

Food Safety Behavior of Low-Income Parents and Guardians of Infants in the U.S.

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ABSTRACT

The U.S. government have concerned about food safety over the last two decades. The concept of the continuum, "from farm to table" was created to explore ways to prevent foodborne illnesses in all stages of food systems. On the continuum, consumers were recognized as the last line of defense to prevent foodborne illnesses, and much efforts were made to educate them safe food handling. This research was conducted to investigate infant formula handling and hand-washing behaviors of low-income families, especially parents and guardians of infants. The subject was selected from participants of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), a federal program for low-income families in the U.S. Stratified 200 local WIC offices were randomly selected based on the number of WIC participants in each state, and 20 randomly selected WIC participants from each selected office were asked to complete questionnaires. SPSS for Windows was used for statistical analyses including frequency, cross-tabulation, and chi-square analyses. A total of 87 WIC offices returned completed questionnaires (N = 1,598), and 492 were parents/guardians of infants. Most respondents were white (51.3%), high school graduates (41.5%), and participated in WIC > 1 year. Most respondents (80.9%) learned about food safety from WIC, and only limited number of respondents (10.2%) used the Internet for food safety information. Most respondents stored prepared formula safely (94.6%) and discarded formula left in the bottle after feeding (84.5%), but fewer used brushes to wash formula bottles (71.3%) and boiled water (15.2%). Chi-square analyses showed respondents in different race/ethnicity had different food handling behaviors. Respondents showed generally good hand-washing behaviors as 94.2% always washing hands after using restroom, 93.2% after touching meat items, and 87.1% before preparing foods. Fewer respondents, however, washed hands after changing baby diapers (77.0%) and touching pets (67.2%). Researchers concluded that WIC education on food safety was effective, as limited food safety education covered during WIC education were followed well (e.g., storing prepared formula and discarding leftover). However, results also indicated that there were many behaviors needed to be reinforced especially to overcome family tradition and culture on food handling behaviors. The WIC may serve as good food safety resources and education agents utilizing mandatory education sessions because the vast amount of food safety information on the Internet was not readily accessible for this low-income population. (*J Community Nutrition* 4(2) : 71~77, 2002)

KEY WORDS : low-income consumer · food safety behavior · consumer food safety · infant food safety · hand-washing behavior.

Introduction

There have been great concerns about food safety in the U.S. for the last two decades. It is estimated that foodborne illnesses cause between one and 76 million cases of illness, 325,000 hospitalizations, and 5,000 deaths in a year in the

U.S. (Mead et al. 1999). The estimated number of cases are in a very large range (1 – 76 million) because experts believe many unreported cases of diarrhea and flu-like symptoms are due to foodborne pathogens.

Food safety research has focused on food manufacturing and processing, restaurant, and other foodservice industries, and has contributed to preventing foodborne illnesses in many areas of the food system. In addition, great efforts have been made to approach and educate consumers on food safety. Many researchers have identified the necessity of consumer education regarding safe food handling and preparation at

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home to ensure food safety (Altekruse et al. 1996 ; Sammarco et al. 1997 ; Williamson et al. 1992).

Consumers are the last and important part of the food safety continuum, "From Farm To Table". Therefore, food safety experts recognize that the last line of defense against foodborne illness is the home meal preparer. The recently revised Dietary Guidelines for Americans emphasized the importance of safe food handling by the general population (United States Department of Agriculture [USDA], 2000). Extension services as well as government agencies put much effort into consumer food safety education. Many programs provide Internet-based consumer education as well as printed materials to inform consumers.

To investigate how aware people are regarding safe food handling practices, a consumer survey was conducted by the Food and Drug Administration and the U.S. Department of Agriculture. The results revealed that, in general, consumers have greater food safety knowledge now than in the past. Older adults and ethnic minorities were found to have better food handling practices than younger and white populations (Food Safety and Inspection Service [FSIS], 1998). Several other researchers found that increased food safety knowledge did not always correlate with safe food handling behaviors. Areas identified as most challenging to achieve consumer food safety include poor hand-washing practices, cross-contamination, and improper storage of food items including take-out foods (Altekruse et al. 1996 ; Sammarco et al. 1997 ; Sawyer 1991 ; Williamson et al. 1992).

