



Can self-compassion improve sleep quality via reduced rumination?

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ABSTRACT

Poor sleep quality is highly prevalent in modern societies and can be associated with a multitude of problems for individuals and organizations, and also for society at large. Thus, there is a demand for efficient treatments. We suggest that short self-compassion interventions will improve sleep quality via reducing ruminative thoughts, a key variable associated with poor sleep quality. We ran three studies to test this hypothesis. In Study 1 (correlational data), a positive relationship between self-compassion and sleep quality emerged in students' self-reports. This effect was mediated by rumination. In Study 2, students in two different self-compassion intervention conditions reported higher sleep quality compared to a control condition. Again, rumination mediated this effect. In Study 3, patients with major depressive disorder reported a significant increase in sleep quality and a significant decrease of ruminative thoughts after one week in a daily self-compassion intervention (compared to patients in a control condition). Limitations and implications for future research, such as the need of placebo control groups, objective sleep quality measures, and person–intervention fit designs are discussed.

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Poor sleep quality is an increasing problem in modern societies. Ohayon (2002) estimated that about one-third of all people in Western industrial countries present at least one insomnia symptom, as defined by the DSM-IV. Comparable data have been reported for the general population of Japan (Kim, Uchiyama, Okawa, Liu, & Ogihara, 2000) and Hongkong in China (Chung et al., 2015). In Germany, where the present studies were run, every third to fourth citizen reported occasional sleep problems in a representative survey (Schlack, Hapke, Maske, Busch, & Cohrs, 2013). Around 50% of these respondents reported sleeping poorly at least once a month; every ninth person additionally reported poor sleep at least three times a week.

Not only is the high prevalence of poor sleep a matter of concern, but also its consequences. Poor sleep plays a crucial role regarding our well-being. An abundance of research has documented negative effects of poor sleep on mental health and emotional well-being (for reviews, see Baglioni, Spiegelhalder, Lombardo, & Riemann, 2010; Kahn, Sheppes, &

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Sadeh, 2013; Vandekerckhove & Cluydts, 2010). Furthermore, poor sleep is not only a problem in terms of subjective well-being, but it can also negatively affect mood and vigilance (Dinges et al., 1997), work performance and accident proneness (Barnes & Wagner, 2009), and thereby organizations and society at large. Therefore, it is not surprising that several interventions have been developed to deal with this problem. The German Society of Sleep Medicine (DGSM) estimated that up to 10% of the population need treatment for these sleep problems to prevent chronic symptoms. Although standard treatments for insomnia and subclinical sleep problems seem effective (Morin et al., 2006), the threshold to search for professional help is high. Opting for therapy is costly for the individual and for health insurance companies in terms of time invested and money spent. This situation obviously calls for efficient low-cost interventions. These interventions should address key causes of insomnia and help people to cope with these causes to enduringly enhance sleep quality. In the following, we will briefly introduce rumination as a key factor of poor sleep quality, and self-compassion as a potential antidote.

The negative link between rumination and sleep quality

Previous research on antecedents of sleep quality has often focused on sociodemographic variables, such as age, sex, and socioeconomic status (Ohayon, 2002; Pearson, Johnson, & Nahin, 2006). Despite the importance of these macro-level factors, persons affected by sleep problems can rarely change these variables. Therefore, the present research focuses on micro-level factors contributing to sleep problems.

In particular, stress represents a key variable associated with poor sleep quality (Åkerstedt et al., 2012; Hall et al., 2000). When people were asked what they considered to be responsible for their poor sleep quality, up to 23% of the participants in a representative German survey stated “worries” and “feelings of stress” as crucial factors (Schlack et al., 2013). Similarly, Zeithofer et al. (2010) reported that in an Austrian representative sample, the most common responses to causes of sleep disturbances were “personal problems” (23%) and “stressful events of the day” (22%).

Other researchers have addressed the underlying mechanisms that drive the detrimental effects of emotionally stressful events on sleep. According to Brosschot, Gerin, and Thayer (2006), perseverative cognitions, such as rumination and worries, are common responses to stress and prolong physiological activation, leading to detrimental effects for one’s health (Clancy, Prestwich, Caperon, & O’Connor, 2016). Accordingly, rumination and worries seem to strengthen the negative relationship between stress and sleep quality due to a heightened level of arousal during the pre-sleep phase (Berset, Elfering, Lüthy, Lüthi, & Semmer, 2011; Guastella & Moulds, 2007; Thomsen, Mehlsen, Christensen, & Zachariae, 2003). Moreover, research from Nolen-Hoeksema and colleagues (e.g., Lyubomirsky & Nolen-Hoeksema, 1995) illustrated that rumination involves focusing on one’s negative emotional state, thereby enhancing its effects on cognition and interfering with instrumental behavior and problem solving. In a similar vein, people suffering from sleep problems seem to have selective attention toward their body reactions and cognitive processes during pre-sleep onset, resulting in a vicious circle of anticipating a detrimental arousal level that ultimately maintains arousal and ruminative thinking (Riemann et al., 2010).

Previous research has also identified certain protective factors against sleep problems. For instance, social support and mindfulness can buffer against the negative influence of

stress on sleep quality (Åkerstedt et al., 2002). In fact, prior research has already investigated mindfulness-based interventions as an alternative, low-threshold treatment for sleep disorders and non-clinical sleep problems (for a review, see Winbush, Gross, & Kreitzer, 2007). Yet, to date, controlled studies have not clearly demonstrated positive effects of mindfulness meditations on overall sleep quality and duration, but rather mild improvements of some sleep parameters (i.e., only total wake time and improved sleep quality, but not sleep onset latency, wake after sleep onset and sleep efficiency, see Gong et al., 2016) in patients with insomnia.

