

# Psychometric Properties of the Malay Version of the Dutch Eating Behaviour Questionnaire (DEBQ) in a Sample of Malaysian Adults Attending a Health Care Facility

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Submitted: 10 Oct 2016

Accepted: 6 Jul 2017

Online: 18 Aug 2017

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To cite this article: Subramaniam K, Low WY, Chinna K, Chin KF, Krishnaswamy S. Psychometric properties of the Malay version of the Dutch Eating Behaviour Questionnaire (DEBQ) in a sample of Malaysian adults attending a health care facility. *Malays J Med Sci.* 2017;**24**(4):64–73. <https://doi.org/10.21315/mjms2017.24.4.8>

To link to this article: <https://doi.org/10.21315/mjms2017.24.4.8>

## Abstract

**Objective:** This study aims to investigate the psychometric properties of the Malay version of the Dutch Eating Behaviour Questionnaire (DEBQ) among Malaysian adults.

**Method:** The Malay version of the DEBQ instrument was administered to 398 outpatients (269 women and 129 men) at the University of Malaya Medical Centre (UMMC). Confirmatory Factor Analysis (CFA) was conducted to study the construct validity of the instrument. Composite reliability coefficient, Raykov's rho, was used to determine the internal consistency.

**Results:** The proposed three-factor structure for the DEBQ instrument was appropriate, although three items (Items 21, 14 and 27) showed problematic loadings with inappropriate model fit and were removed. The modified version had an appropriate model fit  $\chi^2/df = 2.129$ , TLI = 0.908, CFI = 0.918, RMSEA = 0.053 (90%CI = 0.048–0.058), close-fit *P*-value = 0.136 and satisfactory internal consistency of 0.914 for emotional eating scale, 0.819 for external eating scale and 0.856 for restrained eating scale.

**Discussion:** The Malay version of the DEBQ is a valid instrument to study eating behaviour traits among Malaysian adults. Further research is warranted to determine if Items 14 and 27 are appropriate for the Malaysian population.

**Keywords:** eating behaviour, eating disorder, validity and reliability, obesity

## Introduction

Eating behaviours often are ingrained patterns that affect choice of food and desire to eat. Some of the eating behaviours that have been described include emotional eating, which is eating in response to emotional arousal (1); external eating, which is eating in response

to food-related external cues such as sight and palatability of food (2); dietary restraint, which is dietary control via cognitive cues to influence body weight (3), and disinhibition which is overeating in response to external stimuli, including negative emotion, stress, and palatability of food (4).

Such eating behaviour traits are significantly associated with adiposity (5–7) and outcomes of treatment for obesity (4, 8, 9). Cross-sectional studies have shown that body mass index (BMI) or obesity is positively associated with disinhibition (4) and emotional eating (7). Emotional eating was found to be associated with weight gain over time (6, 11). Reduction in disinhibition (4) and emotional eating was associated with the success of weight loss treatment programmes (12). Dietary restraint was found to be associated negatively with weight (5), and high restraint was beneficial for weight loss and its maintenance (8, 9).

Malaysia has witnessed an increasing trend in obesity within the past decade (13). The National Health and Morbidity Survey (NHMS) conducted in 2011 and subsequently in 2015, reported that 27.2% (14) and 30.6% (15) of Malaysian adults had a BMI of 27.5 and above, which is within the BMI range for obesity in the Asian populations (16). A marked increase in the rate of obesity was noted within a short 4-year interval. A recent review showed that Malaysia has the highest rate of male obesity in South East Asia, with a prevalence rate of 11.4%, with the Maldives coming next with a prevalence rate of 8.1%. The rate of female obesity in Malaysia (16.7%) fell closely behind that of the Maldives (17%), and is the highest in South East Asia (17).

