

## Original Article

# Dietary attitudes and behaviours of women in China after the 2008 Wenchuan earthquake in three seismically different zones

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**Background and Objectives:** The sudden occurrence of the 2008 Wenchuan Earthquake not only devastated people's health, but also may have impacted on the psychological and dietary attitudes and behaviours of the survivors. Although the influence of natural disaster on people's health has been extensively investigated, there is a lack of information about the effects on people's dietary attitudes and behaviours. Our aim was to evaluate the influence of the Wenchuan earthquake on the dietary attitudes and behaviours of adult women from different zones of China in July 2008. **Methods and Study Design:** 736 women, aged 18-55 years old, were randomly selected and interviewed after the earthquake. Women were selected from three zones: the earthquake zone (n=206), the shaking zone (n=326), and the non-seismic zone (n=204). **Results:** Although nutrition knowledge mean scores of women in the three zones were relatively low, the women in the earthquake zone became more vigilant about the nutritional value and acceptability of food than women in the other two zones. Nevertheless, women in the earthquake zone also developed some arguably untoward, if understandable, behaviour after the disaster. They increased their consumption and tendency to stock instant food and snack items. That said, these findings were modulated by other factors such as age, residence, Body Mass Index (BMI), and nutrition knowledge itself, as were post-earthquake eating behaviours, as judged by the ordinal logistic regression analyses performed. **Conclusions:** The major Wenchuan earthquake was associated with differentials in dietary attitudes and behaviours among women by seismic zone.

**Key Words:** disaster, earthquake, women, dietary attitudes, dietary behaviours

## INTRODUCTION

The Wenchuan earthquake occurred in Sichuan Province, China, at 2:28 p.m. on May 12, 2008.<sup>1,2</sup> The quake measured 8.0 on the Richter scale, and led to over 400,000 casualties, including the deaths of nearly 30,000 children. Months after the main earthquake, strong aftershocks, including several that exceeded magnitude 6.0, continued to hit the area, causing terrible casualties and damage in different zones of China.<sup>3</sup> This earthquake had a significant impact on individuals, the public, and the state. Such impact may lead to complicated social and psychological outcomes in those affected.<sup>4,5</sup>

More than three million lives have been lost worldwide because of natural disasters in the past two decades.<sup>6</sup> Earthquakes are associated with a greater loss of life than any other natural disaster.<sup>7</sup> Sudden earthquakes lead to a series of tragic events. For example, the 1976 Tangshan Earthquake<sup>8</sup> not only caused harm to people's physical health, but also wreaked havoc on survivors' psychological well-being.<sup>9,10</sup>

Although many investigations have been conducted on the influence of natural disasters on human health,<sup>11,12</sup> the influence of earthquakes on dietary attitudes and behaviours is scarce. Emergencies can adversely affect nutri-

tional well-being across a range extending from malnutrition, to food-borne and related illness (morbidity), and premature death (mortality).<sup>13</sup> During the post-earthquake reconstruction phase, a compromised food supply can perpetuate malnutrition, increased morbidity and mortality.<sup>14</sup> All of this can last for a long time after the earthquake.<sup>15</sup> Thus, tailored nutritional programs are paramount for reducing the burden of nutritionally-related disorder and disease in earthquake zones, especially for women, children and other vulnerable sectors of the population.<sup>16-19</sup> This preparedness is now increasingly a feature of food and nutritional governance in earthquake zones.<sup>13</sup>

In consideration of these factors, the authors of the current study hypothesized that the eating attitudes and behaviours of women might be influenced, not only by an

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earthquake, but also by its aftermath. Hence, the authors conducted an investigation to evaluate the influence of earthquakes on the dietary attitudes and behaviours of adult women in different zones of China, and to provide essential data for the development of effective nutritional countermeasures following future earthquakes.

