The validation of the Malay Yale Food Addiction Scale 2.0: factor structure, item analysis and model fit

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Abstract

Objective: The development of a second version of the Yale Food Addiction Scale (YFAS) coincides with the latest updates in the diagnosis of addiction as documented in the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders*. The objective of the present study was to translate the YFAS 2.0 into the Malay language and test its psychometric properties in a primary-care population.
Design: Patients were assessed for food addiction utilizing the Malay YFAS 2.0. The participants were also assessed for eating disorder using the validated Malay Binge Eating Scale. The psychometric properties of the YFAS 2.0 were determined by analysing factor structure, overall item statistics, internal consistency and construct validity.
Setting: Between 2017 and 2018, participants were chosen from a regional primary-care clinic in the district of Seremban, Malaysia.
Participants: Patients (*n* 382) from a regional primary-care clinic.
Results: The prevalence of food addiction was 5·0 %. A two-factor structure of the YFAS was confirmed as the most optimal solution for the scale via confirmatory factor analysis. In both its diagnostic and symptom count version, the YFAS 2.0 had good internal consistency (Kuder–Richardson $\alpha > 0.80$ and McDonald's $\omega > 0.9$).
Conclusions: We validated a psychometrically sound Malay version of the YFAS 2.0 in a primary-care population. Both diagnostic and symptom count versions of the scale had robust psychometric properties. The questionnaire can be used to develop health promotion strategies to detect food addiction tendencies in a general population.

The health burden of non-communicable diseases in Malaysia has reached alarming levels. Non-communicable diseases contribute to approximately 73 % of the total deaths of Malaysian individuals within the reproductive age group[1]. The National Health and Morbidity Survey in 2015 reported an increasing trend for all non-communicable disease risk factors in the country, especially among adults above the age of 18 years[1]. At least 63 % of all adults were obese, had high blood pressure, high blood sugar level or high cholesterol level[1].

The concept of food addiction is linked to obesity, overeating and binge eating habits[2]. The idea of 'food addiction' was conceptualized to describe substance dependence related to the consumption of foods high in sugar, fat and salt[2–6]. Consequently, the Yale Food Addiction Scale (YFAS) was devised to quantify the predisposition to 'food addiction' (based on the criteria of the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV-R))[7]. The YFAS demonstrated excellent psychometric properties[7]. The scale was successfully validated into German, French, Italian, Spanish, Turkish, Malay and Chinese languages[8–14].

The publication of an updated YFAS 2.0 in 2016 and the validated Malay Binge Eating Scale (BES) in 2013 paved the way for a complete evaluation of the use of the YFAS in Malaysia[15,16]. The newer YFAS 2.0 incorporated four criteria for the diagnosis of addiction in accordance with

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the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-V): (i) 'craving'; (ii) 'use despite interpersonalor social consequences'; (iii) 'failure in role obligations'; and (iv) 'use in physically hazardous situations'.

The YFAS has not been extensively evaluated in Malaysia. A current review suggests the exploration of the addictive effects of 'hyperpalatable food' as a way to explain the rise of obesity in the country[17]. In line with this recommendation, an initiative was undertaken to screen obese patients using a validated Malay YFAS 1.0[11]. However, the inventory was not utilized to screen obese individuals for food addiction tendencies due to the inadequate assessment of construct validity and goodness-of-fit[11].

The primary objective of the present study is to evaluate the psychometric properties of a Malay version of the YFAS 2.0 in an undifferentiated population at a regional primary-care clinic. We aimed to confirm the factor structure and determine the internal consistency and overall validity of the questionnaire.

Materials and methods

Study design and study population

The random sampling of patients attending the Seremban Primary Care Clinic was implemented using a cross-sectional study design between November 2017 and June 2018. A nominal list was generated to allow the random selection of patients based on the daily clinical appointments. Patients who were ineligible or refused to participate in the study were randomly replaced with other available participants on the nominal list. The inclusion criteria for patient recruitment were: (i) individuals between the age of 18 and 65 years; and (ii) fluency in the Malay language. Participants were excluded if they were suffering from a combination of psychological and neurological illnesses identified via individual case record examinations.