Currently, there are not many validated instruments to study the eating behaviour of adults in Malaysia. Some instruments used internationally are as follows: the Dutch Eating Behaviour Questionnaire (DEBQ), which assesses emotional, external, and restrained eating (18); Three-Factor Eating Questionnaire (TFEQ), which assesses dietary restraint, disinhibition, and emotional eating (19); Emotional Eating Scale, which assesses emotional eating (20); and the Revised Restraint Scale (21) for restraint. The DEBQ is deemed suitable for the Malaysian population because of a few reasons: it measures three eating behaviour patterns that have been explained based on psychological theories (18). It has been translated and validated in Italian (22), French (23), Turkish (24), and Spanish (25) populations, and the instrument had good psychometric property, construct validity, and reliability across different cultures (22–26). The three-factor structure of the DEBQ instrument has been replicated across cultures. Problematic loading was reported for only three of the total 33 items, namely Item 3 'Do you have the desire

to eat when you have nothing to do?' (25, 27); Item 28 'Do you have the desire to eat when you are bored or restless?' (25); and Item 21 'Can you resist eating delicious food?' (27). The purpose of this study is to investigate the construct validity and reliability of the Malay version of the DEBQ among Malaysian adults.

## Materials and Methods

### *Sampling and Selection*

The participants of the study were conveniently selected from the University of Malaya Medical Centre (UMMC; Kuala Lumpur Malaysia). The UMMC is a government-funded medical institution that serves as the teaching hospital for the University of Malaya and is a tertiary referral centre for Malaysia with a total of 895 hospital beds. All individuals who were waiting in the pharmacy area to collect medicine during the data collection period were approached, briefed about the study, and recruited with implied consent. Upon recruitment, participants filled up the questionnaire. Researchers were present to clear any ambiguity that arose while answering.

The inclusion criteria for the study were as follows: Malaysian adults aged 18 years and above who could read and write in the Malay language. Exclusion criteria included having been advised by health care professionals to practise dietary control because of their health condition; current participation in weight loss programmes necessitating changes in dietary habits; and inability to read and write in the Malay language. We targeted to recruit a minimum of 330 participants in order to have a ratio of 1:10 responses per item in the instrument (28). In total, 408 responses were obtained. Ten responses were excluded due to incompleteness, leaving 398 responses for analysis, which was equivalent to 97.5% of the total responses obtained.

### *Ethics Approval*

Ethics approval for the study was obtained from the University of Malaya Research Ethics Committee (MEC Ref. No. 732.19).

### *Instrument*

The original version of the DEBQ contains 33 items developed to measure emotional, external, and restrained eating behaviours. Emotional eating was assessed by 13 items,

whereas external and restrained eating behaviours were assessed by 10 items each; the questions that assess the three different behaviours appear in random order in the questionnaire and are answered according to the Likert scale with a scoring system identified as follows: 1 = never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = very often, with the exception being Item 21 'Do you find it hard to resist eating delicious food?', which requires reverse scoring (18).

The English version of the instrument had two modifications. First, the answer option 'seldom' was renamed 'rarely,' and second, Item 21 was rephrased 'Can you resist eating delicious food?' to avoid reverse scoring. The modified English version of the DEBQ (29) was used for the validation exercise. Forward-translation and back-translation methods were used to translate the instrument into the Malay language (30); the English version was translated into Malay and the Malay version was back translated into English by experienced translators. The contents of the back-translated and original version were compared by experts and necessary modifications were suggested to the translation. Translations were back translated again and compared. This process was repeated until the back-translated version and original version were similar. The final translation was again reviewed by content experts to ensure that the items in the original and translated versions were similar in the context being studied.

Socio-demographic correlates (age, gender and ethnicity) and anthropometric information, including self-reported measure of height (in centimetres) and weight (in kilograms) were collected. Self-reported height and weight were used to estimate the BMI in kilograms per metre squared. The BMI was categorised using Asian cut-off values in which BMI values between 18.5 and 22.9 indicate a normal weight, values between 23 and 27.4 indicate overweight, and a BMI of 27.5 and above indicates obesity (16).

