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ORIGINAL ARTICLE

Validity and reliability of the Turkish version of Psoriasis Epidemiology Screening Tool for the detection of psoriatic arthritis in patients with psoriasis

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ABSTRACT

Objectives: The Psoriasis Epidemiology Screening Tool (PEST) is a simple and useful questionnaire designed to screen arthritis in patients with psoriasis. This study aims to evaluate the validity and reliability of the PEST questionnaire in Turkish patients with psoriasis.

Patients and methods: Between August 2019 and September 2019, a total of 158 adult patients with psoriasis (61 males, 68 females; mean age: 43.1±13.3 years; range, 29.8 to 56.4 years) who were not previously diagnosed with PsA were included. The testing procedure for translation and cultural adaptation was carried out according to the following steps: preparation, forward translation, reconciliation, back-translation/back-translation review, harmonization, finalization, and proofreading. Patients' demographic parameters, comorbidities, PEST, and Toronto Psoriatic Arthritis Screen (ToPAS 2) results were recorded. The patients were, then, assessed by a rheumatologist who was blinded to their PEST scores. The diagnosis of PsA was made according to the Classification criteria for Psoriatic Arthritis (CASPAR). The receiver operating characteristic (ROC) was assessed to obtain the sensitivity and specificity of the PEST questionnaire.

Results: Of the patients, 42 had PsA, while 87 did not. Each parameter of PEST showed a low-high internal consistency ranging from 0.366 to 0.781. When the Question 3 was excluded, Cronbach alpha value increased to 0.866. The Cronbach alpha value of the whole scale was 0.829. The test-retest reliability of the Turkish version of PEST was determined as 0.86 for the total score (ICC=0.866 95% CI: 0.601-0.955; p<0.0001). There was a strong positive correlation between PEST and ToPAS 2 (r=0.763; p<0.001) and a moderate positive correlation between PEST and CASPAR (r=0.455; p<0.001). A cut-off value of ≥3 yielded a sensitivity of 93% and a specificity of 89% for the diagnosis of PsA with the highest Youden's index. The PEST scale was found to have a higher sensitivity, but lower specificity in the head-to-head comparison with ToPAS 2.

Conclusion: The Turkish version of PEST is a reliable and valid tool for screening PsA in Turkish patients with psoriasis.

Keywords: Psoriasis epidemiology screening tool, psoriasis, psoriatic arthritis, screening questionnaire.

Psoriasis is a chronic inflammatory skin disease that affects 2 to 4% of the global population.[1,2] Although psoriatic arthritis (PsA) is a rheumatologic disorder that affects 0.1 to 0.3% of the general population, it affects 30% of patients diagnosed with psoriasis.[3,4] The presence or absence of PsA in patients with psoriasis is of great importance to tailor the treatment to be used.[5] Patients with psoriasis exhibit arthritis symptoms about 10 years after the first manifestation of skin symptoms.[6] Scalp and flexural skin involvement, nail dystrophies, increased acute phase reactants in serum, and elevated levels of matrix

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metalloproteinase 3 are well-known risk factors for the development of PsA.[7,8]

Psoriatic arthritis may be overlooked in patients diagnosed with psoriasis. A meta-analysis showed that about 10.1 to 15.5% of patients with psoriasis had undiagnosed PsA.[9] However, other observational studies showed that a large proportion of patients with psoriasis had undiagnosed PsA.[10] A study including 949 patients with the diagnosis of psoriasis who were followed in 34 dermatology centers in North America and Europe reported that the diagnosis of PsA was missed in 41% of the patients.[4] However, a diagnostic delay of more than six months causes worse physical disability and peripheral joint erosions in these patients.[11] Since patients with psoriasis are usually followed by a dermatologist or a general practitioner, there may be a need for an easy, simple, and sensitive test to screen these patients for PsA or to timely refer them to a rheumatologist for consultation.

