The Anxiolytic Effects of Exercise in Third Level Students

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Abstract

Background: Research into anxiety and other comorbidly occurring issues has demonstrated high prevalence. Anxiety in third level students has not been comprehensively investigated. Medications often used to treat anxiety can produce a plethora of negative side effects. Exercise has been shown to reduce HPA-axis activity and symptoms of anxiety. Variations in exercise intensity have demonstrated differing results while lacking methodological standardisation. **Aims:** This study sought to examine the prevalence of anxiety in third level students. Secondly, the anxiolytic effects of exercise were investigated. Finally, high, and low intensity exercise groups had their anxiolytic effectiveness compared. **Method:** Participants were recruited using snowball sampling (n = 152) and completed an online survey containing the Beck Anxiety Inventory (BAI), GAD-7, IPAQ and PRETIE-Q scales. **Results:** Results displayed moderate anxiety prevalence of 22% and 61% respectively for the BAI and GAD-7. There was a small negative correlation between exercise and anxiety, BAI (r = -.29) and GAD-7 (r = -.28). There was no difference in anxiety between exercise intensity groups. **Conclusion:** Findings provide insight on the prevalence of anxiety in third level students. Exercise was shown to have anxiolytic effects and may be more commonly implemented as part of a treatment model. As there was no difference between exercise intensity and anxiety, this demonstrates potential novel findings and indicates that exercise of all variations can produce anxiolytic effects.

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Introduction

Prevalence of Anxiety Disorders

In modern society there is a high prevalence of mental health disorders, anxiety disorders have been classified as the most common psychiatric problem by several large epidemiological studies (Kessler, et al., 2005). It has been suggested that there is a lifetime prevalence of between 25-30% (Kessler, 1994) and even at a non-clinical level, a large percentage of the population suffer from severe anxiety symptomology with one study estimating that between 11-33% of a population will have experienced an anxiety attack within the last year (Norton, et al., 1992). Another more recent systematic review of the literature on the prevalence of clinically measurable levels of anxiety found that 16.6% of the general population will suffer with anxiety over the course of an average year (Somers, et al., 2006). Experiencing anxiety even at a non-clinical level can have a debilitating effect on your life (Craighead, et al., 2017). For individuals plagued with anxiety disorders there is a tremendous burden placed on their mental health, and there can be devastating consequences on psychosocial functioning and if that is not resolved at an early age, individuals can fail to properly integrate into society (Essau, et al., 2014; Settipani & Kendall, 2012). There is a significant global expenditure on treatments for anxiety (Baxter, et al, 2014), often individuals will be prescribed psychotropic drugs as treatment and it has been documented that there was an increase from 57.4-63.8% in the use of these drugs from 2004-2009, with similar trends for benzodiazepines (Wu, et al., 2013). This is concerning and problematic as benzodiazepine has been identified as a major drug of abuse and has several side effects such as psychomotor impairment, memory loss and vertigo. A recent meta-analysis shows that benzodiazepine use causes a wide array of cognitive problems and can impair neuropsychological functioning among other negative side effects (Crowe & Stranks, 2017).

These drugs are only recommended for short durations and addition rates are high (Lader, 1999)

Risk Factors for Developing Anxiety

It can be difficult to identify and isolate the risk factors associated with anxiety however, it does appear that its prevalence is increasing, particularly among younger age groups (Cartwright-Hatton, et al., 2006). Academic stress among students has been shown to be highly prevalent and often results in severe anxiety particularly related to exams (Gosar & Venkatraman, 2019). A study from Ohio found an increase in yearly visits to one counselling centre had increased by 231% in a four-year period and additionally that the top concerns among adolescents were academic performance, pressure to perform and post-graduation plans (n = 374) (Beiter et al., 2015). Without better information on how to treat these disorders apart from the use of potentially harmful drugs there will be negative consequences. There is some evidence to support an early onset age of anxiety, in one such study, participants presenting with DSM-III panic disorders, there was a mean onset age of 24.1 (n = 100) and a second group within this study had a mean onset age of 19.7 years (Thyer, et al., 1985). Another study examined potential antecedents to developing an anxiety disorder and found a relationship between insecure attachment styles and dysfunctional attitudes as an adolescent and developing anxiety (Lee & Hankin, 2009). The mean age of onset can vary considerably, and much older individuals can still develop anxiety due to negative or stressful occurrences in their life with symptoms being chronic and lasting for many years (Lenze et al., 2005).

State/Trait Anxiety and Anxiety in Third Level Students

An important distinction that should be made is the difference between state anxiety and trait anxiety. State anxiety is the development of anxious symptomology and the mental and physiological effects of anxiety in response to an adverse situation or potentially

threatening stimuli, this is transitory and changes throughout an individual's life (Bishop, 2004). Trait anxiety is a predisposition to developing an anxiety disorder due to certain personality traits and tendencies (Endler & Kocovski, 2001). Individuals with trait anxiety are prone to developing panic disorders thus, early onset is far more likely for these people. Anxiety disorders can lead to additional psychiatric problems such as depression or suicidal tendencies and at a minimum can cause development of maladaptive coping strategies and infringe on life satisfaction and emotional wellbeing (Mahmoud, et al., 2012). Anxiety pertaining to academic performance has been shown to relate to maladaptive methods of coping and excessive metacognition (Matthews, et al., 1999; Ellis & Hudson, 2010). This is relevant to third level students as state and trait anxiety in this demographic result in reported poorer quality of life and difficulty in social integration which affects all aspects of a person's life (Barrera & Norton, 2009). Taking these findings into consideration, finding an effective treatment method that can be implemented in these typically younger age groups is important.

In Ireland specifically, these findings of a potential increase in anxiety among young people have been further supported with a study examining the prevalence of these disorders in adolescents. In a sample of 723 adolescents, 19.4% were identified as being at risk of harm due to panic disorders, and a further 15.6% met the criteria for having a current psychiatric disorder (Lynch, et al., 2006). Considering these findings, more research is needed into how anxiety affects young people as there are significant stressors that are unique to this age group such as moving away from home, increased academic pressure, and the forming of new relationships (Eisenberg, et al., 2007). College or University attendance can be a critical juncture in a young person's life and with these stressors involved, there have been high rates of depression and anxiety observed. One study with a sample size of 1119 students measured a 68.5% of mild to severe symptoms of anxiety (Lun et al., 2018). Due to the varied nature of

an individual's experiences and symptoms of anxiety, identification and treatment can be difficult (Yao et al., 2017).

Exercise as a Treatment for Anxiety

While treatment of anxiety is typically conducted using psychotropics and other medications, there has been some indication that regular exercise may have an important role in reducing symptomology and severity of anxiety effectively (Herring, et al., 2011). This may be preferable for younger age groups as there are numerous negative side effects associated with many prescribed drugs for mood disorders, these can range from problems sleeping to decreased appetite (Weintrob, et al., 2002). While there are some studies accurately assessing the prevalence and age-associated risk of developing anxiety, there is a substantial gap in the literature for this topic. Many studies fail to measure anxiety levels of third level students without relating the anxiety measures to specific academic variables such as Mathematics anxiety (Yi & Na, 2019). For this demographic group there is a dichotomy to anxiety and a more generalised picture of anxiety levels is needed (Farrer, et al., 2016).

In the pursuit for alternative treatments for mood disorders, studies showing the potential of exercise to have anxiolytic effects have emerged. Initially, the primary focus of many studies on this topic have been more specifically related to depression, one meta-analysis of 58 randomised trials (n = 2982) showed that participants in the exercise condition had significantly lower depression scores than the control group (effect size = -0.80) (Rethorst, et al., 2009). While anxiety and depression are separate disorders, there is often comorbidity between them (Belzer & Schneier, 2004). They share certain commonalities and risk factors (Iliceto et al., 2011); positive psychological wellbeing is one of these factors this has resulted in a gradual shift of focus onto exercise and its effects on anxiety, with many studies showing a reduction in anxiety symptomology due to exercise (Jayakody, et al., 2013; Herring, et al., 2016). Other studies related to third level students and mental health have

demonstrated a strong link between regular exercise and psychological wellbeing (n = 5061) while controlling for social status and health conditions (Steptoe & Butler, 1996). This study is not focused solely on anxiety however, as psychological wellbeing is considered a risk factor for developing anxiety this is a relevant finding. The mitigation of risk factors must be considered in any long-term intervention (Hettema, et al., 2005) In another study which reviewed existing literature, exercise intervention on anxiety was empirically found to be effective in reducing anxiety over time (Herring, et al., 2013). These findings are relevant as previously mentioned, third level students can be susceptible to developing anxiety and are exposed to many unique stressors (Eisenberg, et al., 2007). Considering that the prescription of psychotropics is not always advised due to side effects (Safer, et al., 2003); research into the potential of exercise and other substitutes as part of a treatment plan is expanding.

The development of anxiety at a young age can influence the acquisition of maladaptive behaviours and health practices (Turk, et al., 2005) which will have a negative outcome on the health of individuals plagued with these disorders. More specifically relating to anxiety and exercise, it has been demonstrated that exercise can improve self-esteem and is associated with lower sympathetic nervous system responses and hypothalamic-pituitary-adrenal reactivity (HPA) (Crews & Landers, 1987; Anderson & Shivakumar, 2013; Mueller, 2007). Numerous studies have observed a link between anxiety, depression, and increased activity in the hypothalamic-pituitary-adrenocortical axis (Landgraf, et al., 1999). If an individual is exposed to significant stressors, the sympathetic nervous system response can result in elevated levels of glucocorticoids (Anderson & Shivakumar, 2013). This has been hypothesised to result in hippocampal degeneration and dendritic retraction among other negative impacts (Conrad, 2008). The relevance of this finding as it relates to anxiety is that these same degenerative effects on the brain, and hippocampus specifically have also been implicated in anxiety disorders and other comorbidly occurring conditions (Cha et al., 2016;

Mah, et al., 2016). There is research to support that exercise can mediate these effects. A meta-analysis displayed a moderate effect that exercise was successful in reducing anxious symptomology in participants suffering from anxiety and stress related disorders (Stubbs et al., 2017). Another study demonstrated that participants who exercised more frequently exhibited lower physiological and psychological responses to stressors (Zschucke, et al., 2015). There appears to be growing evidence supporting the use of exercise as a treatment for anxiety. Due to the lack of constructs in place for identifying the prevalence among third level students, many people simply live with chronic anxiety or are prescribed medications as the use of exercise for an alternative treatment is not yet widespread (Woodgate, et al., 2020) (Miller, 2008).

