University of Texas at Tyler
Scholar Works at UT Tyler

Psychology and Counseling Theses
Psychology and Counseling

Fall 12-2011

The Relationship Between Physical Activity and Cognitive Symptoms of Depression

Katy Manganella

Follow this and additional works at: https://scholarworks.uttyler.edu/psychology_grad

Part of the Psychology Commons

Recommended Citation

Manganella, Katy, "The Relationship Between Physical Activity and Cognitive Symptoms of Depression" (2011). *Psychology and Counseling Theses.* Paper 3.
http://hdl.handle.net/10950/47

This Thesis is brought to you for free and open access by the Psychology and Counseling at Scholar Works at UT Tyler. It has been accepted for inclusion in Psychology and Counseling Theses by an authorized administrator of Scholar Works at UT Tyler. For more information, please contact tgullings@uttyler.edu.

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND COGNITIVE SYMPTOMS OF DEPRESSION

by

KATY A. MANGANELLA

A thesis submitted in partial fulfillment of the
requirements for the degree of
Master of Arts in Counseling Psychology
Department of Counseling and Psychology

Eric L. Stocks, Ph.D., Committee Chair
Charles R. Barke, Ph.D., Committee Member
Dennis R. Combs, Ph.D., Committee Member

College of Education and Psychology

The University of Texas at Tyler
December 2011

The University of Texas at Tyler
Tyler, Texas

This is to certify that the Master's Thesis of

KATY A. MANGANELLA

has been approved for the thesis requirement on
November 22, 2011
for the Master of Arts in Counseling Psychology degree

Approvals:

Thesis Chair: Eric Stocks, Ph.D.

CR Barke PhD

Member: Charles Barke, Ph.D.

Member: Dennis Combs, Ph.D.

CR Barke PhD

Chair, Department of Psychology

Dean, College of Education and Psychology

Table of Contents

List of Tables

Abstract

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND COGNITIVE SYMPTOMS
OF DEPRESSION

Katy A. Manganella

Thesis Chair: Eric L. Stocks, Ph.D.

The University of Texas at Tyler
December 2011

Existing research on exercise habits typically focuses on the physical health benefits. However, this research tends to neglect the potential psychological benefits of exercise. The present research adopts a different perspective by investigating the relationship between exercise and different symptom types of depression. By establishing the amount of physical activity participants consider to constitute exercising “on a regular basis,” participants were separated into self-reported high and low-exercise groups and completed the Zung-Self Rating Depression Scale. By employing a factor analysis of the Zung SDS, the results were analyzed assessing each symptom type of depression: Cognitive, affective, and somatic. Results suggest that not all dimensions of depression are equally related to exercise. The present thesis establishes that only the cognitive symptoms of depression are significantly related to level of physical activity.

Introduction

The relationship between exercise and health has long been established (Bernardo, Abt, Ren, & Bender, 2010; Cooper, 2010; Dogra, Jamnik, & Baker, 2010; Hobson, 2010, Birmingham, 2008; Huffman, 2010; Rockenfeller & Madeo, 2010; Sun, Townsend, Okereke, Franco, Hu, & Grodstein, 2010). The bulk of the research on exercise and health has focused on physical well being (Dogra et al., 2010; Huffman, 2010; Lambourne & Tomporowski, 2010; Lannem, Sorensen, Lidal, & Hjeltnes, 2010; Sun et al., 2010). However, the advantages of exercise extend far beyond the physical benefits. Research suggests that exercise affects our psychological and mental health as well (Callaghan, 2004; DiLorenzo, Bargman, Stucky-Ropp, Brassington, Frensch, & LaFontaine, 1999; Lawlor & Hopker, 2001; Roman, 2010; Tanaka, 2008). For the purpose of clarity, exercise is defined as training of the body to improve its function and enhance its fitness (Blair & Cooper, 2000). Exercise may include cardiovascular activities such as biking, running, walking and swimming. It may also include weight and resistance training, yoga, Pilates, and organized sport activities.

Literature Review

Exercise and Physical Health

There is empirical evidence supporting the valuable role that exercise plays in improving and maintaining physical health. The relationship between exercise and physical health has been documented extensively (Dogra et al., 2010; Huffman, 2010; Lambourne & Tomporowski, 2010; Lannem, Sorensen, Lidal, & Hjeltnes, 2010; Sun et al., 2010). Most people, whether they are physically active or not, are aware of its benefits. As a result, the importance of exercise has become more like common sense and less like a scientific breakthrough.

The lack of regular exercise is associated with a higher risk of many forms of physical illness (Booth & Laye, 2010; Kang, Sung, & Kim, 2010; Newton & Galvao, 2008). It has long been established that a sedentary lifestyle is related to an increased risk of various diseases (Haskell, Lee, Pate, Powel, Blair, & Franklin, 2007). This is relevant because, undoubtedly, physical health is influenced by exercise. Further, maintaining physical health is imperative for longevity. Past research has demonstrated that an extension of the human lifespan and a reduction of age related diseases may be achieved by physical exercise (Birmingham, 2008; Cooper, 2010; Hobson, 2010; Huffman, 2010; Rockenfeller & Madeo, 2010; Stessman, Hammerman-Rozenberg, Cohen, Ein-Mor, & Jacobs, 2009; Sun et al., 2010; Tanaka, 2008). Ultimately, physical health is associated with a range of health benefits, and its absence can have harmful effects on health and well being, including increased risk of coronary heart disease, diabetes, certain cancers, obesity, and hypertension. All of these cause mortality (Center for Disease Control and Prevention, 1996). In short, regular exercise is imperative for maintaining physical health.

Exercise and the Psychological Symptoms of Physical Illness

Research has also documented that both physical and psychological symptoms are improved with exercise (Birminghman, 2008; Booth & Laye, 2010; Callaghan, 2004; Carless & Douglass, 2008; Crone & Guy, 2008; Dogra et al., 2010; Lambourne & Tomporowski, 2010; Lawlor & Hokper, 2001; Newton & Galvao, 2008; North et al., 1990; Roman, 2010; Tanaka, 2008). Further, with a study on breast cancer survivors, Wagner (2007) demonstrated that exercise alleviates the psychological distress experienced as a result of physical illness. To elaborate, breast cancer survivors who exercise regularly report greater use of adaptive coping than women who are sedentary. This research has focused on psychological factors that make physical illness more manageable. Although such research is a step in the direction of using exercise to enhance psychological health, ultimately the primary focus is on physical health. Hence, psychological health has been studied as it is tangentially related to physical health.

Motivation and Exercise

Traditionally, the psychological factors involved in exercise have been studied with the goal of promoting physical health. Much of the empirical evidence regarding mental health and exercise has focused on motivation, a psychological factor that increases physical activity (Gillison, Standage, & Skevington, 2011; Russell & Bray, 2010; Wilson, Mack, & Grattan, 2008). However, this past research on the relationship between motivation and exercise is focused on improving physical health. In other words, merit has been given to understanding the psychological facet of motivation as it has a critical role in enhancing physical activity which combats disease (Wilson et al., 2008). Only recently has research on the relationship between exercise and motivation shifted to focus on improving psychological health. Wilson and Rogers (2008) have suggested that ‘increased attention to the role of basic psychological needs in exercise settings with reference to motivation is encouraging’ (p. 121). This shift in focus lends itself to the present research: The role of exercise in improving psychological health.

