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Application and validation of the weight efficacy lifestyle (WEL) questionnaire among type 2 diabetes mellitus patients in Malaysia

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ABSTRACT

Introduction: Self-efficacy for eating predicts successful weight loss and maintenance in Type 2 Diabetes Mellitus (T2DM) individuals. The Weight Efficacy Lifestyle (WEL) questionnaire determines self-efficacy for controlling eating. This study aims to validate the Malay-translated version of the WEL questionnaire and to establish the cut-off scores to define the level of eating self-efficacy in Malaysian T2DM individuals. **Methods:** A total of 334 T2DM individuals, aged 55.0±9.0 years, were recruited from a primary healthcare clinic based on sampling ratio. Medical records were reviewed for eligibility. Inclusion criteria included BMI ≥23kg/m^2, and no severe diabetes complications. The WEL questionnaire assessed eating resistance during negative emotions, food availability, social pressure, physical discomfort and positive activities, and was back translated into Malay language. Self-efficacy was rated on a 0-9 scale with higher WEL scores indicating greater self-efficacy to resist eating. Factor analysis established the factor structure of the WEL questionnaire. Inter-item and item-total correlations determined construct validity while internal consistency described the reliability of the structure. **Results:** A two-factor structure accounting for 49% of variance was obtained, and it had adequate reliability, as indicated by Cronbach's α of 0.893 and 0.781 respectively. Item-total correlations of r>0.700, p<0.01 and inter-item correlations of r<0.500, p<0.01 demonstrated construct validity. Cut-off scores of ≥44 and ≥32, respectively for factor one and two defined high eating self-efficacies in T2DM individuals. **Conclusion:** The Malay-translated version of the WEL questionnaire appears to be a valid and reliable tool to assess self-efficacy for controlling eating behaviour in Malaysian T2DM population.

Keywords: Diabetes, eating self-efficacy, Malay, reliability, validity

INTRODUCTION

The World Health Organization (WHO) reported that the prevalence of Type 2 Diabetes Mellitus (T2DM) and impaired glucose tolerance are rising at an alarming rate in South East Asia (WHO, 2011). The recent National Health and

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Morbidity Survey (NHMS) in Malaysia reported the prevalence of T2DM has increased to 17.5% as compared to 11.6% in 2006 and this is in tandem with the rise in obesity (NHMS, 2015). The National Diabetes Registry 2009-2012, showed 83.4% of Malaysian T2DM individuals were obese (Feisul & Azmi, 2013) and abdominal obesity was prevalent in 75% of the individuals (Zaki *et al.*, 2010).

It is well established that successful weight loss measures are through lifestyle changes such as diet and exercise (Chee *et al.,* 2017; Carels *et al.*, 2005). However, self-efficacy skills can influence an individual's motivation and capability to sustain the healthy lifestyle behavioural changes (Batsis *et al.*, 2009; Ames *et al.*, 2015). The concept of self-efficacy is central to Bandura's social cognitive theory which contends that behaviour is strongly stimulated by self-influence (Bandura, 1977). Self-efficacy relates to the ability of performing a certain task to attain certain goals even in difficult situations (Bandura, 1982). Several studies showed that higher baseline eating self-efficacy predicts greater weight loss during intervention and maintenance (Clark *et al.*, 1996; Martin, Dutton & Brantley, 2004; Bas & Donmez, 2009). This in turn led to higher diabetes treatment satisfaction and better glycaemic control (Chih *et al.*, 2010; Al-Khawaldeh, Al-Hassan & Froelicher, 2012).