Exercise Type and Effects on Anxiety

It can be said that anxiety resides in uncertainty about the future, this is something that although may not be unique to third level students, is one of their primary concerns (Beiter et al., 2015). It has been demonstrated that aerobic exercise can reduce anxiety sensitivity but the effect it has on intolerance of uncertainty is yet to be fully explored (LeBouthillier & Asmundson, 2015). This requires more focus on third level students specifically. There are few longitudinal studies examining the anxiolytic effects of exercise or how long it takes for a measurable reduction in symptoms. One study conducted which adequately measured anxiety using standardised scales and dealt with young adults followed 2458 participants for a four-year period and found lower levels of reported anxiety in those who frequently exercised compared to the participants who lived sedentary lifestyles (Ströhle, 2008). There are some differing results showing weaker effects for the anxiolytic benefits of exercise, another meta-analysis calculated a weak-moderate effect size of .36 for the exercise conditions compared to control groups (Long & Stavel, 1995). This difference in findings between studies may be due to the poor congruence of exercise type and intensity prescribed

to participants in many studies (Kleemann, et al., 2020). Additional research has emerged that investigates the anxiolytic effects of resistance exercise rather than exclusively using aerobic exercises in anxiety studies. It suggests that different levels of resistance and repetitions even in low intensities may have even greater success at reducing feelings of anxiety (Strickland & Smith, 2014). This finding can be debated as the terminology used to define “low intensity” exercise is not consistent with other studies (Ekkekakis, et al., 2006). Considering these findings, much of what we know regarding how exercise intensity affects anxiety may be critiqued as experimentation with the exact conditions of exercise have not been adequately standardised. This area is still developing a standard operating procedure and “gold standard” for exercise type so that findings can move closer to being 1:1 comparison (Ekkekakis, et., 2011; Tieman, et al., 2002).

To conclude, it is apparent that anxiety and other mood disorders have high rates of prevalence and can cause significant problems for society, additionally the traditional method of treating anxiety disorders with psychotropic drugs has the potential exhibit negative effects. There have been several studies that have effectively measured the anxiolytic effects of exercise and have demonstrated its potential as an alternative treatment however, there has not been significant research conducted into the application of this specifically in young people. Existing research on this topic has varied greatly in the intensity of exercise used with different types of exercise deviating in its anxiolytic effects (Mackay & Neill, 2010) and many studies have not specified the exact exercise conditions involved in their studies. As a result, more research is needed into the anxiolytic potential of exercise and its effects on third level students during a transitory and important stage in their lives.

The Current Study

Anxiety disorders are categorised as the most common mental illness (Kessler, et al., 2005) however, the treatment for this condition is outdated and focuses primarily on the

prescribed use of medications with a range of negative side effects (Crowe & Stranks, 2017). The literature has shown that for people who are prone to anxiety, developing anxiety as an adolescent is common (Higa-McMillan, et al., 2015). The existing literature demonstrates that if anxiety is untreated through adolescence, an individual can suffer extremely negative consequences and can fail to integrate properly into society as a result (Barrera & Norton, 2009). Considering what previous literature has shown it is important that an effective and alternative treatment can be found to treat anxiety. The rationale behind this study comes from promising results in the use of exercise in reducing HPA-axis and sympathetic nervous system responding that can trigger anxiety (Mueller, 2007; Herring, et al., 2016). Third level students are the focus here as there are several unique stressors that have been identified as possible antecedents to anxiety during this transitory stage in life (Eisenberg, et al., 2007). Several large studies and meta-analyses have shown high prevalence of anxiety among third level students (Yao et al., 2017) however, the failure in linking these findings to the use of regular exercise means that there is a lack of constructs in place for treating individuals with this alternative but effective treatment method (Ströhle, 2008).

This study is set to examine to what extent does exercise have measurable anxiolytic effects for third level students. From reviewing the literature, this is a question that has not been answered comprehensibly and the studies that surround this topic have not focused on this specific demographic. This study has three main aims. First to improve our understanding of the prevalence of anxiety in third level students, to see the effects that exercise has in reducing anxiety and to examine whether the type/intensity of exercise used will reduce anxiety in varying degrees. As a result, findings may influence whether further focus is put into the potential of exercise as a treatment for anxiety disorders. This study is being conducted with three research questions.

Research question 1: How prevalent are anxiety scores qualifying as moderate in third level students while being measured on a standardised scale? The hypothesis for this research question is that the number of students suffering from moderate symptoms of anxiety will be approximately 30%. This estimate follows the results of similar studies in the same demographic.

Research question 2: To what extent does exercise have an anxiolytic effect? The hypothesis for this research question is that higher levels of regular exercise will be associated with lower levels of reported anxiety scores in participants. It is expected that participants who exercise more frequently will have lower levels of anxiety than those who do not exercise regularly.

Research question 3: How does the type of exercise in which a person participates affect anxiety levels. Will there be a difference between high intensity exercise such as running, and lower intensity exercise such as walking? The hypothesis for this question is that considering previous research, both forms of exercise will have anxiolytic effects however, high intensity exercise is expected produce higher anxiolytic effects due to a higher concentration of literature on its anxiolytic effects.

Methods

Participants

Demographics

The target population for this study was all third level students. The participants in this sample consisted of 152 third level students (Males: n = 66; Females: n = 86) with a mean age of 21. Participants were required to be 18 years old to be eligible for the study. Participants were from numerous colleges in Ireland, primarily in Dublin. A description of the study accompanied by a link to the online survey was shared through the following social media sites, Facebook, Instagram, and Twitter.

Sampling Methods and Sample size

A description of the study accompanied by a link to the online survey was shared through the following social media sites, Facebook, Instagram, and Twitter. Snowball sampling was involved in the distribution of the survey as participants were encouraged to share the link freely with their friends. There was no remuneration or other incentive offered for participation. As multiple correlations, and a Mann-Whitney U test were conducted, G*Power: Statistical Power Analyses (Faul, et al., 2009) was employed to calculate the adequate sample size with 95% power. The estimates provided for a correlation, and Mann-Whitney U test respectively were 138 and 114 participants. As the responses of all participants would be involved in each step of the analyses, the required sample size was obtained, thus reducing the likelihood of mistakenly rejecting the null hypothesis and making the results generalisable to the population.

Measures

All data for this experiment was collected through an online survey using Google forms. There were four scales/questionnaires used, two for measuring anxiety and two for measuring exercise.

Beck Anxiety Inventory

Anxiety levels were measured using the Beck Anxiety Inventory (Cronbach's alpha = .94) (Beck, et al, 1988; Fydrich, et al., 1992) (see Appendix II), this is a 21-question standardised scale used in many studies of this nature and has been shown to be reliable and internally consistent in measuring panic disorders without overlapping for depression (Leyfer, et al., 2006). This is the most used scale in assessing panic disorders and has a high level of internal reliability (Osman et al., 2002) with a Cronbach's alpha level of .94 (Fydrich, et al., 1992). The Beck Anxiety Inventory is a self-report questionnaire, examining symptoms of anxiety during the previous month before participation in the study and is graded on a Likert scale from '0' being 'not at all' to '3' being 'severely-it bothered me a lot' relating to questions such as 'heart pounding or racing'. Scores can range from 0-63, scores of 0-7 are interpreted as minimal symptoms of anxiety, scores of 8-15 as mild, scores of 16-25 as moderate and finally scores of 26-63 as the most severe signifier of anxiety (Bardhoshi, et al, 2016). In this study the Cronbach's alpha level was (α = .93) this indicated high internal consistency.

The GAD-7

The GAD-7 was also used to measure anxiety as it focuses specifically on psychological symptoms of anxiety (Cronbach's alpha = .79-.91) (Williams, 2014). This will provide a more comprehensive measure of anxiety scores for participants (Spitzer, et al., 2006) (see Appendix III). The GAD-7 is a 7-question scale based on the two weeks prior to participation with each question being scored from 0 to 3 and answers ranging from 'not at all' to 'nearly every day' regarding the frequency of symptoms being experienced with questions such as 'Not being able to stop or control worrying?'. Scores of 5, 10, and 15 are categorised as mild, moderate, and severe levels of anxiety. A score of 10 and above recommends clinical assessment or intervention (Löwe et al., 2008). While the GAD-7 has an 82% specificity for measuring generalised anxiety disorder, it is also effective at screening

for other subtypes of anxiety disorders also (Williams, 2014). The Cronbach's alpha level for this study was (α = .89) which indicated high internal consistency.

The International Physical Activity Questionnaire

The first of the two scales employed for measuring exercise was the International Physical Activity Questionnaire (Cronbach's alpha = .73) (Mannocci et al., 2010) (see Appendix IV) which is a 27-question scale that measures physical activity across a range of different domains of the participant's life; including work, travel, and recreational exercise (Hagströmer, et al., 2006). The form of scoring for the IPAQ that was used for this experiment was the reporting of results based on active minutes weekly. These categorisations of physical activity levels are referred to as the continuous variable of MET units. This is simply all active minutes per-week, added together according to the appropriate values. Each type of physical exercise or activity has a pre-determined MET value, and these values change slightly depending on the domain of a participant's life they are being scored in. These can be work, transportation, domestic, and recreational time. In the work domain, walking is 3.3 METS, moderate physical activity is 4 METS, and vigorous or high intensity physical activity is 8 METS. In the other domains there are slight variations for activities such as gardening work being scored as 4 METS, and inside chores of a moderate level being scored as 3 METS (Hallal & Victora, 2004). Higher overall scores of active minutes clearly indicate a more active lifestyle. The IPAQ has been shown to have a high level of validity and re-test reliability with a Spearman correlation coefficient of .8 (Craig et al., 2003). Cronbach's alpha level for this study was (α = .71) which indicated acceptable internal consistency.

The Preference for and Tolerance of The Intensity of Exercise Questionnaire

The final questionnaire used during this study was The Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q) (Cronbach's alpha = .89) (see

Appendix V). This is a two-factor scale with these factors being either preference for exercise intensity or tolerance of exercise intensity (Ekkekakis, et al., 2005). For this study, only the preference value was used as it is a self-report survey, which looked to assess the type of exercise intensity that was more commonly used or "preferred" by participants.

This applied to the third research question, this scale identified whether individuals participated in high intensity cardiovascular centric exercises such as running, or low intensity exercise such as walking or yoga. There is debate surrounding which variation of intensity is the most effective (Mackay & Neill, 2010). As the PRETIE-Q is self-report, it will divide participants into two groups so that the effectiveness of each can be measured. This is an important consideration if exercise is to be administered as part of a treatment plan for anxiety (Ekkekakis, et al., 2006). Anaerobic exercise such as weightlifting is can also be included in the low intensity group (Ekkekakis, et al., 2005). These are examples of each exercise group; the scale will not specify exact exercise types for participants. It will measure their subjective preferred and typical intensity of exercise. The PRETIE-Q is a 16-item scale examining the participants propensity to exercise. Each question is scored from 1-5, with '1' being 'I totally disagree' to the question and '5' being 'I totally agree'. An example of a question from this scale is 'While exercising, I try to keep going even after I feel exhausted'. Items 2, 4, 8, 12 ,1 ,3 ,9 ,13 are all reverse scored. Higher total scores indicate a preference for higher intensity exercise. This questionnaire will provide the necessary information to answer the final research question. The Cronbach's alpha level for this study was ($\alpha = .82$).

Design

The research design for this present study was cross-sectional as all data was be collected at a specific time, which was during participation in the study. The study was also quantitative in its design with all data for analysis being collected using online surveys. The dependent variable was anxiety scores, the independent variables were exercise scores and

the type of exercise most favoured by each participant. This will be either high or low intensity exercise. For the third research question there was a between-groups design employed as participants fell into one of two exercise categories.

Analysis

Descriptive statistics were used to answer the first research question. Pearson's correlations were used to assess the second research question, while a Mann-Whitney U test was used for the final research question.

