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Diagnostic accuracy and clinical utility of the EARP questionnaire for detecting early psoriatic arthritis: a Turkish multicenter validation study

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Abstract

Introduction: Psoriatic arthritis (PsA) is a common but frequently underdiagnosed comorbidity of psoriasis, and early recognition is essential to prevent irreversible joint damage. The Early Arthritis for Psoriatic Patients (EARP) questionnaire is a brief and sensitive screening tool, yet a validated Turkish version has been lacking. This study aimed to linguistically adapt the EARP into Turkish, evaluate its psychometric properties, and determine its diagnostic accuracy for detecting PsA in dermatology practice.

Material and methods: This multicenter cross-sectional diagnostic study included 119 adults with dermatologist-confirmed psoriasis. Psoriatic arthritis diagnosis was established according to Classification Criteria for Psoriatic Arthritis (CASPAR). The EARP was translated using standardized forward–backward procedures and pilot-tested for cultural relevance. Internal consistency (Cronbach's α) and test–retest reliability ($ICC_{2,1}$) were assessed. Diagnostic performance was analyzed through receiver operating characteristic (ROC) curves, yielding area under the curve (AUC), sensitivity, specificity, and predictive values at the optimal cut-off determined by Youden's index.

Results: Psoriatic arthritis was diagnosed in 51 participants (42.9%). The Turkish EARP demonstrated high reliability, with Cronbach's $\alpha = 0.86$ and $ICC_{2,1} = 0.998$. Discriminative validity was strong: mean scores were significantly higher in PsA patients than in non-PsA individuals (6.47 ±1.99 vs. 1.74 ±1.35; $p < 0.001$). The ROC analysis showed excellent diagnostic accuracy (AUC = 0.971; 95% CI: 0.94–0.99). With the optimal cut-off ≥ 3, sensitivity reached 98.0%, specificity 88.2%, positive predictive value 86.2%, and negative predictive value 98.4%. Most false positives arose in individuals with fibromyalgia-like or mechanical pain symptoms.

Conclusions: The Turkish EARP is a valid, reliable, and clinically practical instrument for early PsA screening in dermatology settings. Routine implementation may enhance diagnostic timeliness, reduce missed PsA cases, and support efficient referral to rheumatology.

Key words: psoriatic arthritis, psoriasis, screening, EARP, validation, diagnostic accuracy, early detection, Turkish population.

Introduction

Psoriatic arthritis (PsA) is a chronic, immune-mediated inflammatory joint disease affecting approximately 20–30% of patients with psoriasis [1, 2]. The disease manifests through synovitis, enthesitis, dactylitis, and axial involvement, leading to progressive joint damage, pain, and functional disability if left untreated [3, 4]. Early recognition and intervention are crucial for preventing irreversible structural changes and preserving patients' quality of life [5].

Despite this, PsA often remains underdiagnosed during its early stages, with an average diagnostic delay of nearly 2 years. Irreversible joint damage may develop in 15–40% of patients within this period [6, 7]. Several factors contribute to this delay: 1) the subtle or absent

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musculoskeletal symptoms frequently encountered in dermatology settings and 2) the marked clinical heterogeneity of PsA presentations [7, 8]. Together, these factors hinder early recognition of PsA, particularly in non-rheumatology settings where inflammatory symptoms may initially be misinterpreted.

To bridge this diagnostic gap, multiple patient-reported screening instruments have been developed for use in dermatology and primary care settings. These include the Psoriasis Epidemiology Screening Tool (PEST), the Toronto Psoriatic Arthritis Screen (ToPAS), the Early Arthritis for Psoriatic Patients (EARP) questionnaire, and the Simple Psoriatic Arthritis Screening (SiPAS) tool [9, 10]. Among these, the EARP questionnaire has gained particular attention because of its brevity, high sensitivity, and ease of clinical application. Originally developed by Tinazzi et al. [11], EARP consists of 10 binary (yes/no) items targeting early musculoskeletal symptoms. Across diverse international cohorts, it has demonstrated sensitivity between 85% and 91% and specificity between 70% and 88% [11, 12]. Its rapid administration and patient-friendly format make it especially practical in busy dermatology clinics.

