



Research Article

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Reduction of Chronic Stress and Trait Anxiety by Inquiry of Cognitive Appraisals with the Inquiry-Based Stress Reduction (IBSR) Method

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Abstract: Background: Chronic stress and anxiety can impair individuals' health. Appraisal theories assume that stress and anxiety are experienced if individuals appraise a situation as threatening for their well-being. Thus, the modification of cognitive appraisals can be expected to reduce stress and anxiety. A potentially effective method to modify individuals' appraisals is inquiry-based stress reduction (IBSR; Mitchell & Mitchell, 2003). Aims: The present study assesses the effects of IBSR on chronic stress and trait anxiety in comparison to a matched control group. Method: We used a quasi-experimental repeated-measurement design and a non-clinical sample of $N = 199$. Participants' chronic stress and anxiety levels were assessed before and three months after a nine-day IBSR training. To account for the consequences of missing randomization, propensity score matching was applied. Results: As expected, data analyses revealed that in the IBSR training group chronic stress and trait anxiety statistically significantly decreased over the course of three months whereas in the matched control group, the levels of chronic stress and trait anxiety did not statistically significantly change. Conclusions: IBSR seems to effectively reduce trait anxiety and chronic stress in a non-clinical sample.

Keywords: health psychology, inquiry-based stress reduction, cognitive appraisals

Introduction

Acute stress responses and anxiety are functional and helpful when one has to deal fast with potentially harmful events (Anisman, 2015). In acute stress situations, sympathetic stress responses can facilitate cognitive performance, promote active coping, and protect against damaging effects of catabolic stress hormones. However, the experience of *chronic* stress (i.e., distress) and anxiety may lead to undesirable health consequences (McEwen, 2008). They can result in behavior changes (e.g., poor sleep quality, the higher consumption of alcohol and nicotine) and have been linked to mental and physical illnesses (e.g., depression, heart attacks, and strokes; Schneiderman, Ironson, & Siegel, 2005). Thus, the reduction of chronic stress and anxiety is an effort worth taking in order to maintain physical and mental health. The aim of the present paper is to investigate the effectiveness of an inquiry-based stress reduction intervention (IBSR; Mitchell & Mitchell, 2003) in reducing chronic stress and anxiety.

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Theoretical background

Psychological stress is experienced when individuals evaluate a situation as challenging for their personal well-being and when the situational demands are subjectively evaluated as taxing or exceeding their resources (Lazarus & Folkman, 1984). Stress is hence caused by a person–situation interaction: A person responds to a psychically relevant situation with stress only if that situation gives rise to certain ‘cognitive appraisals’. Cognitive appraisals are evaluations of environmental features that allow individuals to make very fast distinctions between benign and dangerous situations (Arnold, 1960; Scherer, 1984; Moors, Ellsworth, Scherer, & Frijda, 2013). More specifically, transactional theory (Lazarus, 1999; Lazarus & Folkman, 1984) assumes that stress is experienced as a consequence of a person’s primary appraisal – the situation is potentially challenging or threatening – and secondary appraisal – the person is uncertain if he or she will be able to cope with the threat. For example, starting a new job, a person will experience the situation as stressful only if he or she considers the new job as challenging (primary appraisal) and if he or she is unsure whether the job assignments are manageable (secondary appraisal). Stress can be accompanied by anxiety. According to the control-value theory (Pekrun, 2006), the unpleasant emotional experience of anxiety is caused by specific appraisals: Individuals are assumed to get anxious if they evaluate a stressful situation and its outcome as personally important (value appraisals) but feel that the situation and its outcome are not (fully) under their own influence (control appraisals). More specifically, anxiety will arise in stressful situations that are subjectively perceived not only as challenging but also dangerous and not fully manageable (Laux, Glanzmann, Schaffner, & Spielberger, 1981). Accordingly, the modification of cognitive appraisals is assumed to be helpful for individuals experiencing stress and anxiety (Pekrun, 2006).

As a consequence, the modification of cognitive appraisals and negative thinking is the focus of psychotherapeutic approaches when psychopathological symptoms like stress and anxiety are addressed. For example, in the rational emotive behavioral therapy (Ellis, 2002), several cognitive, emotive, and behavioral techniques are designed to help individuals to modify their dysfunctional and irrational beliefs, such as a direct cognitive debate and logical persuasion. Another specific and potentially effective way to modify cognitive appraisals is IBSR (Mitchell & Mitchell, 2003): In the first step of IBSR, a standardized procedure is applied to identify stressful cognitions. Supported by a standardized worksheet (see Appendix 1), participants focus on a specific stressful situation and in a systematic way write down their beliefs (i.e., appraisals) regarding the situation for future investigation (van Rhijn, Mitnik, & Lev-ari, 2015). In the second step of IBSR, each stressful belief that has been identified (e.g., “My spouse does not listen to me.”) is explored by means of a standardized set of questions (see Appendix 1: The four questions). First, the validity of the stressful cognition is questioned. Then, participants explore and experience the effect, cause, benefit, and functionality of their stressful cognitions. Next, participants are enabled to perceive and experience reality without the distortions caused by the stressful cognition. In the last step of IBSR, participants are asked to turn their beliefs around to the opposite. For example, the stressful belief “My spouse does not listen to me.” could be turned around to “My spouse *does* listen to me.” or “I do not listen to *my spouse*.” For each turnaround, participants are asked to find genuine proof of how each turnaround could be true for them with respect to the initial stressful situation. This way, participants are enabled to explore if the opposite of their stressful beliefs could also be valid. This should allow participants to overcome their confirmation bias (i.e., the tendency to seek or interpret evidence merely in ways that support existing beliefs; Nickerson, 1998) by finding new evidence contradicting the initial stressful belief. Hence, IBSR allows for a cognitive reappraisal and, as a consequence, should lead to the change of negative feelings (e.g., anxiety) stemming from the negative appraisals of the situation. As this reappraisal process is high in personal relevance, comprehensive, and systematic, according to dual process models of information processing (e.g., the heuristic systematic model; Chen & Chaiken, 1999), the reappraisal and the associated emotional change achieved by IBSR should be lasting, especially because the new arguments leading to the reappraisal are self-created and, thus, even more convincing and belief-changing (Briñol, McChaslin, & Petty, 2012).