The permission to translate and validate the original version of the YFAS 2.0 questionnaire in the Malay language was obtained from Dr Ashley Gearhardt.

Instruments (Yale Food Addiction Scale and Binge Eating Scale)

The YFAS is a psychological inventory measuring food addiction symptoms experienced by individuals over a 12-month time period[7]. The questionnaire comprises thirty-five items that represent the twelve food addiction criteria in tandem with DSM-V (for more detailed description, see Table 1)[18,19].

The scores for symptom count and the diagnosis of food addiction were calculated based on the responses to all thirty-five items in the questionnaire. The classification of the twelve DSM-V diagnostic criteria was determined from cut-offs that were consistent with the original YFAS study (a diagnostic score of 1 translates into the endorsement of any criterion)[19]. The scores for the symptom count version range from 0 to 7. On the other hand, the diagnosis of food addiction was defined by: (i) two or more symptoms in the previous 12 months; plus (ii) concurrent evidence of clinically significant impairment or distress.

The BES comprises a sixteen-item questionnaire that identifies binge eating behaviour in participants with a score of ≥18. The scale has been validated in the Malay language and the Cronbach's α in our study was 0·81[16].

Translation of the Yale Food Addiction Scale 2.0

The translation process of the YFAS 2.0 questionnaire into the Malay language was done by a team of medical professionals and linguistic experts. The translation procedure was conducted in two phases. The initial phase was carried out by a general practitioner and a professional linguist from a recognized language translation institute. Subsequently, the back-translation of the validated questionnaire into English was conducted by two general practitioners and a language expert.

Pilot testing

Initially, thirty participants were recruited by closely adhering to the inclusion criteria of the study. Feedback was

Table 1 Criteria of the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-V), items retained and omitted within solved factors of the Malay Yale Food Addiction Scale 2.0

DSM-V criteria	Original items	Items retained	Items omitted
Factor 1 (Psychological Dimension)			
Substance taken in larger amount and for longer period than intended	1, 2, 3	1, 2	3
Persistent desire or repeated unsuccessful attempts to quit	4, 25, 31, 32	4, 25, 31, 32	–
Much time/activity to obtain, use, recover	5, 6, 7	5, 7	6
Use continues despite knowledge of adverse consequences	22, 23	23	22
Tolerance	24, 26	24, 26	–
Characteristic withdrawal symptoms; substance taken to relieve withdrawal	11, 12, 13, 14, 15	12, 13	11, 14, 15
Craving, or a strong desire or urge to use	29, 30	29, 30	–
Use causes clinically significant impairment or distress	16, 17	16, 17	–
Factor 2 (Social Dimension)			
Important social, occupational or recreational activities given up or reduced	8, 10, 18, 20	10, 20	8, 18
Continued use despite social or interpersonal problems	9, 21, 35	9, 21, 35	–
Failure to fulfil major role obligation (e.g. work, school, home)	19, 27	19, 27	–
Use in physically hazardous situations	28, 33, 34	33, 34	28

obtained with consideration to the difficulties faced while answering the items in the questionnaire. This information was then utilized to improve the accuracy of the questions, so they represent the concepts measured in the study correctly. The amended version of the questionnaire was tested on an additional fifty participants, giving an excellent preliminary Kuder–Richardson's α (KR-20) reliability for both the symptom count and diagnostic version of the questionnaire ($\alpha = 0.97$ and 0.92, respectively).

Consequently, the decision to approve the final version of the questionnaire was based on a consensus obtained from a panel of experts comprising a family medicine consultant, two general practitioners, a dietitian and senior primary-care nurse. Consensus was achieved via the iterative process of: (i) scrutinizing feedback solicited from participants during the pilot phase of the study; (ii) improving contextual accuracy of each question by examining the information obtained during the forward- and back-translation of the questionnaire; and (iii) repeated analysis of the responses and comments from participants who answered the revised version of the questionnaire.

Formal Malay Yale Food Addiction Scale 2.0 validation study

The formal validation process was then conducted using the revised version of the translated questionnaire. Once informed consent was obtained, participants were requested to complete the translated Malay YFAS 2.0 questionnaire containing three sections: demographics, the translated YFAS 2.0 questionnaire and the Malay BES inventory. Following completion of the questionnaire, the height and weight of the patients were measured to facilitate the calculation of individual BMI values.

