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Dimensional Structure, Psychometric Properties, and Sex and Ethnic Invariance of a Bahasa Malaysia (Malay) Translation of the Intuitive Eating Scale-2 (IES-2)

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**Abstract**

The Intuitive Eating Scale-2 (IES-2; Tylka & Kroon Van Diest, 2013) is a widely-used measure of facets of intuitive eating. We examined the psychometric properties of a Bahasa Malaysia (Malay) translation of the IES-2 in a sample of Malaysian Malay and Chinese adults (*N* = 921). Participants completed a Malay translation of the IES-2 along with demographic items and measures of psychological well-being, positive and negative body image, and internalisation of appearance ideals. Exploratory factor analyses (EFAs) with Malay subsamples indicated that IES-2 scores reduced to 4 factors in women and 3 in men, both of which diverged from the parent model. Confirmatory factor analysis failed to confirm the parent 4-factor model, and indices for the EFA-derived models were acceptable but not ideal. Of the models tested, the EFA-derived 3-factor model had the best fit indices. Scores on this model had adequate internal consistency and were invariant across sex and ethnicity, but between-group differences in subscale scores were non-significant or negligible. Evidence of the construct validity of Malay IES-2 scores was mixed, particularly in men. These results lead us to question the degree to which intuitive eating as a construct is applicable to Malaysian populations specifically and non-Western populations generally.

**Keywords:** Intuitive eating; Psychometrics; Test adaptation; Malaysia; Body image

**1. Introduction**

In contrast to the historical focus on disordered eating, scholars increasingly recognise the benefits of examining adaptive eating as a means of promoting individual resilience and flourishing (Avalos & Tylka, 2006). The notion of adaptive, healthy eating behaviour is most frequently operationalised in terms of *intuitive eating*, which refers to a set of eating behaviours characterised by a reliance on internal hunger and satiety cues (Tribole, 2017; Tribole & Resch, 2012; Tylka, 2006). Individuals who eat intuitively are aware of and trust their body’s physiological cues, give themselves unconditional permission to eat, are not preoccupied with food and dieting, and choose foods for the purpose of supporting or enhancing their body’s functioning (Tylka & Kroon Van Diest, 2013). Studies have shown that intuitive eating is associated with lower body mass indices (e.g., Camilleri et al., 2016; Tylka, Calogero, & Daníelsdóttir, 2015), as well as weight stability (Tylka, Calogero, & Daníelsdóttir, 2019) and lower gestational weight gain in community samples (Paterson et al., 2019). In addition, intuitive eating is associated with more positive psychological well-being (e.g., life satisfaction, optimism, positive body image; Bruce & Ricciardelli, 2006; Homan & Tylka, 2018; Keirns & Hawkins, 2019; Tylka & Kroon Van Diest, 2013) and healthy eating behaviours (e.g., higher vegetable and fruit intake, lower binge eating; Barad et al., 2019; Craven & Fekete, 2019; Horwath, Hagmann, & Hartmann, 2019; Linardon & Mitchell, 2017; Soulliard & van der Wal, 2019; van Dyke & Drinkwater, 2014).

Not surprisingly, the construct of intuitive eating has emerged as an important component of interventions designed to promote healthier body image and reduce symptoms of disordered eating (e.g., Beintner, Emmerich, Vollert, Barr Taylor, & Jacobi, 2019; Cole et al., 2019; Healy, Joram, Matvienko, Woolf, & Knesting, 2015; Mensinger, Calogero, Stranges, & Tylka, 2016). To measure the construct of intuitive eating, Tylka (2006) developed the Intuitive Eating Scale (IES), a 21-item instrument with item clusters reflecting three domains: Unconditional Permission to Eat (an individual’s willingness to eat when hungry and a refusal to label certain foods as forbidden), Eating for Physical Rather Than Emotional Reasons (eating when one is physically hungry rather than to cope with emotional distress), and Reliance on Hunger and Satiety Cues (an individual’s trust in their internal hunger and satiety cues and reliance on these cues to guide eating behaviours). Exploratory and confirmatory factor analyses with college samples from the United States supported a 3-factor model of IES scores (Tylka, 2006), with subsequent studies supporting construct validity (for a review, see Tylka & Kroon Van Diest, 2013). However, Tylka and Kroon Van Diest (2013) identified limitations with the IES, including: the absence of items measuring *gentle nutrition* (a tendency to make food choices that honour one’s health and body functioning); the fact that most IES items were written to assess the absence of intuitive eating attitudes and behaviours (rather than resistance to dieting and emotional eating); and the relatively low internal consistencies of Reliance on Hunger and Satiety Cues subscale scores.

In order to deal with these issues, Tylka and Kroon Van Diest (2013) developed 17 new intuitive eating items, which were administered to a college sample from the United States with the original 21 items. Exploratory factor analyses (EFAs) led to the extraction of 23 items in four factors that make up the IES-2, namely Eating for Physical Rather Than Emotional Reasons (8 items), Unconditional Permission to Eat (6 items), Reliance on Hunger and Satiety Cues (6 items), and Body-Food Choice Congruence (3 items). Confirmatory factor analysis (CFA) with a college sample from the United States supported a 4-factor model with a higher-order structure, with scores being largely invariant across sex. Men were found to have significantly higher scores than women, with medium effects for total IES-2 and Eating for Physical Rather Than Emotional Reasons scores, small effects for Unconditional Permission to Eat and Reliance on Hunger and Satiety Cues subscale scores, and negligible effects for Body-Food Choice Congruence scores. In addition, internal consistency coefficients were adequate for all subscale scores, test-retest reliability was supported across a 3-week period, and construct validity was established through positive associations with body appreciation, self-esteem, and life satisfaction, and negative associations with eating disorder symptomatology, interoceptive awareness, body shame, and body mass index (BMI) (Tylka & Kroon Van Diest, 2013).

Although the psychometric properties of the IES-2 appear to be robust, the results of CFAs with other samples from the United States have indicated difficulties confirming the 4-factor structure proposed in the parent study (Khalsa et al., 2019; Saunders, Nichols-Lopez, & Frazier, 2018). Instead, the results of EFAs supported a 3-factor structure consisting of Eating for Physical Rather Than Emotional Reasons (4 items), Reliance on Hunger and Satiety Cues (4 items), and Body-Food Choice Congruence (3 items) in a culturally-diverse Hispanic American sample of college students (Saunders et al., 2018), and a 6-factor structure consisting of Avoiding Forbidden Foods (3 items), Permission to Eat (3 items), Avoiding Emotional Eating (4 items), Avoiding Food-Related Coping Strategies (4 items), Reliance on Hunger and Satiety Cues (6 items), and Body-Food Choice Congruence (3 items) in a low-income, Black community sample (Khalsa et al., 2019).

Beyond samples from the United States, a number of studies have examined the factor structure of IES-2 scores in diverse national groups, but here too results have been mixed. Thus, the results of CFAs have supported the parent factor structure in a German-speaking university sample from Luxembourg, Germany, and Switzerland (van Dyck, Herbert, Happ, Kleveman, & Vögele, 2016), a German community sample (Ruzanska & Warschburger, 2017), Portuguese mixed student-and-community samples (Duarte, Gouviea, & Mendes, 2016), community samples of French-Canadian adults (Carbonneau et al., 2016), and a Turkish university sample (Bas et al., 2017). In contrast, CFA with data from an online sample of French adults failed to confirm the expected 4-factor structure (Camilleri et al., 2015). Instead, an EFA resulted in the extraction of 18 of the 23 IES-2 items clustered in three factors: Eating for Physical Rather Than Emotional Reasons (8 items), Reliance on Hunger and Satiety Cues (6 items), and Unconditional Permission to Eat (4 items). This 3-factor model, with an additional higher-order intuitive eating factor, was supported in a subsequent CFA. Likewise, CFA with data from a student-and-community sample from Brazil indicated support for the 4-factor model of IES-2 only once four items (Items #1, 4, 13, and 15) were eliminated (da Silva, Neves, Ferreira, Campos, & Swami, 2019). This study failed to find support for a higher-order dimension of intuitive eating. Finally, an EFA with data from a Turkish university sample indicated support for a 4-factor model, but only following the removal of Items #6 and 21 (Akırmak, Bakıner, Boratav, & Güneri, 2019). In all studies, internal consistency coefficients of total scores and/or IES-2 subscale scores were adequate, and test-retest reliability was adequate where assessed (Akırmak et al., 2019; Camilleri et al., 2015; Carbonneau et al., 2016; Duarte et al., 2016).

