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REVIEW ARTICLE

Psychological Therapies in Management of Psoriatic Skin Disease: A Systematic Review

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Abstract

Background Psoriasis is a chronic, immune-mediated skin disease shown to have a multifaceted relationship with psychological factors. Because these factors have been shown to both worsen and result from psoriasis, an increasing number of studies have sought to investigate the efficacy of various psychological interventions in psoriasis management.

Methods A systematic review of PubMed® and Scopus® databases was performed for studies investigating psychological interventions in psoriasis management published from 1 January 1990 through 4 November 2018. Primary articles published in English and conveying physical treatment outcomes were included, whereas articles not describing clinical outcomes were excluded. Studies supporting intervention efficacy were graded with a level of evidence according to the Scottish Intercollegiate Guidelines Network levels of evidence.

Results A total of 28 reports studying 27 unique sets of patients receiving psychological therapies in psoriasis management were identified, including three case reports and series and 24 clinical trials, investigating 1522 patients in total. Cognitive behavioral therapy and its variants, biofeedback, meditation and mindfulness-based therapies, hypnosis, music resonance therapy, motivational interviewing, emotional disclosure, and educational and multidisciplinary approaches have been studied in the treatment of psoriasis. Although 16 randomized controlled trials were included in this review, literature is limited by heterogeneity of methodology, analyses, and outcomes. Only 4 of 27 studies (three of which investigated cognitive behavioral therapy) were rated a level of evidence of 1+ or greater. Studies, overall, have sample sizes often <50 patients, lack follow-up past 12 months, and have attrition rates $>20\%$.

Conclusions Based on assigned levels of evidence, the most promising methods of psychological intervention in psoriasis include cognitive behavioral therapy, mindfulness-based therapies, motivational interviewing, and educational and interdisciplinary interventions. Further study is needed to determine the efficacy, practicality, and economic feasibility of these treatment options for patients with psoriasis.

Key Points

Psychological interventions used in psoriasis management include cognitive behavioral therapy and its variants, biofeedback, meditation and mindfulness-based therapies, hypnosis, music resonance therapy, motivational interviewing, emotional disclosure, and educational and multidisciplinary interventions.

This review highlights cognitive behavioral therapy and its variants, mindfulness-based therapies, motivational interviewing, and educational and interdisciplinary interventions as potentially useful adjunct therapies in patients with psoriasis.

Studies to date have been limited by heterogeneity in methods, analyses, and outcomes, and future work should seek to determine the efficacy, practicality, and economic feasibility of these treatment options for patients with psoriasis.

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1 Introduction

Psoriasis is an inflammatory skin disease affecting about 3% of adults in the USA [1]. This disorder manifests with thickened and scaly plaques and increased risk for other inflammatory conditions, including cardiovascular disease [1, 2]. Conventional treatment options include a diversity of topical to systemic agents aimed at suppressing aberrant immunological activity, including topical corticosteroids, topical vitamin D analogs, topical or systemic calcineurin inhibitors, phototherapy, methotrexate, vitamin A derivatives, and biologic agents. Although psychological stress has been shown to contribute to psoriasis onset, severity, recurrence, and slowed clearance, conventional psoriasis treatment regimens do not directly address psychological factors associated with the disease [3–5].

In the current literature, the association of psoriasis with increased psychological comorbidities, suicidal ideation, and exacerbation due to psychological factors is well-documented [5, 6]. In a study by Pompili et al. [6], patients with psoriasis showed a significantly greater history of suicidal thoughts than patients with melanoma or allergic dermatoses. Additionally, patients with psoriasis demonstrated significantly greater lifetime history of psychiatric disorders [6]. Comparatively, Manolache et al. [3] reported a significantly increased mean number of stressful events in 169 patients with psoriasis compared with 169 age- and gender-matched controls. In > 54% of these patients with psoriasis, at least one stressful event in the past year was associated with onset, recurrence, or spreading of disease [3]. Although recently published systematic reviews have also confirmed a likely temporal association between psychological stress and psoriasis onset, recurrence, and severity, work in this area has been noted to consist of many studies of limited quality [7, 8].

Interestingly, anxiety and depression may be a significant predictor of disease progression in psoriasis. In an investigation of 112 patients with psoriasis receiving photochemotherapy treatment by Fortune et al. [5], patients with increased worrying were shown to clear 1.8 times slower than those with less worry, despite similar age, alcohol intake, and disease onset, duration, and severity. The largest study suggesting a link between psoriasis and anxiety and depression comes from a cross-sectional evaluation conducted across 13 European countries and encompassing 626 patients with psoriasis [9] in which psoriasis was the skin disease with the highest association with depression, anxiety, and even suicidal ideation. Concerning depression, Lewinson et al. [10] found that patients with psoriasis who developed major depressive disorder (MDD) were at significantly increased risk of developing psoriatic arthritis compared with those who did not develop MDD. Depression has also been shown to occur in other immune-mediated inflammatory diseases, and evidence suggests there may be shared pathophysiological mechanisms [11]. Proinflammatory cytokines affecting monoaminergic neurotransmission, neurotrophic factors, and synaptic plasticity measures suggest associations between the brain and peripheral immune responses [11].

Given these associations with psychological comorbidities and a possible shared pathophysiological underpinning between these comorbidities with psoriasis, a number of studies have investigated the efficacy of various psychological interventions in psoriasis management [12–18]. A questionnaire-based study conducted by Linder et al. [19] investigated patient perception of disease and their doctor–patient relationship and revealed that more than half of patients feel a need to be listened to by their physician regarding their needs and that physicians need to improve their psychological skills and interpersonal communication [19]. Hope is another aspect of patient perception of disease and has been correlated with a higher quality of life (QoL) irrespective of disease severity or duration [20]. QoL impairment in psoriasis may be diminished with increased hope, which can be strengthened through psychotherapeutic intervention [20]. The psychological approach starting with the stressors, neuro-immuno-endocrine paths, psychological comorbidities, and psychological therapies must be taken into consideration by every dermatologist.

A broadened view of the disease and treatment approaches will enhance the chance of solving psychological conflicts, will improve patients' emotional state and coping, and may increase adherence to mainstream burdensome courses of treatment. With this in mind, this systematic review may empower providers to provide patients an active role in improving their QoL. Previous reviews in this area have either been limited to stress-reduction techniques or have not included a means of grading individual studies [21, 22]. Furthermore, given the large volume of literature published in this area in the last 3 years, a more contemporary synthesis of findings is needed. This article aims to provide a concise review of the evidence-based psychological management options used in patients with psoriasis while providing a level of evidence for each study suggesting efficacy in the treatment of psoriatic skin disease.

2 Methods

2.1 Search Criteria

A systematic review of PubMed® and Scopus® databases was performed to identify clinical studies regarding the use of psychological therapy in psoriasis management published from 1 January 1990 through 4 November 2018. Search

criteria implemented for the PubMed® database are presented in Table 1 in the Electronic Supplementary Material (ESM). Only primary articles published in English and conveying physical treatment outcomes were included. Articles not describing clinical treatment outcomes were excluded. Clinical trials, along with case reports and series of patients with psoriasis of all ages receiving psychological therapy (including cognitive behavioral therapy [CBT], biofeedback, mindfulness-based cognitive therapy [MBCT], mindfulness-based stress reduction [MBSR], hypnosis, music resonance therapy (MRT), motivational interviewing (MI), and educational and interdisciplinary interventions), either alone or as an adjunct treatment, were selected for review. From an initial result of 1295 articles, a single rater (AAQ) filtered articles based on title and abstract review, and subsequently on full-text review to determine articles meeting inclusion and exclusion criteria. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist is presented in Table 2 in the ESM.

