

A Systematic Review of the Effectiveness of Brief Interventions on Happiness

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Introduction

For the last few decades, happiness, or specifically how to maximize it has been thoroughly studied scientifically in the fields of neuroscience and psychology. Researchers have studied the neurological basis of several activities including exercise, meditation, and various hobbies; the purpose of this review is to empirically assess the effectiveness of these activities as brief interventions in improving mood and provide theoretical explanations regarding their relative efficacy. The effect of one week of exercise and mindful meditation along with two weeks of personalized interventions, including musical improvisation, will be evaluated due to their observed and hypothesized wellbeing benefits and varied neural correlates, among several test subjects.

Exercise has been known to reduce depressive symptoms and stress similarly to antidepressants (Blumenthal et al., 1999) and increase happiness after even 10 minutes of exercise (Zhang & Chen, 2018). Cortisol levels are reduced (Nabkasorn et al., 2005) and endorphins are released (Korb, 2021), which respectively reduce stress and pain levels. Mindfulness meditation on the other hand has been seen to positively influence emotional regulation (Tang et al., 2015; Wheeler et al., 2017) and increase self-compassion and happiness (Campos et al., 2016). Changes in anterior cingulate cortex (ACC), ventromedial prefrontal cortex (vmPFC), insula, and amygdala activity (Wheeler et al., 2017) neurologically reflect these positive changes in wellbeing and mood, namely emotional regulation. Lastly, like mindfulness meditation, musical improvisation has been associated with ACC and prefrontal activity (Limb & Braun, 2008).

As brief interventions, these activities are all associated with positive changes in happiness and brain structure/activity related to mood. Due to the similar effects of exercise and

antidepressants and the low time needed for effects to be observed, I predict that an exercise intervention will have a moderate to significant positive effect on happiness. The relationship between mindfulness meditation and emotional regulation leads me to predict that there will be a moderate positive effect on happiness and lower variance in mood scores. Lastly, the musical improvisation intervention may have the same effects as mindful meditation on mood score variance due to the similar regions of the brain involved, however only a slight or unnoticeable effect on happiness.

Methods

Across three separate time spans, around 240 students in a Neuroscience and Wellbeing class at UCLA including myself completed an intervention and recorded our mood each day. For the exercise intervention, subjects would participate in 30 minutes of exercise/physical activity for half of the days of the experiment, in this case three to four days out of one week. Each day, subjects would record their own mood on an interval scale from 1 (sad, depressed) to 7 (happy, content) and whether they completed the intervention in the past 24 hours on a Google Form. The procedure for the mindfulness meditation intervention was similar, except on intervention days subjects would participate in 10 minutes of mindfulness meditation (meditating quietly with awareness of body and mind). The time span of one week and self-reported data collection procedure through Google Forms was the same for this intervention. Lastly, each subject would complete their own personal interventions over the course of two weeks, participating this activity for six to eight of the fourteen days allotted for the experiment; the activity I chose as an intervention was 10 minutes of musical improvisation on the piano or keyboard.

For each intervention, the average mood score and standard deviation for days in which the intervention was completed and days in which it was not (control days) was calculated across the entire class. Additionally, these measurements were recorded for my own data to compare with the class.

Results

Across the week for the exercise intervention, the average mood score for all participants and standard deviation on days in which participants exercised was 5.22 out of 7 and 1.22, respectively; control days (no exercise) had an average mood score of 4.70 and standard deviation of 1.28, thus yielding a +0.52 change in mood score between the two conditions. My personal average score for exercise intervention days during the week was 5.75 with a standard deviation of 0.50; for control days my average score was 4.50 with a standard deviation of 0.58, yielding a +1.25 change in mood score. These results are visualized below in Figure 1.