Ethical considerations

Ethical approval to conduct the study was granted by the Medical Research Ethics Committee, Ministry of Health Malaysia (NMRR ID: NMRR-14-1426-22829).

Data and statistical analysis

Data from the study were evaluated using two statistical software packages: IBM SPSS Statistics version 20 and Stata version 15.0, IC Edition 64-bit. The data set was examined to account for missing or invalid values. Subsequently, outliers were removed from the final data set.

The following psychometric properties of the scale were analysed: (i) factor structure; (ii) item statistics; and (iii) internal consistency. The consensus on the adequacy of the sample size required for factor analysis remains mixed[20,21]. In line with pre-existing statistical ratios, a benchmark of 200 participants was considered sufficient as the questionnaire did not involve more than forty items[20,21].

The tetrachoric correlation coefficients of the dichotomous data were reconstituted into a correlation matrix.

Subsequently, this matrix was used in the exploratory factor analysis of the responses obtained from the survey[8,9,22,23]. Inter-item correlation, the Kaiser–Meyer–Olkin statistic (>0.80) and Bartlett's test of sphericity ($P < 0.05$) were used to assess sampling adequacy[20]. The number of factors to be retained was verified by assessing scree plots and eigenvalues[21]. Internal consistency of the Malay YFAS 2.0 was calculated using McDonald's ω and the KR-20 test[24]. The factor structure of the Malay YFAS 2.0 in the diagnostic version of the scale was confirmed by conducting factor analysis on the twelve dichotomous diagnostic criteria. Finally, structural equation modelling was performed to estimate the goodness-of-fit of the Malay version of the YFAS 2.0 as a theoretical model. The model fit was assessed based on path analysis using the Satorra–Bentler scaled χ^2 test for all categorical variables. The following cut-offs were used as indicators of excellent validity and reliability of the psychometric model: KR-20 internal reliability coefficient > 0.7, McDonald's $\omega > 0.9$, comparative fit index > 0.90, Tucker–Lewis index > 0.90 and root-mean-square error of approximation < 0.08[25,26].

Convergent validity was established by determining Pearson's correlation coefficient r between items in the questionnaire. Discriminant analysis was performed using one-way ANOVA to determine the variance between categorical and continuous variables.

Results

Participant characteristics

Out of the 382 invited participants, twenty-four patients were excluded from the final analysis. This step was taken to preserve statistical accuracy by excluding missing values as a consequence of incomplete questionnaires (due to the failure to answer any of the thirty-five items on the Malay YFAS 2.0 questionnaire). Thus, approximately 358 participants were retained in the eventual process of factor analysis.

Analysis of participant characteristics from the pilot study revealed a mean age and mean BMI of 36·67 (SD 26·75) years and 30·54 (SD 2·25) kg/m², respectively. The mean age derived from the final study population (Table 2) was 32·37 (SD 12·76) years. These participants had a mean BMI of 25·77 (SD 6·00) kg/m². The mean for the Malay YFAS 2.0 symptom count was 1·4 (SD 2·3). The prevalence of food addiction within this sample was 5·0 %, with approximately eighteen participants fulfilling the criteria required for the diagnosis. Table 3 summarizes the endorsement rates of the twelve criteria that constitute food addiction symptoms.

Factor structure, internal consistency and model fit

The symptom count component of the translated Malay YFAS 2.0 scale was first evaluated using exploratory factor

Table 2 Characteristics of participants: random sample of patients (*n* 358) from a regional primary-care clinic in the district of Seremban, Malaysia, November 2017–June 2018

