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REVIEW ARTICLE

Psoriatic arthritis and physical activity: a systematic review

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Abstract

Introduction The positive effects of physical activity in both rheumatoid arthritis and ankylosing spondylitis have been proven, but no clear data is yet published regarding psoriatic arthritis (PsA). The aims of this study were (i) to assess the level of physical activity (PA) in these patients and (ii) to review the effects of PA on articular disease, extra articular symptoms, and overall well-being.

Methods The research strategy was performed on Pubmed, Cochrane, PEDro databases using the following keywords: "psoriatic arthritis AND physical activity" without restriction. The PRISMA methodology was used to select and analyze articles. We searched for all studies published online and in English before January 2021.

Results A total of 319 studies were retrieved by our search but only 13 could be included. Two reports showed that 17 and 68% of patients reported practicing regularly physical activity. Exercise improved the BASDAI (Bath Ankylosing Spondylitis Disease Activity Index), the general symptoms (pain and fatigue), and the quality of life. Muscle strength and some of cardiovascular comorbidities were also improved. While the studies concerning the risk of enthesitis or flare induced by physical activity are conflicting, recent clinical trials did not mention any adverse event. Finally, rehabilitation programs were associated with a reduction mainly of pain and fatigue.

Conclusion Studies show clear beneficial effects of exercise in PsA on disease activity, on well-being, and on comorbidities, and they seem to outweigh the risk of enthesitis induced by mechanical stress. Further investigations are necessary to confirm these results and to precise the modalities of exercise.

Key Points
- *Psoriatic arthritis patients have a sedentary lifestyle*
- *Physical activity has beneficial effects on disease activity, well-being and reduced some cardiovascular risk factor in psoriatic arthritis*
- *Risk of enthesitis and flares is low with exercise in psoriatic arthritis*

Keywords Cardiovascular · Enthesitis · Physical activity · Psoriatic arthritis

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Introduction

Psoriatic arthritis (PsA) is a chronic inflammatory rheumatic disease occurring in 0.05 to 0.25% of the general population and 6 to 41% of patients with psoriasis [1]. PsA belongs to the group of spondyloarthritis. Its most common symptom is enthesitis, an inflammation of tendons, and ligament insertion area. The complexity of PsA diagnosis lies in its polymorphism with both axial and peripheral involvement. PsA is associated with an increased risk of metabolic syndrome [2–4] and increased cardiovascular mortality and morbidity [5–9]. Usual treatments such as biodrugs show beneficial effects on articular and cutaneous symptoms [10]. Should the disease go into remission, patients still have more cardiovascular comorbidities than the general population, thus harming their cardiovascular health [11]. The World Health Organization (WHO) has defined physical activity (PA) as "any bodily movement produced by skeletal muscles that require energy expenditure". PA can be performed at any time of the day at work, at home (household chores), when biking or walking. Exercise is in fact a subcategory of PA, consisting of a planned, structured, and repetitive PA. In the general population, the WHO recommends practicing 150 min of moderate aerobic PA weekly, or 75 min of vigorous aerobic PA weekly, or an equivalent combination of moderately and vigorously intense activity [12]. The last EULAR recommendations promote PA in chronic inflammatory rheumatisms with the same modalities than in the general population [13]. More specifically, PA is advised in ankylosing spondylitis and in rheumatoid arthritis because of its positive effects on disease activity and comorbidities [14]. In the most recent GRAPPA recommendations regarding the treatment of PsA [15], no specific guidelines are given about PA.

We therefore performed a literature review in order (i) to assess the level of physical activity (PA) in PsA patients and (ii) to review the effects of PA on articular disease, extra articular symptoms, and overall well-being.

Methods

A systematic review of the literature was performed by two independent readers on the Pubmed, Cochrane, and PEDro free databases using the following key words: "Psoriatic arthritis" AND "Physical activity". This review was not prospectively registered in the International Prospective Register of Systematic Reviews PROSPERO.

Study inclusion and exclusion criteria

The flowchart (Fig. 1) and the methodology of the study were generated in accordance with the PRISMA guidelines in order to carry out a systematic literature review. Population Intervention Comparison Outcome Study (PICOS) criteria of studies included (1) patients with diagnosis of psoriatic arthritis using CASPAR criteria or alternative criteria, age > 18 years, (2) intervention consisting of physical activity or structured exercise, (3) an exercise group compared to a control group continuing usual activity, (4) eEfficacy and safety outcomes, and (5) no restriction on study design or sample size.