In addition, the available research supports the construct validity of IES-2 scores. For example, IES-2 total or subscale scores have been found to be significantly and negatively associated with scores on measures of eating disorder symptomatology (Akırmak et al., 2019; Carbonneau et al., 2016; Duarte et al., 2016; Ruzanska & Warschburger, 2017; van Dyck et al., 2016), negative body image (Carbonneau et al., 2016; van Dyck et al., 2016), emotional eating (Camilleri et al., 2015), and BMI (da Silva et al., 2019; Duarte et al., 2016), and significantly and positively associated with scores on measures of positive body image (Carbonneau et al., 2016; da Silva et al., 2019; Duarte et al., 2016), self-efficacy (Ruzanska & Warschburger, 2017), and psychological well-being (Akırmak et al., 2019; Camilleri et al., 2015; Carbonneau et al., 2016; Ruzanska & Warschburger, 2017). Most test adaptation studies have also examined sex differences in IES-2 scores and have generally reported that men have significantly higher scores than women, with small-to-medium effect sizes. However, interpreting these differences is difficult because comparison of means across groups should only be conducted when scalar or partial scalar invariance is observed (Chen, 2007; Davidov, Dülmer, Schlüter, Schmidt, & Meuleman, 2012). To date, however, only two studies have specifically examined multi-group invariance of IES-2 scores, with one study reporting full scalar invariance (Duarte et al., 2016) and the other reporting only metric sex invariance (da Silva et al., 2019).

In short, although evidence of the psychometric properties of the IES-2 appears to be impressive, particularly in terms of construct validity, there remains some debate as to the factor structure of IES-2 scores across diverse social identity and national groups. Adding to the complexity in interpreting existing results is the fact that many scholars have privileged CFA over EFA in their analytic strategies. Although CFA is useful for testing whether data fit *a priori* hypothesised measurements, it is less useful at detecting whether alternative models that were not tested fit the data better (for a discussion, see Swami & Barron, 2019). Thus, it is quite possible that alternative models of IES-2 scores may fit the data better, even in groups where CFA has been used to support the hypothesised 4-factor model proposed by Tylka and Kroon Van Diest (2013). Indeed, where the possibility of alternative models has been specifically tested using EFA (Akırmak et al., 2019; Camilleri et al., 2015; Khalsa et al., 2019; Saunders et al., 2018), final models that diverge from the parent version have been developed. At the very least, it might be suggested that interpretations of the factor structure of IES-2 scores may diverge across social identity and national groups.

* 1. **The Malaysian Context**

A further issue of note is the fact that, with the exception of Turkey, all existing studies examining the factor structure of IES-2 scores have been conducted in North America, Europe, and South America. As a contribution to this literature, therefore, the present study sought to examine the factor structure and psychometric properties of the IES-2 in a Malaysian adult sample. One previous study has used the IES-2 with Malaysian university students (Gan & Yeoh, 2019), but the authors asked respondents to complete an English version of the instrument (Wan Ying Gan, personal communication, October 9, 2019), did not examine the factor structure of scores, and used total scores in analyses despite less-than-adequate internal consistency (Cronbach’s α = .66). As such, it remains important to examine the factor structure and psychometric properties of the IES-2 with a Malaysian sample. Beyond merely extending the available research to include a hitherto neglected national context, albeit one where psychometrically-valid instruments are urgently required (Swami, 2020; Swami & Barron, 2017), there are additional important reasons for conducting this work.

First, Malaysia has undergone a process of rapid urbanisation and industrialisation, which has transformed eating patterns and expectations about food (Jamal et al., 2009; Karim & Razak, 2019; Shamsul, 2012) and resulted in a rapid increase in the prevalence of adult overweight and obesity (Institute of Public Health, 2015). Although such patterns are common to many middle-income countries (e.g., Lee & Sobal, 2003), two major characteristics distinguish Malaysia from many other nations. The first is the high frequency of eating out in Malaysia: low prices and greater opportunities to consume food outside the home have meant that Malaysian food culture is heavily driven by eating out (Ali & Abdullah, 2012; Olmedo & Shamsul, 2017), which in turn has important influences on attitudes toward food and eating (Fournier et al., 2016). The second reason is the fact that Malaysia is ethnically and culturally heterogeneous, with two main ethnic groups (Malay and Chinese) and many minority groups. Although some food habits are shared by Malaysians generally, each ethnic group also has its own food culture and wide-ranging attitudes toward food (e.g., dietary taboos, frequency of fasting, dining rituals, symbolic meaning of food) (Duruz & Khoo, 2014; Hsin-Huang & Khay-Thiong, 2015). In the context of Malaysia, food and culinary heritages are also sometimes the sites of identity conflicts, as they play important roles in shaping multicultural and transcultural identities (Chee-beng, 2001; Perry, 2017). Thus, examining the ethnic invariance of IES-2 scores in the Malaysian context would be useful, particularly as previous studies have not considered how intuitive eating may – or may not – differ across ethnic groups from the same nation (but see Khalsa et al., 2019; Saunders et al., 2018).

* 1. **The Present Study**

Therefore, the broad aim of the present study was to prepare a Bahasa Malaysia (Malay) translation of the IES-2 and to examine the psychometric properties of scores on the instrument. More specifically, we first sought to examine the dimensionality of scores on the Malay IES-2. In order to do so, we followed best-practice recommendations and conducted an EFA followed by a CFA (Swami & Barron, 2019; Worthington & Whittaker, 2006), which would allow us to explore item behaviour with regards to sample-derived (i.e., through the EFA) and hypothesised models (i.e., based on the hypothesised model in the parent study and EFA-derived dimensionality) of IES-2 scores. Based on the results of Tylka and Kroon Van Diest (2013), we expected to arrive at a 4-factor model of IES-2 scores with a higher-order factor, while also acknowledging – given the problematic factor analytic results reviewed above – the possibility of a discrepant model(s). In addition, we examined the extent to which our final model of IES-2 scores would be invariant at the configural, metric, and scalar levels between women and men, as well as between the two major ethnic groups in Malaysia (i.e., Malays and Chinese, who together make up about 80% of the Malaysian population; Department of Statistics Malaysia, 2017). Our expectation was that IES-2 scores would demonstrate full measurement equivalence across sex and ethnicity.

In addition to the primary objectives above, we also conducted a preliminary assessment of the construct validity of IES-2 scores. Specifically, we included translated and validated measures of positive body image (i.e., body appreciation), negative body image (i.e., appearance orientation and weight perceptions and concerns), psychological well-being (i.e., life satisfaction and subjective happiness), and internalisation of, and perceived pressure from, societal appearance ideals. These constructs were selected based on significant associations reported in the parent study (Tylka & Kroon Van Diest, 2013) and the availability of validated instruments in Malay. Evidence of construct validity would be demonstrated through minimally moderate and significant positive associations between IES-2 scores and measures of positive body image and psychological well-being, and significant negative associations with indices of negative body image and the internalisation of, and perceived pressure from, societal appearance ideals. Finally, we also assessed convergent validity of IES-2 scores through associations with self-reported BMI. Here, we expected significant negative correlations between IES-2 scores and BMI in both women and men.

**2.1. Method**

**2.1. Participants**

The participants were 921 Malaysian citizens (women *n* = 467, men *n* = 454), of whom 607 were of Malay ancestry and 314 were of Chinese ancestry. Participants ranged in age from 18 to 65 years (*M* = 33.86, *SD* = 9.05) and in self-reported BMI from 13.02 to 48.98 kg/m2 (*M* = 24.19, *SD* = 5.31). All Malay participants were considered Muslim, as required by Malaysian constitutional law, whereas Chinese participants were predominantly Buddhists (73.9%; Christians = 20.7%; Muslims = 2.2%; other religion = 3.2%). In terms of educational qualifications, 28.3% had completed secondary schooling, 48.0% had an undergraduate degree, 15.2% had a postgraduate degree, and the remainder had some other qualification. Of the total sample, 43.8% were single, 54.1% were married, 1.5% were divorced, and 0.7% had some other marital status.

**2.2. Measures**

**2.2.1. Intuitive eating.** Participants were asked to complete a Malay translation of the 23-item IES-2 (Tylka & Kroon Van Diest, 2013). All items were rated on a 5-point scale, ranging from 1 (*strongly disagree*; Malay: *sangat tidak setuju*) to 5 (*strongly agree*; Malay: *sangat setuju*). The translation procedure is described below and the IES-2 items in English and Malay are reported in Appendix 1.

**2.2.2. Positive body image**. To measure a facet of positive body image, we used the Body Appreciation Scale-2 (BAS-2; Tylka & Wood-Barcalow, 2015; Malay translation: Swami, Mohd. Khatib et al., 2019). This is a 10-item scale that assesses acceptance of one’s body, respect and care for one’s body, and protection of one’s body from unrealistic beauty standards (sample item: “I respect my body”). All items were rated on a 5-point scale, ranging from 1 (*never*) to 5 (*always*), and an overall score was computed as the mean of all items. Higher BAS-2 scores reflect greater body appreciation. Scores on the Malay version of the BAS-2 have been shown to be unidimensional, and to have adequate internal consistency, construct validity, and incremental validity (Swami, Mohd. Khatib et al., 2019). In the present study, internal consistency as assessed using McDonald’s omega (ω) for BAS-2 scores was .91 (95% CI = .90, .92) for Malays and .91 (95% CI = .91, .93) for Chinese participants.

