Original Article

Psychometric Evaluation of Asthma and Allergy Symptoms

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Abstract

Background: Asthma is a chronic condition that can affect people of all ages and be controlled with correct treatment. Universities settings for potentially accessing almost all students for asthma and allergy screening.
Objectives: This study aimed to adapt the Asthma and Allergy Screening Questionnaire (AASQ) to the Turkish language and assess its psychometric properties for the purpose of evaluating asthma and allergy symptoms in university students and raising awareness among students about controlling the asthma.
Methods: This study was conducted between February and April 2016 in 900 students who study in a faculty of university in Turkey and who agreed to participate. Linguistic validity was verified through front-to-back translation. Psychometric properties of the instrument were studied on a sample of 900 nursing students studying in a faculty of university in Turkey. The relationship between the students' asthma risk factors and TR-AASQ (Turkish Asthma and Allergy Screening Questionnaire) scores was evaluated.
Results: The content validity index of the translated instrument was "0.95". Principal component analysis revealed three factors with an eigenvalue >1. Cronbach's alpha was found to be 0.787 for total scale and between 0.608 and 0.745 for the subscale. Test-retest total scale scores and item scores correlations were significant ($p<0.01$). We conducted CFA for models of three factor. The three factor model represented chi-square=1364.04 (df=62, $p<0.001$), χ^2/df=22.00, RMSEA= 0.153, SRMR=0.081, GFI= 0.81, AGFI=0.72, CFI=0.81.
Conclusion: The data obtained at the end of the study supported TR-AASQ as a valid and reliable tool for evaluating asthma and allergy symptoms in university students.
Key words: Asthma; Allergy; Asthma and Allergy Screening Questionnaire (AASQ); cross-cultural validation; Turkish Asthma and Allergy Screening Questionnaire (TR-AASQ); nursing.

Introduction

Asthma is the fourteenth most important disorder in the world in terms of the extent and duration of disability. Asthma, a disease of the airways, occurs in people of all ages, and wheeze is the most common symptom (Global Asthma Report, 2014). Asthma morbidity and mortality are largely preventable with optimal diagnosis and treatment as well as improved patient education. This under-diagnosis is problematic because it results in therapy delay, which can increase morbidity and mortality (Gerald, et al., 2002).

Delays in the treatment may lead to an increase in asthma prevalence and morbidity, but with valid

and reliable asthma screening, it is possible to identify insufficient diagnosis, and asthma seen in children and adults can be diagnosed early. Particularly in areas where access to health care is difficult, such as inner-city minority populations, it is important to have a more cost-effective and specific screening procedure (Gerald, et al., 2002).

The most recent revised global estimate of asthma suggests that as many as 334 million people have asthma, and that the burden of disability is high. However, it is estimated that many more individuals have not received a diagnosis of asthma in society (Global Asthma Report, 2014; Redline, et al., 2004). In Turkey, one of every 12 or 13 adults and one of every seven or eight children receive a diagnosis of asthma. Asthma occurrence frequency increases daily (World Asthma Day, 2014).

Therefore, this study aimed to test the validity and reliability in Turkish society of using a questionnaire-based screening tool methodologically and descriptively (Asthma and Allergy Screening Questionnaire) that was developed by Susan Redline et al. in 2004 and to identify asthma and respiratory allergies symptoms in nursing faculty students and to create awareness among students in terms of risk factors and asthma control (Redline, et al., 2004).

Material and Methods

This study has a methodological and descriptive design for psychometric testing and validation of TR-AASQ.

Design and sample

This study has a methodological and descriptive design for psychometric testing and validating of Asthma and Allergy Screening Questionnaire. This study was conducted between February and April 2016 in 900 students who study in a faculty of university in Turkey and who agreed to participate. The population consisted of 1205 students studying during the 2015-2016 academic year. The study sample consisted of 900 students [with a confidence interval of 95% and effect size of an α of .05 and an r of 0.20] who were available between February and April 2016 and who agreed to participate.

Instruments

Personal evaluation form

Asthma risk factors the researcher prepared a form that included 24 questions about students' sociodemographic characteristics and individual and environmental risk factors.

The Asthma and Allergy Screening Questionnaire

AASQ was developed by Redline et al. in 2004. The usability of this tool had been studied previously[3]. The scale consisted of 13 items (Supplementary 1). For questions 1 through 7, assign a "1" for each "sometimes" or "a lot" response. If the total scale score is 3 or more, referral for asthma diagnosis may be indicated. A total score of 3 has an estimated sensitivity of 80% and specificity of 70%. For questions 8 and 9, assign a "1" for each "sometimes" or "a lot" response. If the total is 1 or more, referral for allergy diagnosis may be indicated[3]. A score of 1 has an estimated sensitivity of 81% and specificity of 42%. For questions 10 through 13 are required to answer as "Yes" or "No". These questions determine the awareness of individuals with asthma and allergies about disease management.