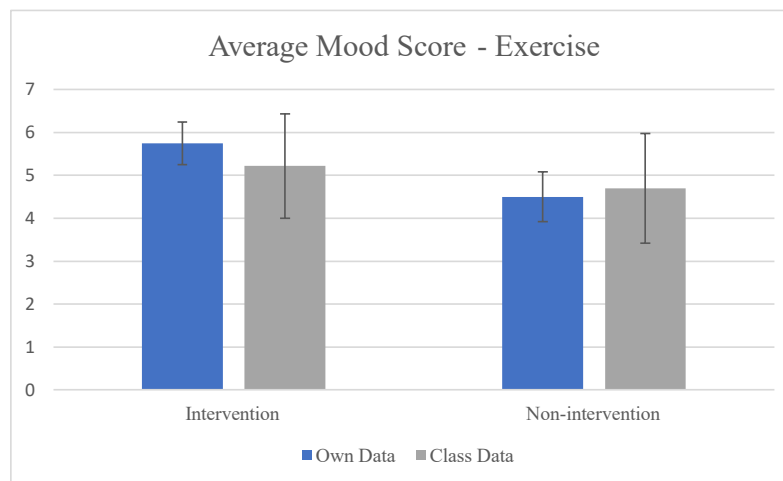


Figure 1. Average mood scores for a 1-week exercise intervention

For the mindfulness meditation intervention, the average intervention day mood score across all participants was 5.29 with a standard deviation of 1.09. The average control day mood score was 4.85 with a standard deviation of 1.19, and the difference between control and intervention day scores was +0.44. My own average intervention day mood score was 4.33 with a standard deviation of 0.58; for control days this was 3.33, also with a 0.58 standard deviation. My difference between control and intervention day scores was +1.00.

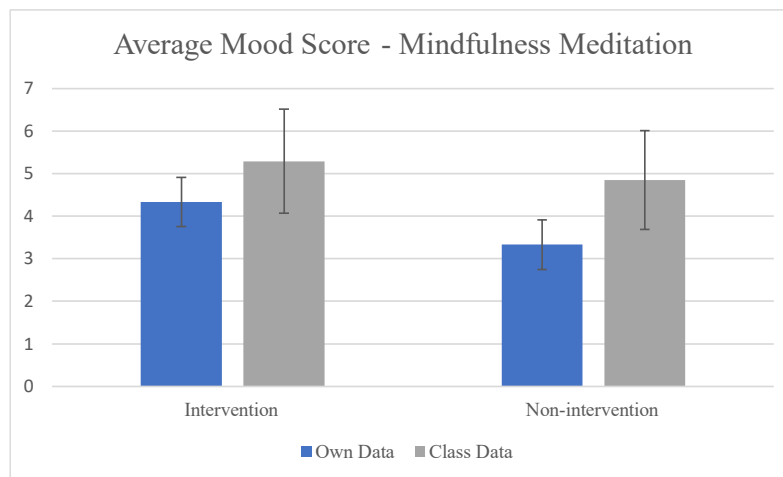


Figure 2. Average mood scores for a 1-week mindfulness meditation intervention

Lastly, the personal intervention average mood scores for all participants across two weeks were 5.28 with a 1.02 standard deviation for intervention days, and 4.71 with a 1.16 standard deviation for control days. The difference between control and intervention mood scores was +0.57. My personal intervention of musical improvisation yielded average mood scores of 4.33 with a standard deviation of 0.82 on intervention days and 4.50 with a standard deviation of 1.22 on control days, with a difference between control and intervention mood scores of -0.17.

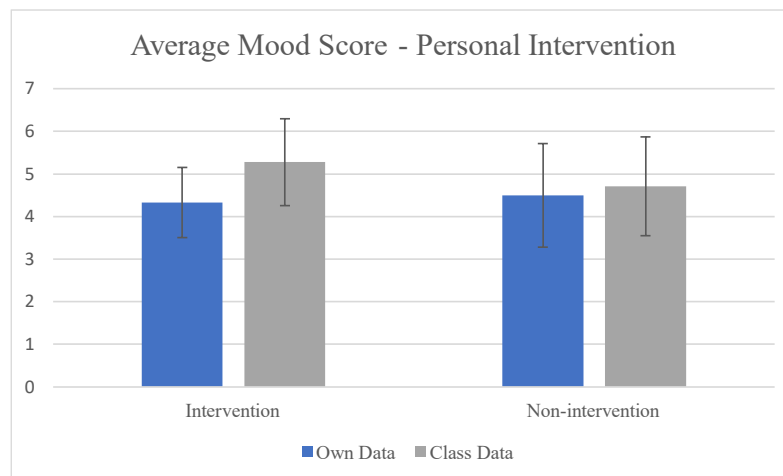


Figure 3. Average mood scores for a 2-week personal intervention

Discussion

Across the roughly 240 subjects, the difference in average mood scores between control and intervention days was greatest for personal interventions with +0.57 (+12%), followed by exercise with +0.52 (+11%), and lastly mindfulness meditation at +0.44 (+9%). My own scores differed from the class in which exercise had the highest difference in mood score with +1.25 (+28%), mindfulness meditation had the second highest (highest percentagewise) with +1.00 (+30%), and personal intervention had the lowest with -0.17 (4%).