However, no Turkish-language adaptation of EARP has been validated to date. This represents an important unmet need, considering the estimated psoriasis prevalence in Turkey of 0.6–1.5% [13]. Although Turkish versions of PEST and SiPAS have been validated, EARP – which offers broader musculoskeletal coverage and higher reported sensitivity – remains untested in this population [14–16]. A brief comparison is warranted: while PEST is simple and widely used, and SiPAS offers an ultra-short format, EARP includes a wider inflammatory symptom spectrum, potentially enhancing early PsA detection in dermatology settings.

A culturally adapted and psychometrically validated Turkish version could standardize PsA screening in routine dermatology practice and strengthen interdisciplinary collaboration between dermatologists and rheumatologists. Therefore, the present multicenter study aimed to conduct a linguistic translation and psychometric validation of the Turkish EARP questionnaire and to assess its diagnostic accuracy for identifying PsA among patients with psoriasis. Establishing a reliable Turkish EARP version will provide clinicians with an efficient, evidence-based screening instrument for earlier PsA detection, facilitating timely referral and improved long-term outcomes.

Material and methods

Study design and setting

This cross-sectional diagnostic accuracy study was jointly conducted at 2 tertiary outpatient centers: the Department of Dermatology at Pamukkale University Faculty of Medicine and the Rheumatology Unit of Denizli State Hospital, Turkey.

Patients were consecutively recruited, ensuring that enrollment reflected routine clinical flow.

Patients were primarily referred due to musculoskeletal complaints, which introduced a referral bias that enriched the sample with individuals at higher PsA risk. This factor was acknowledged and addressed when interpreting diagnostic metrics.

Study population

A total of 119 adult patients (≥ 18 years) with dermatologist-confirmed psoriasis were consecutively enrolled between January and June 2025. Exclusion criteria included cognitive impairment, recent joint trauma, malignancy, major organ failure, or any coexisting inflammatory rheumatic disease.

Each participant underwent a comprehensive rheumatologic examination performed by an experienced rheumatologist, and PsA diagnoses were established according to Classification Criteria for Psoriatic Arthritis (CASPAR). Patients were classified into:

- the PsA group: fulfilled CASPAR criteria,
- the non-PsA group: did not meet CASPAR criteria.

Translation and cross-cultural adaptation

The original English EARP questionnaire was translated into Turkish following established cross-cultural adaptation guidelines. Two bilingual physicians independently produced forward translations, which were harmonized by consensus. Two additional bilingual experts performed a blinded back-translation. An expert committee comprising dermatologists and rheumatologists reviewed discrepancies to ensure conceptual equivalence.

A pilot test involving ten psoriasis patients confirmed clarity and cultural suitability. During this process, minor semantic refinements were made – for example, clarifying the phrasing of "joint swelling" to improve patient comprehension.

Data collection

Demographic and clinical variables – including age, sex, psoriasis phenotype, disease duration, musculoskeletal symptoms, family history of PsA, and comorbidities – were systematically recorded.

The Turkish version of the EARP questionnaire was administered in face-to-face interviews by trained investigators. Psoriatic arthritis diagnoses were confirmed by a rheumatologist blinded to questionnaire results.

For test–retest reliability assessment, a randomly selected subgroup of 50 stable patients completed

Table I. Demographic and clinical characteristics of PsA and non-PsA patients

Variable	PsA group (*n* = 51)	Non-PsA group (*n* = 68)	*p*
Age [years], mean ±SD	48.9 ±11.9	44.8 ±12.9	0.10
Female sex [*n* (%)]	32 (62.7)	37 (54.4)	0.39
BMI [kg/m²], mean ±SD	27.6 ± 4.9	26.9 ± 4.5	0.47
Psoriasis duration [years], median (IQR)	9 (4–15)	8 (3–14)	0.61
Family history of PsA [*n* (%)]	7 (13.7)	4 (5.9)	0.18
Joint symptoms present [*n* (%)]	51 (100.0)	26 (38.2)	< 0.001
Axial involvement/sacroiliitis [*n* (%)]	11 (21.6)	0 (0)	< 0.001
Peripheral arthritis [*n* (%)]	26 (51.0)	0 (0)	< 0.001
Nail psoriasis [*n* (%)]	21 (41.2)	19 (27.9)	0.14
EARP total score, mean ±SD	6.47 ±1.99	1.74 ±1.35	< 0.001

Data are presented as mean ±SD or n (%). Bold values indicate statistical significance (p < 0.05).
BMI – body mass index, EARP – Early Arthritis for Psoriatic Patients, PsA – psoriatic arthritis.

the questionnaire for a second time after a 7–14-day interval.