Exercise and Psychological Health

Consistent with the physical health benefits derived from regular exercise, a growing body of research suggests a variety of psychological health benefits from physically-active lifestyles (Fox, 2002). Research suggests that physical activity is associated with a range of positive mental health outcomes, including lower levels of stress, anxiety, and depressive symptoms (Blumenthal, Babyak, Doraiswamy, Watkins, Hoffman, Barbour, & Sherwood, 2007; Byrne & Byrne, 1993; Norris, Carroll, & Cochrane, 1992; Sallis, Prochaska, & Taylor, 2000). Further, research indicates that among persons with mental illness, there are two distinct types of benefits derived from exercise. The first benefit of exercise is improved psychological health. Exercise increases well being, motivation, achievement, and satisfaction. Second, there are social benefits of exercise that include opportunities for interaction with others and increased social confidence (Crone & Guy, 2008). Moreover, it has been suggested that exercise may expedite recovery from mental illness in some individuals. By changing attitudes, values, feelings, goals, and skills, exercise provides a means to live a satisfying, hopeful, and contributing life (Carless & Douglass, 2008).

Exercise and Schizophrenia

Additionally, research has been conducted to investigate the relationship between exercise and schizophrenia. Faulkner and Sparkes (1999) suggest that exercise has a positive effect on schizophrenic symptoms because physical activity has the potential to help reduce patients' perceptions of auditory hallucinations, raise self-esteem, and improve sleep patterns as well as general behavior. To summarize the literature on schizophrenia and physical activity:

> It is evident that the existing research does not allow any firm conclusions to be made as to the psychological benefits of exercise for individuals with schizophrenia. It does, however, support the efficacy of exercise in alleviating the negative symptoms for schizophrenia and as a coping strategy for the positive symptoms. (Faulkner & Biddle, 1999, p. 453)

Hence, there is beginning evidence of a connection between exercise and schizophrenia. This is an important step in the literature because the focus is on exercise improving psychological symptoms for the sake of enhancing mental health, not simply on improving physical health alone. Also, this research highlights the potential for exercise to be used as a psychological-health intervention.

Exercise and Depression

Research has also been conducted to better understand the relationship between depression and exercise. Empirical evidence suggests that exercise may have an antidepressant effect in individuals (DiLorenzo et al., 1999; North, McCullagh, & Tran, 1990). Additionally, it has been documented that exercise can reduce symptoms of depression (Lawlor & Hopker, 2001; Mata, Thompson, & Gotlib, 2010). Ultimately, empirical evidence suggests that a positive relationship exists between exercise and depression.

Furthermore, research has documented that exercise alleviates depression whether it is implemented in conjunction with traditional treatment or alone:

> In studies of persons with diagnoses ranging from minor depression to treatment resistant Major Depressive Disorder, structured exercise therapy has repeatedly demonstrated equal or greater improvement of mood symptoms when tested opposite usual care, medication alone, or medication plus exercise. (Roman, 2010, p. 153)

These findings speak not only to the relationship between exercise and depression but, further, they suggest the potential power of exercise as a treatment for depression.

Having established that fitness has an inverse relationship with depressive symptoms (Roman, 2010), we may now pose the question: *How* does exercise alleviate depression? North et al. (1990) have suggested that exercise improves depression by changing an individual's daily routine, increasing interactions with others, helping them lose weight, participate in outdoor recreation and master difficult physical and psychological challenges. But which symptoms of depression are alleviated? The general phenomenon of depression has been studied extensively; however, the specific symptom types have been overlooked.

Until now, the research on exercise and depression has regarded depression as a single factor. However, depression consists of several groups of symptoms (Buchwald & Rudick-Davis, 1993). It is important to evaluate the effect of exercise on the individual symptoms of depression so that we may better understand the relationship between depression and physical activity. Better understanding the relationship between exercise and the individual symptom types of depression is the goal of the present thesis.

Zung Self-Rating Depression Scale

The Zung Self-Rating Depression Scale (SDS; Zung, 1965) was created by Dr. William W.K. Zung in 1965. Since its creation and over the decades, many psychological and epidemiological studies have examined the prevalence of depression using the Zung SDS (e.g. Barrett, Hurst, DiScala & Rose, 1978; Bitsika, Sharpley, & Bell, 2009; Blumenthal, 1975; Jara et al., 2011; Katsuura et al., 2011; Slovacek et al., 2010; Zung, 1967). The validity and reliability of this measure in discriminating between those with and without depression have also been well documented (DeJonghe & Baneke, 1989; Lee, 1990; Thurber, Snow, & Honts, 2002; Campo-Arias et al., 2005; Chagas, 2010). DeJonghe & Baneke (1989) computed the psychometric properties of the Zung SDS and found that the scale effectively discriminates between depressed and non-depressed patients. Additionally, they state, "The Zung internal reliability (Cronbach's alpha) of .82 is good, with a split-half reliability of .79 (corrected for test-length)" (DeJonghe & Baneke, 1989, p. 833). Thurber, Snow, & Honts (2002) also computed the internal consistency of the Zung SDS and found that it ranges from .79 to .88. A third line of research, conducted by Innamorati et al. (2006), report sufficient reliability of the Zung SDS (α >.70) and a strong correlation with convergent measures of depression (mean r = .68). Moreover, the Zung SDS is valid for identifying patients with depression, dysthymia and discriminating depressed patients from non-depressed patients (Innamorati et al., 2008).

The scale consists of 20 items that were “constructed on the basis of clinical diagnostic criteria most commonly used to characterize depressive disorders. These items are presented as sentences, based on material from interviews with patients, and selected as most representative for the particular symptoms” (Sakamoto et al., 1998, p. 477). Each sentence statement is measured by the participant on a scale of 1 to 4. A low self-reported rating, (1), indicates the participant agrees with the statement a little of the time. A high self-reported rating, (4), indicates the participant agrees with the statement most of the time.

Establishing Symptom Types: Zung SDS Factor Analysis

Using the total score from the Zung Self-Rating Depression Scale alone would not allow researchers to identify the different types of depressed people. Fortunately, a factor analysis of the Zung SDS, conducted by Sakamoto et al. (1998), enabled researchers to divide the scale into symptom types of depression. Sakamoto et al. administered the Zung SDS to a total of 2,258 undergraduate students from 10 universities. They then conducted a factor analysis of the results and extracted three dimensions of depression as measured by the SDS: 1) Cognitive Symptoms, 2) Affective Symptoms, 3) Somatic Symptoms (Sakamoto et al., 1998). Total scores on the SDS cannot discriminate among those primarily suffering from any specific dimension of depression. Consequently, the factor analysis enables researchers to more accurately differentiate between symptom types. In order to provide more detail on the factor analysis at hand, Sakamoto et al. (1998) state:

> A principle-component analysis with promax rotation was performed on the SDS. We extracted three factors according to the three criterion: Kaiser’s criterion

> (eigenvalues more than unity), a scree test, and the interpretability of resulting factor structures. However, because the final communality estimates were remarkably low in Items 2 (.139) and 8 (.068), these two items were excluded and a principal-component analysis with promax rotation was re-performed on the remaining 18-item SDS. Three factors were extracted again, according to the three criteria. If a factor loading of an item was .40 or above on only one factor, it was selected for a simple structure. (Sakamoto et al., 1998, p. 479)

To emphasize, for an item to significantly load and be considered on only a single factor, it must be correlated with that factor alone at .40 or above. Further, the item must be correlated at less than .40 on all other factors. In the case that an item was significantly loaded on more than one factor (.40 or above), it was not included in an extracted factor. Also, in the case that a item was not significantly correlated with any factor (.40 or above), it was not included in an extracted factor. See Table 1 for details of the factor structures for the Zung Self-Rating Depression Scale (Sakamoto et al., 1998, p. 480).