Data collection and Procedures

Turkish AASQ (TR-AASQ) was completed by the students for a period of nearly 5-10 min. A three-stage route (language and content validity, construct validity, internal consistency and test–retest reliability) was followed to adapt AASQ to Turkish language and Turkish culture and to test its validity and reliability in the study.

Validity and Reliability

Language and content validity

AASQ was independently translated by the investigator and one English linguists as to establish language equivalence between its Turkish translation and English original text and to adapt to Turkish society. The draft of Asthma and Allergy Screening Questionnaire was prepared by selecting the most suitable items, and then the backward translation from English into Turkish was performed and with their English originals (Ercan & Kan, 2004; Eser, 2006; Maneesriwongul & Dixon, 2004).

Subsequently, it was submitted to the 11 expert's opinion their fields for evaluating Turkish Asthma and Allergy Screening Questionnaire (TR-AASQ) with regard to content validity[8]. Conformity of each item was assessed by the experts. A Content Validity Index (CVI) score of 80% or higher is considered to have good content

validity (Polit & Beck, 2010; Oksuz & Malhan, 2005).

Finally, language and content validity were approved after a pilot practice was performed with 30 students to test the intelligibility of the scale (Supplementary 1 and Supplementary 2).

Construct validity

Unlike the original work, principle component analysis and varimax rotation were applied in this study. Factor analysis was utilized to reveal the construct validity of TR-AASQ and to determine the factor loadings of the items and their dimensions included in the scale. Factor loading criterion of the scale items was used as ≥ 0.40 (Gozum & Aksayan, 2003).

Reliability

For the evaluation of TR-AASQ's reliability, test–retest and internal consistency assessments were performed[10]. Test-retest evaluation of TR-AASQ was conducted two weeks apart with 35 students. Cronbach's alpha and item to total correlation analysis were implemented to evaluate TR-AASQ's internal consistency (Polit & Beck, 2010; Oksuz & Malhan, 2005; Gozum & Aksayan, 2003; Gliem & Gliem, 2003). The Cronbach's alpha value is expected to be> 0.60 [9]. Item to total correlation value is expected to be >0.20 (Oksuz & Malhan, 2005)

Data Analysis

In this study, CVI for the content validity, Construct validity with exploratory factor analysis (EFA), Confirmatory Factor Analysis (CFA), reliability analysis (Internal consistency measurement, item to total correlation measurement [Kaiser-Meyer-Olkin (KMO) index], Bartlett's test of Sphericity and test–retest reliability analysis) of the scale were made. Degree of the correlation of the variables was determined using Spearman Correlation Coefficient. An independent-sample *t* test and one-way ANOVA were used for the scale scores and correlation of individuals' risk factors.

In CFA, the data fits the model well when the proportion of chi-square to degrees of freedom (χ^2/df) is less than 5, the comparative fit index (CFI), goodness of fit index (GFI) and adjusted GFI (AGFI) are greater than 0.90, and when the root mean square error of approximation (RMSEA) and standardized mean square residual (SRMR) index are less than 0.08 (Şimşek, 2007; Evci & Aylar, 2017). The level of significance was set at $p < 0.05$. Statistical analyses were carried out using SPSS (SPSS, Version 21) and LISREL.

Ethical issues

In this study, consent of Redline et al., who developed AASQ was obtained to adapt the scale into Turkish language, to evaluate the appropriateness of Turkish culture and to carry out reliability and validity studies. The consents were obtained from the ethics committee and the institutions where the research would be conducted (approval number: 2016/5). Students invited to participate in the study were informed in accordance with Helsinki Declaration and were received their oral consents[14].

Results

Student mean ± SD age was 20.17 ± 1.50 years; 722 (80.2%) were female, and 178 (19.8%) were male. Student BMI was 21.71 ± 3.00 kg/m^2. In addition, 146 (16.2%) of them underwent an allergy test, and 186 (20.7%) had an allergy.

Allergy-causing factors among the students were grouped in Table 1. Most of the allergies were to dust (n=106, 11.8%), pollen (n =67, 7.4%), hair (n=20, 2.2%), mites (n=14, 1.6%), cigarette smoke (n=14, 1.5%), and strong smells (n=22, 2.2%) (Table 1).

Environmental asthma risk factors indicated that the number of those who smoked was limited (8.9%); there were many people who smoked in the environments in which students lived (52.6%); clothes were dried indoors (59.7%); both saturated (58.3%) and unsaturated (62.1%) fatty acids were consumed more than three days per week; and the amount of salt consumed was at small and normal rates (Table 2).

The rate of the students whose family members were diagnosed with asthma is 30.3%. 75.6% of the students expressed that they had been informed about asthma before. A majority (62.1%) of them had learned from the school, 28.8% from the social media, 22.9% from scientific papers, 21.7% from medical staff and 3.1% from other sources.

