

EXERCISE BEHAVIOUR AS A PREDICTOR OF STRESS AND PSYCHOLOGICAL WELL-BEING IN ADULTS

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Abstract

This study examines the effect of exercise in reducing stress and improving well-being in Irish adults. A total of 160 participants completed a questionnaire which evaluated each of these variables. The sample was divided into 3 groups; high, moderate or low exercise group according to their reported levels of physical activity. The study was cross-sectional, correlational and quantitative in nature, using a between-participants design. The results of a one-way analysis of variance showed that those participants who exercised at a high level reported significantly less stress and higher psychological well-being than those who exercised at a low level. No significant difference was found with the moderate exercise group. In conclusion, results obtained suggest that higher levels of exercise reduce stress and improve psychological well-being in adults.

(1) **Introduction**

The past 50 years have witnessed the development of exercise psychology into a viable field of study, however, according to the World Health Organisation, 60% of the global population today are still not active enough to reduce health risks (W.H.O, 2003). This statistic is concerning given the increased susceptibility to chronic diseases and in the United States alone, sedentariness accounts for more than 250,000 deaths annually from heart disease, type 2 diabetes and colon cancer. There is also growing evidence that sedentariness is related to poor mental health and efforts are being actively made to raise awareness among the public and seek change. The World Health Organisation's *Global Recommendations for Physical Activity* (2011) acknowledges the importance of regular exercise in reducing symptoms of depression. In Ireland, the Health Service Executive (HSE) and the Department of Health and Children (2009) produced the *National Guidelines on Physical Activity for Ireland* which provided a consensus on the benefits of exercise for chronic diseases but also its benefits on mental health. However, despite the overwhelming evidence, most of the Irish population are not sufficiently active enough to gain the health benefits from physical activity. The National Survey of Lifestyles Attitudes and Nutrition (SLÁN, 2007) found that 59% of the Irish population were not sufficiently active. Furthermore, it was found that 38% of the population were overweight and another 23% were obese and obesity is now a major public health concern in Ireland (Department of Health and Children, 2005). It is clear from the SLÁN studies that Irish adults are not active enough to stay healthy. It is important to understand health not just in terms of the absence of illness but as a concept that covers a person's physical, mental and social well-being (Department of Health and Children, 2000).

The current study aims to explore the positive effects physical activity has on mental health, particularly looking at the effect on perceived levels of stress in adults and general overall feeling of well-being as a predictor of good mental health. There is a substantial

amount of evidence to suggest people who are physically active feel as though they experience less distress and have a higher sense of well-being (Netz et al., 2005; Reed & Buck, 2009). A recent study by Abu-Omar, Rutten, & Lehtinen (2004) looked at 16,230 adults' reported levels of physical activity in their previous seven days and compared them with reported feelings of depression and nervousness along with feelings of energy and vitality in the previous month. Results showed that those who were more physically active reported better mental health in general. Furthermore, evidence suggested there was a dose-response relationship between mental health and physical activity.

This brings us to the second aim of the current study. The idea that an inverse relationship exists between physical activity and mental health was identified by Morgan (1984). Morgan (1984) suggested that the higher the level of fitness, the lower the degree of psychopathology. However, Morgan (1985) identified that exercise dosage (frequency, intensity, duration) was an area that required further investigation. More recently, the U.S Department of Health and Human Services published quite specific guidelines for exercise behaviours, for instance adults should exercise for 30 minutes at a moderate intensity, 5 days per week or 20 minutes at high intensity 3 days per week, or a combination of both, and include at least 2 days of strength training using major muscle groups (Haskell et al. 2007). Here in Ireland, similar dosages have been recommended by the HSE and Department of Health and Children although interestingly it is suggested that more health benefits can be gained by doubling this amount (National Guidelines on Physical Activity for Ireland, 2009). The present study will further examine this inverse relationship and also look at other correlates such as the individual personal attributes of autonomy, environmental mastery and personal growth. Gender will be looked at to explore whether differences in activity levels and perceived stress exist between males and females. And, finally, the exercise environment such as whether an individual exercises alone or as part of a group will be explored and the

manner in which they exercise be it mainly aerobic activity, using weights or a combination of both.

(1.1) *Physical Activity and Exercise*

Physical Activity is “any bodily movement produced by skeletal muscles that results in energy expenditure” (Caspersen, Powell, & Christenson, 1985, p. 126). This includes a broad spectrum of behaviours from sleeping to household chores to forms of exercise. Exercise is a subset of physical activity which is more purposeful in that it is a planned, structured attempt to achieve some health or fitness gain (Caspersen, Powell, & Christenson, 1985). There are two forms of exercise, acute and chronic. Acute exercise is a single bout of exercise whereas chronic exercise is that which is carried out repeatedly over an extended period of time. Chronic exercise involves various intensities, duration, and frequencies which can improve physical fitness over time. It is chronic exercise to which health benefits are related. The World Health Organisation (2011) stated that regular exercise reduced risk of as well as symptoms of depression suggesting exercise is not only a preventative measure but a viable treatment. The U.S Surgeon General’s Report on Physical Activity and Health (1996) reviewed research which supported the conclusion that exercise promotes psychological well-being. The scientific advisory committee (2008) concluded that physically active adults have lower feelings of distress and poor well-being. The current study will explore any mental health differences that may exist between individuals who perform acute vs those who perform chronic exercise by examining reported activity levels and comparing these with scores on well-being and perceived stress scales.

Interventions are actively put in place in an attempt to increase lifestyle physical activity which can be defined as the “daily accumulation of at least 30 minutes of self-selected activities, which includes all leisure, occupational, or household activities that are at

least moderate to vigorous in their intensity and could be planned or unplanned activities that are part of everyday life” (Dunn, Andersen, and Jakicic, 1998, p. 399). Lifestyle interventions in the environment such as bicycle lanes help to increase active behaviours. Lifestyle activities can increase weekly energy expenditure by choosing the stairs over the lift or walking as a form of commuting. Physical activity and exercise are being promoted globally through the World Health Organisation and Exercise is Medicine and here in Ireland through the Health Service Executive (HSE) and Department of Health and Children who have produced *The National Guidelines on Physical Activity for Ireland* to support the promotion of physical activity in Ireland. The incentive encourages all health professionals, teaching staff at schools, local sports coaches, trainers and youth workers to become involved in promoting physical activity in Ireland. The current literature aims to assist in the promotion of physical activity with a particular focus on the mental health benefits, in particular the effect of regular physical activity on perceived levels of stress.

