



THE EFFECTS OF EXERCISE AND PHYSICAL ACTIVITY ON DEPRESSION LEVELS IN GREEK ADULT POPULATION

Christine Gkatsou¹,
Constantina Katsora²,
Stylianos Kaprinis³ⁱ

¹Department of Sports Management,
Faculty of Human Movement and Quality of Life,
University of Peloponnese,
Greece

²Department of Sports Management,
Faculty of Human Movement and Quality of Life,
University of Peloponnese,
Greece

³Department of Sports Management,
Faculty of Human Movement and Quality of Life,
University of Peloponnese,
Greece

Abstract:

Depression constitutes the most common mental disorder and is associated with problems of emotional, physical and cognitive nature, causing a decrease in well-being, placing a strain on mental health, which ultimately threatens the quality of life. In fact, it tends to become the second most important cause of morbidity and disability in the world after ischemic heart disease. At the same time, exercise and physical activity present as a viral determining factor in the effort to halt the prevalence of the disease. This study examined the relationship between weekly physical activity and depression levels in a sample of seventy Greek adult citizens. Participants completed the Beck Depression Inventory-II (BDI-II) and the Godin Leisure-Time Exercise Questionnaire (GLTEQ). The two questionnaires demonstrated high reliability, and participants who demonstrated a high degree of exercise showed a minimal degree of depression. Using linear regression, it was evident that the effect of physical activity on depression was statistically significant, as the increase in physical activity corresponded with a decrease in the degree of depression. The findings of this study support the view that exercise is an effective proposition for preventing and treating depression.

Keywords: exercise, physical activity, depression

ⁱ Correspondence: email skaprinis@yahoo.gr, skaprinis@uop.gr

1. Introduction

According to the World Health Organization (W.H.O, 2017) 4.4% of the world's population, about 350 million people, suffer from depression. In Europe, this translates as over 40 million citizens, and it is estimated that in the future 17% of the population will experience a depressive episode at least once in their lives (W.H.O, 2017). In Greece, 4.7% of the population suffers from this mental disorder, with 7 out of 10 being women (67.0%) and 3 out of 10 men (33.0%) (Hellenic Statistic Authority, 2016). In general, women are twice as likely to experience a depressive episode, compared to men (Cellano & Huffman, 2011; Clark et al, 2006; Jonsson et al, 2010). Depression is now considered the most common mental disorder and is associated with emotional, physical and cognitive problems and more commonly with a decrease in well-being, increased functional disabilities and medical care services. Furthermore, the World Health Organization (W.H.O. 2009) estimates that, by the end of 2020, depression will constitute the second most important cause of morbidity and disability in the world after ischemic heart disease. At the same time, exercise and physical activity present as a vital determining factor in the effort to abridge the spread of the disease. Sport may have an assisting and auxiliary role, along the side of other therapeutic approaches. In fact, according to Wipfli, Landers, Nagoshi and Ringenbach (2011), sport is deemed to be the best non-pharmaceutical intervention in the treatment of depression. This study investigated the relationship between weekly physical activity and depression levels in a sample of 70 Greek adult citizens.

2. Literature Review

2.1. Depression

The World Health Organization (W.H.O, 2012) defines depression as a common mental disorder characterized by sadness, loss of interest or pleasure, decreased energy, feelings of guilt or low self-esteem, troubled sleep or appetite, feelings of fatigue and poor concentration, which can be long-term and/or repetitive. This mental stress causes severe limitations and can significantly affect a person in their daily life (Cellano & Huffman, 2011). Depression causes, to a pervasive extent, reduced productivity in the workplace while burdening the healthcare systems with several billion dollars due to the expense of antidepressant drugs and psychotherapies (Craft & Perna, 2004).

According to the American Psychiatric Association (A.P.A, 2013) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) diagnostic tool, subjects who are suffering from depression are faced with mobility problems, since their condition is characterized by a negative attitude, persistent sadness, loss of interest in activities that people usually enjoy. They, also, frequently, experience feelings of fatigue, psychomotor retardation and a desire to stay in bed for a prolonged period of time while avoiding the company of others. Finally, they experience feelings of anxiety, low self-esteem, guilt, obsolescence and might exhibit suicidal tendencies. Genetic factors

(heritage), biological (CNS diseases, neurotransmitters) and psychosocial factors (personality type, etc.) constitute the most common factors that can lead to depression (Hapel, et al., 2008; Leppanen, 2006; Sadock et al, 2015). People with low self-confidence, oversensitivity, pessimism, perfectionism, tendencies of social isolation and/or dependence on others tend to be more prone to the onset of depression (Raphael, 2000).