Table 1 Conditions that cause allergies (n= 900)

Situations	n (%)		n (%)
Dust-air pollution		**Nutrients**	
Dust	106 (11.8)	Red Meat	2 (0.2)
Pollen	67 (7.4)	Milk	3 (0.3)
Fuzz	20 (2.2)	Sesame	1 (0.1)
Mite	14 (1.6)	Honey	1 (0.1)
Cigarette smoke	14 (1.5)	Egg	6 (0.7)
Environmental factors		Olive	1 (0.1)
Sun	10 (1.1)	Nuts (walnuts, hazelnuts, roasted)	5 (0.4)
Strong smells (perfumes, detergents, food)	22 (2.4)	Spicy-bitter-fry	3 (0.3)
Cold weather	3 (0.3)	Alcohol	1 (0.1)
Seasonal weather changes	5 (0.6)	Rye	1 (0.1)
Animal bites		Tomato	2 (0.2)
Insect bites	3 (0.3)	Chocolate	5 (0.6)
Mosquito bites	1 (0.1)	Several fruits: kiwi, strawberry	9 (10.0)
Bee sting	5 (0.6)	Other various foods	6 (0.7)
Other factors			
imitation jewelery	3 (0.3)		
Medicine	8 (0.9)		
Hot water	1 (0.1)		
Stress	4 (0.4)		

Table 2 Individual assessment of students according to asthma environmental risk factors (n = 900)

Asthma environmental risk factors		Yes n(%)	No n(%)	M±SD
Infection				
To spent Frequent viral infection		133(14.8)	767(85.2)	1.85± .35
-To allow pets at home		90(10.0)	810(90)	1.90± .30
-Moisture conditions at home		186(20.7)	714(79.3)	1.79± .40
-Drying laundry indoors		537(59.7)	363(40.3)	1.40± .49
Smoke				
Smoking		80(8.9)	820(91.1)	1.91± .28
Smoking status in the living environment		473 (52.6)	427 (47.4)	1.47± .49
Nutrition				
The amount of salt consumed	*without salt*	22 (2.4)		
	less salty	195 (21.7)		
	normal	566 (62.9)		2.86± .65
	very salty	117 (13.0)		
Antioxidant fruit and vegetable consumption	*Never*	36 (4.0)		
	1 day per week	301 (33.4)		
	3 day per week	352 (39.1)		2.82± .83
	Everyday	211 (23.4)		
Saturated fatty acids consumption	*Never*	-		
	1 day per week	375 (41.7)		
	3 day per week	334 (37.1)		1.79± .76
	Everyday	191 (21.2)		
Unsaturated fatty acids consumption	*Never*	-		
	1 day per week	341 (37.9)		
	3 day per week	282 (31.3)		1.93± .82
	Everyday	277 (30.8)		

Table 3 Item to total correlations, internal reliability (Cronbach's α) and intraclass coefficient of the 3-factors TR-AASQ

Subscale items	Item-total correlation (n=900) (p<0.001)	Intraclass coefficient** (n=35) (p<0.001)	The 3-factors Cronbach's α (n=900)	First interview M±SD* (Median) (n=35)	Second interview M±SD (Median) (n=35)
ASTHMA		**0.749**	**0.745**		
Item 1	0.460	0.307		0.31± 0.46 (0.0)	0.20± 0.40 (0.0)
Item 2	0.490	0.537		0.40± 0.49 (0.0)	0.42± 0.50 (0.0)
Item 3	0.490	0.686		0.37± 0.48 (0.0)	0.25± 0.44 (0.0)
Item 4	0.413	0.449		0.61± 0.48 (1.0)	0.60± 0.49 (1.0)
Item 5	0.473	0.501		0.12± 0.32 (0.0)	0.14± 0.35 (0.0)
Item 6	0.485	0.498		0.11± 0.31 (0.0)	0.05± 0.23 (0.0)
Item 7	0.505	0.588		0.33± 0.47 (0.0)	0.31± 0.47 (0.0)
ALLERGY		**0.711**	0.608		
Item 8	0.422	0.454		0.36±.48 (0.0)	0.31± 0.47 (0.0)
Item 9	0.467	0.656		0.61± 0.48 (1.0)	0.60± 0.49 (1.0)
AWARENESS		**0.656**	**0.706**		
Item 10	0.375	0.434		0.04± 0.21 (0.0)	0.02±.16 (0.0)
Item 11	0.249	0.117		0.01± 0.11 (0.0)	0.02± 0.16 (0.0)
Item 12	0.398	0.434		0.03± 0.18 (0.0)	0.02± 0.16 (0.0)
Item 13	0.312	0.468		0.08± 0.27 (0.0)	0.14± 0.35 (0.0)
Total score		**0.822**	**0.787**		

*M±SD: Mean±Standard Deviation; **Pearson correlation coefficient=r.