All studies published before January 2021 and written in English were included. The most relevant articles were hand selected. Two independent investigators (JK and FV) read and reviewed articles. The list of reasons for exclusion of individual articles can be found in the flow chart (Fig. 1).

Data screening, selection, and extraction

Two independent reviewers completed each stage of the review (screening, selection, extraction). Any discrepancies between reviewers were resolved by discussion with the senior author if needed (DW). Two reviewers (JK and FV) independently scanned the titles and abstracts for initial screening and assessed full articles for eligibility and extracted the data from the selected articles. The extracted data included the country in which the study was carried out, patients' characteristics, disease activity, primary and secondary evaluation criteria, levels and effects of PA, along with PA protocols.

Results

Study selection

Of the 319 studies identified in Pubmed database and the 4 studies identified in PEDro database, 303 were excluded after reading the abstract because they did not address PA or were not translated in English. Most studies looked at the effects of treatments on PA or addressed diseases other than PsA (psoriasis, rheumatoid arthritis, ankylosing spondylitis). Five articles were duplicated. Finally, after reading the full text of the remaining 15 articles, we retained 13 studies for analysis: 2 epidemiological studies, 3 therapeutic clinical trials, 4 safety studies, and 4 about rehabilitation programs. The most recent therapeutic clinical trial consisted of 2 articles but was counted as only one [16, 17]. Among the 2 excluded articles, one was about the characteristics of a rehabilitation program [18]. Another one focused on the screening of rheumatic disease in athletes [19]. No Cochrane review on PA in PsA was found (Fig. 1).

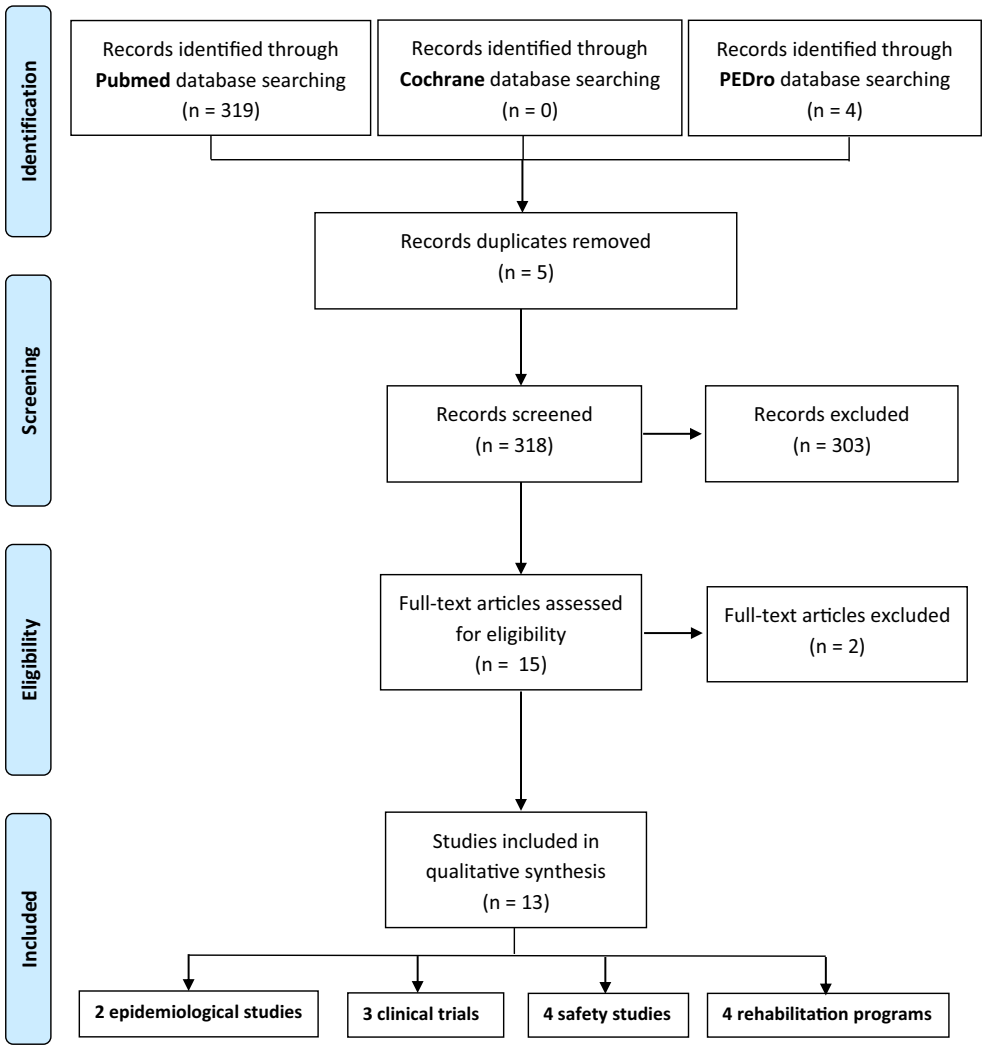

Fig. 1 Flow chart

Physical activity practice in PsA patients (Table 1)

