Original Article

Psychometric Properties of the Persian Food-Life Questionnaire Short Form among Obese Breast Cancer Survivors

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ABSTRACT

Objective: To assist weight control among women with breast cancer, improving their food attitudes may be an effective method. Therefore, the present study validated a short instrument assessing food attitudes (i.e., the Short Form of the Food-Life Questionnaire [FLQ-SF]) among Iranian women with breast cancer who are overweight. **Methods:** Women with breast cancer who were overweight ($n = 493$; mean ± standard deviation age = 52.3 ± 10.7 years) participated in the study. All of them completed the FLQ-SF, questions designed using the theory of planned behavior (TPB; including subjective norm, perceived behavioral control, and behavioral intention), and food frequency questionnaire (FFQ). Both classical test theory and Rasch models were used to examine the psychometric properties of the FLQ-SF. More specifically, the factorial structure of the FLQ-SF was assessed using confirmatory factor analysis (CFA), the item fit was examined using the Rasch model, and the concurrent validity was evaluated using the correlation between the FLQ-SF, TPB elements, and FFQ. **Results:** CFA results confirmed the Persian FLQ-SF has a five-factor structure. Rasch models indicated that all the FLQ-SF items fit in the construct of food attitudes. Significant correlations between FLQ-SF and other instruments (TPB elements and FFQ) supported the concurrent validity of the FLQ-SF. **Conclusions:** The psychometric findings of the present study demonstrated that Persian FLQ-SF is a reliable and valid instrument. Therefore, the Persian FLQ-SF can be applied to assess food attitudes among Iranian women with breast cancer who are overweight.

Key words: Breast cancer, classical test theory, food attitude, obesity, Rasch model

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Introduction

Health and psychosocial impacts of being overweight on people's health can be severe. More specifically, individuals who are overweight may suffer from both health problems (e.g., high risk of developing type 2 diabetes) and psychological health problems (e.g., increased psychological distress and weight-related self-stigma).[1,2] The health problems resulting from being overweight also exist in cancer patients, and the association between mortality and being overweight was found in a study using a prospectively cohort design.[3] Among different types of cancer, breast cancer is one of the most common and is the leading cause of cancer death among women.[4] Furthermore, weight gain has been found to be an important issue for oncologists when taking care of women with breast cancer. After having a diagnosis of breast cancer, patients have a 13% increase of breast cancer-specific mortality and a 12% increase of any-cause mortality for every five pounds they gain in weight.[5] Therefore, assisting women with breast cancer to control their weight is a priority issue for healthcare providers.

Given that the major contributors for gaining weight are lack of physical activity, high levels of energy intake, and genetic factors,[6] dieting appears to be the most appropriate method to assist women with breast cancer in reducing their weight. More specifically, women with breast cancer may not have a high level of energy to engage in physical activity, and there is nothing that can be done concerning their genetic make-up. Consequently, assisting women with breast cancer to select and consume appropriate food is deemed to be an effective method in helping them control their weight.

To assist women with breast cancer to select and consume appropriate food, healthcare providers should first understand how cancer patients judge the food (i.e., what is the attitude of cancer patients toward food and related issues). Indeed, Lozano *et al*.[7] stated that attitudes toward food have been shown to guide individuals to select food and their eating behavior, which consequently influence their general health. Although such attitudes are generally conceptualized as "a summary evaluation of a psychological object captured in such attribute dimensions as good–bad, harmful–beneficial, pleasant–unpleasant, and likeable–dislikeable (p. 28),"[8] when Ajzen[9] proposed the theory of planned behavior (TPB), attitudes toward food should have specific characteristics apart from the generally defined attitudes.[10]

Considering the uniqueness of food attitudes, Aikman *et al*.[11] proposed five domains to describe food attitudes (positive affect, negative affect, abstract cognitive qualities, general sensory qualities, and specific sensory qualities) and

developed the Food Attitude Questionnaire in relation to six specific foods. In addition, Rozin *et al*.[12,13] developed the 25-item Food-Life Questionnaire (FLQ) with a six-domain structure (weight concern [WC], diet and health orientation [DHO], belief in a diet-health link [DHL], food negativity/food importance, disordered eating characteristics, and natural/vegetarian) to examine the attitudes toward healthy foods (i.e., low fat/salt reduced). The FLQ was then reduced to a short form (i.e., FLQ-SF), with only 22 (of which the six FLQ domains were reduced to five: WC, DHO, DHL, food and pleasure [FP], and natural [N]) to feasibly and to quickly assess the food attitudes.[10] Moreover, when compared to the Food Attitude Questionnaire, the FLQ-SF has the advantages of brevity (i.e., 22 items in the FLQ-SF vs. 51 items in the Food Attitude Questionnaire) and broad range of food (i.e., healthy foods in the FLQ-SF vs. six specific foods in the Food Attitude Questionnaire). Given that women with breast cancer may be easily fatigued and find it difficult to complete a long questionnaire, the FLQ-SF appears to be a better choice in helping healthcare providers to understand food attitudes among their patients.