Procedure

The advertising of this study primarily consisted of social media promotion and snowball sampling. Ethical approval was necessary and came through proposing the study to the NCI ethics committee. The topic of anxiety may cause distress and provoke negative emotions for some people (Campbell-Sills, et al., 2006), the focus of the ethical considerations was to prevent this from happening. The debriefing sheet visible upon completion of the study (see Appendix VI) contained the necessary contact information of organisations which could assist in dealing with anxiety and other concerns or issues.

The use of online promotion ensured that various student populations were informed of the study. Mutual friends attending several other colleges made it possible to share the study further and where applicable these people were emailed directly with the link for the study. Once an individual decided to participate in the study, they were instructed to follow the online link that brought them to a Google docs survey. The introductory page contained information pertaining to intended purpose of the study and the details of the researcher. As there was no need for deception, participants were made fully aware of the intended use of their data. This page also contained consent forms to ensure informed consent was obtained

(see Appendix I). This form contained information such as the expected length of participation which was approximately 10 minutes and the option to withdraw consent at any time until the survey had been submitted. Due to no identifying information being collected, participants were informed that data could not be removed once they had submitted their survey. Before participation, two separate boxes had to be checked to confirm that participants had read and understood the terms study and intended use of data.

Once informed consent had been given and the survey had been commenced, the first questionnaire used was the Beck Anxiety Inventory (see Appendix II) (Beck, et al., 1988). This scale contains 21 questions, prior to answering each questionnaire in the study there was a brief description of its purpose and instructions on how to score each question. The Beck Anxiety Inventory is the most widely used measure for anxiety (Osman et al., 2002). The questions asked participants to consider the month prior to the study and to base their answers from this time frame. The next stage in the survey was the GAD-7 (see Appendix III), this is the second survey for measuring anxiety symptomology in participants. This questionnaire focused on psychological symptoms (Spitzer, et al., 2006). This section contained 7 questions, with all answers being assigned a numerical value. The next section of the study was for exercise.

The IPAQ was the first scale encountered by participants for measuring the level of exercise/activity they engaged in daily (see Appendix IV). This is a 27-question scale with each answer given regarding a type of activity being assigned a value of active minutes referred to as MET minutes (Hagströmer, et al., 2006). These units refer to activity levels throughout the average week. Walking is assigned as 3.3 MET units, moderate exercise is assigned as 6 units, with cycling being 4 units, and any vigorous is 8 units. It was not necessary for participants to understand the procedure behind the value of each MET unit as this is only relevant for the statistical analysis of the data. Over the 27 questions included in

this scale, there was three distinct domains for potential exercise of a participant being measured. These were work, travel, and recreational activity. The IPAQ is accredited for having a high level of reliability, with data compiled from many studies correlated at a Spearman's rho of .8 (Craig et al., 2003).

The final questionnaire within the study was The Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q) (see Appendix V). Participants were required to answer 16 questions regarding the intensity in which they typically exercise among numerous subjective responses on how they feel during different forms of exercise. This scale was designed solely for this purpose and has also been noted for obtaining reliable results (Ekkekakis, et al., 2005). This scale is scored from 1-5 on a participant's level of agreeing or disagreeing with the statements provided. Once this section had been completed the participants were presented with a debriefing form (see Appendix VI). This form was used to reiterate that participants were still able to withdraw consent at this point however, if they selected the box that confirms the submission of their data, they would be unable to then withdraw. This page also contained contact details for the study supervisor and myself along with the details needed to contact helplines associated with anxiety support, in the event that participation had resulted in any form of distress.

Results

Descriptive Statistics

The current data is taken from a sample of 152 participants (n = 152). This consisted of 43.4% males (n = 66) and 56.6% females (n = 86). The sample was comprised of third level students from many different Colleges/Universities in Ireland, primarily in Dublin. A small number of Irish students studying abroad 4.7% (n = 7) were also included.

Descriptive statistics were performed for all variables, including scale scores for the Beck Anxiety Inventory, the GAD-7, the International Physical Activity Questionnaire (IPAQ), and the Preference for and Tolerance of the Intensity of Exercise Scale (PRETIE-Q). A preliminary analysis was conducted which indicated through the result of the Shapiro-Wilk test ($p < .05$) and normality plots that the PRETIE-Q scores were non-normally distributed. The data could not be successfully transformed to remove skewness however, in accordance with the central limit theorem the sample size of this data set is deemed large enough (n > 30) to accept that the sample means are approximately in accordance with the means of a normally distributed data set. Therefore, these scores can be treated as normal. On inspecting the data, eight outliers were identified, it was clear that these scores were within the limit for possible results on this measure.

All other variables complied with the assumptions of normality. Means (M), Medians (MD), Standard Deviations (SD), and Range (R) were all calculated, these results are displayed below in Table 1.

Table 1.

Descriptive statistics for all continuous variables (n = 152)

Variable	*M* [95% CI]	*MD*	*SD*	*Range*
Beck Anxiety Inventory	23.34 (21.18-25.50)	22	13.46	57
GAD-7	11.45 (10.57-12.32)	11	5.46	21
IPAQ	188.03 (173.95-202.10)	180	87.81	450
PRETIE-Q	23.73 (23.23-24.23)	24	3.11	23

Hypothesis 1

To determine the prevalence of anxiety in the sample of third level students, descriptive statistics were also computed to assess the frequency of anxiety scores above the cut-off point for moderate. The hypothesis for this research question states that 30% of participants will be categorised as having moderate symptoms of anxiety on both scales; this is in line with previous literature. The Beck anxiety inventory categorises moderate as a score of 16-25, and severe as a score of 26-63. The GAD-7 lists moderate as 10-15 and severe as 16-21. There were 34 participants who scored as moderate on the Beck anxiety scale which was 22% (n = 152), and 94 participants who were categorised as having moderate levels of anxiety on the GAD-7 which constituted 61% (n = 152). These results indicate a substantial number of participants were deemed to be above the cut-off point for having moderate levels of anxiety. Each of the anxiety scales offered a differing frequency of participants who had moderate levels of anxiety. These scales were expected to display similar results; however, these results indicate that the physical symptoms of anxiety which are included in the Beck anxiety inventory are less commonly experienced than the psychological symptoms addressed in the GAD-7. Overall, these findings fell in line with, and above the number of 30% prevalence from the hypothesis.

Inferential Statistics

Hypothesis 2

A Pearson's correlation coefficient was computed to investigate the relationship between anxiety levels and exercise. The first correlation included the Beck anxiety inventory scores and exercise (IPAQ). Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. There was a small negative correlation between Beck anxiety scores and exercise (r = -.29 [95% CI = -.43, -.14], n = 152, p < .001). This indicated that the two variables share approximately 8% of variance. These results indicate that higher levels of anxiety are associated with lower levels of exercise.

A Pearson's correlation coefficient was conducted to investigate the relationship between GAD-7 scores and exercise (IPAQ) to observe any potential difference in correlation due to the anxiety scale used. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. Some outliers were observed, these were eight scores of 21 and one score of 0 however, these scores were deemed to be acceptable as valid responses within the possible range. There was a small negative correlation between GAD-7 scores and exercise (r = -.28 [95% CI = -.40, -.15], n = 152, p < .001) These results indicate that higher levels of anxiety are associated with lower levels of exercise.

Hypothesis 3

A Mann-Whitney U test was conducted to compare anxiety levels from both measures and two separate exercise preference groups, high intensity, and low intensity. The intended form of analysis was an independent samples t-test however, as the data for exercise preference was non-normally distributed, the non-parametric Mann-Whitney U test was more appropriate. There was no significant difference in anxiety levels measured on the Beck inventory between the low intensity exercise group (Md = 18, n = 152) and the high intensity

exercise group (*Md* = 25, n = 152), *U* = 2388, *z* = 1.67, *p* = .094, *r* = -.14. These results indicate that there was no significant difference between exercise groups, it should be noted however that due to three outliers scoring above 55 on the Beck anxiety inventory, the median for this group may be inflated slightly. These outliers have been deemed as valid and possible scores.

A second Mann-Whitney U test was conducted comparing anxiety scores on the GAD-7 between both exercise groups. There was no significant difference in anxiety levels between the low intensity group (*Md* = 10, n = 152), and the high intensity group (*Md* = 12, n = 152), *U* = 2550, *z* = -1.07, *p* = .284, *r* = .08.

Discussion

The first aim of this study was to investigate the prevalence of anxiety among third level students. The rationale in doing so was supported by the literature which examined the unique stressors of this demographic, including academic pressure (Gosar & Venkatraman, 2019) and a constantly changing and demanding social environment (Eisenberg, et al., 2007). A limitation to many previous studies, is that anxiety was only investigated as it related solely to academic stressors. This current study sought to encompass a broader and more appropriate view of anxiety in a participant's life as they attend a third level institution. The second research question sought to investigate the potential for exercise to have anxiolytic effects within a sample of third level students. Finding an alternative treatment for anxiety that may be included in a new intervention framework is an important arear of research. While the use of exercise is becoming more popular as a treatment, methodological limitations in the studies surrounding it, negatively impact the way it is perceived (MacAuley, et al., 2016). Medications such as benzodiazepines often used to treat anxiety disorders, present numerous negative effects and a potential for addiction which can compound any existing problems (Crowe & Stranks, 2017). This provides some of the motivation for further developing alternative treatment methods. The study also sought to investigate with the third research question, whether variations in exercise type affected its ability to reduce anxiety; with the two exercise categories being high and low intensity exercise. Research in this area is slowly developing, traditionally aerobic exercise such as treadmill running had been the gold standard assigned exercise for anxiety studies. However, anaerobic resistance exercise has yielded positive effects on anxiety also (Strickland & Smith, 2014). These variations in exercise type still require more data to make generalisable claims. This final research question aimed to clearly determine whether exercise intensity impacts its anxiolytic effectiveness.

Hypothesis 1: Strengths/Limitations and implications

For this research question, the prevalence of anxiety was assessed using descriptive statistics. This hypothesis stated that there would be a prevalence rate of approximately 30% for moderate levels of anxiety based on similar studies (Eisenberg, et al., 2007; Lun et al., 2018). A strength here was that an element of the study design was novel as two anxiety scales were used to assess the prevalence of anxiety in the most effective and appropriate way. The benefits to assessing anxiety in this way are twofold. Firstly, by not relating anxiety directly to academic pressures, there is no need to control for variations in perceived course difficulty and academic abilities (Putwain, et al., 2010; Smith, et al., 2007). Secondly, a wider array of stressors which relate to this demographic can be accounted for by using these more generalised anxiety scales (Beiter et al., 2015). It was discovered in the literature review that anxiety is associated with increased hypothalamic-pituitary adrenal activity. Some studies have linked exercise with reduced sympathetic nervous system responding (Crews & Landers, 1987), this indicated that more frequent exercise resulted in lower physiological and psychological responses to stressors and anxiety (Zschucke, et al., 2015). This was the rationale behind using two anxiety scales. Somatic or physiological symptoms of anxiety were measured by the Beck anxiety inventory and psychological symptoms were measured by the GAD-7. A previous study has shown that the self-reporting of physiological symptoms can be inaccurate at times (Haug, et al., 2004). This meant the inclusion of two scales hoped to provide a better view on prevalence. The results indicated that a rejection of the null hypothesis was appropriate. The rates of moderate anxiety aligned with and exceeded the approximation stated in the hypothesis which was 30% for the sample. For the Beck anxiety inventory measuring somatic symptoms, 22% of participants scored in the moderate range for anxiety however, for the GAD-7 which measured exclusively psychological symptoms of anxiety, there was a 61% prevalence rate for moderate levels. There is a sizeable difference

between the two scales and their respective scores. This is a potentially novel finding as these results appear to demonstrate that there can be significant variability in anxiety scores depending on the focus of the measure used. The results appear to imply that the somatic symptoms listed in the Beck anxiety inventory may be less commonly experienced than the psychological symptoms of the GAD-7. This cannot be inferred or stated with confidence based solely on these results, each scale varies in the scoring criteria and the degree to which this observation is generalisable is unknown. It can be stated that within this sample, psychological symptoms of anxiety were more prevalent than physical symptoms.

