

Running Head: The Effects of Diet and Exercise on Anxiety and Depression

Annotated Bibliography:  
Analyzing the Effects of Diet and Exercise  
on Anxiety and Depression

1. Battaglia, C., Cagno, A. D., Fiorilli, G., Giombini, A., Borrione, P., Baralla, F., . . . Pigozzi, F. (2014). Participation in a 9-month selected physical exercise programme enhances psychological well-being in a prison population. *Criminal Behaviour and Mental Health*, 25(5), 343-354. doi:10.1002/cbm.1922

### Summary

The aims of this study were first, to test the effects that moderate to vigorous intensity exercise had on the affect of a prison sample, and second, to determine which of two different exercise protocols would influence affect the most, and in what dimensions. Participants had to be aged 18-50 years old, classified as need low to medium security, be detained for at least one year before entry into the study.

Participants were selected from the Italian prison of Larino (Campobasso), and consisted of 75 male inmates aged 18-50 years old. They were randomly assigned to one of three groups: Cardiovascular plus resistant training protocol (CRT), High-intensity strength training protocol (HIST), and a control group. The CRT protocol consisted of aerobic exercise alternated with resistance strength training, followed by some stretching and muscle relaxation. The HIST protocol consisted of cycling for warm-up, then anaerobic exercises alternated with maximal strength exercises and finally stretching and muscle relaxation. The control group used their leisure time however they wished, aside from physical exercise. To measure changes of level and dimension in affect, the researchers used the *Symptom Checklist-90-Revised* (SCL-90-R), which can be split into three global indexes: Global Severity Index (GSI), Positive Symptom Total, and Positive Symptom Distress Index.

This study found that engaging in supervised physical activity does have a positive effect on mental health and well-being in inmates. The most significant effects were found in the inmates that initially rated as mild to moderately depressed, which is consistent with prior research (Craft & Landers, 1997; Strohle, 2009). Between the two experimental conditions, the CRT protocol was more effective at improving several dimensions of mental well-being than the HIST protocol as measured by the SCL-90-R. While there were positive effects found for anxiety and depression, this study found no observable effects on aggression and hostility.

### Critique

One of the biggest downfalls this study had was its lack of diversity in the sample. The sample consisted entirely of men that were serving medium length prison sentences in a medium security prison, which can have problems with generalizability. It would be very interesting to see if these results would hold in other prison populations, such as females serving similar prison sentences, or testing this on short and long-term sentences for both genders.

This article had a very clear sense of organization to the structure and flow. Figure 1 of the paper is a chart detailing the steps between recruitment into the study to the very last assessment, including any attrition. The tables were structured in a very clear and easy-to-read manner, which lends well to beginning readers.

Finally, this study alone cannot state a distinct and specific relationship between physical exercise and mental well-being, but indicates that they do have a positive relationship. There are many factors that could be involved in the improvements observed in affect, such as a sense of

self-efficacy, mastery, or simply a distraction from their prison conditions. Further studies are required to determine the root causes of this.

2. Broman-Fulks, J. J., Kelso, K., & Zawilinski, L. (2015). Effects of a Single Bout of Aerobic Exercise Versus Resistance Training on Cognitive Vulnerabilities for Anxiety Disorders. *Cognitive Behaviour Therapy*, 44(4), 240-251. doi:10.1080/16506073.2015.1020448

### Summary

Broman-Fulks, Kelso, and Zawilinski (2015) looked at the relationship of a single bout of aerobic exercise and resistance training on anxiety sensitivity and CO<sub>2</sub> reactivity as measures of anxiety. This study evaluated the effects of exercise on known anxiety vulnerability factors, such as distress tolerance (DT), and discomfort intolerance (DI). It has been hypothesized that low DT and high DI increase vulnerability to anxiety-related problems due to perceptions that anxiety symptoms and sensations are overwhelming or uncontrollable, and this study aimed to reduce these perceptions through the use of physical exercise. Broman-Fulks et al. hypothesized that after a single session of exercise, participants would report decreases in anxiety sensitivity and CO<sub>2</sub> reactivity.

