Original Article

Food Guide Pagoda and the food safety of women: one-year follow-up study on the effects of the 2008 Sichuan Earthquake

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Background and Objectives: Women are a dominant force in the family's diet and nutrition in China. The short-term effects of the 2008 Sichuan Earthquake were found. However, the long-term effects of the 2008 Sichuan Earthquake on the food safety, energy, and intake frequency of women remain unclear. This study analyzed the effects of the 2008 Sichuan Earthquake on the dietary behaviors of women one year after the earthquake. **Methods and Study Design:** In this cross-sectional study, a total of 207 women were selected using the proportional sampling method. Among them, 91 were from the earthquake-affected area and 116 were from the non-affected area. **Results:** Women from the earthquake-affected area paid significantly more attention to health, diet, food and water safety after the earthquake ($p<0.05$ for each category) when compared with those from the non-affected area. Women from the earthquake-affected area also had a significantly higher proportion of adequate understanding of low-energy food, properly separated their raw food from cooked food, ate high-energy food, and picky eating habits ($p<0.05$ for each category) than those from the non-affected area. In addition, women from the earthquake-affected area were more likely to adhere to the 2007 Chinese Food Guide Pagoda (FGP) guidelines for eating rice than those from the non-affected area (OR=2.25, 95% CI [1.13, 4.51]). **Conclusion:** The female survivors of the 2008 Sichuan Earthquake preferred high-energy food, paid more attention to food safety, and were more likely to adhere to FGP when compared to those that did not undergo the same tragedy.

Key Words: Food Guide Pagoda, food safety, follow-up study, the 2008 Sichuan Earthquake, women

INTRODUCTION

Earthquakes are quite unpredictable, uncontrollable, immediate, and destructive. They cause more devastation than any other natural disaster.[1] They leave physical injury, death, and destruction in their wake,[2] setting of a state of emergency and a series of psychological-stress-related changes in the mood, cognition, and behaviour of the survivors[3,4] such as post-traumatic stress disorder (PTSD) and psychosomatic disorders.[5,6] Previous studies have demonstrated the prevalence of PTSD symptoms[7] and other long-term physical and psychological consequences among earthquake survivors.[8] In addition, PTSD is associated with long-term depression, anxiety, and behavioural changes among children, adolescents,[9] and adults.[10] Earthquakes can increase the prevalence of chronic diseases in affected area as by earthquakes[11] and affecting survival behaviours, including their dietary patterns.[12] This was exemplified during the 2011 Great East Japan Earthquake[12] and after the 2010 Haiti Earthquake when food security became a major problem.[13] These instances demonstrate how survivor's nutritional status and dietary patterns are affected by major natural disasters.[14]

Unhealthy dietary habits expose people to diabetes, cardiovascular diseases, and obesity, and compromise their immunity to various diseases.[15] Large amounts of low- cost energy-dense foods lead to passive overeating and obesity, and oftentimes result in generally poor nutrition.[16,17] Food insecurity can affect the health, learning, growth, and social skills of children,[18,19] and in the case of

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Manuscript received 26 December 2016. Initial review completed 12 January 2017. Revision accepted 22 February 2017.
doi: 10.6133/apjcn.092017.08

severe food insecurity, predispose adults to developing chronic diseases.[20]

China established the "Food Guide Pagoda (FGP) for Chinese Residents" in 2016 to provide all residents with basic scientific information on nutritious diets during nutrition transitions from traditional diets to more-Westernized diets and to promote a healthy lifestyle.[21] The average daily intake of vegetables and fruits was found lower than that recommended in the Chinese dietary guidelines.[22] China Health and Nutrition Survey show that from 1991 to 2011, the consumption of vegetables intake declined significantly, and the intake of fruits kept increasing. The proportion of Chinese adults who consume red meat, poultry, and seafood increased from 65.7% to 86.1%, 7.5% to 20.9%, and 27.4% to 37.8% between 1991 and 2011, respectively.[23] The 2010–2012 China National Nutrition and Health Surveillance study showed that 22%–26% and 14%–19% of adults from urban and rural areas, respectively, satisfied the Chinese dietary guidelines for consuming vegetables, while only 2%–5% of urban living adults and 1%–2% of rural living adults satisfied the guidelines for consuming fruits.[24] This suggests an overall greater increase in meat consumption and less of an increase in fruit and vegetable consumption in the decade.