Characteristic	Participants with food addiction (*n* 18)		Participants without food addiction (*n* 340)		
	n or Mean	% or SD	*n* or Mean	% or SD	*P* value
Gender					
Male	4	22·2	111	32·7	0·35**
Female	14	77·8	228	67·3	
Age (years), mean and SD	29·78	10·75	32·51	12·86	0·38††
Age category*					
<35 years	14	77·8	237	69·7	0·39‡‡
35–54 years	4	22·2	68	20·0	
55–74 years	0	0·0	30	8·8	
≥75 years	0	0·0	2	0·6	
BMI (kg/m²), mean and SD	29·88	5·90	25·56	4·56	0·004††
BMI category†					
Underweight (<18·5 kg/m²)	0	0·0	24	7·4	0·002‡‡
Normal (18·5–22·9 kg/m²)	1	5·8	101	31·1	
Overweight (23·0–24·9 kg/m²)	2	11·8	45	13·8	
Pre-obese (25·0–29·9 kg/m²)	6	35·3	87	26·8	
Obese (≤30·0 kg/m²)	8	47·1	68	20·9	
Ethnicity‡					
Malay	8	44·4	185	54·7	0·35‡‡
Chinese	2	11·1	42	12·4	
Indian	8	44·4	108	32·0	
Others	0	0·0	3	0·9	
Marital status§					
Unmarried	10	55·6	175	51·8	0·70‡‡
Married	8	44·4	156	46·2	
Divorced	0	0·0	3	0·9	
Widow/widower	0	0·0	4	1·1	
Work status‖					
Not working	7	41·2	141	42·2	0·36‡‡
Working full-time	9	52·9	164	49·1	
Working part-time	1	5·9	7	2·1	
Self-employed	0	0·0	22	6·6	
Level of education¶					
Certificate level	6	37·4	81	25·6	0·41‡‡
Diploma	5	31·3	105	33·1	
Bachelor's degree	5	31·3	114	36·0	
Master's degree	0	0·0	15	4·7	
PhD	0	0·0	2	0·6	
Co-morbidities					
Hypertension	3	50·0	33	45·2	–
Dyslipidaemia	0	0·0	5	6·9	
Diabetes mellitus	3	50·0	23	31·5	
Bronchial asthma	0	0·0	7	9·6	
Rheumatoid arthritis	0	0·0	2	2·7	
Hypothyroidism	0	0·0	2	2·7	
Glaucoma	0	0·0	1	1·4	

Data presented are *n* and % unless indicated otherwise.
*Missing, *n* 3.
†Missing, *n* 15.
‡Missing, *n* 2.
§Missing, *n* 2.
‖Missing, *n* 7.
¶Missing, *n* 25.
**χ^2 test.
††Independent *t* test.
‡‡Mann–Whitney *U* test.

Table 3 Endorsement rates for food addiction symptoms among the participants (*n* 358) from a regional primary-care clinic in the district of Seremban, Malaysia, November 2017–June 2018

Criterion	*n*	%
Substance taken in larger amount and for longer period than intended	62	17·3
Persistent desire or repeated unsuccessful attempts to quit	52	14·5
Much time/activity to obtain, use, recover	29	8·1
Use continues despite knowledge of adverse consequences	33	9·2
Tolerance	27	7·5
Characteristic withdrawal symptoms; substance taken to relieve withdrawal	43	12·0
Craving, or a strong desire or urge to use	39	10·9
Use causes clinically significant impairment or distress	18	5·0
Important social, occupational or recreational activities given up or reduced	33	17·3
Continued use despite social or interpersonal problems	62	17·3
Failure to fulfil major role obligation (e.g. work, school, home)	39	10·9
Use in physically hazardous situations	49	13·7

analysis, followed by structural equation modelling. A two-factor model had acceptable fit indices ($\chi^2_{(281)} = 402\cdot66$, $P < 0\cdot001$; comparative fit index = 0·89, Tucker–Lewis index = 0·88, root-mean-square error of approximation = 0·035) with all factor loadings greater than 0·5 (Table 4). We retained a two-factor solution because the one-factor model did not result in noticeably improved fit (comparative fit index = 0·70, Tucker–Lewis index = 0·66, root-mean-square error of approximation = 0·053). Additionally, a scree plot examination showed an elbow break at the second factor. Hence, the two-factor structure was retained as it fulfilled the criteria of factor selection as described by Cattell[26]. Furthermore, the one-factor solution revealed cumulative variance of only 38·9 %. The cumulative variance increased to 53·9 % when a two-factor solution was chosen. The two extracted factors in the symptom count version gave a McDonald's $\omega > 0\cdot90$ ($\omega_{factor\ 1} = 0\cdot92$ and $\omega_{factor\ 2} = 0\cdot93$) and a KR-20 internal reliability coefficient $\alpha > 0\cdot86$ ($\alpha_{factor\ 1} = 0\cdot86$ and $\alpha_{factor\ 2} = 0\cdot88$).

