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Moderation Effect of Anxiety on the Relationship between Exercise and Self-Esteem

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List of Abbreviations

GSES: Global Self-esteem

STAI: State Trait Anxiety Inventory

PPA: Perceived Physical Ability

PSPP: Physical Self-Perception Profile

IPAQ: International Physical Activity Questionnaire

EXSEM: Exercise-Self-esteem Model developed by Sonstroem.

Abstract

Physical activity has been known to have a positive effect on self-esteem but not enough is known about the mechanism of change. The Exercise-Self-esteem model (EXSEM) postulates that this effect is mediated by physical indices such as physical self-perception and physical self-efficacy. However, there are no studies that include mood variables such as anxiety as possible moderator variables. The aim of this study was to test for a moderation effect of anxiety in the relationship between exercise and self-esteem while controlling for physical indices. One hundred and seventy five Lebanese adults (77 males, 98 females, Mean age: 26.87, Range: 19-35) were asked to complete five valid and reliable tests that measured global self-esteem (GSES), state trait anxiety (STAI), physical self-perception (PSPP), perceived physical ability (PPA) and physical activity (IPAQ). Results showed that men scored higher on all variables except STAI. Multiple regression analyses revealed that the variables predicted 74.1% of the scores on self-esteem with PPA, IPAQ and STAI being the only significant contributors. When STAI was removed from the regression equation the predictive value of PSPP, PPA and IPAQ decreased to 62.5%. These findings indicate that anxiety, as predicted, is a strong moderator between physical activity and global self-esteem and suggest the importance of non-physical factors in explaining the positive effects of physical activity. It seems clear that further research on the efficacy of different types of exercise in promoting self-esteem is called for.

Keywords: Self-esteem, Anxiety, Exercise, Physical activity, Moderation

Moderation Effect of Anxiety on the Relationship between Exercise and Self-Esteem

Exercise is a behavior that is as old as it is common across cultures. Exercise has been linked to a wide range of positive effects especially in the field of mental health. Exercise improves self-esteem and decreases symptoms of anxiety in addition to improving physical self-esteem and physical self-efficacy. Exercise's positive effect on self-esteem has been of interest to researchers who study self-esteem and researchers who study exercise behavior alike. Analysis of studies that were done in the last two decades has revealed a consistent positive effect of exercise on self-esteem. Several variables have been suggested as moderator or mediator variables in the exercise self-esteem relationships; namely physical self-esteem, physical self-efficacy and physical self-acceptance. Subsequent research, with a few exceptions, has supported the moderation effect of the three variables on self-esteem which led to the development of the exercise-self-esteem (EXSEM) model. The EXSEM model theorizes that the positive effect of exercise on self-esteem is due to improvements in physical self-efficacy and physical self-perception. Despite adequate support for the EXSEM model the researcher hypothesizes that mood factors, namely anxiety, could be a strong moderator variable in the exercise self-esteem relationship. The following study serves to investigate the acute beneficial effect of exercise on self-esteem while controlling for factors such as age, gender, perceived physical ability, physical self-perception and anxiety. This study also tests for the moderation effect of anxiety on the exercise self-esteem relationship. The effects of exercise in decreasing anxiety and how that decrease in anxiety may contribute to improving self-esteem will be discussed followed by a comprehensive theoretical framework for the effect of exercise on self-esteem.

Background of the Study

Exercise has long been recognized as a requirement for a healthy lifestyle. The American Heart Association recommends at least 150 minutes of moderate exercise per week to prevent heart disease and stroke ("American Heart Associating Recommendations, 2013). Nutritionists commonly recommend daily exercise to better physical fitness in general. Although anecdotal evidence for the beneficial effects of exercise on mental health has been present since the beginning of history it was only in the last three decades that the fields of psychology and psychiatry have begun to study its effects more closely. Since that time, a plethora of studies confirming the benefits of exercise on mental health have been published. Despite the overwhelming evidence for the health promoting effects of exercise, the prevalence of obesity which correlates negatively with physical activity is 26.1 % among Lebanese adults (Chamieh, M. C., Moore, H. J., Summerbell, C., Tamim, H., Sibai, A. M., & Hwalla, N., 2015). To that extent more effort should be put into understanding exercise behavior more fully and also promoting this healthy habit.

"Exercise and mental health" has been the subject of many recent studies (Martinsen, 2008; De Moor et al, 2006; Eyre et al, 2013). In a meta-analysis done in 2006, Petruzello and his colleagues have found that people who exercise for a duration of more than 21 minutes experience reductions in feelings of anxiety (Petruzzello, S. J., Landers, D. M., Hatfield, B. D., Kubitz, K. A., & Salazar, W. 1991). In addition to being a preventive measure for a number of mood disorders, exercise also matches the efficacy of current antidepressant medications such as the SSRI sertraline in treating major depression (Blumenthal et al, 1999). A number of mental health clinics have begun incorporating exercise in their clinical setting. In her book, Working it Out: Using Exercise in Psychotherapy, psychotherapist Dr. Kate F. Hays has advised psychotherapists to include exercise in their therapy approach (Hays, K. F., 1999). She

discovered that a lot of patients benefit greatly from a single bout of exercise (Hays, K. F., 1999). Exercise helped her patients open up and deal with their issues more effectively (Hays, K. F., 1999). Dr. John Ratey also discusses the effect of exercise on the brain in his book Spark: The Revolutionary Science of Exercise and the Brain. He talks about a school in Naperville USA that has a complete and advanced PE program. Students attend a half hour PE session every morning in which they are graded on how much they can raise their heart rate during exercise. Those students ranked among the top students in the country in academics (Ratley & Hagerman, 2008). Ratley claims that exercise improves cognitive functioning, and acts as a preventive measure against depression and anxiety (Ratley & Hagerman, 2008). He proposes that exercise's therapeutic effects on the brain are similar to the effects of stress inoculation therapy which prepares people to become resistant to the effects of stressors in a manner similar to how a vaccination works to make patients resistant to the effects of particular diseases (Ratley & Hagerman, 2008). According to the theory, exercise acts as a kind of condensed stress on the brain which allows the brain to become more resilient. According to Ratley, the benefits of exercise are ubiquitous and ranges from dealing with anxiety, depression, premenstrual syndrome to alleviating symptoms of ADHD and cognitive decline that comes with ageing. (Ratley & Hagerman, 2008)

Among the beneficial effects of exercise, one has been of great interest to mental health researchers; the effect of exercise on self-esteem. According to Dr. Morris Rosenberg, a pioneer in self-esteem research and the developer of the Rosenberg Self-Esteem Scale, self-esteem is described as one's evaluative judgment of the self (Rosenberg, M., 1965). Self-esteem is an important concept because of its predictive value on several factors such as happiness (Baumeister, R. F.; Campbell, J. D.; Krueger, J. I.; Vohs, K. D., 2003) and academic

achievement (Marsh, 1990). High self-esteem prospectively predicts success in life domains such as relationships, work, and health (Orth & Robins, 2014).