One frequently used tool to measure eating self-efficacy is the Weight Efficacy Lifestyle (WEL) questionnaire developed by Clark and colleagues (Clark *et al.*, 1991). The questionnaire has been shown to be easy to use and a valid and reliable measure of eating self-efficacy (Ames *et al.*, 2015; Dutton *et al.*, 2004). The original factor analysis of the WEL indicated eating self-efficacy was best characterised by five situational factors which includes negative emotions, availability, social pressure, physical discomfort, and positive activities (Clark *et al.*, 1991). Thus far, the WEL validation studies reported internal consistency of Cronbach's α 0.700-0.900 in Caucasian population (Clark *et al.*, 1991) and African-American population (Dutton *et al.*, 2004). Recently, the short version of WEL questionnaire (WEL-SF) was developed (Ames *et al.*, 2012), and it has also demonstrated adequate internal consistency with Cronbach's α of 0.920 (Ames *et al.*, 2015). The WEL questionnaire has also been validated in a Norwegian population (Flolo *et al.*, 2014)

In Malaysia, the WEL questionnaire was used in a study among rural natives but it did not report a complete psychometric methodology (Chang, 2007). Hence, we aim to determine the factor structure, validity and reliability of the WEL questionnaire in Malaysian T2DM individuals and to determine the appropriate cut-off scores to define the level of eating self-efficacy applied to the study sample.

MATERIALS AND METHODS

Design, recruitment and settings

This cross-sectional study was conducted in a Primary Care Clinic, in Seremban, an urban township in Peninsular Malaysia. Individuals who were aged 30-65 years with T2DM, and were also overweight or obese with body mass index (BMI) of ≥23 kg/m² were recruited. Individuals diagnosed with Type 1 Diabetes Mellitus, Gestational Diabetes Mellitus, pregnant or lactating and with severe diabetes complications were excluded. A minimal sample size of 200 individuals was required to perform the factor analysis taking into consideration sample to variable ratio. A ratio of at least 10 individuals to each variable is desirable for factor analysis (Pett, Lackey & Sullivan, 2003). However,

in this study 334 individuals were recruited considering the Tabachnick's rule of thumb that suggests having at least 300 individuals for factor analysis (Tabachnick & Fidell, 2013). During recruitment, the T2DM individuals' list was reviewed from the register book available in the clinic. Individuals who did not fit the inclusion criteria were omitted from the list. Thereafter, the medical records were assessed for further eligibility for recruitment. Contact details of T2DM individuals who fulfilled the selection criteria were obtained. The eligible individuals were contacted through the phone for verbal consent after an explanation on the study objectives and procedure were given. Individuals who expressed interest to participate in the study were scheduled to come to the clinic for screening and face-to-face interview for the study.

Ethical approval was obtained from the Joint Committee for Research and Ethics, International Medical University (project number: BN&D I01/2012(10)2014) and the Ethics Committee of the Ministry of Health Malaysia (project number: NMRR-14-1042-19455). Recruited individuals provided written informed consent prior to study initiation and their anonymity was maintained.

Assessment measure

The weight efficacy lifestyle questionnaire

The WEL questionnaire is a 10-point Likert scale ranging from 0 (not confident) to 9 (very confident) to resist the desire to eat. The WEL yields five subscales scores ranging from 0-36 and a global sum of the subscales ranging from 0-180. The negative emotions subscale included questions about eating restraint while anxious, depressed, angry, and feelings of failure. The availability subscale assesses a person's ability to control or resist poor eating habits on the weekends, when different foods are available, during a party, and knowing when certain high-calorie foods are around. The social pressure subscale focuses on resisting eating when in need of saying "no to others", impolite to refuse a second helping, when others are pressuring to eat and resisting eating even when others may be upset. The physical discomfort focuses on resisting eating during times of bodily discomfort, fatigue, headache, or a rundown feeling. Lastly, the positive activities subscale assesses resistance to eat when watching television, while reading, before going to bed, or in a happy mood. Higher WEL scores indicate a higher self-efficacy to resist eating.

