INVESTIGATIVE REPORT

Agreeableness as Predictor of Induced Scratching in Patients with Atopic Dermatitis: A Replication Study

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In patients with atopic dermatitis agreeableness and public self-consciousness have previously been shown to be significant predictors of induced scratching, while depression was significantly related to induced itch. This study aimed to replicate these findings. Itch and scratching were induced by videos of crawling insects or skin diseases. Induced itch was measured using a visual analogue scale. Scratching behavior was evaluated by two raters. Psychological variables were assessed using validated questionnaires. Induced scratching could be predicted significantly by agreeableness (corrected $R^2 = 15.5\%$ or 38% after exclusion of one outlier): Patients scoring low on agreeableness showed a higher increase in scratch movements than patients scoring high on this scale. No associations between induced scratching/itch and public self-consciousness/depression were found. One clinical implication that arises from this study could be to offer patients scoring low on agreeableness certain psychological interventions.

Key words: atopic dermatitis; itch; scratching; personality; agreeableness; itch induction.

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Atopic dermatitis (AD) is a chronic inflammatory skin disease which is characterized by lichenification at certain sites of the body and (other) atopic diseases (asthma bronchiale, rhinitis allergica or AD) in the patient and/or his/her family (1). One of the biggest stressors of this disease is the intense itch which bothers AD patients, especially in the evening and at night (2, 3). In order to decrease itch, patients scratch, which is associated with immunological reactions and a worsening of inflammation (4). Almost every AD patient experiences his/her itch as annoying and unpleasant (3). The itch intensity during a usual itching episode is evaluated as very intense in this patient group (8.3 out of 10 points). Furthermore, itch occurs in 91.4% of the patients at least once a day (3). Many AD patients experience heat sensations and pain in combination with their itch (3, 5).

In some older studies, AD patients were shown to have a certain personality structure which was characterized by high neuroticism scores, hostility and the inability to cope with anger (6, 7). Furthermore, patients with AD were found to be more anxious and depressive than healthy controls (6–10) and described themselves as lower in self-efficacy than healthy controls (8). Even though these relationships could be found, Buske-Kirschbaum et al. (11) posit that one should be rather cautious in relating a certain personality profile to the occurrence of AD, because study results are diverse and not every study found a certain personality structure in patients with AD (11). However, personality characteristics and depression seem to be related to the *intensity of itch* in this patient group (12–14). One study showed that neuroticism was positively associated with the intensity of itch in patients with AD and psoriasis (13). In another study, a positive correlation between self-rated depression and itch intensity was found in AD (12). In addition, being more focused on bodily sensations was linked to the intensity of itch in this patient group (14). Even though the correlations in these cited studies were rather low, we were surprised by the results of a study which we published 3 years ago (15). In this study, we investigated the relationship between *induced* itch and *personality* in AD. We found that *induced* itch and scratching in AD patients were strongly related to certain personality characteristics. Induced scratching could be predicted by public self-consciousness and low agreeableness to a very high degree: Patients who report being very concerned about what other people think about them and at the same time describe themselves as rather rude or aggressive and not very agreeable, displayed more induced scratching than patients with the opposite psychological phenotype (corrected $R^2 = 0.534$). Furthermore, AD patients scoring high on depression reported a higher itch increase than patients who stated they were not very depressive (corrected $R^2 = 0.175$). In contrast, these associations were not found in healthy controls (15).

Even though the results of this previous study (15) were interesting, we believe that the findings need to be replicated in a first step in order to draw clinical implications from them in a second step. In a recently published study on the reproducibility of findings in the field of psychology, it has been outlined that 97% of the original articles investigated reported significant results, whereas not even half of the studies aiming to replicate the significant results were able to do so (16). Thus, many published data seem to report incidental findings, which do not justify treatment modifications. From our

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point of view, replication studies are highly desirable in order to justify clinical implications. In clinical settings, false positive results could lead to the application of non-effective treatments, which would then result in unnecessary time commitment of patients and those working in the field of dermatology. In our case it is possible that time-consuming psychological treatments would lead to frustration not only in the patients but also in staff working in the field of psychodermatology should their effects on itch and scratching be rather low. Moreover, unnecessary costs would also result from these time-consuming treatments, meaning a high financial burden for the health system. Therefore, the goal of this study was to replicate the findings of our former study using again participants with AD in comparison to healthy controls. We aimed to answer the following research question: Can agreeableness, self-consciousness and depression again be shown to predict induced itch or scratching in patients with AD? Thus, this study was carried out in order to be able to draw clinical implications from it in a second step in the event that the results of the former study could be replicated.