2.2 Benefits of Exercise in Mental Health

Sport is inextricably linked to parameters such as physical and mental well-being, while it also constitutes one of the main pillars of the concept of quality of life. Exercise has anxiolytic and antidepressant properties (Baybak et al, 2000; Landers & Arent, 2007; LeUnes, 2008; Salmon, 2000; Wipfli et al, 2011), helps defuse stressors and promotes mental health and well-being in general (Berger & Tobar, 2007; Biddle, Mutrie & Gorely, 2015; Gary et al, 2010; Hassmén, et al, 2002). As a matter of fact, surveys (Biddle et al, 2000; Richardson et al, 2005) point out that exercise is a more efficient option for preventing and treating mental disorders than individual or group psychotherapy.

Psychological variables affected by the involvement in sport include an increase in a person's level of self-esteem and self-confidence (Ekeland et al, 2005; Guskowska, 2004; Netz et al, 2005; Weinberg & Gould, 2011) and improving body-related self-image (Bodin & Martinsen, 2004; Hagger et al, 2001). In fact, the effect of exercise programs on mental euphoria is not encountered solely during exercise but also, releases a delayed anxiolytic effect on the subject (Theodorakis, 2016). In particular, by improving cardiovascular function and the secretion of chemicals within the body caused by exercise (dopamine, serotonin, norepinephrine) there is a positive effect on the mood of the person exercising (Guskowska, 2004). Another interpretation (Theodorakis, 2016) correlates improving the mood of the individual with physical activity by increasing vitality, which in turn, is responsible for the occurrence of pleasant feelings in the person who exercises systematically.

2.3 Exercise as a Therapeutic Intervention for Depression

Physical activity has been widely used in the context of a large number of interventional programs aimed at the rehabilitation of mental disorders, in the form of escorts and auxiliary function. However, it is argued (Biddle, Mutrie & Gorely, 2015) that physical activity as such is not able to act as a treatment for mental health disorders, with the auxiliary role nevertheless, becoming crucial. A Biddle et al (2008) study found that patients who exercised experienced fewer relapses in depressive episodes compared to patients receiving exclusively pharmaceutical relapse. Studies (Osborn, 2001; Paluska & Schwenk, 2000) have found that aerobic exercise helps relieve mild and moderate depression by reinforcing the individuals' daily routines and increasing interactions with others. In another study (Dimeo et al, 2001) the effect of exercise on a treadmill for 30 minutes per day and for a total period of 10 consecutive days was assessed in depressed patients and showed a statistically significant reduction in symptoms and an improvement in the clinical picture of subjects with depression. In her research, Roh

(2016) examined the effect of physical exercise on the resilience of the personality of subjects with depression after a 16-week interventional program using Pilates. There has been a noteworthy increase in variables such as self-confidence, self-image, anger management and communication skills, resulting in a sharp reduction in some symptoms of depression. A similar positive connection between physical activity and self-esteem was also identified in their research by Dopp et al, (2012). The positive contribution of exercise regarding improving the subjects' mental state and resulting in "happiness", is supported by the findings of Broman-Fulks & Storey (2008) in a study concerning neurophysiological changes in exercise in people with depression. The mentioned study concluded that exercise can contribute effectively to lowering the anxiety levels, which is both a manifestation of symptoms and an aggravating factor in depression. Therefore, stress reduction ensures the stability of the mental state of people with depression and reduces its symptoms. In fact, studies such as that of DiLorenzo et al. (1999) argue that the benefits of reducing depression levels, reducing anxiety and uplifting self-image have a long-term duration. In particular, the 12-week survey participants seem to have maintained the benefits they gained in the mentioned areas for a period of time estimated to be twelve months later. Finally, research (Olson et al, 2017) observed a positive correlation between physical activity and cognitive control in people with depression. In particular, the research assessed the effect of aerobic exercise on cognitive control of people with major depressive episodes over an 8-week period. According to the results, there was a statistically significant improvement in cognitive control.

2.4 Scope of Research

The purpose of this research was to study physical activity levels in an adult population, and to examine their relation to depression levels based on their self-reports.

3. Material and Methods

3.1 Sample

The study sample consisted of 70 participants, all legal (adults over 18 years of age). The criteria for selecting the sample were for participants to be engaged in some form physical activity, as well as not to have a diagnosis of neurological or psychological disorders. The survey involved 70 people, with an average age of 27.5 years, with a minimum age of 18 years and a maximum age of 46 years (standard deviation of 7.36 years). In numbers, 53% of the sample were male while 47% were female. Also, 24% were high school graduates, 49% were university graduates, 24% had a master's degree and 3% had a Doctorate. Moreover, 60% of the sample were employed, while the remaining 40% were unemployed and/or students.