Exploratory factor analysis of the diagnostic component of the questionnaire was based on the twelve dichotomous diagnostic criteria in DSM-V. Structural equation modelling revealed a two-factor solution with factor loadings of each criterion greater than 0·4 (Table 4)[19]. The alternative one-factor solution revealed a cumulative variance of 38·0 %. However, the cumulative variance increased to 51·4 % when a two-factor solution was chosen. The evaluation of the items within the diagnostic criteria gave a McDonald's $\omega > 0\cdot90$ ($\omega_{factor\ 1} = 0\cdot94$ and $\omega_{factor\ 2} = 0\cdot90$) and KR-20 internal reliability coefficient $\alpha > 0\cdot7$ ($\alpha_{factor\ 1} = 0\cdot82$ and $\alpha_{factor\ 2} = 0\cdot74$). Similarly, confirmatory factor analysis revealed that the two-factor model of the Malay YFAS 2.0 fit the data ($\chi^2_{(54)} = 127\cdot7$, $P < 0\cdot001$, comparative fit index = 0·92,

Table 4 Factor loadings for the multiple factor structure of the Malay Yale Food Addiction Scale (YFAS) 2.0

Criteria and items of the YFAS	One-factor structure	Two-factor structure	
	Factor 1 loading	Factor 1 loading	Factor 2 loading
Criterion A: Tolerance			
Item 24	0·46	0·60	–
Item 26	0·66	0·79	–
Criterion B: Withdrawal			
Item 11	0·71	–	–
Item 12	0·66	0·62	–
Item 13	0·66	0·59	–
Item 14	0·61	0·50	–
Item 15	–	–	–
Criterion C: Substance often taken in larger amounts or over a longer period than was intended			
Item 1	0·40	0·59	–
Item 2	0·40	0·62	–
Item 3	0·68	–	–
Criterion D: Persistent desire or unsuccessful effort to cut down or control substance use			
Item 4	0·56	0·63	–
Item 25	0·60	0·79	–
Item 31	0·54	0·83	–
Item 32	0·68	0·83	–
Criterion E: Spending a great deal of time in activities necessary to obtain the substances, use the substances or recover from its effects			
Item 5	0·58	–	–
Item 6	–	–	–
Item 7	0·30	0·52	–
Criterion F: Giving up social, occupational or recreational activities because of substance use			
Item 8	0·59	–	–
Item 10	0·67	–	0·82
Item 18	0·67	–	–
Item 20	0·43	–	0·76
Criterion G: Continuing substance use despite physical or psychological problem			
Item 22	0·78	–	–
Item 23	0·68	0·59	–
Criterion H: Significant distress			
Item 16	0·55	–	–
Item 17	0·80	0·64	–
Criterion I: Continued consumption despite social or interpersonal problems			
Item 9	0·68	–	0·73
Item 21	0·56	–	0·81
Item 35	0·80	–	0·67
Criterion J: Failure to fulfil major role obligation			
Item 19	0·67	–	0·85
Item 27	0·60	–	0·82
Criterion K: Use in physically hazardous situations			
Item 28	0·61	–	–
Item 33	0·64	–	0·85
Item 34	0·67	–	0·87

Table 4 Continued

Criteria and items of the YFAS	One-factor structure	Two-factor structure	
	Factor 1 loading	Factor 1 loading	Factor 2 loading
Criterion L: Craving			
Item 29	0·74	0·70	–
Item 30	0·54	0·70	–

Tucker–Lewis index = 0·91, root-mean-square error of approximation = 0·046).

Sampling adequacy was evidenced by a Kaiser–Meyer–Olkin value of 0·86 and the Bartlett's test of sphericity of $P < 0.01$. Mean inter-item correlation was 0·48.

Item analysis and omission from scale

Items with the lowest factor loadings also had the lowest item–total correlation (Tables 4 and Tables 5). Therefore, items 6, 15 and 28 were omitted from the scale due to poor factor loading and item–total correlation. The remaining items in the scale had an item–total correlation of more than 0·30. Although questions 3, 8, 11, 14, 15, 18, 22 and 28 had good item–total correlation, these items were omitted from the construct due to cross-loading between the extracted factors (Tables 4 and 5).

