ORIGINAL ARTICLE

Risk Perception Survey on Developing Diabetes Questionnaire: Translation and Validation of the Malay Version

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ABSTRACT

INTRODUCTION: The Risk Perception Survey on Developing Diabetes questionnaire identifies how women with gestational diabetes mellitus (GDM) perceived the risk of developing diabetes after their pregnancy has ended. The objective of this study was to translate and validate an English questionnaire into Malay. **MATERIALS AND METHODS:** A cross-sectional study was conducted from February 2019 to July 2019 among 200 women with GDM who attended public health clinics in Johor Bahru, Malaysia. The original author of the questionnaire granted us permission to use for this study. The translation of the questionnaire, content, and face validation was performed. It was followed by confirmatory factor analysis using R version 3.5.3 and item analysis for the knowledge domain. The composite reliability and internal consistency reliability using Cronbach alpha were also computed. **RESULTS:** The Malay version consists of 20 items in five domains; personal control (2 items), optimistic bias (2 items), knowledge of diabetes risk factors (11 items), benefits and barriers of preventive behaviour (3 items), and risk perception (2 items). Confirmatory factor analysis confirmed the structure of the model. The goodness-of-fit values were adequate [comparative fit index=0.994, Tucker-Lewis Index=0.990, standardized root mean square residual=0.038, root mean square of approximation=0.021 (90% CI: 0.000,0.064)]. The four domains had composite reliability values between 0.60 and 0.88. The Cronbach alpha value for knowledge of diabetes risk factors domain was 0.843. **CONCLUSION:** The translated Malay questionnaire is valid and reliable to assess the perception of women with GDM towards their future risk of getting diabetes.

Keywords
Risk perception, gestational diabetes mellitus, confirmatory factor analysis, validity, reliability

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Received: 29th August 2022; Accepted: 17th November 2022

Doi: https://doi.org/10.31436/imjm.v22i2

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder that is caused by insufficient insulin production, impaired insulin action or both.[1] In 2021, there were around 500 million adults aged 20 to 79 years with the diagnosis of diabetes.[2] Overall, the global burden of diabetes shows a significant increase since 1990, with 22.9 million new cases in 2017.[3] DM in Malaysia also showed a similar increasing trend. Diabetes prevalence among the adult population in Malaysia was 18.3% in 2019, with women outweighing men by almost 15%.[4] In addition, women in the reproductive age group may be affected by an abnormal condition during pregnancy known as gestational diabetes mellitus (GDM). The diagnosis of diabetes is made when glucose intolerance is first detected antenatally, due to the inability of the body to adapt to the new circumstances, and sufficient insulin is not produced.[5]

The worldwide prevalence of GDM ranges from 5.8% to 11.7%.[6] The wide variation of prevalence might be explained by the differences in diagnostic criteria for GDM.[6] Although 90% of GDM cases will normalize after delivery, some will persist and the women will develop prediabetes or DM. It is reported that around 50% of GDM patients were diagnosed with type 2 DM five years after delivery.[7] In Sri Lanka, a longitudinal study found that a woman with GDM had 10.6 times the odds of developing diabetes in 10 years duration compared to those without GDM.[8] However, lifestyle interventions have the chance to slow down the progression of type 2 diabetes among these women.[9]

It is important to provide accurate and timely information to women with GDM regarding their future risk of getting diabetes. They should also receive intervention that is tailored to their needs. To ensure a continuous change in behaviour concerning positive lifestyle amendment, several elements should be considered which include risk perception, beliefs, and psycho-social impediments.[10] Among others, risk perception is identified as an important determinant of health behaviour in various theoretical health models.[11] A woman who has high-risk perception of having future diabetes was more motivated in doing screening and lifestyle modification.[12]

The Risk Perception Survey on Developing Diabetes (RPS-DD) questionnaire assesses various aspects of a person's perceived risk for having this disease .[13] This tool consists of items on optimistic bias, personal control, knowledge of diabetes risk factors, benefit and barriers, as well as risk perception. Originally applied in the Diabetes Prevention Program Michigan Diabetes Research Centre,[14] it had undergone subsequent validation process among GDM mothers.[13] The internal consistency using Cronbach's alpha was excellent (0.65 to 0.72). RPS-DD questionnaire development process was thorough and multistage; nonetheless, other studies can be organized for evaluation of the confirmatory factor analysis and assessment of its external validity. Furthermore, there is no published instrument in the Malay language measuring the risk perception of developing diabetes among this population. This study aimed to adapt, translate and validate the RPS-DD questionnaire into the Malay language.