Two epidemiological studies have specifically assessed the level of PA in cohorts of inflammatory rheumatisms including patients with PsA, axial ankylosing spondylitis, and rheumatoid arthritis. In a Swedish cohort, among the 2126 spondyloarthritis patients, 1185 had PsA. A total of 68% of all patients said they followed the general WHO recommendations on PA. Young women with PsA tended to be less compliant with the recommendations [20]. In a Chinese cohort, only 17% of PsA patients versus 22% of rheumatoid arthritis patients followed the recommended 30 min of moderately intense PA daily [21]. The last study to publish data about the level of PA in patients with PsA was included as a

Table 1 Epidemiological studies about PA participation in psoriatic arthritis

Study	Patients	Methods	PA participation
Haglund *et al.* (2012), Sweden [20]	*N* = 2126 SPA (PsA = 1185) Skane Health Care Register	A survey with 3 questions :intensity, duration, timer/week	68% respected WHO recommendations about PA
Larkin et al. (2016), China [21]	*N* = 102 (PsA = 12) CASPAR criteria	Yale Physical Activity Survey	17% respected 30 min of walk per day
Wervers et al. (2019), Netherlands [22]	*N* = 87 (PsA = 87) CASPAR criteria	Interview with 2 binary questions : Regularity and avoidance	48% practiced regularly PA

PsA psoriatic arthritis, *CASPAR* classification of psoriatic arthritis, *WHO* World Health Organization, *PA* physical activity

tolerance study. In this cohort of 84 patients with PsA, 48% reported exercising regularly. Among patients who are not physically active, 64% of them avoided doing so voluntarily [22].

Benefits of PA

Disease activity (Table 2)

The 3 clinical trials regarding PA evaluation in PsA were very different. The types of exercise and the evaluation criteria differed from one study to the next rendering the global assessment and the meta-analysis challenging. In the 3 following studies, a first group comprising active patients having followed a specific exercise program was compared to a second control group in which patients were instructed to continue their usual physical activity.

Thomsen et al. evaluated the effects of supervised exercise on disease activity. Patient's characteristics were similar in the exercise group and the control group. Mean age was close to 50 years and mean BMI (body mass index) was 28 kg/m^2 in both groups. Mean disease duration was 3 to 5 years. A total of 91% of patients in the exercise group versus 80% in the control group were treated with conventional synthetic disease-modifying anti-rheumatic drugs (DMARDs) and a third with biological DMARDs ($p > 0.05$). Before starting the training program, the mean patient global assessment (PGA) score was below 40/100 mm (a PGA score ≤ 20 is defined as low disease activity). The mean high sensitivity C-reactive protein (hsCRP) was below 2 mg/l. The training program consisted of high intensity interval training (HIIT) on cyclergometer during 11 weeks (2 times per week, 10 min warm-up, 4 times 4 min, 85–95% of the maximum heart rate separated by 3 min at 70% of the maximum heart rate). Then, instructions and information were given to participants in the intervention group about HIIT exercise and the possibility to apply it in cycling, walking, or running. After 11 weeks, patients were encouraged to continue the same kind of exercise for 6 months without supervision. The PGA was the primary outcome and was not different between both groups at 3, 6, and 9 months. The secondary outcomes about disease activity score (disease activity score 44, *Ankylosing Spondylitis Disease Activity Score*), enthesitis score (Spondyloarthritis Research Consortium of Canada Enthesitis Index), and blood inflammation (hsCRP) measured at 3, 6, and 9 months were similar in the exercise group compared to the control group [16].

