ORIGINAL ARTICLE

Developing a tool to assess women's knowledge and attitude toward managing prediabetes

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ABSTRACT

Prediabetes is a condition characterized by a higher than normal blood sugar level, but not high enough to be diagnosed as type 2 diabetes. Prediabetes can be diagnosed when fasting blood glucose levels are between 100 to 125 mg/dL and HbA1c between 5.7% to 6.4%. Therefore, the study aimed to develop a questionnaire that can assess knowledge and attitude toward prediabetes management. The descriptive study includes validity and reliability tests. The content validity test involved 10 expert panelists. Meanwhile, face validity used 10 participants, and the reliability test included 30 adult women participants. The content validity index (CVI) and kappa statistics score were also adopted in this study. Face validity was carried out by calculating the impact score, while the reliability test used Cronbach's alpha. The content validity of the knowledge component of the questionnaire was analyzed separately for clarity (CVI = 0.44–0.88) and relevance aspect (CVI = 0.77–1). The result of the kappa statistic showed 10 question items in the low category, 5 items had a sufficient rating and 5 items received a very good rating. The face validity assessment with impact score analysis ranged from 3.0–4.6. The analysis of correlation (p-value <0.05) was carried out on 7 question items. The reliability test using Cronbach's alpha showed a coefficient of 0.642. Furthermore, content validity analysis of the attitude component of the questionnaire was performed separately for clarity (CVI = 0.727–1) and relevance aspect (CVI = 0.909–1). The result of the kappa statistic showed two statement items in the low and 18 items in the very good category. Face validity with impact score analysis ranged from 2.5-3.1, and the correlation analysis (p-value <0.05) on the 6 statement items had a Cronbach's alpha of 0.772. The study concluded that the knowledge and attitude questionnaire for prediabetes management had good validity and reliability in the adult women group.

Key words:
adult women; knowledge and attitude; prediabetes; validity and reliability

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INTRODUCTION

Prediabetes is a condition caused by insulin resistance, leading to higher blood glucose levels that do not meet the criteria for diabetes mellitus characterized by impaired fasting glucose (IFG) or impaired glucose tolerance (IGT).[1,2] Prediabetes is generally not diagnosed and considered trivial in the community, leading to a low level of awareness.[3] Lifestyle changes increase the trend of shifting from prediabetes to diabetes very quickly. About 314 million of the world's population have prediabetes, and an increase of 500 million was estimated by 2025.[4] In Indonesia, the incidence of IFG was 26.3%, while IGT was 30.8%.[5] Among adults, 15.3% had hyperglycemia[6] and the prevalence of prediabetes was higher in rural (44.8%) compared to urban areas (34.9%).[7]

Prediabetes increases the risk of cardiovascular disease, nephropathy, and neuropathy.[1] Individuals with prediabetes have a 5-10% chance of developing diabetes, with a 70% risk throughout life.[8] Therefore, an effective strategy is needed for screening as a primary prevention of diabetes mellitus.[3,9] The important steps in preventing diabetes in developing countries include the identification of risk factors by screening, assessment of disease-related awareness, and increasing knowledge, attitude, and practices (KAP) related to lifestyle modification.[10] Knowledge is a personal understanding, attitude is personal feelings about positive or negative statements and practice is personal actions for prediabetes management. The knowledge, attitude and practice (KAP) model has been developed as a tool to investigate what is known, believed and done by participants. Correlation among knowledge, attitude and practice was developed based on the cognitive, affective and behavior theory. Good knowledge is a basic foundation for forming healthy behaviors.[9] Low levels of knowledge, negative attitudes, and unhealthy lifestyles have been identified in individuals with prediabetes.[3,9,11–15] KAP prediabetes is knowledge, attitude and practice about prediabetes management to reduce the progression of prediabetes. Understanding the level of knowledge and attitude facilitates a more efficient process of raising awareness in prediabetes management programs.[16] Education programs show the significance of fostering health literacy among individuals with prediabetes to prevent the onset of diabetes.[17,18] Providing education increases knowledge, fosters a positive attitude, and improve self-care practices in people with prediabetes.[17,19–22]

Implementing efforts to improve health status and measuring their impact requires suitable indicators and tools. The development of questionnaires as a tool to assess knowledge and attitude is important to support valid and reliable assessment. A good questionnaire must demonstrate good validity in measuring the desired components.[23] Previous studies have developed a knowledge, attitude, and practice prediabetes assessment (KAP-PAQ) questionnaire.[14,19] Another study was carried out on the management and obstacles related to KAP in prediabetes among community members and health workers.[15] In Indonesia, the development of the KAP questionnaire was carried out for individuals with diabetes mellitus.[24] However, the development of validity and reliability of prediabetes KAP instruments is still limited. Based on the background, the study aimed to develop a questionnaire as a tool to measure knowledge and attitude about prediabetes management.

