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Validating the Persian Intuitive Eating Scale-2 Among Breast Cancer Survivors Who Are Overweight/Obese

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Abstract

Women with breast cancer are at risk of being overweight/obese which may consequently increase mortality. Intuitive eating is an adaptive eating behavior which might be beneficial for weight outcomes. The present study validated the Persian Intuitive Eating Scale-2 (IES-2) among overweight/obese Iranian females with breast cancer. Women who were overweight/obese with breast cancer (n = 762; mean ± SD age = 55.1 ± 5.7 years) completed the following questionnaires: IES-2, General Self-Efficacy Scale (GSE-6), Hospital Anxiety and Depression Scale (HADS), Short Form-12 (SF-12), Weight Bias Internalization Scale (WBIS), Body Appreciation Scale-2 (BAS-2), and Eating Attitudes Test (EAT-26). Confirmatory factor analysis (CFA) and Rasch analysis were applied to examine the psychometric properties of the IES-2. Associations between IES-2 score and other scale scores were assessed. CFA and Rasch analysis suggested that the Persian IES-2 had robust psychometric properties and all IES-2 items were meaningful in their embedded domains. The four-factor structure of the Persian IES-2 was confirmed. Concurrent validity was supported by the positive correlations between the IES-2 score and scores on the GSE-6, SF-12 mental component, and BAS-2. Negative correlations were found between the IES-2 score and the HADS (anxiety and depression subscales), WBIS, and EAT-26. The present study demonstrated that the Persian IES-2 is a well-designed instrument and is applicable for women who are overweight/obese with breast cancer.

***Keywords**:* breast cancer; obesity; overweight; classical test theory; intuitive eating; Rasch model

Introduction

Women with breast cancer may suffer from weight gain due to cancer treatments (Picon-Ruiz, Morta-Tarifa, Valle-Goffin, Friedman, & Slingerland, 2017). Studies have shown that more than half of women with breast cancer increased their weight during treatments over a three-year period (Demark-Wahnefried, Campbell, & Hayes, 2012; Vance, Mourtzakis, McCargar, & Hanning, 2011). The risk factors for weight gain among this population include premenopausal women, those receiving chemotherapy, and those who are overweight at the time of diagnosis (Nichols et al., 2009). Unfortunately, weight gain among women with breast cancer is a risk factor for mortality. An increase of five pounds after breast cancer diagnosis is associated with an increase of breast cancer-specific mortality by 13% and all-cause mortality by 12% (Nichols et al., 2009). Weight gain following breast cancer diagnosis is associated with increased fatigue, arthralgia, and hot flushes (Demark-Wahnefried et al., 2012). Overweight is deemed to be a crucial issue for women with breast cancer because of increased breast cancer mortality among patients who are overweight/obese.

Intuitive eating, a flexible eating behavior, may be used to assist women with breast cancer in tackling issues surrounding weight gain. The main concepts of intuitive eating focus on trusting one's own hunger and satiety signals and feeling the freedom and enjoyment of eating as proposed by Tribole and Resch (2020). Intuitive eating is beneficial because it is associated with lower levels of body mass index (BMI) and reduced disordered eating compared to other eating patterns, including dieting (Linardon & Mitchell, 2017; Tylka & Wilcox, 2006; Van Dyck, Herbert, Happ, Kleveman, & Vögele, 2016).