### Statistical Analysis

SPSS statistical programme, version 20 (IBM, Armonk, NY, USA) and AMOS graphics were used to conduct the statistical analyses. Descriptive statistical analysis was used to describe the data. Confirmatory Factor Analysis (CFA) was conducted to test the fit of the three-structure model proposed for the DEBQ instrument. Fit Indices used included  $\chi^2/df$  ratio < 3, Comparative Fit Index (CFI) > 0.95,

Tucker Lewis Index (TLI) > 0.95, and Root Mean Square Error (RMSEA) < 0.06 (31, 32). Adaptations were made to the model based on the item loading values, large Modification Indices (MI) values (> 10) (33) and large standardised residual correlation values. Internal consistencies of items from three components of the DEBQ were evaluated using composite-reliability coefficient, Raykov's rho (34, 35). Composite reliability was reported instead of the usual Chronbach's  $\alpha$  as it enables estimation without necessitating the essentially tau-equivalent model assumption (35). The 90% bootstrap confidence limit of the coefficient was used to assess stability of the coefficient (36).

## Results

### Demographic and Anthropometric Characteristics

A total of 398 responses were included for the final analysis. The majority of the participants were women and from the Malay ethnic group. The average age of the participants was 32.6 (SD = 9.92) years. The average BMI was 24.96 kg/m<sup>2</sup> (SD = 10.57). Highest frequency of the BMI category was observed for the normal weight (38%) (Table 1).

### Confirmatory Factor Analysis, CFA

The full model, with 33 items of the DEBQ instruments in three factors, was tested. All items were found to be significant to the model. Item 21 had very low loading (-0.41) value and regression weight as compared to other variables. Items 21 and 27 had high standardised residual covariance values with 9 and 10 items each. Model fit indices did not show a satisfactory fit (Table 2). The model was improved by allowing the uniqueness of several items to be correlated (Table 3) and by removal of Item 21. The fit indices for the new model improved, but were not satisfactory. Item 27 was next removed after which the fit indices improved.

Items 14 and 17 had low loading values of 0.53 and 0.59. Item 14 had a large standardised residual covariance value with 8 items, ranging from -4.37 to -2.07 and was thus removed from the model. The uniqueness of items 3 and 8 was allowed to correlate. The final model, which contained 30 items had acceptable fit indices  $\chi^2/df$  < 3 and RMSEA < 0.06 (Table 2). The standardised regression weight for each item is shown in Table 4. A moderate correlation

**Table 1.** Demographic Characteristic of the participants ( $n = 398$ )

Factor	Frequency ( $n$ )	Percentage (%)
Gender		
Women	269	67.6
Men	129	32.4
Ethnicity		
Malay	213	53.5
Chinese	89	22.4
Indian	91	22.9
Others	5	1.2
Body Mass Index (BMI) Category		
Underweight	38	9.5
Normal weight	151	37.9
Overweight	115	28.9
Obese	87	21.9
Did not know weight/height	7	1.80

**Table 2.** Fit indices for the Dutch Eating Behaviour Questionnaire (DEBQ) three factor measurement models

Model	$\chi^2$	$\chi^2/df$	TLI	CFI	RMSEA (95% CI of RMSEA)	CI Fit $P$ -value
Full model	1175.76	2.44	0.88	0.87	0.060 (0.056-0.065)	0.000
Item 21 removed	1053.24	2.34	0.88	0.89	0.054 (0.058-0.063)	0.002
Item 21 and 27 removed	917.94	2.18	0.90	0.91	0.055 (0.050-0.059)	0.060
Item 21, 27 and 14 removed	823.85	2.13	0.91	0.92	0.053 (0.048-0.058)	0.136

was observed between emotional and external constructs whereas other constructs were weakly correlated (Table 3).

### Reliability Analysis

The composite reliability coefficient values obtained for the three subscales in the final model and the respective bootstrap confidence limits were 0.91 (90% CL: 0.90–0.93) for emotional eating scale, 0.82 (90% CL: 0.79–0.85) for external eating and 0.86 (90% CL: 0.84–0.87) for restrained eating. The reliability coefficient values for all the tested models are shown in Table 5. The value reported in the final model for external eating was not the highest, but improved from that obtained when all the variables were included. The reliability score for restrained eating was stable for both tested models.

