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ORIGINAL ARTICLE

The Reliability and Validation of the Turkish Version of the Asthma Self-Management Knowledge Questionnaire

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Abstract

OBJECTIVES: There is no validated questionnaire in Turkish to assess asthma knowledge. In this study, we aimed to evaluate the reliability and validity of the Turkish version of the Asthma Self-Management Knowledge Questionnaire (AKQ) among asthmatic adults.

MATERIAL AND METHODS: The AKQ was translated into Turkish by two medical-text translators, followed by back translation and final review by two clinicians with experience in asthma management. The Turkish Asthma Self-Management Questionnaire was then applied to 202 adult asthma patients, and additional demographic and clinical features of the patients were collected for analysis.

RESULTS: The internal reliability of the 24-item AKQ was not high (Cronbach's alpha=0.55). Tukey's test of additivity was significant ($p<0.001$). This result revealed that all questions are consistent and measure the same concepts. Factor analysis demonstrated a probable structure of 10 factors that together explained 63.7% of total variance in results. Intra-class reliability of the AKQ was quite high.

CONCLUSION: This study shows that AKQ seems to be a suitable instrument to evaluate the effect of different components of asthma knowledge - such as triggers, medications, asthma exacerbations, and avoidance measures - in adult asthmatics.

KEYWORDS: Asthma, adult asthma knowledge, asthma knowledge questionnaire, validity, reliability

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INTRODUCTION

Effective asthma management necessitates the development of a partnership between the patient and the health care provider [1]. A possible barrier for this partnership, and thus a risk for inadequate asthma control, might be insufficient understanding of asthma and its management by the patients. The improvement of asthma knowledge is one of the main objectives of asthma management, and asthma education has been found to be effective in adult asthmatics [1,2]. Many asthma education programs use validated asthma knowledge questionnaires to measure the effectiveness of the program [3,4]. Through a recent study from Turkey, we have learned that the percentage of controlled adult asthmatics ranges between 3%-39% [5]. The control level was lower in the eastern-southeastern part of the country where asthma patients tend to have lower socioeconomic status and education level compared to the western parts of the country. Because of the low asthma control levels in Turkey, we need to evaluate the level of asthma knowledge in different regions of Turkey to improve the national asthma management program. However, there are no convenient tools for evaluating such knowledge.

Schaffer and Yarandi [6] developed a questionnaire measuring asthma knowledge among asthmatics in 2007, referred to as the Asthma Self-Management Knowledge Questionnaire (AKQ) (Appendix 1). This questionnaire includes 24 items about general asthma knowledge, asthma medications, asthma exacerbations, and environmental triggers, with responses of "true" or "false". A score of one point is given for each correct answer, and the total score indicates the patient's knowledge of asthma. Even it is a useful questionnaire, it has not been previously validated in a language other than English. In this study, we aimed to establish the reliability and the validity of the AKQ when applied to Turkish adults. Additionally, we expected that by developing a suitable questionnaire adapted to the Turkish language it would be possible to more

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accurately determine the low health literacy among Turkish asthma patients, which is one of the main barriers to better asthma control in Turkey.

MATERIAL AND METHODS

Study Design and Population

The study was approved by Medeniyet University and Göztepe Training and Research Hospital's medical ethics committee, and written informed consent was obtained from the participants. Informed consent of illiterate patients was obtained in the form of a fingerprint signature after providing oral information. Illiteracy was defined as the inability to read and write due to the lack of a formal education.

The study was conducted in the Adult Allergy Department of Medeniyet University. Adults were eligible if they had been diagnosed with asthma by a physician at least 6 months prior to the study. Asthma was diagnosed according to the criteria of the Global Strategy for Asthma Management and Prevention by the Global Initiative for Asthma [1]. Patients were excluded if they had a diagnosis of a psychiatric disorder or any severe uncontrolled comorbidity such as heart failure, dementia, hemiplegia, malignant diseases, or liver or renal failure. We consecutively enrolled adult asthma patients (18 years or older) to the study. At baseline, self-reported data including demographic (age, gender, occupation) and clinical characteristics (symptoms, the onset of asthma, smoking history, the history of atopy and familial atopy, the medications used for asthma, asthma severity, Asthma Control Test (ACT) scores, comorbidities, and additional allergic disease) were recorded [1,6].