**2.2.3. Negative body image**. To measure indices of negative body image, we used the Multidimensional Body-Self Relations Questionnaire–Appearance Subscales (MBSRQ–AS; Cash, 2000; Malay translation: Swami, Todd, Mohd. Khatib et al., 2019). The MBSRQ–AS is a 34-item instrument that measures body image attitudes along two psychological dimensions – evaluation and cognitive-behavioural orientation – in three somatic domains, namely appearance, health, and fitness. Items on this measure were rated on 5-point scales, with anchors varying depending on the subscale. Scores on the English version of the scale have been found to reduce to 5 factors (Cash, 2000). However, EFA and CFA with Malaysian adults indicated that a 3-factor model consisting of Body Areas and Appearance Satisfaction (BAAS; 11 items), Appearance Orientation (AO; 7 items), and Weight Perception and Concerns (WPC; 5 items) provided better fit to the data than the parent 5-factor model. In the present study, participants were only asked to complete the AO (sample item: “I check my appearance in a mirror whenever I can”) and WPC subscales (sample item: “I constantly worry about being or becoming fat”). Subscale scores were computed as the mean of all items, with higher scores reflecting greater appearance orientation or weight perceptions and concerns, respectively. Scores on the Malay MBSRQ have been shown to have adequate internal consistency and construct validity (Swami, Todd, Mohd. Khatib et al., 2019). In the present study, ω for the AO scores was .78 (95% CI = .76, .81) for Malays and .80 (95% CI = .76, .83) for Chinese participants, whereas ω for the WPC scores was .78 (95% CI = .75, .81) for Malays and .75 (95% CI = .70, .79) for Chinese participants.

**2.2.4. Appearance ideals.** The survey also included items from the Sociocultural Attitudes Toward Appearance Questionnaire-3 (SATAQ-3; Thompson, van den Berg, Roehrig, Guarda, & Heinberg, 2004; Malay translation: Swami, 2009). The SATAQ-3 is a 30-item scale measuring the multidimensional impact of sociocultural influences on body image, with items rated on a 5-point scale (1 = *definitely disagree*, 5 = *definitely agree*). Although scores on the English version of the scale reduce to 4 factors, Swami (2009) found that scores on the Malay version consisted of 3 dimensions tapping perceived pressure and general internalisation of appearance ideals (14 items), the extent to which different sources of information are considered important in terms of appearance ideals (9 items), and internalization of an athletic ideal (5 items). In the present study, participants were only asked to complete the 14-item Pressure and Internalisation-General subscale (sample item: “I’ve felt pressure from TV and magazines to diet”) and subscale scores were computed as the mean of all fourteen items. Scores on the Malay version of the SATAQ-3 evidence adequate internal consistency coefficients and convergent validity (Swami, 2009). In the present study, ω for Pressure and Internalisation General subscale scores was .80 (95% CI = .76, .84) for Malays and .82 (95% CI = .77, .89) for Chinese participants.

**2.2.5. Life satisfaction.** To measure life satisfaction, we used the Satisfaction with Life Scale (SLS; Diener, Emmons, Larsen, & Griffin, 1985; Malay translation: Swami & Chamorro-Premuzic, 2009), a 5-item scale that taps individuals’ assessments of the quality of their lives on the basis of their own unique criteria (sample item: “I am satisfied with my life”). All items were rated on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*) and an overall score was computed as the mean of all items. Higher SLS scores reflect greater life satisfaction. Scores on the Malay SLS have been shown to have adequate internal consistency and construct validity (Swami & Chamorro-Premuzic, 2009). In the present work, ω for scores on this scale was .88 (95% CI = .86, .89) for Malays and .87 (95% CI = .84, .89) for Chinese participants.

**2.2.6. Subjective happiness.** As an additional measure of psychological well-being, we included the Subjective Happiness Scale (SHS; Lyubomirsky & Lepper, 1999; Malay translation: Swami, 2008), a 4-item molar measure of the extent to which individuals believe they are happy or unhappy people. Two SHS items ask respondents to characterise themselves based on absolute ratings and ratings relative to peers, whereas 2 additional items present brief descriptions of happy and unhappy individuals, and ask respondents to rate the extent to which the descriptions are accurate of themselves. All items were rated on 7-point scales and an overall score was computed as the mean of all items. Higher scores on the SHS reflect greater subjective happiness. Scores on the Malay SHS have adequate internal consistency, adequate construct validity, and good test-retest reliability over a 1-month period (Swami, 2008). In the present study, ω for SHS scores was .82 (95% CI = .77-.87) in Malays and .81 (95% CI = .75, .87) in Chinese participants.

**2.2.7. Body mass index.** Participants were asked to provide their height and weight information. These data were used to compute self-reported BMI as kg/m2. Self-reported BMI has been shown to be highly correlated with actual measurements in Malaysian samples (Kee et al., 2017).

**2.2.8. Demographics**. We requested demographic details consisting of sex, age, ethnicity, marital status, highest educational attainment, and religion.

**2.3. Test Adaptation**

The IES-2 was translated from English into Malay using the 5-stage procedure proposed by Beaton, Bombardier, Guillemin, and Ferraz (2000) and recommended by Swami and Barron (2019). First, an informed and an uninformed translator independently forward-translated the IES-2 items from English to Malay. In the second step, the two translations were scrutinised by a third independent and blind translator, who resolved discrepancies between the translations and produced a synthesised translation. In the third step, two new independent translators who were naïve to the IES-2 back-translated the synthesised translation into English (Brislin, 1970). In a fourth step, the forward- and back-translations were examined by a bilingual committee comprising all the aforementioned translators, a methodologist, and four bilingual authors of the present study. No issues of concern emerged, so in a fifth step, the pre-final version was pre-tested in a sample of 41 individuals (women = 56.1%) who broadly matched the target sample. These participants were asked to rate each item for understanding on a 5-point scale (1 = *do not understand at all*, 5 = *understanding completely*). The mean responses per item were then assessed (overall *M* = 4.03, *SD* = 0.46, range = 3.83-4.41) and one item with relatively lower ratings of understanding (Item #13, *M* = 3.83) was returned to the committee for further consideration. Following committee discussion, minor grammatical adjustments were made to the offending item to improve grammatical clarity. The items of the final translation used in the present study are reported in Appendix 1.

**2.4. Procedures**

All research was conducted in accordance with the principles of the Declaration of Helsinki and ethics approval was obtained from the Institutional Review Board at Perdana University (approval code: PU IRBH 0202). All data were collected in October 2019 via a QualtricsTM research panel, which is an online survey platform available to researchers to facilitate participant recruitment. Inclusion criteria for the study included being of adult age (≥ 18 years), a citizen of Malaysia, of Malay or Chinese ancestry, and fluent in Malay. The project was advertised as a study on “body image and well-being” and included an estimated duration (10-15 minutes). Participants who agreed to take part were asked to provide digital informed consent and were asked to complete the measures described above in a randomised order. Participants were free to omit items they did not wish to respond to, but were prompted to attend to missing entries. IP addresses were inspected to ensure that no participant completed the survey more than once and all participants passed an attention check item embedded in the questionnaire. In exchange for completing the survey, participants were given QualtricsTM points that could be accumulated and redeemed for cash, gift vouchers, or donations to charities. All participants received debriefing information at the end of the survey.

**2.5. Analytic Strategy**

**2.5.1. Data treatment.** There were no missing responses in the dataset, possibly because participants were prompted to attend to missing entries. Improbable BMI values (<12 and > 50 kg/m2; *n* = 8) were recoded as missing data and replaced using the multiple imputation technique (Rubin, 2004). To examine the factor structure of the IES-2, we used a 2-step process involving EFA in the first step and CFA in the second step (see Swami & Barron, 2019). To ensure adequate sample sizes for all analyses, EFAs were performed with Malay women and men, whereas the CFA was performed with both Malay and Chinese participants of both sexes. Thus, the Malay sample was first split using a computer-generated semi-random seed, resulting in one split-half for EFA (women *n* = 201, men *n* = 201) and a second split-half for CFA (Malay women *n* = 106, Malay men *n* = 99); the latter was combined with data from Chinese participants (women *n* = 160, men *n* = 154). There were no significant differences between the two Malay subsamples, or between Malay and Chinese participants, in terms of mean age and BMI, or in the distribution of educational attainments and marital status (all *p*s > .198; full results available from the corresponding author).