METHODS

Research Design

A validity test was conducted using the descriptive study design. Content validity, face validity and reliability tests were carried out on questionnaires measuring knowledge and attitudes regarding prediabetes management. The study was carried out from July – September 2023. Content validity was analyzed using the content validity index (CVI) and multi-rater kappa statistics.[25]

Panelists and Respondents

Content validity involved 10 expert panelists in the fields of nutrition, public health, nutrition education, and behavior change While face validity involved 10 adult women respondents. The decision to include five panelists in the validity test was based on the standard minimum of panelists required, and this was increased to10 panelists to minimize the possibility of accidental agreement.[26] The reliability test and the pilot study were conducted on 30 adult women.[27] Sample determination was carried out by purposive sampling. Panelists and respondents were given an explanation related to the technical and research objectives, and then they filled out and signed the informant consent form.

Procedure

The questionnaire was developed from a literature review with similar articles and instruments.[9,11,14–16,19,24] The development of questionnaire statement items was based on a previous study about knowledge, attitude, and practice prediabetes assessment questionnaire (KAP-PAQ). The KAP-PAQ has been translated and modified with cultural adaptations, incorporating diabetes mellitus management and balanced nutrition guidelines.[14,19,28,29]

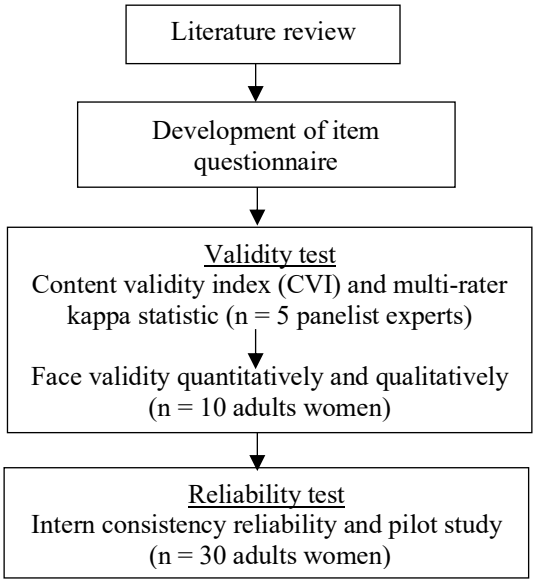

Figure 1. Step development of the questionnaire and item refinement

The questionnaire was developed based on guidelines for the development of knowledge, attitudes and practices instruments (KAP manual guideline).[30] The question items included the knowledge component consisting of 20 questions with one correct answer among four multiple-choice options, while the attitude items included the component consisting of 20 statement items with responses that indicated the level of respondents' agreement on statement items using the Likert scale. The development steps of the questionnaire are shown in Figure 1.

The psychometric properties were evaluated in terms of construct validity,

content validity, face validity and inter consistency reliability. In the validity test, respondents assessed whether the question items clear and relevant to prediabetes management theory. Assessments were given on a scale of 1- 4 for both clarity (unclear - very clear), and relevance (irrelevant - very relevant). Furthermore, the calculation of the content validity index (CVI) was carried out for clarity and relevance of each question item (I-CVI) that was obtained by summing up the number of experts who rated 3 or 4 for clarity or relevance of each question item and then dividing by the total number of experts. The recommended minimum score of I-CVI was not less than 0.78.[31]

The CVI value was adjusted using multi-rater kappa statistics to eliminate the possibility of increasing values due to chance agreement among experts.[25] The probability of change agreement (Pc) calculation was carried out before the calculation of kappa statistics that were classified as follows: values > 0.74 very good, 0.60 – 0.74 good and 0.40 – 0.59 sufficient.[32]

Face validity was carried out both qualitatively and quantitatively.[33] Quantitative assessment was carried out by asking respondents about the importance of question items based on their personal experience, using a five-point scale from 1 – 5 (not important – very important). The assessment results were used to calculate the impact score of each question. If the impact score value was equal to or greater than 1.5, then the question item was retained in the instrument.[33] While qualitative assessment was carried out by asking the level of understanding and the complexity of language used in the questionnaire.