Building on the critical role of rumination in poor sleep and previous studies on mindfulness-based approaches to deal with sleep problems, we propose that a broader self-compassion-based approach could serve as a promising candidate for improving sleep quality.

Self-compassion as a possible antidote to rumination

A self-compassionate mindset comprises a positive and caring attitude of a person toward her- or himself in the face of failures and individual shortcomings. According to Neff (2003), this self-compassionate mindset stems from the cultivation of three interrelated subcomponents and the negation of their counterparts: self-kindness vs. self-judgment (refers to being kind and understanding toward oneself rather than being self-critical), common humanity vs. isolation (refers to understanding suffering as a shared human experience rather than as isolating), and mindfulness vs. avoidance or over-identification (refers to being aware of the present moment and to take a balanced view on personal feelings rather than avoiding them or overidentifying with them). Various work has already demonstrated that self-compassion can provide a buffer against stress (Leary, Tate, Adams, Allen, & Hancock, 2007; Neff, Kirkpatrick, & Rude, 2007) and that self-compassion is negatively associated with rumination (Neff & Vonk, 2009; Raes, 2010). Corroborating this work, Zessin, Dickhäuser, and Garbade (2015) concluded in a recent meta-analysis that self-compassion is strongly linked to well-being ($r = .47$). And, most relevant to the present studies, previous correlational research also found evidence for a positive relationship between self-compassion and sleep quality (Greeson, Juberg, Maytan, James, & Rogers, 2014; Kemper, Mo, & Khayat, 2015; Sirois, Kitner, & Hirsch, 2015). However, to our knowledge, there is no published research on the effects of self-compassion interventions on sleep quality.

The present research

The present studies investigated (1) the effect of different short and low-cost self-compassion interventions on self-reported overall sleep quality (Study 2 and 3 only). They also (2) tested the mediation of effects via reduced rumination. Previous studies have demonstrated the coping function of self-compassion towards negative emotions (Terry & Leary, 2011; Diedrich, Hofmann, Cuijpers, & Berking, 2016), that is, the cognitive reappraisal of stressors and personal problems, leading to a down-regulation of negative mood. Thus, we expect self-compassion to reduce ruminative thinking, as it is characterized as excessive and negatively toned cognitive activity (Harvey, 2002). Focusing on the pre-sleep onset phase, we expect that self-compassion fosters a state of self-soothing and acceptance as an antidote to hyperarousal and repetitive negative thoughts. Due to the suggested decrease in ruminative

thinking, we hypothesize that practicing self-compassion before going to bed will improve overall sleep quality. To investigate whether short self-compassion interventions can improve sleep quality via reduced rumination, Study 1 tested the proposed mediation model by assessing self-compassion, rumination, and sleep quality as trait variables in a correlational design. Study 2 and 3, then, were based on experimental designs. In each of these latter two studies, participants were assigned to either groups with self-compassion instructions or control instructions. Rumination was measured as the mediating variable. The primary dependent measure was participants' overall sleep quality, because an overall score is most likely to provide a reliable and valid estimate about a person's sleep quality (see Jenkins, Stanton, Niemcryk, & Rose, 1988, p. 319) and established assessments use an index of sleep quality comprising different sleep domains (e.g., falling asleep, sleeping through, waking up). These core elements of the study designs were kept constant, but changed in some operational features (e.g., online survey vs. paper–pencil questionnaire) to demonstrate the robustness of the effects and to strengthen the generalization of results. Moreover, across studies, different samples (i.e., students and patients with major depressive disorder) and different designs (between- and within-participants) were used. In all studies, we also assessed additional variables, such as trait self-compassion, stress, and other factors that might affect sleep quality (i.e., substance intake inhibiting or facilitating sleep). These variables were only assessed for exploratory analyses (i.e., moderation of intervention effects or controlling for covariates). However, incorporating these variables in the analyses did not affect results in all three studies, thus we omitted these variables from the method and results section. Notice that the analyses broken down by the different subcomponents of self-compassion were also omitted due to multicollinearity.

Study 1

The first goal of this validation study was to replicate a) the negative correlation between self-compassion and rumination (Neff & Vonk, 2009; Raes, 2010) and b) the negative correlation between rumination and sleep quality (Berset et al., 2011; Thomsen et al., 2003). The second question was to test whether a positive correlation between self-compassion and sleep quality would emerge, and whether this relationship would be mediated via reduced rumination.

Method

Participants

A total of 68 students from the University of Mannheim participated in the study (17 men, 51 women; $M_{\text{age}} = 21.41$, $SD_{\text{age}} = 5.65$).

Design and procedure

Study 1 used a correlational design. Participants completed the study voluntarily and individually in a single laboratory session. First, participants agreed to an informed consent. Next, they reported their level of self-compassion, tendency to ruminate, and sleep quality. At last, participants completed questions about standard demographic information.

Measures

Self-compassion

The trait level of self-compassion was assessed via the short-form Self-Compassion Scale (SCS-SF; Raes, Pommier, Neff, & Van Gucht, 2011). The scale consists of 12 items (e.g., for isolation, “When I’m feeling down, I tend to feel like most other people are probably happier than I am”), with responses ranging from 1 = *never* to 5 = *always*. An overall mean was computed, $M = 3.21$, $SD = 0.62$. The scale had good reliability, Cronbach’s $\alpha = .82$.