Exercise has been consistently shown to increase global self-esteem among different population groups (Mcphie & Rawana, 2012; Levy & Ebbek, 2005; Mcauley et al, 2000; White, K., Kendrick, T., & Yardley, L., 2009). Researchers have suggested several theories to explain how the increase in self-esteem is achieved. Sonstroem and Morgan proposed a model that hypothesized that exercise-induced changes in global esteem are mediated by changes in physical self-efficacy and physical self-esteem which are a result of improvements in physical fitness (Sonstroem, R. J., & Morgan, W. P., 1989). Sonstroem and Morgan administered the Physical Self Perception Profile which theorizes that global self-esteem is related physical self-worth or self-esteem which is how one evaluates his/her physical attributes and strengths (Sonstroem, R. J., Speliotis, E. D., & Fava, J. L., 1992). Some support has been provided for their model (see ex. Haugen, 2011) but certain elements of the model such as the relationship between self-efficacy and global self-esteem was not corroborated by Levy and Ebbek's study on self-esteem and exercise in adult women. Another model proposed by Stathopoulo suggests that reduction in the stress hormone cortisol could play a major part in enhancing self-esteem (Stathopoulou et al, 2006). His model was supported by evidence from studies measuring the physiological and neuroendocrine differences between exercisers and non-exercisers (Broocks, A., 1999). Other studies stemming from self-determination theory posits that true self-esteem is closely related to positive mental health and well-being and is dependent on meeting and balancing three fundamental needs: autonomy, relatedness, and competence (Faulkner & Carless, 2006). Contingent self-esteem on the other hand is based on a fragile insecure sense of self and it relates to low levels of psychological well-being (Faulkner & Carless, 2006). What is of interest

to self-determination theory is that competence, autonomy and relatedness are common reported outcomes of exercise behavior (Faulkner & Carless, 2006). In any case, Sonstroem's exercise-self-esteem (EXSEM) model has been and still remains the most predominant theoretical framework to explain the effect of exercise on self-esteem.

Research linking exercise, affective variables such as mood, anxiety, depression and stress to self-esteem has been unusually scarce considering the relationship between self-esteem and anxiety and exercise has been well established (Mustafa, S., Melonashi, E., Shkembi, F., Besimi, K., & Fanaj, N., 2015). According to Sonstroem's EXSEM theory, exercise increases self-esteem through increasing fitness/body image/physical competence etc which in turn could improve affective variables such as depression and anxiety (Sonstroem, R. J., & Morgan, W. P., 1989). In other words, they claim that self-esteem comes first and change in mood follows.. Despite their claim, they were unable to empirically show an unequivocal temporal relationship between anxiety/depression and self-esteem. A recent longitudinal study revealed that scores that measure depressive symptoms such as negative affect and positive affect were the 1st to change and then were followed by improvements in self-esteem (White et al, 2009). This conclusion is supported by a plethora of studies that have shown that a single bout of exercise immediately improved scores on mood tests such as POMS and others and on state anxiety (Yeung, 1996; Arent, S., Landers, M., & Etnier, J. L., 2000). Since self-esteem is strongly correlated with factors such as anxiety and depression, it makes sense to conclude that exercise improves mood which improves self-esteem. In other words, the change in mood can happen at a much faster rate than a change in global self-esteem.

Hypotheses

This study will investigate if exercise yields a positive contribution to global self-esteem and if anxiety can be a moderator variable in the relationship between exercise and global self-esteem. Other moderators such as physical self-perception and perceived physical activity will be measured as possible moderator variables complementary to anxiety. Gender and age will be controlled for.

Hypothesis 1: There is a positive correlation between physical activity and global self-esteem.

Hypothesis 2: There is a positive correlation between physical activity and physical self-worth.

Hypothesis 3: There is a positive correlation between physical activity and perceived physical ability.

Hypothesis 4: There is a negative correlation between physical activity and anxiety.

Hypothesis 5: There is a negative correlation between anxiety and global self-esteem.

Hypothesis 6: Anxiety is a significant moderator variable between physical activity and global self-esteem.

Purpose of this Study

Improvements in self-esteem through exercise are commonly explained using concepts such as improvements in fitness and body image and physical self-esteem. The mood factor that is enhanced during exercise is largely ignored when seeking to explain the improvement in self-esteem. This paper serves to highlight the relationship between exercise, anxiety and self-esteem and shed light upon an interaction that is seldom researched in the extant literature. In addition, it serves to clarify the ways in which the beneficial effects of exercise are achieved.

Professional Significance of the Study

Numerous studies have expanded on exercise's benefits. Exercise has at times outmatched standard antidepressants in the treatment of depression (see ex: Blumenthal et al, 1999) State and trait anxiety have been successfully treated with an aerobic exercise program (Broman-Fulks & Storey, 2008). Exercisers have consistently performed better on cognitive tasks (Chang, Y., Labban, J., Gapin, J., & Etnier, J., 2012). Exercise significantly improved sleep among people with chronic insomnia (Passos, G., Poyares, D., Santana, M., Tufik, S., & Mello, M., 2012). Given its potential to be the treatment of choice for a lot of clinical symptoms of various ailments, it is only natural that it has spurred the interest of psychotherapists. Today many therapists are engaging their clients in physical exercise (Hays, K. F., 1999). Clinicians are either exercising with their clients, (walking while talking) or prescribing exercise to be done outside the clinical setting or doing exercise in the clinical setting before sessions (Hays, K. F., 1999). Various books have been published that help therapists incorporate exercise into their practice (Hays, K. F., 1999; Ratley & Hagerman, 2008).

Methodology

The study was a quantitative correlational design. Five tests were handed out to university students from random universities. Soft copies were issued by mail to participants who were interested in being a part of the study. I used the State Trait Anxiety Inventory (STAI) to measure state and trait anxiety. Although it can be used to screen for anxiety disorders it is also a useful tool to measure general distress. As a measure of global self-esteem, I used the Rosenberg Self Esteem Scale. It is the most widely used measure of global self-esteem. I measured exercise using the Global Physical Activity Questionnaire (GPAQ). It is a reliable and acceptable measure of physical activity (Armstrong, T., & Bull, F., 2006). Physical Self Perception Profile was used

to measure physical self-esteem. Perceived physical ability was measured by Ryckman's PPA subscale of Ryckman's Physical Self-Efficacy Scale.

Delimitations:

The sample size was based on convenience. Generalizability of the research results despite the strong effect sizes is weak due to convenience sampling and the high likelihood of bias and sampling error. The researcher has made sure to only choose participants with adequate proficiency in the English language; however, the researcher cannot claim that this condition was met with all the tests taken since he was not the sole distributor of those tests.

Definitions

- Physical exercise: Physical exercise is an activity that raises metabolic energy expenditure. It involves using skeletal muscles and raising the heart rate and burning calories. (World Health Organization, 2002)
- Anxiety: According to APA's Encyclopedia of Psychology, Anxiety is an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure. People with anxiety disorders usually have recurring intrusive thoughts or concerns. They may avoid certain situations out of worry. They may also have physical symptoms such as sweating, trembling, dizziness or a rapid heartbeat (Kazdin, 2000).
- Self-esteem: According to Oxford Handbook of Positive Psychology, self-esteem reflects a person's overall subjective emotional evaluation of his or her own worth (Hewit, 2009). Self-esteem encompasses beliefs and emotions such as triumph, despair, pride, and shame (Hewit, 2009). Self-esteem refers to people's representations of their typical, or general,

global feelings of self-worth and self-esteem level reflects people's representations of how they typically feel about themselves across time and context (Rosenberg, 1986)

- Physical Self-Perception: A person's evaluation of their physical self, including evaluations of both physical appearance and physical competencies (Livingstone, 2008). It is measured using the Physical Self-Perception Profile.
- Perceived Physical Ability: A measure of strength, agility, reflexes and physical condition.
- EXSEM Model: A hierarchical model of self-esteem that explains the effect of exercise on self-esteem through mediators such as physical self-efficacy, physical self-perception and physical acceptance.
- Scar Model of Self-Esteem: A model of self-esteem that explains the effect of psychopathology on self-esteem. The model postulates that anxious and depressive symptoms erode self-esteem with time.
- Vulnerability Model of Self-Esteem: A model of self-esteem that asserts that low self-esteem makes a person vulnerable to anxiety and depression with time.