Convergent validity

The Malay YFAS 2.0 symptom counts were associated with higher binge eating severity ($r = 0.46$, $P < 0.001$). Similarly, the diagnosis of food addiction was associated with an increase in binge eating severity ($r = 0.25$, $P < 0.001$). Symptom counts and the diagnosis of food addiction had a small positive correlation with higher BMI level ($r = 0.14$, $P < 0.01$ and $r = 0.16$, $P < 0.01$, respectively). Food addiction symptom counts and BES scores were also associated with the diagnosis of type 2 diabetes ($r = 0.15$, $P < 0.01$ and $r = 0.17$, $P < 0.01$, respectively). However, symptom count and food addiction scores were not associated with gender, age, race or education.

Incremental validity

In a simple linear regression, binge eating score was a predictor of BMI ($t = 22.3$, $\beta = 0.18$, $P < 0.001$), accounting for 6·1 % of the variance. Similarly, Malay YFAS 2.0 symptom count score was also a predictor of BMI ($t = 66.7$, $\beta = 0.37$, $P < 0.001$), accounting for 2·0 % of the variance. In hierarchical multiple regression, when binge eating score was entered in the model, Malay YFAS 2.0 symptom count was not a significant predictor ($t = 0.96$, $\beta = 0.15$, $P = 0.34$).

Discriminant validity

There was a statistically significant difference between BES severity and symptom count score ($F_{(2355)} = 60.9$, $P < 0.001$). A Bonferroni post hoc test revealed that

Table 5 Item statistics for the Malay Yale Food Addiction Scale (YFAS) 2.0

Criteria and items of the YFAS	Mean	SD	Item–total correlation
Criterion A: Tolerance			
Item 24	0·03	0·17	0·38
Item 26	0·06	0·23	0·55
Criterion B: Withdrawal			
Item 11	0·05	0·21	0·43
Item 12	0·03	0·18	0·44
Item 13	0·06	0·23	0·51
Item 14	0·06	0·23	0·44
Item 15	0·006	0·07	0·21
Criterion C: Substance often taken in larger amounts or over a longer period than was intended			
Item 1	0·07	0·25	0·36
Item 2	0·08	0·27	0·36
Item 3	0·08	0·27	0·38
Criterion D: Persistent desire or unsuccessful effort to cut down or control substance use			
Item 4	0·05	0·22	0·50
Item 25	0·06	0·24	0·55
Item 31	0·09	0·29	0·64
Item 32	0·10	0·30	0·62
Criterion E: Spending a great deal of time in activities necessary to obtain the substances, use the substances or recover from its effects			
Item 5	0·06	0·24	0·42
Item 6	0·02	0·14	0·14
Item 7	0·02	0·15	0·38
Criterion F: Giving up social, occupational or recreational activities because of substance use			
Item 8	0·09	0·29	0·42
Item 10	0·06	0·24	0·60
Item 18	0·09	0·29	0·50
Item 20	0·03	0·17	0·61
Criterion G: Continuing substance use despite physical or psychological problem			
Item 22	0·04	0·20	0·45
Item 23	0·08	0·26	0·54
Criterion H: Significant distress			
Item 16	0·02	0·17	0·31
Item 17	0·04	0·19	0·60
Criterion I: Continued consumption despite social or interpersonal problems			
Item 9	0·09	0·29	0·58
Item 21	0·04	0·20	0·70
Item 35	0·11	0·32	0·55
Criterion J: Failure to fulfil major role obligation			
Item 19	0·08	0·28	0·72
Item 27	0·08	0·26	0·64
Criterion K: Use in physically hazardous situations			
Item 28	0·10	0·30	0·29
Item 33	0·05	0·22	0·65
Item 34	0·03	0·16	0·66
Criterion L: Craving			
Item 29	0·07	0·26	0·55
Item 30	0·06	0·24	0·43

mean symptom count was statistically significantly higher in participants with severe binge eating symptoms (3·18 (SD 2·98)) compared with participants with moderate (0·73 (SD 1·43)) and no binge eating symptoms (0·36 (SD 0·94)). On the other hand, the diagnosis of food addiction was associated with higher BES score ($r_t = 0.211$, $P < 0.001$). There was a statistically significant difference in mean BES score between participants with (33·2 (SD 7·77)) and without (23·3 (SD 8·14)) the diagnosis of food addiction ($t_{(356)} = -5.01$, $P < 0.001$).