Previous research has claimed that changes in dietary behaviors significantly correlate with objective changes in body weight (Heber et al., 1992). The prevalence of being overweight and its association with cancer burden has been shown in previous research (Sung

et al., 2019). Consequently, healthy women are encouraged to adjust dietary behaviors to prevent breast cancer. Studies have shown that low-fat dietary pattern leads to a lower incidence of deaths after the diagnosis of breast cancer (Chlebowski et al., 2017, 2018). Women with breast cancer may not eat certain types of food during chemotherapy because of the side effects of treatment, such as nausea and vomiting (Custódio, Marinho, Gontijo, Pereira, Paiva, & Maia, 2016; Kottschade, Novotny, Lyss, Mazurczak, Loprinzi, & Barton, 2016). In addition, healthy eating behaviors are encouraged among women with breast cancer such as a high consumption of unprocessed products rather than refined and processed food (Kwan, Weltzien, Kushi, Castillo, Slattery, & Caan, 2009; Kroenke, Fung, Hu, & Holmes, 2005). A study on 73 patients who received adjuvant chemotherapy treatment, hormone therapy, or radiation for nonmetastatic breast cancer showed that maladaptive eating behavior (e.g., dietary restraint) was highly associated with weight gain at 6 and 19 months after diagnosis (DeGeorge, Gray, Fetting, Rolls, 1990). This suggests that weight gain for women with breast cancer should be managed by utilizing beneficial dietary behaviors, such as intuitive eating. In a large-scale study conducted in Switzerland comprising 5238 adults from the German and French-speaking population, researchers found that the concepts of intuitive eating had positive associations of eating quality scores among women. Additionally, the tendency to choose foods that promote health and body functioning, was largely unrelated to food intake (Horwath et al., 2019). Another study comprising 9581 men and 31,955 women examining the relationship between intuitive eating and food intake indicated that intuitive eating was inversely associated with both the frequency of snacking and the tendency to snack in the absence of hunger (Camilleri et al., 2017).

The effect of intuitive eating has been found last longer than regular diet (Bacon, Stern, Van Loan, & Keim, 2005). Furthermore, engaging in intuitive eating appears to be related to low psychological distress because the benefits of intuitive eating are associated with

increased psychological and physical wellbeing, enhanced enjoyment, decreased anxiety, improved body shape satisfaction, and elevated self-efficacy (Augustus-Horvath & Tylka, 2011; da Silva, Neves, Ferreira, Capos, & Swami, 2020; Ruzanska & Warschburger, 2017; Saunders, Nichols-Lopez, & Frazier, 2018; Smith & Hawks, 2006). Therefore, a practical and valid instrument that assesses intuitive eating would assist healthcare providers to better understand intuitive eating among women who are overweight/obese with breast cancer.

The Intuitive Eating Scale-2 (IES-2) (Tylka & Kroon Van Diest, 2013) contains different aspects of intuitive eating, including unconditional permission to eat (UPE), eating for physical rather than emotional reasons (EPR), reliance on hunger and satiety cues (RHSC), and body-food choice congruence (B-FCC). In brief, the UPE assesses how individuals are ready to eat when they are physically hungry and at the moment what food is desired without categorization into allowed and forbidden foods. EPR reflects the extent to which individuals eat to satisfy physical hunger instead of coping with emotional distress. RHSC examines individuals' awareness of internal signals in hunger and satiety, and subsequent belief in the signs to regulate eating behavior. Finally, B-FCC is aligned with the concept of gentle nutrition, which represents the combination of healthy and tasty nutrition aligned with bodily needs. Therefore, the IES-2 might be a useful tool to assess intuitive eating among women with breast cancer who are overweight/obese.

Research has demonstrated that the IES-2 is a reliable and valid instrument in assessing intuitive eating across different ethnic populations (Bas et al., 2017; Camilleri et al., 2015; Carbonneau et al., 2016; Tylka & Kroon Van Diest, 2013). However, a literature gap exists in the following aspects.

