

Food handling behaviors based on the Health Belief Model in Iranian women

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ABSTRACT

Introduction: Foodborne illnesses are caused by microbial pathogens entering the food chain. Unsafe food handling is the main culprit in the transmission of foodborne illnesses. Given the importance of the subject and the limited number of studies conducted on the subject in Iran, the present study investigates food handling behaviors in women in Kerman city. **Methods:** The cross-sectional study was conducted on 320 women in Kerman, Iran, and responsible for food handling and preparation at home. The data collection tool was a researcher-made questionnaire consisting of items on participants' personal details, food handling behaviors (cleaning, cross-contamination, cooking and chilling) and the Health Belief Model constructs (perceived sensitivity, perceived severity, perceived benefits, perceived barriers and cues to action). **Results:** The mean age of participants were 40.02 ± 12.52 . Cross-contamination behaviors received the highest and chilling behaviors the lowest scores of food handling. Food handling behaviors and the constructs of the Health Belief Model showed no significant correlations with age, household size, the number of children, marital status and the frequency of meal preparation at home. Perceived severity, perceived benefits, perceived barriers and cues to action predicted 18% of food handling behaviors. **Conclusion:** The poor results obtained appear to be due to the lack of food handling knowledge. Research and educational programs targeting food handling behaviors should therefore address the weaknesses and strengths observed in each behavior and place a particular emphasis on chilling behaviors.

Keywords: Food handling, behavior, HBM

Introduction

Foodborne illnesses are caused by microbial pathogens entering the food chain. These pathogens naturally produce toxins and other chemicals ^[1]. Foodborne illnesses are a public health problem ^[2]. In 2011, FBI estimates using FoodNet, the surveillance system that tracks trends of the most common infections caused by FBI within the USA, were published. About one in six (or 48million) people get sick each year from contaminated food, with 128,000 hospitalizations and 3000 deaths occurring annually ^[3]. As a public health problem,

foodborne illnesses become more important when the population at risk of infection increases ^[4] Prevention appears to be the best way to avoid foodborne illnesses ^[5] Research shows that reported cases of foodborne illness are due to unsafe consumer food handling at home ^[6] Food handling practices include the purchase, storage, preparation, defrosting, cooking, serving, leftover storage and re-freezing of food. The following four items should be considered in each stage of food preparation ^[7] **Cleaning** (personal hygiene): Washing the hands before, during and after food preparation is mandatory. The pathogens transferred through poor hygiene cause a higher incidence of disease and impose greater expenses. **Chilling** (refrigerating): Inappropriate handling of leftover food is the most common cause of foodborne illnesses **Cross-contamination** (separation): To prevent contamination with bacteria such as Campylobacteriosis, it is important to separate raw food from cooked food. **Cooking**: Undercooking food is a common cause of foodborne illnesses ^[5] The Health Belief Model is one of the most commonly used conceptual frameworks in public health studies This model suggests that hygiene practices can be improved by increasing perceived

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sensitivity, perceived severity and perceived benefits and reducing perceived barriers^[8]. Many studies have used the HBM to predict food handling behaviors. Hanson et al concluded The HBM is a useful framework for examining food-handling behaviors among older adults.^[2] Lum reported Most participants demonstrate many areas to improve in their food handling practices, knowledge and beliefs.^[8]

Materials and Methods

A cross-sectional study was conducted on a population of women in Kerman city in 2012, and responsible for food handling and preparation at home. The data collection tool used was a ten-part questionnaire. The Socio demographic factors, food handling behaviors (cleaning, cross-contamination, cooking, chilling), and constructs of the HBM (perceived sensitivity, perceived severity, perceived benefits, perceived barriers and cues to action). For the items food handling behaviors, the participants were given four options (always, often, rarely and never) and the answers given were scored from 1 to 4 and choosing the 'Not applicable' option resulted in a score of zero. The perceived sensitivity, perceived severity and perceived benefits constructs were given scores based on a Likert scale, and the answers given were scored from 1 to 4. Similarly, for the cues to action construct, the participants were given four options (often, sometimes, rarely and never) and the answers given were scored from 1 to 4. After the validity of the designed questionnaire was confirmed by experts, its reliability was assessed through a pilot study in Kerman city. The Cronbach's alpha was calculated over 0.78. Data were collected, coded and then analyzed in SPSS using the ANOVA, Pearson's Correlation Coefficient and the regression analysis.