MATERIALS AND METHODS

Ethics statement

The study was approved by the local Ethics Committee of the Justus-Liebig-University of Giessen, Germany. All participants provided written informed consent and were free to withdraw from the study at any time.

Participants

Twenty-three AD patients and 23 healthy skin controls were included in the study (see Fig. S1[1]). Participants were recruited through announcements in a weekly newspaper and at the campus of the Justus-Liebig-University as well as at the Dermatology Department of the University Clinic of Giessen. AD patients were included if they suffered from clinically diagnosed AD according to the criteria of Hanifin & Rajka (1), and if they reported suffering from AD during the last 3 months prior to the study. They were not allowed to use any itch-related medication at least 24 h prior to the examination and no high-potent itch-reducing medication on a regular basis. Additionally, they were excluded if they had already joined an education program for AD patients. Healthy controls as well as AD patients who suffered from any other somatic or psychiatric disease were excluded from the study. Furthermore, participants were excluded if they had already participated in another study at our institute, because they would then know the observation laboratory which could influence their behavior. All participants received an expense allowance of €15 after they completed the study appointment.

Variables

Predictor variables. The predictor variables agreeableness, public self-consciousness and depression were measured using the following 3 validated questionnaires, which we also used in the former study that we aimed to replicate:

1. Neo-Five Factor Inventory (NEO-FFI (17)): This questionnaire contains 60 items and measures 5 personality traits: agreeableness, extraversion, openness to experience, conscientiousness and neuroticism. In this study we were especially interested in the personality trait agreeableness. Persons scoring high on this trait can be described as empathic, cooperative, kind and polite instead of aggressive, stubborn or manipulative (18).
2. The Self-Consciousness-Scale (SCS; (19)) comprises 27 items and measures private as well as public self-consciousness. In this study we were especially interested in the scale public self-consciousness. Subjects scoring high on public self-consciousness pay much more attention to how they are seen by others.
3. The German version of the Hospital Anxiety and Depression (HADS-D; (20)) scale is a 14 item-questionnaire which measures clinically relevant signs of depression and anxiety. In this study we were especially interested in the scale depression.

Even though our main interest was to replicate the significant relationships between induced itch and scratching and the above-named personality characteristics, we applied the whole NEO, SCS and HADS in order to be able to also look at whether this time the other scales of the questionnaires were also not related to induced itch and scratching.

Criterion variables. Induced itch and induced scratching were considered as criterion variables. To determine induced itch, itch intensity was measured by self-ratings immediately after the presentation of the videos (also see procedure) using visual analogue scales ranging from 0–10. Itch increase from the control video (CV) to the experimental video (EV) was calculated by subtracting self-rated itch intensity immediately after the CV from itch intensity measured immediately after the presentation of the EV.

To determine induced scratching, the number of scratch movements during the whole presentation of the EV and CV was counted by two independent raters. Before counting, the raters were instructed by an experienced dermatologist (UG) on how to differentiate between scratching and simple touching. Scratching was defined as any movement including rubbing, while touching was characterized as movements of an extremity without rubbing (also see 15)). The interrater-reliability was highly significant with $r \geq 0.88$; $p \leq 0.001$ in all cases.

Additional variables. In addition, the Patient-Oriented-SCORAD (PO-SCORAD; 21) was measured in order to be able to determine the severity of AD. The PO-SCORAD is an instrument which assesses the extent of the skin symptoms as well as the intensity of 6 objective and two subjective symptoms (21).

Procedure

Patients and healthy controls came in groups of 3 or 4 to our observation laboratory. Patients and healthy controls were examined separately. The study was announced as a study on "the evaluation of teaching material concerning our skin and its function". This title was chosen to blind the subjects to the real intention of the study. Thus, they did not know that the videos were supposed to induce itch and scratching. As soon as they arrived at our laboratory, all participants were asked to sit down in a dimly-lit room. The participants were separated by divider walls in order not to influence each other. They were also asked not to talk to each other, drink or eat during the investigation. After giving their written informed consent, they were then presented with 3 videos in counterbalanced order (also see itch induction). In between the video presentations a 20-min wash-out period took place, during which the patients filled in validated questionnaires to assess the predictor and control variables. At the end of the investigation

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Table I. Timeline of the study visit