Review of the Literature

Exercise as a concept has been present in all cultures, tribes and civilizations. Each culture had a certain sport that is attributed to them. The Olympic Games held in ancient Greece is a festival that includes athletic sports in addition to combat sports, wrestling and horse and chariot racing. It is carried out every four years to honor the god Zeus and this tradition has continued to this day (Burkert, Walter, 1983). Ancient sports were not confined to Greece but were present in Sumerian, Egyptian, Mayan civilizations to name a few. (Wuest, D.A., Bucher, C.A., 1995; Green, P., 1989)

In addition to being an enjoyable sport, exercise or physical exertion was a necessity for the survival of many human entities. Hunting and gathering required an effort that is considered colossal by today's standards. A hunter would typically walk 16 kilometers a day on a rough terrain while carrying food and water for survival. (Eaton, S.B., Shostak, M., and Konner, M., 1988) An effort that is considered colossal by today's standard. Today, that kind of effort is only exerted by athletes.

The change in energy expenditure is a very probable cause for many of today's physiological ailments. Obesity, Type 2 diabetes and cardiovascular disease are all linked to a sedentary lifestyle. (Booth, F. W., Roberts, C. K., & Laye, M. J., 2012, April). However, if we were to follow the old adage "a healthy body in a healthy mind" we would have to consider the effects of our sedentary lifestyle on the brain, behavior and psychological well-being.

The anecdotal evidence for the effect of exercise or physical exertion on mental health is many. But recently a plethora of studies documenting the positive effects of exercise have emerged. However, since exercise or physical activity is a relatively novel interest among researchers it is necessary to start in the beginning and to well define what constitutes physical activity.

Physical exercise is an activity that raises metabolic energy expenditure. It involves using skeletal muscles and raising the heart rate and burning calories. (World Health Organization, 2002) There exist many forms of exercise that are of interest to researchers. Acute physical exercise is differentiated from chronic physical exercise in that the former is a single bout of exercise whereas the latter is a repetition of bouts of exercise that lasts from weeks to years (Audiffren et al., 2007a). Another distinction is also made between aerobic or endurance training and anaerobic or strength training. Anaerobic exercise refers to very brief and intense exercise such as weightlifting or a 100 meter sprint whereas Aerobic exercise refers to constant physical exertion for an extended period of time such as jogging, swimming, cycling or marathon running (Audiffren et al., 2007a).

Since a high level of physical activity was the norm among our paleolithic ancestors the argument can be made that many of our health problems are the result of us diverging from the norm. Ischemic heart disease for example, is the leading cause of death worldwide, killing 7.4 million people in 2012 (World Health Organization, 2014) One of the primary causes for heart disease is obesity and a sedentary lifestyle. (World Health Organization, 2014) However, exercise helps improve heart health, and can even reverse some heart disease risk factors. People who maintain an active lifestyle have a 45% lower risk of developing heart disease than do sedentary people. (Navin Kumar, Sanesh Kumari, 2015)

Just as our heart suffers from our relatively newfound sedentary lifestyle so does our brain. Depression is a common mental disorder with a global estimate of 350 million people of all ages suffering from it according to the World Health Organization Fact Sheet (World Health Organization, 2014). Lebanon is ranked among the top ten. Despite the lack of official statistics depression rates are on the rise according to well renowned Lebanese psychiatrists (Salhani, J.,

2014). According to an article in 2011 by the daily journal "Daily Star", there is a rise in consumption of psychiatric medication as the Lebanese opt for a quick treatment instead of long term psychotherapy (Anderson, B., 2011). Psychiatric medications in turn have many side effects and often increase suicidal tendencies (Jick, M. H., 2004). However, exercise as a treatment for depression has yielded positive results (see ex: Blumenthal et al, 1999). According to Blumenthal and colleagues exercise combines the speedy action of psychiatric medication but without its side effects (Blumenthal et al, 1999) A meta-analysis done in 2016 by Kvam and colleagues (2016) have found that exercise therapy is an effective intervention for unipolar depression and can also be used as an adjunct to medication (Kvam, S., Kleppe, C. L., Nordhus, I. H., & Hovland, A., 2016). They also concluded that exercise therapy yields comparable results to psychotherapy and antidepressants for depression (Kvam et al, 2016)

In addition to being used as a therapy intervention for patients diagnosed with depression exercise also benefits non-clinical populations (Yeung, 1996). A study done by Robert Yeung (1996) documenting the acute mood effects of single sessions of exercise has found that both clinical and nonclinical populations can benefit from a single bout of exercise. (Yeung, 2016) Mood differs from other affective variables in that mood is a transient state whereas other affective variables such as anxiety and depression are more lasting. (Yeung, 2016) Mood is usually measured using Profile of Mood States (POMS) questionnaire immediately after the exercise session. (Yeung, 2016) POMS contains six subscales; tension-anxiety, depression, anger-hostility, vigor-activity, fatigue, confusion-bewilderment (Shacham, S., 1983).

The positive psychological effects of exercise also include decrease in feelings of anxiety among clinical and non-clinical populations (Broman-Fulks, J. J., & Storey, K. M., 2008; Petruzello et al, 1991; Moor, M. D., Beem, A., Stubbe, J., Boomsma, D., & Geus, E. D., 2006).

An extensive body of literature on that subject has been accumulated in the last 40 years. In 2015 a meta-analysis of the randomized controlled trials of the last 25 years was done on 36 randomized control trials to test for the effect of acute exercise on state anxiety. (Ensari, I., Greenlee, T. A., Motl, R. W., & Petruzzello, S. J., 2015) The meta-analysis found a significant positive effect of acute exercise on anxiety levels (Ensari et al, 2015). These findings also extend to chronic exercise and acute exercise (Ensari et al, 2015)

Additional evidence for the contribution of exercise to lowering anxiety levels comes from a large population based longitudinal study by Moor and his colleagues. Participants in the study were adult and adolescent twins and their families. The results revealed that participants who exercised often were in general less anxious, less depressed, more extraverted and less neurotic (Moor et al, 2016)

In an effort to investigate the effect of exercise on childhood PTSD, anxiety and depression, an exercise program was prescribed for 15 female residents of a treatment center for PTSD patients aged between 14 and 17 (Newman, C. L., & Motta, R. W., 2007) The participants engaged in 40 minutes of aerobic exercise, three times a week for a period of eight weeks. Results of this study provided support for the positive effects of aerobic exercise on reducing PTSD, depression, and anxiety (Newman, C. L., & Motta, R. W., 2007).

In a literary review of studies accumulated from 1990 to 1998, Salmon has found that the results of cross-sectional and longitudinal studies are consistent in indicating that aerobic exercise training has antidepressant and anxiolytic effects and protects against harmful consequences of stress (Salmon P., 2001). It also offers a specific psychological treatment that may be particularly effective for patients for whom conventional psychological interventions are less acceptable (Salmon, P., 2001).

In addition to its effect on anxiety, it has long been established that exercise has a positive effect on global self-esteem (Sonstroem, R. J., & Morgan, W. P., 1989; Elavsky, S., 2010; Ekeland, E., 2005; Mustafa, S., Melonashi, E., Shkembi, F., Besimi, K., & Fanaj, N., 2015). A cross-sectional study done in Germany by Kirkcaldy and colleagues on 988 students found that regular involvement in endurance sports or activities was connected to an improved self-image and better psychological well-being than their less active counterparts. (Kirkcaldy et al, 2002) In a review by Martin Rasmussen and Karin Laumann the effect of exercise on psychological variables such as self-esteem in children and adolescents were measured (Rasmussen, M., & Laumann, K., 2013). According to the review which cited longitudinal and cross-sectional studies, exercise contributes positively to self-esteem. (Rasmussen, M., & Laumann, K., 2013).

Since exercise's effect includes improvement in self-esteem the natural question to ask is how this effect comes about. Self-esteem is a very global cognitive evaluation of the self and exercise is not an intervention that works directly on thoughts. The effects of exercise on a variety of psychological attributes lead us to consider the existence of mediating and moderating variables. Research on this subject has led to proposals of models that explain the relationship between self-esteem and exercise.