Statistical Analysis

The validity of statement items was assessed by calculating the score of each statement with the total score. Analysis correlation was carried out using Pearson correlation. A statement item was valid if the coefficient correlation was greater than or equal to r-table (r table = 0.349) based on the degree of freedom (df) at a significant level of 5%. After the validity assessment, Cronbach's Coefficient Alpha (CCA) was used to measure the correlation between the items in the question and answer choices based on the Likert scale.[34] The value of coefficient reliability was recommended with a lower limit of 0.7.[35] If the value of coefficient reliability has not reached 0.7, the item with the largest Cronbach's value will be removed until the coefficient reliability increased to 0.6 for the knowledge aspect, and 0.7 for the attitude aspect.[36]

CVI and kappa statistical analysis was performed using Microsoft Excel, while Spearman and CCA correlation tests for reliability testing were analyzed using SPSS version 16. The research has passed the review of the health research ethics commission of the Faculty of Nursing and Health, University of Muhammadiyah Semarang number 094/KE/07/2023.

RESULTS

Content and Face Validity Analysis

Content validity was assessed quantitatively and qualitatively through the input of 10 panelists. These panelists provided suggestions and comments on aspects of clarity and relevance of questions based on the concept of prediabetes management. A total of 20 question items were compiled and the result of CVI analysis showed that 15 items had a value of < 0.78 in the aspect of clarity. Meanwhile, in the relevance aspect, only 1 question item had a CVI value < 0.78. Analysis of the clarity and relevance aspects of each question item based on kappa statistics showed 10 items in the low-

category including item numbers 1, 2, 3, 5, 6, 7, 8, 9, 17 and 19. Therefore, the question items were rearranged to improve the sentence structure based on the recommendations of the expert panelists. Table 1 shows the test validity analysis of the questionnaire component related to knowledge question items.

Table 1. Analysis of the content validity of the questionnaire aspect knowledge

Items	Number of clarity items agreement	CVI*	Pc**	Kappa statistic	Number of relevant items agreement	CVI*	Pc**	Kappa statistic	Interpretation
1	6	0,66	2,95312	-5,24	9	1	0,00098	0,99	Low
2	4	0,44	1771,87	-3543,3	8	0,88	0,00879	0,87	Low
3	5	0,55	70,875	-141,2	8	0,88	0,00879	0,87	Low
4	7	0,77	0,14062	0,49	9	1	0,00098	0,99	Good
5	6	0,66	2,95312	-5,24	9	1	0,00098	0,99	Low
6	6	0,66	2,95312	-5,24	9	1	0,00098	0,99	Low
7	5	0,55	70,875	-141,2	7	0,77	0,14062	0,49	Low
8	6	0,66	2,95312	-5,24	8	0,88	0,00879	0,87	Low
9	6	0,66	2,95312	-5,24	9	1	0,00098	0,99	Low
10	8	0,88	0,00879	0,87	8	0,88	0,00879	0,87	Excellent
11	8	0,88	0,00879	0,87	9	1	0,00098	0,99	Excellent
12	8	0,88	0,00879	0,87	9	1	0,00098	0,99	Excellent
13	7	0,77	0,14062	0,49	9	1	0,00098	0,99	Good
14	7	0,77	0,14062	0,49	9	1	0,00098	0,99	Good
15	8	0,88	0,00879	0,87	9	1	0,00098	0,99	Excellent
16	8	0,88	0,00879	0,87	9	1	0,00098	0,99	Excellent
17	5	0,55	70,875	-141,2	9	1	0,00098	0,99	Low
18	7	0,77	0,14062	0,49	9	1	0,00098	0,99	Good
19	5	0,55	70,875	-141,2	9	1	0,00098	0,99	Low
20	7	0,77	0,14062	0,49	9	1	0,00098	0,99	Good

*I-CVI: Items-Content validity index, **Pc: Probability of change agreement

Table 2. Analysis of the content validity test of the questionnaire aspect attitude

Items	Number of clarity items agreement	CVI*	Pc**	Kappa statistic	Number of relevant items agreement	CVI*	Pc**	Kappa statistic	Interpretation
1	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
2	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
3	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
4	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
5	8	0,727	5,800781	-10,87	10	0,909	0,010742	0,887	Low
6	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
7	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
8	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
9	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
10	10	0,909	0,010742	0,887	11	1	0,000977	0,998	Excellent
11	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
12	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
13	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
14	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
15	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
16	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
17	8	0,727	5,800781	-10,87	11	1	0,000977	0,998	Low
18	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
19	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent
20	11	1	0,000977	0,998	11	1	0,000977	0,998	Excellent