Roger-Silva et al. assessed the effects of strength exercise on PsA disease activity. The exercise group and the control group were clinically similar. Mean age was close to 50 years in both groups and mean disease duration was 10 to 12 years. More than 75% of the patients were treated with methotrexate (80% in the exercise group versus 72% in the

Table 2 Clinical trials of physical activity efficacy in psoriatic arthritis

Study	Patients		Methods	Results			
	Groups	Characteristics	Exercise/duration	Disease activity	Inflammation	Fatigue/pain	Quality of life
Thomsen et al. (2018), Norway [16]	N = 67 PsA (EG = 32, CG = 35) CASPAR criteria	Age = 48 years, F = 64% BMI = 28 kg/m^2 Disease duration = 4.2 years, csDMARDs = 85%; bioDMARDs = 32%	HIIT (cycloergometer) 11 weeks	PGA − 5.86/100	CRP − 0.11 (mg/l)	Fatigue − 15.86/100*	Not evaluated
Roger-Silva et al. (2017), Argentina [23]	N = 41 PsA (EG = 20, CG = 21) CASPAR criteria	Age = 52.5 years, F = M Disease duration = 11 years csDMARDs = 76%; bioDMARDs = 24%	Strength Ex 12 weeks	BASDAI − 2/10*	Not evaluated	Pain − 25.1/100*	HAQ − 0.27*
Häkkinen et al. (1994), Finland [24]	N = 39 PsA or onset RA (EG = 21, CG = 18)	Age = 43 years, F = M, Disease duration = 3 years csDMARDs = 100%	Strength + aerobic Ex 6 months	Ritchie's articular index − 6.2	SR − 11.6 (mm)	Not evaluated	HAQ − 2.2

*$p < 0.05$ with positive effect on exercise group

PsA psoriatic arthritis, *RA* rheumatoid arthritis, *CASPAR* classification of psoriatic arthritis, *F/M* female/male, *BMI* body mass index, *EG* exercise group, *CG* control group, *HIIT* high intensity interval training, *Ex* exercise, *PGA* patient global assessment, *BASDAI* Bath Ankylosing Disease Activity Score, *CRP* C-reactive protein, *SR* sedimentation rate, *HAQ* Health Assessment Questionnaire

control group; $p = 0.523$). The exercise consisted of performing repeated contractions of the main muscles of the upper limbs, legs, and trunk using specific devices (3 sets of 12 repetitions at 60% of the maximum repetition separated by 2 min of rest) twice a week, during 12 weeks. Exercise was likely supervised but it was not specified in the article. The primary outcome was the Health Assessment Questionnaires (HAQ) score (detailed below). The secondary outcome was the disease activity. The Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) was significantly reduced in the exercise group compared to the control group from 5.5 to 3.3 (3.3 ± 2.1 vs 4.8 ± 2.4 $p = 0.038$), while the Bath Ankylosing Spondylitis Functional Index (BASFI) and the Disease Activity Score 28 (DAS 28) were not significantly improved [23].

Häkkinen et al. later studied the effects of combined exercise associating strength and aerobic exercise on disease activity. Patients with RA or PsA with no information about diagnosis criteria were included. The average age was close to 40 years and the patients were mostly overweight in the 2 groups. All subjects were treated with DMARDs. Strength exercises were performed on the arms, legs, and trunks using elastic bands (the first and second months: 15–30 repetitions at 40% of the one-repetition maximum, the third month: 50–60% of the one-repetition maximum, and the fifth and sixth months: 6–11 repetitions at 70 to 80% of the one-repetition maximum) twice a week during 6 months. In addition, aerobic exercises such as biking, walking, or swimming were prescribed twice a week without instructions about intensity or duration. Primary and secondary outcomes were not clearly defined. Ritchie's articular index decreased in both groups after 6 months, although the result was not statistically significant between both groups. Sedimentation rate decreased only in the exercise group after the exercise protocol (25.2 ± 24.7 before and 13.6 ± 19.5 after $p < 0.05$), but again without a significant difference between both groups [24].

Fatigue (Table 2)

While fatigue is common and an important concern in PsA patients [25, 26], Thomsen et al. found a reduction in the score of fatigue from 43.5 to 27.9 out of 100 (− 15.8 ± 9.8 vs − 3.03 ± 9.79 $p = 0.05$) after 3 months of PA but not after 6 and 9 months. One explanation is that the exercise was supervised for only 3 months and patients were perhaps less compliant afterwards [16]**.** In Roger-Silva et al. study, the vitality score in Short Form 36 (SF36) was not different between groups.