It was found that consumers who are young, undereducated, and have limited income had limited food safety knowledge and poor food handling practices. Low-income respondents were less likely to recognize the food safety label on food packages (Altekruse et al. 1996). A greater proportion of Hispanics, minors, and uneducated respondents were handling foods in an unsafe manner (Maciorowski et al. 1999).

Particular attention needs to be given to subgroups of the population at increased risk of developing food borne illness due to compromised immune function such as infants, young children, pregnant women, and the elderly. Also, improving safe food-handling practices of parents and guardians of infants and children are important because they prepare foods for their dependents and they are role models for the next generation.

Therefore, the goal of this project was to assess the food safety behavior of low income parents and guardians of

infants (< 1 year old) in the U.S. The Special Supplemental Nutrition Program for Woman, Infants, and Children (WIC) participants were chosen for this study. The WIC program is a U.S. federal community nutrition program for low-income and at nutritional risk populations (i.e., infants, children under 5 years old, pregnant, and lactating women). To be eligible for the WIC program, household income level must be at or lower than 185% of federal poverty income levels which is defined differently by region due to variable cost of living in different parts of the U.S. Food safety is particularly necessary for WIC participants with infants because (i) WIC participants are at increased risk of food borne illnesses because they have family members who are more vulnerable to food borne illnesses due to weakened/undeveloped immune systems ; (ii) the consequences of food borne illnesses of infants are more serious due to small body sizes ; and (iii) baby formula preparation has unique food safety concerns. Therefore, it is important that WIC participants and parents or guardians of infants to have food safety knowledge and handle foods safely.

Subjects and Methods

1. Subjects

The subjects of the study were randomly selected WIC participants in the U.S. There were 2,203 local WIC agencies serving 8,042,758 participants in the U.S. (Texas Department of Health, 2000). Persons eligible for the WIC program are those who are at nutritional risk (pregnant, lactating, & post-partum women, infants, and children up to 5 years old) with income level at or lower than 185% of poverty levels. A stratified random sample of 200 local WIC agencies throughout the U.S. was selected based on the number of WIC participants in each state. From each local agency, 20 randomly selected WIC participants were asked to complete the questionnaires.

2. Questionnaire development and data collection

A questionnaire was developed in both English and Spanish. Questions included were to gather (i) demographic characteristics, (ii) food safety behaviors related to infant formula preparation, and (iii) hand-washing behaviors of parents and guardians of infants. The original questionnaire included food safety knowledge and food handling behaviors for the general population. The results discussed in this paper pertain only

to infant formula preparation and hand washing behaviors. This data is part of a larger research project.

The questionnaire was reviewed by a panel of experts for contents and readability. After revision based on experts' comments, the questionnaire and other materials such as cover letters were submitted to the Institutional Review Board (IRB) of Texas Woman's University. The IRB ruled that the rights and welfare of the human subjects were adequately protected, no risks or discomfort to the participants were anticipated, and cover letters to subjects clearly stated the purposes of the research and guaranteed the confidentiality of their responses. A pilot study was then conducted with area WIC participants prior to data collection to examine the clarity of direction and the time necessary for completion of

the questionnaire. The questionnaire was revised as appropriate based on useful comments.

Coloring books were given to participants as incentives. Cover letters, questionnaires, coloring books, and pre-stamped envelopes were mailed to local WIC offices. WIC office receptionists were asked to display, distribute, collect, and mail questionnaires according to instructions.