MATERIALS AND METHODS

Study design and participants

A cross-sectional study commenced between February 2019 and July 2019 among 200 women with GDM who attended three public health clinics in Johor Bahru, Malaysia. The Human Research Ethics Committee of Universiti Sains Malaysia (JEPeM Code: USM/ JEPeM/18100580) and National Medical Research Register (NMMR-18-2914-44376) approved the conduct of this study.

The required number of samples was 200, as referred to as the minimum sample size requirement for a validation study.[15] The number was also commonly used as a rule of thumb for minimum sample size, with reported similar number determined using Monte Carlo method.[15] Convenience sampling was applied to recruit women with GDM regardless of their gestational period. The exclusion criteria were those who do not understand Malay or are illiterate.

Research tool and the translation process

The instrument used in this study was Risk Perception Survey on Developing Diabetes (RPS-DD) questionnaire.[13] It consists of five domains with 22 items and is designed to be answered through self-administered or telephone interviews. There were two items on diabetes risk perception, perception of personal control (4 items), optimistic bias (2 items), barriers and benefits of diabetes prevention (3 items), and 11 items on knowledge of diabetes risk factors. A Likert scale was used, with the options of strongly agree, agree, disagree and strongly disagree.

Eight stages of translation process were applied, consisting of preparation, forward translation, reconciliation, backward translation, harmonization, cognitive debriefing, finalization and final report.[16] (Figure 1)

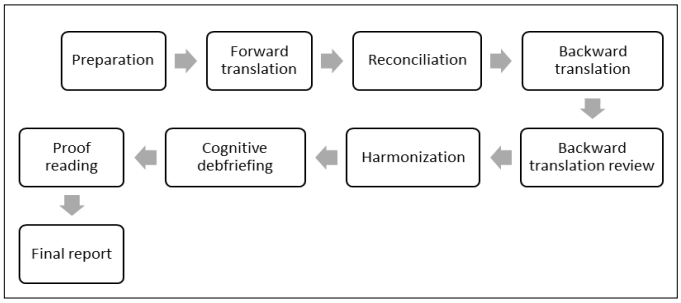

Figure 1: Flow chart of Risk Perception Survey on Developing Diabetes questionnaire process of translation

First, the preparation involved contacting the original author and obtaining his consent to translate the questionnaire. The translators were identified, approached and informed about the research. The second stage included two translators to convert the tool into Malay. One of the translators was an English teacher with a master degree. Another translator was a clinician who have been involved with research for more than 10 years. Subsequently, the reconciliation stage incorporated an expert committee who did the comparison and merging of the forward translation materials obtained from the two translators. The expert committee consists of a public health specialist, a statistician and a family medicine specialist. They compared the translated materials with the original RPS-DD.

Next, two new translators were required to perform the backward translation of the tool. A secondary school teacher with PhD degree and an academician in language centre of our institution were assigned as the translators. The back-translated version of the questionnaire was reviewed and compared with the original one, to look for any inconsistencies. The process was done by the corresponding committee who had analyzed the initial forward translation. The subsequent stage was known as harmonization. In addition to comparing the back translated Malay version with the original one, it also helped in reaching consistent actions for dealing with translation problems. It detected and dealt with any inconsistencies of the two language versions, hence ensuring conceptual similarities not only between the source and targeted language versions but also between all translations. In this study, harmonization was performed together with review of the back translation. Overall, the committee was satisfied with both the newly translated and the original questionnaire.