Robert J Sonstroem is one of the leading researchers in the relationship between exercise and self-esteem. Sonstroem postulates that exercise's effects on global self-esteem are mediated by physical self-efficacy, physical competence and physical acceptance (Sonstroem, R. J., & Morgan, W. P., 1989). According to Sonstroem (1989), exercise improves physical self-efficacy which in turn improves physical competence which leads to physical acceptance (Sonstroem, R. J., & Morgan, W. P., 1989). Both physical acceptance and physical competence improve global

self-esteem (Sonstroem, R. J., & Morgan, W. P., 1989). Physical self-efficacy represents judgment of competence and mastery of a particular sport or skill (walking, cycling, weight training or mountain climbing) (Ryckman, R. M., Robbins, M. A., Thornton, B., & Cantrell, P., 1982). Physical competence is the general evaluation of the self in overall physical fitness and its components include sports competence, physical condition, attractive body and physical strength (Fox, K. R., & Corbin, C. B., 1989). Physical acceptance is measured by the Body Cathexis Scale which is defined as the degree of feeling satisfaction or dissatisfaction with various parts of processes of the body (Secord, P. F., & Jourard, S. M., 1953).

Sonstroem's EXSEM model has received support from many studies. (McAuley, E., Blissmer, B., Katula, J., Duncan, T. E., & Mihalko, S. L., 2000; Haugen, T., Säfvenbom, R., & Ommundsen, Y., 2011; Kirkcaldy, B. D., Shephard, R. J., & Siefen, R. G., 2002) A randomized control trial measured the growth and form of multidimensional self-esteem over a 12 months period in 174 older adults engaging in either a walking or stretching/toning program (McAuley et al, 2000). Changes in physical fitness and physical self-efficacy were related to changes in perceptions of attractive body, strength and physical conditioning and overall physical self-worth (McAuley et al, 2000). Positive changes in global self-esteem were determined upon completion of the program and a decrease in self-esteem was reported in both groups six months after the intervention (McAuley et al, 2000).

Another study by Haugen and his colleagues aimed at investigating the mediating influences of body areas satisfaction, appearance evaluation and physical competence in the relationship between physical activity and global self-esteem (Haugen et al, 2011). This cross-sectional study that was carried out on 2055 Norwegian adolescents revealed that the three

factors were unique mediators in the positive relationship between physical activity and global self-esteem (Haugen et al, 2011).

Another Swedish longitudinal study done between 2000 and 2003 found a significant connection between physical self-esteem and exercise in girls and physical self-esteem and body mass index (BMI) in boys (Raustorp, A., Mattsson, E., Svensson, K., & Ståhle, A., 2006).

The results of the studies mentioned lend further support to the EXSEM model which explains the global self-esteem-exercise relationship through physical indices.

The importance of the model lies 1st in the temporal classification of the three components to global self-esteem. Following an exercise intervention, physical efficacy is the 1st to improve followed by physical competence and acceptance followed by improvements in global self-esteem (Sonstroem, R. J., & Morgan, W. P., 1989). The model's 2nd important point and that which is more relevant to my study is that the primary mediator of the relationship between exercise and self-esteem are primarily physical in nature and any improvement in mood measures are secondary or are a result of the improvement in self-esteem (Sonstroem, R. J., & Morgan, W. P., 1989). The theory that self-esteem influences anxiety levels has been coined the "Vulnerability Model" which states that low self-esteem makes the person vulnerable to anxiety or depressive symptoms with time.

Despite the empirical support for Sonstroem's EXSEM model this 2nd point could be challenged.

The first argument against the primacy of physical factors in explaining global self-esteem improvement is that there are no studies that include anxiety or mood factors as moderators or mediators between exercise and self-esteem. A search on Academic Search Complete, Education Research Complete, ERIC, PsycARTICLES and PsycINFO with the

keywords Physical Exercise AND Self-Esteem, AND Anxiety OR Mood OR Affect revealed that there were no empirical studies that attempted to explain the relationship between exercise and self-esteem with mood variables such as depression and anxiety. One possible reason for why anxiety was disregarded as a moderating factor was that self-esteem was used as a predictor of anxiety and affective variables and not vice versa. However, it is more likely that anxiety has a predictive value on self-esteem and several studies have provided evidence for that interaction. Two models attempt to explain the relationship between self-esteem and anxiety or depression. The vulnerability model of self-esteem states that low self-esteem contributes to anxiety and depression whereas the scar model of self-esteem assumes that low self-esteem is a consequence of psychopathology (Steiger, A. E., Fend, H. A., & Allemand, M., 2015).. Evidence for the scar model comes from a study by Sowislo and Orth's meta-analysis of 77 longitudinal studies, the researchers which has found that anxiety erodes self-esteem with time (Sowislo, J. F., & Orth, U.,2013). According to Sowislo and Orth, the possible mediators between anxiety/depression and low self-esteem are rumination behavior and the constant need for self-assurance (Sowislo, J. F., & Orth, U., 2013). The vulnerability model and the scar model are not mutually exclusive. It is possible that both processes may operate in a reciprocal manner such that low self-esteem can contribute to psychopathology at the same time that psychopathology can erode self-esteem (Coyne, J. C., & Calarco, M. M., 1995).

Another possible reason for the absence of studies that use exercise's effect on anxiety to predict self-esteem is the division among variables that deal with physical effects on one hand and with variables that deal with the self and mood on the other. The link between mood variables and self-esteem variables is well established in the extant literature whereas links on the effect of physical variables on self-esteem through mood are significantly less. Due to the

popularity of the exercise-self-esteem model (EXSEM) researchers build on his model when attempting to explain the effect of exercise on self-esteem. Physical indices are more likely to be included as moderator variables because a theoretical model is present to back their inclusion, in addition to a body of research that supports their significant role as moderator variables in the exercise: self-esteem relationship

The second argument against the EXSEM model is that although physical self-esteem is undoubtedly an important mediator variable in the self-esteem exercise relationship, it is difficult to determine a defining mediating factor when measuring the improvement in self-esteem due to anxiety reduction especially when using a cross sectional design. A longitudinal design is better suited for such purpose. Unfortunately, the longitudinal design studies that were done on the subject did not include mood variables along with physical indices in their list of possible mediating variables. However, a partial answer to this question comes from a longitudinal study done by white and colleagues with the purpose of examining the change in self-esteem, self-efficacy and mood dimensions of depression as potential mediators of the physical activity and depression relationship (white et al, 2009).

The study included thirty nine individuals with anxiety symptoms who were given an exercise program to follow for an eight week period. Measures of depression, self-esteem, self-efficacy, physical self-perception, negative affect and positive affect were taken at the start of the study and after one week, three weeks and eight weeks. What was of interest to the researchers was the temporal relationship of the mediating variables between exercise and depression (White et al, 2009). The results of the study showed an improvement in depression scores and positive and negative affect starting from week 1(White et al, 2009). Improvements in physical self-perception did not occur until week three and continued improving until the end of

the study (White et al, 2009). Since change in affect occurred before change in physical self-esteem, therefore positive and negative affect were more probable mediating factors in the exercise depression relationship than changes in self-perception and self-efficacy.

This study is not completely relevant to my study since it does not attempt to explain the exercise/self-esteem relationship but the exercise/depression relationship through self-esteem as a mediating factor. However what is relevant to my study is that the results reveal a direct relationship between exercise and mood factors such as negative affect and positive affect and more importantly that those mood factors were the first to occur followed by changes in physical self-esteem and self-perception. Exercise had a positive effect on positive affect and negative affect which is independent of the improvement in physical self-esteem variables. This insight into the temporal change that occurs after exercise leads us to the possibility that a decrease in anxiety could be a moderator variable in the relationship between exercise and self-esteem.