First, the IES-2 has mainly been used (and validated) in Western countries (e.g., Camilleri et al., 2015; Carbonneau et al., 2016; Tylka & Kroon Van Diest, 2013; Ruzanska & Warschburger, 2017), and no Persian version has been translated or validated. Culture is a key

element that influences eating behaviors in different countries (Airhihenbuwa, 2010; Kianpour, 2020; Li & Xiao, 2019). Cross-cultural research has focused on the individualism and collectivism dimensions (Orji & Mandryk, 2014). In many collectivist (e.g., Eastern) countries, eating is an important element of social gatherings and it is considered impolite to refuse food especially when it is presented by the hostess, which inevitably cause excess eating (Orji & Mandryk, 2014). Also, Li and Xiao (2019) pointed out that China's business dinners result in extravagant waste given the leftover. Additionally, dinner hosts (where? China?) often persuade others to drink irrespective of whether others want to or not. Therefore, considering the aforementioned cases, the interpretations toward the IES-2 are likely to be different between an Iranian (Eastern) population and Westerners. Moreover, although Iranians have begun to accept Westernized diets, Eastern people still pay more attention to food color, aroma, and taste (Kianpour, 2020; Li & Xiao, 2019).

Second, the IES-2 has mainly been applied to general populations and no studies have evaluated whether the IES-2 is applicable for people with cancer. Given that evidence of psychometric properties is highly dependent upon specific tested populations, testing psychometric properties on a general population may not be generalizable to a specific disease population (Lin et al., 2019a). Therefore, it is important for the psychometric properties of the IES-2 to be tested among patients with specific diagnoses (e.g., women with breast cancer).

Third, most psychometric testing on the IES-2 has been conducted utilizing classical test theory (CTT). Given that Rasch analysis, a form of Item Response Theory (IRT), is useful and applicable to instruments' validation for individual's reported outcomes (Lin et al., 2019b), the use of Rasch analysis on the IES-2 will provide additional information to classical test theory regarding its psychometric properties. When developing new assessments from a conceptual-practice model (i.e., a conceptual model that is used for practice), an

assessment validation process must be chosen to address the issue concerning psychometric properties.

The present study's goals were to examine the psychometric properties of the Persian IES-2 among women who were overweight/obese with breast cancer utilizing (i) two types of test theories (CTT and Rasch analysis); and (ii) concurrent validity of the Persian IES-2 with different psychological health aspects, including self-efficacy, quality of life, weight-related self-stigma, psychological distress, body appreciation, and eating attitudes.

Methods

Participants and procedures

The study participants were recruited from five Iranian oncology centers in Tehran, Tabriz, and Qazvin cities (N=762) from June 2018 to March 2019. To be eligible for the study, participants had to: (i) be aged 18 years or older, (ii) have a body mass index (BMI) > 25 kg/m^2, (iii) sign a written informed consent, (iv) be able to read and write in Persian, and (v) have a history of histologically or cytologically confirmed breast cancer. Participants were excluded from the study if they met the following exclusion criteria: (i) current severe, uncontrolled systemic disease (e.g., unstable or uncompensated hypertension, diabetes, ischemic heart disease, acid peptic, hepatic, or renal disease) and (ii) severe mental disorder (e.g., personality disorder, schizophrenia, paraphilic disorder, and intellectual disability) diagnosed by psychiatrists using the Structured Clinical Interview for DSM Disorders. The oncology centers first provided a list of their patients to the present authors. Research assistants then used the list to contact 1100 patients who received routine care from the clinics. Among the 1100 patients, 108 were not eligible for further assessment and 230 declined the opportunity to participate (response rate: 76.8%). For those participants who agreed to participate, written informed consent was provided before completing the survey instruments. Additionally, all participants were invited to complete the IES-2 again after a

two-week interval resulting in 610 participants completing the IES-2 twice. All the instruments were completed offline using a 'pen-and-paper' method. The study's protocol was reviewed and approved by the Ethics Committee of the Tabriz University of Medical Sciences.

Translation and cultural adaptation

The translation of the IES-2 was performed according to the international guidelines, (Beaton, Bombardier, Guillemin, & Ferraz, 2000; Pakpour, Zeidi, Yekaninejad, & Burri, 2014). Detailed translation process is described in Appendix A. In brief, the following aspects of cross-cultural equivalency were checked: semantic equivalence, idiomatic equivalence, experiential equivalence, and conceptual equivalence.