Table 4 Results of the explatory factor analysis (EFA) (in SPSS) and confirmatory factor analysis (CFA) (in LISRELL) of 3-factors for TR-AASQ using principal component analysis with varimax rotation (factor loading >0.40 are highlighted) (n=900)

		EFA results			CFA results	
Domains	**Items**	**Factor 1**	**Factor 2**	**Factor 3**		
Asthma						
	1	0.557			χ^2 (df)	1364.04 (62)
	2	0.590			χ^2 /df	22.00
	3	0.634			RMSEA	0.153
	4	0.533			SRMR	0.0081
	5	0.647			CFI	0.81
	6	0.585			GFI	0.81
	7	0.641			AGFI	0.72
Allergy					IFI	0.81
	8			0.749	NNFI	0.76
	9			0.725		
Awareness						
	10		0.817			
	11		0.584			
	12		0.876			
	13		0.590			
Eigenvalue		3.921	1.801	1.066		
% Variance		30.161	13.854	8.198		

Total variance= 52.213%.

Principal Component Analysis; Varimax with Kaiser Normalization; RMSEA=Root Mean Square Error of Approximation; SRMR=Standardized Root Mean Square Residual, <0.05 good, 0.05-0.08 acceptable.; GFI, AGFI >0.90; GFI=Goodness of Fit Index; AGFI=Adjusted GFI; CFI=Comparative Fit Index.

Table 5 Evaluation of the difference between scale scores with asthma and allergy nutrition risk factors (n=900)

	TR-AASQ							
	Asthma		Allergy		Awareness		Total scale	
Individual characteristics	**M±SD***	****t (p)**	**M±SD**	**t (p)**	**M±SD**	**t (p)**	**M±SD**	**t (p)**
Gender								
Female (n=722)	2.38±1.98	3.16	1.00±0.81	2.23	0.18±0.62	0.75	3.57±2.77	3.12
Male (n=178)	1.87±1.68	(0.002)	0.85±0.82	(0.026)	0.15±0.50	(0.452)	2.87±2.32	(0.002)
To be diagnosed with asthma in the family								
Yes (n= 273)								
No (n= 627)	2.84±2.05	5.87	1.17±0.82	4.76	0.34±0.83	5.26	4.35±2.95	9.90
	2.03±1.83	(0.00)	0.89±0.80	(0.00)	0.11±0.45	(0.00)	3.03±2.48	(0.00)
To receive information related to asthma								
Yes (n= 220)								
No (n= 680)	2.25±1.85	-0.19	0.93±0.85	-0.83	0.77±0.29	-2.97	3.27±2.39	-1.05
	2.28±1.96	(0.84)	0.98±0.80	(0.40)	0.21±0.67	(0.00)	3.49±2.79	(0.29)

*M±SD: Median±Standard Deviation; **t: Independent Samples T-test (df:898)

Table 6 Evaluation of the difference between individual and environmental characteristics and scale scores (n=900)

Individual and environmental risk factors	TR-AASQ							
	Asthma		Allergy		Awareness		Total scale	
	*M±SD	αt (p)	M±SD	t (p)	M±SD	t (p)	M±SD	t (p)
Do you have any allergies?								
Yes (n= 273)	3.24±2.12	7.76 (0.000)	1.45±0.69	9.54 (0.000)	0.72±1.05	15.11 (0.000)	5.41± 3.09	12.04 (0.000)
No (n= 627)	2.03±1.80		0.83±0.80		0.04±0.27		2.91± 2.33	
To spent Frequent viral infection								
Yes (n= 133)	3.36±2.09	7.19 (0.000)	1.40±0.68	6.68 (0.000)	0.54±1.04	7.83 (0.000)	5.32± 3.11	9.08 (0.000)
No (n= 767)	2.09±1.84		0.91±0.80		0.11±0.46		3.31± 2.48	
Moisture conditions at home								
Yes (n= 186)								
No (n= 714)	2.57±1.99	2.32 (0.02)	1.13±0.81	3.05 (0.00)	0.12±0.54	-1.34 (0.17)	3.84± 2.68	2.29 (0.02)
	2.20±1.91		0.93±0.81		0.19±0.61		3.33± 2.70	
Drying laundry indoors								
Yes (n= 537)	2.36±1.9	1.65	1.03±0.	2.70	0.17±0		3.58±	1.90

No (n= 363)	0	(0.09)	82	(0.00)	.56	-0.43	2.63	(0.05)
	2.15±1.97		0.88±0.81		0.19±0.66	(0.66)	3.23±2.79	
Smoking								
Yes (n= 80)	2.91±2.22	3.24	1.00±0.82	0.26	0.21±0.70	0.46	4.16±3.06	2.51
		(0.00)		(0.79)		(0.63)		(0.01)
No (n= 820)	2.21±1.89		0.97±0.82		0.17±0.59		3.36±2.65	
Smoking status in the living environment								
Yes (n= 473)	2.49±1.98	3.49	0.98±0.82	0.40	0.18±0.61	0.31	3.67±2.73	2.69
		(0.00)		(0.68)		(0.75)		(0.00)
No (n= 427)	2.04±1.86		0.96±0.82		0.17±0.59		3.18±2.65	

Table 6 (Continued)