There were no missing or incomplete item responses; thus, no imputation procedure was required.

Statistical analysis

Analyses were performed using SPSS v26.0 and PASS 2020. Continuous variables were summarized as mean ±standard deviation and compared using independent-samples *t*-tests or Mann-Whitney *U* tests as applicable. Categorical variables were expressed as frequencies (%) and compared using chi-square or Fisher's exact tests.

Internal consistency was assessed, and test-retest reliability was evaluated using the mixed-effects intraclass correlation coefficient. Construct validity was examined by comparing mean EARP scores between PsA and non-PsA groups.

Diagnostic accuracy was evaluated using receiver operating characteristic (ROC) analysis, and the area under the curve (AUC) with 95% confidence intervals was calculated. The optimal cut-off score was determined using Youden's index, and sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were reported.

A sample size of 119 participants provided > 90% statistical power to detect an AUC ≥ 0.85 at $\alpha = 0.05$, assuming a null AUC of 0.50. All tests were two-sided, and $p < 0.05$ was considered statistically significant.

Bioethical standards

The study protocol was approved by the Non-Interventional Clinical Research Ethics Committee of Pamukkale University (Decision No: 2025/13; Document No: E-60116787-020-719051; July 9, 2025). All procedures followed the Declaration of Helsinki, and written informed consent was obtained from all participants.

Results

Patient characteristics and psoriatic arthritis prevalence

A total of 119 adults with dermatologist-confirmed psoriasis were included in this multicenter study. Among them, 51 patients (42.9%) fulfilled CASPAR criteria for PsA. Demographic and clinical characteristics are summarized in Table I.

The PsA group was slightly older than the non-PsA group (48.9 ±11.9 vs. 44.8 ±12.9 years), although the difference was not statistically significant ($p = 0.10$). Sex distribution, body mass index, and psoriasis duration were comparable between the groups (all $p > 0.05$). Joint symptoms were present in all PsA patients but only in 38.2% of non-PsA participants ($p < 0.001$). Sacroiliitis and peripheral arthritis were observed exclusively in the PsA cohort (both $p < 0.001$), supporting the diagnostic distinction between the 2 groups.

These findings collectively indicate that musculoskeletal symptoms – particularly articular pain and stiffness – serve as key clinical indicators warranting rheumatologic evaluation in psoriasis patients.

Psychometric properties of the Turkish Early Arthritis for Psoriatic Patients Questionnaire

The Turkish EARP demonstrated excellent reliability and strong construct validity:

- internal consistency was high (Cronbach's $\alpha = 0.86$),
- test–retest reliability was nearly perfect ($ICC_{2,1} = 0.998$).

Mean EARP scores differed markedly between groups: 6.47 ±1.99 in PsA vs. 1.74 ±1.35 in non-PsA ($p < 0.001$). This

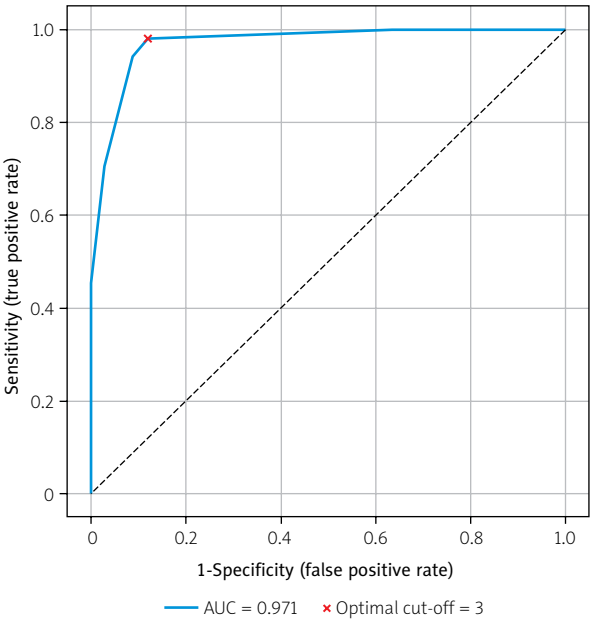

Fig. 1. Receiver operating characteristic (ROC) curve for the Turkish version of the EARP questionnaire in detecting psoriatic arthritis (PsA). The ROC curve demonstrates excellent diagnostic performance with an area under the curve (AUC) of 0.971 (95% CI: 0.94–0.99). The optimal cut-off score was determined as ≥ 3 according to Youden's index, yielding 98.0% sensitivity and 88.2% specificity.

