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ORIGINAL ARTICLE PEDIATRICS

# Should children with psoriasis be consulted to a rheumatologist? Result from pediatric rheumatology-dermatology collaboration

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## ABSTRACT

**OBJECTIVE:** The objectives of this study were to determine the musculoskeletal (MSK) conditions associated with pediatric psoriasis (Pso) and to evaluate the thickness of Achilles tendon of children with Pso and healthy controls (HCs).

**METHODS:** Pso patients who were followed-up in dermatology outpatient clinic were referred to a pediatric rheumatology center. All patients and healthy peers were evaluated with standardized forms. Both patients and controls underwent ultrasonographic evaluation for Achilles tendon thickness.

**RESULTS:** A total of 55 pediatric Pso and 46 healthy children were included in the study. Of patients with Pso 56.4% had arthralgia, 25.5% had lower back pain, 18.2% had heel pain, 12.7% had hip pain, and 10.9% described morning stiffness. Arthritis was detected in 7.3%, sacroiliac tenderness in 12.7%, and enthesitis in 9.1% of the patients. Arthralgia, lower back pain, and heel pain were significantly frequent in Pso group than healthy children median left and right Achilles tendon thicknesses of Pso patients who were significantly greater than that of HCs prevalence of psoriatic arthritis (PsA) among Pso patients was 7.3%.

**CONCLUSION:** Evaluation of a child with Pso regularly for the MSK complaints is critical for the early recognition of PsA. Ultrasonography is a useful technique for screening Pso patients for early detection of enthesopaty.

*Keywords: Achilles tendon; enthesitis; musculoskeletal involvement; psoriasis; psoriatic arthritis; ultrasonography.*

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Psoriasis (Pso) is an immune-mediated inflammatory skin disease displaying several presentations such as plaque, nail, guttate, inverse, pustular, and erythrodermic. Pso may be complicated with systemic features including arthritis, uveitis, and metabolic syndrome. Various musculoskeletal (MSK) manifestations, such

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as peripheral arthritis, enthesitis, dactylitis, and spondylitis, may accompany Pso [1]. According to adult studies, the prevalence of Pso is approximately 2–3% of general population, whereas psoriatic arthritis (PsA) is present in 30% of patients with Pso [1]. In Turkiye, estimated prevalence of Pso is delineated to be 0.4% and among these patients the ratio of PsA is 12.5%, whereas 0.05% of the general population is diagnosed with PsA [2]. However, data regarding e incidence and prevalence of juvenile PsA and Pso is yet lacking. The diagnosis of juvenile PsA is made according to the International League of Associations for Rheumatology (ILAR) criteria [3]. Patients are classified as having juvenile PsA in the presence of arthritis lasting at least 6 weeks and starting before 16 years of age that is associated with either Pso or with two of the following: dactylitis; nail pitting or onycholysis; or Pso in a first-degree relative [3]. There are few studies focusing on the subclinical MSK findings of adult psoriatic patients [4–6]. For instance, Zuliani et al. [4] detected active enthesitis by ultrasonographic evaluation in 20% of Pso patients without known MSK system features [4]. However, the data about the subclinical MSK findings in juvenile Pso patients are lacking. Most recently, Meneghetti et al. [7] reported that MSK pain was frequent in children with Pso and was associated with the severity of skin involvement. Furthermore, they demonstrated that MSK pain had a negative impact on quality of life. [7] Most of the patients with Pso initially present with cutaneous involvement, so they are referred to dermatologists. When skin findings are prominent, MSK complaints can be underestimated and it is still matter of debate whether it is necessary to consult rheumatology without an overt joint involvement [8].

In this study, we aimed to evaluate the presence of articular/extra-articular inflammatory conditions and enthesis thickness by ultrasonographic imaging in pediatric Pso patients who were followed-up by dermatology outpatient clinics.