IBSR differs from cognitive interventions such as rational emotive behavioral therapy (Ellis, 2002) in several ways: First and foremost, IBSR does not employ a cognitive debate on participants’ dysfunctional

and irrational beliefs through logical persuasion by a therapist. IBSR is rather likely to support *experiential* self-exploration. Thus, the exploration of stressful beliefs is not restricted to a logical analysis per se but includes an integration of all kinds of knowing (i.e., observation, kinesthetic and sensory experiences, behavioral learning and intuition; van Rhijn et al., 2015). Second, due to its standardized procedure, the process of modifying irrational and negative thinking is guided by a simple and clearly defined set of questions, allowing for a structured way of *self-inquiry*. Meanwhile, there are several studies providing evidence for the effectiveness of the IBSR method regarding different outcome variables. In particular, there is first empirical evidence that IBSR is potent to reduce anxiety and stress. Lev-ari, Zilcha-Mano, Rivo, Geva, and Ron (2013) evaluated the effects of IBSR in breast cancer survivors ($N = 29$). The diagnosis and treatment of cancer are typical highly stressful events associated with the experience of anxiety. Using a single-group design, Lev-ari et al. (2013) found participants' sleep quality, levels of fatigue as well as physical, social, familial, emotional, and functional well-being to be improved right after the IBSR intervention. However, the study did not include a control group or follow-up measure, which severely limits the interpretation of the results. For example, the findings might also be explained by spontaneous remission effects or by the effects of the medical cancer treatment. Other single-group studies (Leufke, Zilcha-Mano, Feld, & Lev-ari, 2013; Smernoff, Mitnik, Kolodner, & Lev-ari, 2015) measured psychopathological symptoms, such as depression and anxiety, in 47 (197) participants of a nine-day IBSR intervention. Results revealed that these symptoms declined and that these effects remained at least for three (six) months. Yet again, in both studies a control group was missing. The single-group design of all the studies mentioned above makes it difficult to interpret the results – the effects might be due to other factors than the IBSR intervention. The positive outcomes could, for example, be a simple effect of repeated measurement: The first measurement could lead to the increased attention to the variables under consideration and this increased attention – and not the treatment – could result in the lower values of these variables at a later measurement. In addition, all the investigated samples are probably characterized by relatively high baseline values (as participants enter an intervention due to their rather high values of stress). However, in the repeated measurement of values, there is a tendency to the mean. Therefore, it is likely that post or follow-up measures are lower if baseline measures were high independently of potential effects of the intervention.

The present study

The present study investigated the effects of IBSR on chronic stress and trait anxiety in a non-clinical sample. In particular, the present study focusses on replicating the findings of previous studies, which show that IBSR has the potential to reduce stress and trait anxiety (Lev-ari et al., 2013; Leufke et al., 2013; Smernoff et al., 2015), by applying a more solid methodology than those existing studies. In order to overcome the shortcomings of the previous study designs, a two-group quasi-experimental design (intervention vs. control group) was applied. While the intervention group was recruited from a pool of IBSR training participants, the participants of the control group did not receive any treatment. For all participants, the levels of chronic stress and trait anxiety were assessed before and three months after the IBSR intervention. We expected the levels of chronic stress and trait anxiety to decrease over time for participants receiving the IBSR intervention in comparison to the participants in the control group because IBSR aims at the modification of stressful appraisals – the assumed causes of stress and anxiety (Lazarus, 1999; Lazarus & Folkman, 1984; Pekrun, 2006).

Method

Participants

We calculated the sample size to obtain the sufficient power (80% to detect an existing effect; Cohen, 1988) using G*Power 3.1.9.3 (Faul, Erdfelder, Buchner, & Lang 2009). Assuming an effect of the predicted two-way interaction on chronic stress and anxiety of $f = .25$, the power analysis revealed a total sample size of N

= 98. The intervention group ($n = 53$) consisted of individuals who had self-enrolled in a nine-day IBSR training. Participants from the pool of training attendees were personally approached by the research team and recruited after the registration for the training. Due to the fact that the IBSR training was organized by the founder of the IBSR method, our research team was not able to form a waiting-list control group from prospective future IBSR participants. Instead, matching control participants were recruited independently and ostensibly for a research study on well-being via psychological online forums and an e-mail distribution list of an alternative health-care center. To account for the consequences of the missing randomization, we decided to administer a propensity score matching procedure. As this method is very “data hungry” and requires a large pool of prospective control group participants (Heinrich, Maffioli, & Vásques, 2010), we recruited about three times as many control participants ($n = 146$) than IBSR participants. The control group participants who completed all measures were reimbursed with a free 60-minute-coaching after receiving a full debriefing. Participants of both groups (80.4% women; age $M = 42.61$ years, $SD = 12.02$, range = 18–72 years) voluntarily agreed to participate prior to enrollment in the research study. The baseline sample characteristics are presented in Table 1.

Data collection

Participants filled in questionnaires before (time 1) and approximately three months after the IBSR training (time 2).¹ While the participants of the IBSR group filled in questionnaires using a paper-and-pencil instrument at time 1, the participants of the control group answered the same questionnaires online. At time 2, all participants answered the questionnaires online. The online versions of the questionnaires matched the paper-and-pencil versions and were used to ensure higher return rates. At the end of the study, participants provided demographic data (age, gender, German as the first language, educational level). The times of measurements were synchronized for all participants ensuring that the control group participants were tested parallel to the IBSR participants.

Measures

Chronic stress

Chronic stress was measured using the German version of the Trierer Inventory of Chronic Stress (TICS; Schulz, Schlotz, & Becker, 2004). As a standardized questionnaire, the TICS allows for the assessment of different aspects of chronic stress (e.g., work pressure: “I don’t have enough time to do day-to-day tasks.”). It also provides a screening scale of 12 items assessing the general level of perceived chronic stress. When answering the TICS items, the participants were asked how often they had experienced particular stressful situations in the last three months. Participants’ ratings were made by responding to 5-point-scales ranging from 0 (*never*) to 4 (*very often*). For each participant and each data collection respectively, a stress summed score (range = 0–48) was calculated based on 12 screening items, with high summed scores indicating a high level of chronic stress. The TICS screening scale showed excellent internal consistencies (Cronbach’s α for time 1 = .90, time 2 = .91).