Rumination

Rumination was assessed with a shortened version of the Rumination Response Scale by Nolen-Hoeksema and Morrow (1991). While the original scale includes 22 items, we omitted all depression-related items in our non-clinical student sample with only four items remaining. Thus, people read the statement “In general, before going to bed, I do/think about ...”, and then had to respond to a list of four rumination items (“... why I cannot handle things better”, “... my shortcomings/faults/mistakes”, “... why I have problems others do not”, “... why I always react this way”); responses ranged from 1 = *never* to 5 = *always*. On average, people reported values close to the middle of the scale, $M = 2.49$, $SD = 0.95$. The reliability of the scale was good, $\alpha = .82$.

Sleep quality

Sleep quality was measured using the Insomnia Severity Index (ISI; Bastien, Vallières, & Morin, 2001). This index consists of five items (e.g., difficulty falling asleep) and can function as a reliable self-report measure to evaluate perceived sleep difficulties. Response scales ranged from 0 = *not at all* to 4 = *very much*. A sum score was computed, $M = 11.04$, $SD = 5.27$ (with values below 15 reflecting insomnia complaints below clinical threshold). Around 22% of participants in this student sample met criteria for clinical insomnia with moderate severity. Notice that for further analyses, items were recoded with higher values reflecting higher sleep quality. The reliability of this scale was good, $\alpha = .80$.

Results & discussion

Table 1 displays the descriptive statistics, scale reliabilities, and correlations for all variables used in the hypothesized model.

Correlations between self-compassion, rumination, and sleep quality

Replicating previous research, self-compassion was negatively correlated with rumination, $r(65) = -.62$, $p < .001$, and rumination was negatively correlated with sleep quality, $r(65) = -.47$,

Table 1. Means, SDs, Reliabilities and Intercorrelation Coefficients of All Key Variables in Study 1.

Variable	<i>M</i>	<i>SD</i>	95% CI	α	2	3
1. Self-compassion	3.21	0.62	[3.05, 3.35]	.82	.31***	-.62***
2. Sleep quality	3.43	0.74	[3.24, 3.62]	.80		-.47***
3. Rumination	2.47	0.96	[2.24, 2.70]	.82		

Notes: 95% confidence intervals (CI) were obtained by bias-corrected and accelerated bootstrapping ($N = 5000$). Cell size was $N = 65$.

* $p < .05$; ** $p < .01$; *** $p < .001$.

$p < .001$. Importantly, self-compassion was positively correlated with sleep quality, $r(65) = .31, p < .01$. Although this study had a correlative design, the order in which self-compassion and sleep quality were assessed was varied (Order 1: self-compassion/sleep quality, $N = 34$; Order 2: sleep quality/self-compassion, $N = 34$). Thus, students were randomly assigned to one of the order conditions in a factorial between-participants design. The correlations between self-compassion and sleep quality did not differ significantly regarding the order of presentation (Order 1: self-compassion before sleep quality, $r(32) = .34, p = .05$; Order 2: sleep quality before self-compassion, $r(33) = .36, p = .04$), $z = -0.097, p = .46$. Hence, this relationship does not seem to depend on a heightened salience of either variable.

Mediation via rumination

A mediation analysis was run using PROCESS (Hayes, 2013; Model 4), with bootstrap confidence intervals not including zero indicating a significant effect. As expected by our model, self-compassion negatively predicted participants' rumination, $b = -0.96$, 95% BCa CI $[-1.272, -0.659]$. Rumination, in turn, negatively predicted sleep quality, $b = -0.34$, 95% BCa CI $[-0.561, -0.118]$. In sum, there was a significant indirect effect of self-compassion on sleep quality through rumination, $b = .33$, 95% BCa CI $[0.102, 0.817]$.

The results of this study confirmed the proposed mediation model: self-compassion predicted sleep quality and rumination mediated this relationship. However, due to the correlational design, no causal inferences can be drawn. Therefore, Study 2–3 were designed to test whether self-compassion interventions can indeed improve one's sleep quality, especially via reduced rumination.

Study 2

Study 2 tested the hypothesis that participants in two intervention groups – where self-compassion was experimentally induced – will report higher values in sleep quality compared to participants in a control group. This difference between groups should be mediated by a reduced rumination in both self-compassion conditions.

Method

Participants

We recruited 143 students from the University of Mannheim. No participant indicated having participated in a study about self-compassion and sleep quality before. Over the course of the three measurement points, we collected 88 complete datasets from t1 to t3 (with a loss of 33% from t1: $N = 143$ to t2: $N = 96$, and a 9% loss from t2 to t3: $N = 88$; 48 men, 40 women; $M_{\text{age}} = 22.59, SD_{\text{age}} = 3.43$).

Design and procedure

Study 2 was based on a factorial between-participants design, where participants were randomly assigned to one of three different conditions: two self-compassion interventions and one control condition (see details below). The rationale for using two different

self-compassion interventions was to compare potential differences between interventions comprising guided meditation versus writing instructions. All participants were informed that they would take part in a study about sleep quality that should take about 40 min in total, divided into three different sessions. Session 1 was conducted in the lab, whereas Session 2 and 3 were conducted individually at home via online surveys (one just before going to bed and the other after waking up the next day using EFS-Survey). In Session 1, participants completed an informed consent and provided standard demographic information. Next, participants completed the full 26-item version of the Self-Compassion Scale (Neff, 2003), five items about their general sleep quality during last week (e.g., “Did you experience difficulties falling asleep?”), as well as six items about stressors in different life domains during the day (e.g., “Did you experience difficulties regarding your health?”). At last, participants provided their E-Mail address so that they could receive the invitational link to the online parts of the remaining two sessions. Session 2 followed in the evening, that is, at the same day as Session 1. Participants were assigned to either one of two self-compassion conditions or a control condition. Next, all participants had to think about personal problems for three minutes and then received different instructions depending on the condition (listening to a 20 min self-compassionate loving-kindness meditation vs. writing 20 min about personal problems self-compassionately vs. no instruction). Then, all participants had to complete a manipulation check. In Session 3 during the next morning, participants indicated how much they ruminated yesterday before going to bed and how well their overall sleep quality was. Finally, participants were thanked for their participation and invited to enter a lottery with the chance to win one of 10 Amazon coupons (worth 10 Euro each). One week after the study was conducted, participants were debriefed about the purpose of the study.