AKQ and the Translation into Turkish

The AKQ was originally developed to assess patient knowledge of asthma [4]. The questionnaire provides information about the patient's general knowledge of asthma, environmental factors, asthma medications, triggering factors, exacerbating factors, symptom frequency, nighttime awakenings, and activity limitation due to respiratory symptoms in the last four weeks. [4] Permission was obtained from the authors of the original questionnaire for the Turkish validation.

This questionnaire included 24 questions to determine asthma knowledge, and each was answered as "true" or "false" [Appendix]. The option of "I don't know" was added to rate the lack of knowledge. A correct answer was scored as 1, and an "I don't know" response or a wrong answer was scored as 0. The sum of these items gives the total score, which ranges from 0 to 24. The higher scores indicate better asthma knowledge, and there is no specific cut-off for defining a low level of asthma knowledge. All questionnaire data were collected by the same physician through face-to-face interviews, and the total scores were recorded. After receiving permission from the authors of the AKQ, two independent certified translators translated the questionnaire from English to Turkish. During the process, they were blinded to each other's work. Two allergists examined the Turkish translations and selected one of the translated texts. That text was compared with the original text by another independent observer, and back translation was carried out by a third translator with no previous knowledge of the original document.

Table 1. Demographic characteristics and clinical features of the patients

Variables	n (%) or Mean±SD
Age (years)	52±15
Female	173 (85)
Education	
Illiterate	13 (6.7)
Elementary school	99 (51.3)
High school	39 (20.2)
University, master's degree, or PhD	42 (21.7)
Smoking	
Active smoker	2 (1.4)
Never smoker	109 (74.1)
Ex-smoker	24 (16.3)
Asthma severity	
Mild	61 (41.5)
Moderate	59 (40.1)
Severe	23 (15.6)
Asthma Control Test	
Uncontrolled (<20)	101 (50.8)
Partly or well-controlled	98 (49.2)
BMI (kg/m^2)	29.6±5.9
FEV_1 (L)	2±0.7
FEV_1 / FVC (%)	79±9.1

SD: standard deviation; BMI: Body Mass Index; FEV1: force expiratory volume in 1 second; FVC: forced vital capacity

Sample Size

Use of factor analysis requires 5-10 participants for each item of the questionnaire [7]. Therefore, we ended the study after enrolling 202 participants.

Statistical Analysis

Descriptive analysis (mean, median, standard deviation, minimum, maximum) was used for evaluating continuous data. To describe categorical variables, frequencies (n) and percentages (%) were used. We used the split-half method and calculated Cronbach's alpha coefficient to assess the reliability of the questionnaire. In the validation study, an identical factor analysis was performed to ensure the stability of the AKQ domain structure. The preliminary tests for factor analysis included the Kaiser-Meyer-Olkin test (for the adequacy of the sample size) and Bartlett's test (for sphericity). Factor analysis was based on principal component analysis. Rotation was done with the varimax method. Statistical calculations were performed with Statistical Package for Social Sciences version 18.0 (IBM Corp.; Armonk, NY, USA). In our analyses, $p<0.05$ indicated statistical significance.

RESULTS

Study Population

A total of 202 adults (85% female) with a mean age of 52±15 years were included in the study. Six percent of those enrolled were illiterate. Forty-nine percent of them were partly or well controlled according to the ACT results. The demographic characteristics and clinical features of the patients are presented in Table 1. For the allergic comorbidities, our patients