## MATERIALS AND METHODS

This is a cross-sectional study performed between January 2019 and December 2019 by a collaboration between a tertiary pediatric dermatology and pediatric rheumatology clinic. The study group consists of pediatric Pso patients who were diagnosed in the dermatology outpatient clinics and control group is age/gender-matched randomly selected healthy volunteers.

### Highlight key points

- Children with Pso have more MSK complaints in inflammatory character than healthy children.
- Achilles enthesopaty frequency is increased in pediatric Pso population.
- Early diagnosis of psoriatic arthritis is critical in Pso patients for reducing deformities and suppressing inflammation.

Pso is classified according to the pattern of distribution (inverse, flexor, and seborrheic), morphology (plaque, guttat, erythrodermic, pustular, rupioid, and elephantine) and anatomic site (scalp, palmoplantar, genital, nail and, anal Pso) [9]. A pediatric dermatologist examined all patients and recorded their age at disease onset, Pso subtype, presence of nail involvement, and previous medications prescribed for cutaneous or nail Pso. Furthermore, all of them were questioned for the presence of arthralgia, arthritis, morning stiffness, hip pain, lower back pain, and heel pain in dermatology outpatient clinic. Special standardized evaluation forms were used (Appendix 1). Subsequently, pediatric patients with Pso were referred to pediatric rheumatology outpatient clinic.

Healthy controls (HCs) were the volunteers that visited pediatric outpatient clinics for either vaccination or general control. All of them were evaluated by the same questionnaire in pediatric rheumatology outpatient clinic (Appendix 2).

At pediatric rheumatology outpatient clinic, patients with Pso and healthy individuals were initially examined by two pediatric rheumatologists (HES and SGK) and two fellows (AT and FC). Demographic data, including age, sex, weight, height, family history, and comorbidities were also recorded. Subsequently, all patients and HCs were subjected to articular and entheseal examination. Modified Schober's test was performed to all patients and HCs for the evaluation of range of motion of lumbar spine. Measurements of <6 cm were regarded as abnormal. Finally, entheseal thickness of the Achilles tendon was measured by ultrasonography (US). The US examinations were performed in a darkened room by an expert pediatric rheumatologist (NAA), using an US (Venue 40, GE Healthcare) equipped with a broadband 6–18 MHz linear probe. The rheumatologist who performed US was blinded to the patients' diagnoses, questionnaire responses and physical examinations, as well. The thickness of the Achilles tendon was measured at longitudinal section with the probe parallel to the tendon's alignment, near to its insertion onto the calcaneus.

The study was reviewed and approved by the Kanuni Sultan Suleyman Training and Research Hospital Clinical Research Ethics Committee (Ethics approval number: KAEK/2018.6.13) and the parents/patients gave a written consent approving to be a participant of this study.

### Statistical Analyses

Statistical analyses were performed using the SPSS software version 21 (IBM SPSS Statistics V21.0, Chicago, IL, USA). Continuous data were described as mean and standard deviation (SD) or median and minimum–maximum where appropriate. The variables were investigated using visual (histogram and probability plots) and analytic methods (Kolmogorov–Smirnov) to determine whether or not they were normally distributed. Categorical variables were compared with the Chi-square test or Fisher's exact test where appropriate. The Mann–Whitney U-test was used to compare the non-normally distributed continuous data between two groups. $P<0.05$ was considered to show a statistically significant result.

## RESULTS

A total of 55 pediatric Pso patients were included in the study. Among them 20 (36.4%) were male and 35 (63.6%) were female. The mean±SD for age at diagnosis and current age was 9.3±4.1 and 10.3±4.9, respectively. The median body mass index of Pso patients and control group were 19.53 (12.24–34.17) and 18.22 (12.43–29.06), respectively. All Pso patients were referred to pediatric rheumatology clinic with a median of 2.8 (0.2–8) years after diagnosis. Consanguinity rate was 25.2% (n=14). Sixteen (29.1%) patients had a family history of Pso, while only two (3.6%) patients reported a family history of PsA. Among 55 patients with Pso, 10 (18.2%) had inverse pattern. According to morphologic classification, 32 (58.2%) had plaque, 9 (16.4%) had guttate, and 2 (3.6%) had pustular Pso. According to anatomic classification, 21 (38.2%) had nail, 36 (65.5%) had scalp, and 3 (5.4) had palmoplantar Pso. The control group consisted of 46 (20 boys and 26 girls) healthy volunteers. The median age of HCs was 10.45±4.64. The study group and HCs were similar in terms of age and gender.