The first factor, Cognitive Symptoms, consists of hopelessness, personal devaluation, dissatisfaction, confusion, indecisiveness, and emptiness (Sakamoto et al., 1998). For example, Item 14 on the SDS represents hopelessness. Item 14 is, “I feel hopeful about the future” (Zung, 1965). The second factor, Affective Symptoms, consists of crying spells, irritability, and fatigue (Sakamoto et al., 1998). For example, Item 3 on the SDS represents crying spells. Item 3 is, “I have crying spells, or feel like it” (Zung, 1965). The third factor, Somatic Symptoms, consists of sleep disturbance, decreased appetite, weight loss, and tachycardia (an abnormally rapid heartbeat; Sakamoto et al., 1998). For example, Item 4 is, “I have trouble sleeping at night” (Zung, 1965).

Sakamoto et al. (1998), noted that Items 6 (decreased libido) and 19 (suicidal ideation) were not included in any of the three subscales of depression. This is because Item 6 was significantly (.40 or above) loaded on both Factors I and II (Cognitive and Affective). Item 19 was not significantly loaded on any factor in the extracted factor structure. To re-emphasize, in the end, Items 2, 6, 8 and 19 were removed from the factor structure for reasons previously explained.

The three factors (Cognitive, Affective and Somatic) were moderately correlated with each other (Sakamoto et al., 1998). Brace, Kemp & Snelgar (2009) point out that psychological constructs may well be correlated with one another in factor analysis. Because all three factors are facets of the larger psychological construct, depression, it is not surprising that there would be moderate correlation between the extracted factors. Table 3 details the inter-factor correlation between Factors I, II and III (Sakamoto et al., 1998, p. 482).

Preliminary Observation: RunnersWorld.com

In the fall of 2009, I evaluated a forum on www.runnersworld.com which posed the question: “How does running make you feel in your day to day lives?” 28 individuals responded to this post and reported a total of 93 descriptions. The following are typical responses from the forum: “Running for me can be summed up in one word: Therapy;” “tougher mentally;” “sane, balanced, centered, and confident;” “capable, disciplined, accomplished;” and “psychologically healthy.”

I observed that the vast majority of the responses were in reference to exercise improving psychological health. However, a far fewer number alluded to exercise improving physical health. To elaborate, responses that pertained to enhanced physical health stated that running makes them feel “athletic,” and “more energetic.” Upon recognizing that improvements in psychological health were described considerably more than improvements in physical health, it became necessary to categorize the responses.

Q-Sort Analysis

The purpose of conducting a Q-Sort Analysis was to establish more concise descriptions of how running makes people feel. This allows for elimination of any overlap in responses because various words can be used to describe similar experiences. As a means of effectively categorizing the 93 responses, a Q-Sort Analysis was performed in the Social Emotions and Motivation Lab of the Psychology Department at the University of Texas at Tyler. A total of seven research assistants participated in this preliminary study. They were all given identical lists of the descriptions from the forum on www.runnersworld.com. For the sake of simplicity, repeat responses were only listed once. Thus, the list provided in the Q-Sort Analysis was comprised of the following 38 descriptions:

> Calm, less stressed, clear, simple, at peace, clears mind, free, comfortable, motivated, productive, gives me something to look forward to, identity, self-acceptance, balanced, centered, healthy, in control, sane, it’s therapeutic, strong, confident, accomplished, fearless, capable, disciplined, powerful, tough,

empowered, challenged, dedicated, energetic, alert, focused, awesome, wonderful, happy, sexy, and athletic

The research assistants were asked to group these words together in a way that "made sense to them." They were not assigned a set number of categories to create; it was left entirely up to the participants. A total of six categories emerged from the Q-Sort Analysis. Inter-rater reliability was calculated on pairs of responders using Cohen's Kappa. The degree of inter-rater agreement was averaged across pairs, and the results suggest a relatively high level of agreement, $k = .96$. The categories that emerged from the Q-sort analysis are as follows:

- Balanced (e.g. comfortable, centered, calm, clear, sane, therapeutic)
- Confident (e.g. powerful, capable, tough, empowered, fearless, strong)
- Motivated (e.g. productive, gives me something to look forward to, dedicated)
- Better emotionally (e.g. happy, awesome, wonderful, free, less stressed)
- Identity (Running is considered a part of who they are; e.g. self acceptance, identity)
- Physically healthier (e.g. athletic, healthy, sexy, energetic)

To elaborate, four of the six categories are related to cognitive elements (balanced, confident, motivated, identity), one is related to affect (feeling better emotionally), and one primarily relates to physical health benefits. This preliminary study is noteworthy because most runners identify cognitive reward as being the primary benefit to running. While runners may have differing psychological benefits from exercise than individuals that focus on other forms of physical activity, this data both supports and contributes to the formulation of my hypothesis on the relationship between symptoms of depression and exercise as a whole.

Hypothesis

I hypothesize that participants in a self-reported high-exercise group will present significantly lower scores on Cognitive Symptoms of depression from the Zung Self-Rating Depression Scale (Zung, 1965). I do not anticipate exercise level to significantly affect the Affective or Somatic Symptoms of depression. Thus, I argue that not all symptom types of depression are influenced by exercise.

Why Only Cognitive Symptoms?

There are multiple reasons why I expect only the Cognitive Symptoms of depression to be influenced by exercise level. First, in the Q-Sort Analysis, four of the six categories were cognitively oriented. Runners feel more balanced, confident, motivated and have a stronger sense of identity; these descriptions all pertain to cognitive states. Runners did report feeling better emotionally (which relates more so to affective symptoms than cognitive symptoms) and feeling physically healthier (which is more closely related to somatic symptoms than cognitive symptoms). However, of the descriptions of how running makes people feel, 67% pertain to cognitive symptoms whereas only 33% pertain to affective and somatic symptoms.

Second, empirical evidence indicates that exercise influences cognitive functioning (Callaghan, 2004). Past research has established that exercise enhances performance on tasks that involve rapid, automatized behaviors (Lambourne & Tomporowski, 2010). Additionally, exercise-induced arousal improves the speed of mental processes and enhances memory storage and retrieval (Lambourne & Tomporowski, 2010).

Third, the Affective Symptoms of depression, as established by the factor analysis of the Zung SDS, are more readily influenced by outside factors. For instance, the Affective Symptoms (crying, irritability and fatigue) may be influenced heavily by other factors in one's life. To elaborate, research has established that hormones play a role in emotion regulation (Braw, Malkesman, Merlender, Bercovich, Dagan, Maayan, & Weller, 2006; Brummelte & Galea, 2010). As such, an individual with a hormone imbalance will likely experience unpleasant emotional consequences regardless of exercise. Further, sleep deprivation or a disruption in the sleep cycle can exacerbate both fatigue and irritability (Brown, Gallicchio, Flaws, & Tracy, 2009; Fulcher, Phillips, & Robinson, 2010; Goodchild, Treharne, Booth, & Bowman, 2010; Oginska & Pokorski, 2006). Outside factors may intensify the Affective Symptoms of depression and the potential for these outside factors to be amended by exercise is not within the realm of this research.