Table 1. Demographic characteristics and clinical features of the patients

Factors										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Question 1	0.266	0.468	-0.342	0.027	-0.228	-0.099	-0.047	0.286	0.047	-0.080
Question 2	-0.095	0.723	-0.110	0.234	0.077	0.076	-0.038	-0.233	0.027	-0.044
Question 3	-0.060	0.696	0.164	-0.084	-0.012	0.022	0.283	0.143	0.098	-0.024
Question 4	-0.018	0.025	0.724	0.160	-0.083	0.040	0.137	0.037	0.043	-0.077
Question 5	0.078	-0.042	0.146	0.721	-0.097	0.010	0.155	0.091	-0.092	0.031
Question 6	-0.150	-0.087	-0.563	0.300	0.102	0.019	0.135	0.033	0.509	0.014
Question 7	-0.232	0.275	-0.182	0.169	0.010	0.179	0.537	0.173	-0.042	0.208
Question 8	0.028	0.251	0.059	0.645	0.280	-0.042	-0.092	0.139	0.131	-0.013
Question 9	-0.110	0.345	-0.093	-0.201	0.295	0.430	-0.031	-0.049	0.152	0.370
Question 10	-0.317	0.206	-0.321	0.056	0.002	-0.449	0.243	-0.039	0.277	0.267
Question 11	-0.100	0.084	0.045	-0.006	0.034	0.775	0.033	0.100	0.084	0.077
Question 12	-0.001	0.036	0.059	0.024	0.092	-0.070	0.822	-0.027	0.066	-0.057
Question 13	-0.115	0.222	0.009	-0.260	0.413	-0.426	0.000	0.348	-0.019	0.166
Question 14	0.057	0.137	-0.036	0.154	0.764	-0.046	0.087	-0.155	0.025	0.058
Question 15	0.000	-0.269	-0.092	-0.055	0.628	0.154	0.036	0.122	-0.092	-0.237
Question 16	-0.134	-0.050	-0.029	0.120	-0.110	0.224	0.142	0.745	-0.025	-0.001
Question 17	-0.737	0.018	0.064	-0.130	-0.046	0.176	0.109	0.002	0.117	0.102
Question 18	0.742	0.003	0.086	0.081	-0.027	0.000	-0.103	-0.105	-0.008	0.003
Question 19	0.536	-0.104	0.009	-0.223	0.060	0.123	0.226	0.257	0.146	-0.072
Question 20	0.419	-0.095	-0.219	-0.047	-0.155	0.187	0.199	0.066	0.390	0.422
Question 21	0.011	-0.133	0.600	0.235	0.004	0.027	-0.248	0.062	0.305	0.228
Question 22	-0.002	0.162	0.147	-0.060	-0.042	0.059	0.014	0.053	0.787	-0.109
Question 23	0.285	0.055	0.154	0.227	0.121	-0.217	-0.172	0.604	0.199	0.038
Question 24	-0.108	-0.069	0.053	0.039	-0.053	0.014	-0.013	0.019	-0.122	0.841

Method: Principal Component Analysis

Rotation: Varimax with Kaiser Normalization using 45 iterations.

reported having allergic rhinitis (77.7%), drug hypersensitivity (16.3%), urticaria (5.4%), bee venom allergy (3.5%), and atopic dermatitis (2%). The majority of our patients (86%) were reported to have late-onset asthma.

Statistical Analysis

Reliability

Internal consistency

Cronbach's alpha of the Turkish version of the AKQ was calculated as 0.555. Tukey's test of additivity was significant ($p<0.001$). This result revealed that all questions are consistent and measure the same concepts.

Intra-class consistency

The use of the test-retest method to assess intra-class consistency might bias the results. To avoid this bias, the split-half method was used, and the Spearman-Brown coefficient between the first 12 questions and the last 12 questions was calculated. The coefficient was 0.795, and this shows that the intra-class reliability of the Turkish version of the AKQ is quite high.

Validity

Content validity

Each question of the Turkish version the AKQ was scored by three pulmonologists between 1 and 4 for content validity.

4: The item is efficient in explaining the content of the questionnaire.

3: The item is efficient in explaining the content of the questionnaire, but it needs minor changes.

2: The item is confusing and should be revised.

1: The item is irrelevant to the content of the questionnaire.

The mean score was 3.61±0.3.

Construct validity

Based on the patient's preference, a "true" response was scored as 1; an "I don't know" response was scored as -2; and a "false" response was scored as 0. The construct validity of the questionnaire was evaluated using this coding system. The score for the Kaiser-Meyer-Olkin test was 0.577, and the

Table 3. Components of the Asthma Self-Management Knowledge Questionnaire

Components	Name	Question Number
Component 1	Environment	17;18;19
Component 2	General knowledge of asthma	1; 2; 3
Component 3	Triggers and treatment	4; 6; 21
Component 4	Asthma exacerbation	5; 8
Component 5	Usage of inhalers	14; 15
Component 6	Medications	9; 10; 11; 13
Component 7	Other	7; 12
Component 8	Knowledge about inhalers	16; 23
Component 9	Sleep hygiene	22
Component 10	Avoiding exacerbation, treatment for exacerbation	20; 24

diagonal values of the anti-image correlation matrix were between 0.427 and 0.683 (Table 2). These results showed that the sample size of this study was adequate for factor analysis. Bartlett's test was used to assess sphericity ($p<0.001$).