Instruments

All the instruments, except for the IES-2, have previously been translated into Persian for Iranians use with acceptable psychometric properties.

Intuitive Eating Scale-2 (IES-2) (Tylka & Kroon Van Diest, 2013)*:* This scale comprises 23 items and assesses individuals' intuitive eating performance. More specifically, the scale assesses four domains (UPE with six items; EPR with eight items; RHSC with six items; and B-FCC with three items). A sample item is "When I am lonely, I do not turn to food for comfort". All items are rated using a five-point Likert-type scale (1 = strongly disagree; 5 = strongly agree), with a higher score indicating a higher level of intuitive eating. The Cronbach's alpha was satisfactory for IES-2 total score (α = 0.85 to 0.90) and acceptable to excellent for domain scores (α = 0.67 to 0.82 for UPE; 0.91 to 0.93 for EPR; 0.85 to 0.94 for RHSC; and 0.83 to 0.89 for B-FCC) (Ruzanska & Warschburger, 2017; Tylka, Calogero, & Daníelsdottir, 2015; Webb & Hardin, 2016). The Cronbach's alpha in the present study was very good to excellent (Cronbach's alpha of 0.93 for entire IES-2; 0.80 to 0.93 for the IES-2 subscales).

General Self-Efficacy Scale (GSE-6) (Rajabi, 2006)*:* This scale comprises six items embedded in a single domain and assesses self-efficacy. A sample item is "If I am in trouble, I can usually think of a solution". All items are rated using a four-point Likert-type scale (1 = not true; 4 = exactly true), with a higher score indicating a higher level of self-efficacy. The Cronbach's alpha of the Persian GSE-6 was good (α = 0.80) The concurrent validity of the Persian GSE-6 was supported by the significant correlation with self-esteem (r = 0.3) (Rajabi, 2006). Moreover, the Cronbach's alpha of the GSE-6 in the present study was 0.89.

Hospital Anxiety and Depression Scale (HADS) (Lin & Pakpour, 2017)*:* This scale comprises 14 items and assesses individuals' degree of anxiety (seven items) and depression (seven items). A sample item is "I feel as if I am slowed down". All items are rated using a four-point Likert-type scale (0 = not at all; 3 = most of the time) with a higher score indicating a higher level of anxiety or depression. The Cronbach's alpha was acceptable for the Persian HADS depression subscale score (α = 0.79) and anxiety subscale score (α = 0.82). The construct validity of the Persian HADS was supported by the confirmatory factory analysis (comparative fit index [CFI] = 0.985; Tucker-Lewis index [TLI] = 0.982) (Lin & Pakpour, 2017). Moreover, the Cronbach's alpha of the HADS in the present study was 0.84 (anxiety) and 0.81 (depression).

Short Form-12 (SF-12) (Montazeri, Vahdaninia, Mousavi, & Omidvari, 2009)*:* This scale comprises 12 items and assesses individuals' health-related quality of life. It is calculated across two summary scores: physical component summary (PCS) and mental component summary (MCS). A sample item is "Have you felt calm and peaceful". Two-point to six-point Likert-type scales are applied to the 12 items and the raw scores range between 1 and 6. The response anchors for SF-12 include 'yes — no'; 'not at all — extremely'; 'none of the time — all of the time'; 'yes, limited a lot — no, not limited at all'; and 'poor — excellent'. A scoring algorithm is then applied to the SF-12 raw scores to convert the scores into a 0-100

scale for both PCS and MCS (Pakpour et al., 2011). The Cronbach's alpha of the Persian SF-12 was acceptable (α = 0.73 for PCS and = 0.72 for MCS). The construct validity of the Persian SF-12 was supported by the confirmatory factory analysis (CFI = 0.93) (Montazeri et al., 2009). Moreover, the Cronbach's alpha of the SF-12 in the present study was 0.81 (PCS) and 0.80 (MCS).