Methods

Participants

A sample of University of Texas at Tyler students (N = 170) were recruited from the psychology department undergraduate subject pool via the SONA online-scheduling software. Participants could complete psychology studies as an option to fulfill a course requirement in 1000 and 2000 level courses and/or to earn bonus points for certain psychology courses. All participation in this study was voluntary and responses were kept confidential. There were 170 responses to the online survey. The sample was 70% female. Age ranged from 17 – 59 years (M = 20.43, SD = 4.62).

Measures

All participation was through a voluntary survey completed online. Participants read an informed consent form prior to taking the survey. Upon their consent, participants completed a survey that assesses the following:

- Demographic information (e.g. gender, age, ethnicity, and occupation)
- Type of physical activity preferred by the participant (e.g. cardio, weight training, yoga, Pilates, organized sport activity, or other)
- Frequency of exercise per week
- The number of times per week the participant considers exercise to constitute the label “on a regular basis”

Additionally, participants completed the Zung Self-Rating Depression Scale (Zung, 1965) as part of the online survey. There are multiple reasons for using the Zung SDS in measuring depression in this study. First, as previously detailed, validity and reliability of this measure have been well documented over the past 46 years. Further, this scale has been used extensively in measuring the prevalence of depression throughout the literature. These same articles have captured the prevalence of depression across various cultures, ranging from European, Japanese, Australian, American, Columbian and Brazilian populations. Additionally, the Zung Self-Rating Depression Scale is more readily available than other measures of depression, like the Beck Depression Inventory (Beck, 1961), which is protected by copyright, less easily accessible, and cost-prohibited.

Moreover, the use of the Zung SDS has been found to contribute significant incremental utility over the Depression scale of the Minnesota Multiphasic Personality Inventory-2 and over the Beck Depression Inventory (Shaefer et al., 1985; Thurber et al., 2002). Lastly, the factor analysis by Sakamoto et al. (1998), lends itself to the purpose and use of the present research by enabling an evaluation of the relationship between physical exercise and specific symptom types of depression.

Procedures

The study protocol was approved by the University Institutional Review Board. Participants were recruited through the psychology department undergraduate subject pool via the SONA online scheduling software. Participation in this study was conducted through an online survey. Confidentiality is protected as no identifying information was collected from participants. The procedure lasted approximately 15 minutes.

In order to establish low and high-exercise groups, I calculated a median split for the times per week the participants report exercising to constitute the label ‘on a regular basis.’ Participants that report exercising under this frequency are considered low-exercise participants. Participants that report exercising at or above this frequency are considered high-exercise participants.

I analyzed the results on the Zung Self-Rating Depression Scale (Zung, 1965) by assessing each symptom type individually. Using an independent t-test, I evaluated the level of Cognitive Symptoms, Affective Symptoms, and Somatic Symptoms reported by the low and high-exercise groups. I predicted that participants in the high-exercise group would report significantly fewer Cognitive Symptoms of depression compared to the low-exercise group. I did not expect to find a significant difference in the Affective or Somatic symptoms of depression between the low and high-exercise groups.

Results

Participant Descriptives

To better understand the participants' exercise habits, it was necessary to assess which form of exercise they predominantly adopted. In order to reach this end, the question was posed, "When you exercise, which activity do you primarily focus on?" In response, 106 participants reported primarily focusing on cardiovascular activities (running, biking, walking, swimming). A total of 33 participants reported focusing on weight training; 8 participants report focusing on yoga, Pilates, Tae Bo or P90x; 16 participants reported focusing on an organized sport activity; and 5 participants report that their focus is "other." Two participants did not respond to this item. In total, 62.36% focus on cardiovascular physical activities; 19.41% focus on weight training; 4.71% focus on yoga, Pilates, Tae Bo, or P90x; 9.41% focus on an organized sport activity; 2.94% report "other;" and 1.18% did not respond. This information is relevant because it is possible that all forms of exercise are not equally related to the specific symptoms of depression. It is noteworthy that the majority of the participants in the present study were using cardiovascular activities when they exercised. However, the specific influence of different types of exercise on the symptoms of depression is outside the focus of the present research.

High and Low-Exercise Groups

In order to define high- and low-exercise groups, participants were asked to report the number of times per week they consider exercise to constitute the label ‘on a regular basis.’ The minimum a participant could report was never; the maximum times per week a participant could report was greater than 5 times. I conducted a median split and the results yield that exercising 3 times per week constitutes exercising ‘on a regular basis.’ With this information, I established a cutoff for defining high and low-exercise groups.

Later in the survey, participants were asked to report how many times they exercise in a normal week. If a participant reported exercising fewer than 3 times per week, they were classified in the low-exercise group. If a participant reported exercising 3 or more times per week, they were classified in the high-exercise group. Descriptive information on the two groups, high-exercise and low-exercise, are as follows. One participant did not report an answer to this question. For this purpose, in classifying high and low-exercise groups, N = 169. Of the 169 participants that responded to this item, 68 reported exercising 3 or more times per week. 101 participants report exercising fewer than 3 times per week. Hence, 40.24% of the participants were classified in the high-exercise group. 59.76% of the participants were classified in the low-exercise group.

Zung SDS Total Scores

Assessing the total score on the Zung Self-Rating Depression Scale enables a more thorough understanding of the overall level of depression within the sample. Calculating total scores on the Zung SDS is the original method for measuring depression with this scale (Zung, 1965). For the purpose of comparison, I also computed the total score for both the high and low-exercise groups. Total scores on the Zung SDS range from 20 – 80. These scores fall into four categories (Zung, 1965):

- 20 – 49 Normal Range
- 50 – 59 Mildly Depressed
- 60 – 69 Moderately Depressed
- 70 + Severely Depressed

The mean total score on the Zung SDS for the entire sample is within the normal range, which suggests that the present sample is not considered clinically depressed (M = 31.01, SD = 7.31). The high-exercise group has a mean total score on the Zung SDS that is also within the normal range and not considered depressed (M = 29.95, SD = 7.34). Further, the mean total score for the low-exercise group on the Zung SDS is within the normal range (M = 31.75, SD = 7.24).There is no significant difference between the high and low-exercise groups on the mean total score on the Zung Self-Rating Depression Scale, t (162) = 1.74, p = .084. This is noteworthy because this establishes that the sample is not considered depressed, as measured by the Zung Self-Rating Depression Scale. The two groups, high and low-exercise, report non-clinical levels of depression overall. Because of this, effect sizes found in the comparison of symptom types of depression between exercise groups are expected to be small. Hence, differences in mean scores on the symptom types of depression between high and low-exercise groups are only able to vary a minimal amount. The overall Zung SDS scores by exercise group and mean total scores by exercise group and depression symptom types are found in Table 5.

Zung SDS Confirmatory Factor Analysis

In order to ensure that the results of this research align with the factor analysis conducted by Sakamoto et al. (1998), a confirmatory factor analysis of the Zung SDS was performed on the current sample. The results of a Principle Component Analysis with varimax rotation on the current research reveal the same extracted items for the cognitive symptoms factor as Sakamoto et al. (1998). The item factor loadings and inter-factor correlation for this research are found on Table 2 and Table 4, respectively. Psychometric properties of the Zung Self-Rating Depression Scale for this sample were computed. For the current data, the reliability is good for the Zung SDS Cognitive Symptoms factor (α = .82). The Zung SDS Affective Symptoms have acceptable reliability (α = .64) and the Somatic Symptoms have poor reliability (α =.33).