## MATERIALS AND METHODS

### Participants

The investigation was conducted after the May 12, 2008 earthquake during July to September 2008. Stratified random sampling was employed to select 736 adult women, aged 18-55 years old. All zones of China were first divided into three different seismic zones, namely, the earthquake zone, shaking zone, and non-seismic zone. Representative zones were then selected randomly from these three different areas. Afterwards, five villages were randomly chosen from each previously selected zone and all participants were randomly selected from each sub-zone. From the sampling method, a total of 206 participants were recruited from the earthquake zone, particularly from Sichuan [Guangyuan (Qingchuan) and Mianyang (Beichuan)], where the major earthquake occurred; 326 were from the shaking zone, particularly from Chongqing (Yuzhong and Wanzhou districts), Ningxia (Yuanzhou, Guyuan, Haiyuan, and Zhongwei), and Shanxi (Xi'an, Weinan, and Baoji), located around the quake zone; 204 were from the non-seismic zone, particularly from Liaoning (Shenyang), relatively far from Sichuan. The selected places are graphically illustrated in Figure 1. The inclusion criteria for participation in the study were as follows: (1) female, (2) within the age range of 18-55 years, (3) not suffering from severe diseases, (4) local residents who have resided in the area for at least five years, and (5) not pregnant or nursing.

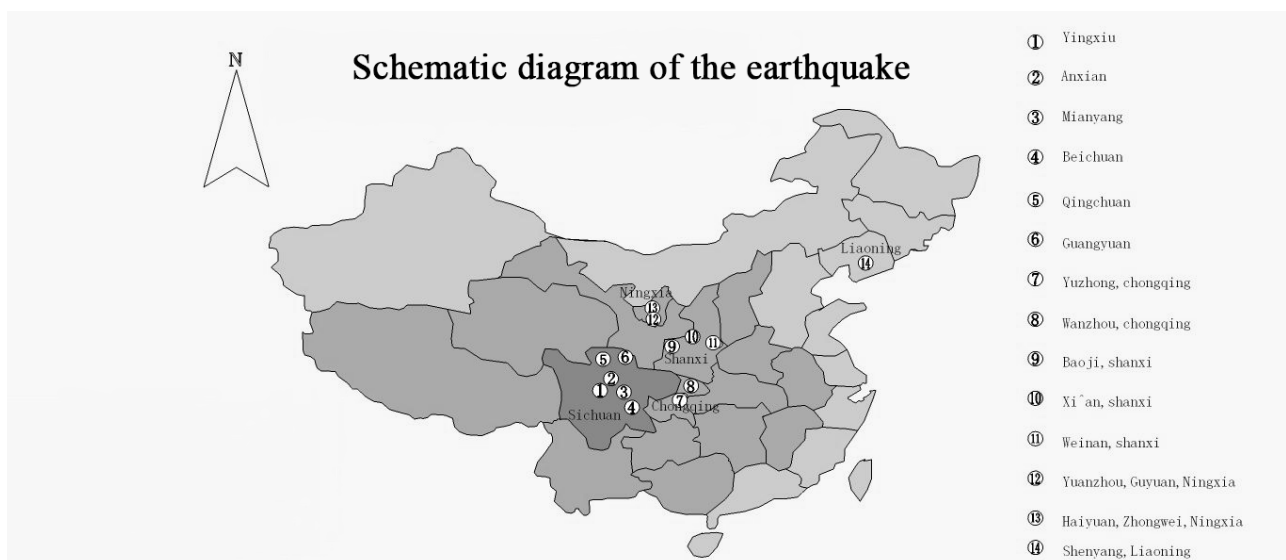
In this study, women were selected as research subjects for two main reasons. First, the mental health of women is usually vulnerable to many external factors. Second,

after the disaster, improving women's nutritional status must be considered a priority.<sup>13</sup> And Chinese women play an important role in the diet of the entire family, given that they are the backbone, and the representative of their family's overall situation.

### Instruments

The questionnaire was created based on the health knowledge-attitude-behaviour model,<sup>20</sup> which was specifically designed for the target population. The final version was completed after a pilot investigation (20 individuals participated in pretest) and repeated discussions with experts. The instrument had acceptable face and content validity, and contained both open- and closed-ended questions that were grouped into seven sections. The seven sections included the following:

- Basic information (age, height, weight, family income per month, etc.);
- Nutritional knowledge (total score of 12, with a higher score indicating higher level of knowledge, and mainly involved in the nutrition knowledge of fruits, vegetables, pure water, biscuits, instant noodles, etc. The total mean score of knowledge was classified into the next three categories based on the quintile scores and coded as  $\leq 60\%$  "low", 61% to 80% "good", and  $>80\%$  "excellent" respectively);
- Dietary psychology (having illusions of aftershocks, paying more attention to "eating", "eating" to ease the pressure, etc.);
- Nutritional attitudes (type of food intake considered to be healthy, consciously ensuring high daily intake of nutrients, etc.);
- Nutrition-related behaviour (changes in food consumption level, the consumption of snacks, stocking on instant food after the earthquake, etc.);
- Food consumption frequency (main food consumption frequency before and after earthquake); and
- Need for nutritional education (getting more nutrition