The promotion of physical activity and exercise is very important in today’s society given its role in weight management. Obesity rates worldwide have doubled since 1980 (Finucane et al., 2011). More worrying is that obesity rates have doubled in children and quadrupled in adolescents in the past 30 years (Centers for Disease Control and Prevention, 2014). The World Health Organisation warned of an obesity epidemic back in the 1990’s and despite action being taken by health professionals, governments and the media, the disease is steadily growing. Here in Ireland, 1 in 5 men were found to be obese in the year 2000 (Food Safety Promotion Board, 2000). Dr Lean O’Flaherty, a senior nutritionist with the National Dairy Council, stated that levels of fat intake in Ireland had not increased and were at the recommended allowance of 37% and that increased rates of obesity were due to more people choosing to live a sedentary lifestyle (irishhealth.com, N.D).

(1.2) *Exercise as a Treatment*

Physical Activity as an alternative form of prevention and treatment of mental health problems does not carry the complications of psychotherapy or drug treatments. Psychotherapy can be long, lasting several years and is expensive (Morgan & Goldston, 2013). Drug treatments are costly and also carry physical health risks through possible side effects (Morgan & Goldston, 2013). A study by Greist & associates (1979) compared exercise with traditional forms of psychotherapy. Subjects who were suffering from moderate to mild depression were placed into either a psychotherapy group or an exercise group. It was found after a 12 month follow up that all but one of the exercise group were free of the depressive symptoms whereas half of the psychotherapy group needed further treatment. Physical activity has also shown to be effective in the prevention of emotional illness (Raglin, 1990). A study by Hassmen (2000) looked at exercise habits and mental well-being in 3,403 Finnish adults. Findings showed that those who exercised 2-3 times per week reported significantly less stress, depression and anger. Given the pandemic nature of mental health disorders, exercise serves as a cost-effective, preventative solution to the problem that characterises modern society (Morgan & Goldston, 2013). Exercise prescription has been somewhat ignored by mental health care professionals as a viable treatment of mental health disorders, possibly due to a lack of knowledge in the field or ignorance (Morgan & Goldston, 2013). The current study examines individuals reporting various levels of exercise in relation to their psychological well-being and stress. Thus, in keeping with the beneficial effects previously reported, it would be expected that those individuals exercising more report better levels of psychological well-being and lower stress.

(1.3) *Exercise & Stress*

Stress has become an everyday topic of discussion among people and the idea that exercise reduces stress has become commonly accepted. People are generally aware of the negative effects of stress but most are unaware of the many of the emotional, cognitive and physical consequences of unmanaged stress (APA, 2003). An alarming 75-90 percent of all physician visits are stress related and stress is linked with the six leading causes of death, heart disease, lung ailments, accidents, cirrhosis of the liver, suicide and forms of cancer (APA, 2003).

Stress is hard to define given its subjectivity but scientifically is viewed as an imbalance in physiological systems causing physiological and behaviour responses in an attempt to restore balance or homeostasis (Buckworth et. al, 2012). The term stress was coined by Hans Seyle (1936) who developed the general adaption syndrome theory (GAS). Seyle (1936) believed that prior exposure and controllability of a stressor, altered the GAS which adapted defences against future stress. Furthermore he suggested that stressors such as muscular exercise led to adaptations that increased resistance to psychosomatic and neurotic diseases. Later research led to the cross-stressor adaptation hypothesis which maintains that exercise and increasing fitness are associated with a reduction of stress responses in non-exercise situations (Michael, 1957; Sothmann et al., 1996).

Stress can cause an array of physical symptoms such as muscle tension, headaches, and dry mouth, stomach upset, eating problems, insomnia, high blood pressure and increased heart rate (American Institute of Stress). In fact it is hard to think of any disease or part of the body that stress does not effect. Any type of mental pressure can cause stress due to one event or a build-up of a series of small events. It is common for people to experience stress by pressure they put on themselves. Not all stress is bad however, and it is not necessary to remove all stress from your life. Seyle (1936) made a distinction between distress (bad stress) and eustress (good stress). A certain amount of eustress is needed to promote well-being. An

example of this is exercise which is enjoyable. Moderate regular exercise can reduce negative stress emotions and enhance positive stress emotions (Buckworth et al., 2012).

In order to understand how exercise may reduce negative stress responses, a brief look at the physiology of stress and how the nervous and endocrine systems respond to different types of stressors, is essential. Neural and endocrine responses regulated by the brain and autonomic nervous system are components of the stress response (Buckworth et al., 2012). The neurotransmitters, norepinephrine and serotonin, in this specific part of the brain influence vigilance and attention, pituitary hormone release, and cardiovascular function during a stress response. They also influence pain, fatigue and sleep. Norepinephrine helps regulate behavioural, cardiovascular and endocrine responses while serotonin helps the body to return to rest. During stress, sympathetic nerves stimulate the heart, adrenal glands and the arteries. The result is a faster beating heart, increased blood flow and the release of norepinephrine. During exercise, this process is necessary as a higher volume of blood is needed to carry extra oxygen to the working muscles. The difference between emotional and exercise stress is that the response during exercise is essential as body metabolism increases whereas emotional stress occurs at near resting metabolism. It is this response to a perceived threat, the fight or flight response, without physical responding that result in chronic elevated stress levels.