Symptom Types of Depression

By separating the total scores on the Zung Self-Rating Depression Scale into the established symptom types, I was able to compare mean scores for the high and low-exercise groups on the three subscales: Cognitive Symptoms, Affective Symptoms, and Somatic Symptoms. For all symptom types of depression, the possible range of scores was 1 to 4 (1 = ‘a little of the time;’ 4 = ‘most of the time’). The individual items constituting each factor were recomputed into new variables to assess the three symptom types of depression.

Beginning with the Cognitive Symptoms, I conducted an independent samples *t*-test and established that participants in the high-exercise group reported significantly fewer cognitive symptoms of depression than do participants in the low-exercise group.

The score on Cognitive Symptoms for the high-exercise group (M = 1.95, SD = .59) was significantly lower than was the score for the low-exercise group (M = 2.15, SD =.66); the difference was significant: t (153) = 1.94, $p < .05$, one-tailed, d = .34. The effect is considered small to medium. Again, this effect size is to be expected as the overall level of depression, as measured by the Zung SDS, is at a non-clinical level for both high and low-exercise groups.

Further, I conducted an independent samples *t*-test on the Affective Symptoms between the high and low-exercise groups. Results suggested no significant difference between the high-exercise group (M = 1.82, SD = .47) and the low-exercise group (M = 1.91, SD = .48); t (159) = 1.29, p = .20, d = .19. This effect is considered small.

Next, I compared the scores of Somatic Symptoms by the high and low-exercise groups. The low-exercise group was not significantly different on this measure (M = 1.99, SD = .56) than the high-exercise group (M = 2.00, SD = .53); t (158) = -.09, p = .93, d =.08. This effect is considered small. See Table 6 for the group means by individual symptom type of depression.

Type of Exercise and Depression

The sample reports primarily using cardiovascular physical activity and weight training, 62.36% and 19.41% respectively. To assess for potential differences in levels of cognitive symptoms of depression by exercise type, I analyzed the cardiovascular activity participants on the level of cognitive symptoms of depression between the high and low-exercise groups. Of the participants that primarily partake in cardiovascular physical activities, the low-exercise group was not significantly different on the cognitive symptoms (M = 2.11, SD = .67) than the high-exercise group (M = 2.07, SD = .59); t (96) = .32, p = .75.

Further, I assessed the weight training participants on the level of cognitive symptoms of depression between high and low-exercise groups. Results show that of weight training participants, there is no significant difference between the low-exercise group (M = 2.06, SD = .52) and the high-exercise group (M = 1.73, SD = .63) on the cognitive symptoms of depression; $t(27) = 1.45$, $p = .16$.

Discussion

The present results are consistent with previous findings that suggest exercise has an inverse relationship with depression. However, the research until this point has not discriminated between the different symptom types of depression. The results of the present study fill this gap by indicating that not all symptoms of depression are equally influenced by exercise. The results reported here suggest that high-exercise participants experience significantly fewer cognitive symptoms of depression, compared to low-exercise participants. No significant differences were found within the other two symptom types of depression.

These findings suggest that although exercise level is related to depression, not all aspects of depression are equally related to exercise level. To understand more fully, identification of the specific items that define the Cognitive Symptoms, Affective Symptoms and Somatic Symptoms of depression from the Zung Self-Rating Depression Scale may be useful; see Table 7. To briefly summarize, the Cognitive Symptoms were composed of Zung SDS items involving clarity of mind, hopefulness, and ease of decision making. Affective Symptoms were composed of items relating to feeling down-hearted, restless and irritable. Somatic Symptoms were most related to difficulty sleeping, changes in appetite and reports of a racing heart.

It is important to understand clearly which specific facets of depression are influenced by exercise so that there is a fuller understanding of the relationship between exercise and depression as a whole. It has now been established that only the cognitive symptoms of depression, as measured by the Zung SDS, are significantly related to exercise. Empirical evidence as to why exercise is related most strongly to the cognitive symptoms of depression has yet to be examined. The present research has laid the groundwork for understanding more specifically how exercise is related to, and may directly influence, depressive symptoms. With continued research in this area, it will be possible to investigate why and how exercise significantly influences only the cognitive symptoms of depression.

Implications

There are multiple implications to derive from the present research. First, better understanding the role of exercise in the experience of depressive symptoms offers empirical support for new treatment interventions. Although the present research does not show a causal relationship between higher exercise levels and fewer cognitive symptoms of depression, it does show a significant relationship exists between the two. Until now, this has never been specified in the literature. With this information and continued research toward this end, psychologists, counselors, and other mental health professionals may be able to implement empirically-supported treatment interventions involving physical activity. Specifically, for patients suffering primarily from depressive thinking patterns and/or maladaptive thought processes, exercise may be especially efficacious in their treatment. This is a significant first step in better understanding and treating depressed patients in the mental health field.

Second, this research is a step in the direction of establishing the empirical relationship between cognitions, mental health and physical activity. As previously discussed, the role of exercise in the improvement of cognitive processes has been established. However, to date, the relationship between all three factors (cognitions, mental health and exercise) has only just begun. Both understanding and changing cognitive processes is the driving force behind Aaron Beck's Cognitive Behavior Therapy (Corey, 2005). Further, Cognitive Behavior Therapy is commonly used to treat depressed clients. Empirical evidence on how exercise may be potentially moderating these factors is important as the psychology field continues to grow and expand.

Third, whereas past research has focused on increasing exercise to improve physical health, the present research shifts the empirical direction by highlighting the importance of exercise for improving mental health. It has been established that exercise both maintains and improves physical health. The psychological factors that increase exercise have also been documented. It is noteworthy that the relationship between exercise and multiple types of mental disorders, not just depression, have only been broadly discussed in the literature. In other words, the specific components of many mental disorders as they relate to exercise have not been well established. The present shift in the research lends itself to a new field of empirical exploration that will allow for a fuller understanding of the ways in which exercise is related to the specific symptoms of psychological disorders.

Limitations

It is important to highlight that the conclusions from the present study were derived from a population that is highly focused on cardiovascular activities. The type of exercise activity could influence the relationship with depressive symptoms. Results revealed no significant differences in level of cognitive symptoms of depression between high and low-exercise groups split between both cardiovascular and weight training participants. However, the sample sizes of the cardiovascular and weight training groups are quite different; n = 98 and n = 29, respectively. Because of this, it is difficult to make any firm conclusions on the relationship between type of exercise activity and levels of cognitive symptoms of depression. At present, the only definitive statement to make is that exercise, in general, is significantly related to fewer cognitive symptoms of depression. There cannot be an inference made about which types of exercise may be most beneficial. The focus of the present study has been toward the specific dimensions of depression related to exercise, not the specific types of exercise that are related to depression.

Additionally, until now, the literature has only shown that exercise has an antidepressant effect (DiLorenzo et al., 1999; Lawlor & Hopker, 2001; Mata, Thompson, & Gotlib, 2010; North, McCullagh, & Tran, 1990). The present research identified the specific symptom type of depression that is significantly related to the level of exercise. However, at present, a *causal* relationship between high-exercise levels and fewer cognitive symptoms of depression has not been identified. Stating that a causal relationship exists cannot be done until it is first established that a relationship exists at all. Establishing the existence of a significant relationship between exercise and the cognitive symptoms of depression has been the goal of the present study.