Weight Bias Internalization Scale (WBIS) (Lin, Imani, Cheung, & Pakpour, 2019c)*:* This scale comprises 11 items embedded in a single domain and assesses individuals' perception of weight-related stigma. A sample item is "It's my fault that I am overweight". All items are rated using a five-point Likert-type scale (1 = strongly disagree; 5 = strongly agree), with a higher score indicating a higher level of weight-related self-stigma. The Cronbach's alpha of the Persian WBIS was excellent (α = 0.90). The construct validity of the Persian WBIS was supported by the confirmatory factory analysis (CFI = 0.93; TLI = 0.91) (Lin, Imani, Cheung, & Pakpour, 2019c). Moreover, the Cronbach's alpha of the WBIS in the present study was 0.86.

Body Appreciation Scale-2 (BAS-2) (Atari, 2016)*:* This scale comprises 10 items embedded in a single domain and assesses individuals' level of body appreciation (Atari, 2017). A sample item is "I respect my body". All items are rated using a five-point Likert-type scale (1 = never; 5 = always), with a higher score indicating a higher level of body appreciation (i.e., better body image to themselves). The Cronbach's alpha of the Persian BAS-2 was very good (α = 0.89). The concurrent validity of the Persian BAS-2 was supported by the significant correlation with BMI squared (r = 0.12) (Atari, 2016). Moreover, the Cronbach's alpha of the BAS-2 in the present study was 0.80.

Eating Attitudes Test (EAT-26) (Ahmadi, Moloodi, Zarbaksh, & Ghaderi, 2014)*:* This scale comprises 26 items and assesses individuals' symptoms and concerns about eating disorders. The items are distributed across three domains (dieting, 13 items; bulimia and food

preoccupation, six items; oral control, seven items). A sample item is "I enjoy trying new rich foods". All items are rated using a six-point Likert scale (0 = never; 5 = always). The six-point Likert scale is then converted into a four-point format for calculation (0 = never, rarely and sometimes; 1 = often; 2 = usually; 3 = always) with a higher score indicating a higher level of disturbance in eating attitudes (Garner, Olmsted, Bohr, & Garfinkel, 1982; Kang et al., 2017; Lee, Kwok, Liau, & Leung, 2002). The Persian EAT-26 has adequate Cronbach's alpha (α = 0.61 to 0.92). The concurrent validity of the Persian EAT-26 was supported by the significant correlation with binge eating (r = 0.42) (Ahmadi et al., 2014). Moreover, the Cronbach's alpha of the EAT-26 in the present study was 0.83.

Statistical analysis

Psychometric properties of the IES-2 were analyzed using both CTT and Rasch analysis. Statistics performed in the CTT included: (i) response rate in each item; (ii) confirmatory factor analysis (CFA); (iii) average variance extracted; (iv) composite reliability; (v) Cronbach's alpha (i.e., Cronbach's alpha); (vi) corrected item-total correlation; (vii) standard error of measurement; (viii) ceiling/floor effects; and (ix) test-retest reliability. Statistics performed in Rasch testing included: (i) item difficulty; (ii) information-weighted mean-square (infit MnSq); (iii) outlier sensitive MnSq (outfit MnSq); (iv) differential item functioning (DIF) across mean age (i.e., < 55 years vs. ≥ 55 years) and educational status (i.e., educational year > 9 years vs. ≤ 9 years); (v) item/person separation reliability; and (vi) item/person separation index. Several further measures (i.e., GSE-6, HADS, SF-12, WBIS, BAS-2, and EAT-26) were used to examine the concurrent validity of the IES-2 (using Pearson's r). Additionally, the Bonferroni method was used to adjust the significance of Pearson's r (i.e., using a p-value < 0.0038 to indicate a significant correlation). Given that the missing values in the present study were minimal (<1%) and were completely at random, no special treatment was applied to the missing data values. CFA and its related statistics were

conducted using MPLUS 7.4, Rasch analysis and its related statistics used WINSTEPS Version 4.1.0, and all other analyses used the SPSS 24.0.