Time (min)	0	10	20	30	40	50	60	70	80	90
Study period		Video 1	Wash-out period 1		Video 2	Wash-out period 2		Video 3		
Action	Information on the study and informed consent	Measurement of scratching behavior	Evaluation of the first video; NEO-FFI		Measurement of scratching behavior	Evaluation of the second video; HADS, SAM, measurement of socio-demographic data		Measurement of scratching behavior	Evaluation of the third video	Debriefing

Each participant was shown a control video (CV) and two experimental videos (EV; on skin diseases and crawling insects). However, in this study, we were only interested in the itch and scratching provoked by one EV in comparison to the CV. Thus, the third study period is marked grey. Patients who were presented with two EVs before the CV were not included in this study, because here a cumulative effect of itch/scratching might have occurred.

all participants were debriefed on the real intention of the study and had the possibility to ask questions about the study (for the procedure of the study, also see **Table I**). For this study, we were only interested in the reaction to one of the EVs.

Itch induction

Itch was induced by the presentation of an EV which either dealt with crawling insects (EV1) or skin diseases (EV2). Each video contained 9 pictures that were presented as a slide show. While seeing the pictures, a speaker (UG) talked in the background about either skin diseases (EV2) or crawling insects (EV1). The number of itch inducing words (e.g. itch, scratching, crawling) was equal in both videos. There was no difference in induced itch between the videos (also see results). The CV which was used as a baseline measure also included 9 pictures that were presented as a slide-show. The topic of the CV was "skin – the communication organ". The same speaker that talked in the EV also talked in the CV. Each video (CV; EV1 and EV2) lasted approximately 9.5 min. The order of video presentations was counterbalanced in order to avoid order effects of the videos: There were 11 subjects in each group who first watched the CV and then the EV, and there were 12 subjects in each group who were first presented with the EV and then the CV.

Statistical analyses

The two main hypotheses tested in this study were:

Hypothesis 1 (H1): Agreeableness and self-consciousness are significant predictors of induced scratching in patients with AD.

Hypothesis 2 (H2): Depression is a significant predictor of induced itch in patients with AD.

Statistical analyses were conducted using SPSS 22. The statistical method used to test H1 and H2 was a regression analysis, which either included the scales "agreeableness" and "public self-consciousness" (H1) or "depression" (H2) as predictor(s) of induced scratching (H1) or induced itch (H2) respectively. In case the regression analysis revealed that the criterion variable could be significantly predicted by a predictor variable, we tested whether the unstandardized and standardized residuals were normally distributed, which was the case. In order to verify that in this study – as in the previous study – the other personality characteristics were not related to induced itch and scratching, correlation analyses were conducted in a second step. To compare participants with and without AD with regard to socio-demographic data, personality, depression and anxiety, *t*-tests for independent samples were computed.

RESULTS

Sample characteristics

AD patients and healthy skin controls were similar in the distribution of gender: In the group of AD patients there were 20 females and 3 males, while in the group of healthy controls there were 21 females and 2 males. AD patients did not differ from healthy controls regarding age or education level ($p > 0.05$). The mean ± SD age in the group of AD patients was 24.3 ± 3.2, while it was 24.4 ± 3.4 in the group of healthy skin controls. In each group, 22 subjects had a university entrance diploma. Patients and healthy controls did not differ regarding depression [T (44) = 0.884; $p = 0.381$] nor public self-consciousness [T (44) = 1.481; $p = 0.146$], but AD patients scored significantly higher on the scale agreeableness than healthy skin controls [T (34.949) = –2.522; $p = 0.016$]. At the time of investigation, patients with AD had a mean PO-SCORAD of 36.3 ± 11.3 (range: 3.5–55.3). Nineteen patients suffered from a moderate PO-SCORAD, two from severe AD and two from mild AD.

Manipulation check "itch induction"

T-tests for dependent groups indicated that a significant increase in itch was induced by the EV [T (45) = –5.515; $p \leq 0.001$], scratching was by trend induced by the EV [T (45) = –1.740; $p = 0.089$]. The mean ± SD itch intensity during the CV was 1.43 ± 2.42, whereas it was 4.33 ± 3.74 during the EV. The mean ± SD number of scratch movements during the CV was 3.16 ± 2.59, whereas it was 3.82 ± 3.38 during the EV [see also **Fig. 1**]. Itch intensity and scratching behavior that occurred during the presentation of EV1 (video on crawling insects) and EV2 (video on skin diseases) did not differ [all $p \geq 0.110$]. Moreover, there were no significant differences in induced itch and