Sichuan is located in southwest China, and its capital, Chengdu, serves as a key economic center in Western China. An 8.0-magnitude earthquake struck Wenchuan County in Northwest Sichuan on May 12, 2008, claiming over 69,200 lives, seriously wounding more than 374,600 people, and rendering more than 18,400 people missing.[25] In addition, the poor structural resistance, the frequent aftershocks, and the concomitant secondary disaster destroyed the homes of five million people within the area.[26] Since the earthquake's devastation, mental health has become a severe problem in Sichuan,[27] with many victims experiencing antenatal depressive symptoms.[28] Posttraumatic stress disorder and depression occurred one year after the World Trade Center disaster.[29] Issues with food supply and safety remained unresolved a year after the earthquake. Many young children in the affected areas developed various forms of long-term malnutrition, particularly anemia; people in these areas followed suboptimal feeding practices, with children being forced to follow adult dietary behaviors.[30] Thus, malnutrition and growth retardation became prevalent among infants and young children after the earthquake.[30]

A previous study was conducted after the 2008 Sichuan Earthquake to document the dietary behaviour and patterns of women in earthquake-affected areas. The findings revealed the short-term effects of the 2008 Sichuan Earthquake, and associated this major disaster with the changes in the dietary behaviour and patterns of women residing within the seismic zone.[31] However, the long-term (one year) effects of the 2008 Sichuan Earthquake on the food safety, energy, and intake frequency of women remain unclear. Clarifying the long-term (one year) effects of the Sichuan Earthquake on the dietary behaviours of women is necessary to develop post-disaster restoration plans and conduct reconstruction plans.

These women suffered emotional distress, which is a predictor of several mental issues (e.g., depression, traumatic stress, and anxiety)[32] that are often experienced by earthquake survivors.[33] Influenced by traditional ideas, many women in China, particularly housewives, consider domestic service as their primary responsibility; therefore, they have great authority in domestic affairs and focus on the diet and nutrition of their families.[34] Therefore, their knowledge, attitudes, and behavior towards nutrition also affect the growth and health of their offspring.[35] In view of this, we conducted a follow-up study one year after the 2008 Sichuan Earthquake to assess the long-term (one year) effect of this disaster on the food safety, energy, and intake frequency of women based on the Food Guide Pagoda.

PARTICIPANTS AND METHODS

Study design and participants

Data was collected from affected (Guangyuan City) and non-affected areas (Baoji City). Guangyuan City is located in Sichuan, located 240 kilometers southeast of the earthquake epicenter (Wenchuan). The earthquake resulted in nearly 4,800 deaths in this city. The non-affected area, Baoji City, is located in Shanxi, 470 kilometers southeast of Wenchuan. Women residing for at least one year in either of these cities and were 18 years or older were personally interviewed by nutrition and preventive medicine undergraduate senior students at Chongqing Medical University. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Chongqing Medical University (2013036). Written informed consent was obtained from all participants.

Procedure

A total of 207 women, among which 91 were from the earthquake-affected area and 116 were from the non-affected area, were selected using the proportional sampling method. These respondents completed the survey one year following the earthquake (from June 2009 to August 2009) and our sampling procedure is described as follows.

First, within the earthquake-affected area of Guangyuan City, we selected communities that were severely affected by the earthquake. Second, we invited women from these communities to participate in the interviews. Five communities were respectively selected in Qingchuan and Jiange counties. Third, we defined our target sample as those women who survived the 2008 Sichuan Earthquake and lived in the area for at least one year. Fourth, 100 women were asked to complete the questionnaire. We followed the same sampling strategy to recruit 120 women from the non-affected area of Baoji City. Thirteen of the 220 returned questionnaires were rejected because of missing data, thereby leaving 207 valid responses for the analysis.

Instrument

The questionnaire was customized for the target population, and the final draft was pilot tested among 10 potential subjects prior to the survey. The questionnaire collected the demographic information, food-safety-related behavior, food-energy-related behavior, and dietary behavior of the respondents one year following the 2008

Sichuan Earthquake.

