Psychometric analysis of an eating behaviour questionnaire for an overweight and obese Chinese population in Singapore

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ABSTRACT

Objectives: Previous studies reveal that the Three-Factor Eating Questionnaire (TFEQ), which assesses eating behaviour, performs differently across population groups and cultures. We aimed to identify the factor structure that is most appropriate to capture eating behaviour in an overweight and obese Chinese population in Singapore.
Methods: TFEQ-51 was administered to 444 Chinese subjects pooled from four separate studies and scored according to various alternative versions of the TFEQ. Confirmatory factor analyses and goodness of fit indices were used to determine the most appropriate factor structure. Known-group validity analyses were conducted.
Results: Niemeier's Disinhibition Factors and the TFEQ-R18 factor structures were found to be the most applicable in our population based on goodness of fit indices, with a x^2/df ratio of <3, RMSEA of ≤0.6 and a CFI value of >0.9 for both. Only two of three factors (Emotional Eating and Uncontrolled Eating) of the TFEQ-R18 showed good internal consistency, while none of Niemeier's Disinhibition Factors showed good internal consistency. Known-group validity showed that Emotional Eating and Internal Disinhibition were significantly associated with higher BMI.
Conclusion: We found that the TFEQ-R18 factor structure is the most appropriate and practical for use in measuring eating behaviour in an overweight and obese Chinese population in Singapore.

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1. Introduction

The growing prevalence of obesity is a worldwide phenomenon (Ogden, Yanovski, Carroll, & Flegal, 2007; Wang & Lobstein, 2006). The implications are considerable as obesity is a known risk factor for a number of metabolic health complications including cardiovascular disease, diabetes and stroke (Kulie et al., 2011; Poirier et al.,

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2006; Suk et al., 2003). Caloric-dense foods and sedentary lifestyles are recognised key contributors to weight gain, but there is growing evidence to suggest that behavioural factors such as eating behaviours can lead to obesity (Bryant, King, & Blundell, 2008; Provencher, Drapeau, Tremblay, Despres, & Lemieux, 2003). Early eating behaviour theories such as the restraint theory (Herman & Mack, 1975), the externality theory (Schachter & Gross, 1968) and psychosomatic theory of eating (Kaplan & Kaplan, 1957) provided the basis for the development of weight-related eating behaviour questionnaires such as the 51 item Three-Factor Eating Questionnaire (TFEQ). The TFEQ-51 was first developed as an empirical approach to distinguish eating behaviours between people of normal weight and overweight or obese (Stunkard & Messick, 1985). The TFEQ-51 broadly characterises eating behaviour into three factors, namely Dietary Restraint, Disinhibition and Hunger. The TFEQ has been widely used in the evaluation of eating behaviours associated with weight loss and maintenance, genetic predisposition to obesity and effects of bariatric surgery (Kalarchian, Wilson, Brolin, & Bradley, 1999; Keranen et al., 2009; Neale, Mazzeo, & Bulik, 2003).

However, studies evaluating the psychometric properties of the TFEQ-51 revealed that the TFEQ-51 is not consistently applicable across different populations, with some studies able to replicate the original factor structure (Bond, McDowell, & Wilkinson, 2001; Chearskul, Pummoung, Vongsaiyat, Janyachailert, & Phattharayuttawat, 2010) while others not (Hyland, Irvine, Thacker, Dann, & Dennis, 1989; Karlsson, Persson, Sjostrom, & Sullivan, 2000). Consequently, alternative versions of the TFEQ-51 emerged. Hyland et al. found that several items from the TFEQ Disinhibition and Hunger factors were correlated and could be reclassified into two separate factors, namely Emotional Eating and Food Interest (Hyland et al., 1989). This reclassification was due to the population studied that included young and only normal weight individuals. Karlsson et al. found that the TFEQ-51 was of unsatisfactory validity in a Swedish population of 4377 individuals with obesity and created a revised structure, the TFEQ-R18. The TFEQ-R18 consists of three factors: Cognitive Restraint, Uncontrolled Eating and Emotional Eating (Karlsson et al., 2000). Niemeier et al. studied 286 overweight Americans and found that subdividing the Disinhibition scale into two subscales, Internal Disinhibition and External Disinhibition, would better predict long-term weight loss outcomes (Niemeier, Phelan, Fava, & Wing, 2007). A validation study performed by Bond et al. in 553 undergraduate females found that most items of the TFEQ-51 loaded into their specific factors. However, the authors suggested further categorising the three factors into several subcategories, so as to distinguish constructs relevant to both clinical and non-clinical populations (Bond et al., 2001).