Because the FLQ-SF has never been used in an Iranian context, the primary aim of the present study was to translate the FLQ-SF into a culturally appropriate Persian version. In addition, the psychometric properties of Persian FLQ-SF were evaluated to determine whether it could be applicable for research and applied intervention studies on breast cancer patients. More specifically, the psychometric testing included three dimensions: (i) applying two types of test theories, including classical test theory and Rasch analysis, to the Persian FLQ-SF; (ii) using external criteria (TPB elements and different types of food consumption) to examine the concurrent validity of the Persian FLQ-SF; and (iii) constructing regression models to further understand the associations between the Persian FLQ-SF and different types of food consumption when demographics and TPB elements are controlled for.

Methods

Participants and procedure

Between February 2018 and January 2019, women with breast cancer were recruited from six oncology centers in three cities of Tehran, Qazvin, and Karaj, (Iran). More specifically, the participants were recruited through convenience sampling and no randomization has been applied in the recruitment process. Eligible patients were at least 18 years old with a body mass index (BMI) >25 kg/m², histologically-confirmed breast cancer, the ability to understand Persian, and willingness to participate in the study. Patients with severe cognitive impairment (as

assessed by the mini-mental state examination), pregnant, or severe mental diseases were excluded from the study. Only women who were overweight or obese were recruited because the scope of the study was to understand problems among women with breast cancer who were overweight or obese. All procedures of this study involving human subjects were approved by the Ethics Committee of the Qazvin University of Medical Sciences. Written informed consent was obtained from all the participants.

Translation procedure

Standard steps suggested by the international guidelines were applied to the translation procedure, including forward translation, backward translation, panel reviewing, and pilot testing.[14,15] For forward translation, two bilingual translators who were native Persian speakers independently translated the FLQ-SF into Persian. Following this, the corresponding author and the two translators reconciled the two forward translations into an interim Persian version. For backward translation, the interim Persian version was translated back into English by two native English speakers, who were unaware of the content of the original English FLQ-SF before performing translation. For the panel reviewing, different versions of the FLQ-SF (two forward translations, interim Persian version, and two back translations) were compared and checked for cross-cultural equivalency by an expert committee comprising a psychiatrist, nurse, psychologist, nutritionist, and psychometrician. A prefinal version was then generated. For the pilot testing, 36 patients completed the prefinal version to ensure that the readability and confirmed the final Persian FLQ-SF.

Instrumentation

Body mass index and clinical data

Weight (kg), height (cm), BMI, hip circumference, and waist circumference were measured by two study researchers using the World Health Organization (WHO) criteria for BMI nutritional status. More specifically, the operational definition of nutritional weight status recommended by the WHO is: 18.5 and below – underweight; 18.5–2.49 – normal weight; 25.0–29.9 – preobesity (overweight); 30.0 and above – obesity (http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi). Clinical data were collected from patient medical records.

Food Life Questionnaire-Short Form

The FLQ-SF comprises 22 items distributed across six domains (WC with six items; DHO with five items; DHL with four items; FP with four items; and N with three items). All items were rated on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree), and a higher score indicates

more WC (for WC domain), higher DHO (for DHO domain), better DHL (for DHL domain), greater FP (for FP domain), or more natural (for N domain). The internal consistency of the FLQ-SF was adequate for the entire FLQ-SF score (α = 0.75) and each FLQ-SF domain score (α = 0.83 for WC, 0.67 for DHO, 0.75 for DHL, 0.73 for FP, and 0.82 for N).[10]