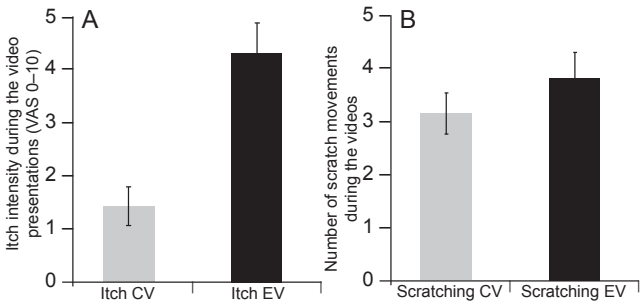

Fig. 1. Itch intensity and number of scratch movements during the presentation of the control video (CV) and experimental video (EV). The presentation of the EV to a significant increase in itch (A: $p < 0.05$) and by trend to an increase in scratching (B: $p < 0.1$).

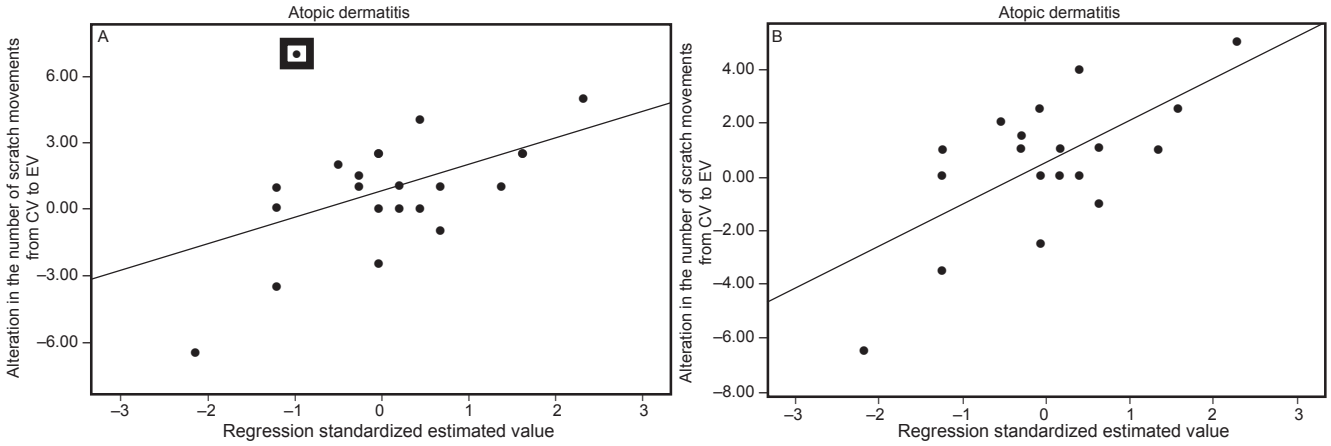

Fig. 2. Results of the regression analyses. The regression analyses showed that 15.5% of the variance in induced scratching could be predicted by agreeableness (A). After excluding one outlier (circled in A), 38% of the variance in the number of scratch movements could be explained by agreeableness (B).

scratching between patients with AD and healthy skin controls [all $p \geq 0.151$].

Results of the regression analyses

The regression analysis revealed that in patients with AD, induced scratching could be predicted by the personality variable "agreeableness" [F (1/22) = 5.022; $p = 0.036$], while public self-consciousness was not significantly associated with induced scratching in this study [r = –0.013; $p = 0.952$]. Agreeableness was able to explain 15.5% of the variance of induced scratching in patients with AD. Again, low agreeableness was related to more induced scratch movements [**Fig. 2**]. When taking a closer look at the results of the regression analysis [Fig. 2A], it becomes obvious that it is justifiable to regard the values of one patient as outliers. In this patient, the increase in scratch movements due to the video was greater than the mean increase in scratch movements plus two standard deviations. After excluding this patient, 38% of the variance of increase in scratch movements could be predicted by agreeableness [F (1/21) = 13.868; $p = 0.001$; corrected $R^2 = 0.38$; regression coefficient B = –4.397; standardized regression coefficient $\beta = -0.640$; Fig. 2B].

In addition, depression was not significantly related to itch induced by the EV in patients with AD in this study [r = 0.069; $p = 0.756$]. Also, none of the other assessed variables (extraversion, neuroticism, openness to experience, conscientiousness, self-consciousness, and anxiety) was significantly related to induced itch or induced scratching in patients with AD.