**Figure 1.** Participants from different zones exposed to the Wenchuan earthquake in China. The investigator recruited the participants from the cities of Guangyuan (Qingchuan) and Mianyang (Beichuan) in Sichuan; the districts of Yuzhong and Wanzhou in Chongqing; the counties of Yuanzhou, Guyuan, Haiyuan, and Zhongwei in Ningxia; and the cities of Xi'an, Weinan, and Baoji in Shanxi and Shenyang in Liaoning.

knowledge, kinds of nutrition knowledge accumulated, etc.).

The participants were asked to report their respective height and weight. BMI was calculated as the ratio of weight (kg) to the square of height (m). Participants with BMI  $\geq 24$  kg/m<sup>2</sup> and  $< 28$  kg/m<sup>2</sup> were classified as overweight, while those with BMI  $\geq 28$  were classified as obese according to the Chinese criteria.<sup>21</sup>

#### **Ethics statement**

The study protocol was approved by the Ethics Committee of Chongqing Medical University. Written informed consents were obtained from all participants. Participation in this study did not affect earthquake relief and treatment, particularly in the earthquake zone.

#### **Survey implementation**

All investigators came from the school of Public Health and Management at the Chongqing Medical University. Some preventive medical and nutrition sciences students were recruited via interview to join the investigation team at the start of each term. Their major teachers (professor Zhao and Zhang) gave the students general training once or twice a month and specialized training before conducting each survey. The training taught them how to introduce our study to the participants and how to avoid misleading participants. The investigators also undertook simulation training to make them more familiar with the study. Only investigators, who were familiar with the approach, objectives, methodology of the research and experienced in handling potentially sensitive issues, were allowed to conduct the survey.

The survey was implemented once the aim of the research was thoroughly explained to the participants by investigators. The participants were informed that they could withdraw from the study at any stage. They were also guaranteed anonymity, along with the confidentiality of their responses. With the approval of the participants, a private interview with each participant was conducted in separate rooms to ensure the completeness and accuracy of information.

#### **Statistical analyses**

The data in the questionnaires were checked carefully before these were encoded in the database, using the Epi-data 3.1 software. All entries were double checked to avoid errors. Strict sorting was conducted, followed by data cleaning. Statistical analyses were performed using statistical analysis system software (version 9.0; SAS Institute, Cary, NC). Such analyses focused on descriptive and analytical statistics. Descriptive data were expressed as mean  $\pm$  standard deviation (SD) or percentage (%). Analysis of variance (ANOVA) was applied to ascertain the significance of the differences among continuous variables. Chi-square test and Fisher's exact test were applied to test for differences in categorical variables between or among two or three groups. All statistics were analyzed through a two-sided test. Here,  $p$ -values of less than 0.05 among the three groups and less than 0.017 between any two groups were considered statistically significant. The formula,  $\alpha' = 1 - \sqrt[n]{1 - \alpha}$ , was utilized to

calculate the Chi-square test critical values for the multiple comparisons.<sup>22</sup>

## **RESULTS**

### **Demographic characteristics of the participants**

The demographic characteristics of participants were shown in Table 1. A total of 736 adult women were recruited to answer the survey questionnaire. Among these, 206 were from the earthquake zone, 326 were from the shaking zone, and 204 were from the non-seismic zone. Their ages ranged from 18-55 years.

### **Nutrition knowledge**

The mean scores on nutrition knowledge gained by the women from the three groups were relatively low (referring to total score: 12 points) (Table 2). The scores of the women in the earthquake ( $6.90 \pm 2.07$ ) and shaking ( $6.93 \pm 1.91$ ) zones were higher than those living in the non-seismic zone ( $6.12 \pm 1.65$ ) ( $p < 0.0001$ ). However, no difference was observed between women from the earthquake zone and those from the shaking zone ( $p = 0.838$ ).

### **Dietary psychology**

#### **Psychological impact on the senses after the earthquake**

Table 3, the sense-related changes experienced by these women were different from one another, and such difference was statistically significant ( $p < 0.0001$ ). Aftershock hallucinations felt by women in the earthquake zone (78.2%) were significantly higher than those felt by women in the shaking (62.8%) ( $p = 0.0002$ ) and non-seismic zones (22.9%) ( $p < 0.0001$ ). Furthermore, aftershock hallucinations felt in the shaking zone were higher than those in the non-seismic zone ( $p < 0.0001$ ).