Pain and quality of life (Table 2)

Although pain measured using a standard visual analog scale (VAS) did not differ between the exercise and the control groups in Thomsen's study [16], in Roger-Silva's study [23], the pain score and the general health score of the SF36 improved significantly in the exercise group at 12 weeks (72.5 ± 19.2 vs 53.4 ± 14.1, $p = 0.0017$; 63.6 ± 13.1 vs 53 ± 14.1 $p = 0.02$) showing a better quality of life. Functional impairment assessed by HAQ also improved from 0.72 to 0.45 (0.45 ± 0.43 vs 0.77 ± 0.55 $p = 0.048$).

Muscle strength

As expected, resistance exercises increased muscle strength. With the exception of biceps strength, all other muscle groups of the upper limbs (triceps, hand) and lower limbs (quadriceps, gluteus) increased in strength in the Roger-Silva et al. study [23], but only leg extension on the right side was significantly different between the control and exercise group ($p = 0.035$). In Häkkinen's study [24], maximal dynamic knee extensor strength was significantly increased in the exercise group compared to the control group on the right (49 ± 55% vs 9 ± 25% $p < 0.01$) and left side (49 ± 73% vs 8 ± 40% $p < 0.05$). Similar results were obtained for trunk strength in flexion (15 ± 18% vs − 4 ± 18% $p = 0.05$) but not in extension. Moreover, the cross section area of the quadriceps was significantly increased in the exercise group from 75.8 ± 16.8 to 79.4 ± 18 cm^2 (+ 5.5% vs + 0.1% $p < 0.05$).

Cutaneous symptoms

Only Thomsen et al. did not identify a difference on psoriasis severity after 11 weeks of HIIT, but the mean PASI (Psoriatic Area Severity Index) at inclusion was 0 because the patients were in remission for both joint and skin symptoms [16].

Cardiovascular diseases

In a second study, Thomsen et al. assessed with the same groups and the same exercise as reported above, the effects of 11 weeks of HIIT exercise on cardiovascular factors. The main result was the VO2 max, a predictor of cardiovascular disease and mortality. VO2 max was significantly increased in the exercise group at 3 and 9 months compared to the control group (+ 3.72 ml/kg/min IC 95% 2.38 to 5.06 $p < 0.001$; + 3.08 ml/kg/min IC 95% 1.63 to 4.53 $p < 0.001$). As for secondary outcome results, the truncal fat percentage measured with a dual-energy X-ray absorptiometry was significantly reduced after 3 months in exercise group compared to control group but not after 9 months (− 1.28% IC 95% − 2.51 to − 0.05 $p = 0.04$). Heart rate and systolic/diastolic pressure were not statistically different between the 2 groups at 3 and 9 months [17].

Moreover, endothelial and cardiac dysfunction was described in early PsA and related to systemic inflammation [27–30]. By analogy with other inflammatory rheumatisms, PA should improve this cardiovascular dysfunction in PsA.

Recently, studies showed an improvement in endothelial dysfunction after 3 and 6 months of aerobic and resistance exercise in patients with rheumatoid arthritis [31, 32], while another study demonstrated an improvement in cardiac function after 2 years of aerobic exercise [33]. Further investigations are needed to explore the benefits of PA on endothelial and on cardiac dysfunction in PsA.

Safety (Table 3)

The question of PA's effects on joint and enthesis in chronic inflammatory rheumatism is crucial to implementing recommendations. In animal models mimicking human psoriatic arthritis, a study suggests deleterious effects of biomechanical stress on Achille's tendon insertion generating local inflammation and an excess of bone formation [37]. But no similar data was published in PsA patients [38] and PA can cause enthesitis in athletes and healthy subjects too [39]. According to Di Matteo's study, 34% of healthy subjects had at least one sonographic inflammatory involvement of a lower limb enthesis according to the PDUS OMERACT criteria [40]. Enthesis thickness was the most frequent abnormality in 28% [40] and 23% [41] of the subjects followed by enthesophyte, hypoechogenesis, and PD signal.

Based on the two most recent clinical trials, no adverse events related to exercise or inflammatory flare of disease were mentioned in the active group [16, 23]. In contrast, in Häkkinen's study, 6 patients in the exercise group and 5 patients in the control group stopped temporarily the protocol due to an inflammatory flare and one in each group due to acute low back pain [24].

The effect of exercise induced mechanical stress on enthesis was indirectly studied in 4 cross-sectional studies and revealed conflicting data. Plantar pressure measured using a gait analysis system was not significantly different between patients with PsA with or without a history of dactylitis, an association of enthesitis and arthritis in toes. This suggests that plantar pressure has no impact on the onset of enthesitis [34].