Trait anxiety

Trait anxiety was measured with the use of the German version of the State-Trait Anxiety Inventory Form X2 (STAI-X2; Laux et al., 1981). The participants were instructed to indicate how they *generally* felt with regard to 20 statements (e.g., “I feel that difficulties are piling up so that I cannot overcome them.”) on a 4-point-

¹ Note that trait anxiety, and not chronic stress, was also assessed right after the IBSR training. A separate data analysis showed that the levels of trait anxiety were already statistically significantly reduced right after the training in IBSR participants, but not for the control group participants. The results of this analysis can be made available on request by the first author.

Table 1. Sample Descriptives and the Pattern of Missing Data

	<i>N</i>	<i>M</i>	<i>SD</i>	%	Missing (<i>n</i>)	Missing (%)
Age (Years)	199	42.61	12.02		0	0
Women	199			78.3 %	0	0
German as the first language	157			93.9 %	42	21.1
Years of Speaking German for Non-natives	157	2.59	9.61		42	21.1
Educational Level						
Doctorate Degree	157			4.0 %	42	21.1
University Degree	157			41.2 %	42	21.1
Polytechnic Degree	157			13.6 %	42	21.1
Technical College Degree	157			22.6 %	42	21.1
Master School Degree	157			27.1 %	42	21.1
Vocational School Degree	157			35.7 %	42	21.1
Other Vocational Degree	157			12.6 %	42	21.1
No Vocational Training	157			2.5 %	42	21.1
Time 1						
STAI-X2	199	39.22	9.94		0	0
TICS: Work Pressure	199	13.66	7.20		0	0
TICS: Social Pressure	199	10.94	5.26		0	0
TICS: Achievement Pressure	197	16.37	6.34		2	1
TICS: Work Dissatisfaction	199	11.87	6.80		0	0
TICS: Work Overexertion	198	6.49	4.19		1	0.5
TICS: Lack of Social Acknowledgement	199	6.30	3.66		0	0
TICS: Social Tension	199	7.40	4.57		0	0
TICS: Social Isolation	199	8.20	5.69		0	0
TICS: Chronic Worrying	199	6.42	3.84		0	0
TICS: Screening Scale	199	17.69	8.89		0	0
Time 2						
STAI-X2	160	38.26	9.42		39	19.6
TICS: Work Pressure	157	13.21	7.50		42	21.1
TICS: Social Pressure	157	9.85	5.17		42	21.1
TICS: Achievement Pressure	157	16.06	7.28		42	21.1
TICS: Work Dissatisfaction	157	11.29	7.01		42	21.1
TICS: Work Overexertion	157	6.24	4.40		42	21.1
TICS: Lack of Social Acknowledgement	157	5.76	3.88		42	21.1
TICS: Social Tension	157	6.58	4.72		42	21.1
TICS: Social Isolation	157	7.93	5.71		42	21.1
TICS: Chronic Worrying	157	5.94	3.79		42	21.1
TICS: Screening Scale	157	16.92	9.33		42	21.1

Note: Regarding participants' educational level, multiple selections were possible. The educational level was assessed during follow-up measurements ($N=157$).

scale ranging from 1 (*almost never*) to 4 (*almost always*). After recoding reversed items, trait anxiety summed scores (range = 20–80) were calculated, with high summed scores indicating high levels of trait anxiety. The STAI-X2 scale showed excellent internal consistencies (Cronbach's α for time 1 = .93, time 2 = .92).

Attrition

For participants' flow and attrition see Figure 1. Fifty-three participants of the intervention group completed the initial measures. Out of these 53 IBSR participants, 42 participants also filled out the follow-up questionnaires, leading to a data dropout of 20.8%. For the control group, 146 people completed the initial measures, of which 118 individuals completed the follow-up survey as well. This equals the attrition of 19.2%. Altogether, these attrition rates are lower than the usual range reported in similar studies (e.g., Smernoff et al., 2015, reported a dropout rate of 48%). To analyze the attrition pattern, we created a dummy variable (code 1 = attrition; 0 = finisher). *T*-tests for independent groups revealed no significant differences between the individuals dropping out of the study vs. the individuals finishing the study regarding initial stress levels measured with the TICS screening scale (the attrition group: $M = 18.90$, $SD = 9.70$, $n = 39$ vs. the finisher group: $M = 17.40$, $SD = 8.69$, $n = 160$), $t(197) < 1$, $p = .447$; or trait anxiety measured with the STAI-X2 (the attrition group: $M = 38.13$, $SD = 10.72$, $n = 39$ vs. the finisher group: $M = 39.48$, $SD = 9.75$, $n = 160$), $t(197) < 1$, $p = .347$. Furthermore, the attrition rates did not systematically differ between groups $\chi^2(1) = .06$, $p = .804$. Thus, there was no reason to assume the systematic dropout of participants.

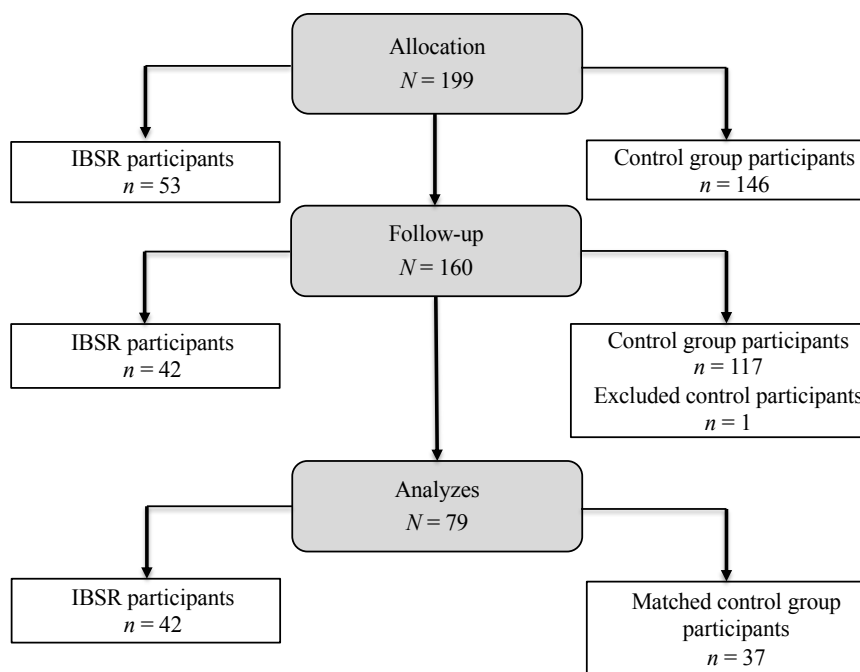


Figure 1. Participants' flow and attrition.