**Table 3.** Correlation between uniqueness and constructs in the final Dutch Eating Behaviour Questionnaire (DEBQ)

Items / Factors Correlated	Correlation ( $r$ )
Emotional Eating	
Item 1 and Item 5	0.31
Item 1 and Item 16	-0.21
Item 3 and Item 8	0.21
Item 3 and Item 28	0.26
Item 5 and Item 16	-0.30
Item 8 and Item 10	0.20
Item 16 and Item 30	0.24
Item 20 and Item 25	0.21
External Eating	
Item 15 and Item 24	0.24
Item 18 and Item 24	0.24
Restrained Eating	
Item 26 and Item 29	0.21
Factor	0.39
Emotional and External	0.13
Emotional and Restrained	-0.18
External and Restrained	

**Table 4.** Descriptive statistics and standardised regression weights from CFA for the Dutch Eating Behaviour Questionnaire

Item	Description	Mean (SD)	Standardised Regression Coefficient $\lambda$
<b>Emotional Eating</b>			
Item 1	Do you have the desire to eat when you are irritated?	2.63 (1.12)	0.645
Item 3	Do you have a desire to eat when you have nothing to do?	2.77 (1.09)	0.469
Item 5	Do you have a desire to eat when you are depressed or discouraged?	2.43 (1.09)	0.743
Item 8	Do you have a desire to eat when you are feeling lonely?	2.27 (1.05)	0.714
Item 10	Do you have a desire to eat when somebody lets you down?	2.12 (1.13)	0.805
Item 13	Do you have a desire to eat when you are cross?	2.04 (1.06)	0.731
Item 16	Do you have a desire to eat when you are approaching something unpleasant to happen?	1.84 (0.99)	0.708
Item 20	Do you get the desire to eat when you are anxious, worried or tense?	2.09 (1.05)	0.739
Item 23	Do you have a desire to eat when things are going against you or when things have gone wrong?	2.13 (1.00)	0.668
Item 25	Do you have the desire to eat when you are emotionally upset?	2.19 (1.06)	0.825
Item 28	Do you have a desire to eat when you are bored or restless?	2.35 (1.08)	0.582
Item 30	Do you have a desire to eat when you are frightened?	1.68 (0.87)	0.620
Item 32	Do you have a desire to eat when you are disappointed?	2.00 (1.03)	0.824
<b>External Eating</b>			
Item 2	If food tastes good to you, do you eat more than usual?	3.61 (0.910)	0.659
Item 6	If food smells and looks good, do you eat more than usual?	3.25 (1.03)	0.744
Item 9	If you see or smell something delicious, do you have a desire to eat it?	3.39 (1.02)	0.733
Item 12	If you have something delicious to eat, do you eat it straight away?	3.27 (1.00)	0.706
Item 15	If you walk past the baker do you have the desire to buy something delicious?	2.99 (1.03)	0.345
Item 18	If you see others eating, do you also have the desire to eat?	2.67 (0.99)	0.546
Item 24	If you walk past a snack bar or a café, do you have the desire to buy something delicious?	2.82 (1.04)	0.469
Item 33	When you are preparing a meal are you inclined to eat?	2.80 (1.08)	0.539
<b>Restrained Eating</b>			
Item 4	If you have put on weight, do you eat less than you usually do?	3.29 (1.17)	0.683
Item 7	How often do you refuse food or drink offered because you are concerned about your weight?	2.61 (1.06)	0.682
Item 11	Do you try to eat less at mealtimes than you would like to eat?	3.00 (1.04)	0.572
Item 17	Do you deliberately eat foods that are slimming?	2.23 (1.08)	0.444
Item 19	When you have eaten too much, do you eat less than usual the following days?	3.02 (1.14)	0.682
Item 22	Do you deliberately eat less in order not to become heavier?	2.90 (1.19)	0.750
Item 26	How often do you try not to eat between meals because you are watching your weight?	2.76 (1.19)	0.665
Item 29	How often in the evening do you try not to eat because you are watching your weight?	2.50 (1.14)	0.638
Item 31	Do you take into account your weight with what you eat?	2.70 (1.23)	0.609

