

The Effects of Psychological Intervention on Atopic Dermatitis

A Systematic Review and Meta-Analysis

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Key Words

Brain-skin axis · Cognitive-behavioral therapy · Complementary and alternative medicine · Mind-body interaction · Psychoneuroimmunology · Psychosomatic medicine · Randomized controlled trial · Relaxation

Abstract

Background: Psychological interventions may be valuable in atopic dermatitis. We systematically reviewed and carried out a meta-analysis of randomized controlled trials of psychological interventions. **Methods:** Electronic searches and manual journal searches were carried out. Two coders independently coded study designs, participants, treatments and outcome characteristics of the studies meeting the selection criteria. **Results:** Eight journal articles published between 1986 and 2006 were included. Eight types of intervention were tested: aromatherapy, autogenic training, brief dynamic psychotherapy, cognitive-behavioral therapy, dermatological education and cognitive-behavioral therapy, habit reversal behavioral therapy, a stress management program, and structured educational programs. Effect sizes were computed as correlation coefficient (r), and random effects models were used in the analysis. For eczema severity, the average effect size for the 8 trials including 8 interventions was -0.367 [$\chi^2(1) = 7.452$, $p = 0.006$; 95% CI -0.579 to -0.108]. The average effect sizes on itching intensity (5 trials

with 5 interventions) and scratching (5 trials with 4 interventions) were -0.805 [$\chi^2(1) = 4.719$, $p = 0.030$; 95% CI -0.971 to -0.108] and -0.620 [$\chi^2(1) = 24.24$, $p < 0.0001$; 95% CI -0.767 to -0.410], respectively. **Conclusions:** Although the present meta-analysis revealed that psychological interventions had a significant ameliorating effect on eczema severity, itching intensity and scratching in atopic dermatitis patients, a definite conclusion about their effectiveness seems premature. Accordingly, future studies should involve more sophisticated methodologies, use established measures of outcome variables, adjust for possible confounders between the intervention and control groups, and provide sufficient data to calculate the effect sizes for future meta-analyses.

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Introduction

Historically, many clinicians have considered allergic diseases to be 'psychosomatic'. Indeed, before the underlying inflammatory basis of allergy was discovered, allergic diseases were among the disorders believed to be purely psychogenic in origin. In 1950, Alexander [1] mentioned atopic dermatitis (AD) and bronchial asthma among the classic psychosomatic disorders. Moreover, recent epidemiological studies have demonstrated a detrimental effect of several psychosocial stresses, such as

caregiver stress, certain personality types, poor family relationships and negative life events, on the symptoms of allergic disease [2–10]. Interestingly, in one retrospective study conducted in Kobe, Japan, the AD of refugees under great psychological stress from a natural disaster, the Great Hanshin-Awaji Earthquake, became worse [4].

AD is a major public health problem worldwide with a prevalence of 10–20% in children and 1–3% in adults. Prevalence has steadily increased by 2- to 3-fold during the past 3 decades in industrialized countries [11]. AD is of a persistent and chronic nature, and long-term pharmacological therapies have potential side effects. Given the close association of psychosocial factors with allergic disease, it might be expected that successful management of AD would involve a multipronged approach, including psychological intervention as well as conventional physical therapies such as skin care, identification and elimination of flare factors, and anti-inflammatory medicine.

There has been much discussion of the effectiveness of psychological interventions in managing AD, but little scientific evidence. Therefore, the purpose of this study was to conduct a systematic review and meta-analysis of randomized controlled trials (RCT) of psychological interventions in AD.

Methods

Research Strategy

Electronic searches were done in Medline (1966 to December 2006); Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, ACP Journal Club and Database of Abstracts of Reviews of Effects (1991 to December 2006); PsycINFO (1872 to December 2006); Web of Science (1900 to December 2006); PubMed (1950 to December 2006); Scopus (1960 to December 2006); and Google. The main search strategy was: ('atopic*') AND ('psych*' OR 'cognitiv*' OR 'behav*' OR 'hypn*' OR 'relax*' OR 'meditation' OR 'family therap*' OR 'group therap*' OR 'individual therap*') AND ('random*'). In addition, we manually searched the reference lists of retrieved publications and reviews. Supplementary information was sometimes obtained directly from the authors by e-mail or from other published reports.

