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## Literature Review and Proposal: Yoga as Group Exercise Involving Oxytocin Release for Positive Mood Improvement

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Spring 2018 Honors Project: "Literature Review and Proposal: Yoga as Group Exercise Involving Oxytocin Release for Positive Mood Improvement."

Rachel Fenton

Introduction

Yoga is a popular form of exercise often practiced in groups regardless of age or ability and is defined as a system of physical postures, combining stretching and other exercises with breathing and meditation that is shown to improve overall physical fitness, strength, flexibility and lung capacity, while reducing heart rate, blood pressure and back pain (Novotney, 2009, para. 1). There is a growing body of research documenting yoga's psychological benefits (Novotney, 2009, para. 2). There are several health benefits, including but not limited to increased mobility, enhanced flexibility, better perceived health, less anxiety, and reduced depression and stress (Ross, Friedmann, Bevens, & Thomas, 2013; Meissner, Cantell, Steiner, & Sanchez, 2016).

While there are studies on the self-reported benefits of yoga, there are few studies that address the physiological impacts of yoga, specifically the neurochemical changes that may occur because of yoga. It is well-established that endorphins are released during exercise (Harber & Sutton, 1984). There is, however, limited discussion regarding the relationship between oxytocin and exercise (Meeusen & De Meirleir, 1995). Oxytocin is a neurochemical produced in the hypothalamus released into the blood via pituitary gland or into other parts of the brain and spinal cord, where it binds to oxytocin receptors to influence behavior and physiology, such as maternal behavior, lactation, selective social bonding, and sexual pleasure (DeAngelis, 2008). Oxytocin release should be further investigated within group exercise, yoga specifically, as some

factors, such as interaction with the instructor and others in the class, may impact oxytocin release. The study of oxytocin during yoga may give insight to how and why the practice of yoga causes an increase in positive mood.

As stated previously, yoga is highly correlated with mental and physical health, evidenced by several types of studies, specifically survey research, experimentation, and observational research (Ross et. al 2013, AMCAS 2016). Interestingly, oxytocin is also released during social relationship situations (Dfarhud, Malmir, and Khanahmadi 2014). These findings are suggestive of a role for oxytocin in group exercise, specifically yoga. Given the relationship between yoga and positive mood, as well as the relationship between social relationships and oxytocin, it is reasonable to speculate a role for oxytocin in the positive health outcomes attributed to yoga. Consequently, I developed a proposal to determine the effects of yoga on oxytocin levels and self-reported mood.

### Yoga and Health

Ross, Friedmann, Bevans, & Thomas (2013) conducted an online survey of 4307 randomly selected yoga practitioners from 15 US Iyengar yoga studios throughout 41 different states to explore participants' health characteristics and responses to yoga and the effects yoga on their health. The results indicated that beliefs about yoga increased energy (84.5%), happiness (86.5%), and social relationships (67%). Moreover, the beliefs did not differ substantially according to race or gender (Ross, Friedmann, Bevans, & Thomas, 2013, 317-319). While there is evidence that yoga positively impacts health, many of the studies involve participants with limited experience with yoga, as opposed to individuals with long-term practice. Surveys were distributed that required participation of individuals who must have practiced yoga at least once a

week for at least two out of the past six months, either in home or in class. Likert scales were used to determine the levels of health and yoga practice, and analysis of the data included statistical inferential tests. Results of the surveys indicated a positive correlation level of practiced yoga and their perception of health, including general health, energy level, and happiness, as well as sleep, interpersonal relationships, weight, and diet. Increased amounts of yoga per week increased the belief that yoga improves overall health, sleep, energy, diet, weight, and interpersonal relationships. The health status (whether practitioners suffer/suffered from anxiety, depression, or other mental health issues) of the practitioners did not predict their beliefs about yoga and health. Additionally, gender, race, and age, and educational levels also did not seem to play a large role in predicting the beliefs. Though there were limitations and discrepancies that were possible due to the survey being online and lacking comparison groups, results indicated positive correlations between yoga home practice, years of yoga practice, frequency of yoga practice, and the belief in the positive impacts of yoga on health. Thus, those who practice yoga are more likely to display or perceive improvements in their health due to yoga.