(1.4) *Psychological Well-Being*

Research on psychological well-being (PWB) has become more popular in recent years (e.g., Diener, Suh, Lucas, & Smith, 1999; Kahneman, Diener, & Schwarz, 1999; Keyes, Schmotkin, & Ryff, 2002; Stratham & Chase, 2010; Seligman, 2011). However, given its subjective nature, the concept of well-being has been hard to define, resulting in overly broad definitions (Forgeard, Jayawickreme, Kern, & Seligman 2011). From a hedonic perspective,

PWB is focused on constructs such as happiness, satisfaction with life, positive affect and low negative affect (e.g., Bradburn, 1969; Diener, 1984; Kahneman, Diener, & Schwarz, 1999; Lyubomirsky & Lepper, 1999). Alternatively, the eudaimonic view focuses on human growth and positive psychological functioning (Ryff, 1989a; 1989b; Waterman, 1993). Perhaps the best approach is to view PWB as a multi-dimensional construct, an approach that most recent researchers have taken (Diener, 2009; Michaelson, Abdallah, Steuer, Thompson, & Marks, 2009; Stiglitz, Sen, & Fitoussi 2009). The constructs involved include: autonomy; environmental mastery; positive relationships with others; purpose in life; realisation of potential and self-acceptance, as identified by Ryff (1989).

Studies on PWB have generally shown that prolonged negative well-being has a significant effect on an individual's mental health leading to depression (Woods & Joseph, 2009), increased anxiety (Ruini & Fava, 2009) and higher levels of stress (Malek, Mearns & Flin, 1994). Positive PWB on the other hand, has many desirable effects on mental and physical health. Positive mood state for example, is found to reduce the risk of coronary heart disease (Giltay et al., 2009) and increase resistance to stress (Fredrickson et al., 2000). Interestingly, positive mood state has also been found to correlate with increased physical activity (Baruth et al., 2006). This brings us to a further aim of the current study which is not only to examine the relationship between exercise and PWB, but to explore the possibility of an inverse relationship which may exist between stress and psychological well-being. Furthermore it will identify individual constructs of PWB such as: autonomy; personal growth; environmental mastery; positive relations with others; purpose in life and self-acceptance, which may motivate an individual to engage in higher exercise activity levels.

(1.5) *Exercise and Psychological Well-Being*

There is a substantial amount of evidence to suggest that people who regularly exercise feel as though they experience less distress and have a higher sense of well-being (Netz et al., 2005; Reed & Buck, 2009). A reduction in feelings of distress leads to reduced odds of suffering coronary heart disease or developing a psychiatric illness. The results of 13 cohort studies on physical activity and well-being suggested that feelings of distress are lowered by as much as 20 per cent in active people (Physical Activity Guidelines Advisory Committee, 2008). Furthermore, a linear 10 per cent reduction in distress occurred for each level of increased physical activity ranging from low to moderate to high. A study of nurses' health looked at 63,000 women aged between 40 and 67 and their reported levels of physical activity every 2 years for 10 years along with self-reported quality of life (Wolin et al., 2007). The research found that those who increased their activity levels over the 10 year period had higher quality of life scores than those who remained the same.

Despite an astounding amount of evidence to support the idea that exercise improves the general mental well-being of the population and prevents mental illness, it has not been adequately utilised by the health service, and it has not become a popular treatment (Tkachuk & Martin, 1999). Perhaps the reason behind this is the insufficient diffusion of the current research to other health professionals. This brings us to the final aim of the current literature which seeks to rectify this and expand on previous research, deepening our understanding of the case for exercise and its potential for improved mental health.

(1.6) *Objective of the study*

The current study is in agreement with the literature presented thus far on the potential benefits of using exercise as not only a preventative measure against physical and mental illness but as a treatment also. Although a lot of research has been carried out in the field, it appears the vast majority of this is confined to the United States and some in the United

Kingdom. The current study aims firstly to assist psychologists here in Ireland, supplementing existing knowledge and research and secondly to publicise the potential health benefits of regular exercise to health professionals.

The objective of the study is to find a significant association between levels of physical activity, stress and psychological well-being. It aims to promote further research in the area, here in Ireland, and to suggest future directions for that research. Overall the study should provide support for previous research in the field and raise awareness of the importance of regular exercise for reduced levels of stress and improved mental well-being. The relationship between psychological well-being and stress will be examined, an inverse relationship expected whereby higher levels of well-being will correlate with low stress levels. Other relationships will be looked at such as whether exercising alone or with others has any effect or the type of training whether it be focused on cardiovascular or muscular training or a combination of both. Finally, a brief look at gender will tell us if any differences exist between males and females in their stress levels or exercise behaviour.

(1.7) *Hypotheses*

Hypothesis 1: There will be a significant difference in reported levels of perceived stress between the low, moderate and high exercise groups.

Hypothesis 2: There will be a significant difference in reported psychological well-being between the low, moderate and high exercise groups.

Hypothesis 3: Higher scores on psychological well-being will predict lower perceived stress.

Hypothesis 4: There will be a significant difference in stress between those who exercise alone and those who exercise as part of a group.

Hypothesis 5: There will be a significant difference in stress between those who exercise aerobically, those who exercise anaerobically and those who do both.

Hypothesis 6: There will be a significant difference in exercise levels and perceived stress between males and females.

(2) Method

(2.1) Participants

A total of one hundred and sixty (N = 160) participants took part in the study. There were one hundred and ten (n = 110) female and fifty (n = 50) male. The population sample was a convenience sample sourced through various sports clubs, fitness clubs, the defence forces, and the general public. The sample was divided into three groups relating to the participants level of exercise activity, Low Exercise Group (n = 41), Moderate Exercise Group (n = 65) and High Exercise Group (n = 55). The overall exercise score was used to rank each participant into one of the three groups by qualified and experienced health professionals in the fitness industry. Participants who scored between 0 and 20 were considered to fall into the low exercise group. A score of 21 – 40 was deemed as being moderately active. Any participant who scored 41 or over was assigned to the high exercise group. Participation was completely voluntary and no incentives were offered. It was explained to all participants that they had the right to withdraw from the study at any stage before submission. The questionnaire was completely confidential and the responses anonymous. For this reason it would not be possible to withdraw after submission as responses could not be attributed to any one participant. The inclusion criteria was that the participant should be able to comprehend the survey and the exclusion criteria was that the

participant was over the age of 18 years. The rate of questionnaires returned was approximately 83% (160 of 192).