Tests using classical test theory

A response rate > 80% is satisfactory (Fincham, 2008). Average variance extracted and composite reliability are similar to Cronbach's α because they all indicate the level of the coherence for items embedded within the same construct. The acceptable value is > 0.5 for average variance extracted and > 0.6 for composite reliability (Fornell & Larcker, 1981). Cronbach's alpha was conducted using Cronbach's α; a value > 0.7 is acceptable (Taber, 2017). A corrected item-total correlation was computed to understand whether each item strongly associates with the latent concept; a value > 0.4 is preferred (Briggs, & Cheek, 1986). Standard error of measurement refers to how much 'noise' involved in the observed score; a small value is preferable. Ceiling and floor effects were computed using the number of participants who had the highest/lowest scores within a specific domain (or total IES-2 score) divided by the number of participants. For example, 62 participants scored 6 (the lowest UPE domain score) on the UPE domain of the IES-2, the floor effect of the UPE domain was 62/762=8.2%. A percentage < 20% is preferred for ceiling/floor effects (Garin, 2014). The test-retest reliability was conducted using the intraclass correlation coefficient (ICC) with a two-way mixed, average measures, and consistency design; a value > 0.4 is desirable (Matheson, 2019).

The CFA was conducted using diagonally weighted least squares (DWLS) estimator on a four-factor structure IES-2. Its structure was assessed using a nonsignificant χ^2, comparative fit index (CFI) > 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 (Hu & Bentler, 2009).

Tests using Rasch analysis

The Rasch analysis, a form of IRT, was conducted using the partial credit model and the four subscales of IES-2 were analyzed separately. The partial credit model assumes that all the items in the same psychometric scale have different thresholds in every two points. For example, the difference between scores 1 and 2 for IES-2 Item 1 is not the same as the difference between scores 1 and 2 for IES-2 Item 2.

Infit (excluding outlier responses) and outfit (including outlier responses) MnSq examined whether an item fitted the embedded construct: MnSq > 1 indicates that the item may not fit its embedded construct; MnSq < 1 indicates the item may be redundant. For example, MnSq of 1.3 indicates the item deviated from its construct by 30%; MnSq of 0.7 indicates that the item contained 30% redundant information. Acceptable range for infit and outfit MnSq is between 0.5 and 1.5 (Lin et al., 2018b).

The DIF indicates whether an item does not assess the same ability between two or more subgroups (e.g., people with high education vs. people with low education). An item displays DIF when different subgroups that share the same ability give different scores on this item. An item with DIF is inappropriate to be used across subgroups. DIF contrast (i.e., the difference of difficulty between the two subgroups) < 0.5 indicates no substantial DIF (Lin et al., 2018b).

Person separation reliability indicates whether the participant ability found in the Rasch model is reliable. Item separation reliability indicates whether the item difficulty found in the Rasch model is reliable. The person separation index refers how well the participants can be classified. The item separation index refers how well the items can be separated. An item and person separation reliability > 0.7 is recommended; an item and person separation index > 2 are recommended for an instrument (Chang, Wang, Tang, Cheng, & Lin, 2014; Lin, Griffiths, & Pakpour, 2018a).

Results

Table 1 reports the mean age of the participants, years of education the participants received, years since a diagnosis of having breast cancer, and other additional characteristics.

(Insert Table 1 here)

The psychometric properties of the IES-2 were satisfactory at the item-level (see Table 2). The results of CTT found that response rates of the items were between 82% and 100%, factor loadings derived from CFA were between 0.61 and 0.87, corrected item-total correlations were between 0.53 and 0.80, and test-retest reliability values calculated using ICC were between 0.71 and 0.93 (Table 2).