Measures and materials

Self-compassion

Self-Compassion was assessed in Session 1 using the 26-item version of the Self-Compassion scale (SCS; Neff, 2003), with responses ranging from 1 = *never* to 5 = *always*, $M = 3.67$, $SD = 0.78$, $\alpha = .94$.

Self-compassion intervention

All participants, regardless of condition, had to think for three minutes about a personal problem. This was done to keep instructions parallel and to set a certain baseline for ruminative thinking in the pre-sleep onset phase in this student sample. The exact instructions read as follows:

And now I'd like you to bring to mind some aspect of your personality, such as a mistake you've made, a failure that has been bothering you lately, something that you perhaps have been criticizing yourself for and that has made you feel inadequate in some way. Whatever this trait or action is, try to get in touch with your feelings about it. What does it make you feel like?

Whereas this was the sole instruction for the control group, participants in the two self-compassion conditions had to reframe these problems in a self-compassionate way. In the first intervention group, students were introduced to self-compassion via an online audio file that provided a guided meditation. This 20 min self-compassionate Loving-Kindness-Meditation should generate feelings of good will and kindness – both directed at others

and the self. The transcript of this meditation was retrieved from self-compassion.org, translated to German, and then recorded with a female voice. In the second intervention group, participants were introduced to self-compassion via three writing exercises that comprised the three positive components of self-compassion (i.e., self-kindness, common humanity, and mindfulness): (1) To be kind to themselves, they should imagine what they would say if a good friend of theirs had these personal problems. (2) To practice mindfulness, participants had to try to think objectively about the feelings they just reported and adjust a cursor on a scale to whatever represents their thinking, for instance, ranging from “This feeling does not matter at all for me” to “This feeling is almost overwhelming”. (3) To develop a sense of common humanity, participants were reminded that good things and bad things happen to each of us. They were asked to make themselves aware that they are not the only person reporting those feelings and to adjust the cursor on a scale accordingly, for instance, from “It’s only me who has these problems” to “Everybody else also has problems from time to time” (see Appendix 1). Participants in the control group were provided with material of the modified Loving-Kindness-Meditation or the written instructions about self-compassion at the end of the study.

As a *manipulation check*, all participants had to describe their current emotional state using 13 self-compassionate adjectives directly after the intervention (or after no further instruction in the control condition) in Session 2 (see Appendix 1, e.g., balanced, isolated, kind and loving, connected, ranging from 1 = *absolutely disagree* to 5 = *totally agree*; $M = 3.43$, $SD = 0.62$, $\alpha = .82$).

Rumination

Rumination was assessed in Session 3 (final morning) with a similar, but longer scale compared to Study 1. We used a modified version of the revisited version of the Ruminative Responses Scale (Treyner, Gonzalez, & Nolen-Hoeksema, 2003), because we strived for a broader measure of rumination compared to the (depression-focused) operationalization used in Study 1. It comprised items that reflect a state version of ruminative thinking and that were focused on the night following the intervention. All depression-related items were omitted in our non-clinical sample (thus only items representing reflection and brooding were included). Participants’ responses were assessed in retrospection of last night. Participants had to respond to 10 different statements resembling those previously used in Study 1 (e.g., “Yesterday, before going to bed, I thought about why I cannot handle things better”). They could state whether they agree or disagree (1 = *not at all* to 5 = *very much*, $M = 2.37$, $SD = 0.78$). The internal consistency was good, $\alpha = .82$.

Sleep quality

Sleep quality was assessed at Session 3 (morning) with an index provided by Jenkins et al. (1988) to broaden the scope of methods used. Similar to Study 1, this index consists of four items, which again focus on the most prevalent phases where sleeping disorders occur: falling asleep, sleeping through the night, waking up early, and fatigue in the morning. We used a modified version of this index by adding one more question: “In general, how well did you sleep last night?”. Participants could agree or disagree to the items (1 = *not at all* to 5 = *very much*) and we calculated an overall mean, $M = 3.58$, $SD = 0.99$. The internal consistency of this modified scale was good, $\alpha = .84$.

Results & discussion

Table 2 displays the descriptive statistics, scale reliabilities, and correlations for all variables used in the hypothesized model. There were no differences regarding participants' reports of baseline self-compassion, sleep quality, and perceived stress, $F_s < 1$.

Manipulation check

Overall, participants differed across conditions regarding their self-compassion state values, $F(2,93) = 3.85$, $p = .02$, partial $\eta^2 = .08$. As expected, participants in both self-compassion groups reported significantly higher agreement with adjectives reflecting a self-compassionate state (meditation: $M = 3.47$, $SD = 0.48$; written instructions: $M = 3.49$, $SD = 0.66$) compared to participants in the control condition ($M = 3.12$, $SD = 0.66$) in a planned contrast, $t(93) = 2.77$, $p < .01$, $d = 0.59$. There was no significant difference between the self-compassion groups, $t < 1$. However, we cannot fully answer whether the manipulation check did result in high self-compassion interpreted as an absolute value, but we checked whether the means of the three groups significantly differed from the scale midpoint (3). In fact, both intervention groups differed significantly from the scale midpoint, $t(55) = 6.38$, $p < .001$, but not the control condition, $t(18) = 1.28$, $p = .22$.

