

Research on the Effect of Mindfulness Practice on Susceptibility to Evaluative Conditioning

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Abstract

Background: Susceptibility to evaluative conditioning (EC) is associated with many social cognitive and psychological biases that are key to psychological problems. For example, depression and anxiety are closely related to susceptibility to negative stimuli, and susceptibility to positive stimuli is associated with healthy psychology and well-being. Therefore, susceptibility to evaluative conditioning is closely related to mental health and cannot be ignored. As a factor that can affect the susceptibility to evaluative conditioning, mindfulness has only recently received attention. This study aims to provide more targeted services for health clubs wishing to support well-being and mental health.

Methods: To explore the feasibility and effect of mindfulness interventions on susceptibility to evaluative conditioning, 72 subjects were included in a fitness club in Hefei. Thirty-six of the subjects participated in mindfulness training with the *Mindful Attention Awareness Scale (MAAS)*, *Positive and Negative Emotion Scale (PANES)*, and using the evaluative conditioning paradigm (picture-picture paradigm) for examination.

Results: The results of the correlation and comparison of differences showed susceptibility to evaluative conditions, and the difference in the experimental group was significant before and after the intervention ($P < 0.05$).

Conclusions: Compared to a control group, 12 hours of yoga and mindfulness training improved mindfulness, as measured on the *Mindful Attention Awareness Scale*, a decrease in negative susceptibility leads to a relative increase in positive susceptibility, therefore, people can feel more positive and have better mental health.

Keywords: Mindfulness, Susceptibility to Evaluative Conditioning, Intervention.

Background

Research has shown that attention bias, explanation bias and negative cognitive styles are important influencing factors in people with high incidences of depression and anxiety disorder [1]. Recent studies have shown that susceptibility to EC is strongly associated with these psychosocial biases [2]. Evaluative Conditioning has been applied to the study of attitude formation, attention bias, and social cognitive bias; it

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has been matched several times by conditioned stimulus (CS) with an unconditioned stimulus (US) with potency so that the CS receives potency that it does not have (this potency comes from the unconditioned stimulus potency). The susceptibility to EC precisely reflects the degree to which it obtains potency. When it becomes more negative than positive, we believe that it produces attention bias or cognitive bias regarding negative stimuli.

Individual difference variables are among the important factors affecting evaluative conditioning, such as mindfulness level. By changing the level of mindfulness, we can theoretically change susceptibility to evaluative conditioning, thus correcting attention deviation and promoting the development of physical and mental health [3,4].

Mindfulness has a good effect on emotional problems, emotional disorders, and mental disorders in the field of clinical psychology [5]. In the field of organizational management, mindfulness has mainly been used to help employees to eliminate stress and increase happiness [6]. Research in school education has also been based on the same purpose, using mindfulness interventions to help students relax, alleviate the pain of negative emotions, and thus achieve better access to education [7]. Recently, a study of brief mindfulness training interventions showed that higher trait mindfulness is associated with low levels of psychological distress and that a brief mindfulness-based intervention seemed to be useful in reducing distress measures in university students [8].

Mindfulness

Mindfulness means paying attention to things in a special way, paying attention on purpose, paying attention to the present, and paying attention to the experience that occurs in every moment without making any judgments [9]. Based on previous studies, this study proposes a relatively accepted definition that mindfulness is a state of consciousness (or trait). It is nonjudgmental to focus on the present and accept the present. Studies have shown that, after eight weeks of meditation, compared with the control group, individuals in the experimental group had significantly reduced emotional conflict [10]. As a means of intervention, mindfulness also has a great influence on individual psychological function. Mindfulness and yoga intervention is considered one of the effective treatments for mindfulness intervention [11]. There is reason to believe that mindfulness training affects the work of emotion-related brain regions. For these reasons, we proposed the following hypothesis.

Hypothesis 1: Long-term mindfulness training can effectively promote the level of individual mindfulness.

Susceptibility to evaluative conditioning

Susceptibility to evaluative conditioning refers to the change in the individual’s evaluation of the stimulus. This

change is caused by a combination of stimuli and other stimuli and can also reflect an individual’s preference for or attention to a particular stimulus [12]. Alternatively, individual susceptibility to stimuli can also be obtained by comparing different stimuli [13]. The term reflects preference for a certain titer, attention bias and potential psychological and social cognitive biases. Sensitivity to negative stimuli reflects possible or existing psychological problems. Sensitivity to negative stimuli also reflects some discrimination and prejudice, which also have some adverse effects on society and individuals [14].