Procedure

Translation of questionnaire into Malay language

The translation and adaptation of the WEL questionnaire conformed to the recommendation by WHO (World Health Organization, 2007). The WEL questionnaire was translated into the Malay language and blinded back-translated into English by a group of investigators who were native speakers of Malay language. The Malay-language WEL questionnaire was compared with the English-version for identifying inadequate concepts or expressions. Subsequently, the original version and translated version was compared for conceptual equivalence of the items. The final version of the Malay language- WEL questionnaire was pre-tested in a small subset (n=30) of overweight and obese T2DM individuals independent of the study.

Socio-demographic and medical history

A general questionnaire was administered to collect information regarding the socioeconomic background, anthropometry, biochemical measures and medical history of the individuals.

Data analysis

Data was analysed using the Statistical Package for Social Science version 22 (SPSS Inc; Chicago, IL, USA). The data was checked for normality and presented as mean ± standard deviation (SD) for parametric distribution and as median ± interquartile range (IQR) for non-parametric distribution. Characteristics of study individuals were described using descriptive statistics.

Items selection for scale construction

Spearman-rho correlation was performed to determine the items to be selected for scale construction. Items were selected after having full-filled the criteria for item-total correlation coefficient of $r>0.700$ and inter-item correlation coefficient of $r<0.800$. Items were eliminated if individuals have low variability in response rate for the items and if the items failed to fulfil the selection criteria.

Scale properties and factor structure

The principal component factor analysis using varimax rotation was performed to determine the scale properties and factor structure of the WEL questionnaire upon elimination of items. The criteria that were used to determine how many factors to be retained were the Kaiser criterion, which selects those factors that have eigenvalues greater than one, observation of an "elbow" in the corresponding scree plot, and parallel analysis.

Reliability of the factor structure

The internal consistency reported as Cronbach's α was used to examine the reliability of the factor structure. A Cronbach's α of greater than 0.700 was considered desirable.

Convergent and discriminant validity

Convergent and discriminant validity are subsets of construct validity. Convergent validity refers to the degree to which two measures of construct that theoretically should be related are indeed related. This means that the variables within a single factor are highly correlated. The convergent validity was established by item-total correlation (Spearman-Rho) of individual items with the total score of the respective factor structure.

Discriminant validity refers to items that are supposed to be unrelated are indeed unrelated. This means that the variables within the factor structure are distinct and have correlation coefficients not exceeding 0.700 (a low to moderate correlation is often considered evidence of discriminant validity). Discriminant validity was established by inter-item correlation (Spearman-Rho) between items in their respective factor structures.

Determining the cut-off scores for the instrument without a gold-standard

The procedure used was applicable for items in a Likert scale (Barua, 2013; Barua *et al.*, 2014). The weightage of each response of each item is directly proportional to the Discrimination Index as well as Cronbach's α. Hence, the weighted score for reach response of each item is obtained by calculating the Observed Item Score multiplied by the product of Discrimination Index and Cronbach's α. The "Correction Factor" is calculated by the ratio of the total weighted score and the total raw score. The cut-off score of the instrument is obtained by multiplying the "Correction Factor" with the 75^{th} percentile of each item and summing them up together.

(1) Calculation of Discrimination Index (DI) of individual item
   = *Spearman-Rho Correlation Coefficient*
(2) Weightage of each response of each item of the questionnaire
   = *(Observed Item Score) X (Discrimination Index) X (Cronbach's α)*

(3) Correction Factor = *[(Total Weighted Score) / (Total Raw Score)]*
(4) The cut-off score of an instrument without a gold standard
= *Sum [(75th Percentile from Raw Score per Item) X (Correction Factor)]*

RESULTS

Characteristics of the study population

Table 1 shows the characteristics of the study population. A total of 334 T2DM individuals comprising 60% women and 40% men completed the study. The recruited individuals had a median age of 55.0±9.0 years. The majority of the participants were Indians (*n*=175, 52%), followed by Chinese (*n*=112, 34%) and Malays (*n*=47, 14%). Majority attained primary (*n*=106, 32%) or secondary (*n*=172, 51%) level of education, while some had no formal schooling (*n*=20, 6%) or attained tertiary level of education (*n*=36, 11%). Approximately 50% of individuals were living with diabetes for duration of 5-10 years and only 16% individuals had diabetes for more than 10 years. A combination of diabetes,