A proposed reason for variation in prevalence between the two scales is the lack of depth in anxious symptomology assessed by the Beck anxiety inventory. The origins of this scale are as a measure which aimed to reduce the overlapping diagnosis between anxiety and depressive disorders (Julian, 2011). The GAD-7 will therefore be expected to produce higher frequencies of participants displaying moderate levels of anxiety, as these symptoms are reportedly more commonly experienced and persistent (Tyrer & Baldwin, 2006). The GAD-7 covers one of the four main subtypes of anxiety disorders and is aligned with the most common self-report symptoms of anxiety from patients (Rose, 2014). A systematic review of the use of the GAD-7 supports its efficacy and accuracy in this moderate scoring range (Plummer, et al., 2016). While both anxiety scales used are robust and accurate, a limitation in the use of two scales is that these results must be reported separately and due to differences in the metrics used for scoring each scale, it is difficult to assess the true implications in their differing results.

Overall, the prevalence rate of moderate levels of anxiety was relatively high and aligned with similar studies (Kessler, et al., 2005). There are participants who scored above and below the cut-off points. This analysis is not the first to demonstrate the high prevalence of anxiety in third level students. It must be noted that there is often an overlap with studies

relating to adolescents specifically, third level students can vary in age. It does seem appropriate that results such as these be given attention by policy makers, or individuals working within the sphere of mental health and education, as a novel intervention framework or improved mechanisms for assisting students who are struggling may be needed. There is evidence to support the pervasive comorbidity of anxiety disorders and other mental health problems such as depression (Belzer & Schneier, 2004). This means the prevalence of anxiety could also be linked to other psychological problems. It could be valuable to measure anxiety using other variations of scales to obtain a comprehensive overview of the most common causes of anxiety for third level students (Yao et al., 2017). There has been research conducted in this way that has yielded interesting results regarding the differences in anxiety while studying for certain professions, such as those studying to become a physician (Dyrbye, et al., 2006). The current study is limited in its capacity to account for variables such as perceived academic difficulty as it may relate to anxiety; this could be mediated by future research.

Hypothesis 2: Strengths/Limitations and implications

The second research question sought to investigate to what extent did exercise have an anxiolytic effect. The hypothesis for this research question was that frequent exercise such that it resulted in higher exercise scores on the IPAQ, would be associated with lower levels of anxiety, regardless of the anxiety scale used (Herring, et al., 2011). A Pearson's correlation was used to investigate the effects. The international physical activity questionnaire (IPAQ) was compared with each anxiety scale separately. The analysis provided very similar results with both scales which demonstrated that there was a small negative correlation between exercise and anxiety in the sample. The Beck anxiety inventory (r = -.29) and GAD-7 (r = -.28) scores were both shown to be affected by how much exercise a participant was involved with in every domain of their life. The null hypothesis could be rejected in this instance.

These results demonstrated very similar correlations between exercise and anxiety as numerous other investigations and analyses (Jayakody, et al., 2013). The small negative correlation between exercise and anxiety on both scales indicates that as exercise levels increased, anxiety levels decreased. While there was still a statistically significant result ($p < .001$), it is possible that anxiety scores were inflated to an unknown extent due to the ongoing pandemic. It is also important to note that gym facilities were subject to unpredictable closures which affected the ability to exercise regularly for many people. As a result, it is likely that the correlation between exercise and anxiety would have been slightly larger if measured during non-pandemic times, which would fall in the same range as previous studies outlined in a meta-analysis (Stubbs et al., 2017).

A strength to this study is that it differed from many predecessors on this topic in that exercise was not measured solely in one domain, which typically constitutes prescribing a set time on a piece of exercise equipment (Herring, et al., 2011). The IPAQ measures physical activity across every domain of life rather than just recreational activity, therefore, provides a comprehensive measure of total physical activity. Due to the all-inclusive nature of the IPAQ, and the use of two anxiety scales to ensure an accurate assessment of its severity, these results demonstrate that even during a challenging time, there is still data to support the anxiolytic effects of exercise. The prescription of exercise as a supplementary treatment for anxiety is becoming more common (Carek, et al., 2011). However, it is still not fully recognised as a treatment option, and often relies on the choice of individual Doctors (MacAuley, et al., 2016). Future research should continue to bring attention to the anxiolytic effects that exercise can have to update the knowledge base that medical practitioners have access to (Khan, et al., 2011). While our knowledge of mental health disorders is always developing, numerous studies have outlined the comorbidity of anxiety and depression (Coplan, 2015). In one such study using a large cohort (n = 1783), it was found that 67% of

those who had a depressive disorder were also categorised as currently having an anxiety disorder (Lamers et al., 2011). The implications of these findings suggest that due to the comorbidity of anxiety and depression, exercise may be useful as part of an overarching model for treating mental health disorders, as its anti-depressive effects have also been supported (Park, 2018; Rethorst, et al., 2009). The addition of an exercise routine for many people is something that can be a challenge to implement for a plethora of reasons such as time constraints or raising children. As the IPAQ measured exercise to varying degrees, it can be suggested that even the addition of light exercise such as walking to work or cycling where possible can still produce anxiolytic effects. This means that exercise should not just be viewed through the lens of recreational activity, it can be implemented into many facets of life to varying degrees and still produce benefits. There does appear to be a stigma surrounding exercise, gym-going and self-report body satisfaction have been linked, this makes it hard for many people to go to a gym (Schvey et al., 2017). Fitness should be for everyone; these stigmas prevent this at times and can contribute to exercise avoidance (Vartanian & Novak, 2011). Exercise is important even if an individual's capacity for exercise is limited (Long & Stavel, 1995). Future studies should seek to investigate how these avoidance behaviours relate to anxiety.

There are some limitations to the use of the IPAQ, while the IPAQ is a more comprehensive measure of exercise than alternative scales, it can diminish in its accuracy when exercise volume is excessive also, it is not possible to assess the exact intensity of the exercise that is reported. For example, walking is assigned a specific value of 3.3 MET units, if a participant engages in a lot of walking, it may inflate their results as their end score may falsely represent the actual volume of physical activity they have done (Bauman et al., 2009). this is a potential limitation as certain studies have found discrepancies in the capacity for low intensity exercise to produce anxiolytic effects (Aylett, et al., 2018) this is still a topic of

debate. Certain participants may have scored relatively high for exercise without any activity apart from walking. This often resulted in them still scoring higher on anxiety levels than another participant who gained the same exercise value through a more vigorous activity. This finding is something that could be further investigated with more specialised research around exercise variations. Another limitation is that the IPAQ is quite a long survey and can take 10 minutes to administer properly, this can limit the usefulness of this scale as it has been reported that the housework and garden sections in particular can cause confusion with their questions (Hallal et al., 2010). This is something that future studies might seek to remedy with a modified version of the scale. The application of this scale may benefit from a modification of the walking questions as previously mentioned, which may reduce the inflation of exercise scores.

Hypothesis 3: Strengths/Limitations and Implications

The third and final research question sought to investigate whether variations in exercise intensity affected its anxiolytic effects. A Mann-Whitney U test was used here as the data was non-normally distributed. The PRETIE-Q scale was used to assess each participants preferred type of exercise, with the two groups being high intensity and low intensity. There were no differences found when each exercise group was tested against anxiety scores on the Beck anxiety inventory and the GAD-7. These results showed that participation in high intensity exercise yielded no greater anxiolytic effects when compared to low intensity exercise. This infers that while it is evident that exercise does have anxiolytic effects, the capacity in which you engage in exercise does not appear to matter, simply exercising in many of its variations will produce some anxiolytic effects. This finding is important as it contrasts that of previously mentioned studies which debate the effectiveness of low intensity exercise (Aylett, et al., 2018; Carek, et al., 2011). These results are intriguing as this area of

study suffers greatly from the semantics used to decide the variation of exercise to be prescribed when observing its effects on anxiety (Kleemann, et al., 2020).

There is typically poor congruence in the exercise type and intensity used by studies assessing the anxiolytic effects of exercise (Mackay & Neill, 2010). There does not yet appear to be a “gold standard” for research in this field. Some studies employ self-report measures, while others prescribe predetermined exercise conditions. In this study, the use of a self-report and subjective measure of exercise intensity seemed the most appropriate. These results which display no difference in anxiety scores depending on exercise group are slightly contrasting with another study which demonstrated greater anxiolytic effects after lower intensity exercise prescribed on an exercise bike (Tieman, et al., 2002). However, this study mentions that the Vo2 max, and physical fitness of a participant should be considered, if an individual has low fitness levels and is tasked with high intensity exercise, this may temporarily increase anxiety as it will be an uncomfortable experience. It is important to recognise that when measuring exercise intensity in participants, the level at which they may give up and stop exercising, differs from their actual biological capacity (Ekkekakis, et al., 2006). This means that a participants self-reported capacity for intense exercise may be inaccurate, experimentation in a clinical setting to compare perceived intensity and actual performance would be beneficial.

It is difficult to evaluate the generalisability of these results and the degree to which the implications can be stated. Within the current sample, the exercise intensity did not influence anxiety scores which indicates that to the extent that an individual can implement exercise into their life, they should benefit from doing so irrespective of the intensity. The limitations here come in the form of a lack of relevant information on the fitness levels and exact exercise used by participants. As the scale is completely subjective and specificity is not required as it relates to exercise type, it is impossible to know what each participant

defined as ‘high’ and ‘low’ intensity exercise. Many other studies have been afforded the opportunity to specifically categorise how they score high or low intensity exercise. A meta-analysis of this literature has demonstrated some greater anxiolytic effects for both high and low intensity exercise, as the definitions for each and prescribed exercises tends to vary (Asmundson et al., 2013). There has been evidence to support the use of lower intensity, anaerobic resistance training and its ability to reduce anxious symptomology (Strickland & Smith, 2014). Future studies in this field may benefit from establishing a set-criteria for exercise intensity. In doing so, results can be compared, and our knowledge of the way exercise intensity effects anxiety can mature as a product of this variable being more clearly defined. To summarise the findings from this hypothesis, in this sample, the intensity of exercise that was preferred by participants had no impact on its anxiolytic effects. This means that a participant was likely to experience a reduction in anxious symptomology, regardless of the perceived intensity of this exercise.