**2.5.2. Exploratory factor analysis.** Data from the first Malay split-half were subjected to principal-axis EFA using the psych package (Revelle, 2019) in *R* (*R* Development Core Team, 2014). Following Tylka and Kroon Van Diest (2013), the EFAs were run separately for women and men. Subsample sizes met Worthington and Whittaker’s (2006) item-communality requirements, as well as assumptions for EFA based on item distributions, average item correlations, and item-total correlations (Clark & Watson, 1995). To determine whether our data were factorable, we computed the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett’s test of sphericity. For the EFAs, we followed Tylka and Kroon Van Diest (2013) in applying a direct oblimin rotation, with a delta weight of zero, so as to allow for moderate relationships between the factors. The number of factors to be extracted was determined using parallel analysis (Hayton, Allen, & Scarpello, 2004), which is less likely than more commonly-used methods to over-retain factors (Velicer, Eaton, & Fava, 2000). Parallel analysis works by creating a random dataset with the same number of cases and variables as the actual dataset. Factors in the actual data are only retained if their eigenvalues are greater than the eigenvalues from the random data (Hayton et al., 2004). Item retention was based on Comrey and Lee’s (1992) recommendation that items with “fair” loadings (i.e., ≥ .33) should be retained and that cross-loading items (i.e., items that had loadings of ≥ .33 on more than one factor) should be omitted. Finally, the degree of factor similarity across women and men was assessed using Tucker’s (1951) congruence coefficient, with values between .85 and .94 corresponding to fair similarity across groups and values ≥ .95 suggesting that factor structures can be considered equal across groups (Lorenzo-Seva & ten Berge, 2006).

**2.5.3. Confirmatory factor analysis.** With data from the second Malay split-half and Chinese participants, we conducted CFA using the lavaan (Rosseel, 2012), semTools (Jorgensen, Pornprasertmanit, Schoerman, & Rosseel, 2018), and MVN packages (Korkmaz, Goksuluk, & Zararsiz, 2014) with *R* (*R* Development Core Team, 2014). Proactive Monte Carlo simulations (Marcoulides & Chin, 2013) indicated that a sample size of 386 would be sufficient for this analysis, which was surpassed in our study (*n* = 519). Our aim was to test the 4-factor model with a higher-order factor proposed by Tylka and Kroon Van Diest (2013) and, if discrepant, the model(s) that emerged from our EFAs. Assessment of the present data for normality indicated that they were neither univariate (Sharipo-Wilks *p* < .001) nor multivariate normal (Mardia’s skewness = 4639.37, *p* < .001, Mardia’s kurtosis = 37.81, *p* < .001), so parameter estimates were obtained using the robust maximum likelihood method with the Satorra-Bentler correction (Satorra & Bentler, 2001). To assess goodness-of-fit, we used the normed model chi-square (χ²/df; values < 3.0 considered indicative of good fit; Hu & Bentler, 1999), the Steiger-Lind root mean square error of approximation (RMSEA) and its 90% CI (values close to .06 considered to be indicative of good fit and up to .08 indicative of adequate fit; Steiger, 2007), the standardised root mean square residual (SRMR; values < .09 indicative of good fit; Hu & Bentler, 1999), the comparative fit index (CFI; values close to or > .95 indicative of adequate fit; Hu & Bentler, 1999), the Tucker-Lewis index (TLI; values close to or > .95 indicative of good fit; Hu & Bentler, 1999), and Bollen’s Incremental Fit Index (BL89; values close to or > .95 indicative of good fit; Hu & Bentler, 1999). Akaike’s Information Criterion (AIC) was used as an index of comparative fit, with lower values preferable.

**2.5.4. Multi-group invariance.** Using data from the second Malay split-half and the Chinese sample, we used multi-group CFA (Chen, 2007) to assess measurement invariance at the configural, metric, and scalar levels for sex and ethnicity. Configural invariance implies that the latent IES-2 variables and the pattern of loadings of the latent variables on indicators are similar across groups (i.e., the unconstrained latent model should fit the data well in all groups). Metric invariance implies that the magnitude of the loadings is similar across groups and is tested by comparing two nested models consisting of a baseline model and an invariance model. Because the Δ*χ*² statistic is overly stringent criterion invariance (Meade, Johnson, & Braddy, 2008), we used ΔCFI < .01 as an indicator of metric invariance (Cheung & Rensvold, 2002). Finally, scalar invariance implies that both the item loadings and item intercepts are similar across groups and is examined using the same nested-model comparison strategy as with metric invariance (Chen, 2007). For scalar invariance, Chen (2007) suggested that invariance is supported when ΔCFI < .01 *and* ΔRMSEA < .015 *or* ΔSRMR < .030, although other scholars suggest that ΔCFI < .01 is sufficient (Cheung & Rensvold, 2002).

**2.5.5. Further analyses.** To assess internal consistency, we computed ω and its associated 95% CI, with values greater than .70 reflecting adequate internal reliability (Dunn, Baguley, & Brunsden, 2014). In the CFA portion of the dataset, evidence of convergent validity was assessed using the Fornell-Larcker criterion (Fornell & Larcker, 1981), with average variance extracted (AVE) values of ≥ .50 considered adequate (Malhotra & Dash, 2011) and meaning that a latent variable is able to explain more than half of the variance of its indicators on average. Sex and ethnic differences in IES-2 scores would only be investigated using a multivariate analysis of variance (MANOVA) with follow-up univariate ANOVAs should scalar invariance be established. To assess convergent validity, we used the total sample and examined bivariate correlations between IES-2 scores and scores on the additional measures included in the survey, namely life satisfaction, subjective happiness, body appreciation, pressure from and internalisation of appearance ideals, and BMI.

**3. Results**

**3.1. Exploratory Factor Analysis**

**3.1.1. Female subsample.** For the female subsample from the first split-half of Malay participants (*n* = 201), Bartlett’s test of sphericity, χ2(253) = 1833.81, *p* < .001, and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, KMO = .79, indicated that the IES-2 items had adequate common variance for factor analysis. Parallel analysis indicated that 5 factors from the actual data had λ greater than the criterion λ generated from the random data (i.e., λ1 4.77 > 1.66, λ2 4.16 > 1.56, λ3 1.71 > 1.46, λ4 1.53 > 1.39, λ5 1.53 > 1.32). A sixth factor derived from the actual data had an λ that was lower than the corresponding criterion λ generated from the random data (i.e., λ6 1.00 < 1.24). As such, we retained 5 factors, which explained 59.58% of the common variance. The fit indices for this model were adequate, χ2(201) = 260.67, *p* < .001, TLI = .88, RMSEA = .066 (90% CI = .049, .074), BIC = -524.82. As reported in Table 1, all 23 items had minimally “fair” factor loadings based on Comrey and Lee’s (1992) standards, although two items cross-loaded (Items #8 and 16).

In this subsample, Items #8 and 16 showed cross-loadings >.33, which is indicative of item redundancy and so were eliminated from the model. Items that loaded onto the first factor included 4 Eating for Physical Rather Than Emotional Reasons items (Items #2, 5, 10, and 11), and Item 17 from the Unconditional Permission to Eat subscale, which also appears to refer to a tendency to eat for physical reasons. We, therefore, called this factor Eating for Physical Rather Than Emotional Reasons and scores had adequate internal consistency (ω = .85, 95% CI = .81, .88). Items that loaded onto the second factor included 3 Unconditional Permission to Eat items (Items #1, 4, and 9) and all 3 Body-Food Choice Congruence items (Items #18, 19, and 20). We considered this factor to be an amalgamation of the two aforementioned subscales and scores had adequate internal consistency (ω = .72, 95% CI = .65, .78). The third factor comprised Items #21, 22, and 23 from the Reliance on Hunger and Satiety Cues subscale and scores had adequate internal consistency (ω = .79, 95% CI = .71, .84). The fourth factor comprised items #12, 13, and 14 from the Eating for Physical Rather Than Emotional Reasons subscale. Given that these items appear to refer to coping with emotional distress and given their similarity to the items extracted by Khalsa et al. (2019), we called this factor Avoiding Food-Related Coping Strategies. Scores on this factor had adequate internal consistency (ω = .76, 95% CI = .65, .81). Finally, the fifth factor comprised Item #3 from the Unconditional Permission to Eat subscale, two Reliance on Hunger and Satiety Cues items (Items #6 and 7), and one Eating for Physical Rather Than Emotional Reasons item (Item #15). However, ω for scores on this factor was less than adequate, at .58 (95% CI .43, .65), so items on this subscale were omitted.

**3.1.2. Male subsample.** For the male subsample from the first split-half of Malay participants (*n* = 201), Bartlett’s test of sphericity, χ2(253) = 1661.71, *p* < .001, and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, KMO = .75, indicated that the IES-2 items had passable common variance for factor analysis. The results of the EFA revealed 7 factors with λ > 1.0, but parallel analysis indicated that 5 factors should be extracted: only the first 5 factors from the actual data had λ greater than the criterion λ generated from the random data (i.e., λ1 4.57 > 1.68, λ2 3.27 > 1.56, λ3 2.26 > 1.46, λ4 1.61 > 1.39, λ5 1.44 > 1.33). The remaining 2 factors derived from the actual data had an λ that was lower than the corresponding criterion λ generated from the random data (i.e., λ6 1.15 < 1.26, λ7 1.04 < 1.21). As such, we retained 5 factors, which explained 57.2% of the common variance. The fix indices for this model were adequate: χ2(201) = 303.50, *p* < .001, TLI = .81, RMSEA = .077 (90% CI = .061, .084), BIC = -481.39. Twenty-one of the 23 item had minimally “fair” factor loadings, two items did not load onto any of the five factors (Items #12 and 15), and one item cross-loaded (Item #1).