Table 1. Characteristics of the total population (*N*=334)

Variables	*n (%)*	*Mean±SD*	*Mdn±IQR*
Gender			
Men	132 (40)		
Women	202 (60)		
Ethnicity			
Malays	47 (14)		
Chinese	112 (34)		
Indians	175 (52)		
Education level			
None	20 (6)		
Primary	106 (32)		
Secondary	172 (51)		
Tertiary	36 (11)		
Duration on diabetes			
<5 years	112 (34)		
5-10 years	167 (50)		
>10 years	55 (16)		
Comorbidities			
DM	18 (5)		
DM and HPT	50 (15)		
DM and DYS	37 (11)		
DM, HPT and DYS	129 (39)		
DM, HPT, DYS and CVD	63 (19)		
Others†	37 (11)		
Age (years)			
Range: 28-73 years			55.0±9.0
Weight (kg)			74.6±16.8
Body mass index (kg/m²)			29.0±6.2
Waist circumference (cm)		100.8±11.5	
HbA1c (%)			7.8±1.4

Abbreviations: DM, diabetes mellitus; HPT, hypertension; DYS, dyslipidaemia; CVD, cardiovascular disease
All data is expressed in frequency (percentage individuals) unless stated otherwise
†Others include diabetes with combination of diseases such as liver disease, hypothyroidism, gout, hypocalcaemia, gastritis, asthma, nephropathy, retinopathy and neuropathy

hypertension and dyslipidaemia was the most common co-morbidity (*n*=139, 39%). Median BMI was of 29.0±6.2 kg/m² and median HbA1c level was of 7.8±1.4%.

Validation of the questionnaire

Items selection for scale construction

Item 8 "I can resist eating even when I feel impolite to refuse a second helping" from the social pressure subscale (r=0.672, p<0.01) and item 10 "I can resist eating when I am reading" from the positive activities' subscale (r=0.245, p<0.01) displayed item-total correlation of r<0.700. Moreover, the inter-item correlation coefficient of item 8 ranged from 0.413 to 0.782 and for item 10 ranged from 0.056 to 0.409. Therefore, in considering clinical judgement of low response rate and low item-total correlation of items 8 and 10, these items were eliminated.

Scale properties and factor structure

Table 2 shows the factor structure obtained for the 18-items translated WEL questionnaire. Factor analysis revealed that a two-factor structure was the most reasonable whereby a distinct "elbow" in the scree plot was observed at the eigenvalue that was second largest in magnitude. There was a dramatic decrease in magnitude from the largest eigenvalue (6.203) to the second largest eigenvalue (2.622). The remaining eigenvalues were 1.182 and 1.023 or less in magnitude. The number of

Table 2. Factor structure of the 18-item weight efficacy lifestyle questionnaire

Items	*Factor 1*	*Factor 2*
Availability		
2. I can control my eating on weekends	0.712	
7. I can resist eating even when there are different kinds of food available	0.747	
12. I can resist eating even when I am at a party	0.770	
17. I can resist eating even when high calorie foods are available	0.658	
Social pressure		
3. I can resist eating when I have to say 'no' to others	0.737	
13. I can resist eating even when others are pressuring me to eat	0.818	
18. I can resist eating even when I think others will be upset if I don't eat	0.776	
Positive activities		
5. I can resist eating when I am watching TV	0.523	
15. I can resist eating just before going to bed	0.532	
20. I can resist eating when I am happy	0.748	
Physical discomfort		
4. I can resist eating when I feel physically run down	0.480	
Negative emotions		
1. I can resist eating when I am anxious (nervous)		0.445
6. I can resist eating when I am depressed (or down)		0.684
11. I can resist eating when I am angry (or irritable)		0.640
16. I can resist eating when I have experienced failure		0.650
Physical discomfort		
9. I can resist eating when I have a headache		0.799
14. I can resist eating when I am in pain		0.753
19. I can resist eating when I feel uncomfortable		0.605