Conclusion

This study has provided clear answers to the research questions it sought to investigate. The prevalence of moderate anxiety in this sample of third level students ranged from 22% on the Beck anxiety inventory which measured somatic symptoms, to 61% on the GAD-7 which measured psychological symptoms. The difference in prevalence between the anxiety scales was an interesting and slightly unexpected finding which may influence future research. This study provides clear support that exercise does have anxiolytic effects. Those who scored higher for exercise consistently displayed lower anxiety scores. While the effect size is between small and medium, this study was conducted during a pandemic which resulted in gym closures, this may have contributed to increased anxiety for some and a reduction in the ability to exercise (Hyland et al., 2020). Finally, there was no difference in anxiety levels between the high intensity and low intensity exercise groups. This result is

novel, as many studies in this field produce contrasting results which support one exercise intensity over the other (Tieman, et al., 2002). It must be acknowledged that the measure used for exercise in this study was self-report, therefore may not be as accurate as measuring performance in a clinical setting (Ekkekakis, et al., 2006). These consistently differing results in many studies appear to indicate a need for a standardised protocol in the study of exercise as a potential treatment for mental health illnesses. Future studies should seek to establish a standard operating procedure for the definition of exercise types, without a widely accepted foundation to base this research on, results are not comparable and in some cases they are not repeatable. While there are some standard or common exercise variations used for many studies, the literature which they are supported by is in many instances not clearly identified. There could be more experimentation on how different exercise intensities relate to the causal mechanisms underlying the positive effects that exercise can have on the brain (Ang, et al., 2007). With some attentive research, this topic would benefit greatly, and a comprehensive but adjustable exercise intervention plan may someday be applied as part of a framework for treating anxiety, and potentially other comorbidly occurring mental health illnesses.

References

Anderson, E., & Shivakumar, G. (2013). Effects of Exercise and Physical Activity on Anxiety. *Frontiers in Psychiatry*, *4*. doi: 10.3389/fpsyt.2013.00027

Ang, E., Gomez-Pinilla, F., Ang, E., & Gomez-Pinilla, F. (2007). Potential Therapeutic Effects of Exercise to the Brain. *Current Medicinal Chemistry*, *14*(24), 2564-2571. doi: 10.2174/092986707782023280

Asmundson, G., Fetzner, M., DeBoer, L., Powers, M., Otto, M., & Smits, J. (2013). Let's get physical: A contemporary view of the anxiolytic effects of exercise for anxiety and its disorders. *Depression and Anxiety*, *30*(4), 362-373. doi: 10.1002/da.22043

Aylett, E., Small, N., & Bower, P. (2018). Exercise in the treatment of clinical anxiety in general practice – a systematic review and meta-analysis. *BMC Health Services Research*, *18*(1). doi: 10.1186/s12913-018-3313-5

Barrera, T., & Norton, P. (2009). Quality of life impairment in generalized anxiety disorder, social phobia, and panic disorder. *Journal of Anxiety Disorders*, *23*(8), 1086-1090. doi: 10.1016/j.janxdis.2009.07.011

Bauman, A., Ainsworth, B., Bull, F., Craig, C., Hagströmer, M., & Sallis, J. et al. (2009). Progress and Pitfalls in the Use of the International Physical Activity Questionnaire (IPAQ) for Adult Physical Activity Surveillance. *Journal of Physical Activity and Health*, *6*(s1), S5-S8. doi: 10.1123/jpah.6.s1.s5

Baxter, A., Vos, T., Scott, K., Ferrari, A., & Whiteford, H. (2014). The global burden of anxiety disorders in 2010. *Psychological Medicine*, *44*(11), 2363-2374. doi: 10.1017/s0033291713003243

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., & Sammut, S. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *Journal of Affective Disorders*, *173*, 90-96. doi: 10.1016/j.jad.2014.10.054

Belzer, K., & Schneier, F. (2004). Comorbidity of Anxiety and Depressive Disorders: Issues in Conceptualization, Assessment, and Treatment. *Journal of Psychiatric Practice*, *10*(5), 296-306. doi: 10.1097/00131746-200409000-00003

Bishop, S. (2004). State Anxiety Modulation of the Amygdala Response to Unattended Threat-Related Stimuli. *Journal of Neuroscience*, *24*(46), 10364-10368. doi: 10.1523/jneurosci.2550-04.2004

Campbell-Sills, L., Barlow, D., Brown, T., & Hofmann, S. (2006). Acceptability and suppression of negative emotion in anxiety and mood disorders. *Emotion*, *6*(4), 587-595. doi: 10.1037/1528-3542.6.4.587

Carek, P., Laibstain, S., & Carek, S. (2011). Exercise for the Treatment of Depression and Anxiety. *The International Journal of Psychiatry in Medicine*, *41*(1), 15-28. doi: 10.2190/pm.41.1.c

Cartwright-Hatton, S., McNicol, K., & Doubleday, E. (2006). Anxiety in a neglected population: Prevalence of anxiety disorders in pre-adolescent children. *Clinical Psychology Review*, *26*(7), 817-833. doi: 10.1016/j.cpr.2005.12.002

Cha, J., Greenberg, T., Song, I., Blair Simpson, H., Posner, J., & Mujica-Parodi, L. (2016). Abnormal hippocampal structure and function in clinical anxiety and comorbid depression. *Hippocampus*, *26*(5), 545-553. doi: 10.1002/hipo.22566

Conrad, C. (2008). Chronic Stress-induced Hippocampal Vulnerability: The Glucocorticoid Vulnerability Hypothesis. *Reviews in The Neurosciences*, *19*(6). doi: 10.1515/revneuro.2008.19.6.395

Coplan, J. (2015). Treating comorbid anxiety and depression: Psychosocial and pharmacological approaches. *World Journal of Psychiatry*, *5*(4), 366. doi: 10.5498/wjp.v5.i4.366

Craighead, W., Miklowitz, D., & Craighead, L. (2017). *Psychopathology: History, Diagnosis, and Empirical Foundations* (3rd ed., pp. 78-114). John Wiley and Sons inc.

Crews, D., & Landers, D. (1987). A meta-analytic review of aerobic fitness and reactivity to psychosocial stressors. *Medicine & Science in Sports & Exercise*, *19*(Supplement), S121???S129. doi: 10.1249/00005768-198710001-00004

Crowe, S., & Stranks, E. (2017). The Residual Medium and Long-term Cognitive Effects of Benzodiazepine Use: An Updated Meta-analysis. *Archives of Clinical Neuropsychology*, *33*(7), 901-911. doi: 10.1093/arclin/acx120

Dyrbye, L., Thomas, M., & Shanafelt, T. (2006). Systematic Review of Depression, Anxiety, and Other Indicators of Psychological Distress Among U.S. and Canadian Medical Students. *Academic Medicine*, *81*(4), 354-373. doi: 10.1097/00001888-200604000-00009

Eisenberg, D., Gollust, S., Golberstein, E., & Hefner, J. (2007). Prevalence and correlates of depression, anxiety, and suicidality among university students. *American Journal of Orthopsychiatry*, *77*(4), 534-542. doi: 10.1037/0002-9432.77.4.534

Ekkekakis, P., Hall, E., & Petruzzello, S. (2005). Some like It Vigorous: Measuring Individual Differences in the Preference for and Tolerance of Exercise Intensity. *Journal of Sport and Exercise Psychology*, *27*(3), 350-374. doi: 10.1123/jsep.27.3.350

Ekkekakis, P., Lind, E., & Joens-Matre, R. (2006). Can Self-Reported Preference for Exercise Intensity Predict Physiologically Defined Self-Selected Exercise Intensity? *Research Quarterly for Exercise and Sport*, *77*(1), 81-90. doi: 10.1080/02701367.2006.10599334

Ekkekakis, P., Parfitt, G., & Petruzzello, S. (2011). The Pleasure and Displeasure People Feel When They Exercise at Different Intensities. *Sports Medicine*, *41*(8), 641-671. doi: 10.2165/11590680-000000000-00000

Ellis, D., & Hudson, J. (2010). The Metacognitive Model of Generalized Anxiety Disorder in Children and Adolescents. *Clinical Child and Family Psychology Review*, *13*(2), 151-163. doi: 10.1007/s10567-010-0065-0

Endler, N., & Kocovski, N. (2001). State and trait anxiety revisited. *Journal of Anxiety Disorders*, *15*(3), 231-245. doi: 10.1016/s0887-6185(01)00060-3

Essau, C., Lewinsohn, P., Olaya, B., & Seeley, J. (2014). Anxiety disorders in adolescents and psychosocial outcomes at age 30. *Journal of Affective Disorders*, *163*, 125-132. doi: 10.1016/j.jad.2013.12.033

Farrer, L., Gulliver, A., Bennett, K., Fassnacht, D., & Griffiths, K. (2016). Demographic and psychosocial predictors of major depression and generalised anxiety disorder in Australian university students. *BMC Psychiatry*, *16*(1). doi: 10.1186/s12888-016-0961-z

Fydrich, T., Dowdall, D., & Chambless, D. (1992). Reliability and validity of the beck anxiety inventory. *Journal of Anxiety Disorders*, *6*(1), 55-61. doi: 10.1016/0887-6185(92)90026-4

Gosar, A., & Venkatraman, S. (2019). Literature Review on Examination Stress amongst School Going Students. *World Journal of Research and Review*, *9*(3). doi: 10.31871/wjrr.9.3.5

Hallal, P., Gomez, L., Parra, D., Lobelo, F., Mosquera, J., & Florindo, A. et al. (2010). Lessons Learned After 10 Years of IPAQ Use in Brazil and Colombia. *Journal of Physical Activity and Health*, *7*(s2), S259-S264. doi: 10.1123/jpah.7.s2.s259

Haug, T., Mykletun, A., & Dahl, A. (2004). The Association Between Anxiety, Depression, and Somatic Symptoms in a Large Population: The HUNT-II Study. *Psychosomatic Medicine*, *66*(6), 845-851. doi: 10.1097/01.psy.0000145823.85658.0c

Herring, M., Jacob, M., Suveg, C., & O'Connor, P. (2011). Short-Term Exercise Training Effects on Generalized Anxiety Disorder Signs and Symptoms. *Medicine & Science in Sports & Exercise*, *43*(Suppl 1), 22. doi: 10.1249/01.mss.0000402734.48654.f5

Herring, M., Johnson, K., & O'Connor, P. (2016). Exercise training and health-related quality of life in generalized anxiety disorder. *Psychology of Sport and Exercise*, *27*, 138-141. doi: 10.1016/j.psychsport.2016.08.011

Herring, M., Lindheimer, J., & O'Connor, P. (2013). The Effects of Exercise Training on Anxiety. *American Journal of Lifestyle Medicine*, *8*(6), 388-403. doi: 10.1177/1559827613508542

Hettema, J., Prescott, C., Myers, J., Neale, M., & Kendler, K. (2005). The Structure of Genetic and Environmental Risk Factors for Anxiety Disorders in Men and Women. *Archives of General Psychiatry*, *62*(2), 182. doi: 10.1001/archpsyc.62.2.182

Higa-McMillan, C., Francis, S., Rith-Najarian, L., & Chorpita, B. (2015). Evidence Base Update: 50 Years of Research on Treatment for Child and Adolescent Anxiety. *Journal of Clinical Child & Adolescent Psychology*, *45*(2), 91-113. doi: 10.1080/15374416.2015.1046177