(2.2) Design

The design used in this research was a quantitative, cross-sectional, quasi-experiment, using a between subjects design to examine the relationship between exercise levels, psychological well-being (PWB) and levels of perceived stress. It used nominal, ordinal and scale data levels of measurement. The predictor variables were PWB scores, exercise levels, exercise preference (alone or with others), exercise type (cardiovascular, muscular endurance or both) and gender. The criterion variable was perceived stress.

(2.3) Materials

A self-administered questionnaire was used to collect demographic data of the sample such as gender, type of training, and whether exercising was done alone or with others. The Godin Leisure-Time Exercise Questionnaire was utilised to collect exercise behaviour data, being a self-explanatory, brief four-item query of usual leisure-time exercise habits. It also comprised of two frequently used and reliable questionnaires. The first questionnaire used was the Perceived Stress Scale (PSS, Cohen, 1983) consisting of 14 questions. Participants were asked to report their thoughts and feelings for the previous month on a five point Likert scale (0 – never, 1 – almost never, 2 – sometimes, 3 – fairly often, 4 – most often). Scores were reversed for the positively worded items (4, 5, 7 & 8) e.g. 0=4, 1=3, 2=2, 3=1, 4=0 and added together with original scores. The total score has been shown to reliably predict feelings of stress experienced by a person having high internal consistency with alpha scores ranging from .84 to .86. The retest reliability was .85 after two days and .55 after a six week period (Cohen et al, 1983).

The second questionnaire used was the Ryff Scales of Psychological Well-Being (Ryff, 1989). The 54 item (medium form) version was used which consists of a series of statements which reflect six areas of psychological well-being: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life and self-acceptance. Respondents were required to rate a series of statements on a Likert scale reflecting their agreement with each statement (1=strongly disagree, 2=disagree, 3=disagree slightly, 4=agree slightly, 5=agree, 6=strongly agree). Roughly half of the items are reverse scored (4, 5, 7, 9, 10, 11, 13, 14, 15, 17, 18, 22, 23, 25, 26, 27, 29, 31, 34, 36, 38, 42, 43, 44, 45, 46, 52 & 53). For each category, a high score indicates that the respondent has a mastery of that area in life and a low score indicates an area in life in which they may be struggling to comfortably handle. The instrument has been found to be a reliable measure in identifying the extent to which respondents are self-accepting, are pursuing meaningful goals, have a sense of purpose in life, have established quality relationships, have confidence in their own opinions, have the ability to master their own environment and the ability to grow and develop. A copy of the questionnaire can be found in (Appendix A).

(2.4) Procedure

Research began only after ethical approval was granted by the Department of Psychology at Dublin Business School. The questionnaire was distributed online through Facebook to willing participants, and hard copies were given to peers and acquaintances of the researcher. Some other voluntary participants were members of various sports teams and fitness clubs. Each participant was provided with their own copy of the questionnaire which informed them that the study being carried out was to examine the relationship between exercise behavior and psychological well-being and stress in adults. They were informed that the questionnaire would take approximately ten minutes to complete but that there was no time limit. An information sheet was provided at the start of the questionnaire which clearly explained the

objective of the study and the involvement of the participant. It addressed confidentiality and ethical concerns and explained that the participant had the right to withdraw at any time. It contained a consent form whereby participants gave informed consent before continuing with the questionnaire. A copy of the information sheet can be found in (Appendix A). A debriefing sheet (see Appendix A) was attached at the end to firstly thank the respondent for their participation and secondly to offer contact information of various support services and contact information for the researcher. The data was collected over a 30 day period and was then entered into the statistical software package IBM SPSS 22 for analysis.

(3) Results

(3.1) Descriptive Statistics

The means and standard deviations were calculated for each of the variables; exercise, stress and each of the subscales of well-being as can be seen in Table 1.

Table 1: Statistics of Psychological measures

Variable	Mean	Std. Deviation	Minimum	Maximum
Exercise	34.82	17.92	.00	85.00
Stress	23.57	9.40	4.00	53.00
Autonomy	38.87	7.44	19.00	54.00
Mastery	38.46	7.58	17.00	54.00
Personal Growth	41.69	6.33	22.00	54.00
Relationships	40.42	8.33	16.00	54.00
Purpose in Life	40.68	7.24	16.00	54.00
Self-Acceptance	37.91	9.36	9.00	52.00

A Levene's Test was conducted to test for equality of variance and variances were assumed roughly equal. A Tukey HSD post hoc test was carried out to take into account the issue of multiplicity.

(3.2) Inferential Statistics

Stress and Psychological Well-being

A bivariate correlation, Pearson's r was carried out to examine the relationship between stress and the subscales of well-being (see Table 2). The relationship between autonomy and stress was found to be negatively and strongly related ($r = -0.534, p < 0.001$). Thus as autonomy increases, perceived stress decreases.

The relationship between environmental mastery and stress was found to be negatively and strongly related ($r = -0.740, p < 0.001$). Thus as environmental mastery increases, perceived stress decreases.

The relationship between personal growth and stress was found to be negatively and strongly related ($r = -0.568, p < 0.001$). Thus as personal growth increases, perceived stress decreases.

The relationship between positive relationships and stress was found to be negatively and strongly related ($r = -0.532, p < 0.001$). Thus as positive relationships increases, perceived stress decreases.

The relationship between purpose in life and stress was found to be negatively and strongly related ($r = -0.605$, $p < 0.001$). Thus as purpose in life increases, perceived stress decreases.

The relationship between self-acceptance and stress was found to be negatively and strongly related ($r = -0.750$, $p < 0.001$). Thus as self-acceptance increases, perceived stress decreases.

Table 2: Correlation of Stress and Well-Being measures

		Perceived Stress Total
Autonomy	Pearson's Correlation	-.534
	Sig. (2-tailed)	.000
	N	147
Environmental Mastery	Pearson's Correlation	-.740
	Sig. (2-tailed)	.000
	N	145
Personal Growth	Pearson's Correlation	-.568
	Sig. (2-tailed)	.000
	N	150
Positive Relationships	Pearson's Correlation	-.532
	Sig. (2-tailed)	.000
	N	147
Purpose in Life	Pearson's Correlation	-.605
	Sig. (2-tailed)	.000
	N	148
Self-acceptance	Pearson's Correlation	-.750
	Sig. (2-tailed)	.000
	N	147

Exercise and stress

When we examine the mean number of perceived stress scores for each group, it can be seen that the high exercise group had the lowest perceived stress (see Figure 1). A one-way analysis of variance showed that there was a significant difference between the three groups in terms of perceived stress ($F(2, 152) = 3.77, p = .025$). Post hoc analysis confirmed that the differences were significant in nature between the high exercise group ($M = 21.23, SD = 8.04$) and the low exercise group ($M = 26.61, SD = 9.56$). No significant difference was found between the moderate group ($M = 23.72, SD = 9.94$) and the other two groups.