Extraction method: principal component analysis. Rotation Method: varimax
Factor loadings of ≥0.400 were retained

Table 3. Convergent validity (item-total correlation) and reliability (Cronbach's α) of the 18-item weight efficacy lifestyle questionnaire

Items	*Factor 1*		*Factor 2*	
Overall Cronbach's **α**	0.893		0.781	
	Cronbach's **α** if item deleted	Item-total correlation (r)†	Cronbach's **α** if item deleted	Item-total correlation (r)†
2. I can control my eating on weekends	0.883	0.719*		
3. I can resist eating when I have to say 'no' to others	0.880	0.712*		
4. I can resist eating when I feel physically run down	0.891	0.511*		
5. I can resist eating when I am watching TV	0.892	0.547*		
7. I can resist eating even when there are different kinds of food available	0.880	0.737*		
12. I can resist eating even when I am at a party	0.878	0.773*		
13. I can resist eating even when others are pressuring me to eat	0.876	0.784*		
15. I can resist eating just before going to bed	0.892	0.588*		
17. I can resist eating even when high calorie foods are available	0.886	0.632*		
18. I can resist eating even when I think others will be upset if I don't eat	0.879	0.733*		
20. I can resist eating when I am happy	0.880	0.749*		
1. I can resist eating when I am anxious (nervous)			0.806	0.622*
6. I can resist eating when I am depressed (or down)			0.736	0.716*
9. I can resist eating when I have a headache			0.731	0.638*
11. I can resist eating when I am angry (or irritable)			0.764	0.597*
14. I can resist eating when I am in pain			0.735	0.647*
16. I can resist eating when I have experienced failure			0.748	0.656*
19. I can resist eating when I feel uncomfortable			0.755	0.536*

†Item-total correlation is presented as Spearman-Rho correlation coefficient (r)
*Data significant at $p<0.01$

Table 4. Discriminant validity (inter-item correlation) of individual items of the 18-item weight efficacy lifestyle questionnaire

Factor 1	*Item 2*	*Item 3*	*Item 4*	*Item 5*	*Item 7*	*Item 12*	*Item 13*	*Item 15*	*Item 17*	*Item 18*	*Item 20*
Item 2	1.000	0.431*	0.338*	0.376*	0.513*	0.543*	0.463*	0.324*	0.448*	0.431*	0.532*
Item 3		1.000	0.416*	0.238*	0.505*	0.469*	0.697*	0.386*	0.323*	0.652*	0.443*
Item 4			1.000	0.262*	0.373*	0.362*	0.373*	0.277*	0.265*	0.364*	0.313*
Item 5				1.000	0.272*	0.371*	0.368*	0.349*	0.318*	0.320*	0.399*
Item 7					1.000	0.653*	0.526*	0.333*	0.405*	0.514*	0.550*
Item 12						1.000	0.544*	0.336*	0.465*	0.504*	0.564*
Item 13							1.000	0.426*	0.441*	0.723*	0.524*
Item 15								1.000	0.379*	0.341*	0.403*
Item 17									1.000	0.403*	0.479*
Item 18										1.000	0.506*
Item 20											1.000
Factor 2	*Item 1*	*Item 6*	*Item 9*	*Item 11*	*Item 14*	*Item 16*	*Item 19*				
Item 1	1.000	0.429*	0.248*	0.237*	0.180*	0.315*	0.128*				
Item 6		1.000	0.404*	0.295*	0.399*	0.418*	0.325*				
Item 9			1.000	0.595*	0.477*	0.275*	0.316*				
Item 11				1.000	0.486*	0.336*	0.222*				
Item 14					1.000	0.410*	0.475*				
Item 16						1.000	0.325*				
Item 19							1.000				

