Research article

# Validation of the Diabetes Knowledge Questionnaire (DKQ) With an Indonesian Population

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**Abstract.**
Patient education is a key element in the treatment of diabetes. Assessment of diabetes knowledge is important for optimum treatment, and for the assessment of this knowledge, a validated tool is essential. No such tool is available in the Indonesian language. The aim of this study was to translate and examine the psychometric properties of the Indonesian version of the 24-item Diabetes Knowledge Questionnaire (DKQ) among type 2 diabetes patients. The standard 'forward–backward' process was used to translate the DKQ into the Indonesian language. Later, it was validated with a convenience sample of 35 patients with type 2 diabetes, between July and September 2021. Internal consistency was assessed by reliability analysis; one-way analysis of variance was applied for known group validity; and multivariate linear logistic regression was applied for identifying significant predictors for patients' DKQ score. Good internal consistency was observed for the DKQ (Cronbach's $\alpha$ = 0.757). The results indicated that the Indonesian version of the DKQ-24 was a valid and reliable measuring instrument for measuring diabetes knowledge in the Indonesian sample.

**Keywords:** diabetes knowledge questionnaire, intraclass correlation coefficient, internal consistency, test-retest, validity, reliability

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# 1. INTRODUCTION

Diabetes Mellitus is a chronic disease characterized by complex hyperglycemia that requires continuous medical care with reduced risk of complications and multifactorial risks beyond glycemic control [1]. Improving methods and strategies for evaluating diabetes patient education interventions has been increasing advocated by both provider and consumer organizations globally [1]–[6]. To assess the patients' diabetes knowledge, Diabetes Knowledge Questionnaire (DKQ) has been developed by the Starr County Diabetes Education Study. DKQ was developed in English language and has been translated and validated in many languages, but it has not been translated and validated in Indonesia [4].

The original DKQ is a 60-item instrument developed by Villagomez [6] in association with project investigators (S.A.B., C.L.H.). When devising the items, the instruments' authors took into account that the average educational level for Starr County residents was sixth grade and that a large portion of the population was unable to read because of visual impairments or illiteracy. Items were written in simple language to aid translation into the style of Spanish used by this population. Questions were written in a manner that could easily be read aloud to all study participants [6]. The instrument was first translated using regional native and bilingual speakers and licensed translators and was then back translated for accuracy and clarity. To avoid difficulties previously reported with using Likert-type scales with Mexican-Americans [2], potential response choices for the DKQ were 1) Yes, 2) No, and 3) I don't know. Items were scored as correct or incorrect, and the correct items were summed to attain a total score. Content validity of the items was established by a panel of experienced nurses and researchers familiar with diabetes related issues of Mexican-Americans [6]. Initial reliability of the 60-item DKQ was established in 1989 with 60 Mexican Americans with type 2 diabetes who resided in Starr County (r = 0.88) [2],[6].

Therefore, study aim was to translate and validate DKQ among T2DM patients in Bahasa language in Indonesia, as Bahasa is the national language of Indonesia and is widely spoken by its population, so that by translating it into Indonesian, researchers, especially Indonesian people, will more easily understand the meaning of the instrument so that it will not cause misinterpretation of the meaning of the research instrument. Besides the research instrument being translated into Indonesian, it is also necessary to test the validity so that the questionnaire is truly able to measure what should be measured and will not measure anything other than what the questionnaire should measure so that the results obtained from measurements with the questionnaire is valid or valid..

## 2. METHODS

The research method used was cross-cultural adaptation and was tested for validity and reliability. The validity that was tested was the validity of the content, which was then tested for the reliability of the questionnaire on valid questionnaire items using SPSS 23 through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). This research was conducted in Tegal Central Java with thirty-five samples participating in this study and filling out the questionnaire directly. Questionnaire DKQ-24 (Diabetes Knowledge Questionnaire) is a questionnaire about the patient's knowledge about

diabetes mellitus. The list of questions DKQ-24 (Diabetes Knowledge Questionnaire) contains 24 question items with correct answer choices (4,16), wrong answers and don't know (0). The method of measuring the DKQ-24 questionnaire is to add up all the questions from no. 1-24 with a category of <55, namely lack of knowledge, 56-75 sufficient knowledge, and 76-100 good knowledge. Instructions for filling out DKQ-24 by ticking (v) in the column provided. For correct answers, a score of 4.16 is given, and if the answers are incorrect and do not know the score is 0. Some of the statements in the questionnaire are correct and some statements are wrong, all questions must be answered with one choice.