As in the previous study, also in this study none of all investigated psychological variables was significantly correlated with induced scratching in healthy skin controls [all $p > 0.05$]. However, private self-consciousness was positively correlated with induced itch and able to predict 14% of the variance of induced itch in healthy controls [F (1/21) = 4.585; $p = 0.044$; corrected $R^2 = 0.14$; regression coefficient B = 3.394].

DISCUSSION

The goal of this study was to replicate the findings of our former study (15), which showed that certain personality characteristics and depression were significantly related to induced itch and scratching, respectively, in AD patients. With the current study we were able to show again that the personality trait agreeableness was related to scratching induced by audiovisual stimulus material. However, in contrast to the findings of the former study, in this study, depression was not significantly related to itch increase due to audiovisual stimuli. Also, public self-consciousness did not turn out to be a significant predictor of induced scratching this time.

The finding that agreeableness and induced scratching are related in AD patients is of high interest for dermatologists and psychologists due to its robustness: This result is not only in line with our former study of AD patients, but also with the findings of our recent study in which we investigated the relationship in patients suffering from psoriasis (22), a skin disease which in many cases is also accompanied by intense pruritus (23). Thus, in patients with chronic itch, agreeableness seems to be an important psychological factor in determining at least partly whether patients with chronic itch tend to scratch or not when they are confronted with itch inducing stimuli. In this regard it is also of note that in the present study as well as in the study on patients with psoriasis (22), chronic itch patients displayed (in case of psoriasis at least by trend) higher scores regarding this personality characteristic than healthy controls. This could be seen as an adaptation process in patients with chronic itch which helps them not to react with impulsive scratching behavior in stressful social situations. When taking a closer look at the items of the scale agreeableness it becomes obvious that patients who score low on this scale can be regarded as stubborn, relentness, rather cool and not very cooperative. Due to the relationship repeatedly shown between low agreeableness and scratching it would in our

opinion be worth identifying patients with such psychological phenotypes during their visit to a dermatological practice. This would give dermatologists the chance to refer these patients to specialists working in the field of psychology/psychotherapy who could offer them certain psychological interventions that have already been shown to be or are regarded as beneficial in the treatment of itch and scratching (24, 25). Interventions we suggest to be especially helpful in patients scoring low on agreeableness are cognitive restructuring and anger management training. From our point of view it is reasonable to apply parts of Ellis' Rational Emotive Therapy (26) to identify irrational beliefs that provoke stubbornness and uncooperative behaviors in the special group of AD patients scoring low on agreeableness. This could then help them to reconsider the positive and negative effects of their beliefs in a next step. Subsequently these beliefs could then be replaced by rational, more functional beliefs (26). Moreover, anger management training, including role plays, which guide patients to react more calmly in anger provoking situations could also help rather aggressive and uncooperative patients by encouraging them to prevent impulsive behaviors directed towards their own skin in itch-inducing situations. On the other hand, one has to keep in mind that besides attitudes, other psychological factors like self-efficacy and intentions are also important factors influencing health-related behavior (in this case scratching) and that experimentally induced changes in attitudes, norms and self-efficacy only have small to moderate effects on health behaviors (27). From our point of view it is therefore an important task of future studies to investigate the size of effects of changing a combination of these variables on scratching behavior in itch inducing situations. Additionally, it would be worth investigating whether there are certain facets of agreeableness that show stronger relationships to induced scratching than others. It is, e.g., conceivable that particularly impulsive behavior directed towards oneself displays a more important predictor of induced scratching than impulsive behavior directed towards others. Unfortunately, in this study we did not apply a measuring instrument which allowed us to further investigate the relationship between induced scratching and different facets of agreeableness. This could be done in a future study.

There are further limitations to this study which should be addressed. With $n=46$ participants, the sample size of this study was rather small. However, due to the fact that this is already the third study (15, 22), which was able to show a significant negative relationship between induced scratching and agreeableness in patients with chronic itch, we are still convinced of the results. In order to be able to draw conclusions for both sexes though, future studies on the relationship between personality characteristics and itch/scratching should include men and women in an equal number, because it is known that men and women differ regarding the perception of experimentally induced itch (28). Moreover, the washout period of 20 min in between the videos was shorter than in the original study, where it lasted 30 min. This difference in study procedure was undertaken due to the fact that we also aimed to test two different EVs in this study, which led to a longer duration of the study visit.

Despite these limitations, this work increased our knowledge of the relationship between agreeableness and scratching behavior in patients with chronic itch. Moreover, in the future the findings might have clinical implications if experimentally changed attitudes in patients with chronic itch have been shown to have an effect on scratching in itch-inducing situations.

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