All data presented as Spearman Rho correlation coefficient (r)
*Data significant at $p<0.01$

factors to be retained was further confirmed by parallel analysis, which also suggested a two- factor solution. The two-factor structure accounted for 49% of the variance. Kaiser-Meyer-Olkin of sampling adequacy was 0.890 and Bartlett's test of sphericity was significant (χ^2 = 2582.8, p<0.001). Eleven items were loaded onto factor one and seven items were loaded onto factor two in the final solution where all the factor loadings were greater than 0.40. For comparison with the Clark and colleagues' validation study (Clark *et al.*, 1991), five factors were forced into the model. The results were not replicated in this study.

Convergent and discriminant validity and reliability

Item-total correlation coefficient of individual items of factor one and factor two were well above r>0.500 (Table 3). There was a high significant (*p<0.01) positive correlation of items in factor one and factor two with their respective total scores indicating high convergent validity. The reliability for the obtained factor structures was indicated by Cronbach's α of 0.893 for factor one and Cronbach's α of 0.781 for factor two. None of the individual Cronbach's α values after item deletion were found to be more than the overall Cronbach's α value for factor one and factor two.

In Table 4, the inter-item correlation coefficient of items within the factor structure was low to moderate with r<0.500. The low to moderate correlation coefficients possesses discriminant quality within the individual items of the factor structure. The difference in the discrimination power of each of these items was also statistically significant (p<0.01).

Cut-off scores of the instrument

The weighted score of the 18-items translated WEL questionnaire calculated by applying equations (1) and (2) in the methodology section. The total weighted score was 21187.2 while the total raw score was 38303.0. Correction factor obtained was 0.55 by applying equation (3) into the calculation.

Table 5 shows the cut-off score set for decisions on low and high levels of eating self-efficacy. Based on the crude mid-value of the minimum and maximum scores possible for factor one and factor two, scores of 50 and 32, respectively were generally to be used to define the levels of eating self-efficacy. However, by applying equation (4), the calculations revealed that the cut-off score for identification of high level of eating self-efficacy should be readjusted to 44 for factor one and 32 for factor two. The interpretation follows that if the overall score of any individual is <44 for factor one and <32 for factor two, then the person should be considered to have low eating self-efficacy level.

DISCUSSION

A two-factor structure of the translated 18-items WEL questionnaire was obtained after excluding item 8 "I can resist eating even when I feel impolite to refuse a second helping" from the social pressure subscale and item 10 "I can resist eating when I am reading" from the positive activities subscale. Low item-total correlation coefficients for items 8 and 10 suggest these items should be eliminated given their low psychometric quality. Moreover, these items were excluded as 75% of study individuals claimed they did not take a second helping to keep their blood glucose level under control, while 99% T2DM individuals claimed that they did not read while eating. Upon eliminating these items, the internal consistency improved by 5% for social pressure subscale (Cronbach's α improved from 0.844 to 0.887) and positive activities

Table 5. Calculation of cut-off value for measurement of high self-efficacy to resist eating for the 18-item weight efficacy lifestyle questionnaire

Factor 1	*Median (50^{th} Percentile)*	*75^{th} Percentile*	*Correction Factor (CF)*	*(75^{th} Percentile) X CF*
Item 2	6	7	0.55	3.85
Item 3	7	7	0.55	3.85
Item 4	7	8	0.55	4.40
Item 5	7	8	0.55	4.40
Item 7	5	7	0.55	3.85
Item 12	5	7	0.55	3.85
Item 13	7	7	0.55	3.85
Item 15	7	8	0.55	4.40
Item 17	5	7	0.55	3.85
Item 18	7	7	0.55	3.85
Item 20	5	7	0.55	3.85
Score range = 0-99				
Adjusted cut-off value				44
Crude mid-value				50
Factor 2	*Median (50^{th} Percentile)*	*75^{th} Percentile*	*Correction Factor (CF)*	*(75^{th} Percentile) X CF*
Item 1	7	8	0.55	4.40
Item 6	7	8	0.55	4.40
Item 9	8	9	0.55	4.95
Item 11	8	9	0.55	4.95
Item 14	8	8	0.55	4.40
Item 16	8	8	0.55	4.40
Item 19	7	8	0.55	4.40
Score range = 0-63				
Adjusted cut-off value				32
Crude mid-value				32

subscale (Cronbach's α improved from 0.589 to 0.646).