2.2 Grading of Evidence

Articles were assigned a level of evidence (LOE) according to the Scottish Intercollegiate Guidelines Network (SIGN) LOE [23]. Articles were assessed for quality according to the following scheme: 1++ = high-quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs with very low risk of bias; 1+ = well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias; 1− = meta-analyses, systematic reviews or RCTs, or RCTs with a high risk of bias; 2++ = high-quality systematic reviews of case–control or cohort studies or high-quality case–control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal; 2+ = well-conducted case–control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal; 2− = case–control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal; 3 = case reports or series; and 4 = expert opinion [23].

2.3 Analysis of Studies

Studies were evaluated for intervention type, study design, number of subjects, attrition rates, physical results, psychological results (if reported), and post-intervention follow-up time. Attrition rates for studies were calculated by comparing the total number of subjects completing the experimental intervention in its entirety and associated follow-up procedures with the number of subjects starting the study (i.e., for RCTs, the number of patients randomized). Mean attrition rates and post-intervention follow-up periods were calculated for all intervention categories that included at least three trials. Computations were carried out using Microsoft® Excel 2013, and means are presented ± standard error of the mean unless otherwise noted.

3 Results

A total of 28 articles studying 27 unique sets of patients receiving psychological therapies in psoriasis management were identified. A flowchart quantitating the study selection process is presented in Fig. 1. Of 27 included articles encompassing 1522 unique patients, three were case reports and series and 24 were clinical trials, including 16 RCTs. Psychological interventions applied in psoriasis management fell into the following major categories: (1) CBT and its variants (eight studies), (2) biofeedback (two), (3) meditation, mindfulness-based therapy (three), (4) hypnosis (two), (5) MRT (one), (6) MI (one), (7) emotional disclosure (three), and (8) educational and multidisciplinary programs (seven). Results of the included studies are presented in Tables 1, 2, 3, 4.

3.1 Cognitive Behavioral Therapy and Biofeedback

CBT is a time-oriented, structured psychotherapy focused on finding current solutions and teaching skills that modify dysfunctional behavior and/or thoughts [12, 24, 25]. CBT has been used in various forms as adjunct therapy in somatic disorders such as chronic pain, irritable bowel syndrome, and psoriasis to address disease-associated depression, anxiety, and distress [25, 26]. Currently, CBT and its variations are the most extensively studied psychological interventions in psoriasis management, with eight included studies [12, 17, 26–31], four of which are RCTs encompassing 353 patients in total [12, 17, 26, 27]. Three of these four RCTs received LOE ratings of 1+ (Table 1). Of the four reports reporting Psoriasis Area and Severity Index (PASI) outcomes [12, 17, 26, 28], three provide evidence for disease severity improvement [12, 17, 28].

In an early study, Price et al. [31] allocated 31 patients either to usual therapy (including topical agents, etretinate, ultraviolet B [UVB], and/or ultraviolet-A with psoralens [PUVA]) alone or to usual therapy in combination with a series of eight, weekly 90-min meetings conducted by a clinical psychologist in which subjects were given the opportunity to discuss problems created by their psoriasis. Patients in the latter group were also taught specific relaxation techniques [31]. At baseline, disease severity as assessed by the mean physician-rated visual analogue scale (VAS) was 41 ± 23 and 31 ± 21 for the study and control groups, respectively. Results showed a significant change

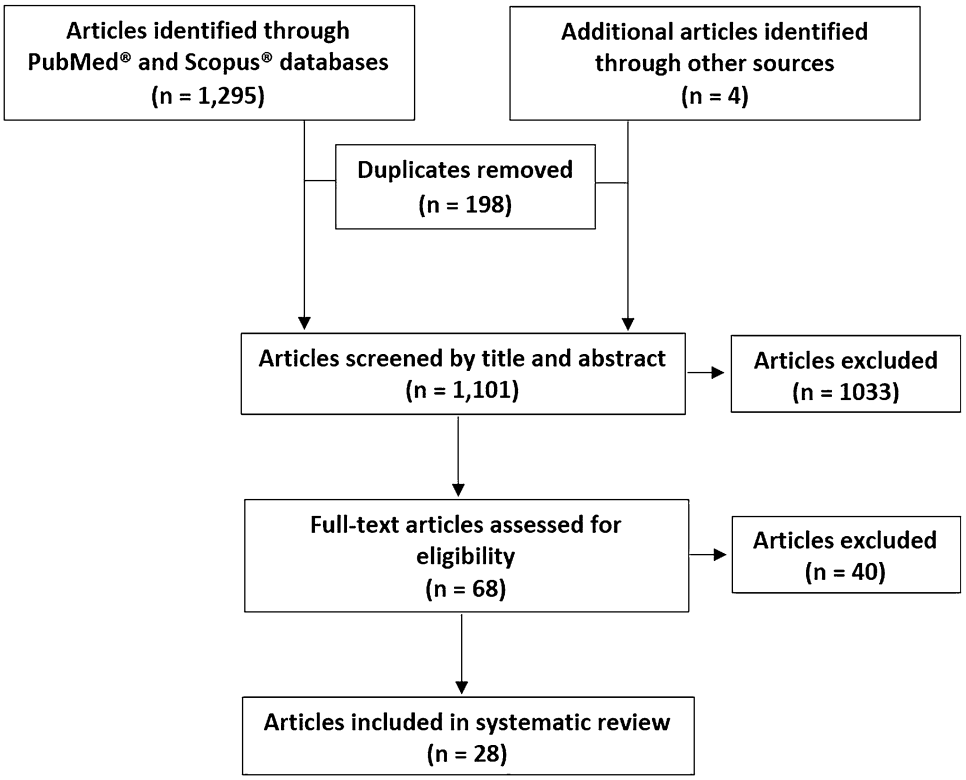

Fig. 1 Literature review screening scheme for articles included in systematic review of psychological therapies for psoriasis. A total of 28 articles were included

on Hospital Anxiety and Depression Scale (HADS) scores ($p < 0.05$) and Eysenk Personality Questionnaire-Revised (EPQ-R) neuroticism ($p < 0.001$) scores at the 6-month post-intervention follow-up. Interestingly, these improvements were not matched by any physical improvement as assessed by clinical ratings and self-ratings on the VAS. A limitation of the study was a 26% attrition rate [31].