Several questionnaires have been developed for PsA screening in patients with psoriasis.[12-18] However, some of these questionnaires are too long and time-consuming to be applied during dermatologic consultations and, thus, unsuitable for routine use.[17] Therefore, the search for questionnaires that can provide practical and satisfying results with adequate sensitivity and specificity is justifiable.[17]

The psoriasis epidemiology screening tool (PEST) is a scale used in dermatology clinics for PsA screening.[19] This scale requiring dichotomous response options (Yes/No) consists of five items. Its application is quick, and the questions are easily understood by the patient, which makes it viable during a consultation with patients with psoriatic skin lesions. Although this scale has been validated in English and Portuguese, it has not been validated in Turkish yet.[19,20] In the present study, we aimed to examine whether the Turkish version of PEST was a valid and reliable tool for PsA screening and to determine a cut-off value to identify PsA in patients with psoriasis.

PATIENTS AND METHODS

This cross-sectional study was conducted at Pamukkale University Faculty of Medicine, Department of Rheumatology between August 15th, 2019 and September 15th, 2019. A total of 158 adult patients with psoriasis who were not previously diagnosed with PsA were included. The patients had to fulfill the following criteria to be included in the study: age >18 years, able to understand and read Turkish, and having a confirmed diagnosis of psoriasis by a dermatologist. Those who were considered to have a diagnosis other than PsA were excluded. Exclusion criteria were as follows: comorbidity that would prevent the patient from participating fully in the study procedures (e.g., terminal conditions such as end-stage renal disease, heart failure, or malignancy), cognitive deficits that would preclude questionnaire completion, other major inflammatory rheumatic conditions (e.g., gout, calcium pyrophosphate dihydrate crystal deposition, rheumatoid arthritis), and non-inflammatory musculoskeletal disorders (e.g., hand osteoarthritis, calcaneal spur, axial pathologies, fibromyalgia, complex regional pain syndrome) that would be followed and treated. These patients were excluded for two reasons. First, the clinic of these pathologies may mimic peripheral and axial spondyloarthritis, causing bias in patient selection. Second, previous validation studies have followed a similar method by excluding diseases that mimic PsA.[21-23]

Patients' age, sex, disease duration, medical treatments, educational level, PEST, and Toronto Psoriatic Arthritis Screen II (ToPAS 2) questionnaire results were recorded in the dermatology outpatient clinic. All patients were re-evaluated to determine the test-retest reliability. They were stable in the interim period. In the second examination, the PEST was administered to assess the time stability of the measurements. The patients were, then, assessed by a rheumatologist who was blinded to the PEST results per protocol, including a complete history and physical examination, routine laboratory tests, and rheumatoid factor evaluation. Radiographs, magnetic resonance imaging, and articular ultrasound were performed, if necessary. The clinical diagnosis was confirmed based on the Classification Criteria for Psoriatic Arthritis (CASPAR).[24]

Assessment variables

Classification Criteria for Psoriatic Arthritis: The CASPAR criteria consist of confirmed

inflammatory articular disease (joint, spine, or entheseal) with at least three points from the following features: current psoriasis (assigned a score of 2 points; all other features are assigned a score of 1), a history of psoriasis or a family history of psoriasis (unless current psoriasis is present), dactylitis, juxta-articular new bone formation (hands or feet), rheumatoid factor (RF) negativity (except latex test), and psoriatic nail dystrophy.[24]

Toronto Psoriatic Arthritis Screen 2: It is a screening questionnaire comprising of 13 questions with four domains, including the skin domain (sum of questions 1, 3 and, 4; maximum score is 3), nail domain (sum of question 2; maximum score is 2), joint domain (sum of questions 6 and/or 7, 8 and 12; maximum score is 3), spine domain (sum of questions 9, 10 and 11), and an additional question (question 13) about the diagnosis of rheumatic and rheumatoid-related diseases. The total score of the questionnaire is calculated by summing the skin domain score, nail domain score, and twice the joint domain score. The Turkish reliability and validity study of this scale was performed.[25]

Psoriasis epidemiology screening tool: The questionnaire contains five questions (19). Each question answered "Yes" is scored 1 (one), while each question answered as "No" is scored 0 (zero) and then, the total score is calculated by summing the all item scores of PEST. Questions 1-5 are as follows: 1. Have you ever had a swollen joint (or joints)?; 2. Has a doctor ever told you that you have arthritis?; 3. Do your fingernails or toenails have holes or pits?; 4. Have you had pain in your heel?; 5. Have you had a completely swollen and painful finger or toe for no apparent reason?, respectively.