Theory of planned behavior elements

All the TPB elements were assessed using the items adopted from Chitsaz *et al*.:[16] (i) Subjective norm was assessed using three items (sample item "My husband believes that I should eat healthy food") rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). A higher score indicates a higher level of subjective norm and the internal consistency of subjective norm was very good (α = 0.84); (ii) perceived behavioral control (PBC) was assessed using seven items (sample item "I have complete control over whether I eat healthy food daily during the next month") rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). A higher score indicates a higher level of PBC and the internal consistency of PBC was excellent (α = 0.93); (iii) behavioral intention was assessed using two items (sample item "In the next month, I intend to eat healthy food every day") rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). A higher score indicates a stronger intention to eat healthy food and the internal consistency of behavioral intention was very good (α = 0.88).[16]

Dietary assessment

Dietary assessment was conducted using a 168-item semi-quantitative food frequency questionnaire (FFQ). The Iranian FFQ includes a list of foods (with standard serving sizes) that are commonly consumed by the Iranians. The frequency reported for each food item was then converted to daily intake. Following this, portion sizes of consumed foods were converted to grams, and the weight of seasonal items (e.g., some vegetables) was calculated using the number of seasons available in each food.[17-19] Although 17 food groups can be generated using the FFQ, the present study only used the following food groups for data analysis: fruit consumption (g/day), vegetable consumption (g/day), whole grain consumption (g/day), and fast food (g/week).

Statistical analysis

Psychometric properties of the FLQ-SF were analyzed using two different testing theories: classical test theory and Rasch analysis. In classical test theory, the following analyses were performed: acceptance, confirmatory factor analysis (CFA) using diagonally weighted least squares (WLSMV) estimator, average variance extracted, composite reliability, internal consistency, corrected

item-total correlation, standard error of measurement, and ceiling/floor effects. In Rasch analysis (using partial credit model), the following statistics were computed: item difficulty, information-weighted mean-square (infit MnSq), outlier sensitive MnSq (outfit MnSq), item separation reliability and index, person separation reliability and index, and differential item functioning (DIF). In addition, DIF was conducted across a mean age (<52 years vs. ≥52 years) and educational status (educational year >9 years vs. ≤9 years). Pearson correlations were conducted to understand the associations between FLQ-SF and several external criteria (subjective norm, PBC, behavioral intention, fruit consumption, vegetable consumption, whole grain consumption, and fast food consumption). Following this, four hierarchical regression models (dependent variables were the consumptions of fruit, vegetable, whole grains, and fast food) were constructed to understand to what extent the FLQ-SF was associated with these dependent variables after controlling for age, gender, BMI, and TPB elements. More specifically, in Step 1 regression models, behavioral intention was not included. In Step 2 regression models, all the controlling variables were included.

Regarding the criteria for determining whether the FLQ-SF is a reliable and valid instrument, the following cutoffs were applied to the analyses using classical test theory: a nonsignificant χ^2, comparative fit index (CFA) >0.9, Tucker–Lewis index (TLI) >0.9, root mean square residual of approximation (RMSEA) <0.08, and standardized root mean square residual (SRMR) <0.08 for CFA.[20-24] In addition, average variance extracted >0.5, composite reliability >0.6, ceiling/floor effects <20%, internal consistency of Cronbach's α >0.7, test–retest reliability using intraclass correlation coefficient (ICC) >0.4, acceptance (i.e., completion rate in %) >80, factor loadings derived from CFA >0.4, and corrected item-total correlation >0.4 were in anticipation.[25,26] The following cutoffs were applied to the Rasch analysis: item and person separation reliability >0.7; item and person separation index >2;[27,28] infit and outfit MnSq between 0.5 and 1.5; DIF contrast <0.5 across age; and educational status.[29,30] The statistics were performed using MPLUS (for CFA), WINSTEP (for Rasch analysis, Muthén & Muthén, Los Angeles, CA, USA), and SPSS (for other analyses, IBM, Armonk, NY, USA).

Results

On average, the participants (*n* = 493) were 52.3 years (standard deviation [SD] = 5.7), received 9.1 years of education (SD = 3.7), and had breast cancer diagnose for 8.4 years (SD = 6.1). Other characteristics of the participants are presented in Table 1.