In another trial, Zachariae et al. [17] allocated 51 patients to either seven 90-min CBT sessions within a 12-week period or to a control group with a 12-week regimen without psychologic treatment. Neither group received concurrent conventional psoriasis treatments. At baseline, the mean PASI was 7.4 ± 1.6 and 8.1 ± 2.7 for study and control groups, respectively. Sessions involved identification of daily stressors, guided imagery, and development of coping skills [17]. Subjects also received relaxation training to use between sessions, and symptom control imagery training was carried out for imagination of a pleasant beach scene. There were also instructions for hypnotic suggestions of analgesia in a reference plaque, a technique that has previously been shown to have beneficial physiologic effects in dermatologic patients [17, 32, 33]. Psoriasis activity showed improvement in the treatment group as evidenced by significant changes in total sign score ($p < 0.05$) and laser doppler skin blood flow ($p < 0.05$) after treatment, whereas no improvement in these measures was observed in the control group [17]. Furthermore, PASI improvement was noted in 74% of subjects in the treatment group, compared with just 43% subjects in the control group [17]. Only two patients in the treatment group did not complete the study (along with five in the control group), and there was no post-intervention follow-up period [17].

Fortune et al. [15] conducted a 6-week, six-group session study using a multidisciplinary team of physicians, psychologists, and nurses investigating adjunct CBT therapy in 40 patients with psoriasis [15]. These patients were compared with a control group of 53 age- and sex-matched patients with psoriasis receiving usual care alone, consisting of topical or systemic agents, phototherapy, or photochemotherapy [15]. At baseline, the mean PASI was 10.3 ± 0.41 and 10.6 ± 0.32 for the study and control groups, respectively. Each CBT group session included didactic teaching on the medical and biological basis of psoriasis, including treatments and stress-reduction techniques [15]. Adjunct CBT coupled with standard psoriasis treatment resulted in greater reduction of psoriasis severity (PASI, $p = 0.001$), anxiety (HADS, $p = 0.001$), and psoriasis-related stress (Psoriasis Life Stress Inventory [PLSI], $p = 0.001$) [15]. Within the intervention group, 64% of patients achieved $\geq 75\%$ clearance of psoriasis compared with only 23% in the control group [15]. In a follow-up study implementing intention-to-treat (ITT) analysis, Fortune et al. [30] showed significant reduction in belief of severity of illness at the 6-month follow-up in CBT patients, with a significantly different reduction between groups over the course of the study period ($p = 0.001$). The number and frequency of symptoms that

Table 1 Studies investigating cognitive behavioral therapy, variants of cognitive behavioral therapy, and biofeedback in psoriasis management

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
CBT									
van Beugen et al. [26]	Personalized eCBT, wkly for mean duration of 25 wk	RCT	$N=131$, mixed severities (BL mean PASI 5.99 ± 5.61 and 4.20 ± 2.87 for study and control groups, respectively)	Conventional therapy (NR)	6 mo	Compared with control group, study group with significant improvement at 6 mo in fatigue (CIS, $p=0.03$) and daily activity impact (RAND-36, $p=0.04$), but not disease severity (PASI, SAPASI)	Better working alliance (WAI-S) at treatment start associated with greater improvements in functioning (both psychological; $r=-0.66$, $p<0.001$, and physical; $r=-0.42$, $p=0.02$)	37.4% (49)	1+
Piaserico et al. [12]	CBT with biofeedback, 8 wkly 1-h sessions	RCT	$N=45$, moderate-severe plaque PS (BL mean PASI 9; 95% CI 7.6–10.4 and 9.1; 95% CI 7.6–10.7 for study and control groups, respectively)	Conventional therapy (UVB)	1 mo	Significant reduction in disease severity (mean PASI) from 9 to 3.8 and 2.5 at 4 and 8 wks, respectively (p-value NR), 65% of pts achieving PASI75 (vs. 15% in control group at 8 wks, $p=0.007$)	Compared with BL, significantly improved anxiety states (STAI-I) in both groups at end of study, but no significant difference between groups	11.1% (5)	1+
Bundy et al. [27]	eCBT, 6 wkly online modules	RCT	$N=126$, mild-moderate chronic plaque PS (BL mean SAPASI 8.2 and 8.8 for study and control groups, respectively)	Conventional therapy (topical, systemic, or herbal/natural treatment)	6 mo	Compared with control group, study group with significant improvement at 6 mo in QoL (mean DLQI) with both analyses 1 and 2 ($p=0.036$, analysis 1), no significant difference in disease severity improvement between groups using either analysis	Compared with control group, study group with significant improvement at 6 mo in anxiety using analysis 1 (mean HADS from 8.3 to 8.1 and 7.6 to 6.1, respectively) ($p=0.033$)	32.5% (41)	1+

Table 1 (continued)

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
Zachariae et al. [17]	Psychotherapy, 7 × 90 min sessions, 12 wk	RCT	$N = 51$, mixed severities (BL mean PASI 7.4 ± 1.6 and 8.1 ± 2.7 for study and control groups, respectively)	No treatment	None	Significant changes in TSS ($p < 0.05$) and LDSBF ($p < 0.05$, not observed in control group), PASI improvement in 74% of subjects (vs. just 43% subjects in control group)	Inverse correlations between depression (BDI scores) and disease severity (PASI and TSS scores) ($r = -0.32$, $p < 0.05$, and $r = -0.30$, $p < 0.05$, respectively)	13.7% (7)	1−
Fortune et al. [30]	CBT, 6 × 2.5-h sessions	Controlled trial	$N = 93$, mixed severities (BL mean PASI 10.3 ± 0.41 and 10.6 ± 0.32 for study and control groups, respectively)	Conventional therapy (topical, systemic, photo-, or photo-chemotherapy)	6 mo	Significant reduction in frequency of associated symptoms vs. control group (significant group × time effect, $p = 0.001$)	Significant reduction in belief of illness severity at 6-mo follow-up vs. control group (significant treatment group × time interaction, $p = 0.001$)	37.6% (35)	2+
Price et al. [31]	Psychotherapy, 90 min, 8 wk	Controlled trial	$N = 31$, mixed severities (BL mean physician-rated VAS 41 ± 23 and 31 ± 21 for study and control groups, respectively)	Conventional therapy (topical, etretinate, UVB, and/or PUVA)	6 mo	Mean physician-rated VAS from 41 ± 23 at BL to 34 ± 19 at 6-mo follow-up in study group, and 31 ± 21 to 33 ± 21 in control group	Intervention arm: Significant improvement in anxiety (HADS, $p < 0.05$) and neuroticism (EPQ-R, $p < 0.001$)	25.8% (8)	2−
Spillekom-Van Koulil et al. [29]	eCBT, 5 mo	Case report	$N = 1$, BL disease severity not quantified	None	6 mo	Improvement in itch and fatigue	Improvement in negative mood and depression	NA	3
Shah and Bewley [28]	Systemic family therapy, 10 sessions, 7 mo	Case report	$N = 1$, BL PASI 24.8	None	6 mo	Improvement in disease severity (PASI, from 24.8 to 0.6 at end of therapy)	Increased confidence, self-esteem continued to 6-mo follow-up	NA	3
Biofeedback									
Goodman [35]	Thermal biofeedback, 13 sessions	Case report	$N = 1$, BL disease severity not quantified	None	12 mo	Gradual disappearance of patches	NA	NA	3

Table 1 (continued)

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
Keinan et al. [36]	Biofeedback with relaxation, 1-to-1, 6 wks	Controlled trial	$N=32$, BL disease severity NR	No treatment	6 wks	No significant difference in disease severity change (6-pt scale) or disease improvement (9-pt scale) between groups	NA	0% (0)	XX[a]