Demographic information

The demographic data included age, household type, highest level of education, and monthly per capita food spending of the family. Age was categorized as 20-25 years, 26–35 years, 36–45 years, and ≥46years. Household type was categorized as either urban or rural. Monthly family food spending was categorized as <200 Yuan, 200–300 Yuan, 300–400 Yuan, 400–500 Yuan, and >500 Yuan [1 USD=6.32 Yuan in March 2018]. Education level was categorized as ≤ primary school, junior middle school (basic education), ≥ senior high school, including vocational/technical secondary school and junior college (secondary education), and ≥ senior college and university (higher education).

Smoking and alcohol drinking behavior

Smoking and alcohol drinking were recorded as either yes or no.

Food-safety-related behavior

The respondents were asked if they i) paid more attention to their health after the earthquake, ii) paid more attention to their diet after the earthquake, iii) worried about food and water safety after the earthquake, iv) knew when their food can be easily contaminated by bacteria, v) checked the shelf life of food products before purchase, and vi) separated their raw food from cooked food.

Food-energy-related behavior

The respondents were requested to identify low-energy food from a selection of food products. They were also asked about their dietary patterns, whether they paid attention to food energy content when purchasing food products, and if they had any food preferences.

Dietary behaviors

We designed 7 questions to measure the adherence to 2007 Chinese Dietary Guidelines. The respondents were asked their consuming behavior on rice, vegetables, fruits, meat, fish, eggs, and milk. According to their answers, respondents were divided into two groups, those who were satisfied the FGP guidelines and those who were not satisfied the FGP guidelines.

Statistical analyses

The characteristics of the respondents were summarized using either means and standard deviations or frequencies and percentages, and were presented using descriptive analysis (percentages). A chi-square test was performed to check for differences between the women from the affected and non-affected areas in terms of categorical variables, and a t-test was performed to check for differences in terms of continuous variables. Logistic regression analyses were performed to check whether dietary-behaviour-related factors satisfy the FGP guidelines. The statistical tests included a two-sided test, and statistical significance was set to $p<0.05$. All data analyses were performed using statistical software (SAS version 9.1.3; SAS Institute, Cary, NC, USA).

Table 1. Baseline characteristics of study women participants (n, %)

Variable	n	%
Zone according to the 2008 Wenchuan earthquake		
The affected area	91	44.0
The non-affected area	116	56.0
Age		
20-25years	70	33.8
26–35 years	56	27.1
36–45 years	58	28.0
≥46years	23	11.1
The type of household registration		
Rural residence	106	51.2
Urban residence	101	48.8
Job		
Unemployed	89	43.0
Farmer	24	11.6
Worker	76	36.7
Civil servants	18	8.7
The highest level of education		
Basic Education	50	24.2
Secondary Education	104	50.2
Higher Education	53	25.6
Families' monthly food spending (in Yuan)		
Less than 200Yuan	16	7.7
200 to 300 Yuan	73	35.3
300 to 400 Yuan	74	35.6
400 to 500 Yuan	32	15.5
More than 500 Yuan	12	5.8
Smoking habit		
Smoker	27	13.0
Non-smoker	180	87.0
Drinking habit		
Drinker	36	17.4
Non-drinker	171	82.6

RESULTS

Participant characteristics

Among the 207 survey participants, 44.0% were from the earthquake-affected area (mean age=32.8±10.3 years) and 64.6% were from the non-affected area (mean age=32.0±10.7 years) (Table 1).

Food-safety-related behaviour one year after the earthquake

Women from the earthquake-affected area paid more attention to health (55.0% vs 43.1%, $p=0.05$), diet (45.1% vs 32.8%, $p=0.012$), and food and water safety (46.2% vs 28.5%, $p=0.02$) after the earthquake when compared with those from the non-affected area. The earthquake-affected area also had a higher proportion of people who separated raw food from cooked food when compared to those from the non-affected area (95.6% vs 75.9%, $p<0.001$). Table 2 showed the food-safety-related behaviour of the respondents one year after the 2008 Sichuan Earthquake.