Results of the Rasch analysis showed that infit MnSq values were between 0.74 and 1.33, and outfit MnSq values were between 0.72 and 1.32. Given that all the items had their infit and outfit MnSq between 0.5 and 1.5, this indicates that all the items in the IES-2 assess the underlying construct properly. DIF contrasts across age groups were between -0.41 and 0.44 and DIF contrasts across educational status were between -0.30 and 0.41 (Table 2).

(Insert Table 2 here)

The psychometric properties of the IES-2 were also satisfactory at the scale-level (see Table 3). The results of CTT showed that the ceiling (2.1% for entire IES-2; 2.2% to 10.4% for IES-2 subscales) and floor effects were trivial (2.7% for entire IES-2; 3.1% to 5.8% for IES-2 subscales), Cronbach's alpha was very good (0.93 for entire IES-2; 0.80 to 0.93 for IES-2 subscales), CFA fit indices were acceptable (CFI=0.93, TLI=0.92, RMSEA=0.065, and SRMR=0.063), and test-retest reliability was very good (0.81 for entire IES-2; 0.80 to 0.84 for IES-2 subscales) (Table 3). The results of Rasch analysis showed that item separation reliability was promising (1.00 for entire IES-2; 0.96 to 0.99 for IES-2 subscales), item separation index was excellent (15.44 for entire IES-2; 5.01 to 9.77 for IES-2 subscales), person separation reliability was acceptable (0.92 for entire IES-2; 0.75 to 0.88 for IES-2 subscales), and person separation index was adequate (3.32 for entire IES-2; 2.07 to 2.77 for

IES-2 subscales) (Table 3).

(Insert Table 3 here)

Regarding the associations between the IES-2 and the further measures, the IES-2 demonstrated adequate concurrent validity. The IES-2 total and domain scores were negatively and moderately correlated with HADS-anxiety (r=-0.39 to -0.28), HADS-depression (r=-0.46 to -0.32), WBIS (assessing weight-related self-stigma) (r=-0.44 to -0.30), EAT-26 (assessing eating attitudes) (r=-0.49 to -0.26), and BMI (r=-0.36 to -0.21). It was also positively and moderately correlated with GSE-6 (assessing self-efficacy) (r=0.21 to 0.41), MCS in the SF-12 (assessing mental components in quality of life) (r=0.35 to 0.48), and BAS-2 (assessing body appreciation) scores (r=0.30 to 0.50). However, the IES-2 total and domain scores were not significantly correlated to the PCS in the SF-12 (assessing physical component in quality of life) (r=0.10 to 0.18) (details in the Supplementary Table).

Discussion

The present findings add to the literature regarding the psychometric properties of the IES-2 in the following aspects: (i) Rasch analysis indicated that all IES-2 items contributed to their embedded domains; (ii) DIF contrasts showed that all IES-2 items were interpreted similarly across age groups and educational status (therefore, meaningful combination or comparison across age groups or educational status can be achieved); (iii) the IES-2 can be used on the breast cancer population, which needs special attention from healthcare providers concerning their recommended BMI.

The concurrent validity of the IES-2 is well established based on its associations with several health outcomes (including physical indicators such as BMI, psychological indicators such as psychological wellbeing, body shape satisfaction, and self-efficacy) (Augustus-Horvath & Tylka, 2011; da Silva et al., 2020; Ruzanska & Warschburger, 2017; Saunders et al., 2018; Smith & Hawks, 2006; Van Dyck et al., 2016), and was also confirmed

by the results of the present study. The IES-2 and these health outcomes are highly related because intuitive eating can assist an individual to be mindful of emotions and pleasures derived from eating (Carbonneau et al., 2016). Therefore, when individuals eat more intuitively, they would enjoy healthy eating and consequently generate better psychological and physical outcomes. Intuitive eating helps individuals trust in their ability in regulating the food intake (Ruzanska & Warschburger, 2017). Therefore, an individual who is an intuitive eater can gain the joy from food and avoid eating unhealthy food. In the present study, women with breast cancer may receive treatments (e.g., hormone therapy) that could cause weight gain (Makari-Judson et al., 2014; Obradović et al., 2019; Playdon et al., 2015). Therefore, it is especially beneficial for this population to apply intuitive eating principles so that they can use physiological satiety cues to determine when (and what) to eat, and consequently facilitate weight management.