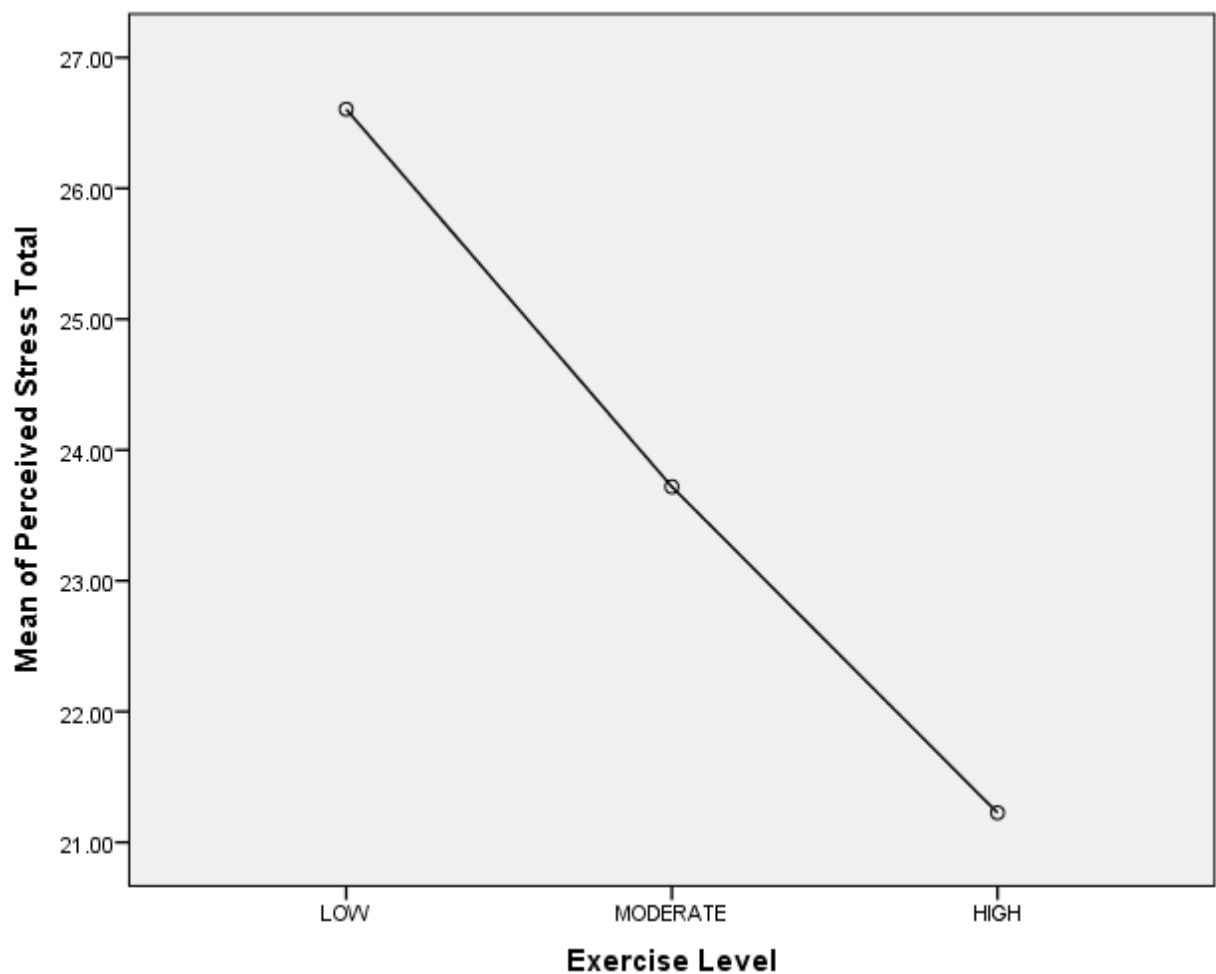


Figure 1: Exercise and Stress Means Plots

Exercise and Psychological Well-Being Subscales

A one-way analysis of variance showed that autonomy differed significantly between the three groups ($F(2, 150) = 9.02, p < .001$). More specifically Tukey HSD post hoc analysis highlighted that the high exercise group ($M = 42.21, SD = 6.37$) scored significantly higher in autonomy than the low exercise group ($M = 37.00, SD = 7.18$) and with the moderate exercise group ($M = 37.16, SD = 7.58$).

A one-way analysis of variance showed that environmental mastery scores differed significantly between the groups ($F(2, 148) = 3.42, p = .035$). More specifically Tukey HSD post hoc analysis highlighted that the high exercise group ($M = 40.32, SD = 6.98$) scored significantly higher in environmental mastery than the low exercise group ($M = 36.11, SD = 8.11$). There was no significant difference between the moderate group ($M = 38.19, SD = 7.48$) and the other two groups.

A one-way analysis of variance showed that personal growth scores differed significantly between the groups ($F(2, 153) = 4.40, p = .014$). More specifically Tukey HSD post hoc analysis highlighted that the high exercise group ($M = 43.52, SD = 5.39$) scored significantly higher in personal growth scores than the low exercise group ($M = 39.71, SD = 7.89$). There was no significant difference between the moderate group ($M = 41.33, SD = 5.67$) and the other two groups.

A one-way analysis of variance showed that positive relationship scores differed significantly between the groups ($F(2, 149) = 5.44, p = .005$). More specifically Tukey HSD post hoc analysis highlighted that the high exercise group ($M = 43.23, SD = 6.80$) scored significantly higher in positive relationship scores than the low exercise group ($M = 37.88, SD = 9.21$). There was no significant difference between the moderate group ($M = 39.63, SD = 8.36$) and the other two groups.