In this subsample, Item #1 showed cross-loadings >.33, and Items #12 and 15 did not load onto any of the 5 factors. Four Eating for Physical Rather Than Emotional Reasons items loaded onto the first factor (Items #2, 5, 10, and 11), which we therefore called Eating for Physical Rather Than Emotional Reasons (ω = .85, 95% CI = .81, .88). Items that loaded onto the second factor included two Unconditional Permission to Eat items (Items #1 and 9), all three Body-Food Choice Congruence items (Items #18, 19, and 20), and Item #22 from the Reliance on Hunger and Satiety Cues subscale. For brevity, we term this subscale Body-Food Choice Congruence and scores had adequate internal consistency (ω = .71 (95% CI = .63, .78). Five items from the Reliance on Hunger and Satiety Cues were found to load onto the third factor (Items #6, 7, 8, 21, and 23) and internal consistency was adequate (ω = .80, 95% CI = .74, .84). Only two items loaded onto the fourth factor (Items #13 and 14 from the Eating for Physical Rather Than Emotional Reasons subscale), so this subscale was considered unstable and omitted. Finally, the fifth factor comprised five Unconditional Permission to Eat items (Items #1, 3, 4, 16, and 17), but ω for scores on this factor was .61 (95% CI = .57-.62) and so these items were also omitted.

**3.1.3. Factor structure congruence and summary.** The factor loadings reported in Table 1 for the female and male subsamples suggest a low degree of similarity across factor structures. Tucker’s congruence coefficient for both EFA-derived models was less-than-adequate (|.49|-|.69|), suggestive of factor-structure divergence. In short, the EFAs point to two models – a 4-factor model comprising 16 items for women and a 3-factor model comprising 15 items in men – that differed substantially from the parent factor structure proposed by Tylka and Kroon Van Diest (2013). For this reason, we tested for model fit of both of these models alongside the parent model in our CFA analyses.

**3.3. Confirmatory Factor Analysis**

**3.3.1. Parent model.** In the second split-half sample (*n* = 519), we first examined the fit of Tylka and Kroon Van Diest’s (2013) 4-factor, multi-level model. Indices were suggestive of poor fit to the data: SBχ²(226) = 1337.77, SBχ²normed = 5.92, robust RMSEA = .110 (90% CI = .104, .115), SRMR = .147, robust CFI = .638, robust TLI = .595, BL89 = .608, AIC = 28910.57. Suggested modification indices were consulted to improve model fit, with modifications being based on correlations among like items from the same factor (Schumacker & Lomax, 2004). Despite freeing up to 3 error covariances per subscale, in accordance with the results from likelihood ratio tests (see Table 2), the fit indices remained below acceptable levels on most indices: SBχ²(217) = 712.02, SBχ²normed = 3.28, robust RMSEA = .073 (90% CI = .067, .079), SRMR = .129, robust CFI = .845, robust TLI = .819, BL89 = .839, AIC = 28100.17.

**3.3.2. EFA-derived 4-factor model.** Second, we examined the fit of the EFA-derived 4-factor model from the female subsample. Fit indices were: SBχ²(113) = 354.237, SBχ²normed = 3.14, robust RMSEA = .070 (90% CI = .062, .078), SRMR = .080, robust CFI = .895, robust TLI = .874, BL89 = .890, AIC = 21213.36. As some indices were less-than-adequate, modification indices were consulted to improve model fit (see Table 2). Error covariances were successively freed based on assumed correlations among like items from the same factor (i.e., Items #1 and 4, 4 and 9, and 12 and 14). These modifications resulted in an improved model fit, although values for CFI, TLI, and BL89 were still less-than-adequate: SBχ²(110) = 301.419, SBχ²normed = 2.74, robust RMSEA = .063 (90% CI = .055-.072), SRMR = .076, robust CFI = .917, robust TLI = .898, BL89 = .912, AIC = 21154.91. We also examined the fit of the EFA-derived 4-factor model with the additional constraint of a higher-order intuitive eating factor. Fit indices were: SBχ²(115) = 365.646, SBχ²normed = 3.18, robust RMSEA = .071 (90% CI = .063-.079), SRMR = .085, robust CFI = .891, robust TLI = .871, BL89 = .886, AIC = 21224.73. As indices were below adequate thresholds, suggested modification indices were again considered to improve model fit based upon the aforementioned conditions (see Table 2). Error covariances were successively freed between Items #1 and 4, 4 and 9, and 13 and 14. These modifications resulted in an improved model fit, although values for CFI, TLI, and BL89 remained less-than-adequate: SBχ²(112) = 321.285, SBχ²normed = 2.87, robust RMSEA = .066 (90% CI = .057, .074), SRMR = .082, robust CFI = .909, robust TLI = .889, BL89 = .904, AIC = 21177.30.

**3.3.3. EFA-derived 3-factor model.** Finally, we examined the fit of the EFA-derived 3-factor model. For this model, fit indices were: SBχ²(84) = 331.79, SBχ²normed = 3.95, robust RMSEA = .084 (90% CI = .074, .093), SRMR = .078, robust CFI = .888, robust TLI = .860, BL89 = .883, AIC = 17788.63. As indices were less-than-adequate, suggested modification indices were again considered to improve model fit. Error covariances were freed at a rate of up to three per subscale, in accordance with the results from likelihood ratio tests (see Table 2) and based on assumed correlations among like items from the same factor. This resulted in an improved fit, although some indices remained below adequate thresholds: SBχ²(81) = 276.58, SBχ²normed = 3.42, robust RMSEA = .076 (90% CI = .066, .086), SRMR = .069, robust CFI = .910, robust TLI = .883, BL89 = .905, AIC = 17731.40. Finally, we examined the fit of the EFA-derived 3-factor model from the male subsample, with the additional constraint of a higher-order intuitive eating factor. However, after 1,339 iterations, a stable solution was not achievable.

**3.3.4. Summary and further analyses.** The CFA analyses indicated that three models (the EFA-derived 4-factor model, the EFA-derived 4-factor model with a higher-order factor, and the EFA-derived 3-factor model) had acceptable fit on some indices, but less-than-adequate fit on other indices. However, comparison of AIC values indicated that the 3-factor model provided the best fit, comparatively. Based on the suggestion that fit thresholds should not be applied rigidly (Swami & Barron, 2019), we elected to use the 3-factor model in all further analyses (see Figure 1). Convergent validity for this model was less-than-adequate, as while AVE was .61 for Eating for Physical Rather Than Emotional Reasons, it was < .50 for the two remaining factors (Body-Food Choice Congruence = .29; Reliance on Hunger and Satiety Cues = .36). In the second split-half sample, ω for Eating for Physical Rather Than Emotional Reasons scores was .83 (95% CI = .79, .87) in women and .87 (95% CI = .83, .89) in men. Omega for Body-Food Choice Congruence scores was .71 (95% CI = .64, .79) in women and .70 (95% CI = .63, .75) in men, whereas ω for Reliance on Hunger and Satiety Cues scores was .76 (95% CI = .70, .82) in women and .77 (95% CI = .70, .82) in men.

**3.4. Sex and Ethnic Invariance**

Next, we tested for measurement invariance across sex and ethnicity for the second split-half subsample, based on the EFA-derived, 3-factor model. As reported in Table 3, all indices suggested that configural, metric, and scalar invariance were supported across both sex and ethnicity. Given these results, we computed a 2 × 2 MANOVA with sex and ethnicity as the independent factors and IES-2 factor scores (i.e., from the 3-factor model) as the dependent variables, using the total sample. The results indicated no significant Sex × Ethnicity interaction, *F*(3, 915) = 0.28, *p* = .843, Wilk’s λ = .99, ηp2 < .01, and no main effect of Ethnicity, *F*(3, 915) = 2.29, *p* = .077, Wilk’s λ = .99, ηp2 < .01. Conversely, there was a significant main effect of Sex, *F*(3, 915) = 11.36, *p* < .001, Wilk’s λ = .96, ηp2 = .04. Inspection of the univariate results indicated that women (*M* = 3.21, *SD* = 0.87) had significantly higher Eating for Physical Rather Than Emotional Reasons scores than men (*M* = 2.87, *SD* = 0.90), *F*(1, 917) = 30.45, *p* < .001, ηp2 = .03. In contrast, there were no significant sex differences on Body-Food Choice Congruence scores (women *M* = 3.66, *SD* = 0.59; men *M* = 3.73, *SD* = 0.59), *F*(1, 917) = 2.91, *p* = .089, ηp2 < .01, and Reliance on Hunger and Satiety Cues scores (women *M* = 3.62, *SD* = 0.59; men *M* = 3.68, *SD* = 0.63), *F*(1, 917) = 1.15, *p* = .284, ηp2 < .01.