Hyland, P., Shevlin, M., McBride, O., Murphy, J., Karatzias, T., & Bentall, R. et al. (2020). Anxiety and depression in the Republic of Ireland during the COVID-19 pandemic. *Acta Psychiatrica Scandinavica*, *142*(3), 249-256. doi: 10.1111/acps.13219

Iliceto, P., Pompili, M., Lester, D., Gonda, X., Niolu, C., & Girardi, N. et al. (2011). Relationship between Temperament, Depression, Anxiety, and Hopelessness in Adolescents: A Structural Equation Model. *Depression Research and Treatment*, *2011*, 1-6. doi: 10.1155/2011/160175

Jayakody, K., Gunadasa, S., & Hosker, C. (2013). Exercise for anxiety disorders: systematic review. *British Journal of Sports Medicine*, *48*(3), 187-196. doi: 10.1136/bjsports-2012-091287

Julian, L. (2011). Measures of anxiety: State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). *Arthritis Care & Research*, *63*(S11), S467-S472. doi: 10.1002/acr.20561

Kessler, R. (1994). Lifetime and 12-Month Prevalence of DSM-III-R Psychiatric Disorders in the United States. *Archives of General Psychiatry*, *51*(1), 8. doi: 10.1001/archpsyc.1994.03950010008002

Kessler, R., Chiu, W., Demler, O., & Walters, E. (2005). Prevalence, Severity, and Comorbidity of 12-Month DSM-IV Disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 617. doi: 10.1001/archpsyc.62.6.617

Khan, K., Weiler, R., & Blair, S. (2011). Prescribing exercise in primary care. *BMJ*, *343*(jul15 3), d4141-d4141. doi: 10.1136/bmj.d4141

Kleemann, E., Bracht, C., Stanton, R., & Schuch, F. (2020). Exercise prescription for people with mental illness: an evaluation of mental health professionals' knowledge, beliefs, barriers, and behaviors. *Brazilian Journal of Psychiatry*, *42*(3), 271-277. doi: 10.1590/1516-4446-2019-0547

Lader, M. (1999). Limitations on the use of benzodiazepines in anxiety and insomnia: are they justified? *European Neuropsychopharmacology*, *9*, S399-S405. doi: 10.1016/s0924-977x(99)00051-6

Landgraf, R., Wigger, A., Holsboer, F., & Neumann, I. (1999). Hyper-Reactive Hypothalamo-Pituitary-Adrenocortical Axis in Rats Bred for High Anxiety-Related Behaviour. *Journal of Neuroendocrinology*, *11*(6), 405-407. doi: 10.1046/j.1365-2826.1999.00342.x

Lamers, F., van Oppen, P., Comijs, H., Smit, J., Spinhoven, P., & van Balkom, A. et al. (2011). Comorbidity Patterns of Anxiety and Depressive Disorders in a Large Cohort Study. *The Journal of Clinical Psychiatry*, *72*(03), 341-348. doi: 10.4088/jcp.10m06176blu

LeBouthillier, D., & Asmundson, G. (2015). A Single Bout of Aerobic Exercise Reduces Anxiety Sensitivity but Not Intolerance of Uncertainty or Distress Tolerance: A Randomized Controlled Trial. *Cognitive Behaviour Therapy*, *44*(4), 252-263. doi: 10.1080/16506073.2015.1028094

Lee, A., & Hankin, B. (2009). Insecure Attachment, Dysfunctional Attitudes, and Low Self-Esteem Predicting Prospective Symptoms of Depression and Anxiety During Adolescence. *Journal of Clinical Child & Adolescent Psychology*, *38*(2), 219-231. doi: 10.1080/15374410802698396

Lenze, E., Mulsant, B., Mohlman, J., Shear, M., Dew, M., & Schulz, R. et al. (2005). Generalized Anxiety Disorder in Late Life: Lifetime Course and Comorbidity with Major Depressive

Disorder. *The American Journal of Geriatric Psychiatry*, *13*(1), 77-80. doi: 10.1097/00019442-200501000-00011

Long, B., & Stavel, R. (1995). Effects of exercise training on anxiety: A meta-analysis. *Journal of Applied Sport Psychology*, *7*(2), 167-189. doi: 10.1080/10413209508406963

Lun, K., Chan, C., Ip, P., Ma, S., Tsai, W., & Wong, C. et al. (2018). Depression and anxiety among university students in Hong Kong. *Hong Kong Medical Journal*. doi: 10.12809/hkmj176915

Lynch, F., Mills, C., Daly, I., & Fitzpatrick, C. (2006). Challenging times: Prevalence of psychiatric disorders and suicidal behaviours in Irish adolescents. *Journal of Adolescence*, *29*(4), 555-573. doi: 10.1016/j.adolescence.2005.08.011

MacAuley, D., Bauman, A., & Frémont, P. (2016). Exercise: not a miracle cure, just good medicine. *British Journal of Sports Medicine*, *50*(18), 1107-1108. doi: 10.1136/bmj.h1416

Mackay, G., & Neill, J. (2010). The effect of "green exercise" on state anxiety and the role of exercise duration, intensity, and greenness: A quasi-experimental study. *Psychology of Sport and Exercise*, *11*(3), 238-245. doi: 10.1016/j.psychsport.2010.01.002

Mah, L., Szabuniewicz, C., & Fiocco, A. (2016). Can anxiety damage the brain? *Current Opinion in Psychiatry*, *29*(1), 56-63. doi: 10.1097/yco.0000000000000223

Mahmoud, J., Staten, R., Hall, L., & Lennie, T. (2012). The Relationship among Young Adult College Students' Depression, Anxiety, Stress, Demographics, Life Satisfaction, and Coping Styles. *Issues in Mental Health Nursing*, *33*(3), 149-156. doi: 10.3109/01612840.2011.632708

Mannocci, A., Di Thiene, D., Del Cimmuto, A., Masala, D., Boccia, A., De Vito, E., & La Torre, G. (2010). International Physical Activity Questionnaire: validation and assessment in an Italian sample. *Italian Journal of Public Health*, *7*(4).

Matthews, G., Hillyard, E., & Campbell, S. (1999). Metacognition and maladaptive coping as components of test anxiety. *Clinical Psychology & Psychotherapy*, *6*(2), 111-125. doi: 10.1002/(sici)1099-0879(199905)6:2<111::aid-cpp192>3.0.co;2-4

Miller, A. (2008). *Living with anxiety disorders*. New York, NY: Infobase pub

Mueller, P. (2007). Exercise training and sympathetic nervous system activity: Evidence for physical activity dependent neural plasticity. *Clinical and Experimental Pharmacology and Physiology*, *34*(4), 377-384. doi: 10.1111/j.1440-1681.2007.04590.x

Norton, G., Cox, B., & Malan, J. (1992). Nonclinical panickers: A critical review. *Clinical Psychology Review*, *12*(2), 121-139. doi: 10.1016/0272-7358(92)90110-t

Osman, A., Hoffman, J., Barrios, F., Kopper, B., Breitenstein, J., & Hahn, S. (2002). Factor structure, reliability, and validity of the Beck Anxiety Inventory in adolescent psychiatric inpatients. *Journal of Clinical Psychology*, *58*(4), 443-456. doi: 10.1002/jclp.1154

Park, S. (2018). Antidepressive Effects of Exercise. *Journal of Korean Neuropsychiatric Association*, *57*(2), 139. doi: 10.4306/jknpa.2018.57.2.139

Plummer, F., Manea, L., Trepel, D., & McMillan, D. (2016). Screening for anxiety disorders with the GAD-7 and GAD-2: a systematic review and diagnostic meta-analysis. *General Hospital Psychiatry*, *39*, 24-31. doi: 10.1016/j.genhosppsych.2015.11.005

Putwain, D., Woods, K., & Symes, W. (2010). Personal and situational predictors of test anxiety of students in post-compulsory education. *British Journal of Educational Psychology*, *80*(1), 137-160. doi: 10.1348/000709909x466082

Rethorst, C., Wipfli, B., & Landers, D. (2009). The Antidepressive Effects of Exercise. *Sports Medicine*, *39*(6), 491-511. doi: 10.2165/00007256-200939060-00004

Rose, M. (2014). Assessment of patient-reported symptoms of anxiety. *Dialogues in Clinical Neuroscience*, *16*(2), 197-211. doi: 10.31887/dcns.2014.16.2/mrose

Safer, D., Zito, J., & dosReis, S. (2003). Concomitant Psychotropic Medication for Youths. *American Journal of Psychiatry*, *160*(3), 438-449. doi: 10.1176/appi.ajp.160.3.438

Schvey, N., Sbrocco, T., Bakalar, J., Ress, R., Barmine, M., & Gorlick, J. et al. (2017). The experience of weight stigma among gym members with overweight and obesity. *Stigma and Health*, *2*(4), 292-306. doi: 10.1037/sah0000062

Settipani, C., & Kendall, P. (2012). Social Functioning in Youth with Anxiety Disorders: Association with Anxiety Severity and Outcomes from Cognitive-Behavioral Therapy. *Child Psychiatry & Human Development*, *44*(1), 1-18. doi: 10.1007/s10578-012-0307-0

Somers, J., Goldner, E., Waraich, P., & Hsu, L. (2006). Prevalence and Incidence Studies of Anxiety Disorders: A Systematic Review of the Literature. *The Canadian Journal of Psychiatry*, *51*(2), 100-113. doi: 10.1177/070674370605100206

Smith, C., Peterson, D., Degenhardt, B., & Johnson, J. (2007). Depression, anxiety, and perceived hassles among entering medical students. *Psychology, Health & Medicine*, *12*(1), 31-39. doi: 10.1080/13548500500429387

Steptoe, A., & Butler, N. (1996). Sports participation and emotional wellbeing in adolescents. *The Lancet*, *347*(9018), 1789-1792. doi: 10.1016/s0140-6736(96)91616-5

Strickland, J., & Smith, M. (2014). The anxiolytic effects of resistance exercise. *Frontiers in Psychology*, *5*. doi: 10.3389/fpsyg.2014.00753

Ströhle, A. (2008). Physical activity, exercise, depression, and anxiety disorders. *Journal of Neural Transmission*, *116*(6), 777-784. doi: 10.1007/s00702-008-0092-x

Stubbs, B., Vancampfort, D., Rosenbaum, S., Firth, J., Cosco, T., & Veronese, N. et al. (2017). An examination of the anxiolytic effects of exercise for people with anxiety and stress-related disorders: A meta-analysis. *Psychiatry Research*, *249*, 102-108. doi: 10.1016/j.psychres.2016.12.020

Thyer, B., Parrish, R., Curtis, G., Nesse, R., & Cameron, O. (1985). Ages of onset of DSM-III anxiety disorders. *Comprehensive Psychiatry*, *26*(2), 113-122. doi: 10.1016/0010-440x(85)90031-8

Tieman, J., Peacock, L., Cureton, K., & Dishman, R. (2002). The influence of exercise intensity and physical activity history on state anxiety after exercise. *International Journal of Sport Psychology*, *33*(2), 155-156.