Further, females were over-represented in the present analysis as the current population is 70% female. It would be useful to assess the relationship between exercise and cognitive symptoms of depression for males versus females, but the gender group size difference in the present data set would yield results that are potentially misleading. There is a significant effect of gender difference on the cognitive symptoms of depression in the present research. Results show that females scored higher on cognitive symptoms ($M = 2.14$, $SD = .65$) than men ($M = 1.88$, $SD = .59$); $f(1,151) = 5.06$, $p = .02$. However, the interaction between exercise groups and gender is not significant ($p>.45$). Essentially, women scored higher on cognitive symptoms of depression but there is no significant interaction between gender and exercise level. Therefore, no firm conclusions can be made about the role of gender difference in the relationship between exercise and the cognitive symptoms of depression.

Future Directions and Considerations

The present study has opened the door to further research on the specific components of depression that are influenced by physical activity. As we move forward, there are various directions to continue research toward this end. To begin, it has now been established that a relationship exists between exercise and the cognitive symptoms of depression. It will be important to further assess a hypothetical causal relationship between physical activity and a reduction in the cognitive symptoms of depression. Future studies could evaluate exercise as a potential treatment intervention for depression. Additionally, it will be critical to assess the role of type of exercise activity in the experience of depression. Do all forms of exercise influence depressive symptoms equally? It is unlikely. Further exploration into different types of exercise activities is important.

Future directions for research could focus on the duration and intensity of exercise needed to significantly influence depressive symptoms. Does an individual that exercises for 20 minutes get the same affect on the cognitive symptoms of depression as an individual that exercises for an hour? Other important factors to consider involve exercising alone versus with a partner, exercising with or without music, and how long an individual needs to maintain an exercise routine in order to experience potential anti-depressant effects. All of these factors possibly mediate the relationship between exercise and the cognitive symptoms of depression.

Related the amount of exercise needed, it will be imperative to assess if more exercise is always better. Is it possible that there is a bell curve for exercise potentially improving mental health functioning? Investigating the role of balance in maintaining an exercise routine is important. As research toward this end is conducted, identifying the ideal amount of exercise will become necessary.

Lastly, future consideration should be directed toward other types of mental disorders that may be influenced by physical activity. The present study has investigated the relationship between exercise and the specific symptom types of depression. Future studies will be needed to better understand the relationship between exercise and related disorders. For instance, the role of exercise in the experience of disorders such as Dysthymia, Post-Partum Depression, Generalized Anxiety Disorder, Panic Disorder, Specific Phobias and Post-Traumatic Stress Disorder will be useful.

Conclusions

Until now, the literature had not employed an investigation of the specific symptom types of depression and exercise. The present thesis fills this gap in the literature by establishing that a significant relationship exists only between the cognitive symptoms of depression and physical activity. While a causal relationship has not yet been substantiated, the existence of a significant relationship here is a noteworthy finding. Until now, the relationship between depression and exercise had not been examined closely enough to consider exercise's potential influence on individual symptoms.

The present study warrants two important conclusions. First, the symptom types of depression are not equally related to exercise. Secondly, it predicates that by not investigating specific components of psychological disorders, significant finds are going unrecognized. In order to fully understand how exercise is related to mental health, it is not only important but necessary to examine the specific symptoms of psychological disorders. This has now been established for the relationship between exercise and depression.

As mental health is an infinitely complex area of study, broadly assessing disorders as they may relate to physical activity overlooks imperative components in understanding the relationship. By assessing the specific symptom types of depression and establishing that only the cognitive symptoms are significantly related to exercise level, it has been discerned that not all facets of depression are equally related to exercise. Further, there is now evidence toward the importance of closely investigating the individual symptoms of psychological disorders. The findings of the present research establishes both a better understanding of the relationship between exercise and depression and lends itself to continued research on the relationship between physical activity and mental health as a whole.

References

Barrett, J., Hurst, M.W., DiScala, C., & Rose, R.M. (1978). Prevalence of depression over a 12-month period in a nonpatient population. *Archives of General Psychiatry*, *35*, 741-744.

Beck, A. (1961). A systematic investigation of depression. *Comprehensive Psychiatry*, 2, 163-170.

Bernardo, L., Abt, K., Ren, D., & Bender, C. (2010). Self-reported exercise during breast cancer treatment: results of a national survey. *Cancer Nursing*, *33*(4), 304-309.

Birmingham, K. (2008). Exercise is the best medicine. *Nursing Older People*, *20*(7), 3.

Bitsika, V., Sharpley, C., Bell, R. (2009). The contribution of anxiety and depression to fatigue among a sample of Australian university students: Suggestions for university counsellors. *Counseling Psychology Quarterly*, 22(2), 243-255.

Blair, S., & Cooper, K. (2000). Exercise. *Encyclopedia Britannica*. Retrieved July 15, 2010, from http://www.britannica.com/EPchecked/topic/197976/exercise.

Blumenthal, J. A., Babyak, M. A., Doraiswamy, P. M., Watkins, L., Hoffman, B. M., Barbour, K. A., & Sherwood, A. (2007). Exercise and pharmacotherapy in the treatment of major depressive disorder. *Psychosomatic Medicine*, 69, 587–596.

Blumenthal, M.D. (1975). Measuring depressive symptomatology in a general population. *Archives of General Psychiatry*, *32*, 971-978.

Booth, F., & Laye, M. (2010). The future: genes, physical activity and health. *Acta Physiologica*, *199*(4), 549-556.

Brace, N., Kemp, R., and Snelgar, R. (2009). *SPSS for Psychologists.* (4th ed.). New York, NY: Routledge.

Braw, Y., Malkesman, O., Merlender, A., Bercovich, A., Dagan, M., Maayan, R., & ... Weller, A. (2006). Stress hormones and emotion-regulation in two genetic animal models of depression.*Psychoneuroendocrinology*, *31*(9), 1105-1116.

Brown, J. P., Gallicchio, L., Flaws, J. A., & Tracy, J. (2009). Relations among menopausal symptoms, sleep disturbance and depressive symptoms in midlife. *Maturitas*, *62*(2), 184-189.

Brummelte, S., & Galea, L. (2010). Depression during pregnancy and postpartum: contribution of stress and ovarian hormones. *Progress In Neuro-Psychopharmacology & Biological Psychiatry*, *34*(5), 766-776.

Buchwald, A.M., & Rudick-Davis, D. (1993). The symptoms of major depression. *Journal of Abnormal Psychology*, 102, 197-205.

Byrne, A., & Byrne, D. G. (1993). The effect of exercise on depression, anxiety and other mood states: A review. *Journal of Psychosomatic Research*, 37, 565–574.

Callaghan, P. (2004). Exercise: A neglected intervention in mental health care?. *Journal of Psychiatric and Mental Health Nursing*, *11*(4), 476-783.

Campo-Arias, A., Diaz-Martinez, L., Rueda-Jaimes, G., & Barros-Bermudez, J. (2005). Validation of Zung's Self-Rating Depression Scale Among University Student Women from Bucaramanga, Colombia. *Revista Colombiana de Psiquiatria*, 32(1[41]), 54-62.

Carless, D, & Douglass, K. (2008). The Role of Sport and Exercise in Recovery from Serious Mental Illness: Two Case Studies. *International Journal of Men's Health*, *7*(2), 137-156.

Center for Disease Control and Prevention (1996). Physical activity and health: a report of the surgeon general. US Department of Health and Human Services, National Center for Chronic Disease Prevention and Health Promotion, Atlanta.