Interestingly, the two-factor structure obtained in this study may help differentiate eating self-efficacy level in two different situations, i.e. positive and negative. Items loaded onto factor one can be reckoned to differentiate eating self-efficacy in positive situations. Items in factor one consists of all items of the availability subscale (items 2, 7, 12 and 17), 3 items of social pressure subscale (items 3, 13 and 18), 3 items of positive activities subscale (items 5, 15 and 20) and item 4 of the physical discomfort subscale "I can resist eating when I am physically run down" (see Table 2). Combining resisting eating when feeling tired onto factor one is sensible as it may simply mean abundant food availability even when tired. Items loaded onto factor two can be reckoned to differentiate eating self-efficacy in negative situations. These items include all items of the negative emotions subscale (items 1, 6, 11 and 16) and remaining three items of physical discomfort subscale (items 9, 14 and 19). Compared to the original five-factor solution that consisted of four-items in each subscale, the new

two-factor structure showed a clear demarcation of items assessing eating self-efficacy when individuals are in positive environment (11 items) and as well as negative environment (7 items) (Table 2).

The distinct categorisation of adequate items to assess eating self-efficacy in these two tempting situations, may provide a global assessment and overall view of an individual's confidence level to resist eating when experiencing positive or negative situations. Assessing eating self-efficacy in T2DM individuals is essential to better manage their weight and glycaemic control (Chih *et al.*, 2010; Al-Khawaldeh, Al-Hassan & Froelicher, 2012). Understanding and knowing in which tempting situations eating self-efficacy level of T2DM individuals is either higher or lower, can help healthcare providers target individualised patient education to motivate and build their confidence into making successful dietary and lifestyle changes (Strychar, Elisha & Schmitz, 2012). Evidences showed that T2DM individuals with higher self-efficacy, had higher motivation to initiate behaviour changes (Chih *et al.*, 2010; Al-Khawaldeh, Al-Hassan & Froelicher, 2012; Strychar, Elisha & Schmitz, 2012).

The two-factor solution had good item-total correlation and inter-item correlation providing evidence in support of construct validity. Obtaining item-total correlation coefficient of $r>0.700$ simply means that these items belong to their respective construct and all these items should be retained providing evident of convergent validity. The factor analysis also revealed that the items were related to their respective construct. The low to moderate inter-item correlation coefficients showed that the items were independent of each other and clearly distinct. This provided evident of high discriminant validity. The internal consistency of the two-factor structure was also good and none of the individual Cronbach's α values after item deletion were found to be more than the overall Cronbach's α values of 0.893 (factor one) and 0.781 (factor two). Hence, all items of the Malay-translated WEL questionnaire were considered important and should be retained in this questionnaire for screening purposes.

This study's finding was consistent with the findings of other validation studies conducted on overweight or obese individuals where Clark and colleagues reported Cronbach's α ranging from 0.700 to 0.900 (Clark *et al.*, 1991), while Dutton and colleagues obtained Cronbach's α ranging from 0.690 to 0.840 (Dutton *et al.*, 2004). This validation study used the Malay-translated WEL questionnaire despite higher percentage of the T2DM individuals being non-Malays (86%). This did not affect the validation of the instrument as supported by the validity and high reliability of the instrument. This study was conducted in a governmental primary care clinic, in which Malay was the primary language for communication. Furthermore, the majority of the studied population were also either primary (32%) or secondary (51%) educated, who predominantly conversed in Malay rather than English or other languages with their healthcare providers. These individuals had a better understanding of the items in the Malay-translated WEL questionnaire and preferred to be interviewed in Malay.