*I-CVI: Items-Content validity index, **Pc: Probability of change agreement

The analysis of the validity test for the attitude component of prediabetes management questionnaire is shown in Table 2. A total of 20 statement items were related to prediabetes management and the results of CVI analysis showed that 2 items had a value of < 0.78 in the aspect of clarity. In the relevance aspect, all statement items had a CVI value of > 0.78. Clarity and relevance aspects of each question item based on kappa statistics showed 2 low-category statement items, namely 5 and 17, while 18 items were rated as very good. Statement 5, pertains to the consumption of three main meals and two snacks as part of a regular diet. This is similar to statement 17, which advocates for exercises, such as walking for a minimum of 150 minutes every week.

Table 3. Clarity and simplicity of language as well as revision of questionnaire items statements

No items	Questionnaire items	Identify the ease and simplicity of the language	Interpretation and revision statements
Knowledge aspect			
1	Diabetes is also known as a disease.	Questions difficult to understand and do not contain question sentences	Added the sentence "what", becomes "what other terms are used for diabetes mellitus ?"
Attitude aspect			
10	Limiting consumption of salty foods (such as salted fish, instant noodles, crackers, citatos, and chips) is important to prevent degenerative and chronic diseases such as hypertension	Statement is complex and difficult to understand, negative statements need to be made to ensure that respondents will read well the statement items before giving a response	The statement changed to "Consumption of salty foods (such as salted fish, instant noodles, crackers, chips) does not need to be limited to prevent prediabetes or degenerative diseases"

After content validity analysis was conducted, a few question and statement items were improved, as shown in Table 3. Knowledge aspect showed a relatively low level of clarity for question items, where only 5 items had a CVI > 0.78. Meanwhile, the test kappa statistic showed a value < 0.40 for a total of 10 question items. This result showed that the level of chance agreement among the panelists was relatively high. Several items had low clarity levels due to the absence of question words, while answer options are very easy to recognize or have the same meaning options. In the aspect of attitude, statement items are relatively easy to understand, but two items were deleted due to language complexity. The kappa statistic showed low validity for certain statement items, specifically 5 and 17. Therefore, improvements were made to the questions and statement items of the prediabetes management questionnaire.

Table 4. Analysis of face validity (impact score) questionnaire knowledge and attitude of prediabetes management

Items	Important percentages (scores 4 and 5)	Average score of interests	Impact score	Interpretation
Knowledge aspect				
1,4,10,11	100	4,6	4,6	Items retained

Items	Important percentages (scores 4 and 5)	Average score of interests	Impact score	Interpretation
2, 5 – 9, 12, 14 - 16	90	4,1	3,6	Items retained
3, 13	80	3,8	3,0	Items retained
Attitude aspect				
16	100	4,4	4,4	Items retained
1, 3, 10, 13 – 15, 17, 18	90	4,2	3,7	Items retained
2, 4, 5, 7	80	3,9	3,1	Items retained
6, 8, 9, 11, 12	70	3,7	2,5	Items retained

Face validity analysis was carried out with adult women using the prepared questionnaires. In the knowledge aspect, there were only 16 questions items because 4 were excluded from the questionnaire. While the attitude aspect had 18 lists of statement items because 2 were excluded. The analysis of the face validity test is shown in Table 4.

Table 5. Validation items and Cronbach's alpha of questionnaire knowledge of management prediabetes

Items	r-items*	Significance (two-tailed)	cronbach's alpha	cronbach's alpha if the items is eliminated	Interpretation
1	0,581	0,001	0,642	0,575	Valid and reliable
2	0,378	0,039	0,642	0,627	Valid and reliable
3	0,588	0,001	0,642	0,614	Valid and reliable
4	-	-	-	-	Invalid
5	0,031	0,869	-	-	Invalid
6	0,530	0,003	0,642	0,591	Valid and reliable
7	0,379	0,039	0,642	0,617	Valid and reliable
8	0,307	0,099	0,642	0,669	Invalid and reliability increase when the items deleted
9	-0,108	0,571	-	-	Invalid
10	0,122	0,519	0,642	0,637	Invalid and reliability increase when the items deleted
11	0,412	0,024	0,642	0,556	Valid and reliable
12	0,643	0,000	0,642	0,626	Valid and reliable
13	0,347	0,060	-	-	Invalid
14	-0,144	0,447	0,642	0,643	Invalid and reliability increase when the items deleted
15	0,326	0,078	-	-	Invalid
16	0,205	0,278	-	-	Invalid

*Pearson correlation

Reliability Analysis

Reliability of the questionnaire was assessed for items assessing knowledge and attitude toward prediabetes management. This assessment included 16 questions items focusing on knowledge aspects. Item validity and reliability analyses were conducted by measuring the Pearson coefficient correlation and assessing interconsistency reliability, respectively. The analysis showed that several question items are valid based on r-value (Table 5).