Following that, this translated questionnaire underwent the process of cognitive debriefing with five women who had been diagnosed with GDM before. There were variations in their background characteristics with regards to educational level and employment status, including housewife, teacher, promoter, doctor, and clerk. The cognitive debriefing process aimed to identify any items in the questionnaire that are confusing or difficult to be understood by the respondents. The respondents were required to read all the items and provide comments especially if they need to be rephrased. It was found that the respondents understood and appropriately interpreted the items in the newly translated questionnaire.

This process was followed by a checking of content validity by a public health specialist and two family medicine specialists. They suggested for removal of five items in the 'knowledge of diabetes risk factors' domain, and five new items adapted from the local clinical practice guidelines were added. One item from the domain of 'Barriers and benefit of preventive behaviour' was also replaced with another two items which provided a better meaning in the Malay language. The I-CVI of the revised version was 1.00, and the S-CVI/AVE were 0.98, indicating excellent content validity.[17]

The next step was face validity assessment to check whether the translated items were clear and comprehensible. Ten conveniently selected women with GDM did not have any problems understanding the items and they admitted that those statements were not culturally sensitive. The face validity index (FVI) was 0.92 for clarity, 0.88 for comprehension, and the overall FVI was 0.90. Therefore, the face validity was satisfactory.[18] This Malay version of the RPS-DD questionnaire evaluated in the next validation study had 23 items: 2 items on diabetes risk perception, 4 items assessing the perception of personal control, 2 items on the optimistic bias, 11 items of knowledge of diabetes risk, and 4 items on barriers and benefits of preventive behaviour.

Data collection

Data collection for confirmatory factor analysis (CFA) were conducted at the health clinics. The selected

respondents were given information regarding the study and written informed consents were acquired. They provided responses on the self-administered questionnaire which contained two sections: i) respondent's data and ii) the translated RPS-DD questionnaire. The time spent to complete the questionnaire was 15 minutes. Data collection was stopped after obtaining the required number of respondents.

Statistical analysis

Data entry was performed using IBM SPSS Statistics Version 24, while CFA was done using R version 3.5.3. Frequency and percentages of categorical variables were presented. The continuous variables were normally distributed and reported using mean and standard deviation (SD).

CFA is a multivariate analysis to check how good the measured variables represent their constructs. The questionnaire validity and reliability were assessed using this analysis. Mahalanobis distance plot was used to check for multivariate normality and presence of multivariate outliers. Measurement of model validity utilized the maximum likelihood robust estimator (MLR). Factor loading refers to the correlation of original variables and the factors. It was considered significant if the value was at least 0.4, hence removal of items below this value was done.[18] Model fit of CFA relies on absolute fit of the standardized root mean square residual (SRMR), parsimony correction fit index by the root mean square of approximation (RMSEA), comparative fit index (CFI) and Tucker-Lewis Index (TLI). The model was considered as good fit if SRMR was ≤0.05 while RMSEA of ≤0.08, CFI and TLI more than 0.95 indicated the model is reasonable fit.[20] Certain modification was done if the model does not fit the data. This included removing the items which were either having low factor loading, high value of standardized residuals or high modification index. These modifications were performed to reach a reasonably fit and theoretically sound model. In addition, the internal consistency and reliability of the latent construct was determined based on the composite reliability value, with a cut-off point of 0.6 or greater.[21]

RESULTS

Two-hundred women completed the validation study. Their mean age was 32.2 (SD 4.79) years. Majority were Malays, 150 (75.0 %) and 85 (42.5%) had received higher education. Most of them were non-nulliparous (90.0%) (Table 1).