Food-energy-related behaviours one year after the earthquake

The earthquake-affected area had a higher proportion of women with the correct understanding of low-energy food (95.6% vs 83.6%, $p=0.007$), with preference for eating high-energy food (19.8% vs 15.5%, $p=0.015$), and with picky eating habits (46.2% vs 30.2%, $p=0.005$)

Table 2. Food safety related behaviour after the earthquake happened one year (n, %)

Items	Zone		*p*-value†
	The affected area (n=91)	The non-affected area (n=116)	
Do you pay more attention to health compared to pre-earthquake			0.050
Yes	50 (55.0)	50 (43.1)	
Hard to say	26 (28.6)	30 (25.9)	
No	15 (16.5)	36 (31.0)	
Do you pay more attention to the diet compared to pre-earthquake			0.012
Yes	41 (45.1)	38 (32.8)	
Hard to say	26 (28.6)	24 (20.7)	
No	24 (26.4)	54 (46.6)	
Do you worry about the safety of the food and water in these days			0.020
Yes	42 (46.2)	33 (28.5)	
Hard to say	20 (22.0)	27 (23.3)	
No	29 (31.9)	56 (48.3)	
In which season, food is easy to contaminated by bacteria			0.142
Wrong answer	26 (28.6)	23 (19.8)	
Right answer	65 (71.4)	93 (80.2)	
When you purchase the food, do you check up the shelf life			0.30
Yes	89 (97.8)	109 (94.0)	
No	2 (2.2)	7 (6.0)	
Do you separate the raw food from the cooked food			<0.001
Yes	87 (95.6)	88 (75.9)	
No	4 (4.4)	28 (24.1)	

Data was presented as n (%).
†A chi-squared test was used to compare differences in categorical variables between women from the affected area and women from the non-affected area.

Table 3. Food energy related behaviours after the earthquake happened one year (n, %)

Food energy	Zone		*p*-value†
	Affected area (n=91)	Non-affected area (n=116)	
Which of the following foods is low energy			0.007
Right answer	87 (95.6)	97 (83.6)	
Wrong answer	4 (4.4)	19 (16.4)	
What about your dietary pattern			0.015
Higher energy food	18 (19.8)	18 (15.5)	
Secondary energy food	72 (79.1)	85 (73.3)	
Low energy food	1 (1.1)	13 (11.2)	
When you purchase the food, do you pay attention to food energy			0.137
Yes	58 (63.7)	62 (53.5)	
No	33 (36.3)	54 (46.6)	
Do you have food preference			0.005
I have had all the time	26 (28.6)	24 (20.7)	
I used to have	42 (46.2)	35 (30.2)	
I have never had	7 (7.7)	8 (6.9)	
I have seldom had	8 (8.8)	30 (25.9)	
Pre-earthquake, I didn't have but I have now	8 (8.8)	15 (12.9)	
Other	0 (0)	4 (3.5)	

Data was presented as n (%).
†A chi-squared test was used to compare differences in categorical variables between women from the affected area and women from the non-affected area.

compared to those from the non-affected area. Table 3 showed the food-energy-related behaviour of the respondents one year after the earthquake.

Satisfaction of the FGP guidelines one year after the earthquake

Women from the earthquake-affected area had a higher proportion of people who satisfied the FGP guidelines for consuming rice (41.8% vs 25.0%, p=0.011), fruits (69.2% vs 81.0%, p=0.049), meat (52.8% vs 31.9%, p=0.003), and fish (37.4% vs 24.1%, p=0.039) compared to those from the non-affected area. However, these respondents showed no significant differences in their compliance with the FGP guidelines for consuming vegetables (33.0% vs 28.5%, p=0.483), eggs (74.7% vs 71.6%, p=0.611), and milk (49.5% vs 37.1%, p=0.074). Table 4 showed whether the dietary behaviours of the respondents meet the FGP guidelines one year after the earthquake.

Logistic regression model for identifying factors that influence the satisfaction of the FGP guidelines among all participants

Table 4. Dietary behaviors meet the Chinese Food Pagoda guidelines after the earthquake happened one year (n, %)