Missing data

Generally, missing data ranged from a low of 0.5% (TICS subscale Work Overexertion measured at time 2) to a high of 21.1% (TICS subscales measured at time 2). The frequencies of missing data for all variables are reported in Table 1.

IBSR Intervention

The IBSR method has three steps. In the *first* step, a standardized procedure is applied to identify stressful cognitions. Supported by a standardized worksheet (see Appendix 1), participants focus on a specific stressful situation and write down their stressful beliefs in a systematic way (van Rhijn et al., 2015). In the *second* step, each belief that has been identified is explored by means of four questions (see Appendix 1 – “The four questions”): First, the validity of the stressful cognition (labeled as “thought”) is questioned (see Questions 1 & 2). With Question 3, participants explore and experience the effect, cause, benefit, and functionality of their stressful cognitions. Also, participants report mental pictures associated with the stressful cognitions and explore feelings and bodily sensations going along with the respective cognitions. Then, participants are enabled to perceive reality without the distortions caused by the stressful cognition (see Question 4) and to experience how they would feel in the same situation without the stressful cognitions. In the *third* step of IBSR, participants are asked to turn their stressful beliefs around to an opposite (see Appendix 1 – “Turn the thought around”). For example, the stressful belief “My spouse does not listen to me.” could be turned around to “I don’t listen to myself.” (turnaround to the self), to “I don’t listen *to my spouse.*” (turnaround to the other), and to “My spouse *does* listen to me.” (turnaround to the opposite). For each turnaround, participants are then asked to find a genuine proof of how the turnaround could be true for them with respect to the initial stressful situation. The materials and worksheets used by the IBSR method are available at www.thework.com.

The present study was conducted during a nine-day IBSR training, which was held in Bad Neuenahr (Germany) in 2015 by the founder of the IBSR method and her staff. The IBSR training followed a standardized procedure. During the first day of the training, the participants learned to self-identify stressful cognitions and to investigate them with the IBSR method. On the following days of the group seminar, the participants focused on different topics and stressful life events (e.g., work and relationships) and investigated their stressful thoughts with the IBSR method. All training sessions were delivered face-to-face and in a group setting. Exercises were conducted in groups and dyads of participants. At the end of the training, participants were instructed to continue the practice of IBSR with a partner and on a daily basis.

Data analyses

All analyses were planned a priori and all analyzed variables are reported. One participant of the control group was excluded from the data analyses because he reported to have actively practiced IBSR before and during the period of this study.

Design

The study had a 2×2 mixed factors design with two conditions (IBSR vs. control group) and two times of measurement.

Propensity score matching

In the present study, the randomized assignment of participants to the intervention group was not possible due to the fact that the IBSR training was organized by the founder of the IBSR method and participants’ self-enrollment process. Thus, we were not able to realize a randomized waiting-list control group. Instead, we independently recruited a control group. This quasi-experimental approach led to differences between the IBSR group and the control group regarding some of the demographic variables (see Table 2). Also, since IBSR trainings offer a technique aiming at reducing stress and negative affect and because the IBSR participants self-enrolled in the training, we expected the IBSR participants to have higher initial levels of chronic stress and trait anxiety than the control group participants. To test for any initial differences

between the groups regarding their baseline stress and anxiety levels, we ran a multivariate analysis of variance (MANOVA) with the factor Group (IBSR vs. control) as the independent variable and the summed scores for the TICS subscales² and the STAI-X2 as dependent variables for all participants who had reported data at the baseline and the follow-up measures. The overall multivariate effect was statistically significant, $F(10, 145) = 2.21, p = .020, \eta^2_{\text{partial}} = .13$. Univariate tests indicated a significant effect of Group on experienced Achievement Pressure (IBSR group: $M = 14.31, SD = 5.61$ vs. control group: $M = 16.92, SD = 6.53$), $F(1, 154) = 5.01, p = .027, \eta^2_{\text{partial}} = .03$, as well as on Lack of Social Acknowledgement (IBSR group: $M = 5.00, SD = 2.84$ vs. control group: $M = 6.65, SD = 3.90$), $F(1, 154) = 5.94, p = .016, \eta^2_{\text{partial}} = .04$ (for all results see Table 3, left column). Somewhat surprisingly, results revealed that participants of the control group reported higher levels of stress on both scales than self-enrolled IBSR participants.

Table 2. Demographic Differences between the Intervention Group and the Control Group Before and After Matching

	Before Matching ($N = 199$)		After Matching ($N = 79$)	
	IBSR Group	Control Group	IBSR Group	Control Group
Mean Age (SD)	43.47 years (9.72)	42.29 years (12.77)	42.81 years (9.55)	44.65 years (13.87)
Percentage of Women	88.7 %	77.4 %	88.1 %	86.5 %
Percentage of Participants Speaking German as the first language	85.7 %	93.9 %	85.7 %	94.6 %
Mean of Years of Speaking German for Nonnatives	3.62 years (9.72)	2.21 years (9.60)	3.62 years (9.72)	2.70 years (11.44)
Educational Level in Percent				
Doctorate Degree	1.9 %	4.8 %	2.4 %	8.1 %
University Degree	47.2 %	39.0 %	59.5 %	45.9 %
Polytechnic Degree	15.1 %	13.0 %	19.0 %	8.1 %
Technical College Degree	24.5 %	21.9 %	31.0 %	32.4 %
Master School Degree	24.5 %	28.1 %	31.0 %	35.1 %
Vocational School Degree	32.1 %	37.0 %	40.5 %	37.8 %
Other Vocational Degree	18.9 %	10.3 %	23.8 %	18.9 %
No Vocational Training	3.8 %	2.1 %	4.8 %	5.4 %

Note: Regarding participants' educational level, multiple selections were possible. The educational level was assessed during follow-up measurements ($N=157$).