Table 1: Characteristics of the participants (*n*=493)	
Characteristics	Data
Age (years); Mean (SD)	52.3 (10.7)
Educational year; Mean (SD)	9.1 (3.7)
Marital status; *n* (%)	
Single	71 (14.4)
Married	359 (72.8)
Widowed/divorced	63 (12.8)
Menopausal status; *n* (%)	
Pre-menopause	212 (43.0)
Post-menopause	281 (57.0)
HRT (yes); *n* (%)	54 (11.0)
Cancer family history (yes); *n* (%)	166 (33.7%)
Treatment ever received; *n* (%)	
Chemotherapy	307 (62.3)
Radiation	351 (71.2)
Surgery	391 (79.3)
First pregnancy age (years); Mean (SD)	20.5 (6.1)
Child number (*n*); Median (IQR)	2.0 (3.0)
Mini-Mental State Exam; Mean (SD)	25.1 (3.1)
Karnofsky Performance Scale Score; Mean (SD)	68.9 (13.7)
Height (cm); Mean (SD)	156.9 (6.8)
Weight (cm); Mean (SD)	72.3 (5.7)
BMI (kg/m²); Mean (SD)	29.7 (8.4)
Waist circumference (cm); Mean (SD)	98.5 (10.9)
Hip circumference (cm); Mean (SD)	110.1 (18.6)
Waist/hip ratio; Mean (SD)	0.89 (0.10)
Time since diagnosis (years); Mean (SD)	8.4 (6.1)
HRT: Hormone replacement therapy	

The psychometric properties in the item level were satisfactory for the FLQ-SF. From the results of classical test theory, the FLQ-SF had good acceptance (83–100); adequate-to-very good factor loadings derived from CFA (0.62–0.87), acceptable-to-good corrected item-total correlations (0.54–0.82), and good-to-excellent test–retest reliability (0.75–0.93) [Table 2]. From the results of Rasch analysis, the FLQ-SF had appropriate infit MnSq (0.77–1.28) and outfit MnSq (0.77–1.27) and had no substantial DIF contrasts (–0.37–0.34 across age group and –0.30–0.41 across educational status). In addition, the Rasch model-generated item difficulties were between –0.74 and 1.21 for WC; –0.73 and 0.57 for DHO; –0.11 and 0.09 for DHL; –0.31 and 0.34 for FP; –0.51 and 0.34 for N [Table 2].

The psychometric properties in the scale level were satisfactory for the FLQ-SF. From the results of classical test theory, the FLQ-SF had trivial ceiling (2.7%–8.1%) and floor effects (1.6%–7.2%), satisfactory internal consistency (α = 0.72–0.91); acceptable fit indices of the CFA (CFI = 0.92, TLI = 0.91, RMSEA = 0.071, and SRMR = 0.050), and excellent test–retest reliability (ICC = 0.77–0.88) [Table 3]. From the results of Rasch analysis, the FLQ-SF had promising item separation reliability (range between 0.93 and 0.99), excellent item

Table 2: Psychometric properties of the Food-Life Questionnaire-Short form in item level

Scale	Analyses from classical test theory				Analyses from Rasch				
Item	Acceptance*	Factor loading	Item-total correlation	Test-retest reliability[†]	Infit MnSq	Outfit MnSq	Difficulty	DIF contrast across age[‡,§]	DIF contrast across educational status [‡,∥]
WC1	83	0.69	0.63	0.80	0.87	0.90	−0.07	−0.33	0.23
WC2	92	0.71	0.59	0.79	0.95	0.98	0.59	0.24	0.11
WC3	88	0.75	0.65	0.92	1.09	0.98	−0.66	−0.04	0.17
WC4	96	0.70	0.55	0.90	1.28	1.27	1.21	0.09	−0.22
WC5	89	0.68	0.61	0.88	0.91	0.93	−0.33	0.03	−0.13
WC6	83	0.73	0.64	0.86	0.85	0.91	−0.74	0.06	−0.30
DHO1	98	0.81	0.74	0.76	1.0	0.99	−0.73	0.34	−0.28
DHO2	100	0.87	0.80	0.88	0.79	0.83	−0.55	0.24	0.41
DHO3	86	0.72	0.69	0.91	1.11	1.14	0.43	−0.17	−0.16
DHO4	88	0.78	0.72	0.77	1.10	1.08	0.26	0.07	0.19
DHO5	93	0.78	0.75	0.84	0.88	0.89	0.57	−0.30	0.01
DHL1	90	0.82	0.78	0.82	1.07	1.08	−0.11	0.10	0.35
DHL2	92	0.85	0.82	0.79	0.92	0.88	0.09	−0.37	−0.05
DHL3	99	0.87	0.81	0.90	0.89	0.89	−0.02	−0.02	0.01
DHL4	100	0.85	0.79	0.77	1.07	1.06	0.04	0.32	−0.06
FP1	89	0.62	0.54	0.89	1.22	1.20	0.25	0.28	0.07
FP2	97	0.64	0.58	0.93	1.08	1.09	0.34	0.09	0.27
FP3	92	0.80	0.68	0.85	0.80	0.77	−0.31	−0.15	0.29
FP4	99	0.83	0.69	0.77	0.77	0.78	−0.27	0.01	0.09
N1	90	0.73	0.67	0.75	1.01	0.95	−0.51	0.13	0.15
N2	86	0.64	0.54	0.86	0.93	0.86	0.17	−0.10	−0.20
N3	88	0.75	0.68	0.81	1.06	0.98	0.34	−0.03	0.33