Effect of self-compassion intervention on sleep quality

Overall, the difference between the three groups regarding sleep quality ($M_{SC1} = 3.93$, $SD_{SC1} = 0.97$; $M_{SC2} = 4.04$, $SD_{SC2} = 1.03$; $M_{CG} = 3.52$, $SD_{CG} = 1.02$) failed to reach a conventional level of significance, $F(1,72) = 1.57$, $p > .05$, partial $\eta^2 = .04$. However, in line with our hypothesis, a planned contrast (specified orthogonally, $SC1 = 1$, $SC2 = 1$, $CG = -2$) revealed that participants in both SC-intervention conditions reported higher sleep quality compared to the control condition, $t(72) = 1.72$, $p < .05$, $d = 0.46$. There was no difference between both SC-intervention conditions regarding sleep quality, $|t| < 1$.

Mediating role of rumination

As in Study 1, we ran a mediation analysis with the dependent variable sleep quality using PROCESS (Hayes, 2013; Model 4). As there was no difference between both SC-intervention conditions regarding the manipulation check and effect on sleep quality, both groups were combined. As expected by our model, when self-compassion was induced, participants' rumination decreased ($b = -.38$, $SE = .20$). Rumination, in turn, negatively predicted sleep quality

Table 2. Means, SDs, reliabilities and intercorrelation coefficients of all key variables in study 2.

Variable	<i>M</i>	<i>SD</i>	95% CI	α	2	3	4
1. Self-compassion	3.67	0.78	[3.49, 3.86]	.94	.35***	-.31**	.25*
2. Sleep quality	3.58	0.99	[3.44, 3.89]	.84		-.59**	.13*
3. Rumination (state)	2.37	0.78	[2.14, 2.55]	.82			-.40**
4. Manipulation check	3.43	0.62	[3.27, 3.59]	.82			

Notes: 95% confidence intervals (CI) were obtained by bias-corrected and accelerated bootstrapping ($N = 5000$). Cell size was $N = 88$.

* $p < .05$; ** $p < .01$; *** $p < .001$.

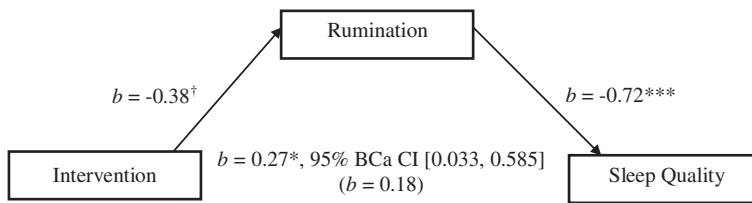


Figure 1. Mediation Model via Rumination in Study 2. 95% confidence intervals (CI) were obtained by bias-corrected and accelerated bootstrapping ($N = 5000$).

[†] $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

($b = -.72$, $SE = .13$). In sum, this resulted in a significant indirect effect of self-compassion on general sleep quality through rumination, $b = 0.27$, 95% BCa CI [0.033, 0.585] (see Figure 1).

To conclude, the present findings support the hypothesis that a single (successful) intervention of self-compassion will lead to higher sleep quality. When students were confronted with personal shortcomings that otherwise lead to poor sleep quality, those who practiced self-compassion reported higher sleep quality. With regard to mediation, less rumination accounted for the higher sleep quality among participants in both self-compassion groups.

However, in the present study, the experimental procedure included a salience of problems induction in all groups. It is therefore unclear whether the effects will still hold when people are not made aware of potential problems before going to sleep. Also, we cannot rule out the possibility that a positive effect of self-compassion on sleep quality might stem from the saliency or change aspect of the manipulation – note that no person in this study was familiar with the concept of self-compassion. Also, the duration of a self-compassion effect remains unclear.

Study 3

The goal of Study 3 was to address some of the limitations addressed in the discussion of Study 2. We therefore (1) measured sleep problems without experimentally inducing the salience of problems beforehand and (2) we tested self-compassion effects in a one week repeated interventions program and therefore tried to rule out mere intervention novelty or saliency effects. In addition, this study aimed to replicate previous findings in a clinical sample (patients with major depressive disorder). Previous research had shown that people suffering from depression are particularly vulnerable to ruminative thinking (Nolen-Hoeksema, 2000) as well as sleep problems (Jackson, Cavanagh, & Scott, 2003). Thus, this sample allowed us to design a control condition without any instruction that explicitly elicited ruminative thoughts. Interventions were also repeated daily across one week. We hypothesized that patients' repeated exposure to self-compassion practice over the course of one week should still improve their sleep quality and reduce rumination.

Method

Participants

We recruited 30 (15 men, 15 women) patients with major depressive disorder from a day hospital ($M_{\text{age}} = 42.45$, $SD_{\text{age}} = 11.54$). Concerning the comparability between intervention and control group, patients in both groups did not differ with regard to trait self-compassion:

$t(28) = -1.75, p > .05$, age: $t(28) = 1.83, p > .05$, sex: $\chi^2(1, N = 30) = 0.13, p > .05$, daily medication (i.e., intake of sleep pills): $\chi^2(1, N = 30) = 1.43, p > .05$, or pretest sleep quality and pretest pre-sleep arousal, $|ts| < 1$].