To account for the consequences of missing randomization, we conducted propensity score matching, a method widely applied in health science and clinical psychology (West, Cham, Thoemmes, Renneberg, Schulze, & Weiler, 2014). It allows for the identification of control participants, who – based on matching characteristics uninfluenced by the treatment – have similar probabilities to be in the intervention group as actual training participants. As matching characteristics, we used demographic variables (gender, age, educational status, and German as the first language) as well as initial levels of trait anxiety and the TICS subscales. Propensity score matching was conducted using SPSS and the FUZZY extension. In the procedure, a logistic regression with IBSR training assignment as the outcome variable and all matching characteristics as predictors was calculated as advised by Caliendo and Kopeinig (2005). For each participant, a probability of enrolling in the IBSR training resulted with a value between $P = 0$ and $P = 1$. The probability values were then used to identify those control participants who – given their specific characteristics – had similar

² We did not use initial levels of stress as provided by the TICS screening scale to avoid the redundant use of information as the screening items are specific items taken from the TICS subscales. A univariate analyzes of variance with Group (IBSR vs. control) as the independent variable and the summed score for the TICS screening scale revealed no statistically significant initial differences between the groups (IBSR: $M = 16.29, SD = 7.00$ vs. control group: $M = 17.85, SD = 9.24$), $F(1, 157) = 0.99, p = .321$.

chances of enrolling into the IBSR training than participants of the intervention group. For this purpose, a matching procedure was employed using a caliper (i.e., a maximum allowable difference between two participants) of .20 and matching without replacements. For 37 out of 42 participants of the intervention group, a matching control participant was found.

To verify the common support condition (Heinrich et al., 2010), we plotted histograms of propensity scores for both groups respectively. Visual inspection of the propensity score distributions showed that before the matching (Figure 2b) most of the 117 control participants had low propensity scores resulting in a skewed distribution (control group: $M = 0.18$, $SD = 0.18$; range = 0.00–0.76; skewness = 1.57, $SE = 0.23$; kurtosis = 2.00, $SE = 0.45$), while propensity scores of IBSR participants (Figure 2a) were distributed more widely (IBSR: $M = 0.47$, $SD = 0.24$; range = 0.14–0.94; skewness = 0.13, $SE = 0.38$; kurtosis = -0.69 , $SE = 0.74$). A Kolmogorov-Smirnov test was statistically significant ($p < .001$), confirming that propensity score distributions were not the same for both groups. *After* the matching, however, visual inspection of propensity score distributions for both groups (see Figure 2a vs. 2c) showed that both distributions were now similar (matched control group: $M = 0.33$, $SD = 0.21$; range = 0.05–0.76; skewness = 0.47, $SE = 0.39$; kurtosis = -0.91 , $SE = 0.76$). As confirmed by a statistically insignificant Kolmogorov-Smirnov test ($p = .90$), propensity score distributions were no longer statistically different across groups. To further ascertain adequately balanced characteristics between the intervention group and the matched control group, we again ran a MANOVA with the factor Group (intervention vs. matched control) as the independent variable and the summed scores for the TICS subscales and the STAI-X2 as dependent variables (for all results see