Means are presented ± standard error of the mean unless otherwise noted

BDI Beck Depression Inventory, *BL* baseline, *CBT* cognitive behavioral therapy, *CI* confidence interval, *CIS* Checklist Individual Strength, *d* days, *DLQI* Dermatology Life Quality Index, *eCBT* internet- or electronic-CBT, *EPQ-R* Eysenck Personality Questionnaire, *h* hours, *HADS* Hospital Anxiety and Depression Scale, *LDSBF* Laser Doppler Skin Blood Flow, *LOE* Level of evidence, *min* minutes, *mo* month(s), *N* sample size, *NA* not applicable, *NR* not reported, *PASI* Psoriasis Area and Severity Index, *PASI75* 75% improvement in PASI, *PS* psoriasis, *pts* patient(s), *PUVA* psoralens with ultraviolet A, *QoL* quality of life, *RCT* randomized controlled trial, *SAPASI* self-administered PASI, *STAI-I* State-Trait Anxiety Inventory-I, *TSS* Total Sign Score, *UVB* Ultraviolet-B, *VAS* visual analog scale, *WAI* Working Alliance Inventory, *wk* week, *wkly* weekly

[a]Study findings did not support implementation of the tested intervention

patients associated with their condition also significantly decreased over the course of the study period ($p=0.001$) [30]. Lastly, a reduced belief in emotional causes of psoriasis in the treatment group over the course of the study was noted ($p=0.001$) [30]. Notably, 6-week attrition rates were 25% and 21% for the intervention and control groups, respectively [15].

Internet-based CBT (eCBT) has also been investigated by Bundy et al. [27] in 126 patients with mild-to-moderate psoriasis. Patients were randomized to either 6 weeks of eCBT in addition to usual therapy (including topical, systemic, or herbal/natural treatment) or usual therapy alone for 6 weeks, followed by 6 weeks of the eCBT program. At baseline, mean self-administered PASI (SAPASI) was 8.2 and 8.8 for study and control groups, respectively. The eCBT intervention content included management of self-esteem, thinking styles, low mood/depression, stress and tension, and coping. Authors performed both a complete cases and ITT analysis. In the complete cases analysis, immediate eCBT adjunct therapy led to reduction in HADS-anxiety from 7.6 at baseline to 6.1 at 6-month follow-up, compared with a reduction from 8.3 at baseline to 8.1 at follow-up with delayed adjunct eCBT ($p=0.033$). Furthermore, DLQI mean scores also improved significantly ($p=0.036$), from 6.6 to 5.0 with immediate adjunct therapy in comparison with the control group, which had a mean score change from 7.4 to 7.7 in the complete cases analysis. Importantly, authors noted a 43% attrition rate with immediate eCBT adjunct therapy compared with a 23% attrition rate in the delayed eCBT group [27].

Another RCT investigated the effect of eCBT in 131 patients with psoriasis randomized to either usual care (not defined by the authors) or usual care with eCBT treatment adjunct [26]. At baseline, the mean PASI was 5.99 ± 5.61 and 4.20 ± 2.87 for the study and control groups, respectively. Investigators implemented a highly individualized treatment regimen consisting of various techniques targeting itch, pain, fatigue, negative mood, and social relationships. Patients spent a mean duration of 25 weeks in treatment. Physical functioning, accounted for by both fatigue measurements from the Impact of Chronic Skin Disease on Daily Life (ISDL) and itch measurements from the Checklist Individual Strength (CIS), was shown to improve from baseline to 6-month follow-up significantly more in the intervention group (composite score from 0.11 ± 0.73 to -0.48 ± 0.77) than in the control group (-0.12 ± 0.79 to -0.55 ± 0.68, $p=0.03$) using ITT analysis. Likewise, the intervention group gained significant benefits in terms of daily activity, as assessed by the RAND-36 Health Status Inventory, from baseline to 6-month follow-up (0.03 ± 0.71 to 0.37 ± 0.69) compared with the control group (-0.04 ± 0.89 to 0.34 ± 0.79, $p=0.04$). A stronger working alliance with the therapist at initiation of treatment was associated with

Table 2 Studies investigating meditation and mindfulness-based therapies, hypnosis, music resonance therapy, and motivational interviewing in psoriasis management

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
Meditation and mindfulness-based therapies									
Fordham et al. [13]	MBCT, wkly group sessions, 8 wk	RCT	$N=29$, mixed severities (BL mean SAPASI 7.42 ± 1.01 for entire sample)	Conventional therapy (topical, systemic, and/or biologic)	NR	Compared with control group, significantly reduced disease severity (SAPASI, $p=0.05$) and QoL impairment (DLQI, $p=0.02$) in study group	No significant difference in perceived stress (PSS) or distress (HADS) between groups	34.5% (10)	1−
Gaston et al. [18]	Meditation alone or with imagery, 12 wk	RCT	$N=24$, scalp PS rated at ≥ 10 of 20 on severity scale (no mean BL disease severity quantification)	No treatment	From wk 12 of treatment to post-treatment BL (NR)	Both intervention arms: 4 of 9 treated pts with disease severity improvement (4-point scale), no treated pts worsened	Positive correlation between disease severity and psychological distress (Psychological Distress subscale of the PAISSR, partial $r=0.31$, $p<0.01$)	25.0% (6)	1−
Kabat-Zinn et al. [16]	MBSR, three sessions wkly, 13 wk	Controlled trial	$N=37$, moderate to severe PS (no mean BL disease severity quantification)	UVB alone or PUVA alone	1 wk	Compared with control group, study group reached halfway and clearing points significantly faster ($p=0.013$ and 0.033, respectively)	No change in psychometric assessment (SCL-90-R) or anxiety level (STAI) between pre-intervention and post-intervention in control or experiment groups	37.8% (14)	2+
Hypnosis									
Boncz et al. [39]	Group hypnotherapy, 7 wkly sessions	Controlled trial	$N=27$, chronic plaque PS (no mean BL disease severity quantification)	PUVA only	None	Itching, skin tenseness, sleeping disorders decreased in all groups, disease severity (assessed on 3-point scale): Hypnosis-only group from 9.9 to 6.0, hypnosis + PUVA group from 10.2 to 3.9, and PUVA alone group from 11.3 to 5.4	NA	NA	2−
Tausk and Whitmore [40]	Hypnosis, wkly sessions for 3 mo	Single-blind RCT	$N=11$, mild to moderate PS (no mean BL disease severity quantification)	Hypnosis group lacking health/skin suggestions	None	No significant difference in disease severity (PASI)	NA	18.2% (2)	XX[a]
MRT									
Lazaroff and Shimshoni [41]	MRT, 3×30-min groups daily for 14 d	Controlled trial	$N=30$, BL mean severity 3.23 (scale of 1–5)	Instructed to "somehow relax"	None	Clinical-rated degree of sickness reduced 65% in MRT group vs. 20% in control group	Self-reported stimulus to scratch reduced 86% in MRT group vs. 29% in control group	NA	2−

Table 2 (continued)