Translation and face validity

Permission was obtained from the authors who developed the original scale. For the translation procedure, the guidelines for cross-cultural modifying with phases were used.[26] The original text of the English version of PEST was translated into Turkish by two independent translators who were native Turkish speakers fluent in English, one of the authors, and a professional translator. These translations were performed independently and, then, compared. The differences in the independent translations were discussed, and it was agreed on the final translation. This final Turkish version was translated back into English by two independent native English speakers who were blinded to the original scale. This version was compared with the original scale, and discrepancies were, then, identified and reviewed. A comparison between the back-translation and the original scale was made to point out the discrepancies between the original and the translated version. The differences between the translated versions were evaluated, and satisfactory compliance with the original scale was achieved by the consensus of the translators. The translation and back-translation phases of PEST produced the Turkish version of the questionnaire (Appendix 1). The final Turkish version of PEST was obtained and applied to a pilot sample of 10 patients aged >18 years who were able to understand and read Turkish and had confirmed diagnosis of psoriasis by a dermatologist, to find out whether they had any doubts about the meaning of the items. This sample included eight females and two males with a mean age of 40.0±12.9 years. The Turkish version of PEST was applied to patients with psoriasis by a researcher who was blinded to the presence of PsA. The patients were asked to explain what they understood after reading each item aloud, what option they chose, and why they chose it. Moreover, where necessary, it was checked whether the items were correctly understood by asking the patients to explain their answers in more detail or to give examples.

Sample size

It was set according to the recommendation of including ten patients for each item in the tool to be validated.[27,28] Therefore, a minimum of 50 patients should be included in this PEST validation study. The study to develop and validate the original scale included 93 patients.[19] A sample size of at least 116 patients was estimated to be necessary for our study, considering the sensitivity (97%) and specificity (79%) of the original questionnaire in its original language with an estimated arthritis prevalence of 20% in psoriatic patients, a Cronbach alpha coefficient of 0.80, and a confidence interval (CI) of 95%.[19,20]

Statistical analysis

Statistical analysis was performed using the SPSS for Windows version 22.0 (IBM Corp., Armonk, NY, USA). Type 1 error limit value

was considered as 0.05 in all statistical analyses. Continuous variables were presented in mean ± standard deviation (SD) or median and interquartile range (IQR), while categorical variables were presented in number and percentage. The Kolmogorov-Smirnov test was used to analyze the normal distribution assumption of the data. When the data were non-normally-distributed, non-parametric tests were used for statistical evaluation. Skewness was used to assess the extent to which distribution of a variable was symmetrical. If the distribution was too peaked, the kurtosis was used. A p-value of <0.05 was considered statistically significant.

Reliability

For reliability analysis, the internal consistency of the scale was evaluated with Cronbach alpha, and the stability over time was assessed using the intraclass correlation coefficient (ICC) between tests and retest scores.[29,30] An ICC between 0.75 and 0.9 indicates good reliability and values greater than 0.90 indicate excellent reliability.[20]

Criterion validity

The criterion validity of the PEST was tested by CASPAR as a reference test.[24] The discriminatory power of the test was measured by estimating the area under the receiver operating characteristic (ROC) curves. It was used to obtain the optimal cut-off of PEST scores for screening patients with the diagnosis of PsA according to CASPAR. The usefulness and adequacy of a test, that is its ability to detect a person with disease or exclude a person without disease, is usually described by terms such as sensitivity, specificity, positive predictive value, and negative predictive value. Moreover, positive and negative predictive values provide estimates of the probability of disease.[31] Therefore, the discriminative statistics of the values of these terms were assessed.