Relationship between mindfulness and susceptibility to evaluative conditioning

Many studies have shown that mindfulness traits are associated with anxiety, depression, and alcohol addiction. Gibbons used positive stimuli and negative stimuli for priming, and the results showed that anxious individuals were more susceptible to negative stimuli in evaluative conditioning [15]. Mindfulness levels are associated with anxiety, which is associated with susceptibility to evaluative conditioning, so it is possible that mindfulness levels are also largely associated with susceptibility to evaluative conditioning. Kiken proposed that mindfulness might be an individual variable that affects susceptibility to evaluating conditioning [13]. Her research showed that mindfulness improves the rating of stimuli in evaluative conditioning, rendering positive stimuli more positive and negative stimuli less negative. Garland et al. found that mindfulness training could improve individuals’ positive cognition and positive emotions. For those reasons, we proposed the following hypothesis [16].

Hypothesis 2: With training, mindfulness should be improved, and susceptibility to negative stimuli should be reduced.

Aim

To provide more targeted services for health clubs wishing to support well-being and mental health.

Methods

The intervention study design is shown in table 1. The mindfulness training group was given yoga classes once per week for eight weeks. Ethical approval was granted by the Jiangxi Normal University School of Psychology Ethics Committee (202105). All of the students were divided into three groups and trained by the same yogi who has been trained in mindfulness for 10 years; the yogi has several professional certifications in mindfulness and yoga. Each session included five minutes of mindfulness breathing and rest, 1.5 hours of mindfulness yoga, 30 minutes of mindfulness class teaching and Q&A; the control group only performed 1 to 1.5 hours of aerobic cycling once per week.

The research group	Mindfulness training group	Control group
Intervention process	Breathing training + Yoga training + Theory class	Aerobic Cycling Training
Frequency	Once a week for 8 weeks	Once a week for 8 weeks

Table 1: The treatment of the mindfulness training group and the control group.

Participants

In a health club in Hefei, Anhui Province, mindfulness levels were measured for all members who had not practiced yoga. On the basis of a free training course, the Chinese version of the MAAS was used for the measurements, and 72 members with the lowest level of mindfulness were selected to receive complimentary courses. The classes are divided into yoga classes (mindfulness training) and aerobics classes. Each class could only enroll 36 students. All of the individual participants provided informed consent by checking a box next to the statement about informed consent. The yoga group (the mindfulness training group) lost 5 members during the training process. In the end, 31 people, including 7 men and 24 women, participated in the course for 2 months and completed it. In the aerobic cycling group (control group), 3 people dropped out during the training, and 33 people, including 14 men and 19 women, finally persisted in participating in the course for 2 months and completed the course.

Measures

Mindful Attention Awareness Scale (MAAS)

The scale was translated based on the MAAS developed by Brown and Ryan, which measures levels of mindfulness based on the concept of "current attention and awareness". The scale is a unidimensional structure consisting of 15 items involving individual cognition, emotion, physiology and other aspects in life. A scale of 1 to 6 ranges from 'almost always' to 'almost never'. High scores reflect a higher level of present moment awareness and attention in the individual's daily life. The correlation coefficients between each item and the aggregate table were between 0.422 and 0.711. The internal consistency coefficient was 0.890, and the retest reliability was 0.870, indicating that the scale had good reliability. The Cronbach's α coefficient of this measurement was 0.842.

Positive and negative emotion scale (PANES)

The PANES, compiled by Watson et al., consists of two dimensions: positive and negative emotions. Each dimension has ten items on a five-point scale, ranging from very mild to very severe on a scale of 1-5. The Cronbach's α homogeneity reliability coefficients of positive and negative emotions were 0.85 and 0.83, respectively, indicating that its homogeneity reliability is high. The Cronbach's α coefficients of the two dimensions measured in this study were 0.91 and 0.86, respectively, and the Cronbach's α coefficient of the total table was 0.89.

Evaluative conditioned reflex materials

US30 words were selected, among which were ten words with positive potency, including *champions*, *bonuses*, and *smiles*; after re-examination and before the experiment, their titer was between 6.717 and 7.717. Ten words with negative potency were also chosen, such as *cruelty*, *evil*, and *hell*; after re-examination and before the experiment, their titer was between 2.304 and 3.957; Ten neutral words were finally chosen, such as *countermeasures*, *houses*, *ordinary*, etc.; after re-examination and before the experiment, their

titer was between 4.978 and 5.500. All of the words were selected from the Chinese affective word system. We chose 9 Japanese words as CS, such as セ、ク, etc. After re-examination and before the experiment, their titer was between 4.457 and 4.978.