Ultrasound diagnosis of enthesitis includes inflammatory damages (Doppler signal, increased thickness of enthesis) and structural damages (calcifications, erosions, enthesophytes). Regular exercise in PsA patients was a risk factor for structural damage to the Achille's tendon assessed by ultrasound (OR = 1.7 CI 1.16–3.17, $p = 0.01$), indicating mechanical damages with no associated inflammatory sign [35]. While in another study, PsA patients reporting regular physical activity did not have an increased risk of ultrasound enthesitis according to the inflammatory-modified MASEI (Madrid Sonographic Enthesitis Index). However, the patients who expressed avoidance of any physical activity had a significantly reduced rate of ultrasound enthesitis ($\beta - 1.71$ IC -3.1 to 0.32) [22].

Finally, in a cohort of ankylosing spondylitis (meeting the modified New York criteria) and psoriatic arthritis (defined by

Table 3 Tolerance data on PA in PsA

	Study	Patients	Methods	Results
Clinical trial	Thomsen et al. (2018), Norway [16]	$N = 67$ PsA (EG = 32, CG = 35)	11 weeks HIIT, cycloergometer	No adverse effect
	Roger-Silv et al. (2017), Argentina [23]	$N = 41$ PsA (EG = 20, CG = 21)	12 weeks Resistance exercise + endurance	No adverse effect
	Häkkinen et al. (1994), Finland [24]	$N = 39$ PsA or onset RA (EG = 21, CG = 18)	6 months Resistance exercise	Flare (EG = 6, CG = 5)
Cross-sectional studies	Wervers et al. (2019), Netherlands [22]	$N = 87$ PsA $N = 25$ healthy	Risk factors of ultrasound enthesitis (upper and lower limbs)	Practice regularly PA (NS)
	Wilkins et al. (2016), UK [34]	$N = 24$ PsA $N = 12$ healthy	Comparison of plantar pressure with or without dactylitis	No difference
	Michelsen et al. (2017), Norway [35]	$N = 141$ PsA $N = 282$ Achilles' tendon	Risk factors of Achille's ultrasound enthesitis	Practice regularly PA (NS)
	Ozaras et al. (2005), Turquey [36]	$N = 14$ AS $N = 16$ PsA	Correlation FAOS items, blood inflammation and radiological damage	No correlation with difficulties in sport and recreation

*$p < 0.05$

PsA psoriatic arthritis, *RA* rheumatoid arthritis, *AS* ankylosing spondylitis, *CASPAR* classification of psoriatic arthritis, *EG* exercise group, *CG* control group, *HIIT* high intensity interval training, *FAOS* Foot and Ankle Outcome Score

the Moll-Wright criteria), the perceived difficulties in sport and leisure evaluated by the FAOS (Foot and Ankle Outcome Score) were not correlated with clinical score (inflamed foot 0–3), inflammatory markers, or radiographic score (Spondyloarthropathy Tarsal Radiographic Index). Thus, the risk of clinical enthesitis and radiographic structural damages does not seem to be linked to PA. A positive correlation between pain and perceived difficulties in sport and leisure has been demonstrated ($r = 0.693$, $p = < 0.01$). This confirms a limitation of physical activity in case of pain [36].

Impact of rehabilitation programs on PA practice (Table 4)

Rehabilitation programs or educational programs included patients with PsA, rheumatoid arthritis, and ankylosing spondylitis. These programs were very heterogeneous in terms of duration and types of exercise [42–45]. Pain improved in all studies and functional capacity improved in 3 studies. Fatigue was reduced in 2 studies. DAS28 only improved slightly in the study by Hagel et al. Positive effects on pain and fatigue appear to decrease over time. After these programs, patients changed their physical activity practice, with a significant increase of stretching and aerobic exercise.

Discussion

For the first time to our knowledge, we have carried out a comprehensive review of PA in patients with PsA. However, it was not possible to conduct a meta-analysis since our search found only 3 clinical trials with significant heterogeneity among the studies' designs.

The scatter of the results concerning the level of PA in PsA patients is probably related to the heterogeneity of the cohorts and to the subjectivity of various measurement strategies. One of the main limitations is that the degree of PA was evaluated using structured interviews or self-reported questionnaires, some of which lack scientific legitimacy. A more objective measurement of the PA using an actimeter is worth exploring. Otherwise, the low results about physical activity compliance are partly explained by the lack of promotion by the rheumatologist, by patients' personal beliefs such as fear of pain or kinesiophobia, and by fatigue and lack of time [46, 47]. Leung et al. assessed the levels of satisfaction and participation in the medical decision-making process involving the patient with PsA [48]. A total of 73% reported that they wanted more explanations and advice on PA and 50% on rehabilitation programs.