Seventy-seven participants met the inclusion criteria and agreed to participate. This sample was 60% female and 85% Caucasian. Before any testing began, participants were given a series of questionnaires consisting of the *Anxiety Sensitivity Index-3* (ASI-3), *Distress Tolerance Scale* (DTS), *Discomfort Intolerance Scale* (DIS), *State-Trait Anxiety Inventory-State Sub-scale* (STAI-S), and the *Physical Activity Readiness Questionnaire* (PAR-Q). Participants were all

fitted with a Polar heart monitor, and randomly assigned to one of three groups: aerobic exercise, resistance training, or rest. The aerobic exercise condition involved walking on a treadmill, and the resistance training condition involved being trained on proper form for three resistance exercises, and completing multiple repetitions of each exercise with weights. Participants in the rest condition were instructed to sit quietly in a chair for 20 minutes and were not permitted to engage in any activity during that time. Five minutes after completion of the assigned condition, participants completed the same initial questionnaire battery a second time and were instructed on the procedure for the CO<sub>2</sub> inhalation task. This task had participants inhale a 35% CO<sub>2</sub>/65% O<sub>2</sub> mixture and hold the mixture in their lungs for five seconds. Twenty seconds after the breath was let out, participants completed the *Acute Panic Inventory* (API) and the ASI-3 a third time.

This study found that individuals that engaged in a single session of aerobic exercise or resistance training reported greater decreases in ASI-3 scores from baseline to post-exercise than did individuals in the rest condition. It also found that aerobic exercise was significantly more effective in decreasing CO<sub>2</sub> reactivity than was resistance training. Though not statistically significant, participants in the resistance training condition did show lower rates of panic symptoms than did the participants in the rest condition. While this study did find a difference in scores from the experimental groups and the rest condition, these results were not statistically significant, indicating that at 5 minutes post-exercise, no significant change in anxiety sensitivity or CO<sub>2</sub> reactivity.

### Critique

This study conflicts with the majority of other studies in this topic in that there are no statistically significant results that indicate physical exercise decreases anxiety in any dimension. This could be due to the small amount of time elapsed from the end of the assigned condition and CO<sub>2</sub> inhalation task to the final assessment of anxiety levels. The researchers indicated that previous studies have shown the anxiolytic effect of exercise is slightly delayed, where the effects are observable at 30 minutes post-exercise, but not 5 minutes (Cox, Thomas & Davis, 2000). Future studies should take this delayed effect into account.

Something this study didn't do that would be valuable to the therapeutic community would be to analyze the difference in efficacy of exercise versus current established therapeutic methods (relaxation techniques, Cognitive Behavioral Therapy, etc). It would also be interesting to observe the CO<sub>2</sub> reactivity over a longitudinal study, as opposed to just one session as was observed in this study. Would participants that are exercising regularly (3-5 times per week) consistently score lower on CO<sub>2</sub> reactivity than would participants that aren't exercising regularly?

Finally, while this article has very interesting methods and findings, it was difficult to read. The formatting is unclear and it not presented in a reader-friendly manner. The wording is quite confusing, as the researchers use a lot of abbreviations for the different dimensions of anxiety and the questionnaires used without clearly distinguishing them. Results and findings were written in an unclear fashion, making it difficult to determine the final results of the study, including statistical significance.

3. Forsyth, A., Williams, P., & Deane, F. (2015). Physical activity, but not fitness level, is associated with depression in Australian adults. *The Journal of Sports Medicine and Physical Fitness*, 55(7-8), 845-854.

### Summary

This study aimed to measure fitness and physical activity and compare it to levels of anxiety and/or depression in Australian adults currently seeking treatment for their mental health. Forsyth, Williams, and Deane (2015) hypothesized that physical activity and fitness levels would be inversely related to levels of anxiety and depression.

General Practitioners (GP's) in the Illawarra Division in Australia referred adult patients that were currently seeking treatment for anxiety and/or depression who did not have any contraindications for physical exercise. Over a period of three years, 109 participants met the inclusion criteria and agreed to participate including 32 (29%) men and 77 (71%) women aged between 18 and 77 years old. Physical activity and fitness levels were measured using the *YMCA Step Test* (physical fitness) and the *Active Australia Survey* (physical activity). Physical fitness levels were compared to population norms, and activity was compared to the general population. Anxiety and depression were measured using the short form of the *Depression, Anxiety and Stress Scale* (DASS).