The third argument against the EXSEM model lies in the data that links exercise to lower levels of anxiety and low anxiety to high self-esteem. The effect of exercise on anxiety has been adequately discussed in this paper. As for the connection between anxiety and self-esteem there's ample evidence for the positive relationship between low anxiety levels and high self-esteem (Sowislo, J. F., & Orth, U., 2013)

Method

Participants

A total of 175 participants (77 males (44%), 98 females (56%), Mean age: 26.87, Range: 19-35) participated in the survey. Fifty were graduate students (28.6%), one participant was in high school (0.57%), 11 were undergraduate students (6.28%) and 113 were employed or self-employed (64.57%).

Materials

Five questionnaires were used to assess the relationship between exercise and self-esteem; State Trait Anxiety Inventory STAI, Physical Self-Perception Profile PSPP, Perceived Physical Ability PPA, International Physical Activity Questionnaire IPAQ and the Global Self Esteem Scale GSES. Scores were accumulated on SPSS and were adjusted for reverse scoring present in STAI, PPA and GSES.

STAI, developed by Charles Speilberger, is a commonly used questionnaire to measure state and trait anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The questionnaire consists of 40 questions; twenty items for measuring state anxiety and 20 items for measuring trait anxiety. State anxiety is defined as discomfort, fear, nervousness and arousal induced by temporary present situations perceived as dangerous whereas trait anxiety is an enduring general disposition to feeling stress, worry, and discomfort (Speilberger, 1994). Items are rated on a 4 point Likert scale and higher scores indicate higher anxiety. It can be used in clinical settings to screen for anxiety disorders (Speilberger, 1994). It is also used as an indicator of caregiver distress (Shapiro, S. L., Brown, K. W., & Biegel, G. M., 2007). Evidence for construct and concurrent validity of STAI is substantial (Spielberger, 1989).

Physical activity was measured using the IPAQ which derives a MET- minutes score. MET stands for metabolic equivalent and each activity has a certain MET score ranging from high (lifting, running) to low (walking). By weighing each type of activity by its energy requirements and multiplying it by the minutes spent doing that activity we get the MET-minutes score. MET-minutes was calculated using a certain formulation described in detail in the test manual (see manual on p.) Based on the MET-minutes number three categories were formed; Category 1: Not Active (MET-minutes < 600), Category 2: Insufficiently active (MET-minutes between 600 and 2999), Category 3: Active (MET-minutes > 3000). The IPAQ instruments have adequate measurement properties similar to other self-report measures of physical activity (Booth et al, 2003). IPAQ's validity has been corroborated by comparing scores on the questionnaire to scores on an accelerometer attached to the participants (Booth et al, 2003). IPAQ has been used in diverse settings with diverse population groups. It was used to measure levels of physical activity of 18- to 65-yr-old adults (Booth et al, 2003).

Global self-esteem was measured using Rosenberg's Global Self-Esteem Scale (GSES) developed by Dr. Morris Rosenberg. The scale consists of 10 items rated on a four point Likert scale; five items have positively worded statements and five have negatively worded ones. GSES had adequate construct validity (Whiteman, 1978) Test-retest reliability for a 2-week interval was calculated at 0.85, the 7-month interval was calculated at 0.63 (Silber & Tippett, 1965)

Physical self-perception was measured using the Physical Self-Perception Profile Revised Edition. PSPP-R is a revised version of Fox and Corbin's PSPP. The Revised Physical Self-Perception Profile (PSPP-R) measures perceived competence linked to domains of the physical self. The questionnaire consisted of 24 items rated on a four point Likert scale. The subdomains were sports competence, physical condition, body attractiveness, physical strength and physical

self-worth (Lindwall, M., Asci, H., & Hagger, M. S., 2011). The reason for choosing the revised edition was because it was deemed clearer and performed similarly to the original on internal consistency and construct validity (Lindwall et al, 2011).

Perceived physical ability was measured using the Perceived Physical Ability subscale of Ryckman, Robbins, Thornton, and Cantrell's (25) Physical Self-Efficacy scale. The subscale consists of 10 items that reflect strength, agility, reflexes, and physical condition. Items are measured on a 6 point Likert scale therefore the scores range from 10-60. PPA had high construct validity (Ryckman, R. M., Robbins, M. A., Thornton, B., & Cantrell, P., 1982). High scores on PPA were related to low social anxiety and high self-esteem (Ryckman, et al, 1982).

Previous research have revealed that PPA and PSPP have been used together as moderator variables in the exercise-self-esteem model (McAuley et al, 2000)

Procedure

Participants were asked to fill out five questionnaires online through Google Forms website. They were ensured of the anonymity this website provides. The participants were contacted by email or through social media sites such as Facebook and Whatsapp. The questionnaires were not accessible to the general public but only through invitations from the researcher. The population chosen varied in profession, level of education and status. None of the participants refused to fill out the questionnaires.

Results

The following chapter will present data pertaining to the hypotheses tested: Cronbach alpha for reliability, followed by correlational analysis amongst the tested variables. Further analysis comprising ANOVA to test for mean differences between different levels of physical activity, in addition to multiple regression analysis to test for the moderation hypothesis will be presented.

First of all, a reliability analysis using Cronbach alpha score was calculated for each of the tests. Alpha coefficients for all tests were satisfactory (see table 1). Overall there is a higher internal consistency in the present results compared to previous research.

Table 1: Alpha Coefficients

Measures	Previous research	Present research
GSES	0.72 to 0.87	0.94
PPA	0.75	0.93
PSPP	0.73 to 0.81	0.97
STAI	0.86 to 0.95	0.96

To test for the correlation between PPA, IPAQ, GSES and PSPP a Pearson product-moment correlation coefficient was computed to assess the relationship between anxiety (scores on STAI), global self-esteem (scores on GSES) and Physical Activity (scores on IPAQ) (see Table 2). Overall, there was a strong, positive correlation between physical activity and global self-esteem. There was also a strong negative correlation between physical activity and anxiety and a strong negative correlation between anxiety and self-esteem. Increases in physical activity contributed positively to self-esteem and negatively to anxiety.

Table 2: Correlations between Age, Gender, GSES, STAI, IPAQ (MET-mins), PSPP, PPA

		Age	Gender	STAI	PSPP	PPA	METmins	GSES
Age	Pearson Correlation	1	.096	.041	.067	.091	-.126	-.017
	Sig. (2-tailed)		.205	.595	.380	.233	.096	.819
	N	175	175	172	175	175	175	175
Gender	Pearson Correlation	.096	1	.395**	-.401**	-.442**	-.541**	-.373**
	Sig. (2-tailed)	.205		.000	.000	.000	.000	.000
	N	175	175	172	175	175	175	175
STAI	Pearson Correlation	.041	.395**	1	-.530**	-.636**	-.596**	-.749**
	Sig. (2-tailed)	.595	.000		.000	.000	.000	.000
	N	172	172	172	172	172	172	172
PSPP	Pearson Correlation	.067	-.401**	-.530**	1	.773**	.607**	.631**
	Sig. (2-tailed)	.380	.000	.000		.000	.000	.000
	N	175	175	172	175	175	175	175
PPA	Pearson Correlation	.091	-.442**	-.636**	.773**	1	.623**	.713**
	Sig. (2-tailed)	.233	.000	.000	.000		.000	.000
	N	175	175	172	175	175	175	175
METmins	Pearson Correlation	-.126	-.541**	-.596**	.607**	.623**	1	.655**
	Sig. (2-tailed)	.096	.000	.000	.000	.000		.000
	N	175	175	172	175	175	175	175
GSES	Pearson Correlation	-.017	-.373**	-.749**	.631**	.713**	.655**	1
	Sig. (2-tailed)	.819	.000	.000	.000	.000	.000	
	N	175	175	172	175	175	175	175

**. Correlation is significant at the 0.01 level (2-tailed).

As predicted by the hypotheses, there was a strong, positive correlation between physical activity and global self-esteem. There was also a strong negative correlation between physical

activity and anxiety and a strong negative correlation between anxiety and self-esteem. Increases in physical activity contributed positively to self-esteem and negatively to anxiety.