Procedure

The first step was to screen the subjects, and then all of the subjects were measured by the MAAS scale.

Second, 72 subjects with the lowest level of mindfulness were selected for evaluative conditioning susceptibility measurements at baseline. The subjects were alone in front of the computer and trained according to the instructions. The subject was told that the experiment was a memory study and was asked to remember as many stimuli as possible. Then, we started the EC training, the EC research paradigm of Livingston and Drwecki was used in the EC training [14]. The stimulus combination was divided into three groups: positive US with CS, neutral US with CS, and negative US with C., Every 3 CS were paired with 10 US with the same potency, and each pair of collocations occurred 6 times, so word collocations with the same potency occurred 180 times. The collocation of CS-US was presented using E-Prime software, version 2.0, and we adopted the presentation mode of suprathreshold stimulation. The order of presentation of the stimuli was that we first presented CS (1 s), followed by a red cross in the center of the screen (125ms), then US (1 s), and finally a blank stimulus (2 s), and so on. At the end of the training, the subjects rated CS on a scale of 1-9, and the higher that the score was, the more that they liked it. Finally, baseline levels of stimulation susceptibility were measured.

In the third step, after baseline level measurement, the subjects were asked to complete PANES to measure their emotional state.

Fourth, groups were created on the basis of voluntary participation, and a mindfulness intervention was implemented.

In the fifth step, after the intervention, all of the remaining subjects participated in a posttest to investigate the training effect, including measures of levels of mindfulness, measures of susceptibility to stimuli, and measures of emotional state. The measurement means and tools were the same as those in the previous three steps. At the end of the posttest, the participants were informed of the purpose of the entire study and were given a random number of membership coupons.

Data analysis

Data from the questionnaires were analyzed using SPSS software, version 23.0.

Results

Correlation

The correlation between evaluative conditioned reflex susceptibility and emotional state was not significant ($P > 0.05$). There was no significant correlation between evaluative conditioning susceptibility and emotional state in the pretest and posttest ($P > 0.05$).

Comparison of differences

From table 2, we can see significant differences between the experimental and control groups in the level of mindfulness and susceptibility to negative stimuli ($P < 0.001$) but no significant differences in susceptibility to positive stimuli ($P > 0.05$). Table 3 shows that there were significant differences in the level of mindfulness, susceptibility to positive stimuli and susceptibility to negative stimuli in the experimental group ($P < 0.05$). The level of mindfulness and susceptibility to positive stimuli were significantly higher than those in the pretest, while the susceptibility to negative stimuli was significantly lower than that in the pretest.

The Effect of mindfulness intervention

From table 4, compared with the control group, there were significant differences in the level of mindfulness and susceptibility to negative stimuli ($P < 0.01$) but no significant differences in susceptibility to positive stimuli ($P > 0.05$).

Discussion

According to the correlation analysis, the assessment of evaluative conditioning susceptibility is not influenced by the current emotional state, and individuals' susceptibility to stimuli is real and validly measured.

Based on the comparison with pretest differences, the posttest differences indicated that mindfulness training was an important reason for the differences between the two groups. Mindfulness training can effectively improve an individual's level of mindfulness and reduce susceptibility to negative stimuli so that individuals can accept negative stimuli and have a nonjudgmental attitude to face life, consistent with previous studies [13]. In terms of the difference in measurements before and after the experimental group, this outcome indicates that, after 8 weeks of mindfulness training, the individual's level of mindfulness has been significantly

improved, and the individual's susceptibility to negative stimuli has been significantly reduced, consistent with our research hypothesis. However, susceptibility to positive stimulation in the experimental group was also significantly improved, indicating that individuals would be more sensitive to positive stimulation after training and would easily obtain the emotional valence of positive stimulation to form a positive attitude and positive emotions toward things, somewhat differently from the existing research. The results of Sauer et al. were similar to those of the present study; that is, mindfulness training renders individuals more positive to neutral stimuli and less negative to negative stimuli. The results of Kiken and Shook's study are inconsistent with the results of this study; that is, mindfulness only had an impact on the susceptibility of individuals to negative stimuli [13]. The reason for this difference might be that the mindfulness training settings included long hours of yoga. The research results of Amaranath et al. showed that yoga training could effectively increase individuals' positive emotional states, and long-term positive state experience could increase individuals' susceptibility to positive stimuli, so the setting of mindfulness training also has an impact on mindfulness itself [17]. There were significant differences in mindfulness level and susceptibility to negative stimuli ($P < 0.01$ or $P < 0.001$) but no significant differences in susceptibility to positive stimuli ($P > 0.05$) between the experimental and control groups. The results indicate that mindfulness training is feasible and effective, and it can improve the level of mindfulness and can be used to evaluate the susceptibility of conditioned reflex, mainly affecting the susceptibility to negative stimuli and reducing the oversensitivity of individuals to negative stimuli.