It has been suggested that characteristics such as gender, age and country of origin should be taken into account when using the TFEQ-51 to analyse eating behaviours (Aurelie et al., 2012). To our knowledge, Chearskul S et al. have reported good reliability and validity of Thai-translated TFEQ among Thai populations, but there are no other studies that have validated the TFEQ-51 or its alternative version in the Asian population (Chearskul et al., 2010).

With the alarming rise in obesity rates in Asia in general, including Singapore, and a number of weight loss interventions being initiated locally, there is an urgent need for a valid and practical questionnaire to evaluate eating behaviour in Asian populations. Additionally, the higher risk of health complications for the same BMI in our ethnic Chinese population compared to as a Caucasian population ("Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies," 2004; Deurenberg-Yap et al., 2001) underscore the importance of understanding drivers for successful weight loss in this population. The study aims to identify an appropriate eating behaviour questionnaire for overweight and obese Chinese living in Singapore, by evaluating the construct validity, internal consistency and known-group validity of the TFEQ-51 and its alternative versions.

2. Methods

2.1. Subjects

We collated data from four ongoing weight-related research studies conducted in the National University Hospital, Singapore. Two of these studies aimed to determine the effects of weight loss on several health parameters, one examined the effects of overfeeding on insulin sensitivity and the final one was a survey conducted among members of the public.

In the weight loss and overfeeding studies, male subjects with BMI ≥ 23 kg/m^2 were recruited to complete the English version of the TFEQ-51 prior to study intervention. Those with chronic illnesses such as hypertension, diabetes mellitus, epilepsy or ischemic heart disease were excluded. For the survey, members of the public entering the National University Hospital, Singapore were approached at staggered timings via convenience sampling. All subjects were screened for history of psychological or eating disorders, special dietary restrictions and had their anthropometric measurements measured with a weighing scale and stadiometer. Only those who met the inclusion criteria and had BMI ≥ 23 kg/m^2 were recruited. For all studies, the TFEQ-51 was self-administered by all subjects. Ethics approval was obtained from the National Healthcare Group Domain Specific Review Board (Singapore) prior to conduct of all studies, and written informed consent (verbal consent for the members of public survey) was obtained from all subjects.

2.2. Data analyses

The TFEQ-51 from each subject was initially scored using the scoring system by Stunkard and Messick. Each question was scored either 0 or 1. Scores were subsequently recalculated according to factor structure and criteria of other alternative versions of the TFEQ including Hyland's TFEQ, Niemeier's Disinhibition Factors, TFEQ-R18 by Karlsson et al. and Bond's revised TFEQ. For example, to score according to TFEQ-R18 (Karlsson et al., 2000), Cognitive Restraint score was calculated from 6 questions of the TFEQ-51 (Qn 6, 28, 33, 43, 46, 50), Uncontrolled Eating from 9 questions (Qn 1, 15, 19, 22, 24, 26, 34, 39, 49) and Emotional Eating from 3 questions (Qn 9, 20, 27). These 18 questions correspond to the items found by Karlsson et al., to have an appropriate fit in their population. Further details on scoring can be found in the Supplementary Materials.

2.3. Statistics

Confirmatory factor analyses were conducted on the scores derived from TFEQ-51 and its alternative versions to identify the version of the TFEQ that best fits our study population. Goodness of fit indices were used to determine the most applicable factor structure. The indices used were the Root Mean Square Error of Approximation (RMSEA), Confirmatory Fit Index (CFI), Tucker–Lewis Index (TLI), Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). The criteria for good fit for the chi-square and degrees of freedom ratio (x^2/df) is a value of less than 3. As for RMSEA, a value of 0.06 or less is used for good fit while the value for CFI and TLI is 0.9 or higher (Hu & Bentler, 1999). For AIC and BIC, a lower number in the model indicates a better fit.