Design and procedure

We ran a 2 (intervention: self-compassion vs. control group) by 2 (time of measurement: pretest vs. posttest) mixed factorial design. First, all patients were told by a research assistant that they would take part in a one-week study about sleep quality consisting of two parts (a pretest and a posttest) – patients in the intervention condition were also informed to complete a daily 5 min self-compassion break before going to bed. Then, they signed an informed consent and provided standard demographic information. Next, the following variables were assessed twice – once in the pretest and once in the posttest – in the shortest form possible, to spare patients' energy and time: trait self-compassion, last week's pre-sleep arousal, and last week's sleep quality. The pretest took place on Sundays and the posttest on Fridays in both conditions. Note that patients were not randomly assigned to both conditions. Instead, 15 patients participated for one week in the self-compassion condition. They were instructed to listen to the 20 min loving-kindness meditation used in Study 2 in the first evening (on Monday) and to a daily self-compassion break (ca. 5 min) in all following evenings via mp3 audio files on a CD that participants received on Monday. All 15 patients in the self-compassion condition reported to have participated at least three times this week in the intervention. Two weeks later, 15 patients without contact to the former 15 patients participated one week in a control group without interventions. This was done to avoid that patients who attended the same group therapy sessions exchange intervention relevant information.

Material

Self-compassion intervention

Patients in the self-compassion group were instructed to listen for 20 min to the same guided loving-kindness meditation as in Study 2 during the first evening (vs. no task in the control group). We chose this intervention since there was no difference to the written instructions in Study 2. Also, patients with major depressive disorder might experience (even) more difficulties adhering to an intervention that requires them to write down feelings about personal problems for 20 min. Listening to a guided meditation or an even shorter self-compassion break might be more feasible for this particular sample. During the next three evenings, before going to bed, patients in the self-compassion group (but not those in the control group) listened to a shorter version (5 min self-compassion break). The former intervention was successful in Study 2, thus we omitted a manipulation check due to time and space constraints in this clinical sample.

Trait self-compassion

As in Study 1, we assessed self-compassion using the short version with 12 items (SCS-SF; Raes et al., 2011), responses ranging from 1 = *never* to 5 = *always*. An overall mean was computed, $M_{\text{pretest}} = 2.94, SD_{\text{pretest}} = 0.73; M_{\text{posttest}} = 2.96, SD_{\text{posttest}} = 0.84$. The scale had good reliability, Cronbach's $\alpha = .88$.

Rumination

We assessed rumination this time using the Pre-Sleep Arousal Scale (PSAS; Nicassio, Mendlowitz, Fussell, & Petras, 1985). This measure not only allowed for the assessment of seven cognitive components of arousal resembling previous items of rumination (e.g., can't shut off your thoughts), but also included eight somatic components (e.g., nervous feeling in stomach). As another advantage, this scale is particularly sensitive to changes over time (Gieselmann, de Jong-Meyer, & Pietrowsky, 2012), which is especially called for in a repeated measures design. Responses were given on a range from 1 = *not at all* to 5 = *very much* and accumulated over the 15 items. An overall mean was computed, $M_{\text{pretest}} = 35.33$, $SD_{\text{pretest}} = 12.60$; $M_{\text{posttest}} = 33.00$, $SD_{\text{posttest}} = 13.33$. The scale's reliability was high, $\alpha = .92$.

Sleep quality

As in Study 1, we used an index closely oriented to the Insomnia Severity Index (ISI; Bastien et al., 2001), adding one more item reflecting morning fatigue, a typical criterion of depression ("Did you feel fatigue after waking up?"), with responses ranging from 1 = *not at all* to 5 = *very much*. Again, items were recoded with higher values reflecting higher sleep quality. A mean score for the six items was computed, $M_{\text{pretest}} = 3.00$, $SD_{\text{pretest}} = 1.05$; $M_{\text{posttest}} = 3.17$, $SD_{\text{posttest}} = 1.08$. The reliability of this scale was good, $\alpha = .88$.

Results & discussion

Table 3 displays the descriptive statistics, scale reliabilities, and correlations for all variables used in the hypothesized model.

Change in sleep quality between pretest and posttest

Sleep quality data were analyzed in a mixed 2 (type of intervention: self-compassion break vs. control group) by 2 (time of measurement: pretest vs. posttest) ANOVA, the second factor being a within-participants factor. As expected, a significant interaction effect between intervention and time of measurement emerged, $F(1,28) = 5.23$, $p < .05$, partial $\eta^2 = .17$ (see Figure 2). Planned contrasts revealed that only patients in the self-compassion group reported significantly increased sleep quality between pretest and posttest, $t(14) = -3.94$, $p = .001$, $d = 0.33$, but not those in the control condition, $t < 1$. No further significant effects were found (type of intervention, $F < 1$, time of measurement, $F(1,28) = 3.50$, $p = .07$).

Table 3. Means, SDs, reliabilities and intercorrelation coefficients of all key variables in study 3.

Variable	Pretest		Posttest		α	2	3
	M	SD	M	SD			
1. Self-compassion	2.94	0.73	2.96	0.84	.88	.45***	-.49***
2. Sleep quality	3.00	1.05	3.17	1.08	.88		-.86***
3. Pre-sleep arousal	35.33	12.60	33.00	13.33	.92		

Notes: Cell size was $N = 30$. Only pretest correlation coefficients were included.

* $p < .05$; ** $p < .01$; *** $p < .001$.