Inclusion Criteria

Criteria for inclusion were as follows: (1) random assignment of subjects; (2) AD was diagnosed by a physician; (3) appropriate control group (i.e. usual medical care, wait-list, attention placebo); (4) English language full-length publication in a peer-reviewed journal; (5) active treatment that included some psychological/psychosocial component beyond simply providing information (e.g. brief patient education) about the disease; (6) if samples overlapped across articles, the article with smaller sam-

ple size was excluded; (7) if more than one kind of intervention was employed in an article, the samples were included separately.

Assessing the Methodological Quality of the Trials

Each study was assessed using a modified 0–5 scale developed by Jadad et al. [12] and summarized as follows: (1) Was the study described as randomized (1 = yes; 0 = no)? (2) Was the outcome assessment blinded (1 = yes; 0 = no)? (3) Was there a description of withdrawals and dropouts (1 = yes; 0 = no)? (4) Was the method of randomization well described and appropriate (1 = yes; 0 = no)? (5) Was the method of blinding well described and appropriate (1 = yes; 0 = no)? (6) Deduct 1 point if methods for randomization or blinding were inappropriate. Modification of this scale was essential because due to the nature of the psychological interventions it would be difficult to conduct double-blinded trials. Therefore, as modified in previous studies [13, 14], in steps 2 and 5 'double-blind' was changed to 'blind'.

Coding Variables

A manual was prepared for coding the studies. The manual was revised during the coding to incorporate important aspects of the located studies. The final list of variables included the following: publication year; number of subjects in the control and intervention groups; mean age (range); type of psychological therapy; type of control condition; clinical outcomes (eczema severity, itching intensity, scratching intensity, self-assessed annoyance, medical compliance, treatment habit, treatment cost, use of topical steroids, anxiety, depression, anger, quality of life, coping of parents, nighttime disturbance and daytime irritation). Data extractions were done by 2 independent assessors (Y.C. and N.H.). Differences were settled by consensus.

Meta-Analysis Technique

When primary studies provided sufficient data or such data were obtained by other means, such as personal communication with the author or indirect calculation, effect sizes were calculated for each of the outcomes. We examined the effects on each of the outcomes after intervention (i.e. the first time point following the treatment) and at follow-up (the last time point assessed). All mathematical and statistical operations were performed on Fisher's z-distribution because of its superior distributional properties. For each intervention, the size of the effect on clinical outcomes was shown as a correlation coefficient (r). Weighted average effect sizes were computed as r by proportionally weighting each study's observed effect size according to its degrees of freedom. Explicitly, this procedure gives more weight to larger studies, which tend to obtain more reliable estimates of the population effect size [15]. Effect size for each intervention was calculated from inferential statistics when possible. If no relevant convertible statistics were presented, other than a p value, we calculated the t statistic from the p value and an $r_{\text{equivalent}}$ [16]. When a paper reported $p < 0.05$, $p < 0.01$ or not significant, we computed $r_{\text{equivalent}}$ with p values of 0.025, 0.005 and 0.50 (one-tailed), respectively, which likely yielded a highly conservative estimate of the effect size. Advantages of reporting meta-analytic results as r as opposed to other effect size indicators (e.g. Cohen's d and Hedge's g) have been discussed by Rosenthal [15]. However, in some cases, when the findings were not statistically significant, there was insufficient data reported to calculate an effect size: the results were then treated as having zero effect and the sample size