The 3 clinical trials were prospective, randomized, and controlled, rendering satisfactory levels of evidence [16, 23, 24]. However, these studies shared 2 biases: a selection bias related to the inclusion criterion based on volunteer patients and an

Table 4 Rehabilitation program effects at short and long term on chronic inflammatory rheumatism

Study	Patients	Methods	Results			
	Groups	PA intervention Day of assessment	Disease activity (DAS 28)	Pain (VAS)	Fatigue (VAS or NHP)	Quality of life (HAQ or NHP)
Leung et al. China 2016 [42]	$N = 97$ PsA (EG = 13, CG = 16)	Therapeutic education + supervised Ex 6 weeks 3 months	Not evaluated	− 0.82/10* − 0.84/10	− 0.35/10 − 0.45/10	− 0.08 − 0.17 *
Gronning et al. Norway 2014 [43]	$N = 141$ PsA = 54 (EG = 26 CG = 28)	Therapeutic education 4 months	− 0.33	− 7.04/100**	+ 2.44	− 0.04
Hagel et al. Sweden 2010 [44]	$N = 115$ peripheral arthritis $N = 59$ SpA No CG	Supervised Ex + stretch 18 days 4 months 12 months	− 0.2& 0 + 0.2	− 13/100& − 5/100 − 6/100	− 28/100& − 24/100& − 20/100&	− 12/100& − 10/100& − 9/100&
Hammond et al. UK 2008 [45]	$N = 167$ PsA = 25 (EG = 10, CG = 15)	Therapeutic education + supervised Ex 6 weeks 12 months	Not evaluated	− 2.67/100 ** − 6.03/100 *	− 5.43/100** − 5.44/100	− 0.01 * + 0.02

*$p < 0.05$, **$p < 0.01$ intergroups, &$p < 0.05$ intragroup

PsA psoriatic arthritis, *SpA* spondyloarthritis, *PA* physical activity, *Ex* exercise, *EG* education group, *CG* control group, *VAS* Visual analog scale, *NHP* Nottingham Health Profile, *HAQ* Quality of Life

evaluation bias in an analysis that is not blinded. Another limitation is the small sample size partly explained by patients' refusal to participate, with a rate of 25 to 50% depending on the studies. The results still suggest that anaerobic exercise (HIIT or strength) seems to have a positive impact on disease activity, on quality of life, on fatigue, on muscle strength, and partly on cardiovascular risk factors [17]. According to Roger-Silva et al., BASDAI was improved with a clinically relevant difference greater than 1.1 [49] after exercise protocol. However, this score mainly takes into account the axial symptoms of the disease whereas in this study, the patients presented mainly peripheral symptoms. Note, in the last 2 clinical trials, fatigue and pain were reduced by more than 15 mm out of 100, corresponding to a clinically relevant result [50, 51]. Compliance and adherence are the major barriers to non-drug treatments such as physical activity. In Thomsen's study, the improvement in fatigue observed at 6 months was not sustained at 9 months. Although the number of dropouts during the unsupervised period was low (n = 28/30), only 43% of patients reported in follow-up diaries that they had engaged in endurance exercise during the unsupervised period. This underscores the importance of supervision in increasing adherence [17]. Although no studies have evaluated the effects of physical activity on psoriasis in patients with psoriatic arthritis, a few studies have been conducted in psoriasis patients without arthritis symptoms. Physical activity is associated with a reduction in the incidence of psoriasis [52, 53]. And PASI is significantly reduced in overweight patients after an education program combining dietary advice and physical activity [54, 55]. In these studies, weight loss was a confounding factor in clearly assessing the efficacy of physical activity on cutaneous symptoms. Recently, Thomsen et al. have shown that obesity and particularly abdominal obesity are associated with an increased incidence of psoriatic arthritis and that high intensity physical activity (> 1 h per week) reduces its occurrence in overweight or obese patients [56]. Regarding cardiovascular outcomes, longer studies analyzing aerobic exercise may show a reduction in other cardiovascular risk factors and major adverse cardiovascular events. For the least recent trial, both patients with rheumatoid arthritis or PsA were included, thus limiting the generalization of the results in PsA patients. We were unable to compare all the studies' results because the protocols were different as were the primary and secondary endpoints. This highlights the variability of exercise protocols and criteria for assessing the disease in PsA [57].