#### **Health concerns**

After the earthquake, the health concerns of the women in the three zones exhibited a statistically significant change ( $p < 0.0001$ ), as shown in Table 3. The women in the earthquake zone (60.7%) began paying more attention to health than those in the shaking (39.9%) ( $p < 0.0001$ ) and non-seismic zones (17.6%) ( $p < 0.0001$ ). In addition, the women in the shaking zone paid more attention to health than the women in the non-seismic zone ( $p = 0.0015$ ).

#### **Dietary concerns**

The survey results showed a significant difference among the women with regards their dietary concerns ( $p < 0.0001$ ), as shown in Table 3. The women in the earthquake (35.4%) and shaking (24.9%) zones paid more attention to eating, compared with those living in the non-seismic zone (0.5%) ( $p < 0.0001$ ). However, no difference was observed between women from the earthquake and shaking zones ( $p = 0.083$ ).

#### **“Eating” to ease the pressure**

A total of 61 women in the earthquake zone, 61 in the shaking zone, and 8 from the non-seismic zone turned to eating in order to relieve their stress after the earthquake (Table 3). A statistically significant difference was observed among the three groups with regards this coping

**Table 1.** Demographic characteristics of the participants from different zones

Variable	Earthquake zone (n=206)	Shaking zone (n=326)	Non-seismic zone (n=204)
Age	30.5 (10.5)	30.6 (10.8)	34.6 (8.2)
Height <sup>‡</sup>	160 (5.2)	161 (5.9)	161 (4.1)
Weight <sup>‡</sup>	52.0 (5.8)	51.9 (7.6)	54.8 (6.4)
BMI <sup>§</sup>	20.3 (2.1)	20.0 (2.9)	21.1 (2.4)
Nationality			
Han	191 (92.7)	272 (83.4)	202 (99.0)
Ethnic Minorities <sup>†</sup>	15 (7.3)	54 (16.6)	2 (1.0)
Vocation			
Student	56 (27.2)	108 (33.1)	1 (0.5)
Company employees	57 (27.7)	92 (28.2)	22 (10.8)
Trader	37 (18.0)	24 (7.4)	2 (1.0)
Worker	3 (1.4)	30 (9.2)	15 (7.3)
Unemployed	53 (25.7)	72 (22.1)	164 (80.4)
Education level			
Junior high school or below	20 (9.7)	31 (9.5)	114 (55.9)
High school/Technical school/vocational school	44 (21.4)	69 (21.2)	74 (36.3)
Junior college	74 (35.9)	74 (22.7)	7 (3.4)
College or above education	68 (33.0)	152 (46.6)	9 (4.4)
Family income per month (CNY)			
<500	10 (4.9)	15 (4.6)	9 (4.4)
500-1,000	61 (29.4)	58 (17.8)	46 (22.7)
1,000-2,000	86 (41.8)	127 (39.0)	64 (31.5)
2,000-3,000	38 (18.5)	98 (30.1)	49 (24.1)
3,000-4,000	9 (4.4)	19 (5.8)	22 (10.9)
>4,000	2 (1.0)	9 (2.7)	19 (6.4)

Data was expressed as mean±SD, in terms of mean (SD) if variables were continuous, and number (%) if variables were binary.

<sup>†</sup>Ethnic minorities refer to the non-Han population in China.

<sup>‡</sup>Body height and weight were obtained from self-administered structured questionnaire.

<sup>§</sup>BMI: Body mass index, calculated as the ratio of weight (kg) to the square of height (m).

**Table 2.** The scores of nutrition knowledge

	Earthquake zone (n=206)	Shaking zone (n=326)	Non-seismic zone (n=204)	<i>p</i>	<i>p</i> <sup>1</sup>	<i>p</i> <sup>2</sup>	<i>p</i> <sup>3</sup>
Score	6.90 (2.07)	6.93 (1.91)	6.12 (1.65)	<0.0001	0.838	<0.0001	<0.0001

Data was expressed as mean (SD).