# 3. RESULT AND DISCUSSION

The DKQ-24 questionnaire was back-translated to bahasa.

Based on table 1 above, it can be illustrated that most of the respondents are female, namely 21 people (60%). Respondents have an average age of 54.93 years. Most of them have elementary education as many as 27 people (48.6%). While university education is 1 person (2.9%).

Most of the respondents were self-employed 15 people (42.9%) and 13 people did not work (37.1%). Most of them have married marital status as many as 29 people (82.9%). Most of the caregivers are their children, namely 20 people (5719%). Respondents had the lowest average length of suffering from DM, namely 0.3 years, while the longest suffering from DM was 10.2 years.

## 3.1. Construct validity

The Kaiser-Meyer-Olkin (KMO) value was 0,362, and the Bartlett's test of sphericity value was $X^2$= 428.144 (df = 276 , *p <0.000* ). Both KMO and Bartlett's test results indicate that the data had sampling adequacy and could be analyzed using EFA [7]. The factor loadings for each item ranged from 0,723 to 0,995.

Parametric statistical test is a test whose model applies the assumptions (conditions). The requirements in parametric statistical tests are that the data used must meet classical assumptions such as the assumption of data normality. The data normality assumption test that is often used is the Kolmogorov Smirnov data normality test and the Saphiro Wilk data normality test. The Kolomogorov Smirnov data normality test is used if the sample is greater than or equal to 50. Meanwhile, the Saphiro Wilk data

Table 1: Description of Respondents Characteristics.

| Characteristics of Respondents | Total | |
| --- | --- | --- |
| | F | % |
| Man | 9 | 25,7 |
| Woman | 26 | 74,3 |
| Age | | |
| mean | 54,93 | |
| median | 57,11 | |
| Range | 53,9 | |
| Minimum | 22,1 | |
| Maximum | 76,0 | |
| Education | | |
| SD | 17 | 48,6 |
| junior high school | 9 | 25,7 |
| senior High School | 8 | 22,9 |
| PT | 1 | 2,9 |
| Work | | |
| Does not work | 13 | 37,1 |
| Work | 0 | 0,0 |
| Farmer | 5 | 14,3 |
| entrepreneur | 15 | 42,9 |
| civil servant | 1 | 2,9 |
| Retired | 1 | 2,9 |
| Marital status | | |
| Widow widower | 6 | 17,1 |
| Marry | 29 | 82,9 |
| Caring family | | |
| Child | 20 | 57,1 |
| Mother father | 3 | 8,6 |
| Husband | 4 | 11,4 |
| Wife | 8 | 22,9 |
| Long Suffering DM | | |
| mean | 2,6 | |
| median | 2,3 | |
| Range | 9,9 | |
| Minimum | 0,3 | |
| Maximum | 10,2 | |

normality test is used if the sample size is less than 50. The data is said to be normally distributed if the p-value is alpha (0.05).

TABLE 2: KMO and Bartlett's Test Diabetes Knowledge Questionnaire (DKQ)

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | Bartlett's Test of Sphericity Approx. Chi-Square | df | Sig. |
|---|---|---|---|
| .362 | 428.144 | 276 | .000 |