3. Data Analysis

The Statistical Package for the Social Sciences (SPSS) 10.1 for Windows was used for statistical analysis (Version 10.1, 2000, SPSS Inc., Chicago, Ill.). Descriptive statistics were calculated to summarize the data, and cross-tabulations with chi-square analyses were calculated to examine differences in responses among respondents with different demo-

Table 1. Demographic characteristics of respondents

Characteristics	Race/Ethnicity Groups (No. of respondents)				Total No. respondents	Total %
	White	Black	Hispanic	Other ²⁾		
<i>Age of respondents (N¹⁾ = 488)</i>						
18 – 21 years old	53	11	44	14	122	25.0
21 – 25	85	29	42	9	165	33.8
26 – 30	69	9	21	8	107	21.9
31 – 35	24	10	15	6	55	11.3
36+	18	4	16	1	39	8.0
<i>Breastfeeding vs. formula feeding (N = 492)</i>						
Breastfeeding	78	25	39	9	151	30.7
Formula feeding	172	40	99	30	341	69.3
<i>Number of family members (N¹⁾ = 483)</i>						
3 or less	99	25	36	15	175	36.2
4–5	111	28	68	21	228	47.2
6+	36	8	32	4	80	16.6
<i>Length of WIC participation (N¹⁾ = 488)</i>						
First time	12	6	3	2	23	4.7
< 6 months	45	3	25	5	78	16.0
6 months – 1 year	61	27	50	15	153	31.4
> 1 year	130	29	60	15	234	48.0
<i>Race/Ethnicity (N¹⁾ = 487)</i>						
White	250	–	–	–	250	51.3
Hispanic/Latin American	–	65	–	–	65	28.3
Black/African American	–	–	138	–	138	13.3
Other	–	–	–	22	22	7.1
<i>Education (N = 492)</i>						
8th Grade or less	4	2	23	5	34	6.9
Some high school	42	13	33	11	99	20.1
High school graduate	114	23	57	10	204	41.5
Some college	71	21	21	10	123	25.0
College graduate	19	6	4	3	32	6.5

1) Number of respondents varies due to missing data

2) Other group includes Asian/Pacific Islanders, other minorities, and persons who did not respond to race/ethnicity question.

graphic characteristics.

Results & Discussion

1. Respondents

A total of 200 local WIC agencies selected, 87 sites returned completed questionnaires. There were 1,598 usable questionnaires returned. Of those 492 respondents indicated that they were parents/guardians of infants (< 1 year old) and were used for data analyses for this paper. Among these, 151 were solely breastfeeding, and 341 were feeding infant formula. Among participants with different racial/ethnic groups, more black respondents breastfed their infants (38.5%) than white (31.2%) or Hispanic (28.3%) respondents. More than one half of respondents were white (51.3%), had 13 years of education (Kindergarten to 12th grades) (68.5%), and had participated in WIC for ≥ 6 months (79.4%). Table 1 shows demographic characteristics of participants.

Table 2 describes resources available for this population and where they received food safety information. Most respondents had TV and radios, and less had access to newspaper/magazine (60.6%) and the Internet (26.6%). Most indicated that they learn about food safety from WIC (80.9%) followed by family (70.7%), and TV (63.4%). Despite the vast amount of food safety information available on the Internet, only 10.2% indicated that they learn about food safety on the Internet.

These respondents were quite atypical compared to the general population because of their income levels. To be

Table 2. Resources available to WIC participants & food safety resources

Items	No	% ¹⁾
<i>Available resources for possible food safety dissemination</i>		
Television	468	95.1
Radio	458	93.1
Newspaper/Magazine	298	60.6
Internet	131	26.6
<i>Food safety resources</i>		
WIC	398	80.9
Family	348	70.7
Television	312	63.4
Friends	229	53.5
Newspaper/Magazine	203	41.3
School	122	24.8
Work	131	26.6
Radio	102	20.7
Internet	50	10.2

1) Percentages are based on total respondents (N = 492)

eligible for the WIC program, household income must be at or under 185% of poverty level set by the U.S. government. This research was the first one which investigated the low-income population only. There have been several consumer food safety studies prior to this research, but most of them underrepresented (Worsfold & Griffith, 1997) or eliminated low-income population to establish a more homogenized sample (Yankelovich Partners, Inc., 1999).