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
MI									
Larsen et al. [42]	MI (6×15- to 60-min phone calls) concurrent with 3-wk climate therapy/heliotherapy	RCT	$N=169$, PS with PASI > 7.0 (BL mean PASI 8.6 ± 0.4)	Climate therapy/heliotherapy alone	6 mo	SAPASI difference at 3 mo was −2.47 units, improved in MI group (95% CI -3.94 to −1.00, $p=0.001$), at 6 mo, difference was −2.45 (95% CI −4.33 to −0.56, $p=0.011$)	Intervention group with significantly lower BIPQ sum score at 3 mo (−3.75, 95% CI −6.73 to −0.77; $p=0.014$)	26% (44)	1++

Means are presented ± standard error of the mean unless otherwise noted

BIPQ Brief Illness Perception Questionnaire, *BL* baseline, *CI* confidence interval, *d* days, *DLQI* Dermatology Life Quality Index, *h* hours, *HADS* Hospital Anxiety and Depression Scale, *LOE* Level of evidence, *MBCT* Mindfulness-based cognitive therapy, *MBSR* Mindfulness-based stress reduction, *MI* motivational interviewing, *min* minutes, *MRT* music resonance therapy, *N* sample size, *n* subset of patients with psoriasis (if heterogeneous patient sample), *NA* not applicable, *NR* not reported, *PAJSSR* Psychological Adjustment of Illness Scale Self-Report, *PASI* Psoriasis area and severity index, *PASI75* 75% improvement in PASI, *PS* psoriasis, *PSS* Perceived Stress Scale, *pts* patients, *PUVA* psoralens with ultraviolet-A, *QoL* quality of life, *RCT* randomized controlled trial, *SAPASI* self-administered PASI, *SCL-90-R* Symptom Checklist 90 Revised, *STAI* State-Trait Anxiety Inventory, *UVB* Ultraviolet-B, *wk* week

[a]Study findings did not support implementation of the tested intervention

better improvements in physical ($r=-0.42$, $p=0.02$) and psychological ($r=-0.66$, $p<0.001$) functioning. A limitation of this study was the 26.2% attrition rate of recruited subjects. The reasons provided for eCBT dropout by ten non-starters (15.4%) included personal or familial obligations and lack of time. For the seven subjects who discontinued participation during therapy, reasons included a lack of computer skills, improved or worsened symptoms, personal or familial circumstances, and comorbidity [25].

Overall, CBT and its variants as adjunct therapy confer benefits to patients with psoriasis, particularly in terms of psychological parameters and QoL. However, direct influence on disease severity improvement is unclear from the present literature, and studies are limited by high mean attrition of 26.4 ± 4.8% in the six trials included. Mean post-intervention follow-up was 4.6 months for the eight included studies and 4.2 ± 1.2 months for the subset of six trials.

Three studies have investigated the utility of biofeedback in reducing severity of psoriasis symptoms and stress burden in patients with psoriasis. Notably, biofeedback is a method that incorporates equipment, specific techniques, and patient interaction to modify the physiology of the patient's autonomic nervous system (ANS) [34]. An early case report detailed the gradual disappearance of patches after 13 sessions of thermal biofeedback [35]. However, in their study comparing biofeedback therapy and relaxation with standard psoriasis therapy coupled with relaxation in 32 patients, Keinan et al. [36] found no significant differences in improvement between the two groups. In contrast, Piaserico et al. [12] demonstrated significant improvement in 45 patients with moderate-to-severe plaque psoriasis receiving 8 weeks of CBT with biofeedback as an adjunct to UVB therapy compared with 8 weeks of UVB alone. The treatment group showed a significant reduction in mean PASI, with improvement from 9 at baseline to 3.8 at 4 weeks and 2.5 at 8 weeks [12]. Maintained clinical improvement was noted at 1 month after the end of treatment [12]. Similar results were seen in the control group, with the exception of maintenance of decreased PASI at 1-month follow-up [12]. Attrition rate for this study was only 11.1%. Investigators concluded that CBT with biofeedback increased the therapeutic benefits of UVB, reduces psoriasis severity, improves QoL, and decreases the number of minor psychiatric stressors [12]. To date, mixed evidence exists regarding biofeedback in management of psoriasis.

3.2 Meditation and Mindfulness-Based Therapy, Hypnosis, Music Resonance Therapy, and Motivational Interviewing

Mindfulness-based therapies, including MBSR, are further examples of commonly used psychological interventions. MBSR has shown promise in improving psychological

Table 3 Studies investigating emotional disclosure therapies in psoriasis management

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
Paradisi et al. [43]	PW or KW, 3×20-min sessions, 3 d in pts with ≥10% BSA	RCT	*N*=78, plaque PS with ≥10% BSA (BL mean PASI 7.5, 6.4, and 8.3 for PW, KW, and control groups, respectively)	NB UVB alone	2 mo	Significant decreased PASI scores in all 3 groups (PW: $p=0.013$, KW: $p=0.003$, control group: $p=0.003$)	Emotions and symptoms scales of Skindex-29 with significant increase for KW	48.7% (38)	1–
Tabolli et al. [44]	PW, 3×20-min sessions, 3 d in pts on systemic therapy	RCT	*N*=202, moderate to severe PS (BL mean PASI 23.16 ± 0.90)	Educational materials only	12 mo	No significant differences in disease severity (PASI and PGA) or QoL (DSQL) observed in PW vs. control group	NA	54.9% (111)	XX[a]
Vedhara et al. [45]	Writing about most upsetting time in life (or conflicts/problems), 20 min, 4 d	RCT	*N*=69, mixed severities (BL mean PASI 7.00 ± 0.68 and 7.09 ± 0.81 for study and control groups, respectively)	Write objective account of previous day	12 wk	No significant difference in disease severity (PASI) and QoL (DLQI) improvements between intervention and control groups	NA	14.5% (10)	XX[a]

Means are presented ± standard error of the mean unless otherwise noted

BL baseline, *BSA* body surface area, *d* days, *DSQL* Dermatology Specific Quality of Life, *h* hours, *KW* King's emotional writing intervention, *LOE* Level of evidence, *min* minutes, *mo* months, *N* sample size, *n* subset of psoriasis patients (if heterogeneous patient sample), *NA* not applicable, *NB* narrowband, *PASI* Psoriasis area and severity index, *PGA* Physician Global Assessment, *PS* psoriasis, *pts* patients, *PW* Pennebaker's emotional writing intervention, *QoL* quality of life, *RCT* randomized controlled trial, *UVB* ultraviolet B, *wk* week(s)

[a]Study findings did not support implementation of the tested intervention

Table 4 Studies investigating educational and multidisciplinary interventions in psoriasis management