The final results indicate that there is not a correlation between physical fitness levels and DASS scores, but it did find that the correlation between physical activity and DASS scores was statistically significant, though only for the male participants. While there was a relationship between physical activity and DASS scores among women, it was rather small in magnitude,

indicating a need for further testing. There was also no significant difference between men and women on their aerobic fitness and muscular endurance levels as observed in this study. This means that in general (though more so for men), there is an inverse correlation between anxiety and depression levels and physical activity levels, but not fitness levels.

### Critique

The results of this study did not have a large significance to them: the scores for men on the DASS and the physical activity and fitness did have statistical significance, but not by a large margin. A correlation was noted in the female sample, but it was small and not statistically significant. These relationships found could be due to the fact that on average, women seek treatment for psychological conditions more often, so their baseline would have been different had they not sought out treatment. This would mean that the men that showed a statistically significant change might be using this as their only therapeutic activity, which would amplify the margin of effect.

The small margins noted in the correlations could also be due to the participants of this study indicating only mild anxiety and/or depression. The researchers note that the participants in their study showed lower levels of anxiety and depression than the participants in another similar study. These low levels could make it very difficult to see the actual strength of the correlation between physical activity and anxiety and/or depression symptoms.

Finally, this study relied on self-reports of levels of physical activity, and only one measure of physical fitness which may not be entirely accurate in recording participant activities. Future studies might benefit from utilizing multiple measures of physical fitness for more



accuracy in scores. However, accurately recording physical activity could be difficult, as participants must self-report to the best of their ability, or have a researcher follow them around for a week. One has issues with reliability, and the other would cost far too much for most studies in both man hours and monetary costs.

4. Forsyth, A., Deane, F. P., & Williams, P. (2015). A lifestyle intervention for primary care patients with depression and anxiety: A randomised controlled trial. *Psychiatry Research*, 230(2), 537-544. doi:10.1016/j.psychres.2015.10.001

### Summary

The aim of this study was to determine if an intervention focused on diet and exercise could ease anxiety and depression symptoms of patients currently seeking treatment for anxiety and depression. Forsyth, Deane, and Williams (2015) also looked at the impact of diet quality and nutrient intake on these symptoms. Forsyth et al. (2015) hypothesized that participation in the lifestyle intervention would decrease anxiety and depression as well as improve diet quality and nutrient intake as opposed to the participants in the attention control condition.

Over two years, 94 patients (26 male, 68 female), aged 18-84 years old were referred to the study by their General Practitioner, met the inclusion criteria, and agreed to participate. An initial assessment was conducted with all participants to obtain consent and baseline measures using the *Depression, Anxiety and Stress Scale (DASS-21)*, *Diet History Questionnaire*, and the *Australian Modified Healthy Eating Index (Aust-HEI)*. Participants were randomly assigned the lifestyle intervention, or the attention control condition. Both conditions lasted for a total of 12

weeks. The lifestyle intervention involved a series of meetings with a Dietitian/Exercise Physiologist (DEP) to discuss beliefs, motivations, and to create goals and homework assignments, address potential barriers in adherence to the lifestyle changes, and to provide professional advice on the best methods to enact a lifestyle change. Participants in the attention control condition were contacted via telephone by a DEP at similar intervals to the lifestyle intervention. These calls lasted approximately 5 minutes and the participants were asked if they had made any changes to their diet or physical activity, but were not provided with any advice. Following the 12 weeks, participants in the attention control condition were offered the lifestyle intervention as well.

This study found significant improvement of DASS scores for both the lifestyle intervention condition and the attention control condition, and the difference between the groups was not statistically significant. However, the lifestyle intervention condition was more efficient at improving diet quality, possibly due to the advice given in the sessions with a DEP. This is possibly because it is motivating to be held accountable for your actions to another person. The lifestyle intervention condition did improve the participant BMI and iron intake significantly; no other dietary factors were significant.