2. Infant formula preparation and bottle handling

Table 3 shows infant formula preparation and bottle cleaning/sanitizing practices. More than one third of respondents (37.8%) prepared infant formula for more than one use. Most of them stored prepared formula in the refrigerator. For

Table 3. Formula preparation and bottle cleaning practices

Behavior questions	No	%
<i>Preparing infant formula for more than one feeding (N = 341)</i>		
Yes	129	37.8
No	212	62.2
<i>Storing infant formula not used as soon as prepared (N = 129)</i>		
Refrigerator* ¹⁾	122	94.6
Counter top	5	3.9
Freezer	2	1.6
<i>Water sources for infant formula (N = 337)</i>		
Filtered/bottled water	122	35.8
Boiled water*	65	19.1
Warm water from faucet	52	15.2
Cold water from faucet	48	14.1
Distilled water	39	11.4
Water from well	11	3.2
<i>Method of cleaning baby bottles (N = 338)</i>		
Wash with soap, water, & brush*	243	71.3
Wash with soap & water	36	10.6
Wash in the dishwasher	32	9.4
Use disposable bottle liners	23	6.7
Rinse with water only	4	1.2
<i>Sanitizing baby bottles (N = 333)</i>		
Boil in a pot*	230	69.1
Soaking in bleach solution	10	3.0
Not doing anything special	17	5.1
No answer or not sure what the sanitizing is	8	2.4
I do not sanitize	68	20.4
<i>What to do with formula left in the bottle after feeding (N = 341)</i>		
Discard*	288	84.5
Keep bottles in the refrigerator for later feeding	36	10.5
Keep bottles in the countertop until the baby finishes	17	5.0

1) Asterisks(*) indicate most safe practice in each category

formula preparation, only 15.2% used boiled water, 33.2% used water from the faucet, and 3.2% used water from wells. Despite no warranty of microbial safety, many used filtered/ bottled or distilled water (35.8%).

When washing bottles, 71.3% of the participants used soap and bottle brushes, and 9.4% used a dishwasher. Although a dishwasher is regarded as safe for bottle washing, proper cleaning may not occur depending on the height and shape of bottles. As to sanitizing, 69.1% of respondents indicated they boiled bottles in a pot. Although 20.4% indicated not sanitizing, an additional 7.5% either did not know how to sanitize or did not do anything special for sanitizing. A majority of people (84.5%) discarded milk left in the bottles, but 15.5% still kept unused infant formula in the bottle for later use.

When results were compared among respondents with different demographic characteristics using chi-square analyses, several behavior differences were found based on race/ethnicity. More black respondents prepared formula for more than one feeding (67.5%) than white (33.1%) or Hispanic (32.3%) respondents ($p < 0.01$).

There were also distinctive differences ($p < 0.01$) in water sources used to make formula among race/ethnicity. Most

white respondents (47.6%) used either warm or cold water from the faucet, while only 20% of black and 13.7% of Hispanic respondents did so. More than a half of Hispanic respondents (53.7%) used filtered or bottled water, yet most black respondents used boiled water (34.1%).

Chi-square analyses also showed significant differences ($p < 0.01$) in methods of cleaning baby bottles among different race/ethnicity. More white respondents used dishwashers to clean bottles (14.7%) than black (9.8%) or Hispanic (2.1%) respondents. A greater proportion of whites used disposable bottle liners (9.4%) than blacks (4.9%) or Hispanic (1.0%) respondents. Most Hispanic respondents used soap and water to wash baby bottles (84.5%), while only 64.7% of white respondents did.

Over 90% of black respondents (92.5%) indicated that they sanitize the bottles between uses, while 70.7% of white and 88.5% of Hispanic respondents reported they did ($p < 0.01$). There were no significant differences found in any other behaviors based on demographic characteristics (i.e., age, education levels, length of WIC participation) of respondents.