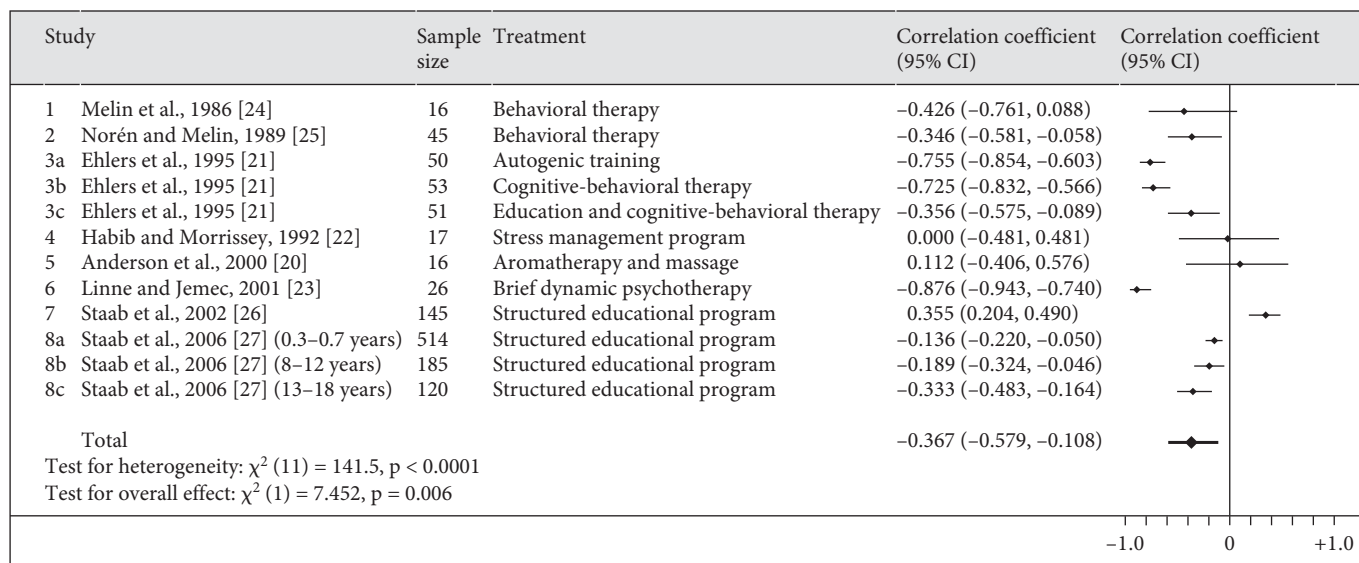


Fig. 1. Meta-analysis of the effect of psychological interventions on eczema severity. More negative correlation coefficients indicate greater beneficial effects on eczema severity.

was simply added to the total sample size when calculating the combined effect size. Because we compared the effect of a wide range of psychological interventions, we decided to use random effects modeling overall (restricted maximum likelihood method). Random effects models take into account the amount of variance caused by differences between studies as well as differences among subjects within studies [17]. Finally, we employed the Q test for homogeneity [18], which tests whether there was variability within the set of effect sizes. All analyses were performed on a Macintosh G4 computer using a meta-analysis program [19].

Results

Our initial search yielded 13 articles that examined psychological interventions for AD. Five articles were excluded, leaving 8 articles that met our inclusion criteria [20–27]. The reasons for exclusion were lack of randomization [28, 29], having an inadequate control condition [30], and being presented only as a meeting abstract [31, 32].

Study Characteristics

Table 1 summarizes the study characteristics, including sample size, mean age (range), type of intervention and control, and quality rating by Jadad et al. [12]. Across the 8 trials, done in the USA, UK, Germany, Sweden and Denmark, sample sizes ranged from 16 to 518, with a mean of 96.8. Five trials were of adults and 3 were of chil-

dren. Because 1 paper reported results from 3 types of intervention [21] and 4 papers employed very similar behavioral therapies [24, 25] or structured educational programs [26, 27], the total number of kinds of interventions was 8 (aromatherapy, autogenic training, brief dynamic psychotherapy, cognitive-behavioral therapy, dermatological education and cognitive-behavioral therapy, habit reversal behavioral therapy, structured educational programs, and stress management program). Stress management psychotherapy, including cognitive therapy, brief dynamic psychotherapy and structured educational programs, was utilized in 5 interventions (62.5%) [21–23, 26, 27]. Of the interventions, 5 of 8 (62.5%) [20, 22, 23, 26, 27] included a relaxation technique component, such as autogenic training and aromatherapy. Four interventions (50.0%) [21, 22, 24, 25] contained a habit reversal behavioral technique that was originally developed by Azrin and Nunn [33].