Satisfied the FGP guidelines	Affected area (n=91)	Non-affected area (n=116)	*p*-value†
Rice			0.011
No	53 (58.2)	87 (75.0)	
Yes	38 (41.8)	29 (25.0)	
Vegetables			0.483
No	61 (67.0)	83 (71.6)	
Yes	30 (33.0)	33 (28.4)	
Fruits			0.049
No	28 (30.8)	22 (19.0)	
Yes	63 (69.2)	94 (81.0)	
Meat			0.003
No	43 (47.3)	79 (68.1)	
Yes	48 (52.8)	37 (31.9)	
Fish			0.039
No	57 (62.6)	88 (75.9)	
Yes	34 (37.4)	28 (24.1)	
Eggs			0.610
No	23 (25.3)	33 (28.5)	
Yes	68 (74.7)	83 (71.6)	
Milk			0.074
No	46 (50.6)	73 (62.9)	
Yes	45 (49.5)	43 (37.1)	

Data was presented as n (%).
†A chi-squared test was used to compare differences in categorical variables between women from the affected area and women from the non-affected area.

Zone, age, household type, job, highest level of education, monthly food spending of families (in Yuan currency), smoking habits, and drinking habits were included in the logistic regression model to identify those factors that influence the satisfaction of the FGP guidelines among all participants. Women from the earthquake-affected area were more likely to adhere to the FGP guidelines for consuming rice (OR=2.25, 95% CI [1.13, 4.51]) than those from the non-affected area. Urban women were more likely to adhere to the guidelines for eating fish (OR= 0.49, 95% CI: [0.25, 0.93]) compared to those from rural areas. In the age spectrum, women between the ages of 26-35 years were more likely to adhere to the guidelines for eating rice (OR=5.84, 95% CI [2.17, 15.6]) and vegetables (OR=2.75, 95% CI [1.15, 6.59]) compared to the 20-25-year-old group. The 36-45-year-old group were more likely to adhere to the guidelines for eating rice (OR=5.82, 95% CI [2.06, 16.41]) and vegetables (OR=4.29, 95% CI [1.73, 10.6]) than the 20-25-year-old group. In the ≥46-year age bracket, women were more likely to adhere to the guidelines for eating rice (OR=8.35, 95% CI [2.36, 29.4]). Compared with unemployed participants, the employed women were more likely to adhere to the guidelines for eating vegetables (OR=2.55, 95% CI [1.25, 5.19]). Women working as civil servants were less likely to adhere to the guidelines for eating rice (OR=0.11, 95% CI [0.02, 0.52]) in comparison with unemployed women. When having education as a parameter, women who received secondary education were more likely to adhere to the guidelines for eating rice (OR=2.65, 95% CI [1.04, 6.80]), fruit (OR=2.42, 95% CI [1.03, 5.64]), meat (OR=2.42, 95% CI [1.03, 5.64]), and fish (OR=3.70, 95% CI [1.49, 9.13]) in comparison to those who received basic education (Table 5).

DISCUSSION

Compared with those of non-affected areas, the residents of earthquake-affected areas had a significantly higher proportion of individuals with a correct understanding of low-energy food and showed a preference for eating high-energy food. Previous studies observed the prevalence of micronutrient deficiencies among infants and young children in China.[36] The above findings emphasize the long-term and profound influence of the 2008 Sichuan Earthquake on the preference of individuals for eating high-energy food. However, the residents of affected and non-affected areas show no statistically significant difference in terms of paying attention to food energy when purchasing food products. These findings may be attributed to their lack of awareness of food energy and the shortage of food in this region. An earlier study on the 1999 Athens Earthquake revealed that this natural disaster had long-term effects on the inadequate intake of energy and protein of the victims.[37] Another study found that food energy was related to economic and social development as well as the supplies of the national government.[38] Accordingly, social marketing warrants further research, and these studies must focus on various types of supplies needed in the aftermath of an earthquake. In order to secure food for the people in need, it is imperative to establish a system that will also deliver this food. Earthquake victims report elevated blood pressure, which could be attributed to their increased consumption of sodium-rich foods.[39] Therefore, a health education program that can guide people in choosing food items with appropriate energy levels while maintaining proper sodium intake must be organized. Food stores, followed by quick- and full-service restaurants mainly sell high-energy foods.[39] Therefore, the government must consider adequate locations for reconstruction of stores when conducting post-earthquake rehabilitation projects.