In the discussion of self-perception of health characteristics and yoga, it is also important to understand the scientific evidence and support that yoga has a positive impact on health. Along with physical improvement in health, mental health improvement, such as positive mood increase, is also important to consider. Of the different forms of yoga, different types- including low-impact yoga- work in a non-competitive fashion and focus on both mental and physical health (Watson 2017). These factors may cause different results that need to be considered.

Rokka (2010) examined the study examining the effect that one session of a dance program, both high and moderate aerobic intensity, had on the mood of healthy adults, as well as

comparing these results to yoga, a lower intensity source of exercise. Non-competitive forms of dance are popular types of exercise (Rokka, 2010). The study was fueled by the idea that group aerobic exercise programs positively affect quality of life and mental health in those participating. Participants' moods were expected to improve because of the exercise, and a comparison between the difficulties was recorded and a determination was made on whether the level of difficulty, type of exercise, etc. altered the amount of improvement of the participants' mood. Rokka mentions the mood improvement in participants in a yoga class as well. The results of the study showed that negative feelings decreased in both groups, but the highest increase in mood positivity was in the high intensity group. This study shows while high intensity had the greatest impact on positive mood, group exercises of any intensity level will improve the overall mood of participants and decrease negativity, as well as encourage continued exercise and a healthier lifestyle. This supports the idea that yoga positively influences the mood of participants, which is consistent with participants' perceptions of the positive health benefits of yoga. Yoga and dance are group exercises. Interestingly, there was no discussion on whether there was an influence on mood due to this group setting.

Streeter (2010) compared the effectiveness of walking with yoga and other exercise on improving moods of individuals. Yoga is often used to decrease negative feelings—depression and anxiety symptoms to name a few—and increase the activity of the Gamma-aminobutyric acid (GABA) system. GABA is an inhibitory neurotransmitter with 18 subtypes of GABA-A receptors, up to 13 possible subunits, and GABA-B and GABA-C receptors that receive signals from chemicals in possible relation to anxiety and depression (Melichar, N.d.). The yoga poses during exercise seemed to cause the release, so the question developed was whether the increased mood came from yoga or exercise in general. Participants were chosen to either

complete 60-minute yoga or walking sessions for 12 weeks. Results showed that yoga had both a greater increase in positive mood and decrease in negative mood compared to walking, and the GABA system was further analyzed to determine specific levels of GABA released from each exercise. Streeter discusses the possibility of yoga impacting positive mood for reasons more than the metabolic requirements of the exercise. Another important note was the positive correlation that occurred between GABA levels and positive mood. The researchers speculated that parasympathetic nervous system activation may cause positive stimulation. Results showed that participants who engaged in yoga reported more positive feelings as compared to those who participated in walking. Based on the pattern of results, more research should be done involving GABA and improved mood.

The increase of positive mood and the decrease in negative mood, as well as the reduction in depression and anxiety that occurs during yoga as compared to walking, creates the possibility that yoga may release other “feel good” chemicals such as oxytocin, as compared to other exercises.

### Oxytocin

Romero et al. (2014) studied on the study of how the increase of oxytocin levels in dogs is related to their social interactions with other dogs and humans. Owners were told to sit in the room with their dog and remain quiet and inattentive. Results showed that dogs with lower initial oxytocin levels exhibited a stronger reaction when the owners started giving them attention than those with higher initial levels before being exposed to oxytocin. Dogs with lower initial oxytocin levels also exhibited a stronger reaction towards their owners than those in the placebo group not exposed to oxytocin at all. This showed the effect of released oxytocin in social

relationships—greater amounts of oxytocin were released when seeing the owner the dog had an established social relationship with, as compared to a constant level ever-present within the individual (Romero, 2014). There is a possibility that over time, since social relationships contribute to overall fitness of an organism, natural selection has adapted the neurological mechanisms to control and enhance their being (Romero 2014). As the dogs were more caring when their oxytocin levels were high, this suggests that high oxytocin levels may promote social interaction in platonic human relationships as well. It also mentions a two-way relationship between social behavior and oxytocin.

Dfarhud, Malmir, and Khanahmadi (2014) discussed the endogenous and exogenous factors involved in happiness in humans, focusing on five major sub-categories: genetics, brain and neurotransmitters (including oxytocin), endocrinology and hormones, morphology and physical attractiveness, and physical health. Oxytocin acts as a mechanism correlating happiness and social relations; by facilitating relationships with others and other positive social behaviors, it in turn causes happiness within an individual (Dfarhud, Malmir, & Khanahmadi, 2014, pg. 1473). Regarding the sub-category physical health, there was also a noted correlation between positive mood and better physical health. Dfarhud concludes that happiness is divided into endogenic and exogenic dimensions, of which brain and neurotransmitters and hormones are part of the endogenic dimension; oxytocin holds a role in happiness and mood regulation.