Methodological Quality of Trials

Across trials, the mean Jadad score was 2.8 (range 1–5). Looking at the specific items that make up the Jadad quality scale, the following was observed. All studies were randomized (a criteria for inclusion in the methods). Unfortunately, 7 studies [20–26] did not describe a proper method of randomization (e.g. table of random numbers, computer generated). Because practitioners frequently cannot be blinded to the treatment condition

Table 1. Summary of RCT characteristics and findings

Study	Design	Controls n	Intervention n	Mean age years	Psychological treatment	Control condition	Jadad score (0–5)
Melin et al., 1986 [24] Sweden	RCT 2 arms	9	7	30.5 (19–41)	behavioral therapy (individual): 2 sessions of psychological habit reversal therapy during the first week	usual medical care	1
Norén and Melin, 1989 [25] Sweden	RCT 4 arms	hydr only: 11 hydr+beta: 11	hydr+behav: 13 hydr+beta+behav: 10	24.8 (16–46)	behavioral therapy (individual): 2 sessions of psychological habit reversal therapy during the first 2 week	usual medical care	1
Ehlers et al., 1995 [21] Germany	RCT 4 arms	DE: 27	AT: 25 CB: 28 DE+CB: 27	25.1 (17–52)	AT, CB therapy, DE+CB therapy (group): 12 weekly 1.5- to 2-hour sessions, CB therapy was composed of habit reversal, positive self-instructions, distraction technique, communication skills, etc.	DE	3
Habib and Morrissey, 1999 [22] USA	RCT 2 arms	8	9	34.0 (22–53)	stress management program (group): 6 weekly 2-hour sessions based on ABC model (awareness, balance and control)	wait-list control	4
Anderson et al., 2000 [20] UK	RCT 2 arms	8	8	4.19 (3–7)	aromatherapy massage (individual): everyday 30-min essential oil massage over the 8-week period	massage alone	3
Linnet and Jemec, 2001 [23] Denmark	RCT 2 arms	14	12	28.3 (5–45)	brief dynamic psychotherapy (individual): average of 15.5 sessions (range 11–18) over the 6-month period	usual medical care	1
Staab et al., 2002 [26] Germany	RCT 2 arms	73	72	3.05 (0.4–12)	structured educational programs (group): 6 weekly 2-hour sessions of medical, psychological and nutritional topics (e.g. a relaxation technique, stress management and issues of coping)	wait-list control	1
Staab et al., 2006 [27] Germany	RCT 6 arms	244 83 50	274 102 70	2.4 (0.3–7) 9.5 (8–12) 14 (13–18)	structured educational programs (group): 6 weekly 2-hour sessions of medical, psychological and nutritional topics (e.g. a relaxation technique, stress management and issues of coping)	wait-list control	5

Figures in parentheses are ranges. In Linnet and Jemec [23], effect sizes are presented as posttreatment minus pretreatment values and follow-up minus pretreatment values. ADAM = AD assessment measure; AT = autogenic training; behav = behavioral therapy; beta = betamethasone valerate; CB = cognitive-behavioral; CES-D = Center for Epidemiological Studies depression scale; DE = dermatological education; hydr = hydrocortisone; STAI = state-trait anxiety index; SCORAD = severity scoring of AD.

in psychological treatment, as they can in drug trials, we checked whether the assessor or evaluator was blinded. The outcome assessment was blinded, and the blinding method was described and appropriate in 3 studies [20–22, 27]. In only 2 studies [22, 27] was there a satisfactory description of withdrawals and dropouts. All studies described the control condition. Finally, 5 studies [20, 21, 23, 26, 27] compared the baseline characteristics of treat-

ment and control groups and 3 studies [21, 23, 26] controlled for baseline differences in the statistical analysis.

Study Outcomes

Outcome variables and effect sizes are summarized in table 1. Figures 1–3 show the pooled effect sizes for eczema severity, itching intensity and scratching after intervention.