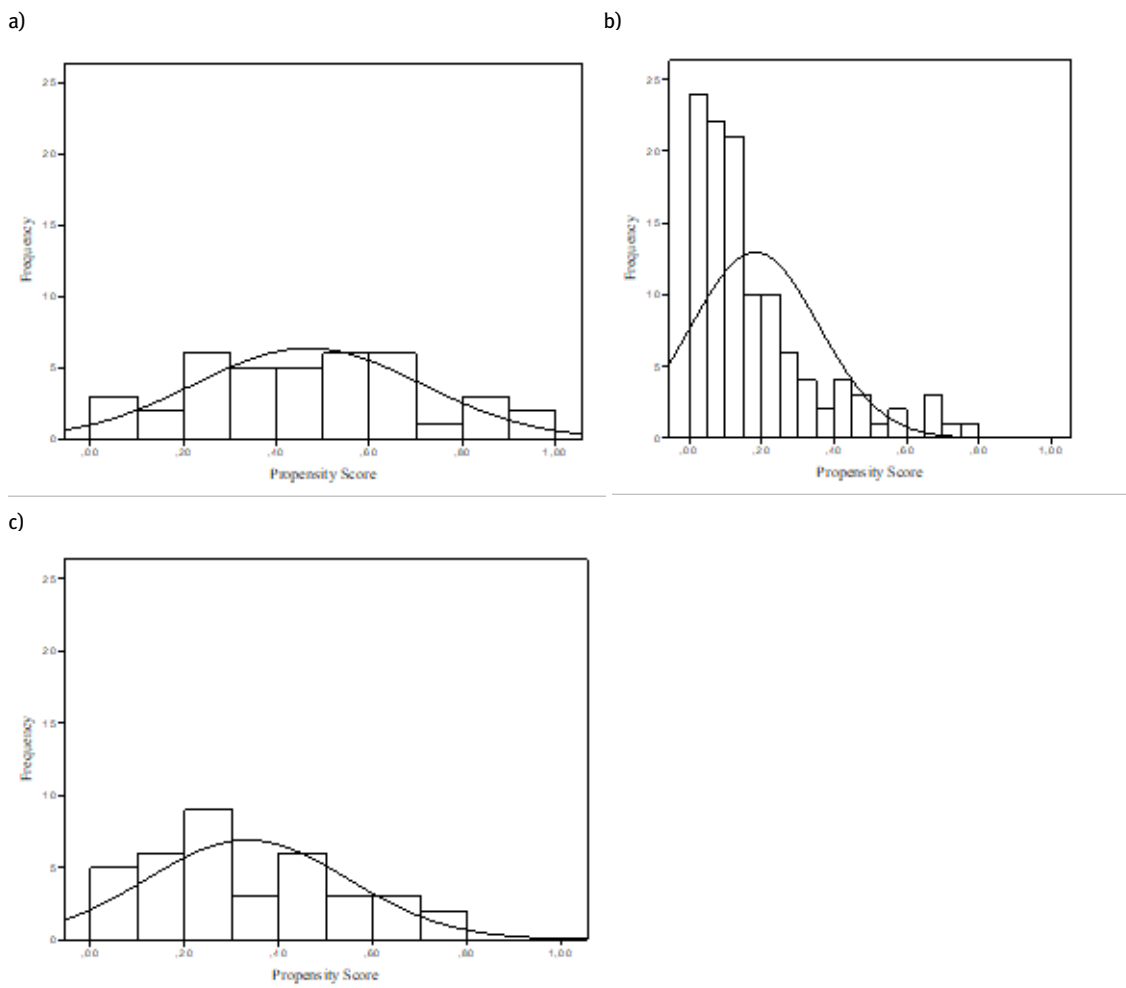


Figure 2. a) Distribution of propensity scores for the IBSR group ($n = 42$); b) for the control group ($n = 117$) before matching; and c) for the matched control group ($n = 37$) after matching.

Table 3, right column). The overall multivariate effect was no longer statistically significant, $F(10, 65) = .32$, $p = .975$, $\eta^2_{\text{partial}} = .05$. Also, after the matching, all univariate F -values for mean differences were statistically non-significant (all $ps > .245$). Therefore, the following analyses were conducted with the matched sample ($n = 79$, 87.3 % women, $M_{\text{age}} = 43.67$ years, $SD = 11.91$, range = 18–72 years).

Table 3. Summary of Multivariate Analyses of Variance (MANOVA) for the Factor Group as an Independent Variable

	Before Matching ($N = 156$)				After Matching ($N = 76$)		
	M IBSR (SD)	M Control (SD)	$F(1, 154)$	p	M Control (SD)	F	p
STAI-X2	39.67 (8.91)	39.47 (9.91)	0.01	.913	38.73 (10.43)	0.18	.674
TICS: Work Pressure	12.41 (6.58)	13.93 (7.42)	1.30	.256	12.84 (7.47)	0.07	.792
TICS: Social Pressure	9.18 (4.01)	10.44 (5.60)	1.67	.198	9.08 (6.36)	0.01	.936
TICS: Achievement Pressure	14.31 (5.61)	16.92 (6.53)	5.01	.027	14.68 (6.45)	0.07	.791
TICS: Work Dissatisfaction	11.87 (6.39)	12.09 (6.72)	0.03	.862	11.62 (7.01)	0.03	.871
TICS: Work Overexertion	6.51 (3.69)	6.21 (4.23)	0.16	.694	6.24 (4.30)	0.09	.770
TICS: Lack of Social Acknowledgement	5.00 (2.84)	6.65 (3.90)	5.94	.016	5.30 (3.73)	0.15	.696
TICS: Social Tension	8.18 (3.40)	7.34 (5.00)	0.91	.342	7.03 (4.66)	1.37	.245
TICS: Social Isolation	8.08 (5.22)	8.77 (5.62)	0.44	.507	8.19 (5.63)	0.01	.928
TICS: Chronic Worrying	6.15 (2.83)	6.39 (3.92)	0.12	.726	5.57 (3.95)	0.56	.458

Note: STAI-X2: State-Trait Anxiety Inventory Form X2. TICS: Trierer Inventory of Chronic Stress.

Results

Chronic stress

To test the effects of IBSR on chronic stress, we conducted a repeated measures analysis of variance with Time (time 1 vs. time 2) as a within-factor, Group (IBSR vs. matched control) as a between-factor, and the summed score for the TICS Screening Scale as the dependent variable. We assumed that the levels of chronic stress would be decreased three months after the IBSR training for the participants of the intervention group, but not for the matched control group participants. Thus, we expected a statistically significant effect of the Time \times Group interaction. Results revealed statistically non-significant main effects (all $Fs < 1$). As predicted, there was a statistically significant interaction effect of Time \times Group, $F(1, 77) = 10.01$, $p = .002$, $\eta^2_{\text{partial}} = .12$, indicating that stress ratings differed between groups over time. To further break down the interaction effect, we plotted the Time \times Group interaction (see Figure 3). Visual inspection suggested that the participants in both groups did not differ in their ratings of chronic stress at the baseline yet three months after the IBSR training they did. As assumed, IBSR participants reported lower levels of chronic stress at time 2 than at the baseline while the stress level in the participants of the matched control group seemed to have remained stable over time. To confirm this observation statistically, we calculated paired-sample t -tests. Results revealed that three months after the training IBSR participants reported statistically significantly lower chronic stress than before the training (time 1: $M = 16.29$, $SD = 6.99$ vs. time 2: $M = 13.48$, $SD = 8.30$), $t(41) = 2.72$, $p = .010$, $d = -0.48$ (CI 95% [-0.05 – -0.92]). In contrast, for the matched control group participants, the levels of chronic stress did not significantly change over the course of time (time 1: $M = 15.76$, $SD = 9.39$ vs. time 2: $M = 17.38$, $SD = 9.88$), $t(36) = -1.76$, $p = .086$, $d = 0.30$ (CI 95% [-0.16 – 0.76]).

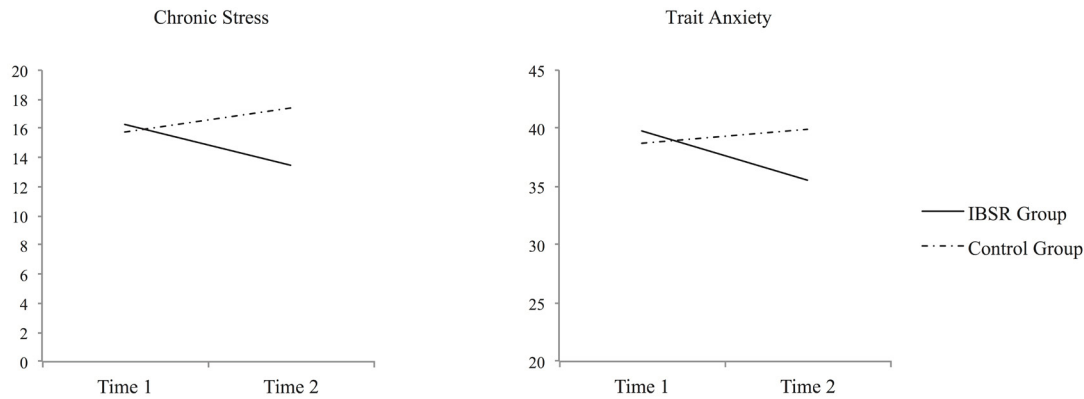


Figure 3. Plotted interaction of Time \times Group for chronic stress and trait anxiety.