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
Singh et al. [46]	Multidisciplinary, 3 group sessions, 30–45 min every 2 wk	RCT	$N=103$, moderate to severe plaque PS (BL mean PASI 9.59 and 8.88 in study and control groups, respectively)	Conventional therapy (topical and/or systemic)	6 mo	Compared with control group, significant improvement in disease severity (PASI) and QoL (DLQI) at 6 mo from end of the intervention in study group ($p<0.01$)	Significantly improved subjective psychological well-being (WHO-5) ($p<0.01$)	31.1% (32)	1+
Balato et al. [49]	12 wk of daily text messages with reminders and educational tools	RCT	$N=40$, PASI 5–15 (BL mean PASI 10.6 ± 0.9 and 10.1 ± 1.1 in study and control groups, respectively)	Conventional therapy (topical, systemic, biologic)	None	Intervention group with significantly better QoL (DLQI) and disease severity (PASI, SAPASI, BSA, PGA) improvement ($p<0.05$)	NA	0% (0)	1–
Bostoen et al. [50]	12 wk educational program, twice wkly 2-h sessions	RCT	$N=29$, mixed severities (BL mean PASI 7.7 ± 3.9)	Conventional therapy (topical, systemic, phototherapy)	6 mo	Significant reduction in mean PASI ($p=0.036$) and mean PDI ($p=0.015$) vs. controls at 3 and 6 mo ($p=0.017$ and 0.02, respectively)	Significant reduction in mean BDI vs. control group at 3, 6, and 9 mo ($p<0.05$ for all)	27.6% (8)	1–
Lambert et al. [14]	12-wk multidisciplinary educational program involving education, stress relief, mindfulness	Clinical trial lacking control	$N=26$, mixed severities (no mean BL disease severity quantification)	None	None	QoL and disability improvement: DLQI improved 3.93 points ($p=0.015$), Skindex-29 improved 23.33 points ($p=0.020$), PDI improved 7.44 points ($p=0.019$) by end of intervention	NA	34.6% (9)	2–

Table 4 (continued)

Study	Intervention	Study design	Sample	Control	Post-intervention follow-up	Physical results	Psychological results	Attrition rate, % (*n*)	LOE
Van Geel et al. [47]	4×2.5-h multidisciplinary sessions over 10 wk	Controlled trial	*N* = 25, mixed severities (BL mean PASI 3.3 and 4.5 in study and control groups, respectively)	Age- and gender-matched (other characteristics NR)	3.5 mo	PASI with minimal (not statistically significant) change in both groups QoL, itching, and scratching improved in both groups (statistical analysis NR)	NA	8% (2)	XX[a]
Schmitt et al. [48]	Interdisciplinary dermatologic and psychiatric care, 6 mo	RCT	*N* = 47, moderate to severe plaque PS (BL mean PASI 16.0 ± 1.4 and 13.7 ± 1.5 in study and control groups, respectively)	Conventional therapy (topical, systemic, biologic therapy)	6 mo	No significant difference in mean change in PASI, % PASI75 response, % PASI50 response, or global disease severity between groups at 6 mo	No significant difference in pt satisfaction (VAS) between groups at 6 mo	10.6% (5)	XX[a]
Ersser et al. [51]	Educational intervention (nurse-led group learning)	RCT	*N* = 64, mild to moderate plaque PS (BL mean PASI 2.34 ± 0.52 and 3.22 ± 0.39 for study and control groups, respectively)	Conventional therapy (emollients or "active therapy")	Up to 6 wk	No significant disease severity (PASI) or QoL (DLQI) changes	NA	7.8% (5)	XX[a]

Means are presented ± standard error of the mean unless otherwise noted

BDI Beck Depression Inventory, *BL* baseline, *BSA* body surface area, *d* days, *DLQI* Dermatology Life Quality Index, *h* hours, *LOE* Level of evidence, *min* minutes, *mo* month(s), *N* sample size, *n* subset of patients with psoriasis (if heterogeneous patient sample), *NA* not applicable, *NB* narrowband, *NR* not reported, *PASI* Psoriasis area and severity index, *PASI75* 75% improvement in PASI, *PDI* Psoriasis Disability Index, *PGA* Physician Global Assessment, *PS* psoriasis, *pt* patient(s), *QoL* quality of life, *RCT* randomized controlled trial, *SAPASI* self-administered PASI, *VAS* visual analog scale, *WHO-5* World Health Organization-5 Well-Being Index, *wk* week

[a]Study findings did not support implementation of the tested intervention

parameters, QoL, and physical functioning in patients with a variety of chronic diseases [37]. This therapeutic strategy incorporates mindfulness meditation and body awareness in stress-reduction techniques. Particular focus has been placed on attention towards the inner experience, including sensations, arousal states, and behaviors to develop acceptance [13]. Three studies were identified describing application of mindfulness-based interventions in 90 total patients with psoriasis (Table 2). Two of the three trials were RCTs, and, although only one reported PASI outcomes, all three studies provided evidence for disease severity improvement. One study was rated 2+ and two were rated 1− (Table 2).

Gaston et al. [18] provided some of the earliest evidence supporting the efficacy of meditation in psoriasis management. Investigators carried out a three-arm trial consisting of 18 subjects with scalp psoriasis receiving therapy as usual randomized into three groups of 12-week adjunct therapies: (1) meditation, (2) meditation and imagery, and (3) control group receiving neither [18]. No mean baseline disease severity quantification was presented. Patients in the meditation and imagery group received the same meditation training as the treatment group in the first 6 weeks of treatment. However, during the subsequent 6 weeks, subjects in group two were taught to use spontaneous imagery techniques to subjectively "transform" images of their psoriatic lesions [18]. Two subjects in each group (four of nine treated patients) had clinical improvement, and no patients experienced worsening of disease during the follow-up period, the length of which was not described by the authors. Furthermore, a positive correlation was observed between psoriasis symptom severity and both psychological distress (as measured by the Psychological Distress subscale of the Psychological Adjustment of Illness Scale Self-Report [partial $r=0.31$, $p<0.01$]) and adverse life event impact (partial $r=0.23$, $p<0.05$) [18]. Notably, five of the original subjects recruited for the study dropped out, citing personal reasons such as work overload or travels [18].

Kabat-Zinn et al. [16] studied the effects of an MBSR intervention in 37 patients with moderate-to-severe psoriasis receiving phototherapy alone or MBSR facilitated by audiotape during phototherapy for 13 weeks. No mean baseline disease severity quantification was presented. Subjects receiving audiotape-guided MBSR cleared psoriatic lesions faster, reaching both the halfway ($p=0.013$) and the clearing points ($p=0.033$) significantly quicker than those in the control group receiving either UVB or PUVA alone. This study featured a short post-intervention follow-up period of 1 week, and no explanation was provided for the 12 patients who dropped out [16].

Of interest, Fordham et al. [13] conducted the largest trial investigating mindfulness-based therapy in patients with psoriasis to date. This pilot study examined 29 patients receiving either (1) 8-week mindfulness group therapy treatment adjunct to usual psoriasis therapy (including topical, systemic, and/or biologic treatment) or (2) usual therapy alone. At baseline, the mean SAPASI was 7.42 ± 1.01 for the entire sample. Mindfulness therapy resulted in statistically lower SAPASI ($p=0.05$) and DLQI impairment scores ($p=0.02$) than usual therapy alone, whereas no difference was found in perceived stress or distress. Post-intervention follow-up time was not described. Importantly, ten of the original 29 recruited patients dropped out of the study for reasons including the impracticality of the intervention [13].