A one-way analysis of variance showed that purpose in life scores differed significantly between the groups ($F(2, 151) = 5.69, p = .004$). More specifically Tukey HSD post hoc analysis highlighted that the high exercise group ($M = 42.94, SD = 5.79$) scored significantly higher in purpose in life scores than the low exercise group ($M = 37.97, SD = 8.34$). There was no significant difference between the moderate group ($M = 40.35, SD = 7.14$) and the other two groups.

A one-way analysis of variance showed that self-acceptance scores differed significantly between the groups ($F(2, 150) = 7.23, p = .001$). More specifically Tukey HSD post hoc analysis highlighted that the high exercise group ($M = 41.49, SD = 7.27$) scored significantly higher in self-acceptance than the low exercise group ($M = 34.55, SD = 10.10$) and the moderate group ($M = 36.90, SD = 9.59$).

Other Findings

An independent t-test was carried out to explore the relationship between exercise preference and perceived stress. No significant difference in stress levels were found between those who exercised alone and those who exercised with others ($t(152) = 1.47; p = .142$).

An independent t-test was carried out to explore the relationship between gender and perceived stress. No significant difference in stress levels were found between males and females ($t(152) = 1.19; p = .238$).

An independent t-test was carried out to explore the relationship between gender and exercise levels. No significant difference in exercise levels were found between males and females ($t(158) = 1.36; p = .178$).

A one-way analysis of variance showed that perceived stress differed significantly between the groups ($F(2, 148) = 5.39, p = .005$). More specifically, Tukey HSD post hoc analysis highlighted that the aerobic group ($M = 25.84, SD = 9.25$) scored significantly higher in

perceived stress than the both group ($M = 21.15$, $SD = 9.48$). There was no significant difference found between the anaerobic group ($M = 20.50$, $SD = 6.86$) and the other groups.

(4) Discussion

(4.1) Aims

The aim of the present study was to provide a quantitative review of the relationship between exercise levels and stress and psychological well-being in adults. A further aim was to look at the relationship between levels of stress and psychological well-being with the hypothesis that high levels of well-being would correlate with low levels of stress. Exercise preferences were looked at such as whether a person exercised alone or as part of a group and the type of exercise performed whether it had a focus on aerobic (cardiovascular) or anaerobic (muscular) activity or a combination of both and were compared with reported levels of perceived stress. Moreover the aim of the current research was to develop on previous research in the area and provide support for the benefits of exercise in reducing stress. A substantial amount of research has been reviewed leading to the formulation of the hypotheses in chapter 1, the results of which were analysed in chapter 3. The present chapter will discuss the findings of the analysis, highlight any limitations and suggest recommendations for future research.

(4.2) Discussion of the findings

The primary hypothesis of the study was that there would be a correlation between exercise and stress. It was hypothesized that people who engaged in higher levels of exercise would report lower levels of stress. The null hypothesis was rejected as a one-way analysis of variance showed that there was a significant difference between the three groups, low, moderate and high exercise, in terms of perceived stress. Post hoc tests showed that the differences lay between the high exercise group and the low exercise group with the high exercise group reporting much lower levels of stress than the low exercise group. This finding is consistent with Morgan's (1984) view that an inverse relationship exists between exercise and mental health with higher levels of exercise being more beneficial to a person's mental health. More specifically, the findings support Michael's (1957) and Sothmann's et al. (1996) cross-stressor adaptation hypothesis which maintains that increasing exercise leads to a reduction of stress responses in non-exercise situations. In fact there has been a growing amount of research on the effects of exercise with people generally reporting lower amounts of stress when they have been physically active (Buckworth et al., 2012). However, the current findings are not consistent with Buckworth's (2012) view that moderate exercise reduces stress. The current research failed to find a significant difference in stress between those who performed moderate and those who performed mild exercise. The current sample suggested that more is better when it comes to exercise activity. In Ireland, the Health Service Executive recommends 30 minutes of moderate activity, 5 days per week for substantial health benefits. It could be possible that an increase in intensity is needed to reap the benefits at least when it comes to stress. The Department of Health and children however, have recognized that doubling the recommended amount results in greater health benefits (National Guidelines on Physical Activity for Ireland, 2009). It appears there is a grey area when it comes to specifying a dose-response relationship and this may be due to the fact that it varies in one person to another. A closer investigation of activity levels is detrimental to the

future studies of exercise and stress reduction. However, the current research has been successful in identifying that a relationship exists between the amount of exercise performed by an individual and the subsequent levels of stress they experience, with a 'more is better than none' philosophy.

In relation to psychological well-being, the findings of the current study were compatible to that of stress with higher levels of PWB correlating with lower levels of stress. This evidence is consistent with the findings of Netz et al. (2005) and Reed and Buck (2009) who both suggested that people who regularly exercise have a higher sense of well-being. Given the health benefits of regular exercise it can be expected that a person should feel better when they are physically fitter, benefiting from increased resistance to illness, strengthening of bones and muscles and improved ability to carry out daily activities (Centers for Disease Control and Prevention, 2011). Although higher exercise levels correlate with well-being, this does not infer that the relationship is causal. It is possible that a person who scores high on well-being has a mastery of an area or areas of their lives that make it more likely they will engage in exercise. For example, scoring high on environmental mastery indicates that a person is in control of most areas of their lives and is likely to engage in healthy behaviours. The idea of well-being having an influence on exercise behaviour was identified by Baruth et al. (2006) who suggested positive mood states correlated with increased physical activity. It is also possible that stress and psychological well-being are the opposites of each other and that it is simply not possible to score high in both of the scales. For instance, being high in well-being could be a result of an absence of stress. The current research investigated this theory by examining the relationship between stress and well-being. The results showed that stress and all of the well-being subscales were negatively and strongly related. This means that as scores on any one of the well-being subscales; autonomy, environmental mastery, personal growth, positive relationships, purpose in life and self-

acceptance increase, perceived stress decreases, suggesting they are concepts that are the exact opposites of each other. Further study is needed to explore this relationship between stress and well-being.