Trait anxiety

To test the effects of IBSR on trait anxiety, we conducted the same analysis with the STAIX2 summed score as the dependent variable. For the repeated measures analysis of variance, we again expected a statistically significant effect of the Time \times Group interaction. The main effect of Group was statistically non-significant ($F < 1$). There was a statistically significant main effect of Time, $F(1, 77) = 11.19, p = .001, \eta^2_{\text{partial}} = .13$, indicating that levels of trait anxiety had changed over time, independently of the factor Group. As predicted, this effect was qualified by a statistically significant interaction effect of Time \times Group, $F(1, 77) = 13.74, p < .001, \eta^2_{\text{partial}} = .15$, indicating that anxiety ratings differed between groups over time (Figure 3). Paired-sample t -tests revealed that three months after the training the participants of the IBSR group reported statistically significant lower trait anxiety than before the training (time 1: $M = 39.76, SD = 9.40$ vs. time 2: $M = 35.55, SD = 7.78$), $t(41) = 4.58, p < .001, d = -0.64$ (CI 95% [-0.20 – -1.07]), while for the matched control group participants the levels of trait anxiety did not change significantly over the course of time (time 1: $M = 38.73, SD = 10.43$ vs. time 2: $M = 39.95, SD = 11.06$), $t(36) = -0.33, p = .743, d = 0.32$ (CI 95% [-0.14 – 0.78]).

Discussion

In the present study, we investigated the long-term effects of an intervention aiming at modifying individuals' appraisals of stressful situations on chronic stress and trait anxiety. We expected the levels of chronic stress and trait anxiety to decrease for the participants of the IBSR group over time, but to remain stable for the matched control group participants. The results of the data analyses confirmed our hypothesis. Three months after the IBSR training, the individuals who had attended the IBSR training demonstrated significantly lower levels of chronic stress and trait anxiety than before the training. For the matched control group participants, the levels of chronic stress and trait anxiety remained stable over the same period of time. Thus, there is preliminary evidence that practicing IBSR seems to effectively reduce chronic stress and trait anxiety. Our results are in line with previous research, which showed that the participants of an IBSR intervention reported improved well-being (Lev-ari et al., 2013) and reduced psychopathological symptoms (Leufke et al., 2013; Smernoff et al., 2015). However, as mentioned, the previous studies lacked control groups, which makes a clear interpretation of the results almost impossible because the effects found might have been due to other factors than the induced modification of cognitive appraisals (e.g., spontaneous remission, regression to the mean). The results of our study significantly add to this literature by showing that the IBSR effects remain visible when a non-treated control group is included in the research design. We interpret the results according to the theoretical assumptions of appraisal theories (Lazarus, 1999; Lazarus & Folkman, 1984; Pekrun, 2006), which state that stress and anxiety are caused by cognitive appraisals. Therefore, stress and anxiety should decline if people modify their cognitive appraisals by investigating

their stressful and anxiety-causing thoughts and beliefs. The IBSR training method supports participants in identifying and investigating the validity of stressful or anxiety-causing cognitions. In particular, the IBSR method allows participants not only to experientially explore the effect, cause, benefit, and functionality of the stressful belief but also the experience of being without the belief and investigating the validity of the opposite belief. The reappraisal process initiated by the IBSR method is thus high in personal relevance, comprehensive, and systematic. Also, the new arguments leading to the reappraisal are self-created by the participants. Therefore, and in line with the dual process models of information processing (e.g., the heuristic systematic model; Chen & Chaiken, 1999), the reappraisal and the associated emotional change achieved by IBSR should be long-lasting.

Limitations and future research

Even though the present study can overcome some of the limits of the previous single-group studies, our research design did not include a randomized active control group (i.e., a control group receiving treatment). Thus, there is a possibility that the effects found are not unique to the IBSR intervention. In particular, the stress and anxiety reducing effects could be due to the attention, which was received by participants during the nine days of the IBSR training (unspecific treatment effects). However, the stress and anxiety reducing effects were found three months after the IBSR training. Therefore, it is reasonable to assume that they were at least in part due to the intervention-specific aspects of IBSR. Nevertheless, future studies should include an active control group to control for unspecific treatment effects.

Secondly, the randomized assignment of participants to the intervention group was not possible due to the self-enrollment process. To minimize the consequences of the missing randomization, propensity score matching was used. With this widely applied statistical method (West et al., 2014), we identified those control group participants who had similar characteristics as the actual training participants and analyzed data with the matched sample. However, it is possible that intervention and control group participants differed on variables that were not assessed and thus not included in the matching procedure such as participants' individual coping strategies, their emotion regulation skills, and their prior experience with the IBSR method or other cognitive treatments. This problem could be overcome by future studies either by assessing such additional variables or by the randomized assignment of participants. Also, when interpreting the results, one needs to keep in mind the possibility of a selection bias: As the intervention participants self-enrolled in the IBSR training, it can be assumed that they were highly motivated to reduce their stress and anxiety through the IBSR training, which was announced to participants as a method to deal with stressful thoughts. Thus, results can only be generalized for individuals interested and motivated to engage in self-enhancement and stress reduction through interventions like IBSR. Yet, we do not think that this is a very serious limitation as these are typical characteristics of individuals looking for interventions. Furthermore, the sample of the present study is largely made up of female individuals (87 percent). One may speculate whether this is a limitation for the generalizability of the present findings. However, there is no theoretical reason to assume that participants' gender should influence the effectiveness of the IBSR method in reducing stress or anxiety. This notion is also supported by empirical studies which report the IBSR method to be effective in reducing psychopathological symptoms (e.g., anxiety) for samples more balanced with regard to participants' gender (e.g., Krispenz & Dickhäuser, 2018 – 67 percent females; Smernoff, et al., 2015 – 68 percent females). In addition, none of these studies reported interactions of the treatment with gender. Nevertheless, future research should explore the effectiveness of a modification of appraisals through IBSR in more diverse samples.