The tolerance of physical activity or exercise was evaluated directly during clinical trials and indirectly during retrospective studies. In clinical trials, no adverse effects on disease activity score or quality of life were reported. The cross-sectional studies about risk factors of clinical or ultrasound enthesitis have many limits. According to Wervers' study, avoiding physical activity reduced the score for inflammatory enthesitis [22]. In almost all studies, the degree of PA is only indicated by a self-report or interviews which are both subjective. Moreover, some factors (for example, a history of enthesitis) could influence the participation of physical activity, thus restricting the interpretation of such results. The hypothesis is that mechanical stress in an inflammatory environment promotes the onset of enthesitis [58]. Reducing the inflammatory environment with treatments could reduce the risk of enthesitis. This is why it seems necessary for patients to be in remission before starting any physical activity. Properly adapted and supervised exercise could also minimize this risk.

Rehabilitation programs included educational programs on physical activity and in particular hand exercises, stretching, ergonomic postures, and fatigue management [42–45]. The duration of the programs ranged from several hours to several days. Three studies were randomized and controlled. Included patients had PsA or rheumatoid arthritis or ankylosing spondylitis. Analysis of results was not done separately, limiting interpretation for psoriatic arthritis. Also, the level of patients' participation in the study was low. Finally, the benefits related to the rehabilitation programs are not only due to the benefits of physical activity since other elements are taken into account in these programs. Recently, a narrative review of the literature was published on rehabilitation in psoriatic arthritis. Physical activity is a minor part of rehabilitation that includes physical therapy, balneotherapy/hydrotherapy, stretching, and occupational therapy [59]. The results still suggest a positive impact of rehabilitation programs mainly on fatigue, pain, and quality of life in chronic inflammatory rheumatisms.

The main strengths of this study are a rigorous methodology and a qualitative analysis of the studies to provide objective evidence regarding the effects of physical activity in psoriatic arthritis. This is one of the first systematic reviews of the literature on PA in psoriatic arthritis.

The main limitation of this systematic review is the small number of studies and participants included in the analysis. It reflects the difficulty of conducting studies in this disease and with this type of non-pharmacological treatment, which require additional motivation and time. This leads the authors to realize studies including patients with psoriatic arthritis and other chronic inflammatory rheumatic diseases such as rheumatoid arthritis or ankylosing spondylitis. Finally, only aerobic physical activity on a bicycle and resistance training were evaluated prospectively. It is therefore not possible to generalize these results to any type of physical activity.

This review challenges beliefs about the potential risks of PA in psoriatic arthritis and highlights its benefits on disease and comorbidities.

Conclusion

PSA patients have low level of PA despite the known benefits of PA on the progression and management of rheumatic

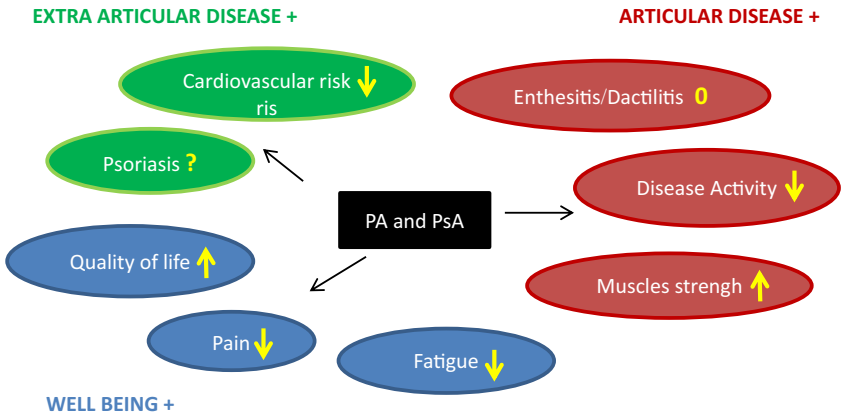

Fig. 2 Summary of physical activity effects in articular disease, extra articular disease, and well-being in PsA patients. 0 = no impact, ? = unknown effect

diseases. Physical activity in PsA showed widespread benefits of functional capacity, general well-being, fatigue, and quality of life. Tolerance of PA in PsA patients is an element of particular interest and today, available data confirms the low risk of flares and enthesitis (Fig. 2). The promotion of supervised physical activity should become a healthcare priority, especially for PsA patients.

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Declarations

Disclosures None.

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