Other variables were addressed in relation to the exercise environment. Whether a person exercised alone or as part of a group or team was considered as potentially having an effect on that person's stress levels. Results showed however that this was not the case having found no significant difference between the groups. This is a positive result however as it suggests a person does not necessarily need to be part of a team to reap the mental health benefits of exercise and can achieve the same results by performing exercise alone. However, an investigation of the type of exercise carried out found there was a significant difference in stress depending on whether a person focused on aerobic (cardiovascular) style training or anaerobic (muscular) style training or used a combination of both. It was found that those who performed a combination of both styles of training scored lowest in perceived stress. The results indicate that weight-training should be implemented along with cardiovascular training to obtain maximum benefits. This point was highlighted by Haskell et al. (2007) who suggested 2 days of strength training should be incorporated with the recommended guidelines of 30 minutes for 5 days per week. Although there was no significant difference found between the anaerobic and aerobic group, it was approaching significance at 0.06%. And, given that the number of participants in the anaerobic group ($n = 18$) was substantially lower than that of the other groups, aerobic ($n = 80$) and both ($n = 53$), it could be expected that a larger sample would be significant. The smaller sample is a limitation of the study which did not specifically set out to obtain relatively equal groups but left the results to chance which were reflective of the population in that a lot more people exercise aerobically than anaerobically. A suggestion for further studies would be to investigate these differences in greater detail, using a larger sample with equal numbers in each group.

Finally, gender was looked at to see if any differences could be found in exercise levels or stress levels between males and females. Results showed no significance for either hypotheses. It is popular view that men exercise more regularly than women but the current research found this not to be the case. Furthermore, it is generally believed that women experience more stress than males which was also not found to be significant in the current research. A possible explanation for these results are that they are reflective of a changing environment here in Ireland whereby women are now exercising more. Interestingly as there are also no differences in stress levels, this may be a direct result of an increase in their level of exercise.

(4.3) Conclusion

In conclusion this study looked at the relationship between exercise, stress and psychological well-being in adults. The findings determined that higher exercise levels were significantly correlated with lower levels of stress and higher levels of well-being. The results suggested performing moderate exercise was no more beneficial than performing low exercise. The research indicated that exercising alone or as part of a group made no significant difference to stress or well-being levels. The type of training had an effect with results suggesting that using a combination of aerobic (cardiovascular) and anaerobic (muscular) training has the most beneficial effects in reducing stress and improving well-being. The small sample size for the anaerobic group was a factor in not finding a significant difference but as it approached significance we would expect it to be so with a larger sample and this was recommended for further study. Despite contrary findings, we did not find any gender differences with exercise levels or stress levels. Females were found to exercise at the same level as men and despite contrary belief they did not report any higher levels of stress. It was

considered that this may be a sign of changing times in Ireland whereby women are becoming more active and are possibly experiencing less stress as a result of this. Overall this study has succeeded in its primary aim of promoting the benefits of exercise for reducing stress and improving well-being.

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Appendices

Appendix A: Copy of Questionnaire

Dear participant, my name is Christopher Clarke and I am a final year student in Dublin Business School. I am conducting a research project as part of my final year of a Bachelor of Arts Honours Psychology degree. I have a strong interest in exercise and mental health and in particular, the effects of exercise on a persons perceived levels of stress and their overall well-being. The main purpose of this study is to enhance our understanding of the relationship between exercise and the effects it has on people's mental health.

I would like you to take part in a questionnaire that will take approximately 10 mins to complete. All results will remain anonymous in the study and you will only be tested once. There are no right or wrong answers. I ask you not to discuss your answers with anyone and to answer as accurately and honestly as you can.

All information that you provide will remain in the strictest confidence and will be held in a secure location. Once the information has been analysed for the purpose of the study it will be destroyed. Thank you for your cooperation.

Consent Form

Please tick:

1. I agree to participate in this research _____
2. I realise that I may withdraw from the study at any time while completing the questionnaire, however once the questionnaire is submitted, I will no longer be able to withdraw as all questionnaires are anonymous_____
3. I recognise that all personal information provided by me will remain anonymous_____
4. I understand that the information I provide in completing the questionnaire may be viewed and analysed by the researcher and their supervisor_____
5. I confirm that I have read and understand the information sheet and have been given the opportunity to ask any questions I may have_____
6. I have been informed on the aims of the research and have been given the researchers name and contact details should I require further information_____

Demographic Details

Please answer the following questions:

I am over the age of 18 _____

Gender: Male _____ Female _____

During a typical **7-Day period** (a week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your free time (write on each line the appropriate number)?

Times Per Week

**a) STRENUOUS EXERCISE
(HEART BEATS RAPIDLY)**

(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)

**b) MODERATE EXERCISE
(NOT EXHAUSTING)**

(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)

**c) MILD EXERCISE
(MINIMAL EFFORT)**

(e.g., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)

During a typical **7-Day period** (a week), in your leisure time, how often do you engage in any regular activity **long enough to work up a sweat** (heart beats rapidly)?

OFTEN
1.

SOMETIMES
2.

NEVER/RARELY
3.

Mostly I exercise:

Alone _____ with Others _____

I exercise mainly:

Aerobically (cardio) _____ or Anaerobically (weights) _____ or Both equally _____

The following set of statements deals with how you might feel about yourself and your life. Please remember that there are neither right nor wrong answers.