	TR-AASQ							
	Asthma		Allergy		Awareness		Total scale	
Nutritional risk factors	*M±SD	+F (p)	M±SD	F (p)	M±SD	F (p)	M±SD	F (p)
The amount of salt consumed								
Without salt (n= 22)								
Less salty (n= 195)	2.04±2.03	9.95	0.90±0.86	0.73	0.22±0.86	0.41	3.18±3.18	5.36
Normal (n= 566)	2.18±1.88	(0.00)	0.92±0.81	(0.53)	0.20±0.67	(0.74)	3.30±2.75	(0.00)
Very salty (n= 117)	2.13±1.86		0.98±0.81		0.98±0.81		3.30±2.59	
	3.17±2.16		1.05±0.87		1.05±0.87		4.36±2.88	

Saturated fatty acids consumption								
1 day per week (n= 375)	2.10±1.91	4.11	0.97±0.82	191	0.21±0.69	0.36	3.29±2.74	2.64
3 day per week (n= 334)	2.29±1.85	(0.01)	0.92±0.82	(0.14)	0.15±0.53	(0.36)	3.37±2.59	(0.07)
Everyday (n= 191)	2.60±2.08		1.07±0.81		0.15±0.52		3.83±2.78	
Unsaturated fatty acids consumption								
1 day per week (n= 341)	2.54±1.97	5.17	1.03±0.81	3.43	0.20±0.63	198	3.78±2.69	4.59
3 day per week (n=282)	2.09±1.89	(0.006)	0.87±0.80	(0.03)	0.21±0.67	(0.13)	3.18±2.75	(0.01)
Everyday (n= 277)	2.14±1.92		1.00±0.83		0.12±0.48		3.27±2.62	

*M±SD: Mean±Standart Deviation; αt: Independent Samples T-test (df:898) +F: One-way ANOVA

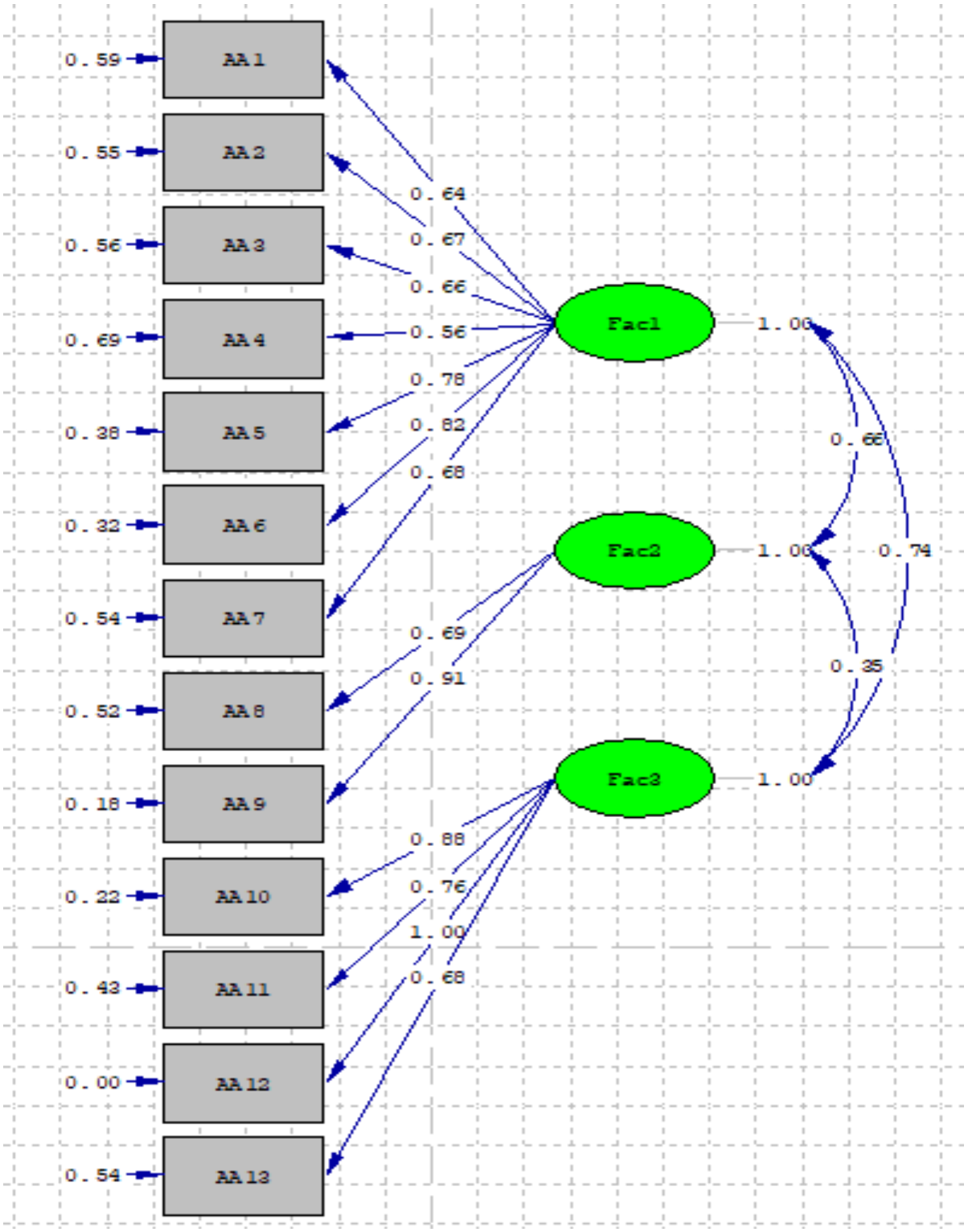

FIGURE 1 Confirmatory factor analysis of TR-AASQ with 3-factors.