TABLE 3

| Communalities | | |
|---|---|---|
| | Initial | Extraction |
| VAR00002 | 1.000 | .730 |
| VAR00003 | 1.000 | .814 |
| VAR00004 | 1.000 | .684 |
| VAR00005 | 1.000 | .722 |
| VAR00006 | 1.000 | .689 |
| VAR00007 | 1.000 | .740 |
| VAR00008 | 1.000 | .839 |
| VAR00009 | 1.000 | .789 |
| VAR00010 | 1.000 | .717 |
| VAR00011 | 1.000 | .633 |
| VAR00012 | 1.000 | .801 |
| VAR00013 | 1.000 | .699 |
| VAR00014 | 1.000 | .760 |
| VAR00015 | 1.000 | .784 |
| VAR00016 | 1.000 | .767 |
| VAR00017 | 1.000 | .866 |
| VAR00018 | 1.000 | .632 |
| VAR00019 | 1.000 | .821 |
| VAR00020 | 1.000 | .677 |
| VAR00021 | 1.000 | .818 |
| VAR00022 | 1.000 | .704 |
| VAR00023 | 1.000 | .833 |
| VAR00024 | 1.000 | .603 |
| VAR00025 | 1.000 | .763 |

Extraction Method: Principal Component Analysis.

Based on the results of the normality analysis of the data as shown in table 4 above, it can be seen that the p-value of knowledge about DM (DKQ-24) has a p-value of > 0.05. This means that the data on knowledge about DM (DKQ-24) is normally distributed.

Based on the table, it is known that of the 24 items of patient knowledge statements about DM (DKQ-24) after the validity test of the statement items was carried out, all statement items were declared valid. This can be seen from the p-value of all question items < alpha (0.05).

TABLE 4

| Total Variance Explained | | | | | | |
|---|---|---|---|---|---|---|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 4.741 | 19.753 | 19.753 | 4.741 | 19.753 | 19.753 |
| 2 | 2.570 | 10.710 | 30.463 | 2.570 | 10.710 | 30.463 |
| 3 | 2.376 | 9.900 | 40.363 | 2.376 | 9.900 | 40.363 |
| 4 | 2.103 | 8.761 | 49.124 | 2.103 | 8.761 | 49.124 |
| 5 | 1.888 | 7.866 | 56.990 | 1.888 | 7.866 | 56.990 |
| 6 | 1.737 | 7.237 | 64.227 | 1.737 | 7.237 | 64.227 |
| 7 | 1.391 | 5.795 | 70.022 | 1.391 | 5.795 | 70.022 |
| 8 | 1.081 | 4.505 | 74.528 | 1.081 | 4.505 | 74.528 |
| 9 | .908 | 3.782 | 78.310 | | | |
| 10 | .891 | 3.714 | 82.024 | | | |
| 11 | .769 | 3.205 | 85.229 | | | |
| 12 | .692 | 2.883 | 88.112 | | | |
| 13 | .679 | 2.829 | 90.941 | | | |
| 14 | .493 | 2.054 | 92.996 | | | |
| 15 | .364 | 1.516 | 94.511 | | | |
| 16 | .334 | 1.392 | 95.903 | | | |
| 17 | .232 | .965 | 96.869 | | | |
| 18 | .224 | .934 | 97.803 | | | |
| 19 | .176 | .734 | 98.536 | | | |
| 20 | .136 | .567 | 99.103 | | | |
| 21 | .082 | .343 | 99.446 | | | |
| 22 | .063 | .262 | 99.708 | | | |
| 23 | .040 | .165 | 99.873 | | | |
| 24 | .031 | .127 | 100.000 | | | |

Extraction Method: Principal Component Analysis.

If the measuring instrument has been declared valid, then the reliability of the measuring instrument is tested, one of the test tools is using the Cronbach Alpha technique. The limit value used to assess the acceptable level of reliability is above 0.70. If the value is below 0.70 then the questionnaire questions asked are not reliable.