Studies investigating mindfulness-based therapies share limitations similar to those investigating CBT, including implementation of a variety of protocols, small sample sizes, and high dropout rates. Trials in this category encountered a mean attrition rate of $32.4 \pm 3.8\%$, whereas mean post-intervention follow-up was not possible to calculate given poorly defined follow-up periods in multiple included studies.

Two studies were found describing the effects of hypnosis in 38 patients with psoriasis. Hypnosis, or the induction of an altered state of consciousness, has been described as a state in which physiology, cognition, emotions, and behavior can be modified [38]. During the hypnotic state, suggestions can be introduced to influence mental and involuntary processes [38]. Hypnosis in psoriasis management has targeted somatic and psychic relaxation by way of direct suggestions that serve to reduce unpleasant concomitant symptoms [39]. A study conducted by Boncz et al. [39] examined 27 patients with chronic plaque psoriasis allocated to three groups, including either hypnosis alone ($N=6$), hypnosis-adjunct to PUVA ($N=14$), and PUVA only ($N=7$) [39]. Baseline disease severity quantification was not presented. All subjects in the trial demonstrated average or better than average susceptibility to hypnosis [39]. Guided imagery was also used, as well as a method of imagining a disease-curing glove, which treats affected skin areas when touched [39]. After three treatment sessions, irritating skin symptoms and related sleeping disorders decreased and, later, disappeared [39]. Combined treatment of PUVA and hypnosis conferred the best results in terms of skin symptoms [39]. However, this study was limited by sample size and lack of statistical analysis or standardized psoriasis severity measurements, such as the PASI. No post-intervention follow-up period was included, and the attrition rate was not presented. Comparatively, in a study by Tausk and Whitmore [40] comparing progressive relaxation and active suggestions of improvement during hypnosis to hypnosis alone in 11 patients with psoriasis, no statistically significant difference in the percentage decrease in PASI scores was observed with ITT analysis. Additional studies are needed to investigate the potential benefits of hypnosis in patients with psoriasis.

Lazaroff and Shimshoni [41] published findings regarding the effect of MRT, a method of stress-reduction by way of music, on patients with psoriasis. In a large trial including 68

patients with neurodermatitis and psoriasis ($n=20$), investigators implemented an intervention consisting of three half-hour groups of MRT per day for 14 days [41]. At baseline, patients with psoriasis had a mean disease severity of 3.23 (on a scale of 1–5). In the patients with psoriasis included in the trial, patient self-assessed stimulus to scratch (before and after the stimulus) measured at the end of the treatment period was 86% reduced in the experimental group, whereas only 29% reduced in the control group [41]. Furthermore, the physician-evaluated clinical-rated degree of sickness was reduced by 65% in the experimental group at treatment end compared with 20% in the control group [41]. No statistical significance was determined for assessment comparisons in this study. Additionally, no post-intervention follow-up period or attrition rates were presented. Further investigation is needed to elucidate potential benefits of musical resonance therapy in patients with psoriasis.

MI implements collaborative communication to improve a patient's motivation and commitment to change and adherence to therapy [42]. MI has been applied in chronic medical diseases such as chronic obstructive pulmonary disease and diabetes, and, in 2014, Larsen et al. [42] published the first report of MI applied in patients with psoriasis. In a sample of 169 patients with a PASI of ≥ 7 receiving climate therapy and heliotherapy, investigators examined the effects of adjunct MI versus climate therapy and heliotherapy alone. At baseline, the mean PASI was 8.6 ± 0.4 overall. Although the subject attrition rate reached 26%, results showed significantly greater SAPASI improvement at 3 months in the MI group (-2.47 units, 95% confidence interval [CI] -3.94 to -1.00; $p=0.001$) in compared with the control group [42]. Beneficial effects were maintained at the 6-month follow-up (-2.45 units, 95% CI -4.33 to -0.56, $p=0.011$) [42]. Furthermore, the intervention group showed a significantly lower Brief Illness Perception Questionnaire sum score at 3 months (-3.75; 95% CI -6.73 to -0.77; $p=0.014$) [42]. This single trial investigating MI was rated 1++, demonstrating promise with this potential avenue for adjunct therapy (Table 2).

3.3 Emotional Disclosure

Emotional disclosure involves writing or talking about tense life events [43–45]. This intervention offers a less intense, time-limited therapy that may be effective in patients who are unable to participate in more extensive, time-consuming psychological interventions [45]. Only three reports detail investigation of emotional disclosure methods in a total of 349 patients with psoriasis (Table 3) [43–45]. Although all three studies are RCTs and report PASI outcomes, only one demonstrated a beneficial effect of the intervention on disease severity [43], and received a level of evidence rating of 1− (Table 3).

Vedhara et al. [45] carried out an RCT investigating emotional disclosure in 59 subjects who were allocated to either 20-min sessions on four consecutive days of an emotional disclosure intervention or a standard control writing intervention. The control group patients were instructed to provide an objective account of the previous day [45]. At baseline, patients had a mean PASI of 7.00 ± 0.68 and 7.09 ± 0.81 in the study and control groups, respectively [45]. Magnitude of improvement in DLQI and PASI was comparable between both groups over the follow-up period, which spanned to 12 weeks after the end of the intervention [45]. The study's attrition rate was 14.5%. Tabolli et al. [44] also carried out an RCT in 67 patients with moderate-to-severe psoriasis using Pennebaker's emotional writing intervention (PW), which asks subjects to write about their worst disease-related life experiences. At baseline, patients had a mean PASI of 23.16 ± 0.90 overall [44]. The intervention lasted for 20 min on each of three consecutive days [44]. Following each session, patients received psoriasis education, including possible causes, treatments, lifestyle modifications, and the importance of health maintenance checkups [44]. Investigators found no significant improvements in PASI, Physician Global Assessment (PGA), or Dermatology Specific Quality of Life (DSQL) between the PW and control groups throughout the 12-month post-intervention follow-up period [44].

Paradisi et al. [43] studied the effect of PW compared with King's emotional writing intervention (KW), consisting of writing about best future life and self-goals, in 40 patients with psoriasis with $\geq 10\%$ affected body surface area who were being treated with UVB phototherapy. Participants were randomly assigned to one of three groups, including one control group and two interventional groups (PW and KW). At baseline, patients had a mean PASI of 7.5, 6.4, and 8.3 in the PW, KW, and control groups, respectively [43]. In a total of 40 patients completing the study, investigators found a significant decrease in PASI scores at the end of the course of phototherapy in comparison with the beginning in all three groups (PW: $p=0.013$, KW: $p=0.003$, and control group: $p=0.003$) [43]. Skindex-29 scores of those in the KW group significantly increased in the emotions and symptoms scales ($p=0.01$ for both), whereas no significant changes were observed in the same scales for PW group subjects during the 2-month post-intervention follow-up [43].

Mean attrition rate was $39.4 \pm 12.6\%$, and mean post-intervention follow-up was 5.7 ± 3.2 months for all three included studies investigating emotional disclosure in the management of psoriasis.

3.4 Educational and Related Multidisciplinary Programs

Educational initiatives for patients with psoriasis have been studied in multiple experimental protocols [14, 46–51].