Results

The present study was conducted in 2012 with the aim of assessing food handling behaviors and their relevant factors according to the HBM in women in Kerman. The participants were aged 19 to 84 and had a mean age of 40.02 ± 12.52 . (Table 1) Cross-contamination received the highest score of food handling behaviors and chilling the lowest score. (Table 2) In the cooking behaviors, the most frequent practice pertained to cooking eggs (86.9%) and the least frequent to the consumption of canned foods (59.2%). A total of 95.1% of the participants washed their hands immediately after touching raw meat, chicken or fish and 47.4% tasted foods to check if they had gone spoiled, comprising the most and least frequent hygiene practices, in respective order. As for the cross-contamination behaviors, 93.9% of the participants kept meat in airtight freezer bags and 44.3% kept raw meat underneath cooked foods in their fridge, comprising the most and least frequent practices, in respective order. As for the chilling behaviors, 93.9% of the participants kept eggs in the fridge and 90.6% defrosted pre-cooked food at room temperature, comprising

the most and least frequent practices, in respective order. (Table 3)

No significant differences or relationships were observed between the mean overall score of food handling behaviors and the mean scores of chilling, cooking, cleaning and cross-contamination in terms of the demographic variables (age, level of education, occupation, marital status, household size and the number of children). Similarly, no significant differences were observed between the mean overall score of food handling behaviors and the mean scores of chilling, cooking, cleaning and cross-contamination based on the frequency of meal preparation at home and the frequency of eating out.

Of the constructs of the HBM, perceived sensitivity to foodborne illnesses was low, and only 44.4% of the participants considered foodborne illnesses a problem. The majority of the participants (86.7%) considered foodborne illnesses harmful to themselves, which represented the highest perceived severity of these diseases, as opposed to the 23.7% who thought only a small number of people need to visit doctors for foodborne illnesses. The greatest benefit of food handling behaviors pertained to children learning hygienic behaviors (94.3%) and the lowest was helping with household finances (90.9%). Warm weather was identified as the biggest barrier with a mean of 73.5%, followed by the great distance from home to the nearest supermarket (58.5%), refraining from throwing out leftover food to avoid wasting (56.25%), neglecting to control the refrigerator temperature (49.5%), the lack of knowledge about proper defrosting methods (41.75%), having little time for defrosting foods (40%), being too lazy to check food expiry dates (35.5%), having insufficient fridge/freezer space for storing food (34.25%), the difficulties of properly re-heating food (33.25%), being busy and handling food carelessly (33%) and being too lazy (29.5%). Attention to food safety labels was considered the best cue to action with a mean of 88.75%, followed by TV and radio news (85.75%), anti-microbial product advertisements (81.25%), word-of-mouth and food safety notices (75.75%), reading about food recalls and market withdrawals (73.25%), reading newspaper and magazine articles on foodborne illnesses (72.25%), reading about people who have developed foodborne illnesses (70.25%), warnings by health personnel (69.25%) and reading books on the subject (62%). Food handling behaviors and the constructs of the HBM showed no significant correlations with age, household size, the number of children, marital status or the frequency of meal preparation at home. The mean score of the cues to action construct differed significantly by the level of education (i.e. between the illiterate and those with associate degrees and between those without a high school diploma and those with associate degrees) and also by occupational group (i.e. between the employed and the retired and between the housewives and the retired). The Pearson correlation test showed no significant correlations between food handling behaviors and perceived sensitivity; however, food handling behaviors were significantly and positively correlated with the other HBM constructs, including perceived severity, perceived benefits, perceived barriers and cues to action. Overall, perceived severity,

perceived benefits, perceived barriers and cues to action predicted 18% of food handling behaviors, with perceived benefits ($\beta=0.56$) identified as the strongest predictor of food handling behaviors (Table 4).