Supplementary 1. Final Instrument

Asthma and Allergy Screening Questionnaire (AASQ)

Please tell us how often you have any of the following:	**Never**	**Sometimes**	**A lot**
1. My breathing sounds noisy or wheezy.			
2. It is hard to take a deep breath.			
3. It is hard for me to stop coughing.			
4. My chest feels tight or hurts after I run, play hard, or do sports.			
5. I wake up at night coughing.			
6. I wake up at night because I have trouble breathing.			
7. I cough when I run, climb stairs or play sports.			
8. My eyes get itchy, puff or burn.			
9. I have problems with a runny or stuff nose.			
Please answer the following questions:			
	Yes	**No**	
10. A doctor or nurse told me that I have asthma.			
11. I stayed in the hospital overnight for asthma or trouble breathing this past year.			
12. I take medicine or use an inhaler for asthma.			
13. I take medicine for allergies.			

Supplementery 2: Turkish Asthma and Allergy Screening Questionnaire (TR-AASQ)

Türkçe Astım ve Alerji Tarama Soru Formu

Lütfen aşağıdaki her bir soruyu ne kadar sıklıkla yaşadığınızıdüşünerek hiçbir zaman, bazen,

her zaman ifadelerinden sadece birisini seçin ve kutunun içini " X " şeklinde işaretleyiniz.

	Asla	**Bazen**	**Herzaman**
1. Hırıltılı ve hışıltılı solunumum var.			
2. Derin nefes almakta zorlanırım.			
3. Öksürüğümü durdurmakta zorlanırım.			
4. Koşu, zorlayıcı oyun veya spordan sonra göğsümde sıkışma veya acı hissederim.			
5. Gece öksürerek uyanırım.			
6. Nefes darlığından dolayı gece uyanırım.			
7. Koşarken, merdiven çıkarken ya da spor yaparken öksürürüm.			
8. Gözlerimde kaşıntı, şişme veya yanma olur.			
9. Burunda tıkanma veya akıntı sorunu yaşarım.			

Lütfen aşağıdaki durumlara evet ya da hayır şeklinde cevap veriniz:

	Evet	**Hayır**
11. Astım hastası olduğumu bir doktor veya hemşireden öğrendim.		
11. Geçtiğimiz yıl, nefes darlığı veya astım nedeniyle en az bir gece hastanede kaldım.		
12. Astım tedavim için tablet ya da inhaler kullanırım.		
13. Alerji için ilaç kullanırım.		

Validity

Language, content validity **and** ***construct validity*** (factor analysis) was used in this study.

Language validity: No item was altered in the scale as a result of the opinions of the experts and students (obtained during a pilot study) in the language validity study performed to adapt the AASQ to the Turkish language and culture.

Content validity: There were no items with scores less than three and four in content validity evaluation for the scale items. The content validity of the scale was determined as .95 in this study. Test results indicated that there was no significant difference among the experts' opinions. The statements in the scale conform to our culture and represent the areas to be evaluated.

Construct validity: Construct validity evaluation indicated that the data supported the factor analysis. In addition, the factor construct, obtained at the end of the analyses, was compatible with the theory and the literature. Three subscales for TR-AASQ with eigenvalues greater than one were obtained using a principal components analysis and a varimax rotation matrix method. The Kaiser-Meyer-Olkin sampling sufficiency criterion was 0.812. For the Bartlett test of sphericity, the approximate χ^2 was (df=78) 2991.856 ($p<0.001$), and three factors constituted 52.213% of the cumulative variance. The variance rates were found to be 30.161% variance of factor 1, 13.854% variance of factor 2, 8.198% variance of factor 3 in the TR-AASQ items (Table 4). In the original study, the EFA and CFA results for the AASQ were not disclosed.[3] The EFA was assessed to explore factor structure of TR-AASQ (Table 4).

According to the research results, items between the first and seventh items, the asthma indicator factors, constituted factor 1; items between the 10th and 13th items, the asthma and allergy awareness factors, constituted factor 2; and the eighth and ninth items, the allergy indicator factors, constituted factor 3. The data supported the factor analysis with the varimax rotation method (Table 4). In this context, the Asthma and Allergy Screening Questionnaire is a valid scale for the Turkish people.

We conducted CFA for models of three factor. The three factor model represented chi-square=1364.04 (df=62, $p<0.001$), χ^2/df=22.00, RMSEA= 0.153, SRMR=0.081, GFI= 0.81, AGFI=0.72, CFI=0.81 (Table 4; Figure 1).