Turk, C., Heimberg, R., Luterek, J., Mennin, D., & Fresco, D. (2005). Emotion Dysregulation in Generalized Anxiety Disorder: A Comparison with Social Anxiety Disorder. *Cognitive Therapy and Research*, *29*(1), 89-106. doi: 10.1007/s10608-005-1651-1

Tyrer, P., & Baldwin, D. (2006). Generalised anxiety disorder. *The Lancet*, *368*(9553), 2156-2166. doi: 10.1016/s0140-6736(06)69865-6

Vartanian, L., & Novak, S. (2011). Internalized Societal Attitudes Moderate the Impact of Weight Stigma on Avoidance of Exercise. *Obesity*, *19*(4), 757-762. doi: 10.1038/oby.2010.234

Weintrob, N., Cohen, D., Klipper-Aurbach, Y., Zadik, Z., & Dickerman, Z. (2002). Decreased Growth During Therapy with Selective Serotonin Reuptake Inhibitors. *Archives of Pediatrics & Adolescent Medicine*, *156*(7), 696. doi: 10.1001/archpedi.156.7.696

Williams, N. (2014). The GAD-7 questionnaire. *Occupational Medicine*, *64*(3), 224-224. doi: 10.1093/occmed/kqt161

Woodgate, R., Tailor, K., Tennent, P., Wener, P., & Altman, G. (2020). The experience of the self in Canadian youth living with anxiety: A qualitative study. *PLOS ONE*, *15*(1), e0228193. doi: 10.1371/journal.pone.0228193

Wu, C., Wang, C., Katz, A., & Farley, J. (2013). National trends of psychotropic medication use among patients diagnosed with anxiety disorders: Results from Medical Expenditure Panel Survey 2004–2009. *Journal of Anxiety Disorders*, *27*(2), 163-170. doi: 10.1016/j.janxdis.2012.11.004

Yao, Z., Liao, M., Hu, T., Zhang, Z., Zhao, Y., & Zheng, F. et al. (2017). An Effective Method to Identify Adolescent Generalized Anxiety Disorder by Temporal Features of Dynamic Functional Connectivity. *Frontiers in Human Neuroscience*, *11*. doi: 10.3389/fnhum.2017.00492

Yi, H., & Na, W. (2019). How are maths-anxious students identified and what are the key predictors of maths anxiety? Insights gained from PISA results for Korean adolescents. *Asia Pacific Journal of Education*, *40*(2), 247-262. doi: 10.1080/02188791.2019.1692782

Zschucke, E., Renneberg, B., Dimeo, F., Wüstenberg, T., & Ströhle, A. (2015). The stress-buffering effect of acute exercise: Evidence for HPA axis negative feedback. *Psychoneuroendocrinology*, *51*, 414-425. doi: 10.1016/j.psyneuen.2014.10.019

Appendices

Appendix I

Participant consent form

You are being invited to take part in a research study. Before you decide to take part, please take the time to read this document which details the purpose of this study and what participation involves. If you have any questions regarding this study, please do not hesitate to contact me using the details provided at the end of this sheet.

What is this study about?

I am a final year student in the BA (Honours) Psychology course at the National College of Ireland. As part of my degree, I must conduct a piece of independent research within the field of Psychology. For my thesis, this current study proposes to examine the anxiolytic effect of exercise in third level students. The aim is to investigate the relationship between exercise and anxiety and additionally the effects that different types of exercise have on potentially protecting against the symptoms of anxiety. It will consist of four self-report scales, two of which will measure anxiety, and the remaining two will measure exercise levels on average, and propensity for exercise including the type of exercise you prefer. I am doing this study as anxiety is highly prevalent in today's society and finding a reliable way to alleviate the symptoms of anxiety is of great importance.

What will taking part in this study involve?

If you decide to participate in this study, you will be required to complete an anonymous online questionnaire on your perceived levels of anxiety and the types of physical activity you engage in during each week. This will be assessed across all domains of your

life, not just recreational exercise. If you decide to take part in this study, participation should take between 10-15 minutes.

Who can take part?

If you are a third level student over the age of 18 or have completed third level education within the last year you are eligible to take part in this study.

Do I have to take part?

Participation in this study is on a completely voluntary basis. You have the right to withdraw your information at any point up until submission of your data. All data collected here is completely anonymous and cannot be traced back to you in any way therefore once you have submitted your answers you will be unable to withdraw consent.

What are the possible risks and benefits to taking part?

If you are personally affected by the topic in this study or possess an interest in the effects that exercise may have on symptoms of anxiety, this study is aiming to provide new information on this research question. While there may be no direct benefits from taking part, the results from this study may provide a valuable insight into a potential treatment to mediate the effects of anxiety on our body and the role that regular exercise plays on mental illness.

There may be risk of distress associated with some of the questions in this study if you are someone who is personally affected by these issues. If so, I would urge you to contact the support organisations that will be listed for you upon completion of the study. This study has been approved by the ethics committee at The National College of Ireland and every attempt has been made to protect against any possible negative effects of participation.

What will happen to my data?

All data collected through participation in this study will be completely anonymous and cannot be traced back to you. Therefore, once you have submitted your answers you will be unable to withdraw your data after this point. You can exit the study at any stage prior to this and no data will be kept. The measures of anxiety in this study will not be used for any other purpose apart from the intended aim of this study, which is to identify the effects that physical activity has on anxiety scores. The anonymous data collected here may be stored for 5 years in accordance with the data protecting policies of NCI.

What will happen to the results of this study?

The results of this study will be used as a component of my Thesis at NCI. The results will be written up and published, then they may be presented at student conference. These results may also be available to students and staff at NCI using the library facilities.

Who to contact for additional information?

Chris Kennedy

Researcher

Email: x18346723@student.ncirl.ie

Dr. April Hargreaves

Academic supervisor for this study

Email: April.Hargreaves@ncirl.ie

To participate in this study, you must give your informed consent. Please ensure you have read and understood the information sheet and what your data will be used for. Please also

make sure you understand what is required of you for participation and all outlined information on the purpose of this research.

I am 18+ years of age.

Yes ☐

No ☐

I am currently in third level education or have been within the last year.

Yes ☐

By clicking the "I consent “button below, you are agreeing to the terms outlined in the information sheet and signifying that you are providing informed consent.

I consent ☐

Appendix II

Beck Anxiety Inventory

This scale is a self-report measure of anxiety based on mainly physiological symptoms. There are 21 questions.

All questions are scored from 0-3. Select the answers that apply to you the most in relation to the symptoms.Indicate how often you have been bothered by that symptom in the last month.

0= Not at all

1= Mildly, but it didn't bother me much

2= Moderately - it wasn't pleasant at times

3= Severely - it bothered me a lot

1.	Numbness or tingling	0 1 2 3
2.	Feeling hot	0 1 2 3
3.	Wobbliness in legs	0 1 2 3
4.	Unable to relax	0 1 2 3
5.	Fear of worst happening	0 1 2 3
6.	Dizzy or lightheaded	0 1 2 3
7.	Heart pounding / racing	0 1 2 3
8.	Unsteady	0 1 2 3
9.	Terrified or afraid	0 1 2 3
10.	Nervous	0 1 2 3
11.	Feeling of choking	0 1 2 3
12.	Hands trembling	0 1 2 3
13.	Shaky / unsteady	0 1 2 3
14.	Fear of losing control	0 1 2 3

15. Difficulty in breathing	0 1 2 3
16. Fear of dying	0 1 2 3
17. Scared	0 1 2 3
18. Indigestion	0 1 2 3
19. Faint / lightheaded	0 1 2 3
20. Face flushed	0 1 2 3
21. Hot / cold sweats	0 1 2 3

Appendix III

GAD-7

This is a second measure of the symptoms of anxiety. This scale measures symptoms of generalised anxiety. There are 7 questions, each scored from 0-3.

Please indicate how often each symptom has bothered you over the last two weeks, including today.

0 = Not at all

1 = Several days

2 = More than half the days

3 = Nearly every day

1.	Feeling nervous, anxious, or on edge	0 1 2 3
2.	Not being able to stop or control worrying.	0 1 2 3
3.	Worrying too much about different things	0 1 2 3
4.	Trouble relaxing	0 1 2 3
5.	Being so restless that it is hard to sit still.	0 1 2 3
6.	Becoming easily annoyed or irritable	0 1 2 3
7.	Feeling afraid, as if something awful might happen	0 1 2 3

Appendix IV

International Physical Activity Questionnaire (IPAQ)

Part 1: Job Related Physical Activity

The first section is about your work. This includes paid jobs, farming, volunteer work, and any other paid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, garden work, general maintenance, and caring for your family. These are asked in Part 3. If you are currently unemployed you may select the options stating you did not engage in any of these activities.

1. Do you currently have a job or do any unpaid work outside your home?
2. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing up stairs as part of your work? Think about only those physical activities that you did for at least 10 minutes at a time.
3. How much time did you usually spend on one of those days doing vigorous physical activities as part of your work?
4. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads as part of your work for at least 10 minutes? Please do not include walking.
5. If you did moderate physical activities in work during the last 7 days, how much time did you usually spend during one of those days doing moderate physical activities as part of your work?
6. During the last 7 days, on how many days did you walk for at least 10 minutes at a time as part of your work? Please do not count any walking you did to travel to or from work.
7. How much time did you usually spend on one of those days walking as part of your work?

Part 2: Transportation and Physical Activity

The questions in this section relate to how you have travelled to and from anywhere you have visited in the last 7 days. This may have been to college, to see friends, to go to the shops, or to work.

1. During the last 7 days, on how many days did you travel in any sort of motor vehicle such as a car, bus, or train.
2. How much time did you usually spend on one of those days travelling in a vehicle?
3. During the last 7 days, on how many days did you cycle for at least 10 minutes at a time to go from place to place?
4. How much time did you typically spend on one of those days cycling?
5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?
6. How much time did you usually spend on one of those days walking from place to place?

Part 3: Housework, House maintenance, and Garden Work

This section asks about any physical activity you may have done around your garden or in your house in the last 7 days. This does not include any recreational exercise.

1. During the last 7 days, on how many days did you do vigorous physical activities around your garden for at least 10 minutes?
2. How much time did you usually spend on one of those days doing vigorous physical activity in your garden?
3. During the last 7 days, on how many days did you do moderate physical activity around garden, such as brushing up leaves or carrying light objects?
4. How much time did you usually spend on one of those days doing moderate physical activity in your garden?
5. During the last 7 days, on how many days did you do moderate physical activity in your home such as hoovering, carrying light objects, cleaning your room or moving furniture?

6. How much time did you usually spend on one of those days doing moderate physical activity in your home?

Part 4: Recreation, Sport, and Leisure-Time Physical Activity

This section is about all physical activities that you participated in during the last 7 days solely for the purposes of recreation, sport, exercise, or leisure. Please do not include any activities you have already mentioned.

1. Not counting any walking, you have already mentioned, during the last 7 days, on how many days did you walk for at least 10 minutes at a time in your leisure time?
2. How much time did you usually spend on one of those days walking in your leisure time?
3. During the last 7 days, on how many days did you do vigorous physical activity like running, weightlifting, cycling, or any other high intensity exercise?
4. How much time did you usually spend doing vigorous physical activity on one of those days in your leisure time?
5. During the last 7 days, on how many days did you do moderate physical activity? This includes jogging, yoga, light weightlifting, and any other moderate level exercises?
6. How much time did you usually spend doing moderate physical activity on one of those days during your leisure time?