Outcome variables	Results	Effect size correlation coefficient (r)
4 weeks after intervention: eczema severity, scratching, itching intensity, self-assessed annoyance and medical compliance	positive: significant reduction of eczema severity, scratching and self-assessed annoyance in the intervention group negative: no significant changes in itching intensity and medical compliance	eczema severity: -0.426 itching intensity: 0.000 scratching: -0.574
after intervention: eczema severity and scratching	positive: significant reduction of eczema severity and scratching in the intervention group	eczema severity: -0.346 scratching: -0.248
1 year after intervention: eczema severity, scratching, itching intensity, topical steroids, anxiety (STAI) and depression (CES-D)	positive: significant effect of AT, CB, and DE+CB on eczema severity, scratching, itching intensity and using topical steroids negative: no significant effect of AT, CB and DE+CB on anxiety and depression	eczema severity: AT -0.755, CB -0.725, DE+CB -0.356 itching intensity: AT -0.695, CB -0.627, DE+CB -0.711 scratching: AT -0.802, CB -0.627, DE+CB -0.688 depression: AT 0.295, CB -0.143, DE+CB -0.177 trait anxiety: AT 0.716, CB 0.764, DE+CB 0.269
after intervention and 8 week follow-up: eczema severity (ADAM), itching intensity, social anxiety and anger	positive: significant effect on itching intensity and social anxiety negative: no significant effect on eczema severity, and state and trait anger	eczema severity: 0.000 itching intensity: -0.996 Social anxiety: -0.989
2 weeks after intervention: eczema severity, postinterventional night time disturbance and daytime irritation	negative: no significant effect on eczema severity, nighttime disturbance and daytime irritation	eczema severity: 0.112
after intervention and 6 months follow-up: eczema severity (SCORAD) and anxiety (STAI)	positive: significant effect on eczema severity and trait anxiety	eczema severity: -0.876; -0.899 state anxiety: -0.931; -0.257 trait anxiety: -0.469; -0.524
1 year after intervention: eczema severity (SCORAD), treatment habit, treatment cost, and quality of life and coping of parents	positive: significant effect on using topical steroids, treatment habit, treatment cost, quality of life and coping strategies negative: no significant effect on eczema severity	eczema severity: 0.355
1 year after intervention: eczema severity (SCORAD), treatment habit, treatment cost, and quality of life and coping of parents	positive: significant effect on eczema severity, itching behavior (catastrophization), quality of life and coping strategies	eczema severity: 0.3-7 years old, -0.136; 8-12 years old, -0.189; 13-18 years old, -0.333

Eczema Severity. All 8 psychological interventions in the 7 trials featured eczema severity as an outcome variable. The methods for measuring this severity were the severity scoring of AD (SCORAD) index [34] in 3/8 studies [23, 26, 27], a modified SCORAD index in 1/8 studies [21], an AD assessment measure (ADAM) [35] in 1/8 studies [22] and authors' original scoring methods in 3/8 studies [20, 24, 25]. Of the interventions, 5 (autogenic training, cognitive-behavioral therapy, dermatological

education and cognitive-behavioral therapy, habit reversal behavioral therapy, and structured educational programs) exhibited a significant reduction in eczema severity, whereas 3 did not (aromatherapy, brief dynamic psychotherapy and stress management program). The average effect size for the 8 interventions was -0.367 [$\chi^2(1) = 7.452, p = 0.006$; 95% confidence interval (CI) -0.579 to -0.108] (fig.1).