Construct validity of the questionnaire was determined by exploratory factor analysis, and principal component analysis was used to determine the structure of the components. A structure with 10 components was found, and this structure explained 63.7% of the total variance (Table 3).

Results of the AKQ

The mean score on the Turkish version of the AKQ was 13.5±3.9. The minimum score was 0 and the maximum score was 20 out of 24. Three questions (Question 8, 13, 23) were answered correctly by less than 20% of the patients, and all three questions were related to knowledge about inhaled steroids. There were no associations between asthma knowledge and asthma control, education level, or gender ($p=0.4$, $p=0.26$, and $p=0.37$, respectively).

DISCUSSION

In this study, the Turkish version of the 24-item AKQ was found to be acceptable as a reliable and valid tool for evaluating asthma knowledge in adult asthmatics. This is the first study validating this questionnaire in a foreign language. The questionnaire addresses the knowledge of environmental factors, proper use of inhalers, asthma exacerbations, sleep hygiene, triggers, and treatments.

Numerous standardized tools for assessing asthma knowledge exist, but most evaluate patient self-management capacities, which is distinct from general asthma knowledge [8-11]. Both components are useful for comprehensive asthma care, but general knowledge is particularly important because it objectively measures components that can accurately determine gaps in asthma understanding and can provide targets for additional training. The validation of this simple AKQ, originally developed by Drs. Schaffer and Yarandi [6], specifically focuses on general knowledge of asthma, which is appropriate to accurately understand the correlation between asthma control and general asthma knowledge in different cultures. Overall, the content of the AKQ considers the essential aspects that asthma patients have to cope with in their daily lives. These issues constitute important objectives for healthcare providers in terms of enhancing the knowledge about identified factors.

In our study, patient characteristics were similar to other studies, with greater participation of women than men [6,12]. However, the education level of our population was lower. Six percent of the study population were illiterate. All questionnaire data were collected by the physician through face-to-face interviews. Collecting data by physicians usually takes a significant amount of effort, but the 24-item AKQ is a short test and takes only 8 to 10 minutes when administered during an interview.

We found that administering the questionnaire through interviews increased the response rate and decreased poor understanding of the questions, especially in less-educated patients, compared to self-administration of the questionnaire. We added the option of "I don't know" to rate the lack of knowledge. When we collected data from the patients, we encouraged them to choose this option where applicable because it was helpful in identifying the main topics we needed to focus on. In this study, asthma knowledge was average in a cohort of 202 asthmatic patients under the established care of asthma specialists. Of interest, the areas in which knowledge was lowest were related to the role of inhaled steroids for the control of asthma. The following three questions on this topic were answered incorrectly by more than 80% of the patient cohort:

- The purpose of steroid medication inhalers is to stop an asthma attack when it occurs
- It is okay to take inhaled steroid medication only when you notice yourself wheezing
- Steroid inhalers will relieve an asthma attack within 20 minutes

This might related with poor understanding of questions about the role of inhaler steroid use, and the contents of these questions might need to be restructured for the Turkish population.

There are no reliable general questionnaires in Turkish that measure various aspects of asthma knowledge and can be compared with the AKQ. Therefore, we used the ACT test for assessment. In our population, we found that total AKQ score was not correlated with asthma control nor with asthma severity. This fact can be due to the relatively higher level of asthma control and education in our population compared to the other parts of Turkey and a lower percentage of severe asthmatics, which might be considered as limitations of our study [3]. Another limitation is the fact that this study was performed in a single institution, thus generalization of the findings is restricted. The application of the Turkish version of the AKQ to a cohort of asthmatics from different centers in Turkey will increase the validity, reliability, and generalizability of the findings of this research. Finally, the reasons for knowledge questionnaires not being translated into other

languages and not being used sufficiently are not well understood. These may be due to a lack of attention to the issue of disease-specific knowledge or to inadequacy of the questionnaire itself.