3.2 Data Collection Tools

For the purposes of the study, (a) the Beck Depression Inventory questionnaire - Beck BDI-II (Beck, Steer & Brown 1996), (b) the Godin Leisure Time Exercise Questionnaire - GLTEQ (Godin & Shephard, 1985) were used. In Beck Depression Inventory, the overall depression score is calculated by summing up the answers to the 21 questions.

The maximum score that can be obtained in the questionnaire is 63. Scores up to 13 indicate a minimum level of depression, scores from 14 to 19 indicate a low level of depression, scores from 20 to 28 indicate a moderate depression, and scores above 28 indicate the existence of severe depression. Similarly, in the Godin Leisure Time Exercise Questionnaire, overall scores above 23 indicate a high degree of exercise, scores from 14 to 23 indicate a moderate degree of exercise, and scores below 14 indicate a low degree of physical activity.

3.3 Statistical Analysis

The statistical analysis was performed through the 25th edition of the SPSS program. Descriptive statistics were performed using both frequencies and percentages as well as the calculation of an average versus standard deviations, the reliability coefficients of the two questionnaires was calculated as well and it was verified that depression and weekly exercise data follow normal distribution using the Kolmogorov-Smirnov Test, which indicated that the data deviated from normal distribution. For the examination of the research cases, non-parametric statistical tests were used, since they do not require the data to follow the normal distribution.

To examine the relationship between exercise and depression levels, a Spearman rho correlation was initially established between the degree of weekly physical exercise and the degree of depression. The potential causal effect of that weekly physical exercise was then examined, as an independent variable, on the subjects' depression levels, as a dependent variable using linear regression.

4. Results and Discussion

Table 1 shows the Mean (M) and Standard Deviations (SD) in all Beck Depression Inventory (Beck BDI II) queries. Participants showcased low scores on depression questions.

On the Godin Leisure Time Questionnaire scale, on average, the sample was engaged in 1.66 weekly 15-minute high-intensity exercises, 1.96 moderate-intensity exercises and 2.34 mild intensity exercises per week (Table 2).

Table 1: Beck Depression Inventory - BDI-II item descriptive

		(M)	(SD)
1	Sadness	0.36	0.539
2.	Pessimism	0.23	0.516
3	Past failure	0.20	0.469
4	Loss of pleasure	0.21	0.478
5	Guilty feelings	0.20	0.437
6	Punishment feelings	0.17	0.416
7	Self-dislike	0.19	0.427
8	Self-criticism	0.33	0.583
9	Suicidal thoughts or wishes	0.09	0.282
10	Crying	0.13	0.378
11	Agitation	0.21	0.508
12	Loss of interest	0.17	0.481
13	Indecisiveness	0.14	0.391
14	Worthlessness	0.14	0.427
15	Loss of Energy	0.26	0.606
16	Changes in sleeping pattern	0.26	0.582
17	Irritability	0.13	0.337
18	Change in appetite	0.09	0.282
19	Concentration difficulty	0.07	0.259
20	Tiredness or fatigue	0.13	0.339
21	Loss of interest of sex	0.10	0.347

Table 2: Godin Leisure Time Exercise Questionnaire items descriptive

		M	SD
1	Strenuous Exercise (Heart Beats Rapidly) (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming)	1.66	1.202
2	Moderate Exercise (Not Exhausting) (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)	1.96	1.160
3	Mild/Light Exercise (Minimal Effort) (e.g., yoga, archery, fishing from river bank, bowling, horseshoes, golf, easy walking)	2.34	1.075

4.1 Reliability Analysis and Average Scores of Depression and Weekly Exercise

Cronbach's alpha (α) reliability index for the Beck BDI-II depression questionnaire was high and therefore, acceptable with $\alpha=0.80$ (21 queries). Based on the reliability analysis, the sum of the answers to the depression questions was calculated. In addition, regarding the weekly exercise in leisure time Cronbach's alpha reliability index was high and acceptable with $\alpha=0.84$ (3 queries). The overall weekly leisure time physical activity score was calculated on the basis of the equation (Strenuous exercise \times 9) + (Moderate exercise \times 5) + (Mild/Light exercise \times 3) (Table 3). On average, the degree of depression in the subjects was minimal (Beck, Steer & Brown, 1996), with an average of 3.8. The overall weekly physical activity score was an average of 31.7 indicating a high degree of exercise

(Godin, 2011). Furthermore, data on depression and weekly exercise did not follow the normal distribution ($p < 0,200$, based on the Lilliefors statistical significance correction).