Discussion

Main findings

In this renewed attempt at validating the Malay version of the YFAS 2.0 questionnaire, greater emphasis was placed on inclusivity. This objective was achieved by obtaining undifferentiated participants from a community-based setting. The results from the study indicate that both the symptom count and the diagnostic version of the scale have a two-factor structure solution. Although this factor structure differs from the original study and translated versions of the YFAS, the validity of the model is supported by excellent internal consistency of the scale in its diagnostic and symptom count versions[7–10].

The responses from the participants appear to support the concept of duality in terms of food addiction symptoms. The validity (factor loadings > 0·4) and the reliability ($\alpha > 0.80$) of both versions were excellent. Hence, the two-factor solution for the symptom count and diagnostic version of the questionnaire demonstrates the dichotomous perspective through which the Malaysian populace views the concept of food addiction: a psychological and a social dimension. This discovery allows the creation of exclusive interventions for food addiction symptoms that are inclined towards either the psychological or social perspective.

Interestingly, the removal of items 3 and 18 from the scale was consistent with a previous preliminary analysis of the scale in Malaysia where similar items were dropped from the YFAS 1.0 scale[11]. Items 6 (much time/activity to obtain, use, recover), 8 (important social, occupational or recreational activities given up or reduced), 11, 15 (characteristic withdrawal symptoms; substance taken to relieve withdrawal), 16 (use causes clinically significant impairment or distress), 18, 22 (use continues despite knowledge of adverse consequences) and 28 (use in physically hazardous situations) were uniquely new items that had to be removed from this scale while preserving the overall integrity of the scale.

Comparison with literature

The prevalence of food addiction in the present study was 5 % based on the assessment of a community-based

population. This result was comparable to other studies done involving similar populations. The prevalence rates seen in the French and English versions of YFAS 2.0 were 7·9 and 6·0 %, respectively[15,27]. The Spanish version of the YFAS 2.0 demonstrated lower food addiction rates in a healthy control group (2·9 %)[28]. However, the prevalence of food addiction appears to be higher in participants with morbid obesity (47 %) and eating disorders (73 %)[28,29]. In our study, obese patients (47 %) and participants with severe binge eating disorder (83 %) had greater risk of being diagnosed with food addiction. These findings suggest that participants with obesity and eating disorders are predisposed to food addiction tendencies.

In the present study, the highest endorsement rate of 17·3 % was exhibited in three criteria, namely 'substance taken in larger amount and for longer period than intended', 'important social, occupational or recreational activities given up or reduced' and 'continued use despite social or interpersonal problems'. In a similar study done in Germany, the criterion 'substance taken in large amount and for a longer period of than intended' exhibited the highest endorsement rate of 24·0 % in a normal population followed by 'persistent desire or repeated unsuccessful attempts to quit' (16·7 %)[29]. A sub-study within the same study involving obese patients demonstrated that the 'persistent desire or repeated unsuccessful attempts to quit' criterion was the single most important factor contributing to food addiction (48·1 %)[29].

Strengths and limitations

There were several limitations of the present study. First, the temporal stability of the translated questionnaire was not assessed. However, this shortfall in the study was addressed by undertaking two phases of rigorous pilot testing along with the integration of information derived from participant feedback. Second, we were not able to assess psychological elements related to food intake in the absence of a validated Emotional Overeating Questionnaire (EOQ) in the Malay language. Further refinements can be made to the Malay YFAS 2.0 by controlling potential mediators (e.g. smoking status or alcohol consumption) that might influence eating patterns in participants.

Conclusions

Data on food addiction in a South-East Asian society are scarce. Our study has validated the YFAS 2.0 inventory in a Malay-speaking population and its utility extends to countries such as Malaysia, Indonesia and Singapore. Furthermore, interventions can be designed to address both psychological and social aspects of a susceptible individual.

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