Convergent validity

The ToPAS 2 scale was used to test the convergent validity of the PEST. Higher correlation coefficients indicated better convergence. The correlation between the described variables was tested using Spearman rho, considering the non-normal distribution of the variables. A correlation coefficient value of 0 was interpreted as no correlation, 0.1-0.3 weak correlation, 0.4-0.6 moderate correlation, 0.7-0.9 strong correlation, and 1.0 perfect correlation.

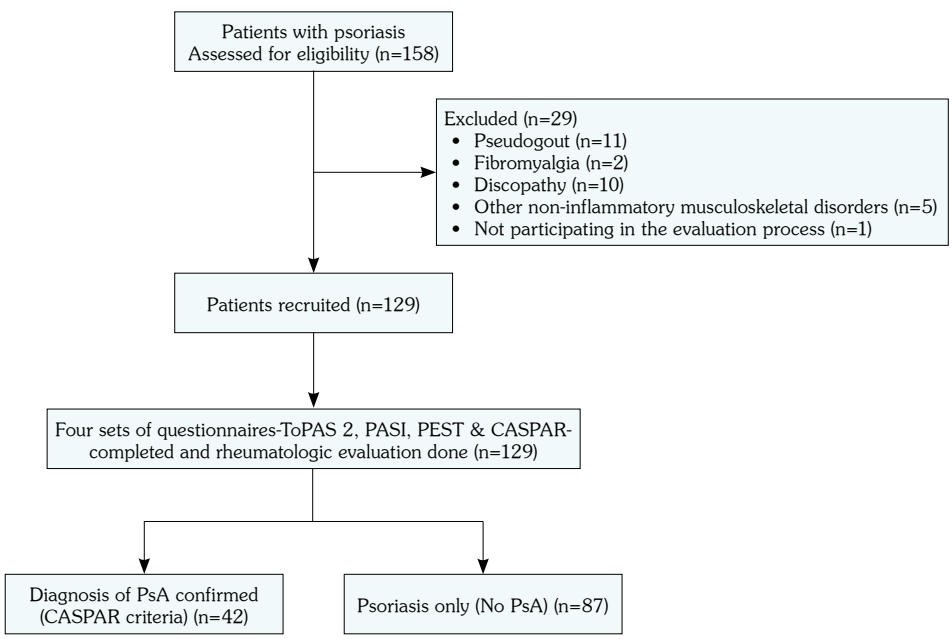

Figure 1. Study flowchart.

ToPAS 2: Toronto Psoriatic Arthritis Screen; PASI: Psoriasis area severity index; PEST: Psoriasis Epidemiology Screening Tool; CASPAR: Classification Criteria for Psoriatic Arthritis; PsA: Psoriatic arthritis.

RESULTS

A total of 158 patients were evaluated for eligibility in this study. Twenty-nine patients were excluded from the study after the evaluation by a rheumatologist. Of these, 11 had pseudogout, six had lumbar discopathy, four had cervical discopathy, two had diabetic cheiroarthropathy, two had fibromyalgia, two had carpal tunnel syndrome, one had complex regional pain syndrome, and one of the patients who did not participate in the evaluation process were excluded from the study (Figure 1). Finally, a total of 129 patients with psoriasis (61 males, 68 females; mean age: 43.1±13.3 years; range, 29.8 to 56.4 years) were included. Moreover, the mean disease duration was 15.5±8.2 years. Of these, 42 patients were diagnosed with PsA according to the CASPAR criteria. Therefore, the prevalence of PsA in our population was 32.5%. The demographic characteristics, educational levels, clinical