Table 6. Validation items and Cronbach's alpha of questionnaire attitude of management prediabetes

Items	r-items*	Significance (two-tailed)	cronbach's alpha	cronbach's alpha when the items is eliminated	Interpretation
1	0,588	0,001	0,772	0,747	Valid and reliable

Items	r-items*	Significance (two-tailed)	cronbach's alpha	cronbach's alpha when the items is eliminated	Interpretation
2	0,613	0,000	0,772	0,746	Valid and reliable
3	0,408	0,025	0,772	0,746	Valid and reliable
4	0,144	0,448	0,772	0,771	Invalid
5	0,216	0,253	0,772	0,766	Invalid
6	0,209	0,267	0,772	0,768	Invalid
7	0,304	0,102	0,772	0,756	Invalid
8	0,242	0,197	0,772	0,766	Invalid
9	0,441	0,015	0,772	0,757	Valid and Reliable
10	0,834	0,000	-	-	Invalid and reliability increase when the items deleted
11	0,459	0,011	0,772	0,762	Valid and Reliable
12	0,276	0,140	0,772	0,777	Invalid
13	0,336	0,070	0,772	0,768	Invalid
14	0,161	0,395	0,772	0,763	Invalid
15	0,145	0,445	0,772	0,767	Invalid
16	0,167	0,377	0,772	0,770	Invalid
17	0,304	0,102	0,772	0,755	Invalid
18	0,316	0,089	0,772	0,755	Invalid

*pearson correlation

Table 7. The pilot study using questionnaire knowledge and attitude prediabetes management

Variable	Univariate analysis	
	n (%)	Mean±SD
Age (years)		40.1±5.2
Knowledge (score)		56.2±14.6
Attitude (score)		56.6±9.7
Marital status		
Married	29 (96.7)	
Others	1 (3.3)	
Ethnicity		
Gorontalonese	33 (100)	
Education level		
Elementary school	12 (40.0)	
Junior high school	8 (26.7)	
Senior high school	8 (26.7)	
University level	2 (6.7)	
Occupation		
Housewife	22 (73.3)	
Other	8 (26.7)	
Knowledge		
Poor knowledge (score ≤ 10)	22 (73.3)	
Average knowledge (score 11-15)	8 (26.7)	
Good knowledge (score (16-20)	0	
Attitude		
Negative attitude (score ≤ 23)	0	
Neutral attitude (score 24 – 51)	9 (30.0)	
Positive attitude (score ≥ 52)	21 (70.0)	

The analysis of item validity and reliability of the questionnaire regarding attitude aspects included 18 statement items. The analysis of item validity showed that several questions were valid, as determined by the respective coefficients correlation (r-value). Regarding reliability, Cronbach's coefficient alpha was calculated at 0.772 (Table 6). Some question items were found invalid and were removed, generally improving reliability. The pilot study indicated that levels of poor knowledge (73.3%) and positive attitude

(70.0%) were found among the respondents (Table 7).

DISCUSSION

Content and Face Validity

Questionnaire development began with a literature review, and then the questionnaire items were prepared based on KAP-PAQ with modifications based on cultural adaptation, diabetes mellitus management and balanced nutrition guidelines.[19,28] Cultural adaptation changes cultural sensitivity including surface level and deep structural elements to increase acceptability and its impact.[37] The questionnaire contains as many as 20 question items on the knowledge aspect and 20 statement items on the attitude aspect. The questionnaire has been prepared for psychometric analysis in terms of construct, content and face validity, and also inter consistency reliability.