Table 1: Background characteristics of the respondents (n=200)

Variable	Mean (SD)*	n (%)
Age (year)	32.20 (4.79)	
Ethnicity		
Malay		150 (75.0)
Chinese		23 (11.5)
Indian		18 (9.0)
Others		9 (4.5)
Educational level		
College/University		85 (42.5)
Secondary school		103 (51.5)
Primary school		12 (6.0)
Employment status		
Employed		94 (47.0)
Unemployed		106 (53.0)
Parity		
Nulliparous		20 (10.0)
1-2		109 (54.5)
>3		71 (35.5)

*SD = standard deviation

The domains included for CFA were diabetes risk perception, perception of personal control, optimistic bias, as well as barriers and benefit of diabetes prevention. The last domain, which was knowledge of diabetes risk factors, was analyzed through item analysis. Therefore, 12 items were assessed using CFA. R software was used to determine the normality of the model and a two-sided multivariate skew test of fit demonstrated a significant p-value. Based on that, the normality assumption was not met, hence robust maximum likelihood (MLR) estimator in R software was applied.

The initial model had poor fit of data with factor loadings of three items (items Prevent1, PC3 and PC4) were found to be low. Thus, these items were removed. The measurement of the final model (Model 3) fit well (Table 2). The overall fit was assessed using CF fit with a p-value of 0.348 shows good model fit. The values of fit indices were 0.994 for CFI, 0.990 for TLI, 0.038 for SRMR, and 0.021 for RMSEA. The range of standardized factor loading values for optimistic bias, perception of personal control, barriers and benefits of diabetes prevention, and

diabetes risk perception were 0.88 to 0.89, 0.54 to 0.72, 0.66 to 0.75 and 0.67 to 0.77, respectively (Table 3). In addition, the values of composite reliability were acceptable: optimistic bias (0.88), perception of personal control (0.60), barriers and benefits of diabetes prevention (0.74), and diabetes risk perception (0.68).

Table 2: Model fit indices for measurement model

Model	Comparative Fit Index	Tucker-Lewis Index	SRMR	RMSEA (90% CI)
1	0.981	0.964	0.039	0.042 (0.000, 0.082)
2	0.813	0.729	0.079	0.097 (0.076, 0.119)
3	0.994	0.990	0.038	0.021 (0.000, 0.064)
4	0.925	0.884	0.075	0.068 (0.041, 0.094)

Table 3: Standardized item loading and reliability of the Malay Version RPS-DD

Factors	Items	Standardized item loading	Composite reliability
Optimistic Bias	OB1	0.892	0.879
	OB2	0.881	
Perception of personal control	PC1	0.721	0.600
	PC2	0.541	
Barriers and benefits of preventive behavior	Prevent2	0.690	0.737
	Prevent3	0.749	
	Prevent4	0.664	
Diabetes risk perception	RP1	0.673	0.677
	RP2	0.771	

Meanwhile, the Cronbach's alpha value for knowledge of diabetes risk factors domain was 0.843 (Table 4). The difficulty index of three items were acceptable, while the remaining items were considered easy (>0.7).[22] The difficulty index represents the ratio of correct response to total number of participants. In addition, majority of the items showed excellent discrimination (>0.36).[22] Discrimination index refers to the capacity of an item to distinguish those participants who obtained high and low scores. Hence, all items in this domain were maintained in the questionnaire. The final validated questionnaire consists of 20 items in five domains of personal control (2 items), optimistic bias (2 items), knowledge of diabetes risk factors (11 items), benefits and barriers of preventive behaviour (3 items), and risk perception (2 items).

DISCUSSION

Risk perception plays a major influence on various health behaviour. However, only a few studies had examined

Table 4: Validity and reliability of knowledge domain

		Item analysis		
Factor	Item	Difficulty Index	Discrimination index	Cronbach's α
Knowledge	Know1	0.85	0.48	0.843
	Know2	0.91	0.56	
	Know3	0.72	0.49	
	Know4	0.72	0.57	
	Know5	0.86	0.64	
	Know6	0.73	0.64	
	Know7	0.79	0.56	
	Know8	0.81	0.56	
	Know9	0.44	0.29	
	Know10	0.57	0.53	
	Know11	0.69	0.56	

diabetes risk perception among women with GDM. One of the instruments used in assessing risk perception is RPS-DD, which was validated among women diagnosed with GDM. This questionnaire was translated into various languages such as the Spanish, with good reliability and validity.[23] The current study continued the translation of RPS-DD, with the justification that Malay is the official language and mainly used in Malaysia. To our knowledge, this is the first report of such study in Malaysia. Thus, this questionnaire will be of important use in the Malaysian population.

