- 1500-2000	65 (76.47)	20 (23.53)	
- 2000-2500	28 (75.68)	9 (24.32)	
- 2500-3000	24 (68.57)	11 (31.43)	
- >3000	17 (68.00)	8 (32.00)	
Experience (years)			
- <5	68 (66.67)	34 (33.33)	21.43**
- 5-10	42 (60.00)	28 (40.00)	
- 10-15	46 (92.00)	4 (8.00)	
- 15-20	18 (81.82)	4 (18.18)	
- >20	15 (93.75)	1 (6.25)	

* and ** indicates significance of value at P <0.05 and P<0.01, respectively
NS – Non-significant

Table 5 : Food handlers with different educational level on the basis of personal habits

Personal habits	Education			Chi square
	Illiterate n (%)	Upto Primary n (%)	Higher Secondary and above n (%)	
Observations				
No smoking	18 (58.06)	40 (51.25)	68 (50.37)	0.60 ^{NS}
Remove rings	3 (13.04)	10 (16.95)	22 (19.64)	0.63 ^{NS}
Hand gloves	1 (2.70)	4 (4.88)	2 (1.42)	2.37 ^{NS}
Headgear	1 (2.70)	4 (4.88)	4 (2.84)	0.72 ^{NS}
Apron	2 (5.41)	5 (6.10)	10 (7.09)	0.17 ^{NS}
Trim nails	26 (70.27)	53 (64.63)	94 (66.67)	0.37 ^{NS}
Face mask	2 (5.41)	6 (7.32)	13 (9.22)	0.67 ^{NS}
Clean clothes	22 (59.46)	56 (68.29)	116 (82.27)	10.58**
Reported values				
Do not scratch	5 (13.89)	13 (16.88)	30 (24)	2.90 ^{NS}
Do not taste foods while cooking	8 (42.11)	14 (26.92)	22 (25.58)	2.21 ^{NS}
Taste each time with fresh spoon	6 (60)	21 (52.50)	43 (58.11)	0.30 ^{NS}
Use fresh water for processing	16 (84.21)	46 (84.79)	72 (79.12)	3.64 ^{NS}
Wash hands before work	27 (72.97)	63 (78.75)	106 (82.81)	1.79 ^{NS}
Wash hands with soap before work	29 (78.38)	76 (93.83)	121 (94.53)	9.65**
Bathe before work	36 (97.30)	78 (96.30)	124 (96.88)	0.16 ^{NS}
Attend toilet needs before work	31 (83.78)	72 (88.89)	115 (89.84)	0.76 ^{NS}
Wash hands with soap after visit to toilet	31 (83.78)	72 (88.89)	121 (94.53)	3.91 ^{NS}
Dry hands with separate napkin	18 (48.65)	46 (56.79)	39 (72.66)	10.91*

* and ** indicates significance of value at P <0.05 and P <0.01, respectively

NS – Non Significant

disease has been recognized for years, food safety initiatives have increased our awareness of particular risks. For instance, strong epidemiological evidence supports the transmission of *Salmonella* and *Campylobacter* to ready-to-eat (RTE) food products via cross contamination with uncooked poultry (D'Aoust, 1989, Deming *et al.*, 1987, Harris *et al.*, 1986; Hopkins *et al.*, 1984). Equally strong evidence exists for the transmission of viral food borne disease by poor personal hygiene of infected food handlers, with data suggesting that 50-95% of confirmed viral food borne disease outbreaks are attributable to human handling (Bean *et al.*, 1997)

No significant differences were found in most practices of food handlers with different educational level (Table 5) and wages (Table 6). Personal habits and food handling practices of food handlers were found to be poor irrespective of their education. More number of better educated handlers wore clean and fresh clothes everyday as compared to illiterates and this difference was statistically significant ($p < 0.01$). Also, a higher per cent of food handlers earning better wages wore clean and fresh clothes everyday than food handlers earning lesser wages ($p < 0.05$). Wages did not make any difference in wearing hand gloves, headgear/cap, apron and facemask.

Most of the food handlers reported of washing hands before starting days work (80%) and after using toilet (90.8%). They also reported of taking bath everyday (90.8%) and attend to toilet needs before starting days work (88.5%). They used a separate napkin for drying hands (65%) and washed hands with soap before starting work (91.9%). Only a few of them reported they do not scratch body parts while cooking (20%), do not taste foods while cooking (18.1%) and from the ones who taste food only a few said they taste foods every time with a fresh spoon (27.7%). Many of them reported of using fresh water for cooking (53.5%).

Chi square test did not reveal an association between the many practices of food handlers with their educational level (Table 5) and wages earned (Table 6). Even the better educated handlers were involved in poor practices such as scratching body parts while cooking, tasting foods while cooking and not using fresh spoon each time while tasting. Most food handlers with low educational level reported use of fresh water for processing as compared to better educated food handlers and this difference was found to be statistically significant ($p < 0.05$). Better educated food handlers reported of drying hands with separate napkin and washing hands with soap before starting work as compared to uneducated food handlers

and the difference was statistically significant at $p < 0.05$. Chi square revealed positive association ($p < 0.05$) between the wages earned by the food handlers and practices such as washing hands with soap after every visit to toilet and before starting work, although wages did not had a significant impact on using fresh water for processing and drying hands with separate napkin. Food handlers were engaged in undesirable practices such as smoking and wearing rings during cooking. Most of them did not

wear gloves, headgear, apron and facemasks. Research indicates that proper glove use can decrease the transfer of pathogens from hands to food (Montville *et al.*, 2001). Previous research, however, suggests that food workers (and consumers) report engaging in food safety practices more frequently than they actually engage in those practices (Manning and Snider, 1993; Oteri and Ekanem, 1989; Redmond and Griffith, 2003).