The content validity aimed to measure the items of the questionnaire that are relevant and representative of the concept being measured.[38] Content validity was carried out quantitatively and qualitatively. The qualitative assessment was carried out by panelist experts who provided comments and relevant indicators about prediabetes management, even though the qualitative validity tends to be subjective.[39,40] The quantitative assessment was developed by assigning a score to every statement item based on the aspects of clarity and relevance.[25]

The analysis of the content validity of the questionnaire with the CVI > 0.78 showed only 5 items in the aspect of clarity and 19 items in the aspect of relevance. The CVI value was further clarified with a multi-rater kappa statistic to reduce accidental agreement among panelists during the questionnaire completion.[25,41] A kappa statistic value < 0.40 for 10 items showed a low category, a value between 0.40 and 0.59 for 5 items indicated a moderate category, and a value > 0.74 for 5 items showed a very good category in the clarity aspect. In the aspect of relevance, all items of the questionnaire with kappa statistic > 0.74 were classified as very good.[32] This classification showed that the items related to the knowledge aspect of prediabetes management in the clarity level need to be improved according to the panelists' recommendations and comments. The results of the content validity analysis of the attitude aspect showed CVI > 0.78, with 18 statement items in the clarity aspect and 20 statement items in the relevant aspect.

Face validity was carried out through qualitative assessment using interviews by asking respondents their level of understanding regarding question items and the complexity of the language used. Complex questions were revised when the material was found to be difficult to understand. Quantitative face validity analysis showed a score > 1.5, suggesting that the question items were retained.[33] The qualitative assessment related to respondents evaluation showed that the number of questions was considerably large. Therefore, it was recommended to reduce the number of question items that have similar meanings. Face validity assessment in the knowledge aspect showed that the use of language was difficult to understand, leading to the revision of question items. The attitude aspect showed good acceptance among respondents because the language used was relatively easy to understand. The simplicity and easy understanding of the statement items were part of the important components for target respondents.[42]

Reliability Analysis

Item validity analysis and reliability testing of the questionnaire were conducted on 30 adult women.[31] The result showed 7 and 5 valid items in knowledge and attitude aspects, respectively. The responses of the respondents were inconsistent for items with the same meaning.[43] Afterward, the

questionnaire was tested for reliability, yielding Cronbach's alpha scores of 0.642 and 0.772 respectively for knowledge and attitude. A total of 4 questions and two statement items were deleted to improve the reliability score. Contrary to study results on validity and reliability of knowledge, attitude, and practice (KAP) among diabetics, internal consistency, Pearson correlation, and factor analysis showed validity in 16 knowledge aspects (Cronbach's Alpa = 0.597 and r value = 0.344). Validity was also shown in 23 attitude aspects (Cronbach's Alpa = 0.777 and r value = 0.361). The KAP questionnaire focusing on blood glucose control was found valid and reliable.[24] Similarly, the validity test of the Asian Diabetes Quality of Life questionnaire showed a significant correlation (p-value ≤ 0.05) between each question's score and the total score of the questionnaire. The correlation shows a strong range (r = 0.496 – 0.856) and Cronbach's alpha reliability test value was consistently ≥ 0.70.[44] The validity and reliability tests for the Summary of Diabetes Self-Care Activities (SDSCA) had a CVI value and Cronbach's alpha of 0.98 and 0.72, respectively.[45]

The pilot study indicates a low level of knowledge among respondents. So, the development of interventions to improve knowledge is important to prevent diabetes mellitus. Lifestyle interventions aimed at overcoming obesity and physical activity were effective in reducing the progression of prediabetes to type 2 diabetes mellitus by 58%.[2,46]

The development of questionnaires was important as a basis for determining the educational intervention methods for prediabetes. Nutrition education program interventions could improve knowledge, attitude, and practice scores.[17,19,21] The studies highlight the positive role of regulating diet and physical activity in preventing prediabetes and subsequently diabetes mellitus.[47,48] This study included content, face, and item validity, as well as reliability, which were carried out directly with respondents. However, the limitation of the study was the relatively low number of respondents compared to other similar development questionnaires.

RECOMMENDATION

The questionnaire on knowledge and attitude regarding prediabetes management was valid and reliable. The questionnaire can be used to measure prediabetes management. However, the psychometric validation process with a larger population and the development of test-retest reliability are important to ensure the attainment of satisfactory levels of validity and reliability for the questionnaire. Further studies need to include longitudinal analyses and cross-cultural adaptations to enhance the applicability and validity of the questionnaire in diverse populations. Collaborative research and dissemination of findings need to be carried out periodically as part of the continuous evaluation and improvement of the study. A valid and reliable questionnaire can assess knowledge and attitudes well, so effective education interventions and health promotion campaigns can be integrated into clinical practice to prevent the progression of prediabetes.

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