**3.5. Further Analyses**

**3.5.1. Construct validity.** We examined the construct validity of the 3-factor model of Malay IES-2 scores through correlations with scores on additional measures included in the present study, using the total sample. Because the 3-factor model was derived from the EFA with men, we examined construct validity separately for women and men. The table of inter-correlations is reported in Table 4. As can be seen, construct validity for the 3-factor model of IES-2 scores was generally supported in women, although correlations between Eating for Physical Rather Than Emotional Reasons scores and additional variables were weak in all cases and non-significant with body appreciation. Similarly, inter-correlations between scores on two subscales (i.e., Reliance on Hunger and Satiety Cues and Body-Food Choice Congruence) and weight perceptions and concerns, as well as perceived pressure from and internalisation of appearance ideals, was weak or non-significant. In men, evidence of construct validity of Eating for Physical Rather Than Emotional Reasons scores was mixed, with non-significant relationships with body appreciation, life satisfaction, and BMI, but weak-to-medium relationships with additional variables. Reliance on Hunger and Satiety Cues and Body-Food Choice Congruence scores in men again showed weak or non-significant relationships with and weight perceptions and concerns on the one hand and perceived pressure from and internalisation of appearance ideals. In addition, the correlation between Reliance on Hunger and Satiety Cues scores and BMI was non-significant.

**4. Discussion**

In the present study, we examined the dimensionality and psychometric properties of a novel Malay translation of the IES-2 in a multi-ethnic sample of Malaysian adults. Overall, we failed to find support for the parent, 4-factor model of IES-2 scores proposed by Tylka and Kroon Van Diest (2013). Using CFA, the parent model did not evidence adequate fit even following the consultation of modification indices to improve model fit. Instead, EFAs pointed to two distinct factor structures – a 4-factor model and a 3-factor model – in women and men, respectively. When we tested the fit of these models using CFA, both evidenced less-than-adequate fit on some indices, though they could be considered acceptable overall. Of the two models, the 3-factor model comprising 15 IES-2 items demonstrated comparatively better fit, although we did not find evidence of a higher-order intuitive eating factor. Overall, then, our results point to some difficulties in determining an appropriate factor structure of IES-2 scores in Malaysian adults. Although we suggest that a 3-factor model may best explain the current data, we suggest that this model may also be deficient for a number of reasons.

First, it is notable that the 3-factor model of Malay IES-2 scores seems to tap three central intuitive constructs, namely Eating for Physical Rather Than Emotional Reasons, Body-Food Choice Congruence, and Reliance on Hunger and Satiety Cues. However, the Unconditional Permission to Eat dimension did not emerge as a distinct factor; rather, two Unconditional Permission to Eat items loaded onto a common construct along with three Body-Food Choice Congruence items. In broad outline, this is similar to the findings of studies of non-college students in the United States (Khalsa et al., 2019; Saunders et al., 2018), where it was not possible to extract Unconditional Permission to Eat items as a distinct factor. This is important because, in both theoretical (Tribole, 2017; Tribole & Resch, 2012) and empirical formulations (Tylka & Kroon Van Diest, 2013), Unconditional Permission to Eat is proposed as a central facet of intuitive eating. In our study, however, Unconditional Permission to Eat does not emerge as a core facet of intuitive eating; rather, Unconditional Permission to Eat appears to be primarily intertwined with Body-Food Choice Congruence. However, interpretation of this factor itself is complicated by the fact that it consists of two Unconditional Permission to Eat items, three Body-Food Choice Congruence items, and one Reliance on Hunger and Satiety Cues item. Thus, it might be suggested that what we, for the sake of brevity, have termed the Body-Food Choice Congruence factor in fact reflects an amalgamation of various IES-2 constructs or, possibly, a general intuitive eating facet. More generally, it is possible that the IES-2 does not measure unique constructs beyond eating styles, as has been recently suggested (Barrada, Cativiela, van Strien, & Cebolla, 2019; see also Kerin, Webb, Zimmer-Gembeck, 2019), which may help explain some of the issues of dimensionality uncovered here.

Second, our 3-factor model of Malay IES-2 scores consisted of only 15 of the 23 original IES-2 items; that is, about a third of the original IES-2 items either captured meanings across more than one factor or loaded onto subscales that evidenced less-than-adequate internal consistency. This is similar to a number of earlier studies (Akırmak et al., 2019; Camilleri et al., 2015; da Silva et al., 2019; Saunders et al., 2018), although it should be noted that, in most translations studies where item omission was required, only a handful of items were discarded. One possibility worth considering is that the notion of intuitive eating as it is currently theorised represents a largely Western conception that may not generalise to Asian populations (cf. Dunne & Pike, 2013). That is, the constructs of intuitive eating formulated by Tribole and Resch (2012) and operationalised through the IES-2 may represent a Western formulation of intuitive eating that does not generalise to all populations, or at the very least to Malaysian adults.

In terms of the latter specifically, it might be suggested that unique features of Malaysian eating habits – including the high frequency of eating out and the complexities of ethno-cultural diversity in terms of cuisine and attitudes toward food (Fournier et al., 2016; see also Pike & Dunne, 2015) – mean that the construct of intuitive eating as originally conceived by Tribole and Resch (2012) may not be fully applicable in this national context. More specifically, eating habits among Malaysian adults may be focused on social associations and gratification (i.e., social and environmental eating) or on the enhancement of social interactions, which may help explain the discrepant factor structure of the IES-2 in this study compared to the parent study. Indeed, there is some evidence to suggest that the nutrition transition – a shift from traditional diets to modern diets with increasing proportions of fats and sugars – results in a parallel transition of eating styles (Hawks et al., 2004). Thus, it might be suggested that the construct of intuitive eating, and hence the IES-2, does not fully capture the crux and meaning of what it means to eat intuitively in nations such as Malaysia, which are undergoing important shifts in nutrition and eating styles.

This speaks to a broader concern with relying on a construct that was developed in Western settings to assess intuitive eating in diverse national and social identity groups. One way to advance research in this area is through the use of an emic approach (Brislin, Lonner, & Thorndike, 1973) in which item content relevant to Malaysian adults is developed iteratively. Such an approach would require a thorough understanding of the ways in which intuitive eating is understood and expressed in Malaysian adults and, as such, would benefit from initial qualitative research that seeks to identify core components of the construct in the context of Malaysia. Although such an approach would lack generalisability – concepts related to intuitive eating generated in Malaysian samples may not be comparable to other cultural groups – it would nevertheless provide a more thorough understanding of intuitive eating relevant to Malaysians. Such an approach may also be useful in helping scholars to better understand why some IES-2 items load onto more than one factor or are less relevant to the concept of intuitive eating in Malaysian adults.

Beyond issues of dimensionality, the present study also found that scores on the 3-factor model of Malay IES-2 scores demonstrated adequate internal consistency coefficients. We also were able to demonstrate that IES-2 factor scores were invariant across both sex and ethnicity in our sample. Comparison of scores across sex were notable because we found no significant between-group differences on two dimensions (i.e., Body-Food Choice Congruence and Reliance on Hunger and Satiety Cues). Where there was a significant sex difference, namely on the EPR subscale, we found that women had significantly higher scores than men. This stands in contrast to previous research (e.g., Tylka & Kroon Van Diest, 2013), which indicated that men had significantly higher Eating for Physical Rather Than Emotional Reasons scores compared to women. Interpreting this difference is difficult in the absence of further data, but it should be noted that the magnitude of the difference was small. Overall, it appears that there are few meaningful sex differences in IES-2 scores in Malaysian adults, just as there were no significant differences between Malaysian Malays and Chinese. The latter result is nevertheless important because it represents the first time that ethnic invariance of IES-2 scores has been established. It is also notable because, despite their different food and culinary heritages (Duruz & Khoo, 2014; Hsin-Huang & Khay-Thiong, 2015), Malaysian Malays and Chinese do not appear to differ substantively in their degree of intuitive eating.

In addition, the results of our study indicate that the derived 3-factor model of IES-2 scores demonstrated mixed construct validity. First, it is important to note that – contrary to Tylka and Kroon Van Diest (2013) – Eating for Physical Rather Than Emotional Reasons scores were either weakly or non-significantly associated with Body-Food Choice Congruence and Reliance on Hunger and Satiety Cues scores. This could be taken as evidence to suggest that Eating for Physical Rather Than Emotional Reasons, as operationalised in the present study, does not represent a core intuitive eating component in Malaysian adults or, alternatively, is unrelated to additional intuitive eating facets. Second, evidence of convergent validity as assessed by AVE in the present study was weak, particularly for the Body-Food Choice Congruence and Reliance on Hunger and Satiety Cues facets. Third, although relationships between Body-Food Choice Congruence and Reliance on Hunger and Satiety Cues scores, respectively, and additional variables in the present study were largely supportive of construct validity, it was notable that some relationships with Eating for Physical Rather Than Emotional Reasons scores did not reach significance or were at best weak, particularly in men. Indeed, it was notable that, where significant associations were found (e.g., the negative associations with body appreciation, life satisfaction, and subjective happiness in women, and the negative association with subjective happiness in men), these were in the opposite direction to that reported by Tylka and Kroon Van Diest (2013). That is, these results suggest that our participants viewed is it as more adaptive to eat for emotional reasons and less adaptive to eat for physical reasons. Although these findings should be read in the context of the weak associations, it is possible that emotional eating in the Malaysian context may not represent a maladaptive eating style, as it does in Western settings. Indeed, other scholars have made a similar point about emotional eating in neighbouring Philippines (Hawks, Madanat, Smith, & Novilla, 2006) and emotional eating has also been found to be non-significantly associated with weight gain in Indonesian university students (Muharrani, Achmad, Sudiarti, 2018). Thus, it might be questioned as to whether the Eating for Physical Rather Than Emotional Reasons facet adequately taps a central feature of intuitive eating for Malaysian adults, although it is possible that this may change as the nutritional transition in Malaysia progresses.