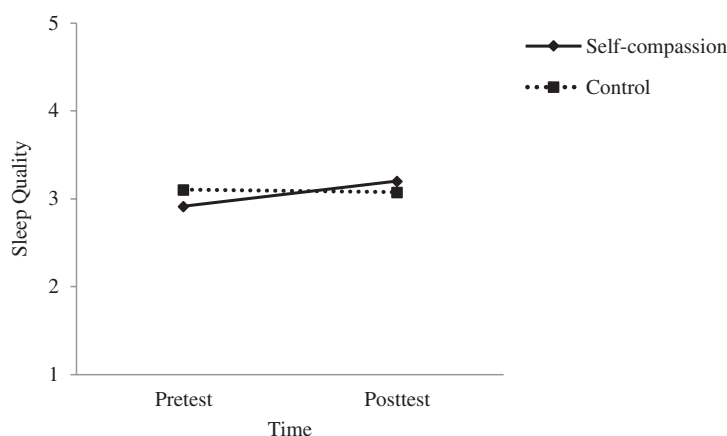


Figure 2. Intervention effect of self-compassion on sleep quality in Study 3.

Change in rumination (pre-sleep arousal) between pretest and posttest

The same two-factorial ANOVA was run to analyze pre-sleep arousal scores. Again, a significant interaction effect between intervention and time of measurement emerged with regard to pre-sleep arousal, $F(1,28) = 4.21$, $p = .05$, partial $\eta^2 = .13$ (but no significant main effects of type of intervention and time of measurement, $F_s < 1$). As hypothesized, planned contrasts revealed that only patients in the self-compassion group reported significantly decreased pre-sleep arousal between pretest and posttest, $t(14) = 2.41$, $p = .03$, $d = -0.36$, but not those in the control condition, $t < 1$.

Mediating role of pre-sleep arousal

We ran a mediation analysis using PROCESS (Hayes, 2013; Model 4), controlling for the respective pretest scores of sleep quality and pretest pre-sleep arousal. As expected by our model, when self-compassion was induced, participants' pre-sleep arousal decreased ($b = -.33$, $SE = .16$). However, although the direction was as expected, pre-sleep arousal was no significant predictor of sleep quality ($b = -.15$, $SE = .16$). In sum, there was no significant indirect effect of self-compassion on sleep quality through pre-sleep arousal, as the confidence interval includes zero, $b = 0.05$, 95% BCa CI $[-0.016, 0.221]$. Whereas the total effect of the self-compassion-intervention on sleep quality was significant, $b = .32$, 95% BCa CI $[0.045, 0.601]$, the direct effect of inducing self-compassion on sleep quality was reduced when rumination was controlled for, as the direct effect was not significant, $b = .27$, 95% BCa CI $[-0.027, 0.571]$. Thus, while the indirect effect was not significant, the direction of the effect was the same as in Studies 1 and 2.

Study 3 replicated the results of Study 2: A short self-compassion intervention enhanced sleep quality and reduced rumination. In addition, the data were able to rule out the alternative explanation that previously found differences with regard to sleep quality stem from instructions that might have elicited rumination in the control condition. Furthermore, the effect of self-compassion on sleep quality still holds after repeated exposure, thus a daily 5 min self-compassion break after a one-time 20 min guided loving-kindness meditation

seems to suffice to improve sleep quality – even for patients with major depressive disorder. However, pre-sleep arousal was not a significant mediator of the SC-intervention effect on sleep quality.

A caveat of the present study is that we could not randomly assign patients to conditions in this study. However, patients did not differ between groups with regard to trait self-compassion and sociodemographic or sleep-related variables (e.g., sleep medication). Also, the sample size ($N = 30$) was rather small, resulting in a low statistical power, for example, for testing mediation effects.

General discussion

The first aim of this research was to test whether short self-compassion interventions can improve one's overall sleep quality. Across three studies, we found support for this hypothesis: In a correlational design (Study 1), trait self-compassion positively predicted sleep quality. Experimental evidence in Studies 2 and 3 further confirmed the causal role of self-compassion interventions: In Study 2, students who were randomly assigned to practice self-compassion before going to bed reported higher sleep quality the next morning compared to students in a control condition. In Study 3, we extended the practice of self-compassion over the course of one week. Results replicated those of Study 2 with a clinical sample: Patients with major depressive disorder reported a significant increase of sleep quality between pretest and posttest when practicing a self-compassion break compared to patients in a control group. Thus, the data corroborated the predicted interaction effect between condition and time of measurement. However, we would also have expected a significant difference between both conditions in the posttest, which could or could not result in a significant main effect for condition. One possible explanation for the lack of a significant difference in the posttest might be the small sample size of 15 patients per group and the slightly (though not significant) lower starting level of sleep quality in the intervention group in the pretest.

Taken together, the present results replicated across different samples, both clinical and non-clinical, with different measures of self-compassion, rumination, and sleep quality, as well as independent of whether studies had been conducted online or via paper-pencil. These findings agree with previous findings that have shown a correlation between self-compassion and sleep quality (Greeson et al., 2014; Kemper et al., 2015; Sirois et al., 2015). Furthermore, they add new knowledge by showing a causal relationship between self-compassion and sleep quality. However, the reliable effects of self-compassion interventions in the present studies are undoubtedly small, with estimated effect sizes ranging from d of .07 to d of .17. Still, we would argue that there are both theoretical and practical reasons why these intervention effects are important. On a theoretical level, the present studies demonstrated that even short, low-cost forms of interventions (e.g., a 5 min self-compassion break) suffice to increase self-reported sleep quality. On the practical level, our work provides a starting point for the development of self-compassion programs directly targeting sleep problems to meet the high prevalence of poor sleep quality. At the same time these low effect sizes leave room for improvement that we will discuss below in the limitation section.

The second aim of this work was to analyze rumination as one theoretically plausible variable that can be expected to mediate the effects of self-compassion on sleep quality.