### Critique

It is not known if the diet quality and nutrition intake would improve the way it did in the lifestyle intervention condition if participants in the attention control condition were given dietary advice and support from a DEP over the phone. Since both conditions had equally efficacious results in improving overall anxiety and depression levels, it would be interesting to

see if providing advice to participants over the phone similar to the lifestyle intervention condition would yield better or similar results for diet quality.

Participants in the study who were referred to participate in this study were already seeking treatment from their GP or a psychiatrist, which could have impacted the results. The researchers indicate that the participants that reported continuing treatment with a psychiatrist showed less improvement than that participants that weren't seeking treatment. This could mean that those participants had more perceived barriers to treatment, or their baseline was shifted due to the ameliorative effects of therapy sessions.

The researchers indicate in the introduction that they also observed the impact of physical activity and fitness, but that was reported in another article. It is not obvious if the same participants in this study were also participating in a physical activity intervention of some sort, and this could impact the results and interpretations. The ambiguity of the specifics of the conditions for the participants makes interpretation of the results difficult.

5. Rebar, A. L., Faulkner, G., & Stanton, R. (2015). An exploratory study examining the core affect hypothesis of the anti-depressive and anxiolytic effects of physical activity. *Mental Health and Physical Activity*, 9, 55-58. doi:10.1016/j.mhpa.2015.10.001

### Summary

In this study, Rebar, Faulkner, and Stanton (2015) examine the effects of the core affect hypothesis in a sample of patients diagnosed with depressive and anxiety disorders. They define core affect as "...a neurophysiological state that is an integration of two dimensions: affective

valence ... and activation...". Valence is defined as a feeling of pleasantness or unpleasantness, and activation is defined as feelings of drowsiness or excitation. This core affect hypothesis states that physical activity can enhance both core affect dimensions in patients with depression, but enhance only one dimension in patients with anxiety.

This study measured a change in affect throughout sessions of aerobic and weight or resistance exercises. They recruited 28 participants (14 diagnosed with depressive disorders, 14 diagnosed with anxiety disorders) from an inpatient facility in Queensland, Australia. 23 of the participants were female. Participants selected the intensity for their exercise regimen to maximize feelings of autonomy, interest, and enjoyment. This exercise regimen consisted of two 20 minute sessions of aerobic exercise (on a stationary bike or treadmill) and 20 minutes of weight or resistance exercise per week. Affect was measured immediately before and after one session of the exercise regimen using the *Feeling Scale* (Hardy & Rejeski, 1989) and the *Felt Arousal Scale* (Svebak & Murgatroyd, 1985).

Rebar et al. (2015) found that 57.14% of the participants with depressive disorders ( $n = 8$ ) experienced an increase in valence, and 54.55% experienced an increase in activation. They found that 50% of the participants with anxiety disorders experienced an increase in valence, and only 35.71% experienced an increase in activation. The findings from this study indicate that sessions of combined aerobic and weight or resistance exercise can increase both valence and activation in people with depressive disorders, whereas these exercise sessions might only increase valence in people with anxiety disorders. These results are consistent with the core affect hypothesis, but more research is needed in order to fully explore these effects.

### Critique

While the findings of this study are very interesting, one weakness of it is the small sample size. A larger sample size in future studies could demonstrate a greater effect on affect through the exercise regimen, and will be more generalizable to the general population. The effects seen in this study may not generalize to the general population due to other confound variables such as self-efficacy, gender differences, or other factors due to all of these participants seeking inpatient treatment for diagnosed mental disorders.

The potential confound variable of all of these participants having already sought out inpatient treatment for anxiety and depressive disorders could have a great effect on the outcome of this study. As they underwent inpatient treatment for their disorders, their symptoms are generally more severe than the general population and thus exercise treatment may not be effective enough to see results. It also doesn't look at the effects of the core affect hypothesis on undiagnosed people with anxious and depressive symptoms, which could change the level of effect on valence and activation.