Table 1. Demographic and clinical features of patients with psoriasis

	Patients with psoriasis (n=129)			
	n	%	Mean±SD	Mean±SE
Age (year)			43.1±13.3	
Sex				
Male	61	48		
Female	68	52		
Level of education				
College or university	12	9		
High school	26	21		
Vocational school or other secondary schools	25	19		
Elementary school	66	51		
Disease duration (year)				15.5±0.5
Comorbidities				
Hypertension	28	22		
Diabetes mellitus	17	13		
Hyperlipidemia	31	24		
Medical treatment				
Topical treatment	18	14		
Methotrexate	43	33		
Biologic agent	68	53		
Clinical type of psoriasis				
Scalp psoriasis	10	8		
Palmoplantar psoriasis	42	33		
Psoriasis vulgaris	23	41		
Guttate psoriasis	29	22		
Pustular psoriasis	25	19		
Clinical type of PsA				
Asymmetric olygoarticular	23	55		
Symmetric polyarticular	17	40		
DIP predominant	2	5		
Arthritis mutilans	0	0		
Spondylitis	0	0		
ToPAS 2			5.6±2.7	
CASPAR			3.8±1.5	
PsA diagnosis by CASPAR	42	35.5		
Dactylitis				
Active	7	5		
History	36	28		
Nail psoriasis	102	79		
RF negative	78	60.5		
New bone formation	41	32		

SD: Standard deviation; SE: Standard error; PsA: Psoriatic arthritis; DIP: Distal Interphalangeal; ToPAS 2: Toronto Psoriatic Arthritis Screen 2; CASPAR: Classification Criteria for Psoriatic Arthritis; RF: Rheumatoid Factor;

Table 2. Demographic and clinical disease manifestation of PsA

	Patients with PsA			
	n	%	Median	IQR
Age (year)			45	10
Woman	25	64		
Disease duration of psoriasis (year)			13	5
Nail psoriasis				
Pitting	38	90		
Onycholysis	30	71		
Subungual hyperkeratosis	33	78.5		
Arthritis				
Active	35	83		
History	36	86		
Heel pain	39	93		
Dactylitis				
Active	7	12		
History	33	88		

PsA: Psoriatic arthritis; IQR: Interquartile range.

characteristics of patients with psoriasis, and a detailed description of the frequency of responses to each subitem of the CASPAR questionnaire are given in Table 1.

The demographic and clinical disease manifestations of patients diagnosed with PsA based on the CASPAR diagnostic criteria are shown in Table 2. While 83% of the patients had active arthritis, 88% had a history of dactylitis.

The questionnaire took less than 5 min to complete by most patients, and the calculation took 1 min on average. The response rates were 100% for every question. As indicated in Table 3, each parameter of PEST showed a low-high internal consistency ranging from 0.366 to 0.781. When Question 3 was excluded, Cronbach alpha value increased to 0.866. The Cronbach alpha value of the whole scale was 0.829. As shown in Table 4, the test-retest reliability for the Turkish version of PEST was found to be 0.86 for the total score (ICC=0.866 95% CI: 0.601-0.955; p<0.001).

The result of the ROC curve assessment is presented in Figure 2. The area under the ROC curve was 0.938 (95% CI: 0.908-0.968), corresponding to an excellent discriminatory capacity of the PEST test to distinguish patients

Table 3. Internal consistency of the turkish version of the psoriasis epidemiology screening tool

Questionnaire item	Scale mean if item deleted	Scale variance if item deleted	Item-total correlation	Cronbach'salpha when the item was excluded
Swollen joints (Q1)	6.71	1.97	0.781	0.747
Told arthritis (Q2)	6.65	2.04	0.754	0.757
Pits in nails (Q3)	6.66	2.50	0.566	0.866
Pain in heel (Q4)	6.67	2.09	0.689	0.776
Digit swollen for no reason (Q5)	6.53	2.37	0.575	0.809
All	8.31	3.29	0.829	

* When the Question 3 was excluded, the Cronbach alpha value increased to 0.866.

Table 4. Stability of the Turkish version of the PEST

	Initial score (n=129)		Retest score (n=129)			
	Median	IQR	Median	IQR	ICC	95% CI
PEST score	1	3.5	1	3.6	0.866	0.601-0.955

PEST: Psoriasis Epidemiology Screening Tool; IQR: Interquartile Range; ICC: Intraclass Correlation Coefficient.