Thirty-one (56.4%) of the Pso patients had arthralgia, while fourteen (25.5%) had lower back pain, ten (18.2%) heel pain, eight (14.5%) neck pain, seven (12.7%) back-pain, seven (12.7%) hip pain, and six patients described morning stiffness. Of 14 patients with lower back pain, only four reported inflammatory pain. Arthritis of knee was detected in four (7.3%), sacroiliac tenderness in seven (12.7%), and enthesitis in five (9.1%) patients by physical examination. None of the patients had dactylitis or uveitis. Comparison of demographic and clinical findings regarding MSK features of Pso patients and HCs is depicted in Table 1.

When evaluated ultrasonographically, median Achilles tendon thickness of Pso patients was significantly greater than of HCs (Table 2). Patients were classified according

**Table 1.** Comparison of demographic and clinical findings regarding musculoskeletal features of psoriasis patients and healthy controls

| | Psoriasis patients (n=55) % | Healthy controls (n=46) % | p |
|---|---|---|---|
| Female/male (n) | 35/20 | 26/20 | 0.3 |
| Age, years, Mean±SD | 10.27±4.95 | 10.45±4.64 | 0.65 |
| Arthralgia | 56.4 | 17.4 | <0.001 |
| Arthritis | 7.3 | 0 | 0.08 |
| Neck pain | 14.5 | 10.9 | 0.4 |
| Heel pain | 18.2 | 4.3 | 0.03 |
| Back pain | 12.7 | 10.9 | 0.51 |
| Lower back pain | 25.5 | 8.7 | 0.02 |
| Hip pain | 12.7 | 4.3 | 0.13 |
| Inflammatory lower back pain | 7.3 | 0 | 0.08 |
| Morning stiffness | 10.9 | 0 | 0.02 |
| Physical examination | | | |
| Enthesitis | 9.1 | 0 | 0.04 |
| Sacroiliac tenderness | 12.7 | 0 | 0.01 |
| Dactylitis | 0 | 0 | – |
| Modified Schober test, Mean±SD | 5.4±0.71 | 5.6±0.51 | 0.52 |

SD: Standard deviation.

**Table 2.** Comparison of median Achilles tendon thickness of patients and healthy controls

| | Psoriasis patients (n=55) cm | Healthy controls (n=46) cm | p |
|---|---|---|---|
| Left Achilles tendon thickness | 0.51±0.13 | 0.38±0.07 | 0.03 |
| Right Achilles tendon thickness | 0.52±0.12 | 0.38±0.07 | <0.001 |

Table 3. Clinical features and Achilles tendon thickness of psoriasis patients according to age groups