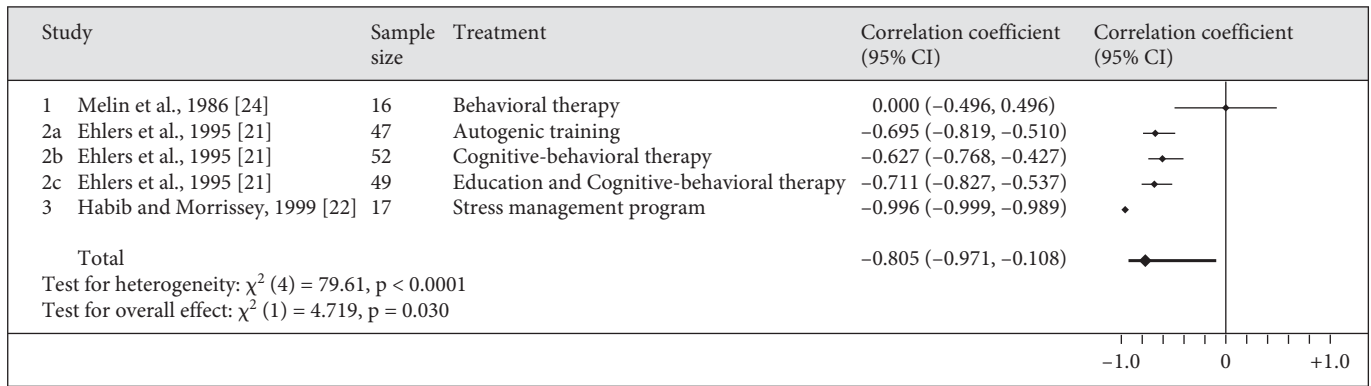


Fig. 2. Meta-analysis of the effect of psychological interventions on itching intensity. More negative correlation coefficients indicate greater beneficial effects on itching intensity.

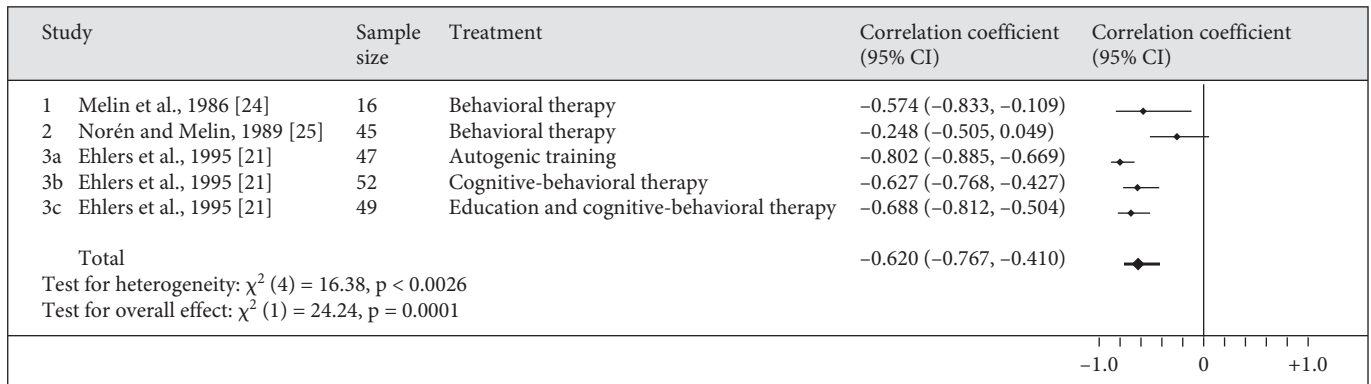


Fig. 3. Meta-analysis of the effect of psychological interventions on scratching. More negative correlation coefficients indicate greater beneficial effects on scratching.

Itching. Five kinds of intervention (autogenic training, cognitive-behavioral therapy, dermatological education and cognitive-behavioral therapy, habit reversal behavioral therapy, and stress management program) in 3 trials [21, 22, 24] evaluated the effect on itching intensity. In all cases, itching was measured using a subjective Likert-type scale. Four kinds of intervention (autogenic training, cognitive-behavioral therapy, dermatological education and cognitive-behavioral therapy, and stress management program) showed a significant decrease in itching, and only 1 did not (habit reversal behavioral therapy). Based on the data of the 5 interventions, the pooled postintervention effect size was -0.805 [$\chi^2(1) = 4.719, p = 0.030; 95\% \text{ CI } -0.971 \text{ to } -0.108$] (fig. 2).

Scratching. Four kinds of intervention (autogenic training, cognitive-behavioral therapy, dermatological education and cognitive-behavioral therapy, and habit

reversal behavioral therapy) in 3 trials [21, 24, 25] assessed the effect on scratching intensity, and all demonstrated a significant improvement. In all cases, scratching intensity was measured using a subjective Likert-type scale. Based on the data of the 4 interventions, the pooled postintervention effect size was -0.620 [$\chi^2(1) = 24.24, p < 0.0001; 95\% \text{ CI } -0.767 \text{ to } -0.410$] (fig. 3).