Erin Digitale (2014) reported two methods to measure oxytocin levels in the brain: an invasive procedure featuring a spinal tap to collect cerebrospinal fluid (CSF), and a safer, less intrusive blood draw to determine levels of oxytocin. Though there is not an exact match of blood and CSF results and the discussion of blood oxytocin levels in relation to brain levels remains controversial, blood draw is the safest and most logical way to obtain the information

needed for the study. Salivary collection is a third option but appears to be inaccurate in representing oxytocin levels in the brain, where blood draw and CSF collection provide a more accurate determination of oxytocin levels (Digitale, 2014).

Theoretical Rationale: filling in the gap

There are four main chemicals in the brain that promote positive feelings: endorphins, oxytocin, dopamine, and serotonin (Breuning, 2012). Focusing on oxytocin, this neurotransmitter is known to be present when positive feelings involving relationships occurs (Ross 2013). Dfarhud (2014) further explains this: “Oxytocin facilitates the relationship with others and is associated with positive social behaviors, so it assumes that related with happiness. While relationship has a strong effect on life satisfactory and there is a significant correlation between happiness and social relationship, the Oxytocin can be a mechanism that produces happiness through facilitating social relations” (pg. 1473). The discussion of the involvement of oxytocin-level increase in social relationships between the dogs and humans suggests that there may be involvement of this increase in human-to-human interaction as well (Romero 2014, Dfarhud 2014). There is no discussion of oxytocin in the research conducted by Ross (2013), Rokka (2010), or Streeter (2010) involving yoga, but the consistent improvement of mood because of yoga discussed in each suggests that there are more than solely endorphins contributing to this improvement. Yoga is a group exercise, and correlation of social relationships and happiness are highly relatable to this low impact type of group exercise, allowing for social relationships to develop. This creates an opportunity to discuss the relationship oxytocin may have with yoga.



## Personal Reflection

In the past two weeks, I attended two separate yoga sessions, one week apart. I was self-observant in relation to my mood throughout the period. In the beginning, according to the Positive and Negative Affect Schedule Scale (PANAS Scale) (Watson, Clark, & Tellegan, 1988), I had a higher negative affect score, as compared to my positive affect score. I can attest to this, as I had come from a fight with someone personally close to me. Descriptors of the PANAS Scale that were numbered high included “distressed,” “upset,” and “irritable.” As the yoga session began and my breathing was regulated during the poses, I still felt some of those negative descriptors, but could feel myself relaxing and focusing more on the exercise than what had upset me beforehand. By the end of the session, I was in no way “fixed”, but I felt genuinely less distressed and angry than when I walked into the room. Positive descriptors that I marked high included “proud,” “determined,” and “attentive.” My mind felt clearer and I went back home in what I perceived as a better mood than when I left. I feel as though yoga had a partial effect on my mood improvement. Distance between myself and the mood depressor, time elapsed after the conversation, and doing something to take my mind off the situation are also factors to consider. With a larger, randomized group and minimal bias, a survey involving the PANAS and Likert scales on mood throughout the session and a consideration of factors that influence mood can help determine whether the effects yoga may have on mood and health are due to exercise or group involvement.

## Proposal: Group Exercise and Mood Improvement

### Proposal Introduction

A study should be conducted to fill in the gap in the literature regarding a possible relationship between oxytocin and yoga. It is important to understand the involvement of oxytocin within the practice of Vinyasa Flow yoga, as it will help determine the possible role oxytocin may play regarding the impact of yoga to reduce stress, anxiety, and depression within its participants. Meissner (2016) states that improvement of affect, mindfulness, perceived stress, and arousal states can be seen in participants who are within clinical populations and are yoga-naïve and healthy. It is important to understand what factors, internally and externally, are causing these improvements. An understanding of self-care by practicing yoga can be supported or disconfirmed; if oxytocin levels are increased, there will be validation to the perceived-improved health benefits of yoga.