*p*: ANOVA for any between groups difference; *p*<sup>1</sup>: Earthquake zone vs shaking zone; *p*<sup>2</sup>: Earthquake zone vs non-seismic zone; *p*<sup>3</sup>: Shaking zone vs non-seismic zone.

mechanism ( $p < 0.0001$ ). When the different zones were compared, significant differences were noted between any two groups ( $p = 0.0046$ ,  $p < 0.0001$ ). The women in the earthquake zone (29.6%) were more likely to eat to ease their psychological pressure, possibly resulting from the earthquake, followed by women in the shaking (18.9%) and non-seismic zones (3.9%).

### Dietary attitudes

#### Understanding of healthy food intake

As shown in Table 4, the survey results indicated that women from the earthquake, shaking, and non-seismic zones did not manifest statistically significant differences in terms of their understanding of healthy food intake (Fisher's exact test:  $p = 0.316$ ).

#### Consciously ensuring high daily intake of nutrients

According to Table 4, the women displayed a statistically significant difference with regards their consciousness of ensuring high daily intake of nutrients ( $p < 0.0001$ ). No difference was found between the women from the earthquake (51.9%) and shaking zones (60.8%) ( $p = 0.045$ ).

However, women from the earthquake ( $p < 0.0001$ ) and shaking zones ( $p < 0.0001$ ) manifested a higher level of consciousness than those from the non-seismic zone (27.8%).

### Dietary behaviours

#### Changes in food consumption level after the earthquake

As seen in Table 5, the results showed a statistically significant difference among the women with regard to the level of food consumption ( $p < 0.0001$ ). All comparisons between any two zones showed a statistical significance ( $p < 0.0001$ ) as well. The women in the earthquake (32.5%) and shaking (22.2%) zones manifested an evident increase in food consumption, but those from the non-seismic zone (2.9%) exhibited almost no change.

#### Changes in the consumption of snacks

As shown in Table 5, the snack consumption of the women after the earthquake differed significantly ( $p < 0.001$ ). All comparisons between two different zones showed statistical significance ( $p < 0.0001$ ). The increase in snack

**Table 3.** Effects of the earthquake on the dietary psychology of the participants from different zones

	Earthquake zone (n=206)	Shaking zone (n=326)	Non-seismic zone (n=204)	<i>p</i>	<i>p</i> <sup>1</sup>	<i>p</i> <sup>2</sup>	<i>p</i> <sup>3</sup>
Whether you have illusion of aftershocks?				<0.0001	0.0002	<0.0001	<0.0001
Yes	161 (78.2)	201 (62.8)	46 (22.9)				
No	45 (21.8)	119 (37.2)	155 (77.1)				
Do you pay more attention to health?				<0.0001	<0.0001	<0.0001	0.0015
Yes	125 (60.7)	128 (39.9)	36 (17.6)				
No	34 (16.5)	92 (28.7)	103 (50.5)				
Unclear	47 (22.8)	101 (31.4)	65 (31.9)				
Do you pay more attention to eating?				<0.0001	0.083	<0.0001	<0.0001
Yes	73 (35.4)	80 (24.9)	1 (0.5)				
No	85 (41.3)	165 (51.2)	127 (62.3)				
Unclear	48 (23.3)	77 (23.9)	76 (37.2)				
Do you ease the pressure through eat?				<0.0001	0.0046	<0.0001	<0.0001
Yes	61 (29.6)	61 (18.9)	8 (3.9)				
No	145 (70.4)	261 (81.1)	195 (96.1)				

Data was expressed as n (%).

*p*: ANOVA for any between groups difference; *p*<sup>1</sup>: Earthquake zone vs shaking zone; *p*<sup>2</sup>: Earthquake zone vs non-seismic zone; *p*<sup>3</sup>: Shaking zone vs non-seismic zone.

**Table 4.** Effects of the earthquake on the dietary attitudes of the participants from different zones

	Earthquake zone (n=206)	Shaking zone (n=326)	Non-seismic zone (n=204)	<i>p</i>	<i>p</i> <sup>1</sup>	<i>p</i> <sup>2</sup>	<i>p</i> <sup>3</sup>
How much food intake is considered to be healthy <sup>†</sup>				0.316			
Half full	26 (12.7)	42 (13.1)	26 (12.7)				
Moderate	175 (85.8)	266 (82.6)	175 (85.8)				
Full	1 (0.5)	10 (3.1)	1 (0.5)				
Just a little every meal	2 (1.0)	4 (1.2)	2 (1.0)				
Consciously ensuring high daily intake of nutrients				<0.0001	0.045	<0.0001	<0.0001
Yes	107 (51.9)	194 (60.8)	55 (27.8)				
No	99 (48.1)	125 (39.2)	143 (72.2)				

Data was expressed as n (%).