Again, across all three studies we found a significant correlation between (measured or induced) self-compassion and rumination. These findings support previous research (Neff & Vonk, 2009; Raes, 2010) that reported on such correlations. Furthermore, in two of the three studies, we found evidence that rumination mediates the relationship between self-compassion and sleep quality. However, a significant mediation was not found in Study 3 (although the direction was the same as in the other studies: the effect of the self-compassion intervention was weaker when rumination was controlled for). This latter result may be due to the small clinical sample size of 30 patients. In addition, self-compassion might improve sleep quality via other pathways than rumination. For example, previous research by Sirois et al. (2015) found a positive correlation between self-compassion and adaptive sleep hygiene behaviors (e.g., going to bed when the body signals fatigue). The beneficial effects of self-compassion on close relationships (e.g., Baker & McNulty, 2011) might also lead to an improved sleep quality, because conflict in close relationships negatively affects sleep quality, and vice versa, poor sleep quality can result in relationship conflicts (for an overview, see Gordon, Mendes, & Prather, 2017). Therefore, future work is needed that may substantiate these preliminary findings and may also take other possible mediators into account.

Limitations and open questions

The present research focussed only on overall measures of both self-compassion and sleep quality. Despite the reliability and validity of overall scores of self-compassion and sleep quality (see for instance Neff, 2016; Jenkins et al., 1988, p. 319), using only brief scales somewhat limits a full comprehension of the interplay between both constructs. Future research should investigate the contribution of the different subcomponents of self-compassion and different aspects of sleep quality.

Another notable limitation of our studies is that all of them rely on self-reports. For instance, regardless of the questionnaire used, participants had to subjectively estimate their sleep quality, often in retrospect within 1 h of waking up. Although being practical and cost-effective – especially when repeated measures are needed – these judgments might be prone to bias and may demand particularly careful interpretation. From a theoretical point of view, we would argue that participants' expectation and anticipation about sleeping well due to less ruminative thinking plays an influential part in improving sleep quality. Placebo effects in this sense may even lead to substantial effects in the long run. Nevertheless, future studies should (1) incorporate placebo control groups, and (2) include objective data to allow for a comparison between self-reported and objectively assessed sleep quality.

Although Study 3 opted for an extended time frame with repeated short pre-sleep interventions (one week), an open question to future research remains whether increasing the duration as well as intensifying the content of the intervention will result in larger effect sizes with regard to sleep quality. We would hypothesize that practicing self-compassion to a higher degree will help people also to apply these strategies in more taxing circumstances (high stress load, accumulation of life events). Especially under these conditions, learned self-compassion might prove to be more efficient than other short-term interventions that merely distract people or help them to relax when ruminating before going to sleep.

Finally, while randomly assigning participants to experimental conditions has obvious benefits for causal interpretation, it would be worthwhile to investigate person-intervention fit with regard to the manipulation of self-compassion (and other) interventions (for instance, allowing participants to self-select themselves to interventions). There are several arguments why self-selection processes may enhance the effects of (self-compassion) interventions, such as enhanced efficiency expectations, more compliance and more efficient intervention acquirement. Designs that include comparisons between self-selection and random assignment conditions can offer interesting future insights in this vein, and not just regarding the dependent variable sleep quality (Bless & Burger, 2016).

Conclusion

In sum, the present studies confirm short self-compassion intervention effects on sleep quality reliably across different samples and conceptual replications. They also show preliminary results that rumination may be one key factor that mediates these effects. Future research should focus on optimizing interventions in order to enhance effect sizes and by also focussing on the sustainability of effects over time and other possible mediators besides rumination.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix 1.

Written instructions to induce self-compassion

And now I'd like you to bring to mind some aspect of your personality, perhaps some mistake you've made, a failure that has been bothering you lately. Something that you perhaps have been criticizing yourself for and that has made you feel inadequate in some way. Whatever this trait or action is, try to get in touch with your feelings about it. What does it make you feel? How have you felt when you've thought about this inadequacy?

Please write down your thoughts and emotions in short sentences:

Self-Kindness

You just thought about something that probably made you feel inadequate and vulnerable. To cope with this feeling, it can help if you do not engage in self-criticism about it. Instead, you can try to give yourself the same kindness, support and acceptance you would give to a good friend, who is feeling bad about themselves.

Please write down the kind words you would use if you had to comfort a friend that just told you about his personal shortcomings:

Mindfulness

Now remember that the situation you just imagined lies in the past and that you cannot change the situation itself. Instead, you could take a step aside to try to think objectively about it and your associated feelings.

Please try to locate your thoughts on the following scale by adjusting the cursor to whatever represents your thinking/feeling:

Nothing has happened to me

This means the world's end to me



This was the best thing that
ever happened to me

This was the worst thing that
ever happened to me



This feeling does not matter
at all to me

I feel completely overwhelmed
by this feeling



Since it happened, nothing feels

Although this happened,

everything is fine with me

Now remember that everyone is in the same boat, everyone feels inadequate in some way, everyone makes mistakes, everyone fails, this is a human condition, this is normal, this is something we all share.

Something like this only happens to me

Something like this happens to everybody

Something like this only happens to you

Something like this also happened to me

A person I look up to
does not make mistakes

Even a person I look up to does make mistakes from time to time

Manipulation Check

Concluding your practice, you can now find adjectives describing your current emotional state. Please rate how much you agree with these adjectives (from *strongly disagree* to *strongly agree*) regarding the statement “Right now, I feel...”:

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
balanced	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
attentive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mindful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
at peace with myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
anxious	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
connected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
safe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
human with my failures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
isolated from others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
understanding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
warm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
benevolent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
loving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>