This study evaluated the effects of the 2008 Sichuan Earthquake on the food-safety-related behaviour of women one year after the disaster. Women from the earthquake-affected area paid more attention to food safety and the FGP guidelines after the earthquake. The female victims were in poorer health than the male victims, which could be attributed to various physiological and psychological factors.[40] People with better diet also showed a better health-related quality of life after the earthquake compared with those with poor diet.[41] Therefore, women from the affected area can improve their health status by observing a better diet. The earthquake promoted diet awareness of the people directly involved and increased their demand for food-safety-related knowledge. The people from the affected area also paid more attention to food and water safety as a consequence of the earthquake. Compared with those from the non-affected area, the people from the affected area had a significantly larger proportion of individuals who separated raw food from cooked food. Consistent with the consequences of the 2011 Great East Japan Earthquake, the individuals from the affected area also developed a

Table 5. Odds ratios (95%CI) for identifying factors that that affect dietary behaviours meet the Chinese Food Pagoda guidelines 2007

Parameter	OR (95% CI)						
	Rice	Vegetable	Fruits	Meat	Fish	Eggs	Milk
Zone							
Non-affected area	1.00	-	1.00	1.00	-	-	-
Affected area	2.25 (1.13, 4.51)*		0.52 (0.27, 1.03)	0.52 (0.27, 1.03)			
Residence							
Rural residence	-	-	-	-	1.00	-	-
Urban residence					0.49 (0.25, 0.93)*	-	
Age							
20-25years	1.00	1.00	-	-	-	-	-
26–35 years	5.84 (2.17, 15.69)*	2.75 (1.15, 6.59)*					
36–45 years	5.82 (2.06, 16.41)*	4.29 (1.73, 10.66)*					
≥46years	8.35 (2.36, 29.49)*	3.40 (1.08, 10.66) *					
Job							
Unemployed	1.00	1.00	-	-	-	-	-
Farmer	0.96 (0.27, 3.41)	1.06 (0.36, 3.10)					
Worker	1.76 (0.82, 3.77)	2.55 (1.25, 5.19)*					
Civil servants	0.11 (0.02, 0.52)*	0.14 (0.02, 1.19)					
Education level							
Basic education	1.00	-	1.00	1.00	1.00	-	1.00
Secondary education	2.65 (1.04, 6.80)*		2.42 (1.03, 5.64)*	2.42 (1.03, 5.64)*	3.70 (1.49, 9.13)*		1.85 (0.84, 4.05)
Higher education	5.22 (1.52, 18.01)*		0.65 (0.275, 1.51)	0.65 (0.28, 1.51)	1.36 (0.47, 3.93)		5.33 (2.16, 13.11)*
Drinking habit							
Non-drinker	1.00	1.00	1.00	1.00	1.00	1.00	-
Drinker	2.33 (0.974, 5.59)	0.35 (0.13, 0.96) *	0.47 (0.21, 1.04)	0.47 (0.21, 1.04)		0.485 (0.21, 1.12)	
Families' monthly food spending							
Less than 200Yuan	-	-	-	-	-	-	1.00
200 to 300 Yuan							1.99 (0.53, 7.51)
300 to 400 Yuan							3.13 (0.83, 11.76)
400 to 500 Yuan							4.77 (1.12, 20.29)*
More than 500 Yuan							0.72 (0.12, 4.41)

OR: odds ratio; CI: confidence interval.
*Statistically significant (p<0.05).

heightened sense of food safety after the 2008 Sichuan Earthquake.[42] Those people, particularly women, who consume unsafe food, face higher risks of gaining weight and suffering from chronic diseases.[43] Food insecurity may be attributed to several factors, such as low household income and high food prices.[44,45] which in turn may be attributed to the battered economy and the limited availability of food after the earthquake.[46] Therefore, the government must provide additional subsidies to the earthquake victims and improve their supervision and management of food supply prices. Integrating an effective monitoring system may help in the enforcement of restrictions on the distribution and consumption of food, thereby improving food safety. The heightened sense of food safety among the people after the earthquake may also be attributed to the anxiety of childrearing mothers who survived the disaster.[47]