Reliability

The corrected item-total correlation changed between 0.249 and 0.505 in the Asthma and Allergy Screening Questionnaire internal consistency analysis. The Cronbach's α scale reliability was between 0.608 and 0.745, and the Cronbach's α total scale reliability was 0.787 (Table 3).

The scale was conducted with 35 students twice in four weeks for the purpose of testing the reliability of the test-retest. A statistically significant and positive correlation was found, outside the item 11, between 0.117-0.686 the test-retest total scale scores (Table 3). The reliability of the scale was statistically high.

The Relationship between the Individual and Environmental Asthma and Allergy Risk Factors and Scale Scores

Total scale scores and asthma, allergy, and awareness subscale scores were significantly ($p< 0.05$) higher for students with a family member with a diagnosis of asthma. However, no relationship was found between being informed about asthma and the scale scores ($p> 0.05$) (Table 5).

Total scale scores and asthma subscale scores for those who stated that people smoked in the areas where they lived, allergy subscale scores for those who dried clothes indoors, total scale scores for those who reported humidity in their houses, and asthma and allergy subscale scores were significantly high ($p< 0.05$). Total scale scores and asthma, allergy, and awareness subscale scores of the students who were allergic to different factors and experienced viral infections frequently were high ($p< 0.05$) (Table 6).

Total scale scores and asthma subscale scores for students who consumed too much salt and asthma subscale scores for those who consumed saturated fatty acids every day were significantly high ($p < 0.05$). Scale scores and asthma and allergy subscale scores for those who consumed unsaturated fatty acids one day a week were significantly higher ($p<0.05$) (Table 6). Asthma, allergy, and awareness subscale scores for students who consumed antioxidant fruits and

vegetables one day a week were high, but no significant relationship was found between them ($p > 0.05$).

Discussion

Individual assessment based on environmental asthma risk factors

Early diagnosis and treatment of asthma is important for improving health and minimizing the social and economic burden of the disease. There is increasing demand for asthma to be diagnosed as early as possible. Studies suggest that treatment of asthma should be initiated quickly, before any permanent lung function abnormalities develop. A simple questionnaire would provide a convenient and timesaving tool to help physicians diagnose asthma (Shin, et al., 2010).

Among children, being male constitutes an asthma risk. Asthma is seen in male children twice as frequently as in female children before puberty. After puberty, this difference disappears, and asthma prevalence becomes higher in women than men (Ozkan, et al., 2014). Student mean age was 20.17 ± 1.50 years, which conformed to findings in the literature. When the students were evaluated for individual asthma risk factors, total scale and asthma and allergy subscale scores in the female students were significantly higher than those in the male students ($p < 0.05$) (Erhabor, et al., 2016; Onbaşı, et al., 2008; Kalyoncu, et al., 2001).

The relationship between genetic factors and asthma indicated that the rate of asthma incidence increased by 20% to 30% among children if either their fathers or their mothers had asthma; this risk increased to 60% to 70% if both the mother and the father had asthma (Erhabor, et al., 2016). Total scale scores and asthma, allergy, and awareness subscale scores were significantly ($p < 0.05$) higher for students with a family member with a diagnosis of asthma. However, no relationship was found between being informed about asthma and the scale scores ($p > 0.05$) (Table 5).

Exposure to cigarette smoke, allergic substances, and chemicals and obesity are among the factors complicating the process of controlling asthma. More than 10% of people with asthma still smoked, and 30% to 40% of those people were obese. Quitting smoking and losing weight facilitated asthma control[4]. When students were evaluated for environmental asthma risk factors, 8.9% were smokers, and 52.6% stated that people smoked in the areas where they lived (Table 2). No student was assessed as obese.

In a study in students performed by Gerald et al. (2002) estimated asthma prevalence was 32% with use of the asthma questionnaire. Current asthma prevalence, cumulative asthma prevalence, and asthma-like symptom prevalence were 0.5%, 2.0%, and 46.7%, respectively, in another study; in addition, the smoking rate was 16.1%. Goktalay et al. (2009) found the rate of allergic rhinitis among students was 20.2% in their study. This study indicated that 39% and 65.2% ($n = 586$) of the scores students obtained could be a reference for asthma diagnosis and allergy diagnosis, respectively, and these findings should be taken into consideration.

Total scale scores and asthma subscale scores for students who consumed too much salt and asthma subscale scores for those who consumed saturated fatty acids every day were significantly high ($p < 0.05$) (Table 6). These results may be references for asthma and allergy diagnoses and indicate that further evaluation is needed (Ozkan, et., 2014).

Scale scores and asthma and allergy subscale scores for those who consumed unsaturated fatty acids one day a week were significantly higher ($p < 0.05$) (Table 6). Guidelines suggest that fish should be eaten at least two days a week for health because it is rich in omega-3 (n-3) (Nutrition Guide for Turkey, 2014). Studies indicated that the incidence rate of asthma among people who consume fish, rich in omega-3 fatty acids, is lower (Ozkan, et., 2014).