The cut-off scores were determined using the Discrimination Index. This was because a basic consideration in evaluating the performance of a test instrument is the degree to which it discriminates between high and low responses (Barua, 2013; Barua *et al.*, 2014). Furthermore, the median and interquartile range of 75th percentile was considered as minimum cut-off for positive scoring scale in this study as the responses of the study population was

skewed and a low correction factor of less than 0.75 was obtained (Barua, 2013; Barua *et al.*, 2014). This study revealed that the cut-off score for defining high eating self-efficacy in positive situations (factor one) to be set at score ≥44 as opposed to the crude value of ≥50 while the cut-off score in negative situations (factor two) to be set at ≥32 same as the crude value. The adjustment of the cut-off scores was necessary considering the random variance of the population. Previously, no cut-off scores have been proposed to define the level of eating self-efficacy. In clinical and research settings, obtaining quantifiable information regarding eating self-efficacy is useful in screening programs. Results of quantifying the level of eating self-efficacy may provide information regarding individual's strength and weakness and this information can be used to assess performance of an intervention method or disease progress over time (Barua, 2013; Barua *et al.*, 2014).

This study failed to replicate the five-factor solution proposed in the original publication of Clark *et al.*, (1991). When five factors were included into the model, there was disagreement between the results of the present study and those of the original study. In our study, only the two-factor structure of the WEL-questionnaire was valid compared to the original five factor solution. This could be explained by socio-cultural differences of the population studied, as the original questionnaire was conducted amongst obese Caucasians. Similarly, studies conducted amongst Norwegians (Flolo *et al.*, 2014), African-Americans (Dutton *et al.*, 2004) and Turkish population (Bas & Donmez, 2009), did not replicate all the five-factor solution in assessing WEL. Geographic locations, socioeconomic status and food availability may also impact eating behaviour (Drewnowski & Kawachi, 2015).

A limitation of the study is that, as the questionnaire was not repeated amongst the T2DM individuals, the stability of the questionnaire over time could not be ascertained. The cut-off scores to define the level of eating self-efficacy were calculated without a gold-standard reference. Hence, future studies may include gold-standard instruments as reference to examine the sensitivity and specificity of the obtained cut-off scores. This was a questionnaire-based survey that may have a high response bias. Nevertheless, all interviews with the T2DM individuals were conducted face-to-face by the investigator to limit the response bias. Furthermore, this validation study was conducted amongst the T2DM individuals, thus, limiting its generalisability. This study used the original instead of the short version of WEL questionnaire as it was crucial to determine which of the 20 potential items psychometrically suited the studied population.

CONCLUSION

The 18-item Malay-translated WEL questionnaire was found to be a valid and reliable tool to measure self-efficacy for controlling eating behaviour in research and clinical settings among the Malaysian overweight and obese T2DM population. This study demonstrated that cut-off scores of ≥44 and ≥32, respectively may help discriminate individuals with high eating self-efficacy in positive (factor one) and negative (factor two) situations. The current findings suggest quantifying and defining the level of eating self-efficacy is essential in clinical settings for screening and diagnosing purposes. Health care professionals should consider measuring eating self-efficacy in overweight and obese individuals with diabetes, as it may provide insights about lack of confidence for controlling eating behaviour and readiness to

engage in behavioural change and thus, target those problem areas in weight loss interventions.

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Authors' contributions

All authors read and approved the final manuscript. HKGS, was involved in data collection and analysis, data interpretation and writing of the manuscript. VLKM, provided input on intellectual content of critical importance to the work described and editing of the manuscript. AB, was involved in data analysis and interpretation, provided input on intellectual content of critical importance to the work described and editing of the manuscript. SZMA, provided intellectual content of critical importance to the work described and editing of the manuscript. WCSS, was involved in conception and design of the study, data analysis and interpretation, editing and writing of the manuscript.

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