Food handlers were surveyed for their knowledge on

Table 6 : Food handlers with different wages on the basis of personal habits

	Monthly wages (Rs.)						Chi square
	<1000 n(%)	1000-1500 n(%)	1500-2000 n(%)	2000-2500 n(%)	2500-3000 n(%)	>3000 n(%)	
Observations							
No smoking	6 (60.00)	33 (52.38)	40 (50.00)	11 (34.38)	23 (67.65)	13 (52)	7.69 ^{NS}
Remove rings	1 (12.50)	9 (17.65)	10 (15.87)	3 (11.54)	8 (29.63)	4 (21.05)	3.68 ^{NS}
Hand gloves	3 (3.85)		2 (1.64)		1 (1.67)		1.17 ^{NS}
Headgear	2 (2.56)		4 (3.28)		2 (3.33)		0.01 ^{NS}
Apron	1 (1.28)		6 (7.06)	4 (10.81)	4 (11.43)	2 (8.00)	6.13 ^{NS}
Trim nails	9 (81.82)	41 (61.19)	54 (63.53)	29 (78.38)	22 (62.86)	16 (64)	4.85 ^{NS}
Face mask	2 (18.18)	9 (13.43)	5 (5.88)	2 (5.41)	3 (8.57)	1 (4)	5.30 ^{NS}
Clean clothes	9 (81.82)	43 (64.18)	60 (70.59)	33 (89.19)	26 (74.29)	23 (92)	13.02*
Reported values							
Do not scratch	1 (9.09)	10 (15.63)	19 (23.17)	5 (14.29)	9 (25.71)	8 (32)	5.58 ^{NS}
Do not taste foods	2 (28.57)	9 (25.71)	13 (26.53)	4 (16.67)	11 (35.48)	8 (34.78)	3.70 ^{NS}
Taste with fresh spoon	1 (25.00)	12 (44.44)	24 (68.57)	17 (77.27)	11 (57.89)	6 (40.00)	10.79 ^{NS}
Fresh water for processing	4 (57.14)	29 (69.05)	43 (86.00)	21 (87.50)	24 (80.00)	17 (80.95)	7.18 ^{NS}
Wash hands before work	9 (81.82)	48 (71.64)	64 (75.29)	35 (94.59)	28 (80)	23 (92)	11.12*
Wash hands with soap before work	64 (82.05)		115 (94.26)		59 (98.33)		13.81**
Bathe before work	75 (96.15)		119 (97.54)		58 (96.67)		0.32 ^{NS}
Attend toilet needs before work	9 (81.82)	53 (79.10)	76 (89.41)	36 (97.30)	31 (88.57)	23 (92.00)	8.78 ^{NS}
Wash hands with soap after visit to toilet	62 (79.49)		115 (94.26)		59 (98.33)		17.72**
Dry hands with separate napkin	7 (63.64)	36 (53.73)	53 (62.35)	31 (83.78)	23 (65.71)	18 (72)	10.23 ^{NS}

* and ** indicates significance of value at $P < 0.05$ and $P < 0.01$, respectively,

NS – Non Significant

Table 7 : Food handlers with different educational level on the basis of correct responses given for carriers of diseases/symptoms

Diseases/ symptoms	Education			Chi square
	Illiterate	Upto primary	Higher secondary and above	
	n (%)	n (%)	n (%)	
Cholera	6 (16.22)	7 (8.64)	20 (14.08)	10.75*
Vomiting	4 (10.81)	1 (1.23)	9 (6.34)	10.40*
Diarrhea	1 (2.71)	2 (2.47)	9 (6.34)	6.95 ^{NS}
Typhoid	1 (2.70)	3 (3.70)	4 (2.82)	4.95 ^{NS}
Discomfort	0 (0)	0 (0)	0 (0)	–
Jaundice	2 (5.41)	2 (2.47)	16 (11.27)	8.74 ^{NS}
Gastroenteritis	1 (2.70)	0 (0)	1 (0.70)	–
Amoebiosis	0 (0)	1 (1.23)	1 (0.70)	–
Food poisoning	4 (10.81)	10 (12.35)	18 (12.68)	5.40 ^{NS}

* indicates significance of value at $P < 0.05$

NS – non significant

carriers of different food and water borne diseases (Table 7). Most of the food handlers did not reply when asked about carriers for spreading various food and water borne diseases. Few of them gave correct answers for carriers of diseases such as cholera (13.1%), typhoid (3.1%), jaundice (7.7%), gastroenteritis (0.8%), amoebiosis (0.8%) and food poisoning (5%). Also very few of them gave correct responses for carriers of symptoms such as vomiting (5.8%) and diarrhea (4.2%). Others gave incorrect answers. Table 7 depicts the responses given for carriers of diseases by handlers of different educational level. Chi square did not reveal any association between knowledge of food handlers about carriers of various food and water borne disease and educational level. Even the better educated food handlers were not aware of carriers for various food and water borne diseases.

Findings of present study reinforce the concerns of FAO/WHO (2003), which indicate that the majority of food handlers lack the appropriate knowledge and expertise in the application of food hygiene and good food handling practices. In a Peruvian study, it showed that the higher the educational levels of the vendors, the better were the hygienic practices, and in general, the women pursued better hygienic practices (Bhat and Waghray, 2000). Better educated, young and less experienced food handlers were more interested in training as compared to others. While the targeted food safety education programme have reported some success, which are only one component of a large initiative to inform and motivate food handlers about food safety (Meer and Misner, 2000; Yang *et al.*, 2000). It can be recommended that the instrument of food safety education should be used to awake the food handlers to consciously apply the principles of food safety in the preparation and sale of foods at public at large.

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