Psychological Effects. A wide range of psychological effects was examined, including anxiety [21, 23], depression [21], anger [22], annoyance [21], daytime irritation [20], nighttime disturbance [20], quality of life [26, 27], coping skills [26, 27], and catastrophization and coping for itching [27]. Anxiety, depression, anger and coping skills were evaluated using self-administered questionnaires including the state-trait anxiety inventory (STAI) [36], the Center for Epidemiological Studies depression scale (CES-D) [37], the positive and negative affect scales

(PANAS) [38], the self-consciousness scale [39], the state-trait anger expression inventory (STAXI) [36], and the Trier scales of coping [40]. The STAI is a 40-question, self-administered questionnaire divided into 20 questions concerning state anxiety and 20 concerning trait anxiety. 'State anxiety' refers to the level of anxiety felt at present, whereas 'trait anxiety' refers to the anxiety felt in general by the person. The CES-D is a 20-item instrument that assesses the level of depressed mood, with higher scores indicating greater depression. The PANAS consists of 20 mood adjectives, 10 of which assess positive and 10 negative affect. The self-consciousness scale comprises 22 items designed to help understand the way in which individuals think and feel in social situations. The STAXI measures experience of anger and expression of state and trait anger. This scale consists of 44 items forming 6 scales (state anger, trait anger, anger-in, anger-out, anger control and anger expression) and 2 subscales (trait angry temperament and trait angry reaction). The Trier scales of coping are a questionnaire with 37 items in 5 dimensions: rumination, seeking information about the disease, seeking social support, minimizing disease-related threat and seeking support in religion. Three types of intervention (habit reversal behavioral therapy, stress management program and structured educational programs) had a positive effect on social anxiety, annoyance, quality of life, coping skills, or catastrophization and coping for itching [21, 22, 26, 27], while the others did not significantly improve psychological distress.

Treatment Behavior. Using topical steroids [21, 26], medical compliance [24] and treatment cost [26] were examined as outcome variables. Four kinds of intervention (autogenic training, cognitive-behavioral therapy, dermatological education and cognitive-behavioral therapy, and structured educational programs) significantly decreased the use of topical steroids [21, 26], and the structured educational programs significantly reduced treatment cost [26]. Habit reversal behavioral therapy failed to improve medical compliance [24]. Overall, because both psychological effects and treatment behavior were inconsistently assessed as outcome variables, we were unable to evaluate them by meta-analysis.

Discussion

To our knowledge, this is the first systematic review to quantify the effects of psychological interventions on AD. Effective psychological interventions on AD seem to be based on 3 rationales. First, as described in the intro-

duction, exacerbation of the skin is often related to perceived stressors [4, 5, 11], which could reasonably be expected to respond to psychotherapy that reduces the intensity of stress. These trials employed cognitive therapy [21], brief dynamic psychotherapy [23], a stress management program [22] or structured educational programs [26, 27]. The cognitive therapy described by Ehlers et al. [21] was effective for the AD symptoms of eczema, itching and scratching. This therapy included several training elements that helped in solving everyday problems and increased the patients' interpersonal and communication skills. The brief dynamic psychotherapy employed by Linnet and Jemec [23] was a counseling intervention focusing on AD perception and AD-related conflicts such as disfigurement, feelings of rejection from others, anxiety and aggression related to itch-scratch patterns, and depressive feelings due to the need to live with AD. The stress management program used by Habib and Morrissey [22] was based on managing stress by incorporating awareness, balance and control (ABC model). Structured educational programs covered medical, nutritional and psychological issues, and were carried out by a multiprofessional team of dermatologists, psychologists and dietitians [26, 27]. Hence, these psychotherapies aided AD patients or their parents in realizing AD-related problems and restructuring their thinking patterns, thereby reducing the intensity of stress.