*p*: ANOVA for any between groups difference; *p*<sup>1</sup>: Earthquake zone vs shaking zone; *p*<sup>2</sup>: Earthquake zone vs non-seismic zone; *p*<sup>3</sup>: Shaking zone vs non-seismic zone.

<sup>†</sup>Fisher exact test: theoretical frequency is too small.

**Table 5.** Effects of the earthquake on the dietary behavior of the participants from different zones

	Earthquake zone (n=206)	Shaking zone (n=326)	Non-seismic zone (n=204)	<i>p</i>	<i>p</i> <sup>1</sup>	<i>p</i> <sup>2</sup>	<i>p</i> <sup>3</sup>
Food consumption level				<0.0001	<0.0001	<0.0001	<0.0001
Increased	67 (32.5)	71 (22.2)	6 (2.9)				
Decreased	46 (22.3)	29 (9.1)	2 (1.0)				
No change	93 (45.2)	220 (68.7)	196 (96.1)				
Consumption of snacks				<0.001	<0.0001	<0.0001	<0.0001
Increased	54 (26.2)	66 (20.7)	8 (3.9)				
Decreased	56 (27.2)	21 (6.6)	3 (1.5)				
No change	96 (46.6)	232 (72.7)	193 (94.6)				
Instant food reserve				<0.0001	<0.0001	<0.0001	<0.0001
Increased	125 (61.0)	103 (32.3)	16 (7.8)				
Decreased	17 (8.3)	17 (5.3)	0				
No change	63 (30.7)	199 (62.4)	188 (92.2)				

Data was expressed as n (%).

*p*: ANOVA for any between groups difference; *p*<sup>1</sup>: Earthquake zone vs shaking zone; *p*<sup>2</sup>: Earthquake zone vs non-seismic zone; *p*<sup>3</sup>: Shaking zone vs non-seismic zone.

consumption in the earthquake zone (26.2%) was more apparent than those in the shaking (20.7%) and non-seismic (3.9%) zones.

#### Changes in the tendency to stock instant food after the earthquake

After the earthquake, the amount of instant food stocked

by women in the three areas differed significantly ( $p < 0.0001$ ). According to Table 5, the increase in the amount of instant food stocked in the earthquake zone (61.0%) was more significant compared with those in the shaking (32.3%) ( $p < 0.0001$ ) and non-seismic zones (7.8%) ( $p < 0.0001$ ), which posted the largest increase among the three groups.

**Table 6.** Logistic regression for the effects of the earthquake on eating behaviours

Variable	Changes in the consumption of snacks after the earthquake <sup>‡</sup>					
	Estimate	SE	Sig.	OR <sup>†</sup>	95% CI <sup>†</sup>	
					Lower bound	Upper bound
Age	0.03	0.01	0.01*	1.03	0.01	0.04
Residence <sup>§</sup>	-0.49	0.21	0.02*	0.61	-0.89	-0.08
BMI	-0.13	0.04	0.00**	0.88	-0.20	-0.06
The scores of nutrition knowledge	-0.10	0.05	0.03*	0.91	-0.19	-0.01
Education level <sup>¶</sup>						
1	-0.28	0.33	0.39	0.75	-0.93	0.36
2	-0.44	0.27	0.10	0.64	-0.96	0.08
3	0.06	0.24	0.81	1.06	-0.41	0.52
4	0 <sup>a</sup>					
Income						
1	-0.26	0.67	0.70	0.77	-1.57	1.05
2	-0.72	0.58	0.21	0.46	-1.86	0.41
3	-0.53	0.57	0.34	0.59	-1.64	0.57
4	-0.21	0.59	0.71	0.81	-1.33	0.90
5	-0.18	0.62	0.77	0.84	-1.40	1.04
6	0 <sup>a</sup>					
Zone <sup>†††</sup>						
1	0.51	0.29	0.08	0.60	-0.06	1.09
2	0.74	0.21	<0.01**	0.48	0.33	1.16
3	0 <sup>a</sup>					

<sup>a</sup>This parameter is set to zero.

<sup>†</sup>OR: odds ratio; CI: confidence interval.

<sup>‡</sup>Changes in the consumption of snacks: 1: decreased; 2: no change; 3: increased.

<sup>§</sup>Residence: 0: town; 1: country.