There is not enough information to explain the differences in food handling practices based on race/ethnicity. One possible explanation, however, would be where respondents learned

Table 4. Cross-tabulations and significant chi-square analyses across the different race/ethnicity

Questions	Race/Ethnic Groups			
	White	Hispanic	Black	Other
<i>Preparing infant formula for more than one feeding ($p < 0.01$)¹⁾</i>				
	← No. of respondents (% of respondents) →			
Yes	57 (33.1)	32 (32.3)	27 (67.5)	7 (38.9)
No	115 (66.9)	67 (67.7)	13 (32.5)	11 (61.1)
<i>Water sources for infant formula ($p < 0.001$)</i>				
Filtered/bottled water	49 (29.5)	51 (53.7)	13 (31.7)	4 (22.2)
Boiled water	22 (13.3)	11 (11.6)	14 (34.1)	4 (22.2)
Warm water from faucet	46 (27.7)	3 (3.2)	4 (9.8)	4 (22.2)
Cold water from faucet	33 (19.9)	10 (10.5)	5 (12.2)	0 (0.0)
Distilled water	9 (5.4)	18 (18.9)	3 (7.3)	6 (33.3)
Water from well	7 (4.2)	2 (2.1)	2 (4.9)	0 (0.0)
<i>Method of cleaning baby bottles ($p < 0.01$)</i>				
Wash w/ soap, water, & brush	110 (64.7)	82 (84.5)	29 (70.3)	13 (72.2)
Wash with soap & water	17 (0.1)	11 (11.3)	5 (12.2)	2 (11.1)
Wash in the dishwasher	25 (14.7)	2 (2.1)	4 (9.8)	0 (0.0)
Use disposable bottle liners	16 (9.4)	1 (1.0)	2 (4.9)	3 (16.7)
Rinse with water only	2 (1.2)	1 (1.0)	1 (2.4)	0 (0.0)
<i>What to do with formula left in the bottle after feeding ($p < 0.01$)</i>				
Discard*	146 (87.4)	84 (89.4)	37 (92.5)	15 (93.7)
Keep bottles in the refrigerator for later feeding	20 (12.0)	8 (8.5)	3 (7.5)	1 (6.3)
Keep bottles in the countertop until the baby finishes	1 (0.1)	2 (2.1)	0 (0.0)	0 (0.0)

1) P values derived from chi-square analyses

about food safety. The second most cited source (following WIC as the most cited source) for food safety information was the family (70.7%). Family tradition may have an impact what type of water is used for formula preparation. More white respondents used city water from faucets for formula preparation (47.6%) and dishwashers for cleaning bottles (14.7%), and fewer Hispanic respondents used water from faucets (13.7%) and dishwashers (2.1%). These differences among different racial/ethnic groups may be due to differences in living standards (i.e., availability of safe water supply and dishwasher) or family tradition.

Over 80% of respondents indicated that they learned about food safety from WIC, where information specific to formula preparation and bottle sanitation is given to respondents as an education module (Texas Department of Health 2002). This may explain the high percentages of proper behaviors such as 94.6% storing prepared formula in the refrigerator and 84.5% discarding leftover formula in the bottle.

3. Hand-Washing Behaviors

In addition to safe preparation and care-taking of infant formula and bottles, hand-washing and other food handling practices of parents/guardians of infants have a significant impact on infant health. Table 5 summarizes the hand-washing practices of respondents. The majority of respondents indicated they always wash hands before touching foods (87.1%), after going to the bathroom (94.2%), and after handling raw meat items (93.2%). However, fewer participants reported that they always wash their hands after diaper changing (77.0%).

Differences in hand-washing behaviors were found among demographic groups. Fewer respondents whose ages were between 18 and 25 years old reported they always washed hands after touching raw meat, chicken, or fish (91.5%) than respondents 26 years or older (96.0%) ($p < 0.05$). More younger respondents reported they wash their hands often (not always) after touching raw meat items indicating more risky behaviors.