Second, because stress has been shown *directly* to exacerbate atopy disorders via several biological pathways [41, 42], relaxation techniques are thought to ameliorate stress-induced pathophysiological exacerbation of AD. Relaxation is incorporated in autogenic training [21], which has been reported as being effective for AD. This relaxation training followed the basic stage of autogenic training described by Luthe and Schultz [43], but was specifically adapted and modified for AD. During autogenic training, patients learn to relax by focusing on specific parts of their body and autosuggestion. Instead of the standard autogenic training version of 'hands and arms warm', Ehlers et al. [21] added the autosuggestion 'skin calm and pleasantly cool' and individually chosen autosuggestions aimed at controlling scratching (e.g. 'I do not need to scratch' or 'my skin stays intact') and at coping with itching (e.g. 'the itch dissolves', 'with every breath the itching gets weaker and weaker', 'my skin is protected by soft, cool silk' or 'a cold wind makes my skin numb'). Aromatherapy is defined as the therapeutic use of essential oil to produce a physiological or psychological effect through the sense of smell. Essential oils are concentrated essences extracted from plants by steam or water distil-

lation. Essential oils have been used for centuries for their positive emotional and mental effects and for improving memory [44]. Therefore, this relaxation technique may strengthen the efficiency of some psychological interventions on AD, although Anderson et al. [20] failed to show that a combination of aromatherapy and massage significantly ameliorates the severity of eczema of AD.

Third, excessive scratching has been reported to exacerbate AD. This intense itch-scratch cycle, which often leads to bleeding, infections and scarring, was suggested to be suitable for behavior therapies such as habit reversal [33]. In line with this suggestion, the habit reversal behavioral technique had a favorable effect on AD [21, 22, 24, 25]. In this therapy, the patients described and demonstrated how and when they scratched. The scratching behavior was divided into 2 parts, the movement towards the itching area and the actual scratching. The patients were then taught 2 procedures, which are incompatible with the above movements, namely clenching their fists for 30 seconds and then pressing a fingernail against or pinching the itching spot. Awareness was achieved by counting scratching episodes and practicing the habit reversal method several times in the doctor's office. The patients were also told to practice the method at least twice a day. If the itch vanished after 30 seconds of fist clenching, the patients were told not to pinch the formerly itching spot. Taken together, the most effective psychological intervention for AD would seem to be a combination of stress-managing psychotherapy, relaxation techniques and habit reversal behavioral therapy. Furthermore, well-structured educational programs including these psychological components might maintain their therapeutic effects and enable the treatment of a larger number of AD patients.

Our literature search identified only 8 published papers that fulfilled selection criteria. This meta-analysis suffers from the so-called 'apples and oranges' problem.

We assume that the large variation in effect sizes (heterogeneity) is due not only to sampling error, but also to systematically different settings. On the other hand, there may be nonspecific therapeutic factors operating, which may be common to all interventions, including receiving attention and information, having the opportunity to share thoughts and feelings, and belief in the efficacy of the interventions. In addition, the methodology of RCTs in this field would benefit from greater sophistication. In several cases, investigators failed to describe an acceptable method of randomization or provide a description of the reasons for withdrawals and dropouts. It is also important to use well-established methods of measuring outcome. The SCORAD, eczema area and severity index (EASI), Costa's simple scoring system and the six area, six sign atopic dermatitis (SASSAD) index have been utilized in many previous RCTs of AD therapy [45], and eczema severity should be assessed by these scales rather than unpublished or modified severity indices. Given the inherent diversity of psychological interventions, authors should describe their interventions in greater detail, including their theoretical background. Finally, it is important to measure baseline characteristics relevant to AD, such as parental allergy, duration of illness and body mass index, and to adjust statistically for such confounders between the intervention and control groups.

In conclusion, the current meta-analysis revealed that psychological intervention has a beneficial effect on AD. However, given some of the above-mentioned limitations, this review should be regarded as a starting point for future updates. Additional research is needed to clarify which psychological interventions (or combination of interventions) are the most effective and which specific characteristics of AD patients are responsive to these interventions, and to examine whether or not such treatments can potentially reduce reliance on pharmacologic therapies.

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