**Table 5.** Composite Reliability coefficient (Raykov's rho ) for the Emotional, External and Restraint Scales of the Dutch Eating Behaviour Questionnaire

Scale	Items in the Scale	Composite Reliability (90% Confidence Level)
Emotional	All Items	0.914 (0.903–0.925)
External	All Items	0.786 (0.755–0.815)
	All Except Item 21	0.826 (0.799–0.850)
	All Except Item 27	0.774 (0.790–0.805)
	All Except Item 21 and 27	0.819 (0.790–0.845)
Restraint	All Items	0.856 (0.835–0.872)
	All Except Item 14	0.856 (0.835–0.874)

## Discussion

The aim of the study was to examine the psychometric properties (construct validity and internal consistency) of the Malay version of the DEBQ instrument. The three-factor construct of the DEBQ instrument was appropriate for the Malaysian population with modifications, i.e. removal of three items: Item 21 'Can you resist eating delicious food?'; Item 27 'Do you eat more than usual when you see others eat?'; and Item 14 'Do you watch exactly what you eat?', from the final model.

Several fit indices were used to evaluate the goodness of fit of the model. For the final model,  $\chi^2/df$  value lower than 3 (37) and a RMSEA value lower than 0.06 (32) indicated a good fit. The CFI and TLI indices did not reach the 0.95 cut-off proposed by Hu and Bentler in 1999 (32). However, the indices were above 0.90, the cutoff that was accepted before Hu and Bentler proposed more stringent criteria (38). In later years, it was warranted that the application of the stringent criteria should be applied with caution (39) and this again led to a query as to whether the appropriate cut-off for fit indices should be 0.90 or 0.95 (38). It is thus suggested that one should not be overly critical about the cut-off values and instead evaluate if the proposed model is logical and theoretically sound (37). As psychometric properties of the DEBQ have been well established (18), the model proposed in this study is deemed suitable.

The reliability co-efficient values for emotional (22–25) and external eating scales (23, 25) were comparable to those reported in previous studies whereas the value obtained for the restraint scale was lower. However, it was within the acceptable range, 0.8 and above (38). Thus, the Malay version of the DEBQ has good internal consistency.

Item 21 (Can you resist eating delicious food?) had low loading value and high residual covariance value with multiple items and was thus removed. The particular item was found to be problematic in the original Dutch version too, in which it was reverse scored (27), but not in the edited English version which does not involve reverse scoring (25). The problematic loading of the item in this study is unexpected as the English version was translated into the Malay language. Modification indices showed that correlating the error term of Item 21 to the restraint scale would result in a huge reduction in  $\chi^2$  values (42.449). This could indicate correlation between the unexplained variation in the item and the restraint scale, or in simpler terms, the item could have been perceived as a restraint question by the respondents. This is attributable to role of language, where the term "resist eating" in the Malay language gives respondents the idea of restraining rather than not succumbing to external stimuli. The item should be reworded to give an impression of not responding to the external cue, the delicious food.