Discussion and Conclusion

The present study was conducted to assess food handling behaviors and relevant factors according to the HBM in women in Kerman. Of the different areas of food handling behaviors examined, cross-contamination received the highest and chilling the lowest scores, which is consistent with the results of other studies. In a study conducted by Lum, the highest awareness about food handling behaviors pertained to cross-contamination and the lowest to chilling and cooking^[8]. In the present study, 90.6% of the participants wrongly chilled cooked food at room temperature before refrigeration; Other studies revealed better findings, for example in Vlasin's study, 35/3%^[3] and in Albrecht's study 88%^[9] people knew the right way to keep food. A careful assessment of these findings reveals better practices in the more recent studies, which indicates a progress in this area. As for chilling practices, 93.9% of the participants stored eggs in the fridge, which is consistent with the results obtained by Lum^[8] The demonstrated proper handling of eggs may be due to the increased public awareness about salmonella poisoning caused by eggs. In clean behaviors, better results were obtained than other studies. 95.1% of the participants washed their hands immediately after touching raw meat, chicken or fish, in Vlasin's study 51%^[3] and in Stenger's study^[10] 61% of the participants knew how to wash hands after contact with raw meat

Studies have shown that personal hygiene, especially washing hands before food preparation, is essential to the prevention of foodborne illnesses, since hands are the main means of food contamination^[11]

The least clean behavior was tasting food to ensure its safety, a practice that was observed in 47.4% of the participants, which can be attributed to people's lack of knowledge on the subject. Cooking behaviors was properly done only by a moderate number of people, whereas in other studies, it was the least performed behavior^[7] In most studies, people used a thermometer to determine the thoroughness of cooking, but in the Iranian culture, people take changes in food color as indicator of well-done food, which may explain the disparity of findings. As for cooking practices, 89.9% of the participants cooked their eggs until both the egg yolk and white were hard, which comprised the most frequent practice in this area. In the study by Honson, however, 71.4% of the participants cooked their eggs until both the yolk and white were fully cooked and hard^[2]. The non-consumption of damaged canned foods was the least frequent cooking practice, as only 58.2% of the participants did not consume damaged canned foods, and maybe they even tasted the foods first to detect changes in taste before proceeding to consume them.

As for cross-contamination behaviors, 93.9% of the participants kept meat in airtight freezer bags, comprising the most frequent practice, and 44.3% kept raw meat underneath cooked foods in their fridge, comprising the least frequent practice in this area. In a study by Lum, only 3% of the participants kept raw meat on top of cooked foods in the fridge, and 62% never placed raw meat on top of cooked foods^[8]. In their studies, Vlasin showed that 60/8% of the participants knew the right place to keep raw meat^[3]

It should be noted that, although the participants paid attention to keeping raw meat away from cooked foods, their cross-contamination behaviors were improperly performed. Of the items pertaining to the constructs of the HBM, the highest mean score was observed in perceived benefits. Children learning hygienic behaviors was the greatest benefit derived from food handling behaviors and suggests that people are willing to teach food handling behaviors to their children. According to the participants, the smallest benefit derived from food handling behaviors was helping with the family finances. The doubts about the financial benefits of proper food handling behaviors may be attributed to the lack of knowledge about the rates of hospitalization due to foodborne illnesses and their treatment costs. Of the constructs of the HBM, participants' perceived sensitivity to foodborne illnesses received the lowest mean score. A careful assessment of the results shows that the participants did not have any knowledge about the causes of foodborne illnesses and did not know that these illnesses are mainly caused by improper food handling behaviors at home^[12] The lack of knowledge about foodborne illnesses and their causes may be the reason for the poor performances in this area. , the participants showed a moderate level of perceived severity.