Table 3: Mean (M), Standard Deviation (SD),
Cronbach's alpha of depression and weekly exercise

	M	SD	Cronbach's Alpha	Number of Questions	Test of Normality Kolmogorov-Smirnov ^a		
					Statistic	df	p
1	3.80	4.193	0.803	21	0.209	70	<0.0005
2.	31.73	17.620	0.844	3	0.190	70	<0.0005

a: Lilliefors Significance Correction

4.2 Examination of Research Cases

Regarding the examination of the research hypothesis and whether there is a statistically significant effect of exercise on the depression levels of the sample, a non-parametric check of Spearman rho correlation on the degree of depression and weekly physical activity was performed. A statistically significant and negative relationship was found between the two factors ($\rho = -0.43$, $p < 0.01$). In particular, when weekly physical activity increases, the degree of depression decreases accordingly and vice versa (Table 4).

Table 4: Correlation of depression and exercise

	Weekly Leisure Exercise (Godin GLTEQ)	
Depression Levels Beck II	Rho	-0.425*
	p	<0.0005
	N	70

* $p < 0.01$

Considering the fact that there is a statistically significant correlation between the two factors, a linear regression was performed with the degree of depression as a dependent variable and the weekly exercise as an independent predictive variable. The model was statistically significant ($F(1,69) = 7.51$, $p = 0.008$), demonstrating that the data fit the linear regression model. Table 5 presents the summary of the model. The multiple regression coefficient was medium with $R = 0.32$, while the rate of observed variation in the degree of depression explained by weekly physical activity was low, with 9.9% ($R^2 = 0.099$).

Table 5: Linear regression model summary

Model	R	R ²	Adjusted R ²	Standard error of estimate
1	0.315	0.099	0.086	4.008

Table 6 effectively shows the predictive strength of total weekly exercise in the context of depression. Total weekly physical activity was a statistically significant predictor of depression ($p = 0.008$), where the one-unit increase in total weekly physical activity

corresponds with a slight decrease of 0.08 points in the degree of depression. The equation of the linear regression model is: Degree of Depression = 6,181 – 0,075 * Total Weekly Exercise.

Table 6: Weekly exercise as a predictive factor

	Model	Non Standard Factors		Standard Factor		
		B	SE B	Beta	t	p
1		6.181	0.992		6.230	0.000
2.	Weekly Exercise (Godin GLTEQ)	-0.075	0.027	-0.315	-2.741	0.008

As a result, the research hypothesis was acceptable and there was a statistically significant and negative relationship between the degree of physical activity and the level of depression in the subjects.

5. Discussion

This study examined the effect of physical activity on depression levels of 70 adult citizens. The total weekly physical activity of the sample had an average of 31.7, a score that is higher than 23 points and indicates the existence of a high degree of weekly exercise (Godin, 2011; Godin & Shephard, 1985). The participants' depression rate was particularly low with an average of 3.8, with a limit of up to 13 points (Beck, Steer & Brown, 1996). It was found that there was a statistically significant negative correlation between depression and weekly exercise, leading to the conclusion that when the frequency of physical activity is increased, the degree of depression in the sample is decreased and vice versa.

These findings also confirm the conclusions of preceding research that has shown a statistically significant relationship between physical activity and the direct or indirect reduction of depression symptoms (Babyak et al, 2000; Broman - Fulks et al., 2008; Dopp et al, 2012; Roh, 2016). This study confirms the results of Strawbridge et al, (2002) which found that people with a low or moderate level of physical activity are more likely to experience depression than people who maintained a high level of physical activity.

The results of this study support the view that exercise is an excellent mechanism for preventing depression. The conclusion is in the same vein with the findings of other research (Biddle, Mutrie & Gorely, 2015; Bodin & Martinsen, 2004; Hassmen, Koivula & Uutela, 2002; Teychenne, Ball & Salmon, 2008) which argue that exercise is an effective proposition for preventing and treating depression.

6. Conclusion

This research has shown that weekly physical activity and depression levels have a statistically significant relationship, with physical activity having a negative correlation resulting in increased rates of exercise, leading to decreased levels of depression. In

addition, it was found that people who are more active are less likely to develop depression and participation in exercise may act as a shield against the risk of developing symptoms of depression.

Conflicts of interest

The authors declare that there are no conflicts of interest.

About the Authors

Chistine Gkatsou is with the Department of Sports Management. Her research interests focus on the study of human behavior in health related fitness. Also, she is interested in organizing sports activities aimed at improving the quality of life.

Konstantina Katsora is a graduate of English Language and Literature (NKUA) and is MSc Student in Master of Science in Sport Management and Organization of sport activities for people with disabilities. Her research interests focus on the study of people with disabilities in sports, special education and linguistics.

Stylianos Kaprinis (PhD) is a specialized educational staff, at the University of Peloponnese, Faculty of Human Movement and Quality of Life, Department of Sports Management. His research interests include sport psychology, school physical education planning and teaching students with disabilities. Moreover, his research area includes the evaluation of interventions in adapted physical activity for individuals with chronic diseases.

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