Of course, this study is not without its limitations. First, the present study relied on an online sample of Malaysian Malays and Chinese adults, which raises two sampling concerns. First, our sample is unlikely to be representative of the wider Malaysian population, particularly in terms of the limited ethnic heterogeneity of our sampling. In future research, it would be useful to consider the extent to which the present results can be replicated in other Malaysian ethnic groups that were not represented in our study, such as Malaysian Indians, as well as in groups differing in urbanicity and socioeconomic status (see Azizan, Thangiah, Su, & Abdul Majid, 2018). Similarly, although Malay is the national language of Malaysia, conducting translation work in Malaysia is complicated by the linguistic heterogeneity of the nation. For example, Malay is unlikely to be the first language of many Malaysian Chinese, for whom it may be more appropriate to consider the use of IES-2 variants in appropriate Chinese dialects. Likewise, although we have no reason to doubt the robustness of our translation of the IES-2 given the translational procedures that were adopted, concurrent presentation of the IES-2 in Malay and English (a widely-spoken *lingua franca*) may be worth considering in future studies. Doing so may help scholars to determine the extent to which the dimensionality issues reported in the present study were a function of the language of IES-2, although we note that participants in a pilot study reported no major difficulties in comprehension.

In the present study, we also did not examine test-retest reliability, nor did we assess additional indices of validity, such as predictive or discriminant validity. In terms of the latter, we were constrained by the dearth of relevant psychometrically-valid tools that could be used in Malay-speaking populations (see Swami, 2020). Nevertheless, future work could extend the present findings through the inclusion of additional instruments that have been recently validated for use in Malay-speaking populations, such as the Functionality Appreciation Scale (Alleva, Tylka, & Kroon Van Diest, 2017; Malay translation: Swami, Todd, Aspell et al., 2019) and the Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012; Malay translation: Todd et al., 2019). Finally, and as we have suggested above, it may be worth considering whether an emic measure of intuitive eating needs to be developed for use in the Malaysian context. Indeed, research on intuitive eating would benefit from sustained attention to the nature and meaning of the construct in national contexts that are infrequently represented in the literature. Such research would certainly benefit from qualitative research that more formally delineated core features of intuitive eating outside English-speaking or Western populations.

Based on our findings, as well as an emerging body of research problematising the dimensionality of IES-2 scores (Khalsa et al., 2019; Saunders et al., 2018), we draw a number of important conclusions. First, we suggest that scholars wishing to use the Malay IES-2 re-examine its factor structure and psychometric properties, where feasible. Indeed, our findings raise concerns about prior use of the IES-2 with Malaysian adults, particularly total scores as in one previous study (Gan & Yeoh, 2019). This is important because the lack of attention to issues of dimensionality may have led to artefactual results. Where (re-)assessments of dimensionality are not feasible, we recommend computation of Malay IES-2 scores based on the 3-factor model hypothesised in the present study and avoiding the use of total IES-2 scores. Beyond this, we also recommend that scholars consider developing novel measures of intuitive eating that may be more sensitive to local cultural and national contexts. Second, we strongly recommend that scholars using the IES-2 in diverse national and linguistic contexts avoid privileging the use of CFA to determine the dimensionality of scores. This is because CFA does not tell us whether alternative models may fit the data better in particular national groups. Indeed, the present results, as well as those of earlier studies (Khalsa et al., 2019; Saunders et al., 2018) suggest that some caution should be exercised when considering the dimensionality of IES-2 scores in diverse social identity groups.

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Table 1. *Item-Factor Loadings for Female and Male Malay Participants from the First Split-Half Subsample.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Item | Dimension in Tylka and Kroon Van Diest (2013) | Women (*n* = 201) | | | | | Men (*n* = 201) | | | | |
| F1 | F2 | F3 | F4 | F5 | F1 | F2 | F3 | F4 | F5 |
| 1 | UPE | -.16 | **.63** | .09 | -.16 | -.07 | .11 | **.46** | -.02 | .10 | **-.45** |
| 2 | EPR | .**73** | .07 | -.01 | -.15 | -.01 | **.78** | -.01 | -.02 | .08 | <.01 |
| 3 | UPE | .22 | .06 | -.01 | -.11 | **.46** | .15 | .15 | .09 | -.07 | **.38** |
| 4. | UPE | .23 | **.38** | .24 | -.03 | -.23 | .28 | .28 | -.03 | .10 | **-.36** |
| 5 | EPR | **.77** | -.05 | -.02 | -.10 | <.01 | **.69** | -.11 | .11 | -.04 | .04 |
| 6 | RHSC | .02 | .17 | .31 | .11 | **.39** | -.04 | -.02 | **.77** | -.10 | -.03 |
| 7 | RHSC | -.04 | .12 | .16 | -.06 | **.63** | .13 | < .01 | **.69** | .03 | -.10 |
| 8 | RHSC | -.17 | .12 | **.33** | -.10 | **.50** | .04 | -.09 | **.73** | .05 | <.01 |
| 9 | UPE | .17 | **.36** | .13 | .11 | .03 | -.01 | **.40** | .12 | -.02 | .01 |
| 10 | EPR | **.66** | .02 | .12 | .20 | .04 | **.77** | .16 | .01 | -.10 | .03 |
| 11 | EPR | **.84** | -.02 | .05 | -.08 | -.01 | **.82** | -.09 | -.01 | -.01 | .04 |
| 12 | EPR | -.01 | .08 | .08 | **.57** | .13 | -.12 | .32 | -.04 | .21 | .05 |
| 13 | EPR | .03 | .10 | .06 | **.55** | -.22 | -.01 | -.04 | < .01 | **.87** | .05 |
| 14 | EPR | -.21 | .04 | .04 | **.71** | -.08 | -.01 | -.01 | < .01 | **.74** | -.09 |
| 15 | EPR | -.15 | .27 | -.14 | .09 | **.51** | -.23 | .19 | .18 | .30 | .30 |
| 16 | UPE | **.40** | -.11 | -.14 | .09 | **.51** | .19 | .18 | .02 | .06 | **.58** |
| 17 | UPE | **.42** | -.30 | .03 | .15 | .23 | .23 | -.09 | -.03 | .01 | **.57** |
| 18 | B-FFC | .18 | **.63** | -.10 | .13 | -.01 | .12 | **.48** | -.01 | .15 | -.16 |
| 19 | B-FFC | -.07 | **.66** | -.03 | .08 | .10 | -.06 | **.77** | .06 | -.02 | -.03 |
| 20 | B-FFC | -.02 | **.74** | .04 | .11 | .09 | -.02 | **.72** | < .01 | -.06 | .11 |
| 21 | RHSC | .05 | -.12 | **.54** | .24 | -.03 | -.03 | .28 | **.45** | .09 | .16 |
| 22 | RHSC | .02 | -.03 | **.89** | .04 | -.01 | -.10 | **.36** | .32 | .05 | .18 |
| 23 | RHSC | .04 | .10 | **.73** | -.09 | .12 | -.10 | .20 | **.51** | .10 | .15 |

*Note.* Items in bold indicate items associated with each factor. UPE = Unconditional Permission to Eat, EPR = Eating for Physical Rather Than Emotional Reasons, RHSC = Reliance on Hunger and Satiety Cues, B-FCC = Body-Food Choice Congruence, F = Factor, HO = Higher order factor.

Table 2. *Modification Indices and Likelihood Ratio Test Results for Model Adjustments.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parent Model | | 4-factor, EFA-derived model | | 4-factor EFA-derived model, with higher-order factor | | 3-factor EFA-derived model | |
| Modification Index | Likelihood ratio | Modification Index | Likelihood ratio | Modification Index | Likelihood ratio | Modification Index | Likelihood ratio |
| 13 + 14, MI = 219.82 | χ²(1) = 284.79, *p* <. 001 | 1 + 4, MI = 24.30 | χ²(1) = 24.91, *p* < .001 | 1 + 4, MI = 23.73 | χ²(1) = 24.28, *p* < .001 | 21 + 23, MI = 46.80 | χ²(1) = 47.41, *p* < .001 |
| 22 + 23, MI = 120.74 | χ²(1) = 127.17, *p* < .001 | 4 + 9, MI = 18.74 | χ²(1) = 19.11, *p* < .001 | 4 + 9, MI = 18.39 | χ²(1) = 18.73, *p* < .001 | 19 + 20, MI = 9.46 | χ²(1) = 8.82, *p* = .003 |
| 3 + 16, MI = 86.46 | χ²(1) = 94.47, *p* < .001 | 12 + 14, MI = 15.85 | χ²(1) = 20.43, *p* < .001 | 13 + 14, MI = 9.43 | χ²(1) = 18.73, *p* = .001 | 6 + 7, MI = 9.94 | χ²(1) = 9.26, *p* = .002 |
| 12 + 15, MI = 78.79 | χ²(1) = 85.01, *p* < .001 |  |  |  |  |  |  |
| 16 + 17, MI = 58.99 | χ²(1) = 64.29, *p* < .001 |  |  |  |  |  |  |
| 21 + 22, MI = 41.76 | χ²(1) = 45.18, *p* < .001 |  |  |  |  |  |  |
| 21 + 23, MI = 50.48 | χ²(1) = 50.98, *p* < .001 |  |  |  |  |  |  |
| 1 + 9, MI = 31.39 | χ²(1) = 43.15, *p* < .001 |  |  |  |  |  |  |
| 12 + 13, MI = 31.18 | χ²(1) = 33.37, *p* < .001 |  |  |  |  |  |  |

*Note*. EFA = Exploratory factor analysis.