Cronbach's alpha (the reliability coefficient) normally ranges between 0 and 1. The closer Cronbach's alpha coefficient is to 1.0 means greater internal consistency of the items in the scale. It is acceptable to have a Cronbach's alpha of 0.70 or higher [13]. In our study, Cronbach's alpha of the Turkish version of the AKQ was 0.555. It was acceptable in the original study [6]. This limitation could mean that some questions in the Turkish context might decrease the coefficient. This might be related to the questions about inhaler steroid use. Increasing the test length, restructuring of the contents of questions, and improving item quality can increase reliability. Likert-type scales can be used instead of "true", "false", and "I don't know" options. Further validation would be needed to extend the use of the Turkish version of the AKQ in clinical practice.

In summary, we have reported the validation of the first Turkish-language knowledge questionnaire of asthma. This study shows that the Turkish version of the AKQ seems to be a suitable instrument to evaluate the effect of different components of asthma knowledge, such as triggers, medications, asthma exacerbations, and avoidance measures, in adult asthmatics. Using this questionnaire might allow physicians dealing with asthma to determine whether their patients are aware of the main features of this chronic disease. This might help to identify and fill the gaps in knowledge. Further studies investigating the impact of different methods of asthma education on patients' knowledge levels will be needed.

Ethics Committee Approval: Ethics committee approval was received for this study from Medeniyet University Ethical Committee.

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

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Author contributions: Concept - A.B.O., L.P.O., A.B.; Design - A.B.O., L.P.O., A.B.; Supervision - G.K., F.K., M.Ş.Ş.; Resource - A.B.O, H.K.; Materials - A.B.O, H.K.; Data Collection and/or Processing - A.B.O, H.K.; Analysis and/or Interpretation - A.B., M.Ş.Ş.; Literature Search - A.B.O., L.P.O.; Writing - A.B.O., L.P.O.; Critical Reviews - G.K., F.K., M.Ş.Ş.

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Appendix

Appendix 1. Asthma Self-Management Knowledge Questionnaire

Please circle "true" for statements that are correct and "false" for statements that are not correct.

1.	Frequent coughing can be a symptom of asthma	**True**	False
2.	People with asthma have swollen and inflamed airways even when they feel normal	**True**	False
3.	Asthma may cause wheezing when you exercise	**True**	False
4.	People with asthma can usually control their symptoms by taking medicine and avoiding things that make their asthma worse	**True**	False
5.	Untreated asthma can cause death	**True**	False
6.	Asthma can be completely cured	True	**False**
7.	People with asthma should avoid exercise	True	**False**
8.	The purpose of steroid medication inhalers is to stop an asthma attack when it occurs	True	**False**
9.	People with asthma do not need to take medicine if they feel normal	True	**False**
10.	Quick relief medication such as Ventolin (albuterol) should always be taken every day	True	**False**
11.	You should wait until your symptoms are really bad before you use a quick relief medication such as Ventolin (albuterol)	True	**False**
12.	It may take 1-4 weeks to notice improvement in your breathing when you start using inhaled steroid medication	**True**	False
13.	It is okay to take inhaled steroid medication only when you notice yourself wheezing	True	**False**
14.	To use an asthma inhaler correctly, you need to breathe in as you press down on the inhaler	**True**	False
15.	You should hold your breath for 10 seconds after each puff of your inhaler	**True**	False
16.	You should wait about one minute between puffs of your quick relief medication (Ventolin/albuterol)	**True**	False
17.	It does not bother your asthma when people smoke cigarettes around you	True	**False**
18.	Your bedroom is the most important room to keep free of dust and animal fur or feathers	**True**	False
19.	Getting rid of cockroaches in your house may help your asthma	**True**	False
20.	Keeping your bedroom windows open at night will help prevent asthma symptoms	True	**False**
21.	Carpets that smell moldy can trigger asthma	**True**	False
22.	Covering pillows and mattresses with plastic covers can help asthma	**True**	False
23.	Steroid inhalers will relieve an asthma attack within 20 minutes	True	**False**
24.	Taking an antibiotic such as penicillin will help most bad asthma attacks	True	**False**

Correct answers are in boldface