Finally, this study leaves a lot of room for future research to explore. First of all, more research into the core affect hypothesis should be done to observe the exact extent of influence exercise has on valence and activation in people with anxiety and depression. Future studies should also look to determine if affective responses to exercise sessions can accumulate into a chronic mental health state. This could potentially be a longitudinal study that assesses individual affect change between sessions as well as across a longer period of time, for example, 6 months to a year.

6. Smits, J. A., Zvolensky, M. J., Davis, M. L., Rosenfield, D., Marcus, B. H., Church, T. S., . . . Baird, S. O. (2016). The Efficacy of Vigorous-Intensity Exercise as an Aid to Smoking Cessation in Adults With High Anxiety Sensitivity. *Psychosomatic Medicine*, 78(3), 354-364. doi:10.1097/psy.0000000000000264

### Summary

This study aimed to examine the effects exercise has on reducing anxiety sensitivity and aiding smoking cessation. The researchers define “anxiety sensitivity” as a fear of anxiety-related sensations and feelings. It was hypothesized that participants assigned to an exercise and smoking cessation treatment condition would have lower levels of anxiety sensitivity and therefore would have more success in quitting smoking. This study lasted a total of 30 weeks with two 15-week halves.

Between January 2010 and July 2014, 136 participants were recruited, met inclusion criteria, and agreed to participate. Inclusion criteria: be a daily smoker, have elevated anxiety sensitivity (determined by their score on the *Anxiety Sensitivity Inventory* [ASI-16]), live a mostly sedentary lifestyle, and be motivated to quit smoking. Participants were given standard smoking cessation care and were randomly assigned to participate in a 15-week exercise protocol (ST+EX), or a 15-week wellness education control condition (ST+CTRL). The *Anxiety Sensitivity Index-3* was used from baseline to final assessment in lieu of the ASI-16. Participants were also assessed from pre-screen to final assessment using the *Inventory of Depression and Anxiety Symptoms* (IDAS).

All participants were given the standard smoking cessation care during weeks 1-15, and a quit attempt was scheduled for week 6. Both interventions consisted of three weekly sessions during the first 15 weeks of the study. Participants in the ST-EX condition exercised on treadmills for 30 minutes three times per week, while the participants in the ST-CTRL condition attended sessions aimed at wellness education at the same intervals. Treatment ended for the participants at week 16, and smoking abstinence was measured during weeks 16-30 using Point Prevalence Abstinence (PPA) and Prolonged Abstinence (PA) obtained from saliva samples.

Consistent with the hypothesis, participants in the ST-EX condition showed decreased levels of anxiety sensitivity and high rates of abstinence after the designated quit day. Participants in the ST-EX condition reported significantly lower anxiety and depression than did the participants in the ST-CTRL during the designated quit day. Participants with low levels of anxiety sensitivity, however, did not show the same levels of significance, which could mean that exercise may only be effective in lowering anxiety sensitivity in people with moderate to severe levels of anxiety.

### Critique

This study differs a bit from the other studies analyzed in this annotated bibliography, but it is still relevant to the general population because it demonstrates that exercise is anxiolytic and can help people struggling with anxiety to overcome their moderate to severe anxiety issues to participate in other tasks. This study shows that aerobic exercise can decrease anxiety sensitivity enough to where participants are able to quit smoking and stay abstinent.

The researchers discuss that other studies are fairly inconsistent in proving or disproving that exercise can be an effective tool in smoking cessation programs. What this study analyzes that others might not is the impact of anxiety sensitivity on the efficacy of a quit attempt. People with high levels of anxiety sensitivity have a difficult time coping with that fear, which forces them to keep smoking in order to maintain their mental health. Future studies could benefit from further analyzing the relationship between anxiety, anxiety sensitivity, and efficacy of a quit attempt for long term smokers.

Finally, this study was limited in that it didn't examine more than one potential anxiolytic activity. It would be interesting to observe the differences in efficacy between Cognitive Behavioral Therapy or certain psychotropic medications and exercise. There could be a stronger effect utilizing multiple methods at once in order to maximize the chances of a quit attempt being a success. Researchers looking to delve deeper into this topic should look at analyzing multiple anxiety treatments including exercise to see what works the best to assist with smoking cessation.



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