| | Group 1 (4–9-years-old) n=21 | Group 2 (10–13-years-old) n=22 | Group 3 (14–18-years-old) n=12 |
|---|---|---|---|
| Female/male (n) | 15/6 | 12/10 | 8/4 |
| Arthralgia, (%) | 37.5 | 50 | 91.7 |
| Arthritis, (%) | 9.5 | 4.5 | 8.3 |
| Neck pain, (%) | 4.7 | 22.7 | 16.7 |
| Heel pain, (%) | 14.2 | 13.6 | 33.3 |
| Back pain, (%) | 0 | 18.1 | 25 |
| Lower back pain, (%) | 4.7 | 22.7 | 66.7 |
| Hip pain, (%) | 0 | 13.6 | 33.3 |
| Inflammatory lower back pain, (%) | 4.7 | 4.5 | 16.7 |
| Morning stiffness, (%) | 14.2 | 9 | 8.3 |
| Enthesitis, (%) | 0 | 9 | 25 |
| Sacroiliac tenderness, (%) | 0 | 18.1 | 25 |
| Dactylitis, (%) | 0 | 0 | 0 |
| Modified Schober test, Mean±SD | 5.2±0.81 | 5.7±0.64 | 5.2±0.81 |
| Right Achilles tendon thickness, cm (min–max) | 0.41 cm (0.33–0.9) | 0.51 (0.35–0.73) | 0.64 (0.45–0.71) |
| Left Achilles tendon thickness, cm (min–max) | 0.43 (0.28–1) | 0.51 (0.36–0.69) | 0.65 (0.45–0.69) |

Min: Minimum; Max: Maximum; SD: Standard deviation.

to age group as follows: Group 1, 4–9 years old; Group 2, 10–13 years old; and Group 3, 14–18 years old. The median thickness of right Achilles tendon was 0.41 cm (0.33–0.9) in Group 1, 0.51 (0.35–0.73) in Group 2, and 0.64 (0.45–0.71) in Group 3, while the median thickness of the left Achilles tendon was 0.43 (0.28–1) in Group 1, 0.51 (0.36–0.69) in Group 2, and 0.65 (0.45–0.69) in Group 3. Clinical features and Achilles tendon thickness of Pso patients according to age group are summarized in Table 3. One patient with Pso had retrocalcaneal bursitis.

When patients with nail or scalp disease were compared with others, there were no differences in terms of gender, MSK symptoms, and median thickness of Achilles tendon.

## DISCUSSION

In this study, arthralgia, heel pain, and lower back pain were more frequently seen in the Pso group than in HCs. Moreover, presence of arthritis, enthesitis, sacroiliac tenderness, inflammatory back pain, and morning stiffness were only observed in Pso patients. The prevalence of PsA was revealed to be 7.3% among children with Pso. Subclinical enthesopathy (9.1%) was detected only in Pso patients. One patient with Pso had retrocalcaneal bursitis as well. The median thickness of the Achilles tendon was significantly higher in patients with Pso (without clinical sign of enthesitis) than in healthy children. To our knowledge, this is the first study presenting data from pediatric dermatology and rheumatology collaboration in pediatric patients with Pso.

Although the etiopathogenesis of JIA is not fully elucidated, the prevalence of chronic arthritis is known to be increased in Pso patients. Inflammatory arthritis occurs in 2–3% of the general population, but among patients with Pso, the prevalence of inflammatory arthritis varies from 6% to 42% in adults [1]. To avoid joint deformity and to improve patients' outcomes, both early diagnosis of PsA and initiation of appropriate treatment are critical [10]. An extended report revealed that diagnostic delay of more than 6 months contributes to poor outcome in psoriatic arthritis patients [11]. Mild arthritis or enthesitis might be overlooked by dermatologists as they are not well experienced on MSK examination. A high number of undiagnosed PsA patients were reported by rheumatologists after evaluating psoriatic populations. Evaluating Pso patients periodically for MSK complaints by