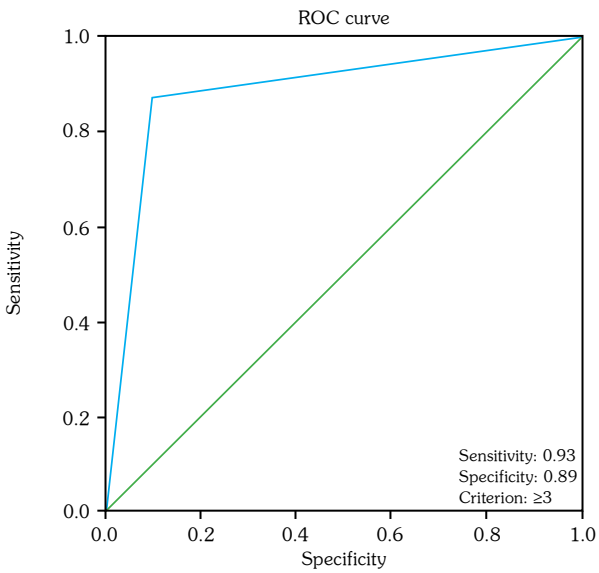

Figure 2. Receiver operating characteristic curve for Psoriasis Epidemiology Screening Tool. Area under the curve: 0.938.

ROC: Receiver operating characteristic.

with and without PsA. The cut-off value was ≥3. It achieved the maximum Youden's index at a score of 3 at a sensitivity of 0.93 and a specificity of 0.89.

There were 44, 39, 102, 46, and 36 patients with psoriasis who answered items 1, 2, 3, 4, and 5 "Yes", respectively. The presence of at least three of the five items answered "Yes" showed a sensitivity of 93% and a specificity of 89%, with a positive predictive value of 0.96. This (at least 3 "Yes") can be considered as the cut-off point (Table 5). The PEST was found to have higher sensitivity but lower specificity in the head-to-head comparison with ToPAS 2 (Table 6).

The correlations between the scores of the questionnaires used in this study (PEST, ToPAS 2, CASPAR) are given in Table 7. There was a strong positive correlation between PEST and ToPAS 2 ($r=0.763$; $p<0.001$) and a moderate positive correlation between PEST and CASPAR ($r=0.455$; $p<0.001$).

DISCUSSION

In this study, we evaluated the validity and reliability of the PEST questionnaire in Turkish patients with psoriasis, and the Turkish version of PEST showed good psychometric properties.

Table 5. Sensitivity, specificity, and predictive value of each cut-off score of the PEST scale according to the CASPAR criterion

	Total score				
	PEST				
CASPAR criterion	≥1	≥2	≥3	≥4	≥5
Sensitivity	1.00	1.00	0.93	0.77	0.56
Specificity	0.74	0.79	0.89	0.97	0.98
PPV	0.58	0.72	0.80	0.95	0.97
NPV	1.00	1.00	0.96	0.87	0.72

PEST: Psoriasis epidemiology screening tool; CASPAR: Classification criteria for psoriatic arthritis; PPV: Positive predictive value; NPV: Negative Predictive Value.

Table 6. Comparison of the sensitivity and specificity of PEST and ToPAS 2

	CASPAR criteria			
	Patients with PsA		Patients without PsA	
	n	%	n	%
PEST				
<3	3	7	77	89
≥3	39	93	10	11
ToPAS 2				
<8	6	14	82	94
≥8	36	86	5	6

PEST: Psoriasis epidemiology screening tool; CASPAR: Classification criteria for psoriatic arthritis; PsA: Psoriatic arthritis; ToPAS 2: Toronto Psoriatic Arthritis Screen.

Table 7. Convergent validity results

	PEST	
	r	*p
CASPAR	0.455	<0.001
ToPAS 2	0.763	<0.001

PEST: Psoriasis Epidemiology Screening Tool; CASPAR: Classification Criteria for Psoriatic Arthritis; ToPAS 2: Toronto Psoriatic Arthritis Screen 2; r: Spearman's rho coefficient; * p<0.05, statistically significant.