Active participants achieved the highest score on the GSES followed by moderately active participants followed by inactive participants.

Table 3: Comparison of Means between Physical Activity and Self-esteem

GSES

METmins	Mean	N	Std. Deviation
Insufficiently active	26.0882	68	6.29317
Moderately active	33.7500	56	6.58718
Very active	38.0000	51	3.23728
Total	32.0114	175	7.56124

Active participants achieved the lowest score on the STAI followed by moderately active participants followed by inactive participants.

Table 4: Comparison of Means between Physical Activity and Anxiety

STAI

METmins	Mean	N	Std. Deviation
Insufficiently active	87.8806	67	14.50760
Moderately active	68.4815	54	20.22957
Very active	59.6275	51	11.76939
Total	73.4128	172	19.87324

A one way ANOVA was calculated to test for the significance in differences in means between active and inactive participants on GSES (see Table 3) and STAI (see Table 4). Significant differences in means were found in both ANOVAs.

Table 5: ANOVA (GSES & Physical Activity)

GSES

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4384.007	2	2192.003	67.762	.000
Within Groups	5563.971	172	32.349		
Total	9947.977	174			

Table 6: ANOVA (STAI & Physical Activity)

STAI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	25029.244	2	12514.622	49.756	.000
Within Groups	42506.448	169	251.517		
Total	67535.692	171			

Table 7: Between Groups Means Comparison

Dependent Variable: GSES

Scheffe

(I) IPAQ	(J) IPAQ	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Insufficiently active	Moderately active	-7.90719	1.00312	.000	-10.3845	-5.4299
Moderately active	Very Active	-4.33818	1.07725	.000	-6.9986	-1.6778
Very active	Insufficiently active	12.24537	1.03029	.000	9.7010	14.7898

The purpose of this study was to test for a moderation effect of anxiety in the relationship between exercise and self-esteem while controlling for gender, age, physical self-perception and physical ability. To that purpose a multiple regression analysis was calculated to predict global self-esteem based on physical activity, physical self-perception and physical ability and state trait anxiety. The results of the regression indicated that the four predictors along with age and gender explained 74.1 % of the variance. It was found that physical activity significantly predicted global self-esteem and so did state-trait anxiety and perceived physical ability. The analysis revealed that physical self-perception did not significantly predict scores on global self-esteem. (see Table 8)

Table 8: Regression with Age, Gender, PPA, PSPP, IPAQ (METmins) and STAI as Independent Variables and GSES as the Dependent Variable

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	27.694	4.266		6.492	.000
	Age	.157	.117	.061	1.345	.181
	Gender	.796	.864	.053	.921	.359
	STAI	-.176	.023	-.468	-7.552	.000
	PSPP	-.001	.030	-.002	-.031	.975
	PPA	.208	.056	.316	3.715	.000
	METmins	1.957	.701	.218	2.792	.006

a. Dependent Variable: GSES

b. $R^2 = 0.741$

Another multiple regression analysis was calculated to predict GSES using physical activity, physical self-perception and physical ability while removing the STAI variable from the regression equation. The results of the regression indicated the three predictors along with age and gender explained 62.5% of the variance.The R^2 decreased from 74.1 to 62.5 which

reveals that, as predicted in the hypothesis, STAI was a significant moderator variable between physical activity and GSES. Physical self-perception was not a significant predictor of GSES scores (see Table 9)

Table 9: Regression with Age, Gender, PPA, PSPP, IPAQ (METmins) as Independent Variables and GSES as the Dependent Variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.372	4.115		2.278	.024
	Age	.055	.129	.022	.422	.673
	Gender	.980	.941	.066	1.042	.299
	PSPP	-.017	.034	-.048	-.521	.603
	PPA	.343	.059	.527	5.825	.000
	METmins	3.755	.738	.417	5.090	.000

a. Dependent Variable: GSES

b. $R^2 = 0.625$

A comparison of means and an independent-samples t-test was conducted to test for gender differences in the variables studied. There was a difference in the scores on IPAQ between men and women. Men scored significantly higher than women on physical activity. Men also scored higher on GSES, PPA and PSPP and lower on STAI. Differences were significant all variables (see Tables 9 - 10)

Table 10: Independent Samples t Test for Gender Differences

	Gender	N	Mean	Std. Deviation	Std. Error Mean	df	t	Sig.
Age	Men	77	26.4286	3.03674	.34607	173	-1.271	.205
	Women	98	26.9898	2.78618	.28145			
STAI	Men	76	64.6053	17.42648	1.99895	170	-5.614	.000
	Women	96	80.3854	18.97276	1.93640			
PSPP	Men	77	69.0649	18.86122	2.14944	173	5.759	.000
	Women	98	52.7653	18.36727	1.85537			
PPA	Men	77	45.6883	10.46707	1.19283	173	6.487	.000
	Women	98	35.5306	10.13436	1.02372			
METmins	Men	77	2.4026	.73017	.08321	173	8.460	.000
	Women	98	1.5102	.66185	.06686			
GSES	Men	77	35.1818	6.72726	.76664	173	5.283	.000
	Women	98	29.5204	7.26981	.73436			

A third regression analysis was calculated to test for the significance of exercise on GSES moderated by STAI within the gender groups. Results revealed that the predictive value of exercise and STAI on GSES was retained in both genders. The only difference was that among women, PSPP replaced PPA as a significant predictor of GSES.

Discussion

As predicted a strong moderation effect for anxiety was present in the relationship between exercise and self-esteem. However the insignificance of the physical self-perception profile (PSPP) in predicting global self-esteem was unexpected since many previously mentioned studies (Sonstroem, R. J., & Morgan, W. P., 1989; McAuley, E., Blissmer, B., Katula, J., Duncan, T. E., & Mihalko, S. L., 2000; Haugen, T., Säfvenbom, R., & Ommundsen, Y., 2011; Kirkcaldy, B. D., Shephard, R. J., & Siefen, R. G., 2002) have established its moderation effect on self-esteem. PSPP remained an insignificant moderating variable even when scores on STAI were omitted from the regression equation. Only when PPA scores were omitted from the regression equation did PSPP scores become significant. Despite the high correlation between PSPP and PPA, and between PSPP and GSES, PPA was a better predictor of GSES than PSPP. Based on the results, it could be concluded that among the physical indices (PPA and PSPP) used to measure the relationship between physical activity and GSES, PPA fared better at predicting GSES scores. As predicted, PPA had a unique effect on GSES that is not explained by anxiety or exercise. Physical self-efficacy which includes perceived physical ability correlates highly with global self-esteem according to the EXSEM model. (Sonstroem, R. J., & Morgan, W. P., 1989).

According to the results of this study, anxiety had a strong predictive value in explaining the relationship between exercise and GSES. Anxiety was the highest predictor of GSES among all variables. These results could open new grounds since as mentioned earlier, no other studies attempted to explain the relationship of exercise and GSES with the STAI. Previous studies were focused on the physical indices relating exercise to GSES and mood factors were completely disregarded.

Despite the significance of those physical indices, mood factors such as anxiety offer a better and unique predictive value according to the results of the present research. Scores on anxiety were better predictors of GSES than PPA and PSPP. The well-established effect of physical activity on anxiety, the negative contribution of anxiety to self-esteem and the results obtained by the present study lay the theoretical grounds for a complementary model which explains the contribution of exercise to GSES with a decrease in anxiety levels in addition to an increase in physical self-esteem.

There is no consensus over what the mechanism in which exercise decreases anxiety and improves mood is. Three models will be explained briefly on the effect of exercise on anxiety levels with the knowledge that more exist but three will suffice for our purpose.