These initiatives have investigated effects on disease severity and QoL of patients while evaluating patient satisfaction. Results suggest patient-oriented educational interventions can leave patients feeling highly satisfied, with improved knowledge regarding psoriasis and better attitudes toward treatment after the interventional program [52]. Significant heterogeneity in methodologies used was noted in the seven studies included in this category [14, 46–51], accounting for 334 patients with psoriasis in total (Table 4). Notably, five of seven reports were RCTs [46, 48–51]. Of the six studies reporting PASI outcomes [46–51], only three provided evidence for improvement in disease severity [46, 49, 50]. One study was rated 1+, two studies were rated 1−, and one study was rated 2− (Table 4).

Ersser et al. [51] conducted a pilot RCT to examine the feasibility and efficacy of an educational nursing intervention to improve self-management practices in 64 patients with mild-to-moderate psoriasis across multiple centers. Investigators studied a theory-based educational intervention designed to include structured, nurse-led group learning experiences, supporting written and audiovisual material, and a follow-up phone consultation [51]. Although this study showed that implementation of an educational initiative is feasible and that subjects with a PASI or DLQI > 6 showed a trend for reduction in PASI up to 6 weeks post-intervention, findings did not reach statistical significance [51].

One randomized open-label pilot study assessed the effects of three separate education sessions with usual (topical and/or systemic) treatment versus usual treatment alone in 103 patients with moderate-to-severe plaque psoriasis [46]. At baseline, mean PASI was 9.59 and 8.88 in study and control groups, respectively. Patients attended three group sessions every 2 weeks, each lasting 30–45 min. The first session included education by a dermatologist about topics including disease course, lifestyle factors, and treatment approaches, whereas the second was conducted with a psychiatrist to discuss management of depression and anxiety. The third session re-introduced the dermatologist and involved group sharing of personal experiences and solutions to problems encountered along with feedback regarding usefulness of the intervention [46]. Only the intervention group showed significant improvement with ITT analysis of both the primary outcome measures (PASI and DLQI) at 6 months from the end of the intervention ($p < 0.01$). Notably, this study was limited by 31.1% of patients being lost to follow-up at 6 months [46].

Lambert et al. [14] conducted a study including additional disciplines in a broader topic of general health and skincare. The 12-week program evaluated changes in patient DLQI, Skindex-29, and the Psoriasis Disability Index (PDI) in a group of 26 patients with psoriasis [14]. No control group was included, nor was any mean disease severity quantification presented at baseline. Patients attended 2-h sessions weekly for 12 weeks, which included an interdisciplinary education team of a dermatologist, dermatologic nurse, pharmacist, psychiatrist, psychologist, dietician, philosopher, training expert, sports coach, mindfulness practitioner, and yoga teacher [14]. The program included an initial 1-h session that included a dermatologist giving basic medical information on all of the diagnoses present in the total patient group [14]. Three 2-h skincare sessions were offered in which a pharmacist worked jointly with a dermatologic nurse to present information on the basic structural, biological, and social functions of skin [14]. Patients also participated in stress-reduction techniques and were given information on lifestyle factors and psychodermatology [14]. Compared with baselines, the DLQI, Skindex-29, and PDI improved by the end of the intervention [14]. There was no post-intervention follow-up and the study's attrition rate was 34.6%.

Overall, studies investigating educational and multidisciplinary psychological interventions have proved promising, suggesting improved QoL and disease severity for patients with psoriasis, with a relatively low mean attrition rate of $17.1 \pm 5.2\%$. However, mean post-intervention follow-up was only 3.3 ± 1.1 months.

4 Discussion

The present review highlights a diversity of psychological intervention strategies studied in patients with psoriasis while underscoring promising results from studies investigating CBT, mindfulness-based therapies, motivational interviewing, and educational and interdisciplinary interventions. Although promising evidence has been produced with a growing number of RCTs, work in this area is largely limited by study quality.

To date, psychological intervention studies in psoriasis are largely limited by small sample sizes, poor retention rates, short length of follow-up, and a lack of standardized methodologies, analyses, and outcome assessments. Only 10 of 27 included trials featured samples of > 50 patients. Mean trial attrition rates reached $26.4 \pm 4.8\%$ for CBT ($n = 6$), $32.4 \pm 3.8\%$ for mindfulness-based therapies ($n = 3$), $39.4 \pm 12.6\%$ for emotional disclosure ($n = 3$), and $17.1 \pm 5.2\%$ for educational and interdisciplinary interventions ($n = 7$). Poor retention rates may be consistent with potentially poor adherence to conventional treatment in patients with psoriasis, as studies in this area have suggested a wide range of non-adherence rates (8–88.3%), likely due to heterogeneous methodologies [53]. Attrition may alternatively suggest that regimented weekly psychological treatment sessions are too time consuming or emotionally demanding for patients, though this is merely speculative. Further studies should be carried out with less stringently

structured psychological treatment courses to characterize the effects of real-world implementation of psychological adjunct therapy for psoriasis. Methods to improve study retention rates are important to adequately assess the feasibility and efficacy of these interventions. Long-term outcomes of these interventions have yet to be characterized, as only 12 of 28 included studies featured a post-intervention follow-up period of ≥ 6 months, and none > 12 months (Tables 1, 2, 3, 4). Data analysis in these studies is also heterogeneous in nature and largely does not offer separate ITT and per-protocol evaluations to provide a holistic presentation of findings.

Literature regarding psychological therapies in psoriasis is an expanding field, as evidenced by 12 of the 16 included RCTs with publication dates of 2010 or later. As studies in this area increase in quality, further study should seek to compare benefits conferred by CBT, mindfulness-based therapies, motivational interviewing, and educational and interdisciplinary interventions to determine comparative efficacy and ideal subsets of patients in which each method is most beneficial. The integrative approach of disciplines using alternative modalities and patient education promises to be valuable adjunct therapy with standard clinical psoriasis treatment. However, given the variety of possible multidisciplinary treatment arrangements, the lack of standardization among these studies makes interpretation difficult. Thus, consistency of protocol implementation is also necessary for robust investigation into the efficacy of specific multidisciplinary psychological interventions in psoriasis management.

A more robust evidence-based guideline for psychological treatment in patients with psoriasis will help achieve goals of slowing disease progression, improving QoL, and minimizing psychiatric sequelae associated with disease progression. Furthermore, dermatologists should be familiar with these methods to better identify and counsel patients who need psychological intervention services. Future work should address questions regarding the cost effectiveness of these interventions, while ensuring greater consistency between studies in terms of methodologies, protocols, samples, outcomes, and statistical analyses. The clinical implications of this systematic review serve to nourish a body of knowledge for providers to better meet the needs of their patients with psoriasis, while highlighting the most supported psychological interventions of CBT, mindfulness-based therapies, MI, and educational and interdisciplinary interventions.

5 Conclusions

A variety of psychological interventions have been studied in patients with psoriasis with varying degrees of success. These interventions include CBT and its variants, biofeedback, meditation and mindfulness-based therapies, hypnosis, MRT, MI, emotional disclosure, and educational and multidisciplinary programs. Based on LOE review, the most promising methods of psychological intervention in psoriasis includes CBT, mindfulness-based therapies, motivational interviewing, and educational and interdisciplinary interventions. Further study is needed to better elucidate how practical and effective these interventions can be in daily practice.

Compliance with Ethical Standards

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