Based on the results of the reliability test as shown in table 4, it was found that all research variables were reliable because the Cronbach's alpha value was above the standard value of 0.7. This means that if the questionnaire is used as a research instrument, it will get the correct or consistent answer. It means that when the instrument is repeated on the same respondent it will produce almost the same answer as the previous answers.
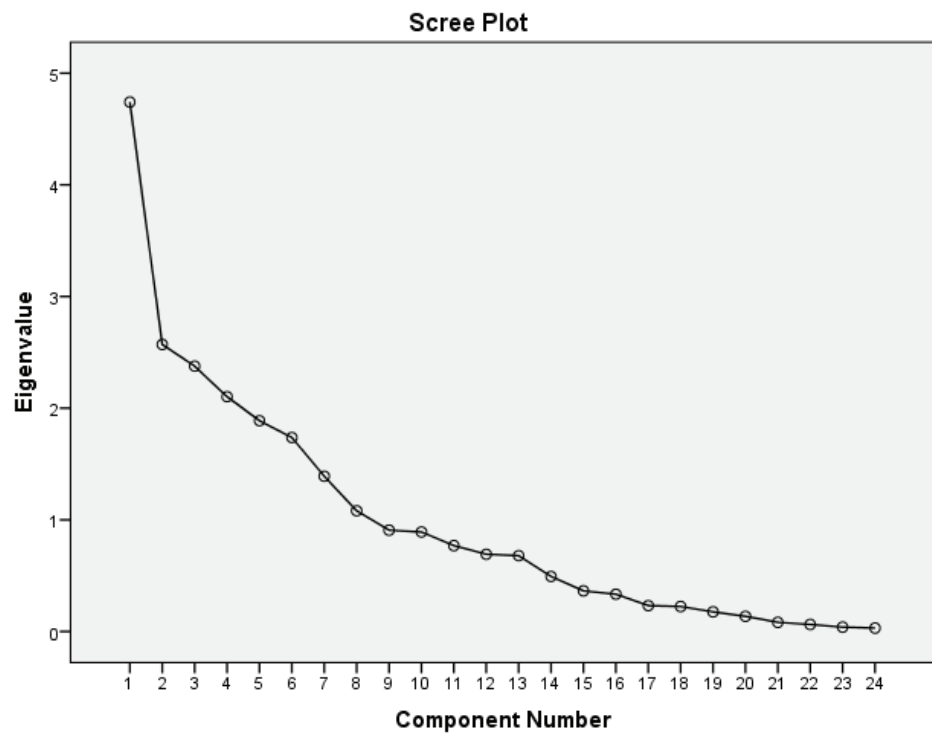
**Figure** 1

## 4. CONCLUSION

The Patient Knowledge Statement Questionnaire about DM (DKQ-24) has acceptable validity when assessing the level of knowledge in adults with diabetes mellitus. It means that the questionnaire item about DM (DKQ 24) which consists of 24 items is really able to measure or be able to describe the level of knowledge of type 2 DM patients.

## AcknowledgMENTS

## CONFLICT OF INTEREST

No Conflict of Interest

TABLE 5

| | Component Matrix$^a$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Component | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| VAR00009 | .723 | -.243 | -.129 | .116 | -.316 | .200 | -.192 | |
| VAR00025 | .657 | .118 | | | -.290 | | -.199 | -.438 |
| VAR00006 | .604 | -.392 | | .238 | -.303 | | | -.137 |
| VAR00024 | .490 | .486 | -.232 | | -.217 | -.144 | | |
| VAR00018 | .486 | .195 | .388 | .276 | | -.281 | -.228 | |
| VAR00022 | .477 | -.297 | -.122 | | .394 | -.179 | -.333 | .272 |
| VAR00016 | .451 | .419 | .226 | -.283 | -.139 | .354 | .289 | -.171 |
| VAR00014 | .252 | .589 | | -.426 | -.257 | .303 | | |
| VAR00013 | .481 | -.559 | .133 | | | -.243 | .272 | |
| VAR00007 | .344 | -.522 | | -.422 | | .403 | | |
| VAR00017 | .253 | | .691 | -.163 | -.125 | | -.523 | |
| VAR00008 | .141 | .543 | -.603 | .330 | | -.228 | | |
| VAR00004 | .449 | | -.576 | -.228 | -.232 | -.199 | | |
| VAR00019 | .435 | .380 | .504 | .194 | .401 | | | .159 |
| VAR00023 | .459 | -.152 | -.504 | | .421 | .132 | -.369 | |
| VAR00021 | .371 | | .122 | .645 | .255 | .231 | .283 | -.221 |
| VAR00011 | .279 | .264 | .330 | .536 | -.214 | | .129 | .161 |
| VAR00010 | .360 | .316 | .185 | -.492 | .396 | | -.214 | |
| VAR00020 | .427 | -.180 | | -.438 | .371 | -.168 | .296 | -.128 |
| VAR00015 | .484 | .267 | | | .493 | | .451 | .161 |
| VAR00012 | .345 | -.299 | .274 | -.111 | -.486 | -.102 | .334 | .384 |
| VAR00002 | .237 | -.190 | -.257 | .342 | | .671 | | |
| VAR00003 | .531 | | | | | -.669 | .167 | -.228 |
| VAR00005 | .446 | | -.300 | -.105 | -.143 | | | .625 |