Part 5: Time spent sitting

The last section relates to the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television. Do not include any time spent sitting in a vehicle that you have already mentioned in the transportation section.

1. During the last 7 days, how much time did you usually spend sitting on a weekday?
2. During the last 7 days, how much time did you usually spend sitting on a weekend day?

Appendix V

Preference for and Tolerance of the Intensity of Exercise Questionnaire PRETIE-Q

Please read each of the following statements and then use the response scale below to indicate whether you agree or disagree with it. There are no right or wrong answers. Work quickly and mark the answer that best describes what you believe and how you feel.

Each question is scored from 1-5

1 = I totally disagree

2 = I disagree

3 = I neither agree nor disagree

4 = I agree

5 = I totally agree

1. Feeling tired during exercise is my signal to slow down or stop.
2. I would rather work out at low intensity levels for a long duration than at high-intensity levels for a short duration.
3. During exercise, if my muscles begin to burn excessively or if I find myself breathing very hard, it is time for me to ease off.
4. I'd rather go slow during my workout, even if that means taking more time.
5. While exercising, I try to keep going even after I feel exhausted.
6. I would rather have a short, intense workout than a long, low-intensity workout.
7. I block out the feeling of fatigue when exercising.
8. When I exercise, I usually prefer a slow, steady pace.
9. I'd rather slow down or stop when a workout starts to get too tough.
10. Exercising at a low intensity does not appeal to me at all.

11. Fatigue is the last thing that affects when I stop a workout; I have a goal and stop only when I reach it.
12. While exercising, I prefer activities that are slow-paced and do not require much exertion.
13. When my muscles start burning during exercise, I usually ease off a bit.
14. The harder and more intense the workout, the more pleasant I feel.
15. I always push through muscle soreness and fatigue when working out.
16. Low-intensity exercise is boring.

Appendix VI

Debriefing Sheet

I would like to sincerely thank you for taking the time out of your day to participate in this study. If you have any questions or are affected by the issues covered during this study, please do not hesitate to get in touch or to contact the organisations listed below. Once you click 'submit' your data cannot be removed.

Support Services

Mental health Ireland

Mental health and wellbeing information

Website: https://www.mentalhealthireland.ie

Phone: (01) 284 1166

Jigsaw

Support service for mental health

Website: https://jigsaw.ie/

Phone: +353 1 472 7010

Samaritans Ireland

Crisis support

Website: https://www.samaritans.org/ireland/samaritans-ireland/

Phone: 116 123

Anxiety Aware

Anxiety support

Website: https://www.aware.ie/information/anxiety/

Phone: 1800 80 48 48

Contact Information

If you need any additional information on this study or the intended use of any data collected, please contact either myself or my academic supervisor for the study.

Chris Kennedy

Researcher

x18346723@student.ncirl.ie

Dr. April Hargreaves

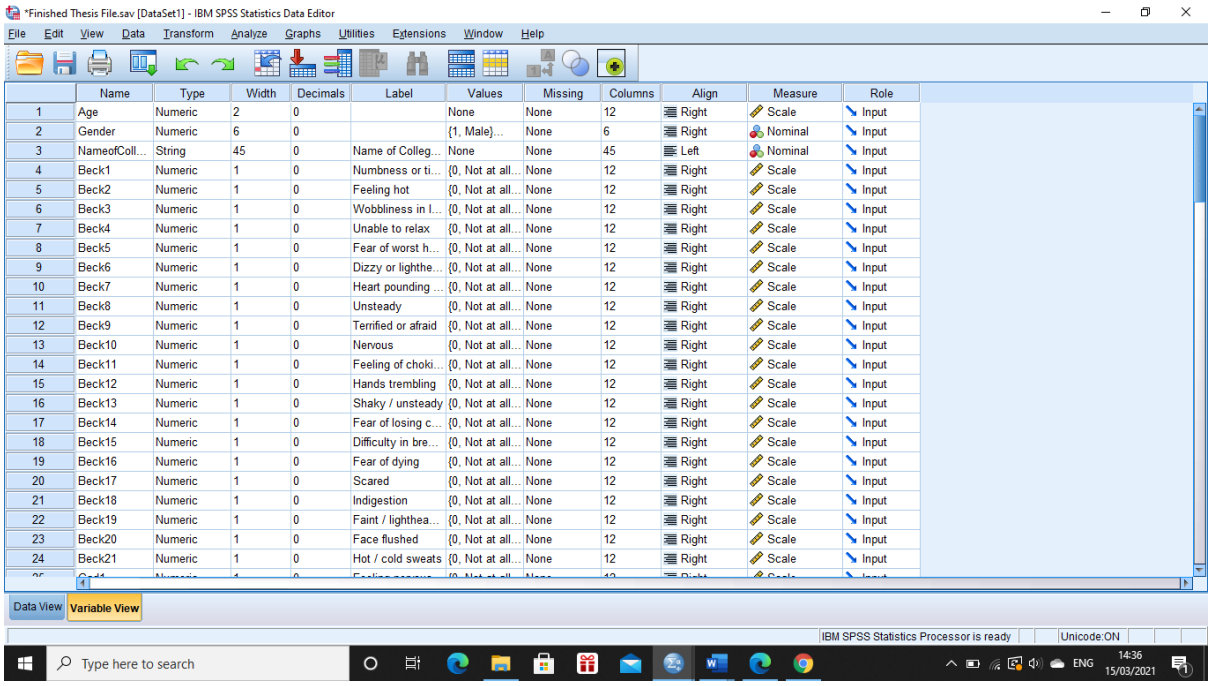
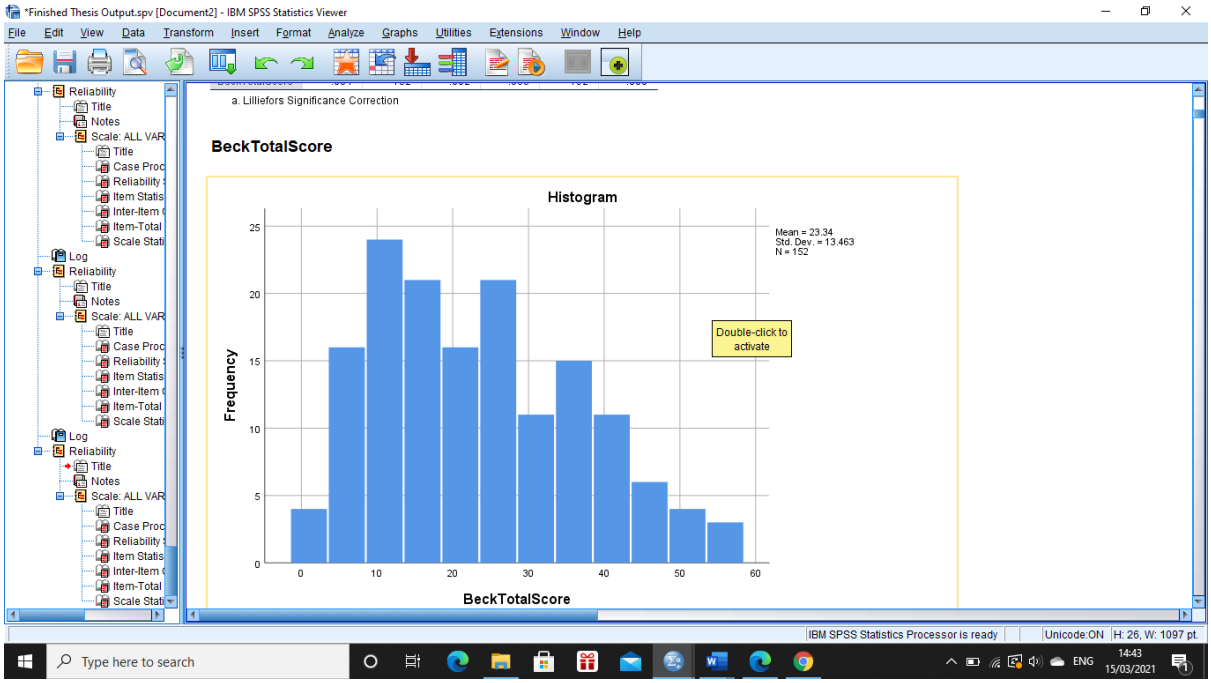
Supervisor

April.Hargreaves@ncirl.ie

Thank you for your time!

Appendix VII

Additional information available upon request.



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Age	Numeric	2	0		None	None	12	Right	Scale	Input
2	Gender	Numeric	6	0		{1, Male}...	None	6	Right	Nominal	Input
3	NameofColl...	String	45	0	Name of Colleg...	None	None	45	Left	Nominal	Input
4	Beck1	Numeric	1	0	Numbness or ti...	{0, Not at all...	None	12	Right	Scale	Input
5	Beck2	Numeric	1	0	Feeling hot	{0, Not at all...	None	12	Right	Scale	Input
6	Beck3	Numeric	1	0	Wobbliness in l...	{0, Not at all...	None	12	Right	Scale	Input
7	Beck4	Numeric	1	0	Unable to relax	{0, Not at all...	None	12	Right	Scale	Input
8	Beck5	Numeric	1	0	Fear of worst h...	{0, Not at all...	None	12	Right	Scale	Input
9	Beck6	Numeric	1	0	Dizzy or lighthe...	{0, Not at all...	None	12	Right	Scale	Input
10	Beck7	Numeric	1	0	Heart pounding ...	{0, Not at all...	None	12	Right	Scale	Input
11	Beck8	Numeric	1	0	Unsteady	{0, Not at all...	None	12	Right	Scale	Input
12	Beck9	Numeric	1	0	Terrified or afraid	{0, Not at all...	None	12	Right	Scale	Input
13	Beck10	Numeric	1	0	Nervous	{0, Not at all...	None	12	Right	Scale	Input
14	Beck11	Numeric	1	0	Feeling of choki...	{0, Not at all...	None	12	Right	Scale	Input
15	Beck12	Numeric	1	0	Hands trembling	{0, Not at all...	None	12	Right	Scale	Input
16	Beck13	Numeric	1	0	Shaky / unsteady	{0, Not at all...	None	12	Right	Scale	Input
17	Beck14	Numeric	1	0	Fear of losing c...	{0, Not at all...	None	12	Right	Scale	Input
18	Beck15	Numeric	1	0	Difficulty in bre...	{0, Not at all...	None	12	Right	Scale	Input
19	Beck16	Numeric	1	0	Fear of dying	{0, Not at all...	None	12	Right	Scale	Input
20	Beck17	Numeric	1	0	Scared	{0, Not at all...	None	12	Right	Scale	Input
21	Beck18	Numeric	1	0	Indigestion	{0, Not at all...	None	12	Right	Scale	Input
22	Beck19	Numeric	1	0	Faint / lighthea...	{0, Not at all...	None	12	Right	Scale	Input
23	Beck20	Numeric	1	0	Face flushed	{0, Not at all...	None	12	Right	Scale	Input
24	Beck21	Numeric	1	0	Hot / cold sweats	{0, Not at all...	None	12	Right	Scale	Input