Chi-square analysis showed differences in hand washing after touching pets based on race/ethnicity ($p < 0.001$). More black and Hispanic respondents indicated that they always washed hands after touching pets (84.8% and 86.5%, respectively) than white respondents (53.7%). This result may also be due to cultural differences in racial/ethnic groups.

Summary and Conclusion

WIC provides supplemental foods for families with pregnant or lactating women, infants, and children under 5 years old who are at increased nutritional risk. In addition, the federal government mandates WIC participants to attend classes for further support with nutrition and other education. Although 80.9% of respondents indicated that they learn about food safety from WIC, food safety information given by WIC offices is limited because there are many other nutrition educational needs which take priority to food safety education. Most food safety education topics for parents/guardians of infants are limited to formula preparation (i.e., water selection, storing prepared formula), bottle sanitation (i.e., washing and sanitizing bottles), and leftover control.

Results from this study showed that many WIC participants were practicing safe infant formula preparation and handling. Over 90% of respondents indicated that they kept the reconstituted formula in the refrigerator (94.6%), > 80% indicated that they discarded formula left in the bottle after feeding (84.5%), and about 70% of respondents indicated that they wash bottles with soap, water, and brush (71.3%) and they sanitize baby bottles in a boiling pot (69.1%). It is not surprising to see > 80% of people responding to the first two items listed above because they are included and emphasized in the education module for parents/guardians of infants. The other two items having lower levels of compliance may be due to less emphasis during the education sessions. The sanitizing issue was not reinforced as strongly as previous items, perhaps due to manufacturer's instructions for usage which

Table 5. Hand-washing practices of parents/guardians of infants

Hand-washing occasions	Always	Often	Some-times	Seldom	Never
	← % of Respondents →				
Before food preparation	87.1	9.7	2.5	0.6	0.2
After using bathroom	94.2	4.5	1.2	0.0	0.0
After touching raw meat, chicken, or fish	93.2	4.9	1.0	0.2	0.6
After changing baby's diapers	77.0	15.0	7.2	0.8	0.0
After touching pet	67.2	20.6	10.0	1.6	0.6

often do not include the necessity of sanitizing.

Most (around or > 90%) respondents also reported appropriate hand-washing behaviors before food preparation, after using bathroom, and after touching raw meat, chicken, or fish. However, after changing diapers or touching pets, < 80% indicated that they washed their hands.

Therefore, more food safety education must be provided to reinforce some the issues with lower levels of compliance discussed above. Especially, parents/guardians of infants must treat changing diapers for infants as using bathrooms for adults and wash hands well to prevent food borne illnesses.

Food safety knowledge and food handling behaviors not related to infant formula preparation is not often covered during the education sessions via the WIC program. Although there is no direct cause-effect relationship between adult food safety and infant food safety because infants do not consume regular foods, it is important for parents/guardians of infants to follow safe food handling including personal hygiene practices. Parents/guardians can become hosts of food borne pathogens easily transferable to their infants.

Although there is a vast amount of food safety information available on the Internet, this low-income population has very limited access to such information. Extension and government agencies targeting this population must find better methods to reach them. Since there are many opportunities to educate these low-income families through WIC (i.e., mandatory attendance at education sessions), government and public health officials may consider using WIC for disseminating general food safety information to this population. Information related to food preparation, storage, and preventing cross-contamination is much needed for the general population (Medeiros et al. 2001).

One of the limitations of this study is that not all low-income consumers were included in this study. Also, we can safely assume that low-income consumers who do not have any family members eligible for WIC, especially low-income males, will not benefit from food safety education from WIC. Another limitation is that the results cannot be generalized outside the U.S. Different countries have different sanitation standards ; and water quality, cleaning practices, and resources available may be different. Therefore, different priorities

for food safety education may be applied to ensure food safety of any specific population.

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