dermatologists is an important first step for the early recognition of PsA. In the light of this idea, there are some reports concerning the evaluation of adult Pso patients for detecting PsA beforehand [12–18]. For the early recognition of PsA by dermatologists and general practitioners, several screening questionnaires were developed, such as the Psoriasis Epidemiology Screening Tool (PEST), Psoriatic Arthritis Screening and Evaluation, and Early Arthritis for Psoriatic Patients [13, 19–21]. However, these screening tools were developed for adult patients and there are no recommended and validated tools for early detection of PsA in pediatric Pso patients. Burden-Teh et al. [22] had evaluated the dermatologists' approach and experiences of assessing joint complaints of children with Pso [22]. This study had shown that there is a lack of knowledge about questioning of children for PsA and performance of MSK examination. Although over 80% of dermatologists had questioned the presence of joint pain or soreness, only 39% of them were asking to their patients about joint swelling, 4% of them were questioning morning stiffness and 22% of them were questioning the affected sites (entheses or hands) and most of them were evaluating their patients just by the first visit. Consequently, the authors had recommended dermatologists to question joint complaints including pain, swelling, stiffness, "sausage" finger/toe, family history of Pso, or PsA, if possible to perform Pediatric Gait Arms Legs Spine assessment or PEST for children over 12 years-age and to refer their patients to pediatric rheumatology department if any signs or symptoms were present. In this study, all patients were questioned with the same form by the same dermatologist to standardize the evaluation. Finally, 4 (7.3%) patients were diagnosed with PsA. Furthermore, we had shown that arthralgia, joint swelling, morning stiffness, heel pain, and inflammatory back pain were observed more commonly in Pso patients than in HCs. Parallel to these complaints, enthesitis, arthritis, and sacroiliac tenderness were observed only in the patient group. Although it is a cross-sectional study, we believe that children with Pso should be followed by pediatric dermatology and rheumatology collaboration.

In the recent years, due to having various superiorities, MSK US has become a more important tool than other imaging techniques in pediatric rheumatology practice. Non-invasiveness, rapidity of performance, ease of repeatability, high patient acceptability, lack of exposure to ionizing radiation, and not necessitating sedation while scanning younger children had made MSK US a more preferable technique [23].

It was shown in previous studies that subclinical synovitis and enthesitis had influenced the risk of developing PsA in psoriatic patients [24, 25]. For detecting enthesitis, MSK US coupled with power Doppler (US-PD) has been proven to be accurate for assessing tendons and joints. In several studies, US-PD was used to detect subclinical enthesitis in adults with PsA [5] and in children with enthesitis-related subtype of JIA [26–28]. US studies had revealed that frequency of subclinical enthesitis among adult Pso patients were between 11.6% and 41% [5, 6, 29, 30]. Most recently, Meneghetti et al. [7]. performed US examination to nine pediatric Pso patients who had pain on palpation of entheses and they found a sign of enthesitis in the calcaneus in only one patient. However, there is no study examining all Pso patients with or without MSK complaints with US and comparing them with HCs. In this cross-sectional study, we found that 9.1% of Pso patients had enthesitis detected with US. Studies have suggested that there are three clinically silent stages in Pso patients before clinical detection of PsA. The first stage is preclinical phase which is characterized by aberrant activation of the immune system. Subsequently, it is followed by subclinical phase with soluble biomarkers and imaging findings without any clinical symptoms and finally, prodromal phase in which patients suffer from arthralgia without presence of synovitis and/or enthesitis [31]. In our opinion, collaborative approach may provide clinicians to define the predictor factors in progression of Pso to PsA. Ultrasonographic findings could change by age, gender, and ethnicity. Tendon thickness has a linear relationship with age. However, the data about the normal thickness of tendons are still lacking. Chauvin et al. [32] evaluated the normal ultrasonographic findings of healthy children and they found the mean thickness of Achilles tendon as follows: 3.4 mm in young children (4–9 years of age), 4.1 mm in peripubertal children (10–13 years of age), and 4.5 mm in adolescents (14–18 years of age) [32]. In the present study, the median Achilles tendon thickness was significantly higher compared to our HC group and the study group of Chauvin et al. [32] as well.

Ash et al. [33] reported an association between nail disease and subclinical enthesopathy and they suggested that nail involvement may have a predictive role in PsA evolution. However, Zuliani et al. [4] did not find any association between nail findings and ultrasonographic differences in Pso patients. In the present study, we could not find any differences between patients with nail and scalp disease and others in terms of gender, MSK symptoms and thickness of Achilles tendon.