Chagas, M., Tumas, V., Loureiro, S., Hallak, J., Trzesniak, C., de Sousa, J… (2010). Validity of a Brazilian version of the Zung self-rating depression scale for screening of depression in patients with Parkinson's disease. *Parkinsonism & Related Disorders*, 16(1), 42-45.

Cooper, K. (2010). The benefits of exercise in promoting long and healthy lives - my observations.*Methodist Debakey Cardiovascular Journal*, *6*(4), 10-12.

Corey, G. (2005). *Theory and Practice of Counseling and Psychotherapy.* (7th ed.). Belmont, CA: Brooks/Cole-Thomson Learning.

Crone, D., & Guy, H. (2008). 'I know it is only exercise, but to me it is something that keeps me going': A qualitative approach to understanding mental health service users' experience of sports therapy. *International Journal of Mental Health Nursing, 17*(3), 197-207.

De Jonghe, J., & Baneke, J. (1989). The Zung Self-Rating Depression Scale: A Replication Study on Reliability, Validity and Prediction. *Psychological Reports* 64, 833-834.

DiLorenzo T.M., Bargman E.P., Stucky-Ropp R., Brassington G.S., Frensch P.A. & LaFontaine T. (1999). Long-term effects of aerobic exercise on psychological outcomes. *Preventive Medicine* 28, 75–85.

Dogra, S., Jamnik, V., & Baker, J. (2010). Self-directed exercise improves perceived measures of health in adults with partly controlled asthma. *The Journal Of Asthma: Official Journal Of The Association For The Care Of Asthma*, *47*(9), 972-977.

Faulkner, G., & Biddle, S. (1999). Exercise as an adjunct treatment for schizophrenia: A review of the literature. *Journal of Mental Health, 8*(5), 441-457.

Faulkner, G., & Sparkes, A. (1999). Exercise as therapy for schizophrenia: An ethnographic study. *Journal of Sport & Exercise Psychology, 21,* 52-69.

Fox, K. R. (2002). Self-perceptions and sport behaviour. *Advances in sport psychology, 2,* 83-99.

Fulcher, B., Phillips, A., & Robinson, P. (2010). Quantitative physiologically based modeling of subjective fatigue during sleep deprivation. *Journal Of Theoretical Biology*, *264*(2), 407-419.

Gillison, F., Standage, M., & Skevington, S. (2011). Motivation and body-related factors as discriminators of change in adolescents' exercise behavior profiles. *The Journal Of Adolescent Health: Official Publication Of The Society For Adolescent Medicine*, *48*(1), 44-51.

Goodchild, C., Treharne, G., Booth, D., & Bowman, S. (2010). Daytime patterning of fatigue and its associations with the previous night's discomfort and poor sleep among women with primary Sjögren's syndrome or rheumatoid arthritis. *Musculoskeletal Care, 8*(2), 107-117.

Haskell, W., Lee, I., Pate, R., Powell, K., Blair, S., Franklin, B., et al. (2007). Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise, 39*, 1432-1434.

Hobson, K. (2010). How exercise can boost longevity. *U.S. News & World Report, 147*(2), 30.

Huffman, D. (2010). Exercise as a calorie restriction mimetic: implications for improving healthy aging and longevity. *Interdisciplinary Topics In Gerontology*, *37*, 157-174.

Innamorati, M., Lelli, M., Aiello, S., Di Lorenzo Del Casale, F., L., Russo, S., & Ferrari, V. (2006). Validazione convergente e discriminante della versione italiana della Zung Self-Rating Depression Scale [Convergent and discriminant validation of the Italian version of the Zung Self-Rating Depression Scale]. *Psicoterapia Cognitiva e Comportamentale*, 12, 343-353.

Innamorati, M., Pompili, M., Ferrari, V., Girardi, P., & Tatarelli, R. (2008). Cannabus use and the risk behavior syndrome in Italian university students: Are they related to suicide risk? *Psychological Reports*, 102, 577-594.

Jara, C., Popp, R., Zulley, J., Hajak, G., Geisler, P. (2011). Determinants of depressive symptoms in narcoleptic patients with and without cataplexy. *Journal of Nervous and Mental Disease*, 199(5), 329-334.

Kang, K., Sung, J., & Kim, C. (2010). High risk groups in health behavior defined by clustering of smoking, alcohol, and exercise habits: National Health and Nutrition Examination Survey. *Journal of Preventive Medicine And Public Health - Yebang Ŭihakhoe Chi*, *43*(1), 73-83.

Katsuura, S., Kamezaki, Y., Yamagishi, N., Kuwano, Y., Nishida, K., Masuda, K., Tanahashi, T., Kawai, T., Arisawa, K., Rokutan, K. (2011). Circulating vascular endothelial growth factor is independently and negatively associated with trait anxiety and depressive mood in healthy Japanese university students. *International Journal of Psychophysiology*, 81(1), 38-43.

Lambourne, K., & Tomporowski, P. (2010). The effect of exercise-induced arousal on cognitive task performance: a meta-regression analysis. *Brain Research*, *1341,* 12-24.

Lannem, A., Sorensen, M., Lidal, I., & Hjeltnes, N. (2010). Perceptions of exercise mastery in persons with complete and incomplete spinal cord injury. *Spinal Cord: The Official Journal Of The International Medical Society Of Paraplegia*, *48*(5), 388-392.

Lawlor D.A. & Hopker S.W. (2001) The effectiveness of exercise as an intervention in the management of depression: systematic review and meta-regression analysis of randomized controlled trials. *British Medical Journal* 322, 763–766.

Lee, H. (1990). Reliability, validity and fakability of the Zung Self-rating Depression Scale. *Bulletin of the Hong Kong Psychological Society*, 24-25, 5-15.

Mata, J., Thompson, R., Gotlib, I. (2010). BDNF genotype moderates the relation between physical activity and depressive symptoms. *Health Psychology, 29*(2), 130-133.

Newton, R., & Galvao, D. (2008). Exercise in prevention and management of cancer. *Current Treatment Options In Oncology*, *9*(2-3), 135-146.

Norris, R., Carroll, D., & Cochrane, R. (1992). The effects of physical activity and exercise training on psychological stress and well-being in an adolescent population. *Journal of Psychosomatic Research*, 36, 55–65.

North T., McCullagh P. & Tran Z. (1990) Effect of exercise on depression. *Exercise and Sport Sciences Reviews*, 379–415.

Oginska, H., & Pokorski, J. (2006). Fatigue and mood correlates of sleep length in three age-social groups: School children, students, and employees. *Chronobiology International*, *23*(6), 1317-1328.

Rockenfeller, P., Madeo, F. (2010). Ageing and Eating. *Biochimica et Biophysica Acta*, 499-506.

Roman, M. (2010). Physical exercise as psychotherapeutic strategy: How long? What will it take?. *Issues in Mental Health Nursing, 31*(2), 153-154.

Russell, K., & Bray, S. (2010). Promoting self-determined motivation for exercise in cardiac rehabilitation: the role of autonomy support. *Rehabilitation Psychology*, *55*(1), 74-80.

Sakamoto, S., Kijima, N., Tomoda, A., & Kambara, M. (1998). Factor structures of the Zung Self-Rating Depression Scale (SDS) for undergraduates. *Journal of Clinical Psychology*, *54*(4), 477-487.

Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine & Science in Sports & Exercise*, 32, 963–975.

Shaefer, A., Brown, J., Watson, C. G., Plemel, D., Demotts, J., Howard, M. T., Petrick, N., Balleweg, B. J., & Anderson, D. (1985). Comparison the validities of the Beck, Zung, and MMPI Depression scales. *Journal of Consulting & Clinical Psychology*, 53, 415-418.