There are no precise statistics on the rate of hospitalization due to foodborne illnesses in Iran, which has led to the wrong assumption among the participants that only a small number of people visit doctors for these illnesses. Nevertheless, in developed countries, statistics show that a high percentage of hospitalizations are in fact due to foodborne illnesses and some cases may even lead to death^[13] Warm weather was proposed as the biggest barrier, and the participants believed that foods getting thawed after purchase due to the warm weather could not be avoided. Considering that the present study was conducted in a warm region (Kerman) and during the summer, such results were not unexpected. However, it is worth noting that, even in warm weather, food can be properly handled, and keeping frozen foods in insulated containers prevents their thawing. The most frequent cues to action consisted of food labels while the least frequent was health personnel's warnings about foodborne illnesses. Other studies, such as the one by Lum, have also reported food labels as the best way of communicating food safety information^[8]. Nevertheless, it is important to understand how food safety labels and anti-microbial product advertisements can guide and teach proper behaviors to the consumers. And although health personnel's warnings about foodborne illnesses can be more effective, people are deprived of these warnings. The main reason for the

poor results on food handling behaviors appears to be the lack of knowledge about these behaviors. Despite the acceptable results in some areas, occasionally behaviors were observed that suggested a lack of knowledge. Research and educational programs targeting food handling behaviors should therefore address the weaknesses and strengths observed in each behavior and place a particular emphasis on chilling practices.

The present study was the first effort of the kind in Iran; however, it examined food handling behaviors through a self-report questionnaire rather than observation, which can be considered a limitation. Another limitation of the study is the large number of items it assessed, which proved to be beyond participants' patience in most cases. Future studies are therefore recommended to use both questionnaires and observation as the tools of assessing food handling behaviors.

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Table 1: The frequency distribution of participants' demographic variables

Variable	Variable Label	Number	Percentage	Mean	Standard Deviation
Age	19-29	61	2.23	40.02	12.52
	30-39	88	30.9		
	40-49	57	20		
	50 and Over	74	26		
	Total	286	100		
Level of Education	Illiterate			-	-
	Below High School Diploma	21	6.6		
	High School Diploma	60	18.9		
	Associate Degree	142	44.8		
	Bachelor's Degree	33	10.4		
	Master's Degree and Higher	58	18.3		
	Total	3	0.9		
	Employed	317	100		
	Housewife	12			
	Retired	60	19		
Occupation	Total	230	72.8	-	-
	Retired	26	8.2		
	Total	316	100		
	Married	288	93.5		
Marital Status	Widowed	16	5.2	-	-
	Divorced	4	1.3		
	Total	308	100		
Household Size	1-2	39	12.3	3.9	1.38
	3-4	194	61.4		
	4 and Above	74	26.3		
	Total	316	100		
Number of Children	0-1	97	30.8	2.58	2.02
	2-3	146	46.3		
	4-5	43	13.7		
	5 and More	29	8.8		
Total	315	100			

Table 2: The frequency distribution of the variables related to food handling behaviors in the participants

Variable	Variable Label	Number	Percentage
Frequency of main meals prepared at home	Always	171	53.6
	Often	121	37.9
	Sometimes	27	8.5
	Total	319	100
	Unknown	10	
Frequency of main meals eaten out	0-1 per week	146	46.8
	2-3 times per week	32	10.3
	More than 4 times per week	4	1.2
	Never	130	41.7
	Total	312	100
	unknown	17	

Table 3: The mean and standard deviation of food handling behaviors

	Mean	Standard Deviation
Cross-Contamination	30/99	2/97
Cleaning	34/52	2/94
Cooking	26/25	2/54
Chilling	37/87	2/88
Food Handling Behaviors	129/56	7/15

Table 4: The correlation coefficient matrix of the HBM constructs in terms of food handling behaviors in the participants

	Foodhandling Behavior	Perceived Sensitivity	Perceived Severity	Perceived Benefits	Perceived Barriers
Foodhandling Behavior	1				
Perceived Sensitivity	-0/079	1			
Perceived Severity	0/198**	0/090	1		
Perceived Benefits	0/260**	-0/125*	0/313**	1	
Perceived Barriers	-0/272**	-0/041	0/057	-0/190**	1
Cues to Action	0/271**	-0/030	0/191**	0/221**	0/366**

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