The test-retest reliability of the Turkish version of PEST seemed to be good.

In their study, Ibrahim et al.[19] developed a useful test for screening PsA in patients with psoriasis. A cut-off value of 3 yielded a sensitivity of 92% and a specificity of 78% for PEST in the diagnosis of PsA. Mazzotti et al.[20] reported the sensitivity and specificity for PEST as 84% and 63%, respectively, with a cut-off value of ≥3. A study conducted in Iran found the sensitivity and specificity as 58% and 96%, respectively, using a cut-off value of 3.[32] The sensitivity and specificity for the diagnosis of PsA were 93% and 89%, respectively, with a cut-off value of 3 in our study. The differences in sensitivity and specificity values among our study and other studies can be attributed to three reasons. First, the prevalence of PsA in the present study was 32.5%, whereas a range of 21 to 28% of PsA was reported in other studies.[19,20,32] Second is the pattern of articular involvement (axial versus peripheral) in psoriatic patients. The PEST scale did not question spinal involvement and also the exclusion of axial pathology in the present study might contribute to a higher sensitivity of PEST compared to other studies.[33,34] Similar to the present study, the sensitivity of PEST was found to be high in the study of Chiowchanwisawakit et al.[34] due to the lower proportion of patients with axial involvement. Third, the sensitivity and specificity of screening tests may vary among ethnicities.[14] Although these studies determined the sensitivity and specificity of PEST, they did not evaluate its ICC.[19,20,32] However, Cronbach alpha value was 0.720 in the study of Mazzotti et al.[20] In our study, the ICC value of PEST was 0.866, and Cronbach alpha value was 0.829. These results demonstrated the validity and reliability of the Turkish version of the PEST for screening PsA. Moreover, in current clinical practice, it is usually not viable that all patients with psoriasis visiting a dermatologist are also assessed by a rheumatologist for PsA screening. Therefore, the PEST scale provides a significant advantage in PsA screening due to its properties such as being an easy questionnaire consisting of only five questions, which takes a very short time to complete without a physical examination component.

To determine an optimal tool for identifying patient populations at risk of developing PsA, further head-to-head comparisons should be carried out with other tools for earlier and accurate diagnosis of PsA in clinical practice.[35] In the literature, head-to-head comparisons of PEST with other screening tests have yielded different results. The study by Mease et al.[4] reported the sensitivity and specificity of PEST as 84% and 75%, respectively. In the aforementioned study, PEST was found to be more sensitive and specific for PsA screening compared to PASQ and ToPAS. Another study reported the sensitivity and specificity of PEST as 68% to 71%, respectively.[35] In this study, the PEST scale was found to have higher sensitivity and specificity than PASE and Early Arthritis for Psoriatic Patients (EARP). However, some studies showed lower sensitivity or specificity for PEST, compared to other screening tests.[36] Nevertheless, the PEST scale was found to have a higher sensitivity, but lower specificity in the head-to-head comparison with ToPAS 2 in our study. The reason for the difference between the study results can be attributed to the PsA prevalence, articular involvement (axial or peripheral) difference, mean age, and bias in patient selection. On the other hand, the number of studies investigating the correlation of PEST with other tests is limited. Mazzotti et al.[20] found a significant and moderate correlation of PEST with CASPAR. Our study showed a strong positive correlation between PEST and ToPAS 2, as well as a moderate positive correlation between PEST and CASPAR. Nonetheless, the PEST questionnaire may be a better alternative in the general population with a lower prevalence of PsA than psoriatic patients due to containing fewer questions and ease of use compared to other screening tools.[32]