Cognitive approach:

The first cognitive theory for the effect of exercise on anxiety was reported in 1973 when studies claiming phobic patients were effectively treated by exposure to the phobic stimulus after exhaustive exercise (Orwin, 1973). This successful uncontrolled treatment was explained in terms similar to systematic desensitization; the conditioning to the phobic stimulus of a physiological response (exhaustion) incompatible with anxiety (Orwin, 1973)

Current cognitive accounts of anxiety suggest an alternative explanation. According to Clark, exercise might have facilitated a benign attribution of the arousal produced by the phobic stimulus and thereby prevented the fear-induced element of panic (Clark, 1986) In 1991, van Zijderveld and colleagues provided further evidence to Clark's theory by testing the anxiety response of aerobically fit undergraduates to adrenaline infusion. The anxiety response was less in fit subjects who might have been more familiar with exercise-induced exertion (Van Zijderveld, et al 1991). Patients suffering from panic disorder show physiological responses

similar to controls even though their subjective anxiety is higher than controls (Rief & Hermanutz, 1996). In a randomized controlled trial in panic anxiety, dropout from 10 weeks of strenuous exercise treatment was equal to placebo (Broocks et al., 1998). The previous findings are supported by recent studies on the effect of exercise on the Hypothalamic Pituitary Axis (Anderson, E., & Shivakumar, G., 2015). The HPA axis is responsible for the development of adaptive responses to physical and psychological stressors (Salmon, 2001) Dysregulations to the HPA lead to anxiety symptoms (Anderson, E., & Shivakumar, G., 2015). Exercise induces changes to the HPA axis which results in less sensitivity to stress and anxiety (Anderson, E., & Shivakumar, G., 2015).

Neuroendocrinological approach:

Neuroendocrinological theory of the effect of exercise was first posited by CJ Cooper in 1973 and it states that exercise affects certain neurotransmitters in the brain which affect behavior (Cooper, C. J., 1973). This theory was reintroduced twenty years later with the advancement in neuroscience and brain research. In the book Exercise and Cognitive Function (2009) Terry McMorris and his colleagues explain that Noradrenaline, dopamine, 5-HT and, to a much lesser extent, adrenaline act as neurotransmitters in the brain (McMorris, T., Tomporowski, P. D., & Audiffren, M. Eds.., 2009). 5-Hydroxy tryptophan (5-HT) which is also called serotonin is a neurotransmitter that regulates mood, appetite and sleep. Dopamine plays important roles in executive functions, motor control, motivation, arousal, reinforcement, and reward. During and after physical exercise those neurotransmitters are released to a varying degree in the peripheral nervous system (McMorris et al, 2009). Dopamine and Noradrenaline enter the brain through diffusion affecting various parts in the brain whereas 5-HT synthesis is not affected by the blood-brain barrier therefore it readily enters the brain (McMorris et al,

2009). The increase of those neurotransmitters in the brain leads to changes in cognitive functioning and behavior (McMorris et al, 2009). Increase of serotonin in the brain possibly produces cognitive and mood enhancements (McMorris et al, 2009). Selective Serotonin Reuptake Inhibitors SSRIs are a family of common drugs that are used to treat anxiety and mood disorders and they work by increasing serotonin in the brain by inhibiting their reuptake into the synapse (McMorris et al, 2009). According to the neuroendocrinological model, exercise's cognitive and mood enhancing effects is the result of altered neurotransmitter function in the brain. (McMorris et al, 2009)..

Transient Hypofrontiality Theory:

Transient Hypofrontiality Theory (THT) was first mentioned as a plausible explanation for the anxiolytic effect of exercise in 2003 by Arne Dietrich from the American University of Beirut. According to Dietrich, exercise does not increase blood flow to the brain despite popular belief (Dietrich, A., 2006).The brain receives a steady supply of oxygen. According to THT, the brain has limited metabolic resources and exercise forces the brain to make profound changes to how it allocates those resources (Dietrich, A., 2006). The brain is then forced to shift activity from neural structures in whose functions are not critically needed such as the prefrontal cortex. Affective states, such as depression and several of the anxiety disorders are accompanied by excessive activity in prefrontal regions (Dietrich, A., 2006). The excess metabolic demand of exercise forces the brain to normalize activity in the prefrontal regions therefore decreasing feelings of anxiety (Dietrich, A., 2006). These changes in brain function do not occur if the exercise is low intensity because the firing of neurons will not reach a sufficient level to allow such change. THT can also adequately explain why anxiolytic post exercise effects occur less in nonaerobic exercise tasks (Dietrich, A., 2006).

The three theories mentioned are not mutually exclusive. They are also not exhaustive nor are they unequivocally universally accepted despite the empirical support they received. They provide valid models to explain the relationship between exercise and anxiety.

Although the specific action by which anxiety leads to low self-esteem is not fully understood, one can speculate. Anxiety is related to negative affect which can be defined as "the extent to which an individual feels upset or unpleasantly engaged, rather than peaceful" (Watson, D., & Clark, L. A., 1984). Negative affect includes feelings of anger, fear and nervousness (Watson, D., & Clark, L. A., 1984). These feelings often lead the person to develop problematic relationships or withdraw from social activities and events and become increasingly reclusive (Selby, E. A., 2010). Avoiding social contact becomes negatively reinforced and leads to lack of positive affirmation (Selby, E. A., 2010) According to Alice Boyes this kind of avoidance coping causes anxiety to snowball because when people use avoidance coping they typically end up experiencing more of the very thing they were trying to escape. (Boyes, A., 2013). Negative affectivity eventually leads to poor self-concept and lower self-esteem (Watson, D., & Clark, L. A., 1984).

Another possible explanation for the effect of anxiety on self-esteem lies in the cognitive biases that result from anxiety. Individuals with anxiety disorders tend to selectively process threat-relevant information in their environment (Beard C., 2011). For example, when talking in public, an anxious person is more likely to attend to threatening facial expressions such as anger or disgust rather than neutral expressions. That person is also more likely to interpret a negative facial expression as indicative of the conversation partner’s disgust with him/her rather than the content of the conversation. As there is usually more information than cognitive resources available to process the information, this habit of selectively attending (attention bias) and

interpreting (interpretation bias) creates a vicious cycle in which an ambiguous world is experienced as threatening (Beard, C., 2011) . Hirsch & Mathews discovered that anxiety disorders are also characterized by interpretation bias which is the tendency to interpret ambiguous or mildly negative stimuli in a negative manner (Hirsch, C., & Mathews, A., 1997). They investigated the extent to which individuals with high or low levels of anxiety made emotionally-congruent interpretative inferences while reading descriptions of a relevant ambiguously-threatening event (being interviewed for a job) (Hirsch, C., & Mathews, A., 1997). Results revealed that individuals with high anxiety do not infer positive outcomes to ambiguous events whereas non-anxious individuals do. Results revealed that unlike non-anxious participants, individuals with high anxiety did not infer positive outcomes to ambiguous events (Hirsch, C., & Mathews, A., 1997). These cognitive biases could erode self-esteem with time.

Claiming that decreases in anxiety or mood enhancement is the sole mediator in the exercise self-esteem relationship is not accurate and neither it's this study's claim. According to the results, exercise had a unique effect on GSES that couldn't be linked to any of the moderator variables suggested. Exercise programs are usually done in a social context which offers its participants social contact with peers that have the same interest and this factor is often therapeutic by itself. Participants in competitive and team sports identify with their sport to an extent that it becomes part of their social sphere. Dancing is a sport that offers in addition to physical activity a medium of expression through movement. Finally, yoga and exercises based on meditation have reported benefits that most likely couldn't be explained by an increase in physical activity alone. However, even physical activity devoid of skill, expression or social contact but based on raising the heart rate of its participants is beneficial to people suffering

from anxiety, depression, stress and self-esteem issues (Martinsen, 2008; De Moor et al, 2006; Eyre et al, 2013; Sonstroem, R. J., & Morgan, W. P., 1989).

Results of this study will help us understand the mechanisms by which exercise works on self-esteem and take into account other variables that are not physical in nature.