pronounced difference supports the discriminative ability of the Turkish version in distinguishing inflammatory from non-inflammatory musculoskeletal symptoms.

Diagnostic accuracy and optimal cut-off

The ROC analysis showed outstanding diagnostic performance, with an AUC of 0.971 (95% CI: 0.94–0.99) (Fig. 1, Table II). The ROC curve analysis was performed using SPSS v26.0.

Using the optimal cut-off score of ≥ 3 (Youden's index), the following diagnostic parameters were obtained:

- sensitivity: 98.0% (50/51),
- specificity: 88.2% (60/68),
- false-positive cases: 8 patients,
- false-negative cases: 1 patient,
- false-negative rate: 1.6%.

The extremely high sensitivity minimizes missed PsA diagnoses, which is particularly important in dermatology settings where early inflammatory symptoms may be subtle.

As noted in the methodological considerations, the observed high specificity may partly reflect the referral enrichment of symptomatic patients.

Predictive values and clinical implications

At the cut-off ≥ 3, the Turkish EARP yielded:

- PPV: 86.2%,
- NPV: 98.4%.

These metrics confirm that the Turkish version is robust both for identifying PsA and, importantly, for ruling it out in dermatology practice. The very high NPV indicates that patients scoring below the cut-off are highly unlikely to have active PsA, whereas the strong PPV supports using EARP scores to prioritize timely rheumatology referral.

Discussion

This multicenter validation study demonstrates that the Turkish version of the EARP questionnaire is a reliable, valid, and clinically effective screening tool for identifying early PsA among patients with psoriasis. The tool showed excellent psychometric performance and diagnostic precision within real-world dermatology settings.

Reliability and psychometric strength

The Turkish EARP exhibited outstanding reliability, with near-perfect temporal stability ($ICC_{2,1}$ = 0.998)

Table II. Diagnostic accuracy metrics of the Turkish EARP questionnaire for PsA detection

Metric	Value	95% CI/range	Interpretation
AUC	0.971	0.94–0.99	Excellent discrimination
Optimal cut-off (Youden's index)	≥ 3	–	Derived by maximizing (Se + Sp – 1)
Sensitivity	98.0%	94.5–100%	Very high; minimizes missed PsA
Specificity	88.2%	79.5–94.3%	High; acceptable false-positive rate
False-negative rate	1.6%	0.0–4.7%	Rare missed cases
PPV	86.2%	78.4–93.2%	Probability PsA given EARP ≥ 3
NPV	98.4%	95.7–100%	Probability non-PsA given EARP < 3
Youden's index (J)	0.862	0.81–0.90	Overall diagnostic efficiency

Values are calculated at the optimal cut-off (≥ 3).
AUC – area under ROC curve, NPV – negative predictive value, PPV – positive predictive value, Se – sensitivity, Sp – specificity.

and strong internal consistency (Cronbach's α = 0.86). These metrics are higher than those reported for other Turkish screening tools such as PEST, ToPAS II, and PASE, where ICC values typically range between 0.85 and 0.92 [17–19]. This level of reproducibility indicates that symptom reporting remains stable over time, supporting the tool's use not only in cross-sectional screening but also for monitoring early musculoskeletal symptoms longitudinally.

Diagnostic accuracy in context

The diagnostic performance of the Turkish EARP was equally impressive, with an AUC of 0.971 – one of the highest reported internationally. A cut-off score of ≥ 3 provided 98.0% sensitivity and 88.2% specificity, exceeding values from the original Italian cohort and subsequent Spanish and Korean adaptations [11, 20, 21]. These findings align with the primary goal of screening in dermatology: maximizing sensitivity to avoid missed PsA diagnoses, particularly during the preclinical or oligosymptomatic phase.