<sup>¶</sup>Education level: 1: junior high school or below; 2: high school /technical school/vocational school; 3: junior college; 4: college or above.

<sup>††</sup>Income: 1: <500; 2: 500-1000; 3: 1000-2000; 4: 2000-3000; 5: 3000-4000; 6: >4000.

<sup>†††</sup>Zone: 1: non-seismic zone; 2: shaking zone; 3: earthquake zone.

\*Statistically significant ( $p < 0.05$ ); \*\*Statistically significant ( $p < 0.01$ ).

### Logistic regression for the effects of the earthquake on eating behaviours

Several factors were considered in modeling the effects of the earthquake on eating behaviours (e.g., changes in the consumption of snacks after the earthquake). Age, residence, BMI, the scores of nutrition knowledge, and the zone affected the eating behaviours, as observed in the ordinal logistic regression analysis (Table 6). The women were more likely to increase their consumption of snacks after the earthquake with increasing age (OR=1.03). Those who lived in town were more likely to increase their consumption of snacks after the earthquake those in the countryside (OR=0.61). The women were more likely to increase their consumption of snacks after the earthquake with decreasing BMI (OR=0.88) and nutrition knowledge scores (OR=0.91). The women in the earthquake zone were more likely to increase the consumption of snacks after the earthquake than those in the shaking zone (OR=0.48).

### DISCUSSION

In terms of objective data, limited food sources result in few food choices for earthquake-stricken people.<sup>23</sup> With limited options, these people usually pay minimal attention to food color, flavor and nutrition. Under these conditions, people are more prone to inadequate nutrient intake and food insecurity. Thus, relief and public health professionals should focus more on the occurrence of various diseases and their prevention.<sup>17,18</sup> Ideally, ongoing nutritional surveillance should be a standard prac-

tice so that a deteriorating situation can be identified early on.<sup>13</sup> In terms of the subjective aspect, the food intake psychology, dietary attitudes behaviours of people after an earthquake generally exhibit major changes. These people become more vigilant about the nutritional value and acceptability of the food they eat than those who live in other areas.

#### Nutrition knowledge

The results of this study show that the mean scores in nutrition knowledge gained by the women from the three groups are relatively low. One's knowledge may have important effects on his dietary attitudes and behaviours, so it is necessary to carry out nutrition health education after an earthquake.

#### Dietary psychology

The survivors' psychological health is a critical force in strengthening the capacity for disaster preparedness in nutritional needs.<sup>13</sup> On the one hand, we found that the earthquake exerted a huge impact on survivors' psychological health. For example, many respondents reported experiencing aftershock hallucinations or being in a state of anxiety and restlessness. On the other hand, some respondents began paying more attention to health and eating, and even resorted to some unhealthy dietary behaviour in order to ease psychological pressure. As such, at this time, the right diet guidance and psychological channel are particularly important.

### ***Dietary attitudes***

Most of the people who experienced the earthquake were in a bad mood afterwards. Some even manifested clinical anxiety and depression. Clearly, the mental state of people significantly affects their need for food. Several individuals encountered gastrointestinal problems because of a sluggish state under difficult times. After the earthquake, the safety of food and drinking water became a major problem in the reconstruction efforts. The safety of food and water obviously plays a key role in preventing malnutrition and a possible epidemic. The results of this study show that women in the earthquake zone became more cautious of their diet, compared with those in the other zones.

The women in the earthquake zone also experienced strengthened subjective nutritional intake requirements. At the same time, they needed substance and had to satisfy other objective conditions. Thus, they were more inclined to increase their nutrient intake to ensure sufficient daily nutrient supply as much as possible.

### ***Dietary behaviours***

Food is the most basic human physiological need, and seeking for food is explained by certain psychological and behavioral science principles. The change experienced in relation to this need affects the motivation to eat and can either stimulate or dissipate one's eating behavior.<sup>24</sup>

After the earthquake, the people in the earthquake zone ate less because of food shortage. Their eating behaviours were affected by food shortage. Moreover, the psychological influence of earthquakes on people can be observed through both subjective and objective factors.

This study shows that the food consumption level of women in the earthquake and shaking zones significantly increased compared with those in the non-seismic zone. The insufficient food supply triggered fear and other psychological changes among the people after the earthquake. Food available from aid agencies were mostly in the form of instant food, which contained high amounts of energy and fat. Thus, people were more prone to exhibit irrational and excessive consumption.