The original version of RPS-DD consisted five domains with 22 items. The Malay translated questionnaire has gone through a comprehensive validation process and reliability assessment.[16] The conceptual equivalence of the items as examined by the expert committee during content validation phase revealed that the domains of the original instrument were equally relevant and important to be used among the local population. However, five items in the 'knowledge of diabetes risk factor' domain and one item in the 'barriers and benefit of preventive behaviour' domain were changed with new items that were approved by the expert committee. Changes of the items took place after considering the cultural differences of eastern and western countries, showing the variance in understanding on different set of translated questionnaires among different populations.

The quantitative assessment of content validity produced I-CVI of 1.00, and the S-CVI/AVE of 0.98. In addition,

the FVI values for clarity and comprehension were 0.92 and 0.88, respectively. It portrays that this translated questionnaire has an excellent content validity.[17] The FVI results also showed that it was translated well, using clear and understandable sentences. Moreover, this questionnaire was well adopted into the local context.

Following content and face validation assessment, CFA was conducted to estimate the validity of the structural theory and identify a valid measurement model. Maximum likelihood ratio (MLR) was frequently used in CFA as fitting function for structural equation models, considering that the assumption of multivariate normality was met. MLR was robust against moderate violations of assumption including un-modelled heterogeneity and able to accommodate for data that did not fulfil multivariate normal distribution. The later reason justified the use of MLR estimation method in this study.

RMSEA is a parsimony-adjusted index and a value closer to zero represents a good fit. Therefore, the value in this study indicated reasonable fit.[24] Meanwhile, the CFI and TLI compare the fit of the target model to the fit of an independent (null) model. The validity was further confirmed by SRMR, which refers to the difference between the residuals of the sample covariance matrix and the hypothesized model. All the values were within acceptable ranges.[24] Thus, the construct validity was fulfilled. Nonetheless, other types of validity such as concurrent validity was not assessed, and could be considered in future studies.

Regarding the knowledge of diabetes risk factor, item analysis of all 10 items demonstrated acceptable difficulty and discrimination indices. An item with slightly lower values (difficulty index 0.44, discrimination index 0.29) was not removed in view of its essential contribution in assessing the knowledge among women with GDM. Similar approach of keeping such items in the questionnaire was also reported in other studies.[25,26]

In addition to validity assessment, the reliability of the translated questionnaire was computed using composite reliability. It ranged between 0.6 and 0.88. Meanwhile, the internal consistency reliability for knowledge of diabetes risk factor domain as measured by Cronbach alpha was also acceptable (0.84).[19] It was higher than the value of the original questionnaire (0.70).[13] Composite reliability was frequently applied for assessing reliability of the factors following CFA since it took into consideration the error covariance and offered lesser bias estimate of reliability than Cronbach alpha. Nonetheless, the distinction between these two reliability estimates were not practically significant and they may be applied interchangeably.[27]

There were some limitations identified in this study. A convenience sampling method which is a non-probability sampling may limit the generalizability of the study findings. In addition, a majority of the study population were Malays with small percentages of other ethnic groups in Malaysia. Therefore, the generalization of the results was limited. Nonetheless, it is common that all the ethnic groups in Malaysia are able to communicate in Malay, with the exception for a small minority.

CONCLUSION

This study demonstrated that the Malay version of RPS-DD is a valid and reliable tool to measure the risk perception of developing diabetes among women with GDM. It consists of five domains with 20 items. The comprehensive process of translation and cross-adaptation using content and face validation as well as confirmatory factor analysis resulted in good psychometric properties of this questionnaire. It is culturally appropriate to be used in future research utilizing Malay language among women with GDM.

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