Most recently, a new set of classification criteria for JIA patients has been created by Pediatric Rheumatology International Trials Organization. However, these new classification criteria could not achieve a consensus to define pediatric PsA patients [34]. They suggested that prospective data collection is required to identify the correct definition of pediatric PsA patients. Therefore, we still classify our pediatric PsA patients according to ILAR classification criteria. However, we believe that improvement of the knowledge about the patients with PsA will provide us to classify these patients more easily.

The main limitation of our study is that the small patient sample size is not enough to show the accurate incidence or prevalence of PsA in children with Pso. Furthermore, the severity scores for Pso did not consider pediatric specificities such as progression of body surface area according to age, clinical aspect, and clinical types, and there was not a severity threshold for children. Due to the lack of a validated tool for assessing the disease severity in childhood Pso, we could not calculate the PASI score. Multicentric longitudinal studies with large number of patients are required for estimating incidence of PsA in Pso. Despite this limitation, there is a lack of published data about the MSK complaints of children with Pso and our study is the first pediatric study evaluating enthesitis and Achilles' thicknesses by US in children with Pso.

## Conclusion

Children with Pso have more MSK complaints in inflammatory character than healthy children. Although it is not enough to meet the criteria for diagnosis of PsA, existence of enthesopaty requires close follow-up in this patient population. Dermatologists should be aware of MSK features of Pso patients and should evaluate them regularly in this context. Early referral to pediatric rheumatologists of suspicious patients is critical to prevent joint deformity by starting treatment immediately. MSK examination and assessment of enthesitis with US by a pediatric rheumatologist may be an option for screening these patients to avoid diagnostic delay of PsA.

**Ethics Committee Approval:** The Kanuni Sultan Suleyman Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 05.07.2018, number: KAEK/2018,6,13).

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## Appendix 1. Evaluation form of musculoskeletal system findings in patients with psoriasis

| | | | |
|---|---|---|---|
| Name: | Gender: | Date of birth: | Date: |
| Date of diagnosis: | History of consanguinity: | | |
| Type of psoriasis: | | | |
| Nail involvement: | Scalp involvement: | | |
| Arthralgia: | Joints: | | |
| Joint swelling: | Joints: | | |
| Morning stiffness: | Duration of stiffness: | | |
| Heel pain: | Neck pain: | Back pain: | |
| Lower back pain: | Inflammatory back pain: | Hip pain: | |
| Myalgia: | Muscle weakness: | | |
| **Family history** | | | |
| Psoriasis: | Psoriatic arthritis: | Ankylosing spondylitis: | |
| Rheumatic disease: | | | |
| **Physical examination** | | | |
| Arthritis: | Joints: | | |
| Axial examination | | | |
| Dactilitis: | Fingers of dactilitis: | | |
| Sacroiliac tenderness: | | | |
| Modified shober: | Enthesitis: | | |
| **Ultrasonography** | | | |
| Right Achilles thickness (cm): | Left Achilles thickness (cm): | | |

## Appendix 2. Evaluation form of musculoskeletal system findings in healthy children

| | | | |
|---|---|---|---|
| Name: | Gender: | Date of birth: | Date: |
| Arthralgia: | Joints: | | |
| Joint swelling: | Joints: | | |
| Morning stiffness: | Duration of stiffness: | | |
| Heel pain: | Neck pain: | Back pain: | |
| Lower back pain: | Inflammatory back pain: | Hip pain: | |
| Myalgia: | Muscle weakness: | | |
| **Family history** | | | |
| Psoriasis: | Psoriatic arthritis: | Ankylosing spondylitis: | |
| Rheumatic disease: | | | |
| **Physical examination** | | | |
| Arthritis: | Joints: | | |
| Axial examination | | | |
| Dactilitis: | Fingers of dactilitis: | | |
| Sacroiliac tenderness: | | | |
| Modified shober: | Enthesitis: | | |
| **Ultrasonography** | | | |
| Right Achilles thickness (cm): | Left Achilles thickness (cm): | | |