### ***The effects of the earthquake on eating behaviours***

The effects of the earthquake on eating behaviours, especially the tendency to eat snack foods, have public health significance because they are usually unhealthy. Factors like age, residence, BMI, the scores of nutrition knowledge, and zone (earthquake zone, shaking zone, and non-seismic zone) affected the women's snack-consumption behaviour after the earthquake. Nutrition knowledge scores affected their behaviours, after the earthquake. As such, the women were more likely to increase their consumption of snacks, with every decreasing nutrition knowledge scores. In addition, the women in the earthquake zone were more likely to increase their consumption of snacks after the earthquake than those in the shaking zone. Thus, nutrition health education is particularly important for women who come from the earthquake zone. Furthermore, after the earthquake, many people in a state of anxiety and restlessness experienced loss of appetite. Snacks, although not sedated, can play a role in regu-

lating people's mood by defusing tension and eliminating anxiety. Thus, the diet of these people should be improved by adding more carbohydrates usually found in foods such as lotus seeds, dates, and bananas.

Furthermore, people manifested genuine awareness about natural disasters after their earthquake experience, thereby highlighting the importance of considerate treatment and improved quality of life through nutrition and health care. The psychological and physical trauma caused by the earthquake induced long-term anxiety; hence, many respondents blindly believed that eating highly nutritious food could increase their appetite. Most of the Chinese people's beliefs about nutrition are unpopular; specifically, some beliefs and behaviours regarding nutritional concepts contain no scientific basis.<sup>25</sup> Moreover, disasters increase the susceptibility of people to various diseases and food poisoning infections. The blind pursuit for nutritional needs could mislead people into experiencing adverse consequences. Therefore, providing essential data is necessary in developing effective nutritional interventions on dietary attitudes and behaviour.

### ***Limitations***

This study is not without limitations. First, there is a lack of a valid and reliable questionnaire in this field. The questionnaire was self-designed after the pretest and repeated discussions with experts. We have yet to conduct a concurrent study for the questionnaire. Second, in terms of timing, the survey was conducted two months after the earthquake. By that time, the dietary attitude and behaviour of the people might have already changed. It would have been better if we had conducted the survey immediately after the earthquake occurred. Third, an earthquake is an emergency, for which a baseline survey cannot be performed, so there is no related information before the earthquake in Wenchuan. Fourth, there were both measured and unmeasured differences among three zones that could introduce bias. Fifth, the representativeness of the sample, as carried out from the selected zones, was not the same and may be insufficient. Finally, the study design, which is cross-sectional in nature, can only determine association and not causality. Although we used regression models, further longitudinal studies may be needed to confirm our finding.

### ***Conclusions***

The major Wenchuan earthquake was associated with differentials in dietary attitudes and behaviours among women by seismic zone. We have found the need to carry out nutrition health education in the earthquake zone so as to improve the diet psychology of the people in this area, diminish the hazards of the earthquake, and gain more benefits from the post-disaster reconstruction.

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#### AUTHOR DISCLOSURES

The authors declare that they have no competing interests.

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Original Article

## Dietary attitudes and behaviours of women in China after the 2008 Wenchuan earthquake in three seismically different zones

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### 对中国三个不同地域的女性在 2008 年汶川地震后的饮食态度和行为调查

**背景和目的：**2008 年突发的汶川地震不仅摧毁了人们的健康,还可能对幸存者的心理、饮食态度和行为造成影响。尽管已有许多关于自然灾害对人们健康影响的调查,但缺少对人们饮食态度和行为影响的相关研究。本研究的目的是评估汶川地震对居住在中国不同地区的成年女性的饮食态度和行为的影响。**方法与研究设计：**随机抽取了 736 名 18-55 岁的女性作为研究对象,分布为地震区(206 名)、震感区(326 名)和非地震区(204 名)。**结果：**3 组女性的营养知识平均得分均相对较低,但地震区的女性比其他两个地区的女性更加警惕食物的营养价值和可吸收性。然而,在地震区的女性也养成了一些不良饮食行为,如储存速食食品和增加零食消费。Logistic 回归分析显示,年龄、地区、BMI 和营养知识得分是女性震后零食摄入行为的影响因素。**结论：**本研究表明汶川地震对不同地区女性的饮食态度和行为带来了不同程度的影响。

**关键词：**灾害、地震、女性、饮食态度、饮食行为