There are some limitations in the present study. First, only women who were overweight were recruited. Therefore, the findings might not be generalizable to women with breast cancer who are not overweight. Although women with breast cancer are at greater risk of being overweight (Nichols et al., 2009), some survivors may maintain their weight during the cancer treatment period. For those who are not overweight, intuitive eating may also have positive effects on them (e.g., enhanced wellbeing) (Augustus-Horvath & Tylka, 2011; da Silva et al., 2020; Ruzanska & Warschburger, 2017; Saunders et al., 2018; Smith & Hawks, 2006). Future studies should also examine whether the IES-2 has robust psychometric properties among women with breast cancer who are not overweight. Second, the responsiveness (i.e., sensitivity to change) of the IES-2 was not examined. Therefore, it is not known whether an effective program on intuitive eating enhancement can be identified by the IES-2. Third, most of the further measures that were used to assess the concurrent validity of the IES-2 were rated by the participants. Therefore, self-report biases cannot be excluded. Additionally, although breast cancer is rare among males, sex differences in the IES-2 total

score, UPE, and EPR have been found in previous studies (Ruzanska & Warschburger, 2017; Tylka, & Kroon Van Diest, 2013; Dockendorff, Petrie, Greenleaf, & Martin, 2012). Researchers have concluded that females are more likely than males to use eating to cope with their emotions (Dockendorff, Petrie, Greenleaf, & Martin, 2012). Future studies may consider examining gender differences for the Persian version of IES-2 for breast cancer patients who are overweight. Moreover, the present study's participants may have last received intensive cancer treatment some years prior to the study (average time since diagnosis=9.2 years). Given that intensive cancer treatments usually have strong adverse effects (Fang, Cheng, & Lin, 2018), the psychometric properties examined among the present sample might not necessarily generalize to those who are currently receiving intensive cancer treatments. Finally, the present study did not collect qualitative data on how the participants evaluated the IES-2 (e.g., regarding potential changes in intuitive eating due to cancer treatment). Therefore, it is unclear how intuitive eating specifically changes due to cancer treatment and future studies are needed to provide further clarification on this issue.

Weight gain is an important issue that should be addressed among women with breast cancer (Picon-Ruiz et al., 2017). Healthcare providers may consider improving their knowledge and behaviors of intuitive eating (an adaptive eating behavior) which will result in beneficial weight outcomes. Therefore, investigating the psychometric properties of the IES-2 to ensure it can be used as a reliable and valid tool among women with breast cancer is the first step. Using the psychometrically robust IES-2 will assist healthcare providers in correctly and effectively understanding intuitive eating behaviors among women with breast cancer who are overweight. Resulting changes can therefore be monitored and evaluated with the implementation of an intuitive eating enhancement program.

Conclusion

The present psychometric testing study demonstrated that the Persian version of the

IES-2 is a well-designed instrument and can be applicable to Persian women with breast cancer who are overweight. The original four-factor structure was replicated and supported by the CFA findings. The IES-2 items were all valid and reliable as supported by both CTT and Rasch model findings.

382 **Figure legends**

383 Figure 1. Confirmatory factor analysis of the Intuitive Eating Scale-2. UPE = unconditional
384 permission to eat; EPR = eating for physical rather than emotional reasons; RHSC = reliance
385 on hunger and satiety cues; B-FCC = body-food choice congruence. U1-U6 indicates UPE
386 items; E1-E8 indicates EPR items; R1-R6 indicates RHSC items; B1-B3 indicates B-FCC
387 items.

388

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