*Completion rates in %. [†]Using Intraclass Correlation Coefficient (ICC). [‡]DIF contrast >0.5 indicates substantial DIF. [§]DIF contrast across age=Difficulty for younger patients (< mean age [52 years]) -Difficulty older patients (≥mean age [52 years]). [∥]DIF contrast across educational status=Difficulty for patients with high educational status (>9 years) -Difficulty for patients with low educational status (≤9 years). WC: Weight concern; DHO: Diet-health orientation; DHL: Diet-health link; FP: Food and pleasure; N: Natural; MnSq: Mean square error; DIF: Differential item functioning

Table 3: Psychometric properties of the Food Life Questionnaire-Short Form in scale level

Psychometric testing	WC	DHO	DHL	FP	N	Suggested cutoff
Ceiling effects (%)	8.1	3.4	2.7	4.1	5.6	<20
Floor effects (%)	2.7	1.6	4.1	7.2	2.1	<20
Internal consistency[†]	0.83	0.89	0.91	0.81	0.72	>0.7
Confirmatory factor analysis						
χ^2 (df)		760.927 (199)[‡]				Nonsignificant
Comparative fit index		0.92[‡]				>0.9
Tucker-Lewis index		0.91[‡]				>0.9
RMSEA		0.071[‡]				<0.08
SRMR		0.050[‡]				<0.08
Average Variance Extracted	0.50	0.63	0.72	0.53	0.50	>0.5
Composite Reliability	0.86	0.89	0.91	0.82	0.75	>0.6
Standard error of measurement	0.84	1.03	0.54	1.26	0.63	The smaller the better
Rasch analysis						
Item separation reliability	0.99	0.99	0.93	0.94	0.96	>0.7
Item separation index	9.76	8.32	5.84	3.96	5.16	>2
Person separation reliability	0.87	0.85	0.86	0.79	0.74	>0.7
Person separation index	2.85	2.60	2.51	2.74	2.21	>2
Test-retest reliability[§]	0.83	0.79	0.81	0.88	0.77	>0.4

*$P<0.001$. [†]Using Cronbach's α; [‡]The fit indices were calculated using the CFA included all five domains (WC, DHO, DHL, FP, and N) in the same structure; [§]Using Intraclass Correlation Coefficient (ICC). WC: Weight concern; DHO: Diet-health orientation; DHL: Diet-health link; FP: Food and pleasure; N: Natural; RMSEA: Root-mean square error of approximation; SRMR: Standardized root mean square residual

separation index (range between 3.96 and 9.76), acceptable person separation reliability (range between 0.74 and 0.87), and adequate person separation index (range between 2.21 and 2.85) [Table 3].

Moreover, FLQ-SF was adequately associated with external criteria, which support its concurrent validity. More specifically, the FLQ-SF domain scores were positively and significantly correlated to subjective norm ($r = 0.28$–0.43), PBC ($r = 0.34$–0.41), behavioral intention ($r = 0.24$–0.42), fruit consumption ($r = 0.28$–0.47), vegetable consumption ($r = 0.23$–0.32), and whole grain consumption ($r = 0.26$–0.39) and negatively and significantly correlated to fast food consumption ($r = −0.32$—0.22) [Table 4]. The hierarchical regression model further showed that DHO domain (as compared with other FLQ-SF domains) appeared to be a stronger predictor in all types of consumption. Nevertheless, the associations between FLQ-SF domains and the food consumptions were generally supported after controlling relevant confounders [Table 5].