Items 27 and 14 were removed due to the large amount of residual covariance and relatively low loading. This is unexpected, as the items have not been reported to be problematic in any other studies. In our opinion, this could be linked to the characteristics of the respondents studied. It is of note that 51% of the participants in the study were overweight or obese. This represents the combined prevalence rate of overweight and obesity, reported in National Health and Morbidity Surveys, 2006 44.5% (40) and 2015, 48.3% (15). The obese individuals have been reported to exhibit enhanced food related attentional bias as compared to their lean counterparts, regardless of being hungry or satiated (41). However the attentional bias was not found to be correlated with caloric intake

in the overweight and obese group (42). The correlation between attentional bias and actual caloric intake was only noted in the normal weight external eaters (42). This could explain the finding obtained in the current study where the sensitivity to the sight of others eating, a socio-normative cue which results in desire to eat among the external eaters, was captured via the appropriate loading of Item 18 'If you see others eating, do you also have the desire to eat?' Item 27, which was on consuming in response to the cue, did not show a clear trend possibly due to differential response by the normal weight and overweight or obese respondents. Overweight and obese adults have been noted to under-report energy intake in previous epidemiological studies (43, 44). Thus, lack of motivation to provided honest answers on increased consumption or eating little in public to avoid being labelled as lacking control in eating could also have led to the failure of item 27 to load appropriately.

The problematic loading of item 14 shows that watching exactly what is eaten is not a notable restraint characteristic among the respondents. The study was conducted in an urban setting, recruiting mainly people living around the capital of the country. Urban Malaysians have been reported to consume higher calories, higher fat (30% calories from fat) (45) and show a higher preference for processed and fast food (46) as compared to the rural population. Lack of time to prepare meals and the availability of a variety of calorie-rich food choices at affordable prices are contributors to unhealthy food choices by the city dwellers. This life-style could have made them less particular on what exactly is consumed. With the country having reached the highest rate of obesity in South East Asia (17) it is not surprising if Malaysians generally—not just the urban population—lack in awareness on healthy eating.

A point worth considering is that the Italian version of the DEBQ was shown to be stable across gender, BMI and age groups using multigroup CFA (22). A sample of Dutch population used to validate the Dutch version had an almost similar rate of overweight and obese participants as in the current study but did not show problematic loading patterns for items 14 and 27 (27). Thus the current findings could be due to the socio-economical and environmental differences that exist between

the populations. Further research with a mix of Urban and Rural populations and larger sample sizes to enable multi-group comparisons across BMI categories and urban and rural settings is warranted before a decision to remove the two items is made.

There are some limitations in our study. The selection of participants was not made using random sampling techniques in the general population. Respondents were recruited in a hospital setting. The UMMC is a tertiary referral centre for the country and therefore the patient population is expected to consist of people from Kuala Lumpur, the surrounding area as well as a handful from other states. This information was not recorded and thus the portion of participants from different places is unknown. We did not compare the instruments with other instruments that had been used in Malaysia, such as the Eating Disorder Test-26 (47) and thus no criterion-related validity has been established. The current study is the first to evaluate the performance of the DEBQ instrument on Malaysian adults. The demographic characteristic of the recruited sample, specifically ethnicity, does not resemble the general Malaysian population exactly; there was a higher proportion of Indian respondents in the sample compared to the general Malaysian population. An advantage of this is that all the major ethnic groups have been adequately represented and thus the findings could be used to conclude that the instrument is generally suitable for the Malaysian population. Future studies involving community dwelling respondents from urban and rural settings should be conducted to solve the issues regarding the problematic loading of items 14 and 27.

## Conclusion

Our findings show that the three-factor structure identified elsewhere for the DEBQ instrument is reproducible for the Malaysian sample. Three items had problematic loading and one of them (Item 21) has been identified to be problematic in other studies. The instrument had good construct validity and reliability and, therefore, is suitable to be used to identify the eating behaviour traits of Malaysian adults. Further research with a different sample is needed to determine if two other items with inappropriate loading should be removed.

## Acknowledgements

The authors thank the University of Malaya for funding this study via the Postgraduate Research Fund (Grant no: PV122-2012A). They also thank University of Malaya Medical Centre for all the support.

## Conflict of Interest

None

## Authors' Contributions

Conception and design: KS, LWY, KC, CKF, SK  
 Analysis and interpretation of the data: KS, KC  
 Drafting of the article: KS  
 Critical revision of the article for important intellectual content: LWY, CKF, SK  
 Final approval of the article: LWY, KC, CKF, SK  
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