\This study implied that the consumption frequency of unsaturated fatty acids is lower than the required frequency. Although there is no significant relationship between them, the consumption rate of saturated fatty acids is higher than the required rate (Table 6). Results from one study indicate that this rate is a risk factor for developing asthma and allergy (Ozkan, et., 2014).

Asthma, allergy, and awareness subscale scores for students who consumed antioxidant fruits and vegetables one day a week were high, but no significant relationship was found between them ($p > 0.05$). Consuming too much fast food, low antioxidant (fruits and vegetables) intake, increased n-6 polyunsaturated fatty acid (found in margarine and vegetable oil) intake, and insufficient n-3 polyunsaturated fatty acid (found

in oily fish) intake are thought to increase the rate of asthma and atopic diseases (Abadoglu, et al., 2010). Guidelines highlight the importance of consuming at least five portions of fruits and vegetables every day of the week. At least two portions of the daily consumption of fruits and vegetables should be green leafy vegetables or citrus fruits like oranges and lemons and antioxidant foods such as tomatoes (Nutrition Guide for Turkey, 2014).

House dust mites (indoor allergens), animal allergens (cats, dogs, and cockroaches), and pollens and fungi (outdoor allergens) are important for sensitivity and asthma development. In the event that a person makes contact with an allergen he or she is sensitive to, asthma symptoms may emerge, and those symptoms may become permanent (Ozkan, et., 2014). Results from some studies indicate that house dust mites are a risk factor for asthma development, but results from other studies have not yet confirmed those findings. Cockroaches were considered to be significant factors for allergic sensitization (Abadoglu, et al., 2010).

Acute viral respiratory infections increase the number of the symptoms both in children and adults (Ozkan, et., 2014; Abadoglu, et al., 2010). Exposure to cigarette smoke in both the prenatal and postnatal periods leads to some damage, including asthma-like symptoms (Nutrition Guide for Turkey, 2014).

Total scale scores and asthma subscale scores for those who stated that people smoked in the areas where they lived, allergy subscale scores for those who dried clothes indoors, total scale scores for those who reported humidity in their houses, and asthma and allergy subscale scores were significantly high ($p< 0.05$). Total scale scores and asthma, allergy, and awareness subscale scores of the students who were allergic to different factors and experienced viral infections frequently were high ($p< 0.05$) (Table 6). This is thought to be a risk factor for asthma and allergy development.

Validity

Redline et al. (2004) explained the tradeoff in sensitivity and specificity for predicting the clinical designation of asthma when considering a progressively increasing number of symptoms as constituting a positive screen. Analyses of data from the students questionnaire suggest that high levels of sensitivity (87%) and moderate specificity (59%) can be achieved by requiring at least 2 positive symptom responses, with slight decreased sensitivity (80%) and improved specificity (70%) when considering a positive screen based on 3 affirmative item responses. In summary, In the presence of at least 3 asthma symptoms suggesting that asthma may be suspected and referral considered in students reporting this number of symptoms. Requiring a positive response to either “itchy eyes” or “runny nose” appears to have relatively high levels of sensitivity using the students (81%) responses.

On the original AASQ, it was found that the presence of asthma symptoms in 1-7 items increased the likelihood of asthma (OR>1, Sensitivity 44-69%, Specificity 60-89%), and the presence of allergy symptoms in the 8th and 9th items increased the likelihood of allergy (OR>1, Sensitivity 50-80%, Specificity 57-73%) (Redline, et al., 2004). In this study a score of three or higher for the questions between 1 and 7 could be a reference for asthma diagnosis, and a score of one or higher for questions 8 and 9 could be a reference for allergy diagnosis. We found that 357 (39.7%) students had a score of three or higher for the questions between 1 and 7, and 586 (65.2%) students had a score of one or higher for questions 8 and 9.

These results are thought to be references for asthma and allergy diagnoses. In agreement with the literature, it is safe to say that this student group should be checked for asthma and allergy and further evaluation is required to confirm the diagnoses (Redline, et al., 2004).

In this study, factor analysis of TR-AASQ resulted in three factors with 13 items (Table 4). CFAs were conducted for three factor model of TR-AASQ to show fit indices. It was found that only the SRMR value (0.081) of the three-factor scale was found to be within acceptable limits of compliance (0.06-0.08), the CFI (0.81), GFI (0.81), IFI (0.81) values were slightly below the acceptable compliance limit (0.90), and the baseline criteria could not be reached for other parameters (Table 4; Figure 1).

Limitation

The addition of clinical measures in our students identified as having possible asthma and allergy appears to increase the specificity of the screening procedure. There are limitations to this study and further research is needed before such screening programs are widely implemented.

Conclusions

We used this questionnaire to prove its validity and reliability. Because, before a widespread adoption of any screening instrument, its universal applicability across diverse communities must be demonstrated. In the light of all results, TR-AASQ was a valid and reliable tool for evaluating the presence of asthma and allergy symptoms in university students. Therefore, using TR-AASQ to screen Turkish people for asthma and allergy symptoms is recommended.

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