Compared with those from the non-affected area, the women from the earthquake-affected area were more likely to adhere to the FGP guidelines for eating rice. However, no significant differences were observed in the compliance of these parties with the FGP guidelines for consuming vegetables, fruits, meat, fish, eggs, and milk. The female survivors of the 2008 Sichuan Earthquake showed improvements in their dietary patterns. Similarly, the survivors of the 2011 Great East Japan Earthquake showed prudent dietary patterns and intake of vegetables, fruit, and milk a year after the disaster; the ability of these survivors to maintain a healthy diet was mainly attributed to their economic situation at the time.[12] In addition, the 2008 Sichuan Earthquake also reduced the number of heat sources in the affected area, limited the food supply, and drove people to live in emergency shelters. However, malnutrition remained prevalent in the area two years after the disaster[30] as a result of the inadequate and innutritious food supply during the outset of the earthquake. Therefore, these survivors required continuous nutritional support since it is known that healthy dietary patterns can lead to better living conditions, education, and nutritional literacy.[48] For that reason, governments must teach their people how to develop appropriate dietary patterns. Nutrition consultants may also organize various activities that can effectively improve the nutrition of these survivors. The effects of changing eating habits have on the general nutrition of earthquake victims presents an interesting avenue for research. Identifying those individuals who are at risk of developing nutritional deficiencies can help in the effective management of future emergencies. Social research must focus on how food-based dietary guidelines can be adjusted to change the lifestyle and improve the nutrition of consumers. Apart from providing nutritional counseling and health education, educational programs must also focus on the mental health of the 2008 Sichuan Earthquake victims to improve their well-being and encourage appropriate dietary behaviour and patterns.

This study also found that age, residence type, job, highest level of education, monthly food spending, and drinking habits of the earthquake victims also affected their compliance with the FGP guidelines for consuming rice, vegetables, fruits, meat, fish, eggs, and milk. Therefore, these factors may be considered when designing health education programs on the FGP guidelines.

This study specifically focused on women because of their significant influence on the diet of Chinese families and their important relationship with the health of their families. Therefore, focusing on the food-related behaviour of women within a family unit can improve the dietary and nutrition behaviours of many families. The nutrition of pregnant women and women of childbearing age must also be monitored to improve the mother and offspring's health conditions. Therefore, governments should consider the nutrition of women of childbearing age when designing post-earthquake rehabilitation programs.[30] Individuals may also succumb to various diseases when faced with limited food supplies.[49] Accordingly, the 2008 Sichuan Earthquake victims focused on the amount of nutrients in their food. Therefore, the roles of women in improving human health warrant further investigation.

This study has several limitations. First, the cross-sectional survey data prevented the researcher from making direct causal inferences, exploring whether the unmeasured factors may better explain the observed relationships, and determine the direction of causality. Although we employed regression models, future longitudinal studies must be conducted to confirm our findings. Second, this study did not assess the concurrent validity of the self-designed questionnaire. We did not assess the validity and reliability of this questionnaire by employing measures without established validity limits. Third, the respondents from the affected area were mostly from urban areas, while those from the non-affected area were mostly from rural areas.

In conclusion, the aforementioned findings suggest that the 2008 Sichuan Earthquake has significantly influenced the food safety, energy, and intake frequency of women in the affected area. The female survivors preferred to eat high-energy food, paid more attention to food safety, and were likely to adhere to the FGP guidelines. Therefore, the effects of natural disasters on the dietary behaviour and attitudes of their victims must be considered when developing post-disaster restoration plans and conducting reconstruction work. Most of these women also did not follow the FGP guidelines for consuming rice, vegetables, meat, fish, and milk. Zone, age, residence type, job, highest level of education, monthly food spending, and drinking habits can also determine whether the dietary behaviours of these women meet the FGP guidelines. Therefore, these factors must be considered when organizing health education programs that focus on the FGP guidelines.

ACKNOWLEDGEMENTS

This study was funded by Summer Social Practice Project of School of Public Health and Management, Chongqing Medical University. Thanks Xue Hai-li, Tang Bin, Yan Man-rong, and Kong Wen-xia in Chongqing Medical University for their actively participation.

AUTHOR DISCLOSURES

Xianglong Xu contributed to the study design, data analysis, data interpretation, and drafting of the manuscript. Yong Zhao participated in the design of the study, and contributed to the interpretation of study results and helped draft the manuscript. Bing Li, Ruixue Bai, Yunshuang Rao, Lingli Liu, Cesar Reis, Manoj Sharma contributed to the interpretation of study results

and helped draft the manuscript. All authors have seen and approved of the final version of the manuscript. The authors declare that they have no conflicts of interest.

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