Discussion

To the best of our knowledge, no prior study has ever examined the psychometric properties of the FLQ-SF since the FLQ was shortened by Sharp *et al.*[10] Therefore, the present study is the first to have examined the psychometric properties of the FLQ-SF among women with breast cancer. Moreover, the FLQ-SF was translated into Persian version

Table 4: Intercorrelation between study variables													
	2	3	4	5	6	7	8	9	10	11	12	Mean	SD
1. WC	0.48	0.51	0.33	0.25	0.36	0.36	0.31	0.29*	0.28*	0.37	-0.28	18.34	3.22
2. DHO	1	0.44	0.35	0.30	0.38	0.34	0.26*	0.24*	0.27	0.34	-0.32	15.11	3.81
3. DHL	-	1	0.20	0.27	0.31	0.41	0.24	0.28	0.23	0.39	-0.24	16.03	4.26
4. FP	-	-	1	0.36	0.43	0.34	0.29	0.47	0.32	0.26	-0.30	13.48	2.91
5. N	-	-	-	1	0.28	0.34	0.42	0.31	0.26	0.28	-0.22	10.66	2.74
6. Subjective norms	-	-	-	-	1	0.26	0.34	0.45	0.38	0.33	-0.19	3.26	0.89
7. Perceived behavioral control	-	-	-	-	-	1	0.46	0.35	0.29	0.40	-0.26	3.41	1.02
8. Intention	-	-	-	-	-	-	1	0.41	0.32	0.38	-0.30	3.01	1.08
9. Fruit consumption (g/d)	-	-	-	-	-	-	-	1	0.48	0.27	-0.33	401.21	39.67
10. Vegetable consumption (g/d)	-	-	-	-	-	-	-	-	1	0.34	-0.21	234.51	14.83
11. Whole grain consumption (g/d)	-	-	-	-	-	-	-	-	-	1	0.18*	72.10	15.63
12. Fast food (g/wk)	-	-	-	-	-	-	-	-	-	-	1	199.30	48.12

WC: Weight concern; DHO: Diet-health orientation; DHL: Diet-health link; FP: Food and pleasure; N: Natural. All *P*<0.01, except for **P*<0.05

Table 5: Hierarchical linear regressions of healthy eating behaviors onto age, gender, body mass index, weight concern, diet-health orientation, belief in a diet-health linkage, food and pleasure, natural food preferences, attitude, subjective norms, perceived behavior control and intention								
	B (SE)							
	Fruit	Vegetable	Whole grains	Fast food	Fruit	Vegetable	Whole grains	Fast food
Age	0.80 (0.65)	0.01 (0.01)	-0.05 (0.08)	0.01 (0.04)	0.66 (0.64)	0.01 (0.03)	0.07 (0.08)	0.02 (0.04)
Gender	0.08 (0.07)*	0.19 (0.11)	0.14 (0.19)	0.05 (0.10)	0.13 (0.08)	0.17 (0.12)	0.18 (0.19)	0.08 (0.10)
BMI	-0.63 (0.24)*	-0.15 (0.05)**	-0.02 (0.02)	0.08 (0.03)**	-0.67 (0.26)*	-0.17 (0.07)*	-0.02 (0.02)	0.05 (0.03)
WC	0.52 (0.57)	0.05 (0.02)**	0.27 (0.17)	-0.19 (0.06)**	0.23 (0.57)	0.05 (0.02)**	0.36 (0.16)*	-0.12 (0.08)
DHO	4.64 (0.56)**	0.50 (0.10)**	0.48 (0.14)**	-0.06 (0.02)**	4.48 (0.55)**	0.49 (0.10)**	0.55 (0.11)**	-0.24 (0.09)**
DHL	2.36 (0.48)**	0.32 (0.09)**	0.03 (0.16)	-0.35 (0.07)**	1.94 (0.48)**	0.27 (0.09)**	0.07 (0.016)	-0.18 (0.07)**
FP	0.04 (0.09)	0.04 (0.08)	0.01 (0.03)	-0.19 (0.08)*	0.03 (0.09)	0.05 (0.08)	0.01 (0.03)	-0.05 (0.05)
N	0.24 (0.19)	0.17 (0.10)	0.07 (0.13)	-0.01 (0.02)	0.26 (0.19)	0.20 (0.10)*	0.04 (0.13)	-0.05 (0.04)
SN	0.41 (0.44)	0.05 (0.03)	0.02 (0.05)	-0.06 (0.07)	0.30 (0.44)	0.01 (0.03)	0.03 (0.05)	-0.06 (0.05)
PBC	2.79 (0.44)**	0.16 (0.08)*	0.56 (0.13)**	-0.21 (0.09)*	1.76 (0.48)**	0.06 (0.09)	0.24 (0.14)	-0.23 (0.09)*
Intention	--	--	--	--	1.75 (0.38)**	0.18 (0.07)*	0.55 (0.11)**	-0.30 (0.06)**
Model summary								
*R*²	0.663	0.332	0.160	0.261	0.676	0.412	0.198	0.298
Adj. *R*²	0.658	0.320	0.150	0.240	0.670	0.330	0.180	0.280
F change	115.408	26.105	10.17	22.09	20.596	6.585	24.67	23.886