Stress within the United States is commonly linked to other diseases or disorders. According to the American Psychological Association (2012), 34% of the general population feels overwhelmed with stress levels of 5.2, and 61% and 55% suffering from depression and obesity feel overwhelmed with stress levels of 6.3 and 6.0, respectively. In 2012, 39% of adults reported that their stress had increased in the past year. Understanding how yoga may help reduce stress and improve mood may create further non-medicinal treatment options for those suffering from mild to severe stress or other stress-related diseases or disorders.

Pizer (2018) explains Vinyasa Flow yoga, which links movement with breath. In comparison to other forms of yoga, such as Hatha, which focus on one pose at a time, Vinyasa focuses on linking different poses together while maintaining proper breath. The rationale for

using this form of yoga is to allow for instructors to choose the poses that flow into each other. Each pose and transition between poses has modifications for simpler movement to account for participants who are older, less mobile or flexible, or may previously or presently suffer from injuries.

### Research Hypotheses

This proposed study will focus on levels of the oxytocin and self-reported mood before and after participating in yoga. It is hypothesized that participants who engage in a 45-minute yoga session will have an increase in positive self-reported mood, as compared to prior to conducting the yoga session as well as compared to a control group. It is also hypothesized that participants who engage in a 45-minute yoga session will have an increase in oxytocin levels due to yoga being conducted as a group exercise, as compared to their normal levels. This study will help support or deny the continuation of research in this area to determine whether the relationships and comradery within yoga is a contributing factor to the mood improvement seen after the sessions. This study will help support or deny the continuation of research regarding comradery within yoga as a contributing factor to the mood improvement seen after the sessions. This study will help to provide confirming or disconfirming evidence that oxytocin plays a role in exercise and is released to trigger positive feelings within individuals during the exercise. To date, there is no study linking oxytocin release and mood improvement in group exercise, specifically yoga. The expected results will be an increase in oxytocin levels, measured through blood draw, and a noticeable increase in self-reported mood through analysis of questionnaires.

## Participants

Participants will be recruited from yoga classes at the Bowling Green State University Recreational Center. Participants must be 18 years of age or older and willing to sign an informed consent form. The following demographic information will be collected: age, sex, health status, and yoga experience. The demographic information will be used to determine correlations between oxytocin levels, yoga experience levels, sex, and age.

## Materials

### *Positive and Negative Affect Schedule (PANAS) Scale*

The Positive and Negative Affect Schedule (PANAS) Scale is a well-validated measure of mood and is useful in clinical work (Crawford & Henry, 2004). In their study, 1,003 participants were given the PANAS as a non-clinical sample, resulting in only mild demographic influences and high reliability of the PANAS: “the pattern of relationships between the PANAS and the Depression Anxiety Stress Scales (DASS) and Hospital Anxiety and Depression Scale (HADS) were consistent with tripartite theory” (Crawford and Henry, 2004, pg. 245). The PANAS scale has also been verified in its ability to discern between the feelings of anxiety and depression, while the positive and negative scales stand independently. Given that the PANAS is a well-validated measure of mood, it is an appropriate measure of possible mood changes due to yoga.

The scoring instructions for the PANAS are as follows:

Positive Affect Score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 16, and 19.

Scores can range from 10 – 50, with higher scores representing higher levels of positive affect.

Mean Scores: Momentary = 29.7 ( $SD = 7.9$ ); Weekly = 33.3 ( $SD = 7.2$ ).

Negative Affect Score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20.

Scores can range from 10 – 50, with lower scores representing lower levels of negative affect.

Mean Score: Momentary = 14.8 ( $SD = 5.4$ ); Weekly = 17.4 ( $SD = 6.2$ ) (Watson, Clark, & Tellegan, 1988).

The PANAS will be given to several yoga classes each week for ten weeks to record results and determine mood changes throughout both the individual yoga sessions and the duration of ten weeks. Surveys will be analyzed through SPSS and results will be discussed afterward. The PANAS can be found in the appendix.