Circle the number that best describes the degree to which you agree or disagree with each statement.	Strongly Disagree	Disagree	Disagree Slightly	Agree Slightly	Agree	Strongly Agree
1. Most people see me as loving and affectionate.	1	2	3	4	5	6
2. I am not afraid to voice my opinion, even when they are in opposition to the opinions of most people.	1	2	3	4	5	6
3. In general, I feel I am in charge of the situation in which I live.	1	2	3	4	5	6
4. I am not interested in activities that will expand my horizons.	1	2	3	4	5	6
5. I live life one day at a time and don't really think about the future.	1	2	3	4	5	6
6. When I look at the story of my life, I am pleased with how things have turned out.	1	2	3	4	5	6
7. Maintaining close relationships has been difficult and frustrating for me.	1	2	3	4	5	6
8. My decisions are not usually influenced by what everyone else is doing.	1	2	3	4	5	6
9. The demands of everyday life often get me down.	1	2	3	4	5	6
10. I don't want to try new ways of doing things—my life is fine the way it is.	1	2	3	4	5	6
11. I tend to focus on the present, because the future always brings me problems.	1	2	3	4	5	6

Circle the number that best describes the degree to which you agree or disagree with each statement.	Strongly Disagree	Disagree	Disagree Slightly	Agree Slightly	Agree	Strongly Agree
12. In general, I feel confident and positive about myself.	1	2	3	4	5	6
13. I often feel lonely because I have few close friends with whom to share my concerns.	1	2	3	4	5	6
14. I tend to worry about what other people think of me.	1	2	3	4	5	6
15. I do not fit very well with the people and the community around me.	1	2	3	4	5	6
16. I think it is important to have new experiences that challenge how you think about yourself and the world.	1	2	3	4	5	6
17. My daily activities often seem trivial and unimportant to me.	1	2	3	4	5	6
18. I feel like many of the people I know have gotten more out of life than I have.	1	2	3	4	5	6
19. I enjoy personal and mutual conversations with family members or friends.	1	2	3	4	5	6
20. Being happy with myself is more important to me than having others approve of me.	1	2	3	4	5	6
21. I am quite good at managing the many responsibilities of my daily life.	1	2	3	4	5	6
22. When I think about it, I haven't really improved much as a person over the years.	1	2	3	4	5	6
23. I don't have a good sense of what it is I'm trying to accomplish in my life.	1	2	3	4	5	6
24. I like most aspects of my personality.	1	2	3	4	5	6
25. I don't have many people who want to listen when I need to talk.	1	2	3	4	5	6
26. I tend to be influenced by people with strong opinions.	1	2	3	4	5	6
27. I often feel overwhelmed by my responsibilities.	1	2	3	4	5	6

Circle the number that best describes the degree to which you agree or disagree with each statement.	Strongly Disagree	Disagree	Disagree Slightly	Agree Slightly	Agree	Strongly Agree
28. I have a sense that I have developed a lot as a person over time.	1	2	3	4	5	6
29. I used to set goals for myself, but that now seems a waste of time.	1	2	3	4	5	6
30. I made some mistakes in the past, but I feel that all in all everything has worked out for the best.	1	2	3	4	5	6
31. It seems to me that most other people have more friends than I do.	1	2	3	4	5	6
32. I have confidence in my opinions, even if they are contrary to the general consensus.	1	2	3	4	5	6
33. I generally do a good job of taking care of my personal finances and affairs.	1	2	3	4	5	6
34. I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	1	2	3	4	5	6
35. I enjoy making plans for the future and working to make them a reality.	1	2	3	4	5	6
36. In many ways, I feel disappointed about my achievements in my life.	1	2	3	4	5	6
37. People would describe me as a giving person, willing to share my time with others.	1	2	3	4	5	6
38. It's difficult for me to voice my own opinions on controversial matters.	1	2	3	4	5	6
39. I am good at juggling my time so that I can fit everything in that needs to be done.	1	2	3	4	5	6
40. For me, life has been a continuous process of learning, changing, and growth.	1	2	3	4	5	6
41. I am an active person in carrying out the plans I set for myself.	1	2	3	4	5	6

Circle the number that best describes the degree to which you agree or disagree with each statement.	Strongly Disagree	Disagree	Disagree Slightly	Agree Slightly	Agree	Strongly Agree
42. My attitude about myself is probably not as positive as most people feel about themselves.	1	2	3	4	5	6
43. I have not experienced many warm and trusting relationships with others.	1	2	3	4	5	6
44. I often change my mind about decisions if my friends or family disagree.	1	2	3	4	5	6
45. I have difficulty arranging my life in a way that is satisfying to me.	1	2	3	4	5	6
46. I gave up trying to make big improvements or change in my life a long time ago.	1	2	3	4	5	6
47. Some people wander aimlessly through life, but I am not one of them.	1	2	3	4	5	6
48. The past has its ups and downs, but in general, I wouldn't want to change it.	1	2	3	4	5	6
49. I know that I can trust my friends, and they know they can trust me.	1	2	3	4	5	6
50. I judge myself by what I think is important, not by the values of what others think is important.	1	2	3	4	5	6
51. I have been able to build a home and a lifestyle for myself that is much to my liking.	1	2	3	4	5	6
52. There is truth to the saying that you can't teach an old dog new tricks.	1	2	3	4	5	6
53. I sometimes feel as if I've done all there is to do in life.	1	2	3	4	5	6
54. When I compare myself to friends and acquaintances, it makes me feel good about who I am.	1	2	3	4	5	6

INSTRUCTIONS:

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate your response by placing an “X” over the circle representing HOW OFTEN you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don’t try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

Almost Fairly Very

In the last month, how often have you been able to control irritations in your life?

In the last month, how often have you been upset because of something that happened unexpectedly?

In the last month, how often have you felt that you were on top of things?

In the last month, how often have you felt that you were unable to control the important things in your life?

In the last month, how often have you felt nervous and “stressed”?

In the last month, how often have you dealt successfully with day to day problems and annoyances?

In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?

In the last month, how often have you felt confident about your ability to handle your personal problems?

In the last month, how often have you felt that things were going your way?

In the last month, how often have you found that you could not cope with all the things that you had to do?

Never	Never	Sometimes	Often	Often
0	1	2	3	4

	Never	Almost Never	Sometimes	Fairly Often	Very Often
	0	1	2	3	4
In the last month, how often have you been angered because of things that happened that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you found yourself thinking about things that you have to accomplish?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you been able to control the way you spend your time?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for your participation in the study. Please take away this sheet with you which contains my contact information below should you have any queries regarding the research.

Also, if you feel you have been affected by any of the content within the questionnaires, I have attached some relevant numbers which may be of some help to you.

Shine (Mental Health Service)	018601620
Mental Health Ireland	012841166
Samaritans (emotional support helpline)	1850609090
Aware	www.aware.ie