B: Unstandardized regression coefficients; WC: Weight concern; DHO: Diet-health orientation; DHL: Diethealth link; FP: Food and pleasure; N: Natural; SN: Subjective norms; PBC: Perceived behavior control. **P*<0.05. ***P*<0.01.

with methodological rigor (i.e., the linguistic validity and cultural adaption were both robust). In comparing the present study with the only other psychometric testing study concerning the FLQ-SF,[10] findings from both studies have a number of agreements: the factorial structure of the FLQ-SF is five-factor, the internal consistency of the FLQ-SF is acceptable, and the concurrent validity of the FLQ-SF is supported by the significant correlations with TPB elements and different types of food consumptions.

Apart from the consistent findings between the present results and the results of Sharp *et al.*,[10] the present study significantly extends the psychometric properties of the FLQ-SF given that the present study found: (i) the FLQ-SF items all fit their embedded domains and only little redundancy exists among these items as the Rasch model indicated that all the FLQ-SF items had acceptable infit

and outfit MnSq (i.e., ranged between 0.5 and 1.5);[26,27] (ii) all the FLQ-SF items were interpreted similarly across age group and educational status given that all the DIF contrasts were not substantial (i.e., DIF contrast <0.5).[29,30] As no substantial DIF was displayed for FLQ-SF items, all the FLQ-SF items can be used to combine or compare women with breast cancer among different age groups or different educational levels; (iii) the FLQ-SF had satisfactory test–retest reliability in both item level and scale level. Therefore, the reproducibility of the FLQ-SF is confirmed and healthcare providers can use FLQ-SF across a period of time; (iv) the confirmation of the factorial structure for the FLQ-SF was corroborated by the CFA results. Because Sharp *et al.*[10] only used exploratory factor analysis (EFA) to determine the FLQ-SF factorial structure, they recommended that a CFA was needed to verify their EFA structure findings.

The psychometric findings in the present study concerning the FLQ-SF among women with breast cancer may help guide healthcare providers to tackle the important problem of weight gain for women with breast cancer.[31] More specifically, because the FLQ-SF is found to be reliable and valid among women with breast cancer, healthcare providers may use the FLQ-SF to understand the food attitudes for these patients and further decide whether programs that improve food attitudes are essential. In other words, using a reliable and valid FLQ-SF will assist healthcare providers in correctly and effectively understanding food attitudes among overweight women with breast cancer.

There are some limitations in the present study. First, the study only recruited women with breast cancer who were overweight or obese. Given that some breast cancer patients may not be overweight, the generalizability of the findings might not be applicable to those who are in other weight status categories (e.g., normal weight or underweight). Therefore, future studies are needed to examine whether the FLQ-SF is also reliable and valid among women with breast cancer who are not overweight. Second, although the test–retest reliability was examined (which indicated the reproducibility of the FLQ-SF), the responsiveness for the FLQ-SF was not examined. Therefore, it cannot be concluded whether the FLQ-SF can detect meaningful or important changes in food attitudes after the participants completed an effective program on food attitudes improvement. Therefore, future studies are needed to further examine the responsiveness of FLQ-SF. Third, all the external criteria that were used to assess the concurrent validity of the FLQ-SF (i.e., TPB elements and food consumptions) were self-reported by the participants. Therefore, the common method of bias cannot be excluded because FLQ-SF was also self-report. Future studies could use other types of external criteria (e.g., food diary to objectively record food consumption) to eliminate the common method bias. Finally, only women who were overweight or obese were recruited. Therefore, the findings cannot be generalized to those who are underweight or normal weight. Future studies are required to examine these unstudied populations.

Conclusion

The present study demonstrated that FLQ-SF serves as a simple measure for assessing food attitudes. The validity, reliability, and feasibility of the FLQ-SF among a sample of breast cancer patients were supported by the rigorous analysis carried out using both classical testing and Rasch analysis.

Conflicts of interest

There are no conflicts of interest.

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