The PPV of 86.2% and NPV of 98.4% further support the ability of EARP to stratify risk efficiently (Table III). A negative score reliably excludes PsA, whereas a positive score directs dermatologists toward timely rheumatology referral. The clinical relevance is clear given that diagnostic delays exceeding 1 year are associated with irreversible joint damage and poorer long-term outcomes [22, 23].

Clinical interpretation and comparative insights

Demographic characteristics such as age, sex, body mass index, and psoriasis duration did not differ significantly between PsA and non-PsA groups – a finding consistent with previous studies indicating that demographics alone are insufficient to predict PsA emergence [24]. Instead, the strength of EARP lies in identifying early inflammatory symptoms such as morning stiffness, peripheral swelling, and enthesitis, which often precede structural damage.

In comparison with Turkish versions of PEST and SiPAS, EARP covers a broader spectrum of inflammatory musculoskeletal symptoms and displays higher reported sensitivity, making it particularly suited for early detection in dermatology settings. This broader scope may explain its superior discriminative ability, especially in populations where musculoskeletal complaints are heterogeneous.

False positives and referral bias

Eight patients were classified as false positives despite scoring above the cut-off. This pattern is consistent with known clinical overlaps between psoriasis, mechanical back pain, osteoarthritis, and fibromyalgia-like syndromes – conditions that frequently coexist in dermatology clinics [25–27]. These findings highlight that false positives largely reflect symptom overlap rather than questionnaire failure, underscoring the importance of brief clinical assessment to contextualize EARP results.

To reduce false positives in daily practice, combining EARP scores with targeted physical examination or, when available, focused musculoskeletal ultrasound may enhance accuracy.

The high sensitivity and specificity observed may partly reflect referral bias, given that the study population largely consisted of patients already reporting musculoskeletal symptoms. This enrichment likely elevated PPV and specificity and suggests that performance in unselected dermatology cohorts might be slightly lower. Nevertheless, this study design reflects real-world referral pathways, aligning the tool with typical clinical patterns in Turkey.

Table III. Predictive values of the Turkish EARP questionnaire

Metric	Value (%)
PPV	86.2
NPV	98.4
False positive rate	11.8
False negative rate	1.6

Values are calculated at the optimal EARP cut-off score (≥ 3). PPV – probability of PsA among EARP-positive patients, NPV – probability of non-PsA among EARP-negative patients. These results reflect strong discriminative power and confirm the tool's reliability in dermatology-based screening.
NPV – negative predictive value, PPV – positive predictive value.

Future directions and clinical implementation

Future research should follow EARP-positive patients prospectively to determine its predictive value for transition to definitive PsA, as well as its ability to forecast radiographic progression or treatment outcomes. Integration with advanced imaging methods could help validate subclinical inflammation in early or uncertain cases.

From an implementation perspective, embedding EARP into electronic dermatology record systems or automated clinic intake algorithms could streamline routine screening and optimize referral pathways.

Such digital integration may be particularly impactful in countries like Turkey, where dermatologist-led triage and a limited rheumatology workforce highlight the need for efficient PsA detection strategies.

Study strengths

Strengths of the study include its multidisciplinary structure, use of CASPAR criteria for diagnostic confirmation, and multicenter design, which improve internal validity and generalizability. The robust psychometric evaluation and strong statistical power (> 90%) further reinforce the reliability of the findings.

Study limitations

Limitations include the absence of factor analysis to evaluate item-level structure, the cross-sectional design precluding assessment of long-term predictive validity, and a moderate sample size that limited subgroup analyses based on psoriasis phenotype or comorbidities. Nonetheless, these limitations do not diminish the strong performance observed.

Conclusions

The Turkish EARP emerges as a highly sensitive, reproducible, and clinically feasible screening tool for early PsA detection. Its adoption in routine dermatology practice has the potential to significantly reduce diagnostic delays, promote earlier specialist referral, and ultimately improve long-term outcomes in patients with psoriatic disease.

Disclosures

Conflict of interest: The authors declare no conflict of interest.
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Ethical approval: The study was approved by the Non-Interventional Clinical Research Ethics Committee of Pamukkale University (Decision No: 2025/13; Document No: E-60116787-020-719051; Date: July 9, 2025).
Data availability: The data that support the findings of this study are available on request from the corresponding author (U.B.).

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