#### Procedure

Participants will be randomly assigned to participate in either group yoga sessions or individual yoga sessions. Yoga sessions will be taught in a basic or beginner Vinyasa Flow setting. This style of yoga focuses on the breath during poses and the flow of moving from one pose to another (Pizer 2018). Poses to be conducted during the sessions include cat-cow, tree, warrior I and II, frog, pigeon, bridge, child's, cobbler's, cobra, downward facing dog, extended side angle, garland, half forward bend, happy baby, head to knee, knees, chest, and chin, low lunge, mountain, plank, pyramid, seated forward bend, seated wide angle, staff, supine spinal twist, triangle, easy, and half lord of the fishes poses (Pizer 2018). Each session will end in corpse pose, commonly known as Savasana. These are beginner, low impact poses used to

increase mobility and flexibility while focusing on the breath (Pizer 2018). Each session will be held in the same location and taught by the same instructor for ten weeks. The yoga sessions will be conducted by an experienced yoga instructor certified through 200 Hour Yoga Teacher Training (YTT) to ensure proper instruction and minimal risk to participants. The group yoga sessions will occur once a week, with each session lasting 45 minutes. The individualized yoga sessions will occur for 45 minutes for ten weeks.

### Oxytocin Measurements

Oxytocin levels will be measured via blood draw. The blood draw will be collected after the sessions and analyzed to determine if levels of oxytocin are elevated above normal functioning levels after yoga is practiced. To determine this, participants will come in four weeks prior to the start of the ten-week yoga session each week to test their oxytocin levels to determine a control, or basal level of oxytocin level. Oxytocin levels will be measured at the end of each yoga session once a week for ten weeks.

Tabak, McCullough, Szeto, Mendez, & McCabe (2011) describe a procedure for blood draw and assessment. The laboratory task of blood draw will be conducted by a licensed phlebotomist, fitting consenting participants with a plastic intravenous catheter into their nondominant arm. Blood samples will be drawn into two 6 mL vacutainer tubes, the catheter remaining in each participant's arm for the remainder of the procedure. Ten minutes later, a second blood sample will be collected into one 6 mL tube. (Tabak, McCullough, Szeto, Mendez, & McCabe, 2011, pg. 4). After collection of blood samples, 0.38 mL of Aprotinin reagent will be added to each tube. The tube will be gently rocked, submerged into an ice bath, and centrifuged at four degrees Celcius and 1600 g for 20 minutes, within one hour. This plasma will be frozen at

–80 degrees until time of assay. Solid phase chromatography was used to extract plasma oxytocin from the samples. This plasma was assayed by radioimmunoassay (RIA) to determine oxytocin levels. Extracted plasma oxytocin levels via RIA are subject to low sensitivity (Tabak, McCullough, Szeto, Mendez, & McCabe, 2011, pg. 5). These samples will be extracted after each yoga session. The blood will be drawn at the Falcon Health Center. The blood will be kept on ice until assessment.

### Conclusion

The oxytocin measures and questionnaires proposed in this study will help us understand the possible impacts of yoga on mood, particularly relationships between oxytocin and group exercise. This may help develop forms of group exercise to assist or replace treatment for stress-caused or stress-related disorders, such as anxiety, depression, or simply improve a decreased mood.

Group Exercise (Yoga) Survey

The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988)

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word.

1. Indicate to what extent you felt this way prior to attending the yoga session

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

2. Indicate to what extent you felt this way during the yoga session

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid



3. Indicate to what extent you felt this way after completion of the yoga session

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

<p>_____ 1. Interested</p> <p>_____ 2. Distressed</p> <p>_____ 3. Excited</p> <p>_____ 4. Upset</p> <p>_____ 5. Strong</p> <p>_____ 6. Guilty</p> <p>_____ 7. Scared</p> <p>_____ 8. Hostile</p> <p>_____ 9. Enthusiastic</p> <p>_____ 10. Proud</p>	<p>_____ 11. Irritable</p> <p>_____ 12. Alert</p> <p>_____ 13. Ashamed</p> <p>_____ 14. Inspired</p> <p>_____ 15. Nervous</p> <p>_____ 16. Determined</p> <p>_____ 17. Attentive</p> <p>_____ 18. Jittery</p> <p>_____ 19. Active</p> <p>_____ 20. Afraid</p>
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4. Place an “X” on the scale regarding how interacting with others affected your mood.

5. Place an “X” on the scale regarding how conducting the poses affected your mood.

6. Place an “X” on the scale regarding the statement: “I feel accomplished at the end of the session.”

7. Did other specific factors of the group exercise make you more positively/negatively? If so, describe each factor and how it influenced your mood.

MANIPULATION CHECK

Please rate the degree to which you participated in today's session, with 1 being very little and 5 being very much.

1                      2                      3                      4                      5

Please rate the degree to which you interacted with other members of the group, with 1 being very little and 5 being very much

1                      2                      3                      4                      5

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