Slovacek, L., Slovackova, B., Slanska, I., Hrstka, Z., Priester, P. (2010). Incidence and relevance of depression among palliative care female inpatients. *European Journal of Cancer Care*, 19(5), e8-e9.

Stessman, J., Hammerman-Rozenberg, R., Cohen, A., Ein-Mor, E., & Jacobs, J. (2009). Physical activity, function, and longevity among the very old. *Archives Of Internal Medicine*, 169(16), 1476-1483.

Sun, Q., Townsend, M., Okereke, O., Franco, O., Hu, F., & Grodstein, F. (2010). Physical activity at midlife in relation to successful survival in women at age 70 years or older. *Archives Of Internal Medicine*, *170*(2), 194-201.

Tanaka, K. (2008). Exercise, physical activities and public health (3). For good quality of life leading to long healthy life. *[Nippon Kōshū Eisei Zasshi] Japanese Journal of Public Health*, *55*(5), 350-354.

Thurber, S., Snow, & M., Honts, C. (2002). The Zung Self-Rating Depression Scale: Convergent validity and diagnostic discrimination. *Assessment*, 9(4), 401-405.

Wagner, C. (2007). Exercise in breast cancer survivors: Predicting quality of life with the cognitive-appraisal model of stress and coping. *Dissertation Abstracts International*, 68.

Wilson, P., & Rogers, W. (2008). Examining relationships between perceived psychological need satisfaction and behavioral regulations in exercise. *Journal of Applied Biobehavioral Research*, *13*(3), 119-142.

Wilson, P., Mack, D., & Grattan, K. (2008). Understanding motivation for exercise: A self-determination theory perspective. *Canadian Psychology/Psychologie canadienne*, *49*(3), 250-256.

Zung, W.W.K. (1965). A self-rating depression scale. *Archives of General Psychiatry, 12,* 63-70.

Zung, W.W.K. (1967). Depression in the normal aged. *Psychosomatics, 8,* 287-292.

Tables

Table 1. Sakamoto et al. (1998) Factor Structures of the Zung SDS

No.	Item Content	Cognitive	Affective	Somatic
17	Personal devaluation	**0.745**	0.168	0.078
14	Hopelessness	**0.720**	0.030	0.050
12	Psychomotor retardation	**0.684**	-0.142	0.009
16	Indecisiveness	**0.666**	-0.025	0.189
18	Emptiness	**0.614**	-0.130	-0.057
11	Confusion	**0.570**	-0.279	-0.027
6	Decreased libido	0.487	0.401	-0.221
20	Dissatisfaction	**0.434**	-0.114	-0.118
15	Irritability	-0.028	**0.770**	-0.041
13	Psychomotor agitation	0.144	**0.670**	-0.027
1	Depressed affect	-0.300	**0.598**	0.044
10	Fatigue	-0.137	**0.559**	0.156
3	Crying spells	-0.038	**0.496**	0.156
7	Weight loss	0.185	0.040	**0.643**
4	Sleep disturbance	0.053	0.212	**0.474**
9	Tachycardia	0.105	0.324	**0.410**
19	Suicidal ideation	-0.091	0.191	0.352
5	Decreased appetite	0.154	0.185	**0.724**

Note. Sakamoto et al., 1998, p. 480. Bolded items indicate specific factor loading. Items 2 (Diurnal variation) and 8 (Constipation) were excluded in the factor analysis. Items 6 did not significantly load on only one factor. Item 19 did not significantly load on any factor. Items 5, 6, 11, 12, 14, 16, 17, 18, and 20 are reverse items. For details on each statement, see Zung (1965).

Table 2. Present Research Factor Structures of the Zung SDS

No.	Item Content	Cognitive	Affective	Somatic
17	Personal devaluation	**0.767**	0.432	-0.203
14	Hopelessness	**0.732**	-0.421	0.127
12	Psychomotor retardation	**0.690**	0.179	-0.524
16	Indecisiveness	**0.665**	0.222	-0.133
18	Emptiness	**0.682**	-0.269	0.229
11	Confusion	**0.654**	0.244	-0.249
6	Decreased libido	0.144	-0.519	-0.219
20	Dissatisfaction	**0.724**	0.418	0.218
15	Irritability	0.354	0.398	**0.522**
13	Psychomotor agitation	-0.175	**0.567**	0.166
1	Depressed affect	0.366	**0.954**	0.577
10	Fatigue	0.206	**0.751**	0.162
3	Crying spells	**0.422**	0.386	0.180
7	Weight loss	-0.227	0.176	**-0.991**
4	Sleep disturbance	0.146	0.496	**0.409**
9	Tachycardia	-0.427	0.134	**0.796**
19	Suicidal ideation	0.161	0.371	0.686
5	Decreased appetite	0.156	0.192	0.180

Note. Bolded items indicate specific factor loading. Items 2, 9, 6 and 19 were not included, as Sakamoto et al. (1998) excluded these items. Items 5 was excluded from the present extraction
as the factor loadings were very small.

Table 3. Sakamoto et al. (1998) Inter-Factor Correlation of the Zung SDS

	Cognitive	Affective	Somatic
Cognitive	-	-0.446	-0.297
Affective		-	0.280
Somatic			-

Note. Sakamoto et al., 1998, p. 482.

Table 4. Present Research Inter-Factor Correlation of the Zung SDS

	Cognitive	Affective	Somatic
Cognitive	-	0.453	0.087
Affective		-	0.361
Somatic			-

Table 5. Overall Zung SDS Score and Total Symptom Factor Scores

	Low-Exercise	High-Exercise
Overall Total	31.75 (7.24)	29.95 (7.34)
Cognitive Symptoms	15.57 (5.26)	14.20 (4.51)
Affective Symptoms	8.32 (2.64)	7.72 (2.55)
Somatic Symptoms	7.97 (2.24)	8.00 (2.14)

Note. Total factor score computed by adding responses to relevant individual items. Overall total score was computed by adding responses to total factor scores. Overall total score cutoff for non-clinical levels of depression is < 49.

Table 6. Mean scores on Symptom Types of Depression

	Low-Exercise	High-Exercise
Cognitive Symptoms	**2.15 (.66)[a]**	**1.95 (.59)[b]**
Affective Symptoms	1.91 (.48)[a]	1.82 (.47)[a]
Somatic Symptoms	1.99 (.56)[a]	2.00 (.53)[a]

Note. Item rating scale (1) = Low symptoms to (4) = High symptoms. Bolded items differ at p<.05.

Table 7. Individual depression symptom items from the Zung Self-Rating Depression Scale

No.	Cognitive	Affective	Somatic
11	My mind is as clear as it used to be.	-	-
12	I find it easy to do the things I used to.	-	-
14	I feel hopeful about the future.	-	-
16	I find it easy to make decisions.	-	-
17	I feel that I am useful and needed.	-	-
18	My life is pretty full.	-	-
20	I still enjoy the things I used to do.	-	-
1	-	I feel down-hearted and blue.	-
3	-	I have crying spells or feel like it.	-
10	-	I get tired for no reason.	-
13	-	I am restless and can't keep still.	-
15	-	I am more irritable than usual.	-
4	-	-	I have trouble sleeping at night.
5	-	-	I eat as much as I used to.
7	-	-	I notice that I am losing weight.
9	-	-	My heart beats faster than usual.