Thirdly, the present study did only assess individuals' chronic stress and trait anxiety. To enhance the confidence in the training's efficacy, future studies should measure a higher number of outcome variables (e.g., overall well-being, self-efficacy) as well as discriminant measures (i.e., symptoms other than anxiety) to further prove the IBSR training's efficacy in reducing stress and anxiety. Moreover, future studies should investigate if IBSR is as effective as other therapeutic approaches in modifying dysfunctional beliefs of individuals suffering from psychological disorders such as a rational emotive behavioral therapy (Ellis, 2002). Also, due to the cognitive nature of the IBSR method, future studies should explore if the effective

practice of the IBSR method requires a certain level of cognitive abilities (i.e., the absence of any cognitive disorders). Finally, while the present study evaluated the positive effects of the IBSR method, we did not directly investigate the psychological mechanisms (particularly the change of cognitive appraisals) underlying these effects. Further (experimental) research is needed to investigate the mechanisms causing the positive effects of the IBSR method.

Practical Implications

Our findings have important practical implications for non-clinical health settings: As chronic stress and anxiety can lead to undesirable consequences for physical and psychological health (McEwen, 2008), the change of cognitive appraisals provides an effective way to reduce stress and anxiety. Our results provide evidence that IBSR is effective in reducing stress ($d = -0.48$) and anxiety ($d = -0.64$) in a non-clinical sample. Due to its standardized procedure, in IBSR the process of modifying one's irrational and negative thinking is guided by a clearly defined set of questions, allowing for a simple to follow and structured way of self-inquiry. This makes the IBSR method an individually applicable technique for stress and anxiety reduction. It also can be combined with other therapeutic approaches such as a cognitive behavioral therapy (van Rhijn et al., 2015). However, the IBSR intervention evaluated in the present study lasted nine days making participation in an initial IBSR training costly. Thus, future research should investigate the effects of a short IBSR intervention and IBSR self-learning programs.

Conclusions

Our findings provide preliminary evidence for the effectiveness of IBSR in reducing chronic stress and trait anxiety in a non-clinical sample. The results suggest that individuals can apply IBSR to self-identify and self-explore stressful cognitions in order to reduce their stress and anxiety in the longer run.

Ethical Statement: By the time we conducted the study and acquired the data, it was neither compulsory nor customary in Germany to seek explicit ethical approval for a study including only participants' self-reports on chronic stress and anxiety. However, we carefully ensured that the study was conducted in line with the ethical guidelines of the American Psychological Association and in full accordance with the ethical guidelines of the German *Psychological Society*. The study made use of anonymous questionnaires exclusively. The data was matched for the analyses using codenames only. A written informed consent was obtained according to the guidelines of the *German Psychological Society*. The informed consent included information about (1) research object, (2) study procedure, (3) duration and allowance, (4) possible benefits of participation, (5) anonymity of data collection, and (6) possible risks of participation. Also, participants were explicitly informed that participation in the data assessment was voluntary and could be terminated at any time without any reason or negative consequences for the participant. Participants had to declare that they were at least 18 years old, had read the information presented in the informed consent, and agreed to the rules of participation.

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Appendix 1. IBSR-Worksheet for the Identification of Stressful Cognitions (“Judge-Your-Neighbor Worksheet”)

THE WORK OF BYRON KATIE 

Judge-Your-Neighbor Worksheet

Judge your neighbor • Write it down • Ask four questions • Turn it around

Think of a recurring stressful situation, a situation that is reliably stressful even though it may have happened only once and recurs only in your mind. As you answer each of the questions below, allow yourself to mentally revisit the time and place of the stressful occurrence. Use short, simple sentences.

1. In this situation, who angers, confuses, saddens, or disappoints you, and why?

I am _____ with _____ because _____
emotion name

Example: I am angry with Paul because he doesn't listen to me.

2. In this situation, how do you want them to change? What do you want them to do?

I want _____ to _____
name

Example: I want Paul to see that he is wrong. I want him to stop lying to me. I want him to see that he is killing himself.

3. In this situation, what advice would you offer to them?

_____ should/shouldn't _____
name

Example: Paul should take a deep breath. He should calm down. He should see that his behavior frightens me. He should know that being right is not worth another heart attack.

4. In order for *you* to be happy in this situation, what do you need them to think, say, feel, or do?

I need _____ to _____
name

Example: I need Paul to hear me when I talk to him. I need him to take care of himself. I need him to admit that I am right.

5. What do you think of them in this situation? Make a list. (Remember, be petty and judgmental.)

_____ is _____
name

Example: Paul is unfair, arrogant, loud, dishonest, way out of line, and unconscious.

6. What is it about this situation that you don't ever want to experience again?

I don't ever want _____

Example: I don't ever want Paul to lie to me again. I don't ever want to see him ruining his health again.

Now investigate each of the above statements using the four questions. Always give yourself time to let the deeper answers meet the questions. Then turn each thought around. For the turnaround to statement 6, replace the words “I don't ever want to...” with “I am willing to...” and “I look forward to...” Until you can look forward to all aspects of life without fear, your Work is not done.

The four questions

Example: Paul doesn't listen to me.

1. **Is it true?** (Yes or no. If no, move to 3.)
2. **Can you absolutely know that it's true?** (Yes or no.)
3. **How do you react, what happens, when you believe that thought?**
4. **Who would you be without the thought?**

Turn the thought around

- a) **to the self.** (*I don't listen to myself.*)
- b) **to the other.** (*I don't listen to Paul.*)
- c) **to the opposite.** (*Paul does listen to me.*)

Then find at least three specific, genuine examples of how each turnaround is true for you in this situation.

For more information on how to do The Work, visit thework.com