The feasibility was evaluated with the difficulties experienced by patients while responding to items and with the number of unanswered items by patients. In the linguistic

validation stage, the most challenging item in the forward translation process was Question 3 (pits in nails) in terms of ensuring compliance. Furthermore, there were minor discrepancies between the translators for Question 3 of PEST, which were edited by translators. Moreover, the individuals who responded to the questionnaire items misunderstood Question 3, since it yielded a poor internal consistency (upon exclusion, the Cronbach alpha coefficient of the item increased to 0.866). Two important reasons were considered for this. First, this question was about nail pitting. When it was examined, it was found that the patients understood the word "PIT" better among the Turkish meanings of the words "HOLE" or "PIT" in the original question, but they misunderstood the word "HOLE". Therefore, instead of the Turkish version of the original question "Do your fingernails or toenails have holes or pits?", the Turkish version of "Do your fingernails or toenails have pits?" was asked. This was also the difference between the edited form and the original form of Question 3. The second important reason was explained by the high sensitivity and low specificity of nail pitting, since it occurs in many skin diseases, as there may be a detachment of the nail from the nail bed (onycholysis), scaly white folds (subungual hyperkeratosis) as well as changes in the appearance of the nail bed in addition to nail pitting. Accordingly, Turkish patients may have misunderstood Question 3, since it does not include the mentioned specific words.

Our study has three potential limitations. First, excluding rheumatic diseases and non-inflammatory musculoskeletal disorders that mimic PsA. Although we attempted to create a homogeneous cohort, the effects of the excluded diseases on the sensitivity and specificity of PEST could not be determined. Also, the area under the ROC curve was unavoidably found to be very high. Second, the center where the study was conducted is a tertiary care center, and there is no other center following treatment-resistant, severe, and long-term follow-up psoriatic patients in our region. A total of 58% of the patients were on biological agents and 33% were on methotrexate. The majority of these patients also had risk factors for the development of PsA (nail psoriasis). Moreover, the fact that psoriatic patients were not screened for PsA so far in the center where the study was conducted is another point to consider. Therefore, these patients were found to have a higher rate of undiagnosed PsA than expected. Third, not evaluating the extent of skin involvement in patients with psoriasis is another limitation of our study.

In conclusion, the Turkish version of PEST is a reliable and valid tool for screening PsA in Turkish patients with psoriasis, in whom all other rheumatic diseases are excluded. Using a cut-off value of ≥3.0 for PEST, high sensitivity and specificity can be obtained for the diagnosis of PsA.

Ethics Committee Approval: The study protocol was approved by the Pamukkale University Faculty of Medicine Ethics Committee (date: 09.08.2019, no: E.54842). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Conception or design of the work; data collection, data analysis and interpretation: S.K.; Conception or design of the work, data analysis and interpretation: U.K.; Conception or design of the work: N.K.; Conception or design of the work, data collection: H.A.

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Psöriyazis Epidemiyoloji Tarama Testi (PEST)

Hasta Adı : .....

Doğum Tarihi : .....

Vizit Tarihi : .....

		Evet	Hayır
1	Daha önce hiç şiş bir ekleminiz oldu mu? (veya eklemler)		
2	Daha önce bir doktor sizde eklem iltihabı olduğunu ifade etti mi?		
3	Parmak veya ayak tırnaklarınızda çukurlaşma var mı?		
4	Topukta ağrınız oldu mu?		
5	Belirli bir sebep olmadan tamamen şiş ve ağrılı bir parmak veya ayak parmağınız oldu mu?		
	Total Pest Skoru		

Appendix 1

Psöriyazis Epidemiyoloji Tarama Testi (PEST)

Hasta Adı : .....
Doğum Tarihi : .....
Vizit Tarihi : .....

		Evet	Hayır
1	Daha önce hiç şiş bir ekleminiz oldu mu? (veya eklemler)		
2	Daha önce bir doktor sizde eklem iltihabı olduğunu ifade etti mi?		
3	Parmak veya ayak tırnaklarınızda çukurlaşma var mı?		
4	Topukta ağrınız oldu mu?		
5	Belirli bir sebep olmadan tamamen şiş ve ağrılı bir parmak veya ayak parmağınız oldu mu?		
	Total Pest Skoru		

Aşağıdaki çizimde, lütfen rahatsızlığa neden olan eklemleri (yani sert, şişmiş veya ağrılı eklemler) işaretleyin.