The results showed that, compared with the control group, the level of mindfulness in the experimental group was significantly increased ($P < 0.001$), and the susceptibility to negative stimuli was also significantly decreased ($P < 0.01$).

	Control group (N=33)	Experimental group(N=31)	t	p
Mindfulness level	50.63±4.01	56.52±1.93	7.54***	0.00
Susceptibility to positive stimulus	0.73±1.04	0.90±1.45	0.56	0.58
Susceptibility to negative stimulus	1.45±1.02	0.19±1.36	-4.19***	0.00

Table 2: Comparison of post-test differences between the experimental group and the control group (M±SD).

	Pretest (N=31)	Post-test (N=31)	t	p
Mindfulness level	49.65±3.18	56.52±1.93	-10.99***	0.00
Susceptibility to positive stimulus	0.00±1.24	0.90±1.45	-2.56*	0.02
Susceptibility to negative stimulus	1.48±1.23	0.19±1.36	3.60***	0.00

Table 3: Comparison of pretest and post-test differences in the experimental group (M±SD).

	Control group (N=33)	Experimental group(N=31)	t	p
Mindfulness level pretest-post-test	1.15±4.52	6.87±3.48	5.69***	0.00
Susceptibility to positive stimulus pretest-post-test	0.39±1.78	0.90±1.96	1.09	0.28
Susceptibility to negative stimulus pretest-post-test	-0.12±1.64	-1.29±1.99	-2.56**	0.01

Table 4: Comparison of pretest and post-test difference between the experimental group and the control group (M±SD).

This outcome indicates that mindfulness interventions can effectively improve the level of mindfulness and reduce susceptibility to negative stimuli, similar to the research results of Kiken and Shook [13]. There was no significant difference in susceptibility to positive stimulation between the experimental and control groups ($P > 0.05$). However, combined with the above data analysis, the difference in susceptibility to positive stimulation before and after the test of the experimental group was significant ($P < 0.05$); that is, mindfulness training can significantly improve susceptibility to positive stimulation. However, the increase was not significant compared with the control setting. One possibility is that spinning as exercise also slowly increased an individual's positive susceptibility over the course of eight weeks of training. Conversely, because mindfulness training focuses more on accepting and tolerating negative stimuli and reducing negative stimuli, the effect of mindfulness training on increased susceptibility to positive stimuli was less significant than the decrease in negative stimuli, so the difference was not significant compared with the difference before and after the control group.

Actually This study puts forward measures to improve the mental health level of club members. Through a certain period of mindfulness yoga training, the individual's level of mindfulness can be promoted to reduce the individual's susceptibility to negative stimulus, so as to make the individual's mental health level in a better level, however, the paper does not further explore whether the lasting effects of mindfulness yoga training are temporary or not, how long does it take to get a significant improvement? There is no detailed explanation in this paper. Therefore, in the future, researches can continue to explore the improvement effect of mindful yoga training on individual mental health and provide accurate measures.

Conclusion

The final intervention results showed that compared to a control group, 12 hours of yoga and mindfulness training improved mindfulness, as measured on the *Mindful Attention Awareness Scale*, affect the susceptibility of the evaluative conditioned reflex, reduce susceptibility to negative stimuli, and increase susceptibility to positive stimuli to promote the individual's mental health growth.

Declarations

Ethics approval and consent to participate

Verbal informed consent was obtained from all of the individual participants included in the study. Ethical approval was granted by the Jiangxi Normal University School of Psychology Ethics Committee (202105).

Consent to publish

The authors agree to publish this study upon acceptance by the journal.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no conflicts of interest.

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Authors' contributions

JH: Research questions raised, Study designing, Data collection, Data analysis, Paper writing, Paper revising. LJ: Data analysis, The main paper writing work of the article, Paper revising. BN, SY&XY: Data collection, prepared tables and Paper revising. All authors have reviewed the manuscript.

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