Gender differences were present across all variables except age. Men were more likely to be active and were more likely to score higher on PSPP, PPA and GSES and score lower on STAI.

According to surveys of 1146 participants in the National Health and Nutrition Examination Survey, women were less moderately or vigorously active than men (Loprinzi, P. D., & Cardinal, B. J., 2012). Possible reasons for the difference in levels of physical activity between genders are that men make trips out of the house more often whereas women were more likely to do lower intensity activity such as tasks around the house (Davis et al, 2011). As for children and adolescents, boys were more likely to engage in active play during school recesses and after school (Brockman, R., Jago, R., & Fox, K. R., 2010). Women who were less active were more likely to depressed (Loprinzi, P. D., & Cardinal, B. J., 2012). These conclusions were corroborated by the results in this research which confirmed the lower level of physical activity exerted by women in comparison to men and women's higher scores on STAI which is highly comorbid with depression (Cameron, O. G., 2007). Women may benefit from physical activity to combat mild depression. (Loprinzi, P. D., & Cardinal, B. J., 2012)

Although men and women show an improvement in self-esteem as they grow older, men generally have higher self-esteem than women worldwide according to a large online cross-cultural sample (Bleidorn et al., 2015). These conclusions were corroborated only partially by our results. Men did indeed score higher on global self-esteem and physical self-perception and

perceived physical ability. However, an insignificant negative correlation was present between age and self-esteem and not a significant positive one. It is still unclear why women have lower self-esteem than men but the results were consistent across cultures and the difference was even higher in industrialized countries (Bleidorn et al., 2015). A possible reason for the absence of a positive correlation between age and self-esteem in this study could be the small sample size and the limited range of the age of the participants (19-35). Another possible reason is that 78.2% of the participants in the study were between the ages of 25 and 29 therefore the ages outside this interval were under represented.

It has long been established that women have consistently higher prevalence rates of anxiety disorders (Lewinsohn, P. M., Gotlib, I. H., Lewinsohn, M., Seeley, J. R., & Allen, N. B. 1998). The National Comorbidity Survey (NCS; conducted from 1990 to 1992) found that lifetime prevalence rates for any anxiety disorder were 30.5% for women and 19.2% for men (Kessler et al., 1994). These studies were in line with our results in which men scored 16 points lower than women on the STAI. A possible explanation for why women are more anxious is the difference in brain chemistry and hormone fluctuations (McLean, C. P., & Anderson, E. R., 2009). Stress from reproductive events is also associated with hormonal changes and anxiety (McLean, C. P., & Anderson, E. R., 2009). Women also have different coping strategies for dealing with stressors. While men engage in problem solving women are more likely to ruminate (McLean, C. P., & Anderson, E. R., 2009).

This study is definitely not without its limitations. The small sample size was based on convenience. Generalizability of the research results despite the strong effect sizes is tenuous due to convenience sampling and the high likelihood of bias and sampling error.

As mentioned in the literature review, correlational studies preclude causation and do not provide a comprehensive understanding of the effects of exercise and the temporal relationship between the effected variables. Longitudinal experimental studies are more suitable to test for the effect of exercise on physical indices, anxiety and self-esteem. Experimental designs with random assignment of groups into exercise treatment and control such as relaxation training is obligatory to single out the therapeutic element that is inducing the change in GSES.

Studies should include persons with an anxiety disorder to test for the effect of exercise on self-esteem moderated by anxiety. Other variables related to mood which may offer a better predictive value such as positive affect, negative affect, depression and stress should be included in the research.

Finally, most research on the effects of exercise use a single form of exercise most commonly aerobic in nature. Current research is discovering benefits of other forms of exercise most notably anaerobic or weight training. There is evidence that anaerobic exercise increases adrenaline and noradrenaline in the brain and enhances cognition and mood (McMorris, et al, 2009). Anaerobic exercise shares most of the benefits associated with aerobic exercise with special benefit to enhanced brain function and increased bone mass. Improvement in brain function was related muscle gains. A number of studies revealed that weight training resulted in lower levels of anxiety and depression and higher levels of self-esteem (Melnick, M. J., & Mookerjee, S., 1991; Tsutsumi et al, 1998). Weight training also improved cognitive function in older adults and reduced symptoms of dementia among people with cognitive impairments (Tsutsumi et al, 1998). The inclusion of anaerobic exercise as a variable group would increase our understanding of its effects on mood and self-esteem

The solid body of literature on exercise's effects should be a signal for us to move from the theoretical to the practical. Therapists have already begun incorporating exercise in their interventions and issuing exercise treatments for their clients (Hays, K. F., 1999). There is no consensus over what is the best kind of exercise for anxiety, depression or self-esteem. Some studies argue that the exercise program should not be competitive but repetitive and should allow the participant to zone in and out, whereas other studies didn't see that requirement as necessary and argue that an effective exercise program is one that is personalized to fit the person doing it (Hays, K. F., 1999). The dose prescription for cardiovascular health is three to five times per week, of moderate intensity, lasting 20-40 minutes has been transferred to an appropriate dose for psychological well-being as well although a number of studies have only found results with higher doses (Hays, K. F., 1999). Aerobic exercise seems to be the exercise of choice especially for patients with anxiety disorders (Hays, K. F., 1999). Exercise adherence is not an easy task despite the apparent benefit for the person engaging in it, therefore short and long term goals should be put with the help of the therapist (Hays, K. F., 1999).

The link between perceived physical ability and global self-esteem should be taken into account in a therapy setting. People with low self-esteem are more likely to perceive themselves as physically weak whether that is their case or not (Sonstroem, R. J., & Morgan, W. P., 1989). It would most likely be helpful to engage them in exercises that would increase their strength and help them to correct any cognitive distortions they may have about their perceived physical ability.

For most of the past 2.4 million years we lived a life of hunting and gathering; over time the human genetic profile gradually adapted through natural selection for individuals to survive and thrive in an environmental climate that demanded large amounts of regular physical work

the same constitution that is adapted to very high levels of physical activity (Eaton, S.B., Shostak, M., and Konner, M., 1988). Technological advancements have produced an ease in our way of life and a much more sedentary lifestyle that allows us to do much while moving very little. This change in lifestyle produced a myriad of physical and psychological problems (World Health Organization, 2014). Physical exercise is a way to increase our activity in line with how our brains and bodies evolved to being accustomed to and in doing that we experience its benefits.

The wide range of benefits that exercise offers begs the following question. Why is exercise treated as a very marginal subject in Lebanese schools? Why is it limited to one hour per week when schools who increase the number of exercise hours fare better on school subjects? Why is Lebanon behind in issuing weekly exercise recommendations to the public similar to other countries? Due to the high efficacy of exercise in raising self-esteem clinicians in Lebanon should begin to incorporate it into their therapy programs. Exercise can be used as an alternative to psychiatric medications or as an adjunct to them (Kvam, S., Kleppe, C. L., Nordhus, I. H., & Hovland, A., 2016). Exercise seems to be the activity of choice to treat and prevent a wide array of ailments; it should be encouraged and supported.

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Appendix A

Haigazian University

Social and Behavioral Sciences Department

Participant Assent Form

Thesis Title: The Moderation Effect of Anxiety on the Relationship between Exercise and Global Self-Esteem

Graduate Student: Nader Toutounji

This is an assent form to allow you to take part in this study. It contains information about the study and what you expect if you should take part.

This study is completely voluntary and all results received will be anonymous. If you decide to not partake in the study then simply disregard this email.

Thesis topic: The following study serves to investigate the acute beneficial effect of exercise on self-esteem while controlling for factors such as age, gender, perceived physical ability, physical self-perception and anxiety. This study also tests for the moderation effect of anxiety on the exercise self-esteem relationship.

Procedure: You will be asked to fill out five questionnaires online through Google forms that assess your global self-esteem, perceived physical ability, physical self-perception, physical activity levels and anxiety levels. The website ensures anonymity and confidentiality