Table 3. *Measurement Invariance Across Sex and Ethnicity in the Second Split-Half Subsample.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Model | SBχ² | *df* | Robust CFI | Robust RMSEA | SRMR | Model Comparison | ΔSB*χ*² | Δ*df* | *p* | ΔRobust CFI | ΔRobust RMSEA | ΔSRMR | PGFI |
| Sex | Configural | 435.83 | 168 | .878 | .087 | .081 |  |  |  |  |  |  |  | .615 |
|  | Metric | 446.90 | 180 | .869 | .083 | .083 | Configural *vs*. metric | 11.07 | 12 | .807 | .009 | .004 | .002 | .659 |
|  | Scalar | 464.49 | 192 | .879 | .081 | .084 | Metric *vs*. scalar | 17.59 | 12 | .299 | .010 | .002 | .002 | .702 |
| Ethnicity | Configural | 462.80 | 168 | .870 | .091 | .081 |  |  |  |  |  |  |  | .615 |
|  | Metric | 487.10 | 180 | .865 | .089 | .086 | Configural *vs*. metric | 24.30 | 12 | .023 | .005 | .002 | .005 | .658 |
|  | Scalar | 528.10 | 192 | .856 | .089 | .088 | Metric *vs*. scalar | 41.00 | 12 | <.001 | .009 | <.001 | .002 | .701 |

Table 4. *Associations between the 3-Factor Model of Intuitive Eating and Additional Measures Included in the Study and for the Total Sample, Reported for Women (Upper Diagonal) and Men Separately.*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| 1. EPR |  | -.01 | .13\* | -.13\* | .14\* | .21\*\* | .34\*\* | -.12\* | -.17\*\* | .14\* |
| 1. B-FFC | -.02 |  | .47\*\* | .50\*\* | .47\*\* | .13\* | .08 | .27\*\* | .24\*\* | -.13\* |
| 1. RHSC | .07 | .41\*\* |  | .40\*\* | .39\*\* | -.07 | -.04 | .22\*\* | .17\*\* | -.23\*\* |
| 1. Body appreciation | -.07 | .53\*\* | .32\*\* |  | .40\*\* | -.14\* | -.20\*\* | .58\*\* | .51\*\* | -.25\*\* |
| 1. Appearance orientation | .25\*\* | .38\*\* | .18\*\* | .30\*\* |  | .24\*\* | .21\*\* | .25\*\* | .21\*\* | -.06 |
| 1. Weight perceptions and concerns | .30\*\* | .12\* | .02 | .02 | .39\*\* |  | .40\*\* | -.06 | -.09 | .53\*\* |
| 1. Pressure and Internalisation-General | .42\*\* | .05 | .08 | -.03 | .42\*\* | .47\*\* |  | -.12\* | -.24\*\* | .14\* |
| 1. Life satisfaction | -.03 | .26\*\* | .17\*\* | .47\*\* | .18\*\* | .06 | .08 |  | .68\*\* | -.01 |
| 1. Subjective happiness | -.24\*\* | .26 | .17\*\* | .46\*\* | .07 | -.03 | -.13\* | .60\*\* |  | -.01 |
| 1. Body mass index | -.02 | -.13\* | -.08 | -.15\* | -.06 | .39\*\* | -.01 | -.03 | .02 |  |

*Note*. *N* = 921. EPR = Eating for Physical Rather Than Emotional Reasons, RHSC = Reliance on Hunger and Satiety Cues, B-FCC = Body-Food Choice Congruence \* *p* < .05, \*\* *p* < .001.

**

*Figure 1.* Path diagram and estimates for the 3-factor model of Malay Intuitive Eating Scale-2 scores. The large ovals are the latent constructs, with the rectangles representing measured variables. The path factor loadings are standardised with significance levels were determined by critical ratios (all *p* < .001).

**Appendix 1**

*Intuitive Eating Scale-2 Items in English and (in Italics) Bahasa Malaysia (Malay).*

|  |  |
| --- | --- |
| Item |  |
| 1 | I try to avoid certain foods high in fat, carbohydrates, or calories / *Saya cuba elak daripada sesetengah makanan yang tinggi lemak, karbohidrat atau kalori.* |
| 2 | I find myself eating when I’m feeling emotional (e.g., anxious, depressed, sad), even when I’m not physically hungry / *Saya akan makan apabila saya sedang beremosi (contoh: berasa resah, tertekan, sedih) walaupun saya tidak lapar secara fizikal.* |
| 3 | If I am craving a certain food, I allow myself to have it / *Sekiranya saya mengidam makanan tertentu, saya benarkan diri saya untuk memakannya.* |
| 4 | I get mad at myself for eating something unhealthy / *Saya marah pada diri sendiri kerana makan sesuatu yang tidak sihat.* |
| 5 | I find myself eating when I am lonely, even when I’m not physically hungry / *Saya akan makan apabila saya kesunyian, walaupun saya tidak lapar secara fizikal.* |
| 6 | I trust my body to tell me when to eat / *Saya percaya badan saya untuk beritahu bila hendak makan.* |
| 7 | I trust my body to tell me what to eat / *Saya percaya badan saya untuk beritahu saya apa yang hendak dimakan.* |
| 8 | I trust my body to tell me how much to eat / *Saya percaya badan saya untuk beritahu saya berapa banyak perlu dimakan.* |
| 9 | I have forbidden foods that I don’t allow myself to eat / *Saya ada makanan terlarang yang saya tidak benarkan diri saya makan.* |
| 10 | I use food to help me soothe my negative emotions / *Saya gunakan makanan untuk membantu tenangkan emosi negatif.* |
| 11 | I find myself eating when I am stressed out, even when I’m not physically hungry / *Saya akan makan apabila saya tertekan walaupun saya tidak lapar secara fizikal.* |
| 12 | I am able to cope with my negative emotions (e.g., anxiety, sadness) without turning to food for comfort / *Saya mampu menghadapi emosi negatif saya (contoh: resah, sedih) tanpa mengambil makanan untuk meningkatkan keselesaan.* |
| 13 | When I am bored, I do NOT eat just for something to do / *Apabila saya bosan, saya TIDAK makan hanya untuk melakukan sesuatu.* |
| 14 | When I am lonely, I do NOT turn to food for comfort / *Apabila saya kesunyian, saya TIDAK mengambil makanan untuk meningkatkan keselesaan.* |
| 15 | I find other ways to cope with stress and anxiety than by eating / *Saya mempunyai cara lain untuk menghadapi tekanan dan keresahan selain daripada makan.* |
| 16 | I allow myself to eat what food I desire at the moment / *Saya benarkan diri saya makan apa sahaja makanan yang saya idamkan pada ketika itu.* |
| 17 | I do NOT follow eating rules or dieting plans that dictate what, when, and/or how much to eat / *Saya TIDAK ikut aturan makan atau pelan diet yang menentukan apa, bila dan/atau berapa banyak untuk dimakan.* |
| 18 | Most of the time, I desire to eat nutritious foods / *Kebanyakan masa, saya teringin untuk makan makanan yang berkhasiat.* |
| 19 | I mostly eat foods that make my body perform efficiently (well) / *Saya kebanyakannya makan makanan yang menjadikan tubuh badan saya berfungsi dengan berkesan (baik).* |
| 20 | I mostly eat foods that give my body energy and stamina / *Saya kebanyakannya makan makanan yang memberi tubuh badan saya tenaga dan stamina.* |
| 21 | I rely on my hunger signals to tell me when to eat / *Saya bergantung kepada isyarat lapar untuk memberitahu saya bila hendak makan.* |
| 22 | I rely on my fullness (satiety) signals to tell me when to stop eating / *Saya bergantung kepada isyarat kenyang (kekenyangan) untuk memberitahu saya bila untuk berhenti makan.* |
| 23 | I trust my body to tell me when to stop eating / *Saya percaya tubuh badan saya untuk beritahu bila untuk berhenti makan.* |