Being that my exercise intervention was well outside the control standard deviation, the data suggests that exercise was the source of the observed difference and therefore supports my hypothesis that exercise would moderately to significantly improve mood for myself. While there is no specific prescription of exercise treatment to reduce depression and anxiety/improve mood, there has been a large observed effect of exercise on mood and mood disorders across several studies and a reasonable neurochemical basis for these effects (Ströhle, 2008; Matta Mello Portugal et al., 2013). Studies with animals show that the neurotransmitters

norepinephrine, dopamine, and serotonin, along with opioids and endocannabinoids are modulated by physical exercise and affect blood pressure, reward, anxiety, and pain (Matta Mello Portugal et al., 2013). With exercise and the other interventions, the entire sample size on the other hand had intervention scores well within their respective control standard deviations suggesting that the intervention had a limited but positive effect on mood.

Mindfulness meditation yielded my highest percentage change in mood, initially outperforming my expectations. However, this can be attributed to the abnormally low control day average score for that week. As mindfulness meditation is implicated with emotional regulation (Tang et al., 2015; Wheeler et al., 2017), the data does not support my hypothesis that this intervention would lower variance in mood as the standard deviation was equal to the control SD for the week and other SDs throughout other interventions. A detail that does not explain the minimal variances and differences in both my own data and the class's is the fact that many observed effects in studies are related to amount of experience with mindfulness meditation. While beginners who participated in this activity had increased activity in the ACC, insula, orbitofrontal cortex, and other regions; experts had less activity in the lateral prefrontal cortex and "enhancements" in the insula and other regions related to pain-processing (Tang et al., 2015). Beginners had a more active, cognitive approach to emotional regulation in fMRI studies, which may contradict the lack of differences in mood and SDs in the results.

I hypothesized that my personal intervention, musical improvisation, would have similar effects to mindfulness meditation due to the similar areas (ACC, DLPFC, and mPFC) involved with improvisation (Limb & Braun, 2008). However, this was not supported by the higher standard deviations (which may be interpreted as mood fluctuations) and a slightly lower average mood score compared to control days. After collecting results I believe it was not well-informed

to assume a causal relationship between increased activity in regions associated with the intervention and other emotional functions of such regions; the activity in the ACC and DLPFC in fMRI studies can be explained by a greater need for attention and cognitive/motor abilities during improvisation. Experienced musical improvisors also had less activity in the lateral prefrontal cortex while less experienced musicians had more activity (Pinho et al. 2014), which demonstrates a need for comparative studies with more test subjects in order to establish any relationship between improvisation and mood.

Limitations: First, the fact every mood score was self-reported makes one subject's average mood scores susceptible to experimenter's bias. Since every participant was assigned the same log entailing the effectiveness of their own personal intervention, it is reasonable to suggest that participants would be more inclined to report greater differences in mood (along with other metrics of wellbeing recorded in the Google Forms) between control and intervention days for any given intervention. Every intervention, in particular the personal intervention, was not monitored and therefore subject to high variation in the time, manner, place, and duration in which the interventions were completed. The sample size was more than adequate, however it would be much more favorable to collect data among a less homogenized group (i.e. every participant was a college student attending a neuroscience and wellbeing class).

Regarding my own data collection, more trials of the same interventions across different weeks would be desired to form a well-supported conclusion. Additionally, I believe the duration of my own intervention was not long enough and that additional studies over a longer time span with musicians varied in experience with improvisation should be conducted to observe any possible changes in mood. There were around 240 different cases to observe the overall effects of different 1-to-2-week interventions on mood and wellbeing, so these changes are only

necessary at the individual level due to the several outside factors affecting mood throughout one person's week.

Conclusion:

The intervention with the greatest positive effect on my mood was exercise while the one with the least effect was musical improvisation. Throughout the class, there was less of a difference between average mood scores during the exercise intervention. I do not exercise as frequently as many of my peers, which can possibly explain my deviation from the class average. Exercise also has a strong neurological basis for producing and maintaining happiness compared to musical improvisation which needs to be further studied to produce any conclusions. Mindfulness meditation was subjectively the least enjoyable, however it may take more experience to produce the neurological effects in the studies. Overall, I will exercise more and observe my mood going forward and further study the neurological effects and substrates of various musical activities and wellbeing.

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