Extraction Method: Principal Component Analysis.

a. 8 components extracted.

TABLE 6: Normality Test Results of Research Variable Data.

| Variabel | Kolmogorov-Smirnov$^a$ | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Tingkat Pengetahuan tentang DM (DKQ-24) | .152 | 35 | .089 | .966 | 35 | .340 |

# References

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TABLE 7: Test Results of Validity of Patient Knowledge Statements about DM (DKQ-24).

| item | Question | Validity Test Results | | |
|---|---|---|---|---|
| | | r | p-value | Ket. |
| 1 | Eating too much sugar and other sweet foods is a cause of diabetes | .786** | 0,000 | valid |
| 2 | The usual cause of diabetes is lack of effective insulin in the body | .504** | 0,005 | valid |
| 3 | Diabetes is caused by failure of the kidneys to keep sugar out of the urine. | .425* | 0,019 | valid |
| 4 | Kidneys produce insulin. | .705** | 0,000 | valid |
| 5 | In untreated diabetes, the amount of sugar in the blood usually increases. | .571** | 0,001 | valid |
| 6 | If I am diabetic, my children have a higher chance of being diabetic | .779** | 0,000 | valid |
| 7 | Diabetes can be cured. | .715 | 0,000 | valid |
| 8 | A fasting blood sugar level of 210 is too high | .601** | 0,000 | valid |
| 9 | The best way to check my diabetes is by testing my urine. | .696** | 0,000 | valid |
| 10 | Regular exercise will increase the need for insulin or other diabetic medication. | .772** | 0,000 | valid |
| 11 | There are two main types of diabetes: Type 1 (insulin-dependent) and Type 2 (non-insulin-dependent) | .671** | 0,000 | valid |
| 12 | An insulin reaction is caused by too much food. | .720** | 0,000 | valid |
| 13 | Medication is more important than diet and exercise to control my diabetes. | .669** | 0,000 | valid |
| 14 | Diabetes often causes poor circulation | .625** | 0,000 | valid |
| 15 | Cuts and abrasions on diabetics heal more slowly | .834** | 0,000 | valid |
| 16 | Diabetics should take extra care when cutting their toenails. | .730** | 0,000 | valid |
| 17 | A person with diabetes should cleanse a cut with iodine and alcohol. | .803** | 0,000 | valid |
| 18 | The way I prepare my food is as important as the foods I eat. | .852** | 0,000 | valid |
| 19 | Diabetes can damage my kidneys. | .600** | 0,000 | valid |
| 20 | Diabetes can cause loss of feeling in my hands, fingers, and feet. | .618** | 0,000 | valid |
| 21 | Shaking and sweating are signs of high blood sugar. | .628** | 0,000 | valid |
| 22 | Frequent urination and thirst are signs of low blood sugar. | .711** | 0,000 | valid |
| 23 | Tight elastic hose or socks are not bad for diabetics | .904** | 0,000 | valid |
| 24 | A diabetic diet consists mostly of special foods. | .485** | 0,007 | Valid |

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TABLE 8: Reliability Test of Patient Knowledge Statements about DM (DKQ-24).

| No | Variable | Alpha Cronbach''s value | Standart | Information |
|---|---|---|---|---|
| 1 | Patient knowledge about diabetes mellitus (DKQ-24) | 0,757 | Minimal 0,7 | Reliabel |

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